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Supranational Supervision

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Abstract

We exploit the establishment of a supranational supervisor in Europe (the Single Supervisory Mechanism) to learn how the organizational design of supervisory institutions impacts the enforcement of financial regulation. Banks under supranational supervision are required to increase regulatory capital for exposures to the same firm compared to banks under the local supervisor. Local supervisors provide preferential treatment to larger institutes. The central supervisor removes such biases, which results in an overall standardized behavior. While the central supervisor treats banks more equally, we document a loss in information in banks' risk models associated with central supervision. The tighter supervision of larger banks results in a shift of particularly risky lending activities to smaller banks. We document lower sales and employment for firms receiving most of their funding from banks that receive a tighter supervisory treatment. Overall, the central supervisor treats banks more equally but has less information about them than the local supervisor.

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1 Introduction

The design of banking supervision has been heavily debated since the Great Financial Crisis. Regulatory forbearance and a lack of coordination among supervisors resulted in bail-outs of distressed financial institutions covered by taxpayers' money.[1] Particularly in Europe, the incongruence of supervisors' jurisdictions and globally active banks' playing field resulted in the uncoordinated resolution of distressed banks. At the core of this debate has been the level of centralization and harmonization of regulation and supervision. While bank regulation has been harmonized globally by the Basel Committee on Banking Supervision, the supervision of banks is conducted by several different institutions. In the US banking supervision is organized at both the federal and state level depending on the type of charter a banking organization has. In the Euroarea bank supervision of large banks has been moved away from national authorities to a more centralized supervisor, the so-called Single Supervisory Mechanism (SSM), while smaller banks remained under the surveillance of national regulators.

From a theoretical perspective, it is unclear whether banking supervision should be organized at a central or local level. On the one hand, local supervisors may not take the externalities of their decision-making into account, if the activities of banks lie beyond the jurisdiction of their supervisors. With regards to financial markets that could be especially important given that systemically important banks are globally interconnected and the potential costs of their distress tend to spread internationally. Another potential concern is the close proximity between local supervisors and the supervised institutions. This proximity could result in mutually beneficial relationships between the supervisors and the supervised (Shleifer and Vishny (1993)). Particularly large institutions might be able to capture the supervisor (Stigler (1971), Peltzman (1976)). On the other hand, the large distance between the supervisor and the supervised institution associated with centralized supervision might be a disadvantage when it comes to information transmission. Local supervisors might be better informed about local macroeconomic decisions and can potentially better evaluate the information reported by firms (Hayek (1945)). If decentralization dominates centralization as it allows local supervisors to tailor their actions to local needs (Oates et al. (1972)). Furthermore, Tiebout (1956) argues that competition between jurisdictions improves the provision of services.

In this paper, we exploit the introduction of the "Single Supervisory Mechanism" (SSM) in Europe to learn how the organizational design of supervisory institutions impacts the enforcement of regulation. More specifically, we aim to understand how the organizational design of supervision impacts supervisory outcomes as well as the underlying reasons responsible for differences in the behavior of central and local supervisors.

[1] Please refer to reports on the financial crisis in the US (Commission et al. (2011) and Europe (Liikaanen (2012).

Furthermore, we aim to understand the consequences of having separate regulators for larger, more complex financial firms as opposed to smaller financial firms with regard to lending market structure. Differences in supervisory outcomes could result in a shift of certain activities from stricter to more leniently supervised financial institutions which impact the allocation of resources within an economy.[2]

Following the financial crisis of the year 2008, leaders of the Eurozone government decided to establish the European Banking Union in 2012. Before this event, all banks in a given national market had been under the local supervision of a single national competent authority (NCA). From September 2012 on, the SSM took the supervisory tasks over Eurozone banks having assets of more than €30 billion, or alternatively, constituting at least 20% of their home country's GDP, while banks beyond this threshold remained with the NCAs.[3] We refer to those banks that were shifted to the supranational supervisor as SSM banks, while those that remained under local supervision as LSI banks (i.e. less significant institutions). For banks with assets larger than €30 billion, the SSM incorporated a joint supervisory team that consists of ECB staff, staff from the local supervisory institution as well as staff from the other supervisory institutions of the Euroarea. Irrespective of whether banks are supervised by supranational or local supervisors, the same regulatory rules apply to all banks (during our sample period this is Basel II/III). This regulation, however, allows substantial discretion by the supervisor with regard to determining the level of banks' regulatory capital.

We exploit micro-level data from the German credit register from Deutsche Bundesbank around the establishment of the new supranational supervisor.[4] Based on this dataset we define a metric to learn about how supervisors treat a given financial institution. To ensure banks' capital adequacy, regulators set and monitor banks' capital requirements.[5] Under the IRB approach, the level of regulatory capital requirements depends on the risk weights that are associated with a particular exposure the bank holds on its balance sheet. So banks determine for each loan exposure a specific risk weight using internal risk models. Supervisors approve and monitor the validity of these models and, doing so, provides the supervisor with substantial discretion in setting the level of these risk weights (see e.g. Behn et al. (2022)).

Our main identification strategy relies on firms with multiple lending relationships around the introduction of the SSM. In the pre-period, the local supervisor is responsible

[2] A similar argument has been done by the literature analyzing shadow banks (see e.g., Buchak et al. (2018)).

[3] From November 4th 2014 on, ECB had taken over the supervisory responsibility for roughly 130 financial institutions in the Euroarea.

[4] Our sample focuses on German banks that use the IRB approach to determine their regulatory capital requirements. These banks use their own internal risk models to determine their regulatory capital charges. This process is closely supervised by the respective supervisor (see Section 2 for details).

[5] According to Basel III regulatory capital requirements are defined as the ratio of Tier 1 capital to total risk-weighted assets that have to be at least 10.5%.

to monitor the risk weights reported by all banks. Following the introduction of the SSM, the supranational supervisor takes over the responsibility of all banks with assets above €30 billion, while local supervisors continue to monitor smaller banks. When focusing on firms that have a lending relationship with at least one bank that experiences a shift to the supranational supervisor and another bank that remains under the local supervisor, we can estimate whether the new supervisor applies a different assessment of risk-weights compared to the local supervisor. Any firm-level changes in the underlying riskiness of a loan exposure around the SSM introduction should in principle get removed by our specification. Our identification strategy is neither influenced by firm-specific nor by bank-specific shocks.

Applying this estimation strategy to our data, we find that more distance between the supervised and the supervisor results in a less lenient behavior. Reported risk weights for exposures of the same firm have increased by about 7 percentage points for SSM compared to LSI banks following the establishment of the SSM. This increase in risk weights of SSM bank exposures is not associated with changes in their loan terms, since ex-post loan loss rates of these exposures have not changed. We also focus on the probabilities of default (PDs) of banks' exposures that constitute the most relevant input of risk weights. These PDs constitute banks' estimate of a specific borrower's default during the upcoming 12 months. This event does not depend on loan terms, and thus all banks that lend to a specific borrower should report on average the same level of PD. Following the establishment of the central supervisor, SSM banks increased their reported PD by 4.1% compared to LSI banks for exactly the same borrower.

By design, banks under the local supervisor are smaller and less complex compared to banks under the supranational supervisor. We exploit a specific institutional aspect of the SSM to test for different supervisory outcomes within a sample of banks with similar size and complexity. When a bank is present in another Euroarea country, the local supervisory authority of this country appoints supervisors to the joint supervisory team. As a consequence, the fraction of local supervisors within a joint supervisory team depends on the location of banks' subsidiaries. Banks with similar size and complexity that have foreign subsidiaries located in other Euroarea countries compared to those located in non-Euroarea countries will have a lower fraction of local supervisors in their team. Across specifications, we document significantly higher reported risk weights and PDs for banks with a lower share of domestic supervisors following the SSM implementation.

We further investigate the underlying reasons for the observed differences in the leniency of supervisors. The close proximity between the supervised entities and the supervisor likely impacts the incentives of local supervisors. Supervisors might build up a personal relationship with the supervised institutions and/or certain banks are able to capture their supervisors (Stigler (1971), Peltzman (1976)). Since larger banks have

more resources available for such activities, we expect them to receive more favorable treatment under a local supervisor compared to smaller banks in case such a bias exists. Alternatively, local supervisors might care more about local macroeconomic conditions compared to more distant supranational supervisors. If such considerations impact the behavior of local supervisors, we expect local supervisors to provide favorable treatment to troubled banks.

We test in the cross-section of banks whether specific institutes were able to report systematically lower risk parameters under the local supervisors in the period before the SSM was initiated. Larger banks (i.e. those banks that were shifted to SSM supervision) reported 8.2 percentage points lower risk weights for an exposure to the same firm compared to smaller banks. Local supervisors accept that larger banks hold significantly lower regulatory capital charges when lending to the same firm compared to a smaller bank. This magnitude is similar to the magnitude we reported for the increase in risk weights once the SSM took over supervision. Despite reporting lower risk weights, the larger banks experienced on average higher loss rates by 60 basis points for the same loans compared to LSI banks. The supranational supervisor removed this bias. We find that larger banks report the same level of risk weights and PDs compared to smaller banks for exposures to the same firm following the SSM implementation.

We do not find similar patterns when we compare how banks that experienced high losses and those that had low losses with each other. Both of these types of banks report very similar risk weights and PDs for exposures to the same firm. Overall, a larger distance between the supervised institutions and the supervisor results in a more similar treatment among the different institutions. The results of the previous section can be explained by the ECB removing biases of the local supervisor which results in an overall less lenient behavior.

Central and local supervision likely differs in the production of information during the supervisory process. Due to the lower proximity, local supervisors could be able to gain more insights into the supervised institute as well as the local economic conditions. Central supervisors might be able to generate more information about the supervised institute by being more skilled and/or having a better overview of the macroeconomic environment. To learn about this trade-off, we focus on the discriminatory power (i.e. actual information content) of banks' underlying risk models.[6] We observe that over time the quality of risk models of banks under the local supervisor improved. The situation is different for SSM banks. For less risky loans, the discriminatory power has actually worsened under the supranational supervisor.

Alternatively, we focus on the dispersion of PDs produced by banks' risk models. A

[6]The discriminatory power of a model denotes its ability to differentiate between defaulting and non-defaulting borrowers, which informs us about the actual quality/ability of a risk model to detect risky borrowers.

better-informed supervisor would be able to differentiate between risky and non-risky borrowers, which should result in an increase in the dispersion of each bank's PDs.[7] The standard deviation of the PDs of large SSM banks has reduced by 6% compared to banks under the local supervisor. In sum, a higher distance between supervisors and banks results in fewer biases in supervision despite that the supranational supervisor operates with less information.

In the second part of our analysis, we focus on the impact of differential regulatory treatment on banks' behavior. SSM banks experienced tighter supervision in the new regime. We aim to understand how the presence of two regulators in the same market impacts market structure. Applying our main specification to lending outcomes, we find that banks under tighter supervision reduce their lending to the same firm by about 10 percent more than banks under the local supervisor following SSM establishment. All else equal, banks under SSM surveillance are incentivized to shed exactly those assets that are associated with the highest risk weight. Given this, we look at high PD firms and document that these firms receive less funding following the event from affected banks (i.e. relative to low PD firms). Note that this specification allows to systematically control for bank-specific shocks. Banks under the local supervisor lend more to riskier firms compared to the other group in the post-event period. This is explained by SSM banks cutting their lending to riskier firms as a consequence of tougher supervision. We also examine the impact of the SSM establishment on the issuance of new loans where the effect of shifting risky assets from SSM to LSI banks should be even more pronounced. Indeed our findings show that the magnitude for new loans is considerably higher compared to existing loans.

To illustrate the point of shedding riskier assets further, we apply data on banks' security holdings from Deutsche Bundesbank. Given that security holdings are more liquid compared to loans, SSM banks can instantly sell these assets. We find that the SSM introduction has resulted in a drastic reallocation of security holdings by German banks. Using ratings as a proxy of risk weights, we see almost all of the risky corporate bonds (for market-making or other reasons that create demand for these bonds) are being held by LSI banks following the establishment of a new regulator.

Overall we document risk-shifting between SSM and LSI banks. One implication of this finding is that in the future, riskier activities will be conducted by smaller banks. Given smaller banks tend to be less difficult to be resolved in case of distress this could be a desirable outcome. However, if smaller institutes take over more risky activities while operating under a less sophisticated risk management system, the aggregate implication for financial stability is unclear.

[7]The reason for this is that a better informed/more skilled supervisor would assign very low PDs to good borrowers and very high PDs to risky borrowers. A less informed/skilled supervisor would assign similar PDs to all borrowers.

We also examine the implications of the SSM for the real sector. Using balance sheet data provided by Bureau van Dyck for the German corporate sector, we find that firms that obtain most of their pre-event funding from SSM banks - all else equal - obtain relatively less funding following the SSM establishment. This has a significant impact on these firms' sales, investments, and employment.

Finally, we expand our analysis to the other Euroarea countries using bank-level data. Previous findings are on average very similar to the evidence documented for Germany. We exploit variations in the composition of the JSTs to estimate the impact of the SSM within the sample of European SSM banks. Large SSM banks whose supervisory teams were staffed by mostly non-local staff, increased their risk-weighted asset ratio by about 3.2 percentage points compared to smaller SSM banks with a higher fraction of local supervisors. We find a very similar magnitude for our German micro-level data using a similar specification. We further find also for the CGIIPS countries (i.e. Cyprus, Greece, Ireland, Italy, Portugal and Spain) that were impacted by the European sovereign debt crisis a very similar magnitude. European banking markets differ significantly in their concentration. While e.g. the French banking sector is basically dominated by three large banks, small regional banks hold a significant asset share in Germany. Thus, the market share of banking assets under SSM supervision varies considerably between European countries. An increase in the percentage of assets supervised by SSM by 1% leads to an increase of banks' risk weights by 0.121%.

Our work is broadly related to several strands of literature. It is directly related to papers on regulatory architecture involving multiple regulators (Laffont and Martimort (1999), Martimort (1999), Agarwal et al. (2014)). A recent literature has focused on supranational banking supervision. Beck et al. (2019) and Holthausen and Rønde (2004) study motivation behind cooperation in supranational banking supervision among countries. Colliard (2014), Calzolari et al. (2017) and Carletti et al. (2016) present theoretical models analyzing supervisory incentives and optimal architecture of supranational supervision. Our work contributes to this literature by providing systematic empirical evidence on differences between different regulators in the same market and tracing the reasons and consequences of these differences. Our paper speaks to the literature that focuses on impact of regulatory policies and regulatory uncertainty (Prager (1989), Viscusi (1983), Teisberg (1993)).

Another recent literature focuses on the link between capital regulation and the emergence of shadow banking. From a theoretical point of view, tight capital regulation spurs shadow banking activity and especially riskier borrowers can be incentivized to obtain external finance from the shadow banking sector. Consequently, relaxing capital requirements might be optimal (Plantin (2015), Martinez-Miera and Repullo (2019), Farhi and Tirole (2020)). Our paper provides empirical evidence that discrepancy in regulatory

behavior results in a very similar trade-off. Following the emergence of the systematically stricter regulator, we observe a shift of the risky borrowers to banks under the more lenient regulator. This finding is similar to Irani et al. (2018) who document for the U.S. corporate loan market that in response to higher regulatory capital requirements less-capitalized banks reduce loan retention and non-banks fill the void.

Our paper is also connected to the literature on internal models and their strategic use (Plosser and Santos (2014), Mariathasan et al. (2012), Begley et al. (2017), Behn et al. (2022), Colliard (2018)). Behn et al. (2022) document that banks misreport on loans to low PD firms. On the other hand, Plosser and Santos (2014) find that errors are higher when loans are riskier, to achieve the same reduction in risk weights. This points to the possibility that different supervisors can audit the internal models differently. Colliard (2018) provides theoretical motivation for why differences can exist in the auditing of internal models by supranational and local supervisors which can produce different capital ratios set by the supervisors.

Our paper is structured as follows. Section 2 discusses the institutional details on the implementation of the SSM. Section 3 introduces the methodology and our underlying data sources. Section 4 presents our empirical results on the differences between the two supervisors, Section 5 focuses on why these differences exist and Section 6 discusses the impacts of these differences. Section 7 provides the Euroarea results and Section 8 concludes.

2 Institutional Background

2.1 The Establishment of the SSM

As a consequence of the uncoordinated settlement of the global financial crisis, the heads of governments of Eurozone countries decided to establish the Single Supervisory Mechanism (SSM) in Brussels on 28-29 June 2012. The agreement marked a shift towards the creation of a banking union in the Eurozone. While the establishment of the SSM has been widely accepted by the political leaders in the Eurozone, there has been some wrangling over the design of the new institutions. Most importantly, debates have rumbled on among the Eurozone politicians regarding the composition of the SSM board, the scope of competencies of the new supranational institution, and which types of bank will be placed under the SSM. In response, the European Commission developed a proposal specifying institutional details for the supranational supervisor in September 2012.[8] The proposal stated that the ECB would take on a supervisory role with respect to the relevant financial institutions. More specifically, the ECB would directly supervise Eurozone

[8]See http://europa.eu/rapid/press-release_MEMO-13-251_en.htm?locale=en for details.

banks with assets of more than €30 billion, or, alternatively, those with assets constituting at least 20% of their home country's GDP.[9] On 13 December 2012, the proposal was unanimously agreed on by the ECOFIN Council, which subsequently announced its rapid implementation. Given that the implementation of the SSM became certain as of this date, we consider December 2012 as its announcement date.

Following the formal approval of ECB oversight of Eurozone banks by the European Parliament and Council in 2013, the starting date of the SSM was set at 4 November 2014. From this date on, the ECB took over supervisory responsibilities for roughly 130 financial institutions in the euro area. These institutions are referred to as systematically important financial institutions and they comprise about 85% of the total banking assets of the euro area. Throughout the paper we refer to these institutions as SSM banks and to institutions that remain under the local supervisor as LSI banks (i.e. less significant institutions). In this paper, we focus on the impact of the SSM's implementation in the German banking sector. By November 2014, the responsibility for supervising the 21 largest banking institutions in Germany was moved from the national competent authorities (NCA) (i.e. Deutsche Bundesbank and BaFin) to the SSM under the ECB.

With regard to the organizational design of the SSM, the most important decision-making body within it is the Supervisory Board. The Supervisory Board has oversight of the ECB's supervisory tasks and is, therefore, responsible for the coordination of the Joint Supervisory Teams (JSTs) that conduct the actual supervision in practice. Furthermore, the Supervisory Board makes decisions about setting banks' micro- and macro-prudential capital requirements ("buffers") as well as imposing enforcement measures and sanctions. The composition of the Supervisory Board is as follows: a chair and vice-chair (chosen from among the members of the ECB's Executive Board), four ECB representatives, and representatives of national supervisory bodies.

2.2 Banking Supervision in Germany following the SSM

Since November 2014, day-to-day supervision of the 21 largest banks in Germany has been conducted by a Joint Supervisory Team (JST) that the ECB set up for each SSM bank under its jurisdiction. At the top layer of each JST is the coordinator (also referred to as the chair) who leads the team. The coordinator must not be a national of the country in which the respective bank is headquartered. Below that, the second layer comprises a sub-coordinator originating from the relevant NCA. In cases where a specific bank is materially present in another SSM member states, sub-coordinators of the relevant foreign NCAs also join this layer. These sub-coordinators, as well as the JST chair, are jointly responsible for the implementation and monitoring of all supervisory tasks. Meanwhile,

[9]Furthermore, financial intermediaries to have requested or received financial assistance from the European Financial Stability Facility or the ESM would move under the direct supervision of the ECB.

bank supervisors constitute the third layer of each JST which is composed of ECB staff, staff of the respective NCA, and staff of foreign NCAs.

To allocate the necessary supervisory resources for each JST, the ECB classified banks into five different risk clusters. This classification is based on various factors such as size, supervisory complexity, and the bank's external risk rating. The largest and most systemically significant institutions are assigned to cluster 1 (i.e. global systemically important banks (G-SIBs)) and the smallest and least significant institutions are assigned to cluster 5.

There are two interesting institutional aspects regarding the composition of the JSTs. First, the SSM was severely short-staffed in the period following its introduction. According to the 2016 European Court of Auditors report, the staff shortage in the JST came as a surprise to the ECB which had underestimated the SSM's workload.[10] Due to this situation, the JSTs of smaller, less complex banks (i.e. banks assigned to clusters 4 and 5) were composed mainly of representatives from NCAs. In fact, for several cluster 4 and 5 banks, only the JST coordinator originated from the ECB (and thus originated from a different nation than the one in which the bank is headquartered), while all other JST members originated from the local NCA. Larger, more complex banks' JSTs (i.e. banks in clusters 1, 2, and 3) were immediately staffed with ECB and foreign NCA supervisors along with local NCA supervisors. Table A.1 presents several extracts and quotes from ECB reports and SSM directors documenting this practice.

Second, the presence of an SSM bank in other participating member states also impacts the composition of its JST. Those banks operating in their local (i.e. national) market and in countries outside the euro area have one domestic sub-coordinator in their JST. Where a bank is present in other euro area countries, there will be additional sub-coordinators originating from the respective countries and, in addition, the NCAs of these countries assign supervisors to the third layer of the JST (see ECB's SSM manual CITATION). As a consequence, the composition of a JST varies among banks even within the same cluster depending on whether a bank is present in other Euroarea countries. A simple example illustrates this point: Bank A is present in Germany and the US. Bank A's JST will have a non-German coordinator and a German sub-coordinator. Alternatively, consider Bank B being present in Germany and France. Bank B's JST will have a French and German sub-coordinator and French NCA supervisors will be added to the third layer of the JST. Consequently, Bank B will have a higher fraction of non-local

[10]European Court of Auditors (2016): Staffing note from DGMS I and II dated 16 March 2015, just four months after the start of the ECB's direct supervision, requested 29 new FTEs for DGMS I and 88 new FTEs for DGMS II (all permanent staff) indicating that the future workload had at the very least been underestimated. A number of reasons for the request were given in the note including higher than expected workload for some supervisory tasks. No studies, reports, or other documentation from before the ECB took up its supervisory duties in November 2014 quantified the resources that would be necessary to cope with the new, considerably more complex supervisory system. Nor did the ECB perform any ex-ante, bottom-up assessments of its anticipated resource needs.

supervisors in its JST compared to Bank A. By comparing the supervisory treatment of banks that differ in their presence in Euroarea countries within the same cluster, we obtain variation in the fraction of local supervisors while holding constant the size and complexity of these financial institutions.

Banks having assets of less than €30 billion (i.e. LSIs) remain under the supervision of their local NCA following the implementation of the SSM. Each local NCA reports information about the financial health of these institutions to the SSM. In cases where a LSI is considered to constitute a threat to financial stability or is close to distress, the SSM may take over the supervision of such an institution.

Our sample includes all 43 German banks that apply the internal-rating-based (IRB) approach to determine their capital charges. We focus on IRB banks for the following two reasons: first, IRB banks are the largest banks and, thus, we have a relatively homogeneous sample; and, second, supervisors play a more prominent role for IRB banks given that they review their internal risk models regularly (see the next section for details). Among these 43 banks, the ECB has classified 29 banks as SSM banks and the remaining 14 institutions as LSIs. From November 2014 onwards, supervision for these 29 SSM banks has shifted to the supranational SSM, while supervision of the 14 LSIs has remained under the auspices of the local NCA (i.e. BAFIN/Bundesbank). To classify the 29 SSM banks into the different clusters, we apply the EBA's important institution capital surcharge buckets.

3 Empirical Methodology and Data

3.1 Measuring Supervisors' Activities

In this section, we introduce our metric to compare the activities of different supervisors. The key task of supervisors is implement prudential regulation concerning the amount of capital that banks are required to hold. According to the Basel regulatory framework, capital requirements are supposed to reflect asset risk (i.e. banks are supposed to hold more capital for riskier assets). Since all of our sample banks follow the IRB approach, asset risk is determined by banks' own internal risk models that are constantly approved and validated by supervisors. Previous literature has documented that supervisors have a substantial discretion in this process (see e.g. Behn et al. (2022)). We thus evaluate supervisors' activities by comparing banks' risk assessments of exactly the same asset (or borrower) at the same point in time by banks under different supervisory regimes.

More specifically, capital requirements are defined by the ratio of banks' core capital (often referred to as tier 1 capital) to the sum of a bank's risk-weighted assets. While determining the nominator is based on accounting principles, supervisors are more extensively involved in determining the level of the risk-weighted assets. Under the IRB

approach, the risk weight (RW_{ijt}) for a specific loan from bank j to firm i at time t is determined as follows:

$$RW_{ijt} = \frac{collateral_{ijt}}{loan_{ijt}} \times RW(collateral)_{ijt} + \frac{loan_{ijt} - collateral_{ijt}}{loan_{ijt}} \times RW(borrower)_{ijt} \quad (1)$$

with $RW(collateral)_{ijt}$ being the risk weight attached to the collateral and $RW(borrower)_{ijt}$ being the risk weight attached to the borrower. The loan amount is indicated by $loan_{ijt}$ and the value of the collateral is indicated by $collateral_{ijt}$. Moreover, under the IRB approach, the risk weight of the corporate borrower is a function of the probability of default (PD) of the borrower.[11] In sum, the risk weight of an asset contains all the information with regards to the riskiness of a loan. The most relevant parameter determining the risk weight attached to a borrower ($RW(borrower)_{ijt}$) is the borrower's probability of default ($PD(borrower)_{ijt}$) that banks determine based on their own internal risk models. Since the level of the $PD(borrower)_{ijt}$ determines banks' capital requirements associated with the respective exposure, supervisors regularly monitor banks' internal PD models.

In our empirical analysis, we use loan-specific regulatory risk weights (RW_{ijt}) and their most important component, borrowers' PD ($PD(borrower)_{ijt}$) to measure differences in the leniency of supervisors. While the (RW_{ijt}) includes all loan- and borrower-specific characteristics relevant to determining regulatory capital, $PD(borrower)_{ijt}$ only incorporates borrower-specific factors. With this in mind, two separate banks should on average obtain the same estimate for the $PD(borrower)_{ijt}$ irrespective of the different loan terms.

Even though banks determine these parameters based on their internal risk models, supervisors directly impact the level of these parameters via off- and on-site monitoring. Supervisors grant approval and conduct annual reviews of each bank's internal risk models. If the supervisor is not satisfied with the outcome of the underlying models, banks are required to adjust these models to be more conservative or to improve their discriminatory power.[12] Further, there have been specific reviews (i.e. so-called targeted reviews of internal models (TRIMs)) to ensure that internal models do not understate the true riskiness of banks' assets.[13]

3.2 Data and Descriptive Statistics

Our empirical analysis is based on several regulatory datasets compiled by Deutsche Bundesbank. The principal source of data is the German credit register which contains

[11] Note that under the advanced IRB approach, banks also determine the loss given default, exposure of default, as well as the average maturity by using internal models. Under the basic IRB approach, these parameters are provided by the regulator while only the PD of each borrower is determined by internal models.

[12] See Behn et al. (2022) for a detailed description of the IRB approach to determine regulatory capital requirements.

[13] These reviews of been conducted in parallel by the SSM and the different NCAs.

quarterly information on all outstanding loans. The credit register started in 1993 and includes information on the identity of lenders and borrowers, the amount of the loan outstanding, and several other loan characteristics. In response to the Basel II reform, reporting requirements for the credit register were expanded considerably from 2008 onwards. In addition to the previously required information, banks now also report loan-level information on the regulatory approach (SA or IRB), risk-weighted assets (RWAs), PD, and the value of collateral and loan losses (if any). Our sample spans from Q1 2008 to Q4 2017.

To measure the impact of different supervisory regimes on banks' security trading activities, we use Bundesbank's security holding statistics data. The security holdings statistics comprises the portfolio holdings on a security-by-security basis for different asset classes, such as bonds, equities, and mutual funds of all German financial institutions. This information is directly collected by Deutsche Bundesbank from financial institutions at the end of each quarter. Finally, we obtained balance sheet data for the German corporate sector from the Bureau van Dijk Amadeus dataset.

Table 1 provides descriptive statistics of our main dataset. On average, SSM banks are considerably larger in terms of total assets compared to LSI banks (€205 billion vs. €24 billion). However, in terms of average capital ratios and profitability these two types of banks are quite similar. Descriptive statistics for our loan level variables are presented in Panel B. While loans provided by SSM banks are considerably larger compared to the loans provided by LSI banks (i.e. 71 million EUR vs. 19 million EUR), the average risk weight, probability of default and collateral ratio is very similar among these two tapes of banks. We also consider banks' corporate bond holdings in Panel C. The average holdings is about 10 million EUR for both types of banks (nevertheless SSM banks hold a much higher number of bonds, i.e. 40,000, on their balance sheet compared to LSI banks, i.e. 3,000). Descriptive statistics of our balance sheet dataset of non-financial firms is reported in Panel D. SSM-firms are defined as those firms which have more than the median amount of debt from SSM banks. SSM-firms are slightly larger in terms of sales and employees compared to the non-SSM firms.

Given we have our main datasets together, we report on the mean changes of our main variables of interest around the SSM's implementation in Panel F. Risk weights for SSM banks increased by 5.7%, while LSI banks observed a decrease in risk weight by 1.2%. The difference of these differences is 6.9% which is highly statistically significant. When we focus on PDs we observe a similar pattern. While the PDs of LSI banks remained basically unchanged, the PDs of SSM banks increased by 5.7%. Again, the difference of these differences is 6.3% which is highly statistically significant. This descriptives suggest that the supranational supervisor applies a less lenient treatment to its supervised institutes compared to the local supervisor.

3.3 Empirical Strategy

Our main identification strategy examines how changes in the supervisory regime affect the loan-specific risk weights, loss rates and borrower specific PDs of banks shifted to the SSM compared to those that remained under the local NCA. Formally, we estimate the following differences-in-differences model:

$$y_{ijt} = \alpha_{ij} + \alpha_{jt} + \delta \times POST_t \times SSM_i + \epsilon_{ijt} \tag{2}$$

where i is bank, j is firm, t is quarter. The dependent variable y_{ijt} stands either for the risk weight RW_{ijt}, the loss rate LR_{ijt} or the probability of default PD_{ijt} of a given exposure reported by the bank to the regulator at quarter t. The dummy variable SSM_i takes the value of 1 for SSM banks and 0 for LSI banks; the dummy variable $POST_t$ takes the value of 1 after the implementation of SSM and 0 before this event. We incorporate firm $\times$ bank fixed effects (α_{ij}) to control for any time-invariant relationship-specific factors that may impact the level of the risk parameter. By including firm $\times$ quarter fixed effects (α_{jt}) we are able to measure how the two supervisors assess the risk parameters for the same exposures before and after the SSM implementation. Our main specification is based on all loans that existed before the implementation of the SSM. We exclude loans that ceased before November 2014 and were given out after Nov 2014 in our main analysis.[14] Standard errors are double clustered at the bank and firm level to correct for between-bank and within-bank serial correlation in the error terms.

Our coefficient of interest δ measures the difference in the parameters a SSM bank compared to a LSI bank reports to the supervisor for a loan of the same firm before and after the introduction of the SSM. We refer to this test as the "SSM vs LSI" test. While the parameter risk-weight incorporates loan specific terms, any changes to the relationship-specific loan terms should cancel each other out given that we are examining the universe of German corporate loans. To investigate this further, we re-run specification 2 using the ex-post loss rate of the same exposures as a dependent variable. Any systematic changes in the loan terms of exposures by SSM as compared to LSI banks following the SSM introduction should be reflected in differences in the ex-post loss rates. In case we observe changes in the risk weights, but at the same time no changes in the loss rate, we can trace these changes back to differences in the supervisory treatment. Finally, we also apply relationship specific PDs, PD_{ijt}, as our dependent variable. Importantly, the PDs bank report to the supervisor do not depend on loan-specific factors. Thus, a change in a borrower's PD should, irrespective of the relationship-specific loan terms, impact all lending relationships of that specific borrower in the same way. In this case, our coefficient of interest δ captures differences in the regulatory treatment between the

[14] In Section 6, we also focus on the entire sample of corporate loans.

local and supranational supervisory bodies.

A remaining concern is that unobservable factors might affect SSM banks around the introduction of the SSM in a different way compared to LSI banks. SSM banks are larger in size compared to LSI banks which could give ground for such a concern. To address this issue, we exploit variation in the composition of banks' JSTs. SSM banks with a significant subsidiary in another Euro area country will have a lower fraction of local supervisors in their JST (see Section 2.2 for details). Once we focus on cluster 3 banks - that all have a similar size and complexity - we can test for this subsample of very similar banks whether the fraction of local supervisors in a JST has an impact on supervisory treatment of the respective bank.[15] We refer to this test as the "within cluster" test.

4 Differences in the Treatment by Local and Supranational Supervisors

We start our empirical analysis by comparing how banks' risk weights change once the SSM took over their supervision relative to banks which remained under the local supervisor. To rule out that these differences could be driven by changes in loan terms, we repeat this comparison for loss rates. Besides risk weights that ultimately determine the level of regulatory capital, we also focus on PDs that constitute the most relevant input of risk weights. The advantage of focusing on PDs is that they do not dependent on loan specific factors such as LGD, EAD and maturity of the loan and, therefore, banks should report on average similar PD estimates.

We report results of our main specification in Table 2. SSM banks' risk weights increased by 7.3 percentage points (pp) compared to LSI banks following the introduction of the supranational supervisor (column (1)). Our strictest specifications rely on the variation of the same firm having loans from multiple banks (at least one SSM and one LSI bank) around the time of the SSM's implementation by including firm $\times$ quarter fixed effects. Doing so allows us to control for changes in the risk weight of exactly the same firm, which results in a similar coefficient of 9.9 pp (column (2)). We further include bank $\times$ firm fixed effects to control for any relationship-specific factors that might impact the determination of a specific risk weight. Again, the coefficient of interest remains highly significant and has a similar magnitude of 7.1 pp (column (3)). The coefficients are statistically significant and economically meaningful. If the average risk weights of a bank increase by 7.1 pp, this means that the bank needs to increase its core capital by the same percentage magnitude in order to keep its regulatory capital ratio constant.

[15] We chose cluster 3 banks for the following reason: our sample consists of only one cluster 1 bank and one cluster 2 bank; cluster 4-5 banks tend to be mostly staffed with NCA supervisors and do not have international subsidiaries.

Across specifications, we confirm insights from the previous descriptive analysis above. Supranational supervisors are tougher and systematically require banks to assign a higher risk weight for a given exposure.

In columns (3) to (6), we substitute the left-hand side variable with the loss rate. We observe in all specifications an insignificant coefficient with a magnitude close to zero. Importantly this result implies that the underlying loan terms of SSM banks did not deteriorate following the SSM implementation. Thus, the increase in risk weights of SSM banks relative to LSI banks is explained by differences in the supervisory treatments, or in other words, the supranational regulators requires a higher risk-weight for the same level of risk taken by the bank.

Finally, we consider the impact of the SSM implementation on the underlying PDs in Table 2, columns (7)-(9). Note that PDs are independent of any loan specific terms, so that in principles all banks should come up with a similar PD level for the same borrower. Across all specifications, banks report higher PDs after being supervised by the ECB. SSM banks report for exactly the same borrower a 4.1% higher PD than banks under the NCA following the SSM implementation (column (9)).

Due to a staff shortage at the ECB, the JSTs of cluster 4-5 banks were mostly staffed by local supervisors, while only the JST coordinators originated from the SSM. Thus, comparing cluster 1-3 banks with LSI banks provides for a cleaner identification of the actual impact of moving supervision from a local to a supranational supervisor. These results are reported in Table 3. Indeed, we observe that the magnitude of our coefficient of interest increases. Exposures by the same firm obtain an 8.4 pp higher risk weight following the SSM's implementation relative to banks under the given NCA in our strictest specification (column (3)). These increases in risk weights cannot be explained by differences in the loss rates (columns (4)-(6)). When we focus on PDs and compare cluster 1-3 banks with LSI banks, this magnitude increases to 8.3%. Thus, the key reason behind the observed differences in the risk weights can be explained by differences in the PD assessments under different regulatory regimes.

SSM banks are considerably larger compared to LSI banks. Exploiting variation in the fraction of local supervisors within the cluster 3 banks allows us to test for the impact of SSM supervision within a sample of banks with similar size and complexity (see Section 3.2 for more details on this test design). Across specifications, we document significantly higher risk weights and PDs for banks with a lower share of domestic supervisors (see Table 4). Again the there is no differences in the ex-post risk of the loans compared in our specifications as indicated by the insignificant coefficients in the loss rates.

It is worth highlighting that the different magnitudes of the coefficients on risk weights in Tables 2- 4 imply a monotonic relationship between the share of local supervisor and the

leniency of the supervisory outcome. In our baseline specification (Table 2, Column 3) we observed a magnitude of 7.1% higher risk-weights for the same exposure when comparing SSM and LSI banks among each other. Once we exclude cluster 4-5 banks that have a higher share of local supervisors compared to cluster 1-3 banks, the magnitude of this coefficient increases to 8.4%. For our within-cluster test, we observe a magnitude of 2.2% higher risk-weights for comparing cluster 3 banks with and without subsidiaries in the Euro area. Here, the share of local supervisors is only about 3% higher for those cluster 3 banks that do not have a subsidiary in the Euro area.

Table A.2 reports the results of several robustness tests. First, we provide more evidence that our results cannot be explained by differences in bank size. In column (1), we restrict our sample to banks with assets smaller than EUR 50 billion. Moreover, for these smaller banks, we observe significantly higher risk weights following the SSM's implementation for banks under EU surveillance. In column (2), we restrict our sample to banks with assets smaller than EUR 30 billion (i.e. all non-SSM banks) and introduce a placebo cut-off of EUR 15 billion. Here, we do not observe any changes in the average risk weight of the larger and smaller non-SSM banks following the SSM's implementation. In column (3) we exclude the period between the announcement and the implementation of the SSM from our main specification since the ECB conducted the so-called comprehensive asset quality review (AQR) before taking banks under its supervision. We further exclude the largest three banks, whereby all other banks have less than EUR 300 billion in assets (column (3)), and then the seven largest German banks, whereby all other banks have less than EUR 130 billion in assets (column (5)). Finally, SSM banks might have experienced a more critical review regarding the valuation of their collateral and guarantees. We, therefore, focus only on unsecured loans (column (6)) and unsecured loans without guarantees (column (7)). Our main coefficient remains statistically significant under all robustness checks.

5 Explaining the Differences between Supervisors

In this Section, we exploit the underlying reasons for the previously observed differences in the leniency of supervisors. The key difference among local and supranational supervisors is the distance between the supervisor and supervised. The differences in distance could impact the incentives of supervisors as well as the set of information supervisors have available for their decision making. Both of these differences could potentially explain why we observe that local supervisors are more lenient compared to the more distant ones. We discuss these two possibilities in the two subsequent subsections.

5.1 Cross-section Differences in Supervisory Treatment

Close distance between the supervised entities and the supervisor could impact incentives of the supervisor as follows: local supervisors may build a relationship or expect a position in the future from the supervised institution (i.e. revolving doors). In case such factors influence local supervisors their behavior is likely characterized by "self-interest" (Shleifer (1996)) and certain institutes might be able to capture them as described by Stigler (1971) and Peltzman (1976). Alternatively local supervisors care more about local macroeconomic conditions and employment compared to supranational supervisors. Shleifer (1996) describes such a behavior as "local interests" of the supervisor. Both of these issues likely result in a bias of the local supervisor. If supervisors' behavior is characterized by "self-interest", local supervisors should favor large banks, since these can potentially offer more attractive jobs to supervisors or invest more resources in lobbying activities. If supervisors behavior is characterized by "local interests", we likely observe preferential treatment of troubled banks by local supervisor since those failing would result in a disturbance of the local macroeconomic conditions.

To investigate these alternatives, we estimate our main specification for the pre-period only. More specifically, we test in the cross-section whether specific institutes were able to report systematically lower risk parameters under the local supervisors compared to other institutes:

$$y_{ij} = \alpha_{ij} + \delta \times BankCharacteristic_i + \epsilon_{ij}, \tag{3}$$

where variables are defined as in specification 1. The dependent variable y_{ij} stands either for the risk weight, the loss rate , or the PD of a given exposure reported by the bank to the supervisor at a given point in time. We take the average value of these parameters from 2012Q1 to 2014Q4 (i.e. our sample period before the SSM was implemented). The indicator variable $BankCharacteristic_i$ stands either for the size of the institute (i.e. SSM or LSI banks) or whether a bank was troubled (measured by the loan losses experienced by the bank in the period before the test). By including firm $\times$ quarter fixed effects (α_{jt}) we compare the value of the dependent variable for the same firm reported by different banks. Thus, our coefficient of interest δ measures the difference in the risk parameter a large (or troubled) bank reports to the supervisor compared to the risk parameter a small (or healthy) bank reports for a loan of the same firm. Given that all banks has been under local supervision in the pre period, we can learn whether certain banks had been treated systemically different by the local supervisor.

Table 5 reports our results. Larger (i.e. SSM bank) banks reported 8.2 percentage points lower risk weights for an exposure to the same firm compared to a smaller (i.e. LSI bank) bank (column (1)). Thus, local supervisors accepted that larger banks hold significant lower regulatory capital charges when lending to the same firm compared to

a smaller bank. Note that the magnitude of this difference is similar to the magnitude of the treatment effect we reported for the SSM when comparing SSM to LSI banks (7.1 percentage points). Once we exclude cluster 4-5 banks from the analysis in column (2) this magnitude increases further to 11.1 percentage points.

We verify that the lower risk weights reported by SSM banks are not associated with actual lower risk of the respective exposures. Interestingly, we observe the opposite pattern. Despite reporting lower RWs, SSM banks experienced on average higher loss rate by 60 basis points for the same loans compared to LSI banks (column (5)) or 80 basis points once excluding cluster 4-5 banks (column (6)). This magnitude might seem small, but banks have an incentive to underreport and delay the recognition of losses (see, e.g., Blattner et al. (2019), Bischof et al. (2021)).[16] The fact we observe these differences for such a noisily measured variable suggests that actual magnitudes are even higher.

Since PDs do not depend on loan terms, the level of reported PDs for the same firm should be similar for different banks. In other words, the coefficient of interest δ in specification 3 should be zero in case the local supervisor treated small and large banks in the same way. We do observe that larger banks (SSM banks) reported on average a 2.2 percent lower PD for the same firm to the local regulator compared to a LSI bank (column (9)) and 1.3 percent when leaving out cluster 4-5 banks (column (10)). This evidence further strengthen our previous observation that the local regulator was more lenient to larger as compared to smaller banks. The fact the shown results are less pronounced for PDs as compared to RWs which are ultimately responsible for the regulatory capital requirements suggests that especially larger banks that tend to apply the advanced IRB approach may rather underreport other parameters such as EAD, LGD or loan maturity.

We do not find similar patterns once we compare how banks that experienced high losses and those that had low losses with each other. Both of these types of banks report the same risk weights and PDs for exposures to the same firm as indicated by coefficients close to zero in columns 3-4 and 11-12. We also do not observe any differences in the ex-post riskiness of these exposures as measured by the loan loss rates (columns 7-8). In sum, our results indicate that local supervisors gave a preferential treatment to larger banks before the SSM was introduced. Troubled banks had not been treated in a different way compared to healthy banks. Thus, we support for that local supervisors' behavior was characterised by "local interest", but rather by "self interest".

[16] At the time of default, loss rates need to be estimated, since it often takes many years until actual recovery rates have realized, and banks use models in order to do this estimation. We initially wanted to document the extent of this underreporting as well, but unfortunately the extent of the underreporting is only known at the aggregate level and the structure of the data in the credit register prevents us from doing this analysis at the loan level. However, back of the envelope estimates suggest that the extent of underreporting was very significant (as large as 50 percent). Furthermore, the extend of underreporting is more severe the larger the fraction of IRB loans in a given portfolio.

Finally, we examine whether the supranational supervisor changed this bias and estimate specification 3 for the period after the SSM was initiated. To do so, we average the risk parameters for each exposure for the period 2015Q1 to 2017Q4. Results are reported in Table 6. Throughout the specifications, we find that larger banks report the same level of risk-weights and PDs compared to smaller banks (columns 1-2 and 5-6). Larger banks seem to have also adjusted the loan terms, so that the ex-post losses are not different anymore (columns 3-4). Thus, the new supervisor basically removed the bias of the local supervisor when taking over the supervision of larger banks. Overall, a larger distance among the supervised institutions and the supervisor results in a more similar treatment among the different institutions. Results of the previous section can be explained by the ECB removing biases of the local supervisor which results into an overall less lenient behavior.

5.2 Differences in the information content of banks' risk models between supervisors

The differences in the distance between supervisors and supervised institutions might impact the set of information supervisors have available for their decision making. Differences in the underlying information available, could also explain previously observed differences in the leniency of supervisors.

Previous regressions focused on the level of calibration of banks' PD models which, in the end, determines the level of regulatory capital requirements. Now, we examine the impact of the SSM on the discriminatory power of banks' PD models. The discriminatory power of a model denotes its ability to differentiate between defaulting and non-defaulting borrowers, which informs us about the actual quality/ability of a risk model to detect risky borrowers.

By monitoring the discriminatory power of PD models around the time of the change in the supervisory body, we can learn more about how the quality of supervision has changed. A priori it is not clear whether we would expect the models to improve or worsen once supranational supervisors take over. On the one hand, national supervisors have a long history and more local information available to more accurately estimate models. On the other hand, supranational supervisors combine the knowledge of several countries and might thus have more skilful staff and better technologies available.

The most common statistical measure for testing the discriminatory power of rating systems is the cumulative accuracy profile (CAP). The concept here is very similar to that of deriving a Gini coefficient. All debtors are first ordered from riskiest to safest based on the estimated PD. For a given fraction x of the total number of debtors, the CAP curve is constructed by calculating the percentage of defaulters whose PDs are equal to or lower than the maximum score of the fraction x (Satchell and Xia 2007). A perfect

PD model would assign the lowest scores to the defaulters (thus increasing linearly) and then stay at one. For a random PD model, the fraction x of all debtors with the lowest rating scores will contain x percent of all defaults (and so on). In this case, we would observe a line at 45 degrees.

Figure 1, Panel A plots a CAP curve for non-SSM banks for the pre- and post-SSM period.[17] For the non-SSM banks, we observe that the post-SSM curve is northwestern to the pre-SSM curve. Thus, over time the quality of risk models of banks under the NCA improved. The situation is different for SSM banks. Indeed, note that we focus on cluster 1-3 banks since the effect is clearer for these banks. As shown in Figure 1, Panel B, there is a similar pattern for the riskier loans. For less risky loans, however, the discriminatory power has actually worsened under the supranational supervisor. Having only national supervisors on the team is associated with higher discriminatory power of banks' risk models.

To numerically summarize this observation, we compare the accuracy ratios of the pre- and post-SSM models, that are defined as the ratio of the area between each model's CAP and the CAP of the random model, and the area between the CAP of the perfect rating model and the CAP of the random model:

$$AccuracyRatio = \frac{AUC_{Model} - AUC_{RandomModel}}{AUC_{PerfectModel} - AUC_{RandomModel}} \tag{4}$$

For the non-SSM banks, this accuracy ratio takes on a value of 0.5177 for the pre-SSM period and a value of 0.5847 for the post-SSM period. The models of Cluster 1-3 banks experience a slight decrease in their accuracy ratios: a value of 0.6336 for the pre-SSM period and a value of 0.6138 for the post-SSM period. This finding illustrates that actual NCAs tend to have an information advantage when supervising banks. The supranational regulator tends to ask for more conservative estimates of banks' risk parameters.

To provide more evidence for this pattern, we investigate the information content involved in supervisors' assessments. If the supranational supervisor is better equipped to identify the actual riskiness of borrowers, one would expect to observe an increase in the dispersion of each bank's PDs. The reason for this is that a better informed/more skilled supervisor would assign very low PDs to good borrowers and very high PDs to risky borrowers. A less informed/skilled supervisor would assign similar PDs to all borrowers. Comparing how the second moment of PDs changes around the time of the SSM's implementation allows us to differentiate between these two alternatives. Formally,

[17] Here we calculate the CAP based on percentile steps. Using more precise or broader steps results in almost identical graphs and accuracy ratios.

we regress the following specification:

$$Log\left(\frac{\sigma_{PD_{it}}}{\mu_{PD_{it}}}\right) = \alpha_i + \alpha_t + \gamma \times (Post \times SSM)_{it} + \epsilon_{it} \quad (5)$$

The standard deviation of each bank's portfolio i of PDs during quarter t is denoted by $\sigma_{PD_{it}}$. We scale $\sigma_{PD_{it}}$ by the respective mean of the PDs, PD_{it}, and take the log. The coefficient of interest γ measures how the dispersion of PDs changes for banks following coming under surveillance by the new regulator relative to banks that remain under NCA surveillance.

Table 7, Panel A, reports the results for our PD dispersion test. The standard deviation of the PDs of cluster 1-3 banks has reduced by 6% compared to banks under the national supervisor following the SSM's implementation (column (1)). We further split the sample according to the dispersion of low and high PDs according to the sample mean in columns (2) and (3). Interestingly, we find that PD dispersion has been reduced for small PDs.

In sum, higher distance between supervisor and banks results in less biases in supervision despite that the supranational supervisor operates with less information.

6 Consequences of different treatment by supervisors

Following the SSM implementation, SSM banks experienced a tighter supervision. In the new regime, these banks are required to hold more regulatory capital for the same exposure. Since SSM banks operate in the same market as LSI banks, the larger SSM institutes have lost their competitive advantage due to a preferential treatment by the supervisor.

All else equal, we expect SSM banks to reduce their lending and security holdings relative to LSI banks in response to the tougher treatment imposed by the supervisor (in order to dampen the increase in regulatory capital requirements following from the higher risk weights). This behavior should be particularly pronounced for those exposures/assets that carry a high risk-weight (i.e. risky loans or non-investment grade securities). Potentially, LSI banks that have a more lenient supervisor would step in and take over these riskier activities. Lastly, we test whether changes in supervision have an impact on real economic outcomes like employment and investment through the bank lending channels.

6.1 Lending and Risk Shifting

As a starting point we plot aggregate lending volumes of SSM and LSI banks in Figure 2.[18] This graph illustrates that LSI banks have a higher market share in the corporate loan segment compared to SSM banks. During our sample period SSM banks keep the aggregate lending volume mostly constant. There is only a slight drop in aggregate lending following the SSM implementation. In contrast, LSI banks drastically expanded their lending following the introduction of the supranational supervisor. This pattern suggests that LSI banks did take over some of SSM banks' business activities. In the subsequent we explore this pattern in more detail.

In order to identify a shift in the supply of SSM relative to LSI banks, we estimate specification 1 and substitute the dependent variable for the *log* of lending for each bank i to a firm j. The corresponding results are summarized in Table 8. SSM banks reduced their lending relative to LSI banks by 3.6% (column (1)). In our strictest specification, we focus on the relative change in lending supply by SSM banks compared to LSI banks to the same firm while controlling systematically for any relationship specific factors. For this test, we observe a relative decrease in the SSM banks' lending by 10.3% (column (3)). This suggests that the increase in market share of LSI banks is particularly pronounced for lending to firms that also had a relationship with SSM banks. Once we leave out cluster 4-5 banks and compare cluster 1-3 banks with LSI banks, the magnitude of this coefficient increases further to 14% (column (6)). For consistency reasons, we focus on the sample of IRB banks in Table 8 as we did in the previous Section. For analyzing the impact of the SSM on lending, it is also interesting to include SA banks in our sample since there might be substitution of lending from SSM to LSI banks. Table A.4 reports results for the extended sample included SA banks to the control group. All coefficients are slightly higher in magnitude, but very similar to the previously presented results.

Next, we test whether this pattern is more pronounced for those exposures that carry a high risk-weight. We use the PD of a firm as a measure of its riskiness and the risk weight it generates, and we compare firms with a higher PD to those with a lower PD within the same bank. We achieve this by including a triple interaction term $(Post \times SSM\ bank \times Pre\text{-}Event\ High\ PD)_{ijt}$. Moreover, we define a high PD firm as one which had a PD among the top quartile of all firms before the SSM's implementation. Note that this specification allows us to add bank $\times$ quarter fixed effects which systematically controls for any time-varying differences between SSM and LSI banks.

We find that banks under the supranational supervisor are lending less to riskier firms by 10% (Table 9, column (1)). In column (2), we include bank $\times$ quarter fixed effects to control for bank-specific shocks and perform a within-bank analysis. We find that

[18] In our previous analysis we have only include LSI banks that use the IRB approach to determine their capital charges. For this graph, we have included all banks operating in the German banking market.

SSM banks have reduced lending to riskier firms by 15.3% relative to LSI banks. Leaving out cluster 4-5 banks does not have a strong impact on these findings (columns (3) and (4)). This pattern has led to a change in the debt structure of riskier firms towards smaller banks. From a financial stability perspective the fact that riskier assets are now with multiple small banks rather than a few large banks might be desirable. However, if the monitoring of those riskier assets is not performed well by smaller banks or the more lenient supervisor, the net impact on financial stability is unclear. Meanwhile, the proportion of high PD firms' loans with smaller banks has increased by around 6% in the German economy since the SSM's implementation. The above results are for existing loans and since they cannot be sold or completely stopped before maturity, it would be reasonable to expect that risk-shifting patterns will become more pronounced for new loans.

We estimate the following equation to analyze patterns for new loans to riskier firms:

$$Log(loan)_{ijt} = \alpha_i + \alpha_t + (Post \times SSM)_{it} + (Post \times SSM \times High\ PD)_{ijt} + (High\ PD)_{jt} + \epsilon_{ijt} \tag{6}$$

where $High\ PD_{jt}$ is firms with PD in top quartile calculated at each quarter. We only include loans in the quarter in which they originated. This implies that we cannot include firm or firm $\times$ quarter fixed effects. $High\ PD_{jt}$ is included to close the specification. We find that the probability of a new loan being issued to a high risk borrower by an SSM bank relative to an non-SSM banks is 44.2 percent smaller following the SSM implementation (column (5)). Leaving out cluster 4-5 banks results in a even higher coefficient (column (6)).[19] Again, we re-estimate all results of Table 9 by also including SA banks to the control group in Table A.5. The estimated coefficients are slightly higher in magnitude compared to the previous results.

Importantly, this pattern of risk-shifting, in the long run, will lead to a situation where safer activities are supervised by stricter supervisors and riskier activities are supervised by more lenient supervisors.

6.2 Security Holdings

Another asset class to investigate are corporate bond holdings. We examine security-level holdings of German banks at the quarter level and we present evidence in the form of the market value of the holdings in euros. Different than loans, corporate bonds are highly liquid and can be sold off via OTC market or exchanges by banks in need of increasing their capital ratios as risk weights are high for corporate bonds as well. Since

[19]There can be a potential concern that increases in capital requirements brought in for globally and domestically systemically important banks could drive the lending results. We perform a robustness check in Appendix Table A.3 for this concern by removing Cluster 1-3 banks which had the additional capital requirements. We find that the results are very similar.

non-investment grade bonds tend to have higher risk weights, banks are incentivized to reduce their holdings of these risky bonds in response to higher capital requirements.

We estimate our main specification 1 and substitute the dependent variable with the logarithm of the end-quarter market value of each bond holding by each bank in euros. The results are reported in Table 10. Interestingly we do not find an impact for the overall level of bond holdings of the SSM introduction (column (1)). We next add the triple interaction term Post × SSM × Non-Investment Grade to this specification. Thus, we can test whether SSM banks and LSI banks substituted risky non-investment grade bonds with investment grade bonds that have lower risk weighted assets. Note that this specification allows us to add Bank × Quarter fixed effects to control for time-varying systematic differences between SSM and LSI banks. Since the SSM's implementation SSM banks have shed a large percentage of their non-investment-grade bond portfolios (riskier assets) and are now in smaller banks' portfolios (columns (2) and (3)). In columns (4) and (6) we replicate the previous analysis leaving out cluster 4-5 banks which basically yields very similar results. Overall, these findings illustrate that more risky assets are now shifted form banks under the stricter supervisor towards banks under the more lenient supervisor.

6.3 Real Effects through the Bank Lending Channel

Overall, we did not observe a reduction in aggregate loan supply Germany as a consequence of the SSM introduction. Good macroeconomic conditions in combination with low interest rates resulted in an expansion of credit by LSI banks, while we do not observe the same pattern for SSM banks. In fact, we documented that SSM banks reduced their loan supply by about 10 percent relative to LSI banks when controlling for loan demand. Firms which obtain most of their loans from SSM banks might by at a disadvantage compared to those firms that obtain most of their loans from LSI banks following the SSM introduction.[20]

In this section, we show that differences in supervisors can impact the real sector via the bank lending channel. Thus, supervision can impact firms' activities such as debt, sales, employment and investment. This analysis is based on credit register data merged with firm balance sheet data from Amadeus. We test in how far the share of loans obtained from SSM banks prior to the SSM introduction impact firms' activity in the subsequent years by estimating the following specification:

$$Y_{jt} = \alpha_j + \alpha_t + (Post \times SSM\ share)_{jt} + \epsilon_{jt} \tag{7}$$

[20]This argument is based on the existence of frictions that prevent banks switching banks when a relationship bank of the firm is constrained. Due to the important of asymmetric information, several empirical papers have documented that such frictions do play an important role in credit markets.

where j is firm and t is year (Amadeus data is at annual level). Y are variables of interest like log(debt), log(employment), log(fixed assets) and log(sales). The variable $SSMshare$ is the proportion of lending from SSM banks prior to the introduction of the SSM. In addition to firm and year fixed effects, we include industry × year, county × year, size bins × year (we divide the sample into 4 bins according to total assets) and age bins × year (we divide the sample into 4 bins according to the age of the firm) fixed effects to rule out any industry, county, size and age effects.

Results are reported in Table 11. A firm whose relationship banks are SSM banks obtain between 7.8% to 10.0% less debt compared to firms that have all loans from LSI banks prior to the SSM introduction (columns (1)-(2)). This difference in access to external finance impact firms their sales. We observe a similar drop by 4.1 % to 5.1% in sales by firms whose borrowing originates from SSM banks compared to firms that obtain all their funding from LSI banks(columns (7)-(8)). The difference in external fund provision also impacts corporate investments and employment. Fixed assets are lower for affected firms by 9.3 % (columns (5)-(6)). We observe a relative reduction in employment by 2.5 % for affected firms (columns (3)-(4)). These results imply that differences in banking supervision can have an impact on real economic outcomes. Since lending is more reduced to riskier firms, employment and investment of such firms will be reduced even more.

7 Euroarea Results

Previous evidence is based on supervisory data on Germany. What about the external validity of these findings? Can these findings be generalized for the other Euroarea countries? While we do not have detailed data available for these countries, we can estimate the average effect of the SSM introduction on risk-weight using balance sheet data of banks from SNL.

SNL data is only available for large banks that are generally under SSM supervision. However, as described in Section 2, there is variation among the composition of supervisors. Due to staff shortages within the ECB, only cluster 1-3 banks have been staffed with ECB supervisors while cluster 4-5 banks have been basically entirely staffed with NCA staff (besides the JST head). We exploit this variation in the composition of the JSTs to estimate the impact of the SSM within the sample of SSM banks. We estimate the following bank-level regression:

$$Y_{ict} = \alpha_i + \alpha_t + \delta(Post \times \ Cluster\ 1\text{-}3)_{it} + X_{ct} + \epsilon_{it} \tag{8}$$

where i is bank, c is country and t is year. We include GDP growth and log(GDP) as macro controls for each country. The dependent variable is total risk-weighted as-

sets/total assets (RWA/Aseets) using balance sheet data. The coefficient of interest δ measures how the average risk-weights of banks supervised with a higher fraction of non-NCA staff have changed in response to the SSM introduction compared to banks supervised with a higher fraction of NCA staff. Results are shown in Table 12. Cluster 1-3 banks whose supervisory teams were staffed by non-NCA staff, increased their risk-weighted asset ratio by about 3.2 percentage points compared to cluster 4-5 banks (column (1)). We do the same test, i.e. compare cluster 1-3 to cluster 4-5 banks, for our German data in Panel B of Table 12. Depending on the specification we obtain a magnitude of 2.8 to 4.0 percentage points which is exactly in the same range as the Euroarea result. In a next step, we test whether the supranational bank treated banks located in the CGIIPS countries (i.e. Cyprus, Greece, Ireland, Italy, Portugal and Spain) differently compared to banks located in the other Euroarea countries. Following the European sovereign debt crisis, banks located in these countries had been suspected to hold a large fraction of non-performing loans in their balance sheet. We add an interaction term to our Euroarea specification with a dummy taking a value of one if a bank is located in Cyprus, Greece, Ireland, Italy, Portugal and Spain and zero otherwise. This interaction term is close to zero and statistically insignificant indicating that the SSM did not treated banks located in the CGIIPS countries differently compared to banks located in the other Euroarea countries (column (2)). These results are in line with our previous observation that the SSM applied a standardized approach to the banks under its surveillance irrespective of the actual asset risk of these institutes.

Interestingly, European banking markets differ significantly in their concentration. While the French banking sector is basically dominated by three large banks, small regional banks hold a significant asset share in Germany. Given that the responsibility between the SSM and NCAs are determined based on a fixed cut-off rule based on banks' total assets (see Section 2 for details), the differences in banking market structure results different intensity of SSM supervision in the different markets. Countries with a more concentrated banking sector, like France, have shifted considerably a higher fraction of their banking assets to the tougher supranational SSM as compared to countries that have many small savings and cooperative banks like Germany. Consequently, 92% of banking assets have been supervised by the SSM, while in Germany only 67% of assets shifted to the supranational supervisor following the SSM implementation (see Table A.6). We replicate specification 8 and substitute the cluster 1-3 dummy with the percentage of assets supervised by SSM with the country. Table 12, column (3) reports the results. We compare the median country by the percentage of assets supervised by SSM with the country with the highest percentage of assets supervised by SSM. The difference between Germany and France is 25%. An increase in the percentage of assets supervised by SSM by 1% leads to an increase of RWA/A by 0.121% (column (3)) which implies that banks in

France observe an increase of RWs of 3.025% versus Germany. Again, we do not find that there has been any different treatment for banks located in CGIIPS countries (column (4)).

8 Conclusion

The establishment of the European Banking Union has been the most ambitious policy experiment in Europe since the introduction of the single currency. In the new regime, large banks are supervised by a supranational supervisor, while small banks remain under different local supervisors. Our findings document that this endeavor was successful in establishing a more standardized behavior which resulted in tighter supervision of larger institutes.

The impact of the supranational supervisor on financial stability in the Eurozone is not clear. Our results illustrate a shift of risky activities from large to small banks. This trend could be an intended consequence of the European Banking Union since it weakens the 'too big to fail' problem. However, in the new regime, smaller institutes under the more lenient supervisor hold considerably more risky positions on their balance sheets and took over significant market shares from the larger banks. In case smaller banks are not able to cope with holding more risky assets, the net effect on financial stability is a priori not clear.

Finally, there might be further issues associated with having different supervisors being responsible for different banks that operate in the same market. In case of a bank distress, coordination among these different supervisors might be problematic. Further motives for separation of supervisors such as supervisory competition and protection against collusive behavior have been suggested in the public economics literature ((Laffont and Martimort (1999)), Martimort (1999))). Further research is required to establish the trade-offs of the design of the new supranational supervision in Europe.

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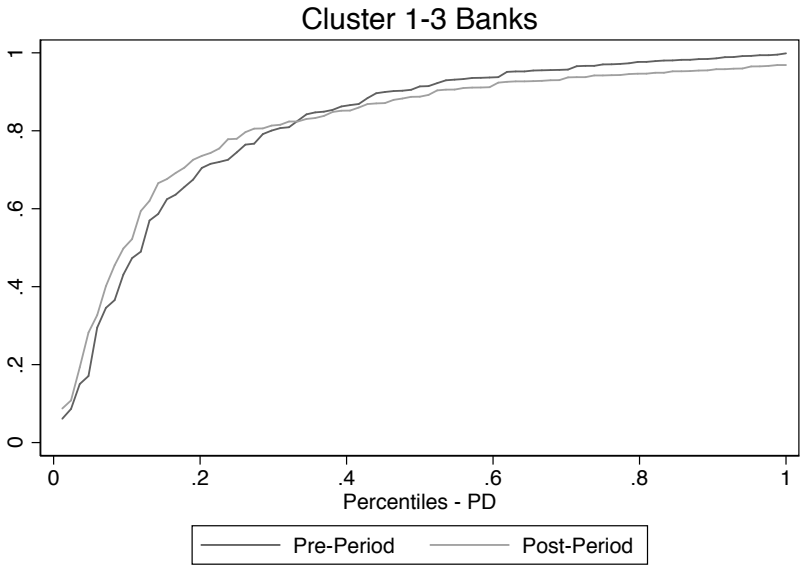
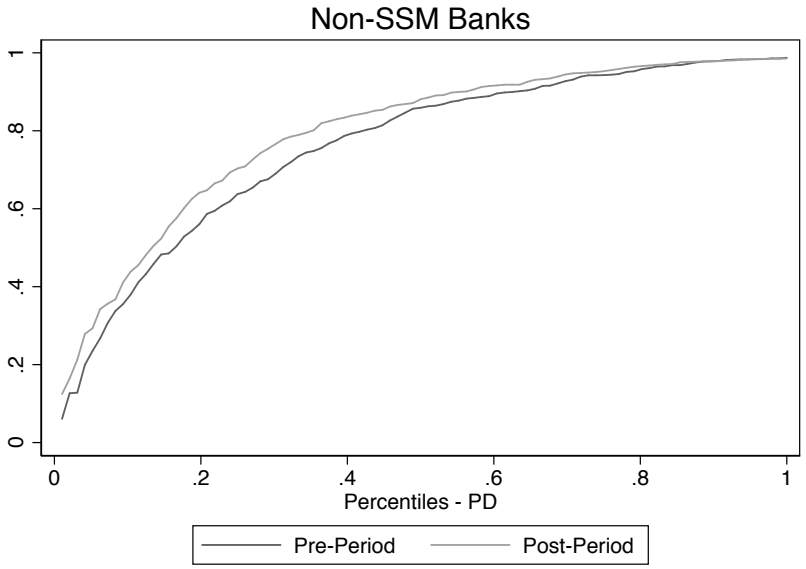
Figure 1: Model Performance - Cumulative Accuracy Profiles



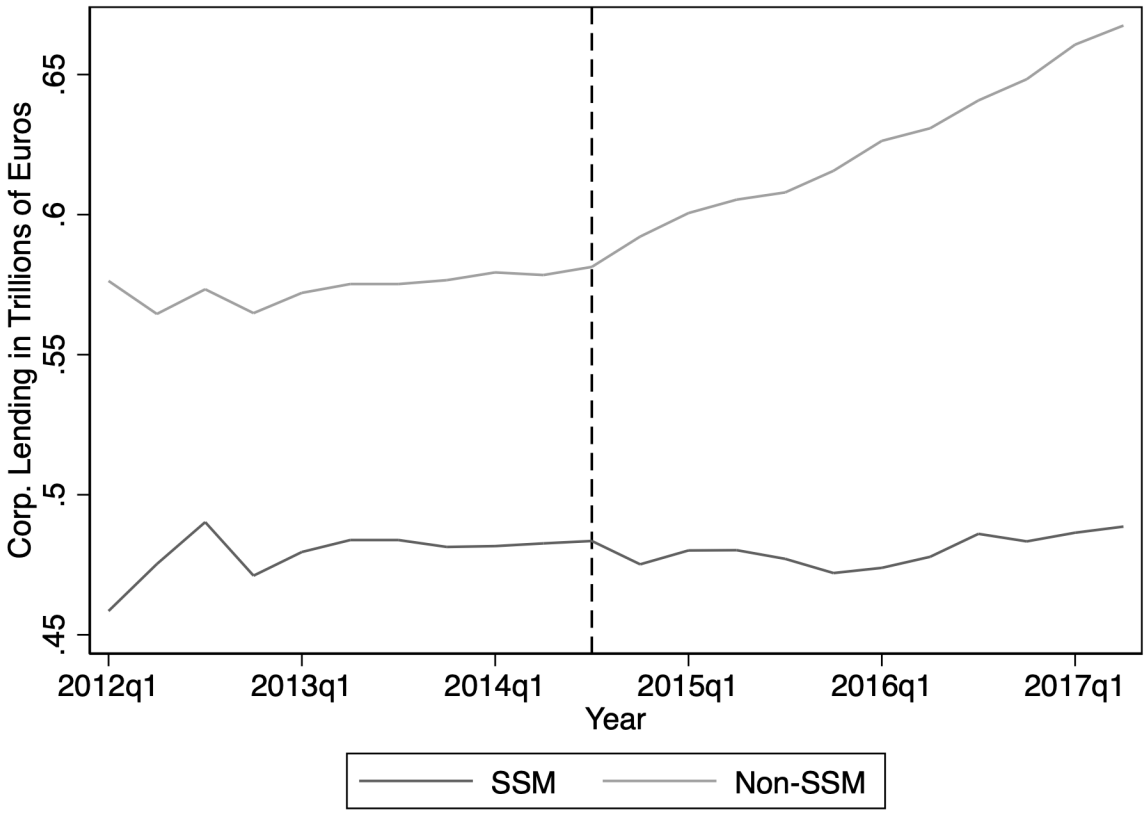
Panel A



Panel B

This figure plots the cumulative accuracy profile for the internal PD models of cluster 1-3 banks and non-SSM banks before (2012 - 2014) and after (2014 - 2017) the introduction of the SSM.

Figure 2: Aggregate Lending around the SSM implementation



We plot log(loans) normalised to the value of 1 for 2012 from 2012 to 2017 for SSM and Non-SSM banks in the graph. The dotted vertical line at 2014 mark the year immediately before the implementation of the SSM.

Table 1: Descriptives

Sample is IRB banks and descriptives are provided from the period before the implementation of SSM. Panel A shows descriptive statistics for the groups of SSM and Non-SSM banks. An SSM bank is one that is supervised by the SSM and Non-SSM is supervised by national competent authority. Panel B shows summary statistics for loans in the German credit register. Panel C contains information on holdings at security level of sample banks from Bundesbank's Security Holdings Statistics Database. Panel D contains information for matched sample of 22,925 firms with the credit register. Firm balance sheet information is obtained from Amadeus Database. Panel E provides bank-level details for the Euroarea sample. Panel F provides test of means from before and after implementation of SSM and Difference-in-Difference coefficients.

Panel A: Bank Descriptives				
	SSM banks (29 banks)		LSI banks (14 banks)	
	Mean	S.D.	Mean	S.D.
Bank Assets (billion euros)	205.418	364.103	23.927	29.410
Capital Ratio	0.114	0.132	0.126	0.167
Bank equity (ROA)	0.702	0.574	0.698	0.611

Panel B: Loan Descriptives				
	SSM banks (50,110 firms)		LSI banks (5,457 firms)	
	Mean	S.D.	Mean	S.D.
Loan size (million euros)	71.368	1814.777	18.597	428.046
RWA to Loan Ratio	0.468	0.441	0.492	0.489
Probability of Default	0.0170	0.0517	0.0175	0.0408
Collateral to Loan Ratio	0.879	0.441	0.913	0.398
Probability of Default	0.0170	0.0517	0.0175	0.0408

Panel C: Security Holdings Descriptives				
	SSM banks (40,506 bonds)		LSI banks (3,080 bonds)	
	Mean	S.D.	Mean	S.D.
Corp.bond holdings (million euros)	9.777	20.454	10.637	17.542

Panel D: Firm descriptives				
	SSM Firms (20,880 firms)		Non-SSM Firms (2,045 firms)	
	Mean	S.D.	Mean	S.D.
Debt (million euros)	262.400	3096.769	219.706	2620.349
Employees	3070.375	26621.660	1962.138	19621.130
Fixed assets (million euros)	656.690	8004.121	416.645	4538.384
Sales (million euros)	1656.205	14096.065	1240.510	9205.645

Panel E: Euroarea Data				
	Cluster 1-3 (222 banks)		Cluster 4-5 (76 banks)	
	Mean	S.D.	Mean	S.D.
Bank Assets (billion euros)	656.21	575.32	43.97	36.49

Panel F: Difference-in-Difference coefficients			
	SSM banks	Non-SSM banks	
	After - Before	After - Before	Dif-in-Dif
RWA to Loan Ratio	0.057***	-0.012	0.069***
	(0.002)	(0.013)	(0.014)
Log(PD)	0.057***	-0.006	0.063***
	(0.002)	(0.006)	(0.006)

Table 2: Differences Between Supervisors: SI vs. LSI

The dependent variables are risk-weights, loan loss rates and log of probability of default in columns 1-3, 4-6, and 7-9, respectively. Post × SSM is a dummy which is 1 for SSM bank after the implementation of SSM and 0 otherwise. Robust standard errors adjusted for double clustering at the bank and firm level are reported in parentheses. Note: * indicates statistical significance at the 10% level, ** at the 5 % level and *** at the 1% level.

Dependent Variable:	Risk-Weights			Loss Rates			PDs		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Post × SSM	0.073***	0.099***	0.071***	0.0003	-0.0003	-0.0002	0.066***	0.049**	0.041**
	(0.027)	(0.038)	(0.027)	(0.0002)	(0.0010)	(0.0008)	(0.015)	(0.019)	(0.016)
Adj. R-squared	0.692	0.495	0.801	0.944	0.754	0.964	0.713	0.601	0.842
Obs.	1,043,270	321,648	321,648	1,043,270	321,648	321,648	1,045,360	336,440	336,440
Bank FE	Yes	Yes	-	Yes	Yes	-	Yes	Yes	-
Firm FE	Yes	-	-	Yes	-	-	Yes	-	-
Quarter FE	Yes	-	-	Yes	-	-	Yes	-	-
Firm × Quarter FE	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes
Bank × Firm FE	No	No	Yes	No	No	Yes	No	No	Yes

Table 3: Differences Between Supervisors: Cluster 1-3 vs. LSI

The dependent variables are risk-weights, loan loss rates and log of probability of default in columns 1-3, 4-6, and 7-9, respectively. Post × Cluster 1-3 is a dummy which is 1 for Cluster 1-3 SSM bank after the implementation of SSM and 0 otherwise. Robust standard errors adjusted for double clustering at the bank and firm level are reported in parentheses. Note: * indicates statistical significance at the 10% level, ** at the 5 % level and *** at the 1% level.

Dependent Variable:	Risk-Weights			Loss Rates			PDs		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Post × Cluster 1-3	0.095***	0.135***	0.084***	0.0000	-0.0011	-0.0010	0.082***	0.050*	0.083***
	(0.025)	(0.036)	(0.027)	(0.0002)	(0.0010)	(0.0008)	(0.019)	(0.030)	(0.028)
Adj. R-squared	0.664	0.466	0.784	0.936	0.752	0.958	0.720	0.554	0.833
Obs.	750,241	210,331	210,331	750,241	210,331	210,331	748,250	223,094	223,094
Bank FE	Yes	Yes	-	Yes	Yes	-	Yes	Yes	-
Firm FE	Yes	-	-	Yes	-	-	Yes	-	-
Quarter FE	Yes	-	-	Yes	-	-	Yes	-	-
Firm × Quarter FE	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes
Bank × Firm FE	No	No	Yes	No	No	Yes	No	No	Yes

Table 4: Differences Between Supervisors: Within Cluster Test

The dependent variables are risk-weights, loan loss rates and log of probability of default in columns 1-3, 4-6, and 7-9, respectively. Post × High Intl. is a dummy which is 1 for Cluster 3 banks that have subsidaries in non-euro area countries after the implementation of SSM and 0 otherwise. Robust standard errors adjusted for double clustering at the bank and firm level are reported in parentheses. Note: * indicates statistical significance at the 10% level, ** at the 5 % level and *** at the 1% level.

Dependent Variable:	Risk-Weights			Loss Rates			PDs		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Post × High Intl.	0.023***	0.035***	0.022**	0.0001	0.0007	0.0005	0.018*	0.016**	0.010***
	(0.006)	(0.012)	(0.011)	(0.0001)	(0.0005)	(0.0003)	(0.010)	(0.008)	(0.003)
Adj. R-squared	0.695	0.518	0.805	0.966	0.841	0.986	0.756	0.596	0.895
Obs.	342,243	72,825	72,825	342,243	72,825	72,825	362,849	81,982	81,982
Bank FE	Yes	Yes	-	Yes	Yes	-	Yes	Yes	-
Firm FE	Yes	-	-	Yes	-	-	Yes	-	-
Quarter FE	Yes	-	-	Yes	-	-	Yes	-	-
Firm × Quarter FE	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes
Bank × Firm FE	No	No	Yes	No	No	Yes	No	No	Yes

Table 5: Pre-Period Cross-Section Comparison

The dependent variables are risk-weights, loan loss rates and log of probability of default in columns 1-4, 5-8, and 9-12, respectively. Bank Size is a dummy which is 1 for SSM banks and 0 otherwise. Bank Losses is a dummy which is 1 for banks which have above the median loan loss ratio in the preceding quarter. Robust standard errors adjusted for double clustering at the bank and firm level are reported in parentheses. Note: * indicates statistical significance at the 10% level, ** at the 5 % level and *** at the 1% level.

Dependent Variable:	Risk-Weights				Loss Rates				PDs			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Bank Size	-0.082***	-0.111***			0.006***	0.008***			-0.022**	-0.013		
	(0.012)	(0.017)			(0.001)	(0.002)			(0.011)	(0.011)		
Bank Losses			-0.001	0.003			0.001	0.001			-0.004	0.005
			(0.008)	(0.012)			(0.001)	(0.001)			(0.018)	(0.010)
Sample	All	Excl. Cluster 4-5	All	Cluster 3	All	Excl. Cluster 4-5	All	Cluster 3	All	Excl. Cluster 4-5	All	Cluster 3
Adj. R-squared	0.446	0.457	0.830	0.841	0.802	0.802	0.825	0.773	0.573	0.560	0.814	0.795
Obs.	173,500	111,250	152,357	37,851	173,500	111,250	157,196	41,716	181,343	118,645	152,357	37,851
Firm × Quarter FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Bank × Firm FE	No	No	Yes	Yes	No	No	Yes	Yes	No	No	Yes	Yes

Table 6: Post-Period Cross-Section Comparison

The dependent variables are risk-weights, loan loss rates and log of probability of default in columns 1-4, 5-8, and 9-12, respectively. Bank Size is a dummy which is 1 for SSM banks and 0 otherwise. Robust standard errors adjusted for double clustering at the bank and firm level are reported in parentheses. Note: * indicates statistical significance at the 10% level, ** at the 5 % level and *** at the 1% level.

Dependent Variable:	Risk-Weights		Loss Rates		PDs	
	(1)	(2)	(3)	(4)	(5)	(6)
Bank Size	0.010	-0.008	0.001	0.001	0.035	0.034
	(0.028)	(0.030)	(0.001)	(0.001)	(0.023)	(0.024)
Sample	All	Excl. Cluster 4-5	All	Excl. Cluster 4-5	All	Excl. Cluster 4-5
Adj. R-squared	0.421	0.420	0.715	0.708	0.617	0.582
Obs.	149,730	100,328	149,730	100,328	158,207	106,382
Firm × Quarter FE	Yes	Yes	Yes	Yes	Yes	Yes

Table 7: Model Performance: Standard Deviation of PDs

The dependent variable is standard deviation of probability of default. Post × Cluster 1-3 is a dummy which is 1 for Cluster 1-3 SI bank after the implementation of SSM and 0 otherwise. Robust standard errors adjusted for double clustering at the bank and firm level are reported in parentheses. Note: * indicates statistical significance at the 10% level, ** at the 5 % level and *** at the 1% level.

	All PDs	Low PDs	High PDs
	(1)	(2)	(3)
Post × Cluster 1-3	-0.060***	-0.089***	-0.025
	(0.018)	(0.023)	(0.022)
Adj. R-squared	0.700	0.747	0.690
Obs.	720	720	720
Bank FE	Yes	Yes	Yes
Quarter FE	Yes	Yes	Yes

Table 8: Consequence of differences between supervisors: Lending

The dependent variable in all regressions is log(loan). Post × SSM is a dummy which is 1 for SSM bank after the implementation of SSM and 0 otherwise. Post × Cluster 1-3 is 1 for SSM banks that are part of cluster 1-3 after the implementation of SSM and 0 otherwise. Robust standard errors adjusted for double clustering at the bank and firm level are reported in parentheses. Note: * indicates statistical significance at the 10% level, ** at the 5 % level and *** at the 1% level.

	SSM vs Non-SSM			Cluster 1-3 vs non-SSM		
	(1)	(2)	(3)	(4)	(5)	(6)
Post × SSM	-0.036***	-0.060**	-0.103***			
	(0.013)	(0.030)	(0.025)			
Post × Cluster 1-3				-0.034**	-0.110***	-0.140***
				(0.014)	(0.038)	(0.029)
Adj. R-squared	0.768	0.434	0.813	0.764	0.441	0.805
Obs.	1,147,105	423,639	423,639	833,756	289,305	289,305
Bank FE	Yes	Yes	-	Yes	Yes	-
Firm FE	Yes	-	-	Yes	-	-
Quarter FE	Yes	-	-	Yes	-	-
Firm × Quarter FE	No	Yes	Yes	No	Yes	Yes
Bank × Firm FE	No	No	Yes	No	No	Yes

Table 9: Consequence of differences between supervisors: Risk-Shifting in Lending

The dependent variable in all regressions is log(loan). Post × SSM is a dummy which is 1 for SSM bank after the implementation of SSM and 0 otherwise. Post × Cluster 1-3 is 1 for SSM banks that belong to cluster 1-3 after the implementation of SSM and 0 otherwise. Pre-Event High PD is 1 for firms which have PD in top quartile before the implementation of SSM. High PD is 1 for firms which have PD in top quartile calculated in each quarter. Robust standard errors adjusted for double clustering at the bank and firm level are reported in parentheses. Note: * indicates statistical significance at the 10% level, ** at the 5 % level and *** at the 1% level.

	Existing Loans				New Loans	
	SSM vs Non-SSM		Cluster 1-3 vs LSI		SSM vs Non-SSM	Cluster 1-3 vs LSI
	(1)	(2)	(3)	(4)	(5)	(6)
Post × SSM	-0.080***		-0.114***		0.121	0.183
	(0.024)		(0.026)		(0.234)	(0.259)
Post × SSM × Pre-Event High PD	-0.100**	-0.153***	-0.080	-0.118**		
	(0.043)	(0.043)	(0.057)	(0.055)		
Post × Cluster 1-3						
Post × Cluster 1-3 × Pre-Event High PD						
Post × SSM × High PD					-0.442**	-0.557***
					(0.183)	(0.211)
Post × Cluster 1-3 × High PD						
High PD					-0.294***	-0.295**
					(0.099)	(0.124)
Adj. R-squared	0.819	0.821	0.814	0.815	0.429	0.452
Obs.	336,440	336,440	223,094	223,094	21,278	15,019
Bank FE	-	-	-	-	Yes	Yes
Firm FE	-	-	-	-	No	No
Quarter FE	-	-	-	-	Yes	Yes
Firm × Quarter FE	Yes	Yes	Yes	Yes	No	No
Bank × Firm FE	Yes	Yes	Yes	Yes	No	No
Bank × Quarter FE	No	Yes	No	Yes	No	No

Table 10: Consequence of differences between supervisors: Risk-Shifting in corporate bond holdings

The dependent variable in all regressions is log(bond holdings). Post × SSM is a dummy which is 1 for SSM bank after the implementation of SSM and 0 otherwise. Non-Investment Grade is 1 for bonds which have rating of Ba or lower from Moody's. Robust standard errors adjusted for double clustering at the bank and bond level are reported in parentheses. Note: * indicates statistical significance at the 10% level, ** at the 5 % level and *** at the 1% level.

	SSM vs Non-SSM			Cluster 1-3 vs LSI		
	(1)	(2)	(3)	(4)	(5)	(6)
Post × SSM	-0.061	0.126		0.007	0.232**	
	(0.085)	(0.094)		(0.099)	(0.109)	
Post × SSM × Non-Investment Grade		-1.112***	-1.156***		-1.368***	-1.439***
		(0.135)	(0.142)		(0.175)	(0.175)
Adj. R-squared	0.416	0.416	0.422	0.371	0.372	0.379
Obs.	99,676	74,090	74,090	61,748	48,114	48,114
Bond × Quarter FE	Yes	Yes	Yes	Yes	Yes	Yes
Bank × Bond FE	Yes	Yes	Yes	Yes	Yes	Yes
Bank × Quarter FE	No	No	Yes	No	No	Yes

Table 11: Consequence of differences between supervisors: impact on firms

The sample includes credit register matched firms with Amadeus from 2012 to 2017. Post × SSM Firm is a dummy which is 1 for firms that obtain loan only from SSM banks after the implementation of SSM and 0 otherwise. Robust standard errors adjusted for clustering at the firm level are reported in parentheses. Note: * indicates statistical significance at the 10% level, ** at the 5 % level and *** at the 1% level.

	Log(debt)		Log(employees)		Log(fixed assets)		Log(sales)	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Post × Pct. Lending from SSM Banks	-0.078***	-0.100***	-0.017***	-0.025***	-0.086***	-0.093***	-0.041***	-0.051***
	(0.011)	(0.013)	(0.004)	(0.005)	(0.008)	(0.009)	(0.009)	(0.010)
Adj. R-squared	0.693	0.699	0.932	0.932	0.888	0.892	0.909	0.908
Obs.	78,109	68,425	90,965	79,108	88,323	77,698	43,105	36,409
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	-	Yes	-	Yes	-	Yes	-
Industry × Year FE	No	Yes	No	Yes	No	Yes	No	Yes
County × Year FE	No	Yes	No	Yes	No	Yes	No	Yes
Size Bins × Year FE	No	Yes	No	Yes	No	Yes	No	Yes
Age Bins × Year FE	No	Yes	No	Yes	No	Yes	No	Yes

Table 12: Euroarea Results

Panel A has includes Eurozone banks' balance sheet information from 2012 to 2017 and Panel B includes German banks' data from the credit register. Post × Cluster 1-3 is 1 for SSM banks that belong to cluster 1-3 after the implementation of SSM and 0 otherwise. Post × Percentage Asset SSM is a dummy which is percentage of assets supervised by SSM in that country after the implementation of SSM and 0 otherwise. Robust standard errors adjusted for clustering at the bank level are reported in parentheses. Note: * indicates statistical significance at the 10% level, ** at the 5 % level and *** at the 1% level.

Panel A: Euroarea Results				
Dependent Variable	RWA/Assets			
	(1)	(2)	(3)	(4)
Post × Cluster 1-3	0.032**	0.038**		
	(0.013)	(0.015)		
Post × Cluster 1-3 × CGIIPS		-0.016		
		(0.014)		
Post × Percentage Assets SSM			0.121***	0.138***
			(0.044)	(0.043)
Post × Percentage Assets SSM × CGIIPS				-0.012
				(0.016)
Adj. R-squared	0.925	0.925	0.926	0.926
Obs.	1745	1745	1745	1745
Bank FE	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes
Macro Controls	Yes	Yes	Yes	Yes
Panel B: Germany Results				
Dependent Variable	Risk-Weights			
	(1)	(2)	(3)	
Post × Cluster 1-3	0.028***	0.037***	0.040***	
	(0.010)	(0.009)	(0.008)	
Adj. R-squared	0.651	0.478	0.779	
Obs.	961,287	286,440	286,440	
Bank FE	Yes	Yes	-	
Firm FE	Yes	-	-	
Quarter FE	Yes	-	-	
Firm × Quarter FE	No	Yes	Yes	
Bank × Quarter FE	No	No	Yes	

Internet Appendix for:

"Supranational Supervision"

Appendix A Additional Tables

Table A.1: Institutional Setup - Staff shortage

Supervisor/Institution	Quote	Date	Source
European Commission	"**Some concerns however arose** in relation to certain structural aspects of the framework that could affect JSTs' efficiency in practice, such as uncoordinated reporting lines, language problems and **insufficient staff allocation**"	2017	Report from the Commission to the European Parliament and the Council on the SSM
European Parliament	"**More involvement of ECB personnel and less reliance on staff from NCAs would improve the independence of supervision,** together with the use of staff from the competent authority of one Member State to supervise an institution from another Member State."	2017	Banking Union Annual Report
European Court of Auditors	"**JSTs are still largely staffed by nationals of the originating NCAs.**"	2016	European Court of Auditors report on SSM
European Central Bank	"**It was necessary to reinforce the staffing related to the direct supervision of significant banks, most notably for the small and medium-sized significant banks.**"	2016	ECB Annual Report on Supervisory Activities
Sabine Lautenschläger	"**Basically we need more supervisors for the small and medium-sized banks which we supervise directly.**"	2015	Member of ECB's Executive Board

Table A.2: Differences between supervisors: RWs - Robustness Checks

The dependent variable in all regressions are risk-weights. Post × SSM is a dummy which is 1 for SSM bank after the implementation of SSM an 0 otherwise. Column 1 restricts the sample to banks below 50 billion euros in assets, Column 2 restricts the sample to banks below 30 billion euros in assets and performs a placebo test with 15 billion euros as the cutoff, Column 3 excludes observations between announcement and implementation of SSM, column 4 excludes largest 3 banks, Column 5 excludes the largest 7 banks, Column 6 restricts the sample to unsecured loans, and Column 7 restricts the sample to unsecured loans without guarantees. Robust standard errors adjusted for double clustering at the bank and firm level are reported in parentheses. Note: * indicates statistical significance at the 10% level, ** at the 5 % level and *** at the 1% level.

	≤ 50 Bn euros	≤ 30 Bn euros	Excl. AQR	Excl. largest 3 banks	Excl. largest 7 banks	Non-Collateral	Non-Collateral & Non-Guarantee
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Post × SSM	0.041**		0.078**	0.064***	0.060***	0.068***	0.059***
	(0.017)		(0.040)	(0.024)	(0.022)	(0.024)	(0.018)
Post × ≥ 15 Bn euros		0.002					
		(0.024)					
Adj. R-squared	0.811	0.834	0.780	0.816	0.823	0.824	0.829
Obs.	6,007	4,524	216,148	160,249	65,200	220,154	84,385
Firm × Quarter FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Bank × Firm FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Table A.3: Consequence of differences between supervisors: Risk-Shifting in Lending - Robustness Check

The dependent variable in all regressions is log(loan) and we exclude Cluster 1-3 banks from the sample since they had an increase in capital requirements due to other regulations. Post × SSM is a dummy which is 1 for SSM bank after the implementation of SSM and 0 otherwise. Pre-Event High PD is 1 for firms which have PD in top quartile before the implementation of SSM. High PD is 1 for firms which have PD in top quartile calculated in each quarter. Robust standard errors adjusted for double clustering at the bank and firm level are reported in parentheses. Note: * indicates statistical significance at the 10% level, ** at the 5 % level and *** at the 1% level.

	Existing Loans		New Loans
	(1)	(2)	(3)
Post × SSM	-0.011		-0.003
	(0.035)		(0.191)
Post × SSM × Pre-Event High PD	-0.153**	-0.193***	
	(0.072)	(0.072)	
Post × SSM × High PD			-0.478***
			(0.169)
High PD			-0.309**
			(0.137)
Adj. R-squared	0.819	0.824	0.267
Obs.	68,833	68,833	7,453
Bank FE	-	-	Yes
Firm FE	-	-	No
Quarter FE	-	-	Yes
Firm × Quarter FE	Yes	Yes	No
Bank × Firm FE	Yes	Yes	No
Bank × Quarter FE	No	Yes	No

Table A.4: Lending Results: including all banks in the control group

The dependent variable in all regressions is log(loan) and sample includes both SA and IRB banks. Post × SSM is a dummy which is 1 for SSM bank after the implementation of SSM and 0 otherwise. Robust standard errors adjusted for double clustering at the bank and firm level are reported in parentheses. Note: * indicates statistical significance at the 10% level, ** at the 5 % level and *** at the 1% level.

	(1)	(2)	(3)
Post × SSM	-0.099***	-0.180***	-0.145***
	(0.011)	(0.014)	(0.010)
Bank FE	Yes	Yes	-
Firm FE	Yes	-	-
Quarter FE	Yes	-	-
Firm × Quarter FE	No	Yes	Yes
Bank × Firm FE	No	No	Yes

Table A.5: Risk-shifting Results: including all banks in the control group

The dependent variable in all regressions is log(loan). Post × SSM is a dummy which is 1 for SSM bank after the implementation of SSM and 0 otherwise. Pre-Event High PD is 1 for firms which have PD in top quartile before the implementation of SSM. High PD is 1 for firms which have PD in top quartile calculated in each quarter. Robust standard errors adjusted for double clustering at the bank and firm level are reported in parentheses. Note: * indicates statistical significance at the 10% level, ** at the 5 % level and *** at the 1% level.

	Existing Loans		New Loans
	(1)	(2)	(3)
Post × SSM	-0.063**		0.128
	(0.026)		(0.256)
Post × SSM × Pre-Event High PD	-0.142***	-0.169***	
	(0.034)	(0.034)	
Post × SSM × High PD			-0.581***
			(0.211)
High PD			-0.295**
			(0.119)
Bank FE	-	-	Yes
Firm FE	-	-	No
Quarter FE	-	-	Yes
Firm × Quarter FE	Yes	Yes	No
Bank × Firm FE	Yes	Yes	No
Bank × Quarter FE	No	Yes	No

Table A.6: Percentage of banking assets supervised by SSM in 19 Eurozone countries.

Country	Percentage of banking assets supervised by SSM
Luxembourg	0.18
Malta	0.31
Ireland	0.39
Latvia	0.44
Austria	0.47
Slovenia	0.49
Slovakia	0.58
Estonia	0.62
Portugal	0.66
Germany	0.67
Lithuania	0.71
Cyprus	0.76
Belgium	0.79
Finland	0.81
Italy	0.86
Netherlands	0.89
Spain	0.89
France	0.92
Greece	0.95