Supranational Banking Supervision, Credit Supply and Risk-Taking: European Evidence from Multi-Country Credit Registers*

Carlo Altavilla **Miguel Boucinha** **Martina Jasova**
José-Luis Peydró **Frank Smets**

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Abstract

We show that supranational banking supervision can increase credit supply and contain risk taking, identifying the associated mechanisms. For identification, we exploit a novel dataset of multi-country credit registers and an institutional change from national to supranational supervision. Supranational supervision increases the supply of credit in financially stressed countries, while limiting the supply of credit to the riskiest (zombie) firms. The effects are driven by cross-country heterogeneity in national supervisory incentives toward the largest banks and local economy, lower national supervisory abilities, and a weaker overall domestic control of corruption. Moreover, supranational supervision further increases credit supply but also leads to more termination of loans in countries with weaker insolvency laws. The reduction of riskiest lending (consistently by freeing more bank capital) allows higher overall credit supply.

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*Altavilla: European Central Bank and CEPR, Email: Carlo.Altavilla@ecb.europa.eu; Boucinha: European Central Bank, Email: Miguel.Boucinha@ecb.europa.eu; Jasova: Barnard College, Columbia University. Email: mjasova@barnard.edu; Peydró: Imperial College London, ICREA-Universitat Pompeu Fabra- Barcelona GSE, and CEPR, Email: jose.peydro@gmail.com; Smets: European Central Bank, University of Ghent and CEPR, Email: Frank.Smets@ecb.europa.eu. We especially thank Maria Dimou and Francesca Caucci for the excellent research assistance. We would like to thank Diana Bonfim, Paul Bouscasse, Lorenzo Burlon, Jerry Caprio, Elena Carletti, Luisa Carpinelli, Andrea Fabiani, Kristopher Gerardi, Victoria Ivashina, Anil Kashyap, Anna Kovner, Natalya Martynova, Atif Mian, Giorgio Primiceri, Ricardo Reis, Lars Svensson, conference participants at the 2019 NBER Monetary Economics Program Meeting, 46th EFA Annual Meeting, ECB 2018 Annual Conference on Monetary Policy, 2018 Annual Meeting of the Central Bank Research Association (CEBRA), CEPR European Summer Symposium in International Macroeconomics (Spain), Central Bank of Ireland Workshop on "Banking, Credit and Macroprudential policy", and seminar participants at the Federal Reserve Board, Banque de France, Bank of Portugal, and the European Central Bank for their helpful comments. This project has received funding from the European Research Council (ERC) under the European Union's Horizon 2020 research and innovation programme (grant agreement No 648398). The opinions in this paper are those of the authors and do not necessarily reflect the views of the ECB or the Eurosystem.

1 Introduction

Public regulation is widespread in modern societies (Stigler, 1971; Tirole, 2014), but it requires effective supervision (Laffont and Tirole, 1993). Banking supervision is more challenging than for other industries (Dewatripont and Tirole, 1994; Myers and Rajan, 1998; Morgan, 2002), involving also bank lobbying activities and revolving doors between supervisors and (largest) banks (Johnson and Kwak, 2010; Acemoglu and Robinson, 2013). There is also an ample consensus that the 2008 financial crisis highlighted the limitations of the prevailing supervisory framework in preventing excessive risk-taking, which reignited a debate on supervisory changes (Dewatripont and Freixas, 2012), including the potential benefits of supranational supervision (Draghi, 2018). Although local (national) supervisors may have better information than more centralized (supranational) supervisors, they may adversely affect credit supply and excessive risk-taking because of differences in supervisory incentives toward the local economy and banks, supervisory abilities, or local "quid pro quo" corruption behavior between supervisors, banks and firms.

In this paper, we analyze the effects of supranational supervision on credit supply and risk-taking. For identification, we exploit: (i) a novel, unique, supervisory dataset consisting of the multi-country credit registers over an important time period from 2012 to 2017; (ii) the institutional change leading to supranational bank supervision for some banks in November 2014; and (iii) variation in financial (economic) distress, national supervisory ability, national supervisory incentives (toward the largest banks, firms and local economy) and overall domestic control of corruption, as well as differences in insolvency frameworks.

We show that supranational supervision increases the supply of credit in financially stressed countries. We also show that supranational supervision limits the supply of credit to the riskiest (zombie) firms. Results suggest that this lower risk-taking due to supranational supervision is driven by biased incentives of national supervisors toward local largest banks and the local economy as well as weaker overall domestic control of corruption, while for overall credit supply effects due to supranational supervision, national supervisory lower abilities are also crucial. Supranational supervision increases more credit supply but also leads to more loan terminations in countries with weaker insolvency laws. All this suggests a reduction in "extend and pretend" behavior, consistently freeing more bank capital to support a higher overall credit supply, particularly to more credit-worthy firms.

We exploit multi-country euro area credit registers comprising a unique confidential granular dataset collected in the context of the preparatory phase of the AnaCredit project by the European System of Central Banks. This represents the only dataset using multiple loan-level credit registers across numerous countries available during a crucial period, in which there was a change (for some banks) from national to supranational banking supervision as well as the euro area Sovereign Debt Crisis for some countries. Data frequency is biannual, covering loans to non-financial firms over the period from June 2012 to December 2017. We collapse our data at the *borrower-bank-time* level, with information on e.g., loan volume, bank size, borrower risk and industry.

The sample period used in the empirical analysis covers a key institutional change in Europe. In November 2014, the European Central Bank (ECB)'s Single Supervisory Mechanism (SSM) became operational, a crucial step toward the European Banking Union. We assess the effects of this institutional change by exploiting the associated heterogeneity in the time and cross-sectional dimension, since the change affected only a subset of euro area banks. Supranational banking supervision through the SSM inherited the tools from local authorities of participating Member States – the National Competent Authorities (NCAs).

We examine the effects of supranational supervision, as opposed to domestic supervision, on bank credit supply and risk-taking behavior. In the baseline analysis, we measure borrower riskiness as a ratio between credit exposures in arrears and total credit exposures directly from the credit registers. The definition of arrears is homogenous across countries and refers to the delayed principal amount and/or interest payments that are past due more than 90 days. We also collect financial data and construct three additional proxies for low borrower quality: (1) return on assets (*ROA*) to capture the firm's profitability, (2) the *sales-to-employee* ratio to proxy for the firm's productivity, and (3) the *z-score* to capture firm's risky leverage. Further, combining these three measures we construct a *zombie firm* proxy that identifies firms with simultaneously low values of ROA and sales-to-employee and z-score (high risky leverage).

Exploiting the granularity of data at the *borrower-bank-time* level is crucial to control for multiple sources of unobserved heterogeneity when analyzing credit supply and bank risk-taking. Controlling for borrower (demand side) fundamentals is important, even more in a period of stressed financial (and economic) conditions. Firm-time fixed effects exhaustively control for time-varying unobserved borrower fundamentals, proxying e.g., for firm-level credit demand,

growth opportunities and risk. As firm-time fixed effects require firms to borrow from at least two banks, we also use sector-time fixed effects to control for time-varying firm fundamentals using all firms in our sample. Moreover, as different banks (e.g., with different risk appetite) may be matched with different borrowers (e.g., in terms of credit-worthiness), bank-firm fixed effects are essential to control for bank-firm lending relationships. Overall, only a credit register allows for this type of identification.[1] Moreover, having multi-country credit registers is essential as the effects of supranational banking supervision may depend on countries' financial conditions. Given the euro area crisis, in some regressions, we conduct the empirical analysis separately for two groups of countries: financially "stressed" (Italy, Portugal, and Spain) and "non-stressed" (Austria, Belgium, France, Germany, Lithuania and Slovakia).[2]

We estimate the credit supply effects using Poisson regressions that allow us to consider the adjustments both on the intensive and extensive margin. Importantly, this set up addresses a potential censoring problem where banks can choose to terminate their lending to high-risk firms, i.e., it considers the importance of the extensive margin (loan terminations) directly in the baseline specification. Our identifying assumption is that in the absence of the centralized supervision, supranationally supervised (compared to other) banks would have followed parallel trends.

We start by examining the effects of the introduction of supranational banking supervision on overall credit commitment. The results show that supranational supervision increases the supply of credit to firms in stressed countries, while effects in non-stressed countries are less robust and, if anything, suggest a decrease in credit supply. Interestingly, the coefficient estimates show that after introducing fixed effects that help control for firm credit demand (bank-firm and firm-time fixed effects), the estimates remain positive, statistically and economically significant for stressed countries, while they turn negative and statistically significant for non-stressed countries.

We then present the heterogeneous analysis of credit supply to firms of different ex-ante riskiness. We find that the effect of supranational banking supervision on credit supply is positive

[1] In the robustness analysis we also control for additional bank-time fixed effects. Though these fixed effects do not allow us to identify credit supply due to supranational supervision (as this variable is at the bank-time level), it allows to identify risk-taking (credit supply reallocation) controlling for observed time-varying bank characteristics (such as bank profits, capital and liquidity) as well as unobserved ones (e.g., business models and risk appetite).

[2] This classification is normally used in the ECB and in academic analyses. This classification is consistent with defining as "stressed" – i.e., subject to high sovereign stress – countries whose 10-year sovereign yield exceeded 6% (or, equivalently, four percentage points above the German yield) for at least one quarter in our sample period.

for lower-risk firms (without credit in arrears); estimated effects suggest 5 to 8% higher credit supply volume in stressed countries, statistically significant with or without firm-time fixed effects (instead, estimated effects in non-stressed countries imply lower credit supply).

Importantly, we show that – in response to the introduction of supranational supervision – banks that become supranationally supervised in stressed countries reduce credit supply to high-risk firms (with a part of past credit in arrears). The reduction in risk-taking in stressed countries is robust across all empirical specifications. In terms of magnitudes, supranational supervision leads to a reduction in credit supply to a high-risk (compared to a low-risk) firm by 13% in stressed countries, comparing firms with credit quality at opposite extremes; for a one standard deviation change in credit quality, the corresponding figure is close to 2.4%. Instead, in non-stressed countries, we report insignificant effects in the baseline specification.

We also present results using event study plots with complete vectors of time dummies that alleviate potential concerns regarding parallel trends. These plots show that the credit supply response aligns with the timing of the introduction of supranational supervision. Banks in stressed countries that became subject to the new supranational supervisor increase credit supply to more credit-worthy firms and decrease the credit supply to high-risk firms as compared to the other banks. Effects line up with the timing of the supervisory changes at the end of 2014, i.e., the effects become significant only after the change in the supervision at the end of 2014 and not before.

We also document robust findings using additional proxies of borrower riskiness by using firms' profitability, productivity, and z-score, as well as their combination – a combined measure of low ROA, low productivity and higher risky leverage using firm z-score (i.e., a measure of zombie firms with high risky leverage and at the same time with low productivity and profits).[3] The effects are not only robust before versus after the ECB becomes the supervisor for some banks, but they are also statistically significant only (and immediately) after the ECB assumed supervisory duties, which aligns with the parallel trends assumption.

[3] We consider two different cut-offs to construct the measure of a zombie firm – i.e., the indicator takes the value of one if all three financial proxies rank in below median (or the lowest tercile) of the distribution of all firms in country c in year t, which corresponds to the worse 16% (or 7%) of firms in the sample. This particular high credit risk-taking of firms with high risky leverage and at the same time low profitability and productivity (as well as the baseline measure of past delinquent loans) has a negative connotation in theoretical models and in banking crises (e.g., Rajan, 1994; Caballero et al., 2008; Freixas and Rochet, 2008).

Guided by these credit supply and risk-taking effects, we next analyze the channels. Using a range of cross-country proxies and, when available, within-country regional measures, we explore the role of national supervisors' ability, national supervisors' incentives and domestic corruption. That is, supranational supervisors could increase credit supply and reduce risk-taking toward riskiest firms because of lower ability of national supervisors, or because of national supervisors' biased incentives toward local firms and banks, or due to weaker domestic control of corruption (including banks and supervisors quid pro quo behavior). These measures have substantial variation across all the euro area countries, and also within stressed and non-stressed countries.

First, we study the role of domestic control of corruption using a range of cross-country proxies and, when available, within-country regional proxies. We find that banks in countries with weaker domestic control of corruption decrease more credit supply to high-risk firms after being assigned the supranational supervisor. Additionally, when control of corruption is weaker, supranationally supervised banks increase more credit supply to firms which are more credit-worthy (less risky).

Second, we evaluate the role of incentives of national supervisors. We analyze both the differences in incentives related to banks (national supervisors might be more lenient toward the largest local banks) and firms (local supervisors might care about the local economy and turn a blind eye on excessive risk-taking involving low quality firms that generate high employment). We show that globally systemically important banks (GSIB) cut more their credit supply to the riskiest firms once supervision moves to the supranational level, consistent with local supervisors favoring the largest banks in stressed economies (where the economy performs poorly) in their lending to financially unhealthy firms. Our results also suggest that local supervisors care more about credit supply to firms in industries with higher share of employment, both in general and specifically via credit supplied by the largest banks.

Third, we analyze the role of the ability of national supervisors. We investigate whether bank credit supply and risk-taking are impacted when a national supervisor with lower ability is replaced by a supranational entity with access to a broader pool of knowledge. The results suggest that the transfer of supervisory duties from low-ability national supervisors to supranational supervisors limits more credit supply to high-risk firms and increases more credit supply to the rest of firms.

Finally, we present a horse-race of supervisory incentives, ability and corruption. We find that national supervisory incentives and overall domestic control of corruption yield strong and

consistent results in reducing risk-taking toward the riskiest firms, while we document only limited support for national supervisors' ability hypothesis for credit supply effects to the riskiest firms – nonetheless, this supervisory ability channel has strong effects for credit supply to more credit-worthy firms. We also report consistent and robust findings when we further control for all possible interactions with time-varying sovereign CDS spreads.

Finally, we present additional analysis on the role of insolvency laws and resolution of zombies. We find that the positive effects of supranational supervision on credit supply (including containing risk-taking toward riskiest firms) are stronger in countries with weaker insolvency laws, and the associated higher credit supply happens despite that there are also more terminations of existing loans, i.e., a decrease in the "extend and pretend" behavior, consistent with freeing bank capital to allow for a higher overall credit supply (to more credit-worthy firms).

Contribution to the literature. We contribute to the growing literature focusing on the link between prudential banking supervision and bank lending decisions, including zombie lending. We show that supranational supervision (stronger supervision) can increase the supply of credit overall, and we also provide evidence on why this is the case. The results show that supranational supervision increases the supply of credit to firms in stressed countries (while effects in non-stressed countries are less robust and, if anything, suggest a decrease in credit supply). Moreover, the effects of supranational supervision stem from limiting the supply of credit to the riskiest firms in financially stressed countries due to national supervisory biased incentives, lower national supervisors' ability, and weaker overall domestic control of corruption. Furthermore, the effects of supranational supervision on credit supply are stronger in countries with weaker insolvency laws, and the associated higher credit supply of supranational supervision happens despite that there are also more terminations of existing loans (i.e., a decrease in the "extend and pretend" behavior), all consistent with freeing bank capital to support higher overall credit supply (to more credit-worthy firms). It is important to highlight that our findings imply novel and important results, revealing strong cross-country heterogeneity in credit supply and risk-taking. Moreover, we uncover the underlying mechanisms, which are only possible in our settings with multiple credit registers across numerous countries during a pivotal period –that is, during these economically difficult times controlling for economic borrower fundamentals is crucial if we want to isolate credit supply, and hence (multiple) credit registers are essential.

Our paper most closely relates to the seminal contribution of Agarwal et al. (2014) who analyze supervisory decisions of U.S. banking federal vs. state supervisors and find that federal regulators are tougher than state regulators on reporting past risk.[4] Our paper addresses a different but related question (in a different setting with higher variation across states, e.g., in insolvency frameworks), thereby providing novel insights. We show how supranational supervision affects credit supply. We contribute by showing that supranational supervision does increase the supply of credit in financially stressed countries. Supranational supervision reduces credit supply to high-risk firms, while increasing credit supply to more credit-worthy firms. Similar to Agarwal et al. (2014), we show that differences in supervisory incentives play a key role. We further contribute by exploiting variation across differently financially stressed countries and by showing that national supervisors favor the largest banks turning a blind eye on lending to financially unhealthy firms, especially in areas with weaker overall domestic control of corruption. We further contribute by showing that lower ability of domestic supervisors and insolvency frameworks also play a crucial role.

We also contribute to the growing recent literature focused on the effect of supervisory changes in Europe (Ampudia et al. 2022; Bonfim et al., 2022; Fiordelisi et al., 2017, Haselmann et al., 2022; Passalacqua et al., 2020).[5] Specifically, in the context of stressed countries, Passalacqua et al. (2020) find that banks that are subject to onsite supervisory inspections in Italy cut credit supply overall driven by a cut of credit to the very high-risk firms. Similarly, Bonfim et al. (2022) document that onsite inspections limit zombie lending in Portugal. We contribute to this literature by analyzing the impact of the introduction of supranational banking supervision, and showing that banks subject to the supranational supervisor can increase overall credit supply, while cutting credit supply to high-risk (zombie) firms.[6] Therefore, the overall effects of credit supply are

[4] In theory, supranational supervision may overcome coordination failures connected to the supervision of the large multinational banks (Calzolari et al. 2019); in addition, the allocation of supervisory powers and responsibilities may also influence bank decisions (Dell'Ariccia and Marquez, 2006).

[5] Our paper also relates to evidence outside of the context of the euro area. Acharya et al. (2018) show that bank stress test in the U.S. reduce credit supply particularly to risky borrowers. Granja and Leuz, (2023) conclude that stricter regulatory oversight can lead to an expansion in lending. A lower level of supervisory attention leads to an increase in banks' willingness to take risk (Kandrac and Schlusche, 2019). Focusing on heterogeneity across banks, some studies find that because large banks receive more attention from supervisors, they tend to hold less risky loans and are less sensitive to industry-specific fluctuations (Eisenbach et al., 2016; 2017; Hirtle et al. 2018). With respect to these papers, we analyze a different supervision change: the transition from national to supranational supervision.

[6] Extensive literature on zombie lending practices has shown that banks may choose to renew their loans to keep high-risk, financially borrowers alive and to avoid recognizing losses on their balance sheets (Peek and Rosengren 2005; Giannetti and Simonov 2013; Acharya et al. 2021).

different in the two different settings: transition from local to supranational supervision vs. onsite supervisory audits. Our findings reveal that supranational supervision increases the supply of credit to firms in stressed countries, while for non-stressed countries the results, if anything, suggest a decrease in credit supply. Relatedly we also contribute to this literature by showing that credit supply reallocation from high-risk zombie firms to more credit-worthy firms is only present in the financially stressed countries (Italy, Spain and Portugal), while we report null effects for non-stressed countries. Moreover, differences in national supervisory incentives, national supervisory ability, and domestic control of corruption are key in rationalizing these lending effects.

Our paper also relates to Haselmann et al. (2022) who analyze the introduction on supranational supervision – but in this case only in Germany – and find that while local supervisors provide preferential treatment to larger banks, the supranational supervisor reduces this bias. We contribute by providing novel results, including strong differences in credit supply and risk-taking from supranational supervisors across stressed vs. non-stressed countries, as well as evidence on the role of supervisory incentives and ability as mechanisms. We also show that national supervisors allow higher supply of credit toward riskiest firms by the largest local banks. These effects are more pronounced in financially stressed countries, particularly concerning the largest local banks' lending to firms in industries that make the highest contributions to employment. Regarding other channels, our cross-country data e.g. allows us to identify a channel of corruption that might not be salient in Germany (the country with the strongest control of corruption in the sample) but our results suggest that it also plays a key role in understanding results over a broader set of countries.

Finally, our paper also provides evidence on the channels through which supervision affects bank credit supply and risk-taking. Specifically, we find that the main drivers of the results associated to the change in the supervisory responsibility (from national to supranational) are related to quality of the institutions in the country where banks operate (Acemoglu, Johnson, and Robinson, 2005) and to the differences in incentives toward firms (Agarwal et al., 2014) and large systemically important banks (Carletti et al., 2016; Repullo, 2017). Furthermore, we highlight the importance of insolvency frameworks and resolution of zombies (Becker and Ivashina, 2021).

The rest of the paper is organized as follows. Section 2 summarizes the supervisory change, while Section 3 describes the data. Sections 4 to 6 present the results on credit supply, risk-taking and the different channels. Section 7 briefly concludes.

2 Centralized supervision in the euro area

On the 4th of November 2014, centralized supervision became operational in the euro area through the establishment of the Single Supervisory Mechanism (SSM). Since then, while the local authorities of participating countries – the National Competent Authorities (NCAs) – continue to supervise banks that are classified as "less significant", the European Central Bank (ECB) is responsible for direct supervision over the so-called "significant institutions". For a bank to be included in the list of significant institutions supervised by the SSM it should meet any of the following criteria: (i) total assets exceed €30 billion; (ii) the ratio of total bank assets over GDP of the participating Member State exceeds 20%; (iii) the bank is among the three largest credit institutions in a participating Member State; (iv) total assets exceed €5 billion and the ratio of its cross-border assets in more than one other participating country to its total bank assets is above 20%; (v) the institution has requested or received funding from the European Stability Mechanism or the European Financial Stability Facility.

Supranational banking supervision through the SSM inherited the prudential tools from national supervisory authorities which can be activated to ensure the safety and soundness of the European banking system. These tools include carrying out supervisory reviews (including stress tests), conducting on-site inspections and investigations, granting or withdrawing banking licenses, authorizing banks' acquisitions of qualifying holdings, ensuring compliance with EU prudential rules, setting higher capital requirements ("buffers") in order to counter financial risks, and imposing corrective measures and sanctions. There are, however, potential improvements in the effectiveness of the overall supervisory process following the new institutional setting, connected to the reallocation of responsibilities among supervisory authorities.

3 Datasets

The analysis uses a unique confidential granular credit dataset collected in the context of the preparatory phase of the AnaCredit project by the European System of Central Banks. Importantly, this is the only credit register dataset available for more than one country over this pivotal time period and it covers a broad set of European countries. The euro area countries included are: Austria, Belgium, Germany, Spain, France, Ireland, Italy, Lithuania, Latvia, Malta, Portugal,

Slovenia and Slovakia. Some countries are excluded from the analysis due to data availability and quality issues (these are Ireland, Latvia, Malta and Slovenia).

Data collection is biannual and covers the period from June 2012 to December 2017. The dataset includes information on important bank and borrower characteristics such as credit volume (including both drawn and undrawn committed credit), borrower risk, the sector of activity of the borrowers and bank size. We also match this information with firm and bank balance sheet data. Online Appendix Table A.2 shows, for each country, the reporting threshold of the individual credit register, the initial number of observations available in the dataset and the final number of observations remaining after cleaning and harmonizing the data by dropping inconsistent information and reporting errors.[7] Moreover, the dataset is restricted to exposures to non-financial corporations, and to (drawn and undrawn) lending, dropping debt securities. Finally, we harmonize the unit of observation to borrower-bank-time, as some credit registers do not report different loans between the same firm and bank in a time period.

Given the significant heterogeneity in the euro area economies, we conduct key empirical analyses separately for two groups of countries: financially "stressed" (Italy, Portugal, and Spain) and "non-stressed" (Austria, Belgium, France, Germany, Lithuania and Slovakia). This classification is normally used in the ECB and in academic literature covering this period, and is consistent with defining a country as "stressed" – that is, subject to high sovereign stress – if a country's 10-year sovereign yield exceeded 6% (or, equivalently, four percentage points above the German yield) for at least one quarter in our sample period.

Table 1 reports the summary statistics for the main variables used in the empirical analysis over the available sample for the two groups of countries. Significant cross-country heterogeneity emerges when looking at the average loan volumes (the total loans and credit lines at the borrower level in euro thousands) with the average credit granted in stressed countries being substantially lower than the one in non-stressed countries: 550 vs. 2,100 thousand euro, respectively. This difference in part reflects the higher reporting thresholds in non-stressed countries (as reported in Online Appendix Table A.2). With that said, as we document in the robustness section our results

[7] To be precise, we drop banks with less than 100 borrowers and banks for which information on borrower quality is missing for more than half the observations.

are robust to different thresholds.[8] The baseline analysis considers the *total credit* (the sum of drawn and undrawn credit). We further present the robustness analysis using only *drawn credit*.[9]

We examine whether the level of direct supervision – either centralized (i.e., conducted by a supranational authority) or local (i.e., conducted by a national supervisory authority) – influences bank credit supply, including risk-taking. To this end, we construct an indicator variable Supranational supervision (*Sup*) that takes value one for banks supervised at supranational level after November 2014, and zero for banks supervised at country level. As discussed in Section 2, the establishment of the SSM impacted banks that met the "significant institution" criteria. For banks under centralized supervision (exposed banks) vs. local supervision (unexposed banks), while there are expected differences in firm size due to the SSM criteria and consistently in capital ratios (exposed banks are larger and at 90% confidence level less capitalized), there are no statistically significant differences in their NPL ratios, liquidity ratio, NFC credit (to asset ratio) or ROA.

High-risk firm variable indicates, for each borrower, the ratio between credit exposures in arrears and total credit exposures. The definition of arrears is homogenous across countries and refers to the delayed principal amount and/or the delayed interest payments that are past due more than 90 days. In line with the difference in the economic performance of the two groups of countries, the mean default frequency is larger for stressed countries (5%) than for non-stressed countries (3%).

In addition to riskiness of borrowers obtained from the credit registers, we collect financial data from Orbis and construct three additional proxies for low borrower quality: (1) return on assets (*ROA*) to capture the firm's profitability, (2) the *sales-to-employee* ratio to proxy for the firm's productivity, and (3) the z-score. The first two measures are commonly associated with the identification of zombie firms, while the latter provides a more comprehensive measure of firm riskiness, including risky leverage.

[8] We provide robustness results using the highest reporting credit register threshold of EUR 1,000,000 (credit register of Germany) as well as the second highest reporting credit register threshold (credit register of Austria). The rest of the thresholds are very similar across countries.

[9] Table 1 reports that summary statistics for drawn credit are very similar to the ones of the total credit.

Further, we also combine the three measures and construct a cumulative zombie firm proxy that identifies firms with low values of ROA and low sales-to-employee and low z-score jointly.[10] We consider two different cut-offs to construct the measure of a *zombie firm* – i.e., the indicator takes the value of one if all three financial proxies rank in below median of the distribution of all firms in country *c* in year *t,* which corresponds to the worse 16% of firms in the sample. We also present a robustness zombie firm indicator that identifies firms for which all three financial proxies rank in the bottom tercile of the distribution of all firms in country *c* in year *t,* which corresponds to the worst 7% of firms in the sample.

Finally, to examine the underlying channels in the second part of the paper, we match the credit registers with additional datasets that allow us to exploit differences of domestic control of corruption, national supervisory ability, and insolvency frameworks. First, we use cross-country variation in Control of Corruption, Regulatory Quality, and Rule of Law based on the World Bank's World Governance Indicators (WGI). Second, we add regional differences in regional control of corruption based on the European Quality of Government Index (Charron et al., 2022). Third, we use data from the Bank Regulation and Supervision Survey (BRSS) and construct proxies to assess the ability and human capital of national supervisors. Fourth, we complement the dataset with the World Bank's Doing Business report and examine the Insolvency score and Recovery rate score.

Overall, we observe noteworthy differences across these measures. For instance, while Germany ranks highest in domestic control of corruption and haw a very strong quality of its insolvency framework, it falls within the middle of the distribution concerning supervisory ability. Importantly, it is not the case that non-stressed countries necessarily rank above stressed ones. For example, Portugal has the second-best insolvency framework, and Spain and Italy report higher insolvency scores compared to France. Similarly, while France ranks among the top three countries with the strongest control of corruption, it is positioned at the lower end of the cross-country distribution in terms of supervisory ability and insolvency scores.

[10] Note that though z-score is related to leverage, volatility and average profits, the variables low ROA and low z-score provide complementary information, the correlation of these two measures is low, and hence combining these measures significantly reduces the number of riskiest firms.

4 Credit supply, risk-taking and banking supervision

4.1 Methodology

We analyze the effects of supranational supervision, as opposed to country-level supervision, on bank credit supply and risk-taking behavior, by estimating the following model:

$$\text{Credit}_{b,f,t} = \alpha^{FE} + \delta \text{Sup}_{b,t-1} + \theta \text{High-Risk Firm}_{\text{f,t-1}} + \beta\left(\text{High-Risk Firm}_{f,t-1} \times \text{Sup}_{b,t-1}\right) + \epsilon_{b,f,t}. \quad (1)$$

The dependent variable ($Credit_{b,f,t}$) is the total credit granted (drawn and undrawn) by bank b to firm f at time t where credit is either positive or zero (i.e., both the intensive and extensive margins). The model includes a variable that accounts for the level of supervision of each individual bank. More specifically, $Sup_{b,t-1}$ is a dummy variable that takes value of one for banks directly supervised by the SSM ($bank\ b \in SSM$) after November 2014 and zero otherwise:

$$\text{Sup}_{b,t} = \begin{cases} 1 \ if\ b \in \text{SSM and } t \geq \text{November 2014} \\ 0 \qquad\qquad \text{otherwise} \end{cases}$$

The estimated coefficient of *Sup* identifies the overall supply of credit. We are agnostic to the sign of the estimated coefficient. On the one hand, as credit in general implies an exposure to risk, tougher supranational supervision may imply a reduction of the supply of credit. On the other hand, by allowing less credit supply to riskier firms (see interaction below) supranational supervision may free bank capital to allow for overall higher credit supply.

The explanatory variable $High\text{-}Risk\ Firm_{f,t-1}$ is a measure of borrower riskiness. In the baseline it is constructed for each borrower as the ratio between credit exposures in arrears and total credit exposures, and it ranges between zero – when firms have no arrears – and one – when all of the firm's exposures are in arrears. We also present results using alternative measures of borrower's riskiness including profitability (ROA), productivity (sales-to-employee ratio) and z-score, as well as combination of all these firm measures for low-quality firms (in which each of these measures is below the median or the lowest tercile).

Moreover, the specification also includes an interaction term between borrower riskiness and bank supervision ($High\text{-}Risk\ Firm_{f,t-1}\ x\ Sup_{b,t-1}$). Regarding risk-taking, the main hypothesis we

want to test is whether the risk-taking behavior of banks is affected by the change in the allocation of responsibilities between national and supranational supervisors. If banks reduce credit supply to borrowers with higher riskiness once they become supervised by the SSM, then we expect a negative coefficient on the interaction term ($\beta < 0$). On the other hand, as said above, better supervision can lead to more lending and hence potentially higher risk-taking.

We further saturate the model with different sets of fixed effects (FE) to control for shocks to the demand for credit. In the baseline specification, we introduce firm-time fixed effects to control for time-varying unobserved firm characteristics (including proxies for firm-level credit demand, growth opportunities and risk factors), thereby ensuring that the results capture bank (credit supply side) variation (Khwaja and Mian, 2008). A possible caveat of including firm-time fixed effects is that this restricts the analysis to firms with multiple lending relationships. Appendix Figure A.1 shows the share of borrowers with multiple lending relationships, ranging from around 40 to close to 90%. In order to also capture firms with single lending relationships, we also estimate specifications using sector-time – rather than firm-time – fixed effects to account for time-varying unobserved heterogeneity in demand and risk across sectors. The sectors of economic activity are grouped according to the 2-digit NACE2 industrial classification (i.e., we have 99 sectors).

In addition, bank-firm fixed effects control for possible (time-invariant) non-random matching between lenders and borrowers. The inclusion of these fixed effects implies that our estimates are identified by the time variation in lending within a bank-firm relationship. An example for why these controls may be important is that a bank's ex-ante assessment of the creditworthiness of a borrower may persistently differ from that of another bank: a bank might simply believe that a firm is relatively safe (or have private information on it) and thereby be more willing to lend to it. At the same time, a firm might have a persistent preference toward a specific bank. That is, these bank-firm fixed effects account for lending relationships (Freixas and Rochet, 2008).

In the robustness analysis we also control for additional bank-time fixed effects. Though these fixed effects do not allow us to identify credit supply due to supranational supervision (as this variable is at the bank-time level), a key question for our paper, these fixed effects allow to identify risk-taking (credit supply reallocation) controlling for observed time-varying bank characteristics (such as bank profits, capital and liquidity) as well as unobserved ones (e.g., business models and risk appetite).

In our empirical model, we exploit the change in the supervisory process from national to supranational, for exposed versus non-exposed banks (the latter remained supervised at the country level). We estimate the credit supply effects using Poisson regressions that allow us to consider the adjustments both on the intensive and extensive margin. Importantly, this set up addresses a potential censoring problem where banks can choose to terminate the lending to a high-risk firm altogether, i.e., it considers the importance of the extensive margin (exits) directly in the baseline specification.[11] We cluster standard errors at bank and firm level.

Our identifying assumption is that in the absence of the introduction of the centralized supervision, supranational supervised as compared to the other banks would have followed parallel trends. We expand the Model (1) into the dynamic set-up to provide support to the parallel trends assumption. Specifically, we estimate the sequence of coefficient estimates β^k and δ^k from estimating a dynamic version of Model (1). We present these estimates in event study plots of our results for the complete vector of time dummies for *Sup* (δ^k) and *Sup x High-risk firm* estimates (β^k).

4.2 Main findings

We start by examining the effect on the introduction of supranational supervision on overall bank credit supply at the loan-level. That is, we estimate Model (1) without the interaction of supranational supervision with ex-ante firm risk, but only analyzing the effects of *Sup* on credit. We progressively saturate that specification with different set of fixed effects, starting from no fixed effects and then adding stepwise sector-time FE, bank-firm FE, and finally firm-time FE. Table 2 summarizes the results. We find that supranational supervision increases the supply of credit to firms in stressed countries, while effects in non-stressed countries are overall less robust and they suggest a decrease in credit supply. The coefficient estimates show that after introducing fixed effects that help control for credit demand (bank-firm and firm-time fixed effects), the coefficients estimates remain positive and statistically and economically significant for stressed countries (though they decrease in magnitude), while they turn negative and statistically significant

[11] Additionally, we also present results using alternative methodology using changes in borrower quality. To this end, we present results that analyze the effect of the change in high-riskiness on change in credit supply using the symmetric growth rate of credit. Similar to the Poisson regression, such setup also accommodates for both intensive and extensive margin (loan initiations and terminations).

for non-stressed countries.[12] Figure A.4 shows that results are only significant after the ECB takes over as supranational supervisor for some banks, i.e. consistent with the parallel trends assumption.

Guided by this evidence, we focus on the heterogeneous analysis as summarized by Model (1). We examine whether centralized supervision, as opposed to country-level supervision, influences bank credit supply and risk-taking behavior.

Table 3 presents the main findings. The effect of supranational banking supervision ($Sup_{b,t-1}$) on credit supply is positive for lower-risk firms (without credit in arrears). Estimated effects suggest 5 to 8% higher credit supply volume in stressed countries, statistically significant with or without firm-time fixed effects, while in non-stressed countries estimated effects imply lower credit supply by 6 to 9%.[13]

The negative and statistically significant coefficient of $High\text{-}Risk\ Firm_{f,t-1}\ x\ Sup_{b,t-1}$ for both specifications in stressed countries indicates that after the ECB takes over on supervision for some banks, supranationally supervised banks decrease credit supply to high-risk borrowers. In non-stressed countries, we report a statistically significant effect only in the specification with sector-time fixed effects. The effect is however massively reduced and becomes statistically insignificant in column (4) that uses firm-time fixed effects.

In terms of magnitudes, the baseline coefficient in column (2) of Table 3, where we fully control for unobserved heterogeneity at the firm-time level to better identify credit supply, indicate supranational supervision leads to a reduction in credit supply to a high-risk (compared to low-risk) firm by 13% in stressed countries, comparing firms with credit quality at opposite extremes; for a one standard deviation change in credit quality, the corresponding figure is close to 2.4%. Conversely, for non-stressed countries, the estimated coefficient in this specification is not economically or statistically significant (column (4)).

[12] We report similar results for only drawn credit in Table A.3. Relatedly, in Appendix Table A.8, we aggregate credit data at the bank-level and show that the introduction of centralized supervision is associated with an increase in overall lending for banks exposed to the change in the law in stressed countries, and a decrease in non-stressed countries. This pattern holds both for total credit and drawn (balance sheet) credit. For this result, however, it is crucial to control for country-time fixed effects, which suggests that a local measure of economic/firm fundamentals (very aggregate as country-time fixed effects, or in loan level data firm-time effects) is important for the size of the estimated coefficients (note that these are financially stressed countries and hence controlling for economic fundamentals, demand side, is important).

[13] For non-stressed countries, as in Table 2 for overall effects, credit supply effects for not high risky firms are not fully robust, see Table 4.

Furthermore, Figure 1 presents event study plots of our results for the complete vector of time dummies for *Sup* and *Sup x High-risk firm* estimates. Panel (a) shows the plots for stressed countries while Panel (b) reports the plotted estimated for non-stressed countries.

The top plot of Panel (a) presents the baseline estimates using the *High-risk firm* proxy for borrower riskiness. The figure illustrates that, prior to the introduction of supranational supervision, the lending dynamics supported the parallel trend assumption. In response to the introduction of supranational supervision, banks in stressed countries that became subject to the new supranational supervisor increased credit supply to low-risk firms (upward-sloping blue line plotting the full set of *Sup* time dummies) and decreased the credit supply to high-risk firms (downward-sloping red line plotting the full set of *Sup x High-risk firm* time dummies). In Panel (b), we report the full event study plots for non-stressed countries. Similarly, to the baseline regression results (Table 3), we find zero response of credit supply to high-risk firms.

4.3 Robustness

In this section, we present a battery of robustness tests using sample restrictions, drawn credit, different credit thresholds as well as inclusion of higher-order fixed effects or alternative empirical specifications.

As discussed in Section 2, bank size is one of the main criteria used to define the set of institutions subject to supranational supervision. We therefore define a robustness exercise where we focus the analysis on a subset of banks which, despite limited size heterogeneity, are assigned to different supervisory authorities. This subset includes the three largest locally supervised banks and the three smallest centrally supervised ones for each country. The choice of three banks is motivated by the fact that the law defines this as the minimum number of supranationally supervised banks in each country. The results of this exercise are shown in columns (1) and (2) of Table 4. Risk-taking results are strong and statistically significant for the stressed countries only.

Our main results consider all credit commitments by banks therefore including both drawn and undrawn credit (e.g., undrawn credit lines) in order to fully capture lending decisions by banks (as changes in drawn credit is more subject to firm demand). However, one might wonder whether results would change in case only actually drawn credit is considered, i.e., the volume of loans outstanding. Columns (3) – (4) of Table 4 show that the credit drawn results are consistent with the total credit commitment.

Furthermore, in columns (5) and (6) of Table 4, we provide the estimates using the highest reporting threshold among credit registers in the sample (EUR 1,000,000, which is the one for the German credit register).[14] In addition, Appendix Table A.9 reports consistent findings using the second highest reporting credit register threshold (credit register of Austria). Results are robust using these sample restrictions.

Moreover, we present additional robustness tests in the Online Appendix. Most notably in columns (1) – (3) Table A.4., we document the reduction of credit supply for high-risk firms in stressed countries is robust to the inclusion of bank-time fixed effects which further control for any observable and unobservable time-varying bank characteristics. We show consistent results for main sample, the subset of six banks per country around the regulation threshold, drawn credit and the alternative measures of firm risk. Note that as we not only use firm-time and firm-bank but also bank-time fixed effects, we cannot identify the overall credit supply but only the supply of credit to high-risk (versus low-risk) firms associated with supranational banking supervision.

Finally, Appendix Table A.5. present an analysis using *changes* in borrower quality. To this end, we present results that analyze the effect of the change in high-riskiness on change in credit using the symmetric growth rate of credit as the dependent variable, defined as:

$$\frac{Credit_{f,b,t}-Credit_{f,b,t-1}}{0.5(Credit_{f,b,t}+Credit_{f,b,t-1})}$$

Similar to the Poisson regression, this setup accommodates loan initiations and terminations and has been widely used in micro-level data firm-data studies (Davis et al., 1996) and more recently this is commonly applied in the credit analysis (e.g., Chodorow-Reich, 2014; Gomez et al., 2021). In this case, the coefficient of interest is about how supranational supervision changes the change in credit supply to firms with changing credit quality. The results of this analysis are reported in Table A.5 and indicate that the introduction of centralized supervision is associated with a decrease in credit supply changes for borrowers with deteriorating quality. Similar to the baseline level analysis, the estimates for banks in stressed countries are strongly economically and statistically significant in both specifications. Conversely, for banks in non-stressed countries, the risk-taking estimates are not statistically significant.

[14] See Table A.2 for reporting thresholds of every credit register. Thresholds below the Austrian credit register are very similar across countries, and hence we do not report with lower thresholds.

4.4 Alternative proxies of borrower riskiness

In the baseline analysis, we proxy for borrower riskiness using a share of credit in arrears to total credit. In what follows, we present results using additional proxies of borrower riskiness by using firms' profitability, productivity, and z-score (a measure of risky leverage), as well as their combination.

Table 5 presents estimates of all of the above listed measures of borrower risk. Panel (a) reports the coefficient estimates using low *ROA* in Columns (1) – (4) and low *sales-to-employee ratio* in Column (5) – (8). *ROA* is an indicator variable for whether a borrower's ROA ranks in the bottom quartile of the variable's distribution within the same country and year. Sales-to-employee is an indicator variable for whether a borrower's productivity (sales per employee) ranks in the bottom quartile of the variable's distribution within the same country and year.

We find that the interaction coefficient for both ROA and sales-to-employee ratio is negative and statistically significant in all specifications in stressed countries. Conversely, the effects for non-stressed countries are mostly positive and non-statistically significant from zero. Moreover, with respect to credit supply effects for low-risk firms, results suggest an increase in credit supply for supranational supervised in stressed countries, while effects for non-stressed countries are negative (and significant in some specifications), thus indicating (if anything) a decrease in credit supply.

Next, Panel (b) reports the findings for the two more complex proxies: z-score and zombie firm. The *z-score* estimates are standardized and inverted (i.e., for consistency, higher coefficient is associated with a lower z-score). Note that the z-score is a measure of risky leverage as it is related to leverage (equity) and it also takes into account profits and volatility of profits. Finally, *zombie firm* is a dummy that takes the value of one if each of the three measures (ROA, sales-employee and z-score) rank below the median of their respective distributions in the same country and year, and the zombie firm indicator identifies the riskiest 16.65% firms.[15]

Similar to the previous proxies, we find robust evidence that in response to the introduction of supranational supervision, exposed banks in stressed countries increase credit supply to less-risky

[15] Note that though z-score is related to leverage, volatility and average profits, the variables low ROA and low z-score provide complementary information, the correlation of these two measures is low, and hence combining these measures significantly reduces the number of riskiest firms.

(more credit-worthy) firms and decrease credit supply to high-risk, zombie firms. For non-stressed countries, we find the opposite effects, which is statistically significant for zombie firms (see column 8).[16]

Furthermore, we use all four additional firm proxies and provide a full set of time dummies of *Sup* and *Sup x High-Risk Firm* estimates for all of these proxies in Figure 1, and find consistent results. We also document robust findings when saturating the model with bank-time fixed effects (Table A.4). Finally, in the analysis, we consider two different cut-offs to construct the measure of a *zombie firm*. In the baseline, discussed above, the indicator takes the value of one if all three financial proxies rank below the median of the distribution of all firms in country *c* in year *t,* which corresponds to (approximately) the worse 16% of firms in the sample. We also present a robustness zombie firm indicator that identifies firms for which all three financial proxies rank in the bottom tercile of the distribution of all firms in country *c* in year *t,* which corresponds to (approximately) the worse 7% of firms in the sample. We report consistent results for the tercile cut-off, as shown in Online Appendix Table A.6. and the complete set of time dummies in Appendix Figure A.3.

5 Channels

In this section, we present the analysis of the channels behind the credit supply and risk-taking effects. We examine the role of national supervisory ability, national supervisory incentives (toward local firms and banks), and overall domestic control of corruption, using a range of cross-country proxies and, when available, within-country regional measures.

5.1 Corruption

In Table 6, we present an analysis focusing on the role of domestic corruption and governance quality. In Columns (1) – (3), we use cross-country variation in Control of Corruption, Regulatory Quality, and Rule of Law based on the World Bank's World Governance Indicators (WGI). In Column (4), we consider regional differences in control of corruption based on the European

[16] Moreover, in Panel B, with respect to credit supply effects for low-risk firms, results suggest an increase in credit supply for supranational supervised in stressed countries, while effects for non-stressed countries are negative and significant, thus indicating a decrease in credit supply.

Quality of Government Index (Charron et al., 2022). We augment Model (1) with the respective proxy of corruption and governance quality *Sup x Proxy* and *Sup x High-Risk Firm x Proxy*.

Column (1) of Table 6 reports a negative coefficient estimate for the triple interaction, which indicates that banks in countries with higher *ex-ante* corruption (weaker control of corruption) disproportionately decrease credit supply more to high-risk borrowers after being assigned the new supranational supervisor. Additionally, the interaction coefficient between banks that are supervised supranationally after the ECB takes over and high corruption index is positive and statistically significant, suggesting that supranationally supervised banks further increase the supply of credit to firms which are less risky. We observe consistent findings when considering cross-country differences in regulatory quality and rule of law in columns (2) and (3). Regarding economic effects, column (1) indicates that a one standard deviation increase in ex-ante corruption index implies that supranational supervision implies a further decrease of credit supply to high-risk firms of around 4.5%, while furtherly increasing credit supply to more credit-worthy firms by around 7%.

Additionally, we collect and match location data of firms with a measure of regional corruption. This allows us to conduct further corruption analysis across regions within the same country. We present these findings in column (4) of Table 6. As the geolocation data is available only for a subset of firms, the sample size decreases. However, the triple interaction of banks being supervised supranationally after the passage of the law, high-risk firm, and high local corruption proxy – our key coefficient of interest – remains negative and statistically significant. This result lends further support to the hypothesis that local supervisors tend to be more lenient toward bank lending to high-risk (financially unhealthy) firms in countries with weaker control of domestic corruption and lower institutional quality, suggesting the possibility of quid-pro-quo behavior among banks, high-risk firms and supervisors. This behavior substantially diminishes once the supranational supervisor assumes (for some banks) control of bank supervision.

5.2 Incentives

In Tables 7 and 8, we evaluate the role of incentives toward the local economy of national supervisors. We analyze both the differences in incentives related to banks (national supervisors might be more lenient toward the largest local banks) and firms (local supervisors might turn a blind eye on excessive risk-taking involving low quality firms that generate a lot of jobs).

First, Table 7 presents the analysis of incentives toward banks. Similar to the corruption analysis, we expand Model (1) with a proxy of bank size*:* *Sup x Proxy* and *Sup x High-Risk Firm x Proxy*. Panel (a) summarizes the results using the indicator variable denoting globally systemically important banks (GSIB), where this definition comes from the euro area (we analyze the effects for the sample of stressed and non-stressed countries). Next, Panels (b) and (c) present the analysis for GSIB as well as other bank size cutoffs (we analyze the effects for the sample of stressed countries and all countries, respectively). The key coefficients of interest are the triple interaction of banks supervised after the ECB takes over as supranational supervisor for some banks, high-risk firms and a large bank dummy, and the double interaction of banks being supranationally supervised and a large bank indicator.

In Panel (a), we report that, in response to the introduction of supranational supervision, GSIBs disproportionately decrease the supply of credit to high-risk firms. The effects are strong economically speaking, doubling the magnitude of the effects of other banks after the introduction of supranational supervision. The negative and statistically significant triple interaction coefficient is robust across all three specifications for stressed countries. However, we observe null (or even positive) effects for GSIBs in non-stressed countries.

In Panel (b), we present the analysis for GSIB as well as additional bank size cutoffs (total assets exceeding EUR 500bn, 400bn, 300bn, and 200bn, as well as the largest bank in each country) for the sample of stressed countries. We report a consistent negative and statistically significant coefficient of the triple interaction for very large banks up to the EUR 300bn cutoff (Columns (1) – (4)). In Column (5), we find that the difference is no longer statistically significant at the EUR 200bn cutoff or for other lower unreported thresholds, suggesting that only the largest banks drive the extra additional effects.[17]

In Panel (c), we pool all countries together and repeat the analysis for all bank size cutoffs. The main findings reported in stressed countries remain robust also for the full sample of countries; the only difference is that we find statistically significant effects for the largest bank only in stressed countries.

[17] Note that banks being supervised by the ECB were above the EUR 30 billion threshold for all the main countries, which gives us enough variation in the data.

Overall, the bank size analysis shows that local supervisors in stressed countries tend to display more leniency toward excessive risk-taking by very large local banks. The findings from Panels (a) and (b) further suggest that national supervisors favor the largest lenders in stressed countries where the economy is performing poorly and supervisors have an incentive to turn a blind eye on lending to financially unhealthy firms. Instead, our result reveal that the supranational entity does not share the same incentives regarding the importance of locally large banks in credit supply to high-risk (financially unhealthy) firms within stressed economies.

Second, Table 8 explores differences in incentives toward non-financial firms. We start by testing the hypothesis that local supervisors might allow excessive risk-taking in bank-lending activities, especially if it promotes lending to industries employing a large number of workers. To this end, we use the industry (NACE 2) classification directly from the credit register and match it with data on the share of total employment in a respective NACE 2 industry to the total employment in country *c* at time *t*. This allows us to split the sample into loans provided to firms in industries with large (above median) employment share and small (below median) employment share.[18]

In Columns (1) – (2), we focus on firms in industries with large employment share and find that the interaction coefficient between banks being supervised supranationally after the ECB takes over as a centralized supervisor and high-risk firm is negative and statistically significant in both stressed and non-stressed countries (although the coefficient is double for loans in stressed countries as compared to non-stressed countries). Columns (3) and (4) report that this effect is statistically and economically smaller (stressed countries) or null (non-stressed countries) for firms operating in industries characterized by smaller employment shares. The increase in the estimated coefficient for stressed countries for industries with above vs. below median size of employment is around 100%. This suggests that following the introduction of supranational supervision, a crucial shift in the risk-taking behavior within bank lending activities occurs for firms contributing significantly more to employment, aligning the results further with the local supervisors' incentives (toward the local economy) hypothesis.

[18] In Online Appendix Table A.7, we also present the robustness using directly firm-level employment and split the sample into large vs. small firms. A limitation of the firm-level employment analysis is that the data is available only for a subset of firms covered in the Orbis database. As a result, in the main list of tables, we present the finding using industry level employment shares (at NACE 2 level) which covers the entire universe of the credit registers.

Next, in Columns (5) – (8), we present the analysis using a combination of incentives toward non-financial firms' employment and banks. We augment the specifications presented in Columns (1) – (4) with a triple interaction term including the GSIB dummy (*Sup* x *High-Risk Firm* x *GSIB*). Taking the two margins together, we find that strongest reduction in risk-taking occurs in stressed countries where large (GSIB) banks disproportionately reduce credit supply to high-risk firms in high employment share industries, as evidenced by the large negative statistically significant triple interaction coefficient estimate in Column (5). Moreover, effects on employment are driven by firms within industries with higher employment but not driven by the largest firms (see Appendix Table A.7). Taken together all these sets of results, we find strong robust evidence in support of the national supervisory incentives hypothesis toward the local economy.

5.3 Ability

Next, we analyze the role of the ability of the national supervisor. We explore the cross-country differences in the ability of local supervisors and investigate whether bank credit supply and risk-taking are impacted when a national supervisor with lower ability is replaced by a supranational entity with access to a broader pool of knowledge. To this end, we use data from the Bank Regulation and Supervision Survey (BRSS) and construct three proxies to assess the ability and human capital of national supervisors*:* (i) the ratio of supervisors with post-graduate degrees (MBA, CPA, CFA, etc.), (ii) the number of hours dedicated to training at the regulatory agency, and (iii) the ratio of bank supervisors to the number of banks in each country. For consistency purposes, we standardize all three proxies and invert the measure so that the higher values are associated with *Lower (Supervisory) Education*, *Lower (Supervisory) Training* and *Lower (Supervisory) Examiner Ratio*, respectively. Similar to the previous channel analysis, we augment Model (1) with the respective proxy of lower supervisory ability *Sup x Lower Sup Ability* and *Sup x High-Risk Firm x Lower Sup Ability.*

Table 9 reports the results. The coefficient estimate of the triple interaction of banks being supranationally supervised after the ECB takes over*,* high-risk firm and low-ability local supervisor is negative and statistically significant across all three specifications, thus suggesting that transfer of supervisory activities from low-ability local supervisors to supranational supervisors limits credit supply to high risk (financially unhealthy) borrowers, while the coefficients of the double interaction *Sup x Lower Sup Ability* indicates that the supranational

supervisor further increases overall credit supply to low-risk firms if the national supervisor has low ability.

Similar to the corruption channel, results show that, once supranational supervisors take over, credit supply to riskiest firms is reduced, consistent with freeing bank capital to support an increase in overall credit supply (to the rest of the firms). Regarding economic effects, column (1) indicates that a one standard deviation decrease in ex-ante local supervisors ability implies that supranational supervision implies a further decrease of credit supply to riskier firms of around 9.2% (4.2% and 8.2% in columns (2) and (3) respectively), while further increasing credit supply to more credit-worthy firms by around 18.3% (6.7% and 9% in columns (2) and (3) respectively).

5.4 *Horse-race of competing channels*

Finally, Table 10 presents a horse-race between corruption, incentives and ability. To analyze the horse-race of the three channels, we use one measure for each channel, which is the strongest measure (in terms of economic and statistically significance) for each channel presented in Tables 6, 7 and 9. Column (1) – (3) report the horse-race of every pair of the competing channels respectively and Column (4) presents the complete analysis of all three explanations.

We find that national supervisory incentives and domestic control of corruption yield strong and consistent results in reducing risk-taking toward the riskiest firms, and are key in rationalizing the lending effects documented in the first part of the paper. Lower national supervisor ability for the reduction of credit supply to unhealthy firms when transitioning to supranational supervision (though significant alone) is less robust when horse racing with the other measures. Nonetheless, the supervisory ability channel is important and robust in increasing the supply of credit to the high credit-worthy firms. Finally, we also report consistent, robust findings when we further control for all possible interactions with time-varying sovereign CDS spreads.

Taken together, our results indicate that our core findings that supranational supervision leads to better credit supply allocation is because of national supervisory biased incentives, lower national supervisory ability and weaker overall control of domestic corruption.

6 Resolution of zombies and insolvency frameworks

In this section, we present additional analysis on the role of insolvency frameworks and resolution of zombies. We explore the differences in insolvency frameworks in the cross-section of euro area countries. Using the World Bank annual Doing Business report, we consider two proxies: *Insolvency score* (the main indicator) and *Recovery rate score*. There are interesting cross-country variations in the country-level measures. For example, Germany has the lowest corruption score and a strong insolvency framework but ranks in the middle of the distribution in terms of the ability of the supervisors. Further, in terms of insolvency framework quality Portugal ranks in the second place, and Spain and Italy receive better insolvency scores than France.

We augment Model (1) with the respective proxy of the quality of insolvency framework: *Sup x Proxy and Sup x High-Risk Firm x Proxy.* Following the rest of the analysis, in Panel (a) of Table 11, we examine the effect on total credit as the dependent variable. In Columns (1) – (2), we present the finding using the baseline *High-Risk Firm* measure, while in Columns (3) – (6), we show the results using the *Zombie Firm* proxy. Within the zombie firm proxy analysis, we consider either all zombie firms (Columns (3) and (4)) or only the subset of zombie firms that are financially unhealthy (based their simultaneously low ROA, low sales-to-employee ratio and worst z-score) but do not have existing loan arrears (Columns (5) and (6)). The negative and statistically significant triple interaction coefficient estimate suggests that the introduction of a supranational supervision has a stronger impact on limiting lending to zombie firms in countries with weaker insolvency resolution rules. The results imply that the transfer of power to the supranational supervisory body inhibits "extend and pretend" practices associated with loan ever-greening.

We also explore loan terminations in Panel (b). We construct the dependent variable *Exit* that takes the value of one if the loan is terminated and the bank-firm relationship from period *t-1* ceases to exist in period *t*, and zero otherwise.[19] The comparison of Panels (a) and (b) presents an interesting result, when analyzing the double interaction of sup and insolvency proxies. In Panel (a), where we examine a combination of intensive and extensive margin using Poisson regressions, we find that banks that become supervised by the ECB in countries with ex-ante weaker *insolvency framework* further increase credit supply. Conversely, Panel (b) reveals that these same banks also

[19] Note that the triple interaction in Panel (b) with the insolvency proxy is not robust across the six columns (it is significant only in the first two columns).

terminate more loans. Therefore, for banks in countries with worse insolvency laws, supranational supervision allows a further expansion of credit supply while at the same time also an increase of the termination of loans. This suggests a decline in the "extend and pretend" practices, consistent with freeing bank capital for supporting an increase in credit supply to more credit-worthy firms.

7 Conclusion

The financial crisis highlighted the limitations of the prevailing supervisory framework in preventing excessive risk-taking, which fostered a debate on changes to the institutional setting, including the potential benefits of supranational supervision. In this paper, we analyze the effects of supranational *versus* national banking supervision on bank credit supply and risk-taking behavior. For identification, we exploit a novel dataset of multi-country credit registers and the institutional change from national to supranational supervision.

We show that supranational supervision increases the supply of credit in financially stressed countries, while limiting the supply of credit to the riskiest (zombie) firms. Results suggest that the effects are driven by cross-country heterogeneity in national supervisory incentives toward the largest banks and local economy, lower national supervisory abilities, and weaker overall control of domestic corruption. Supranational supervision increases credit supply but also leads to more termination of loans in countries with weaker insolvency laws, thus inhibiting the "extend and pretend" behavior associated with loan ever-greening policies. All this reduction of strong bank risk-taking, consistent with freeing bank capital, allows for higher credit supply to more credit-worthy firms.

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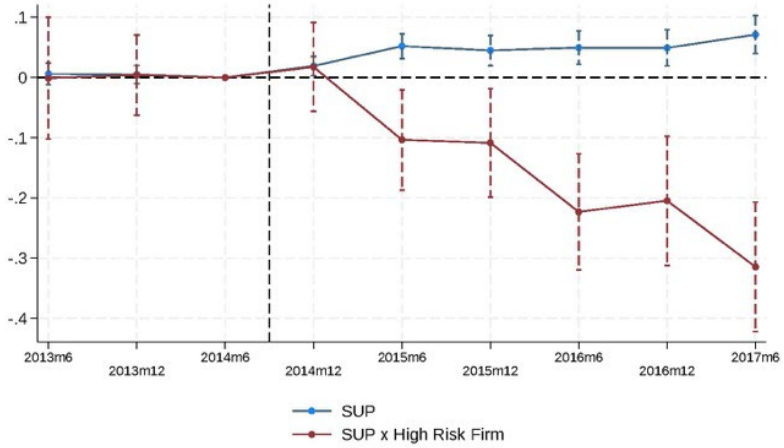
Figures and Tables

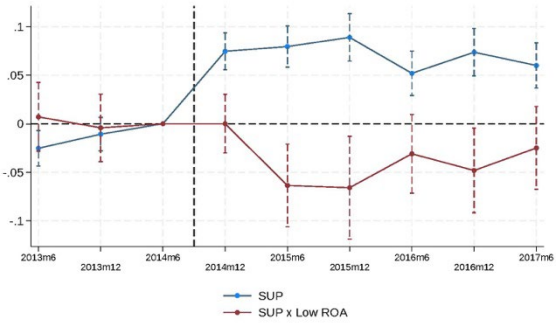
Figure 1: Centralized supervision, credit supply and high-risk firms: Dynamic effects

Panel (a): Stressed Countries

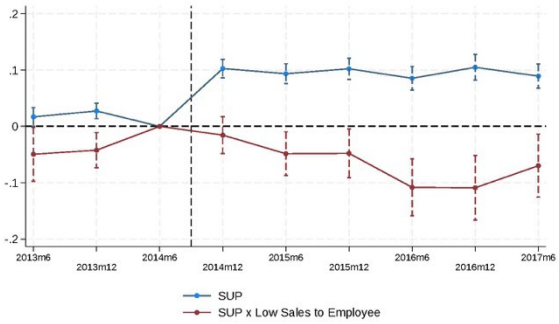
High Risk-Firm (Baseline)



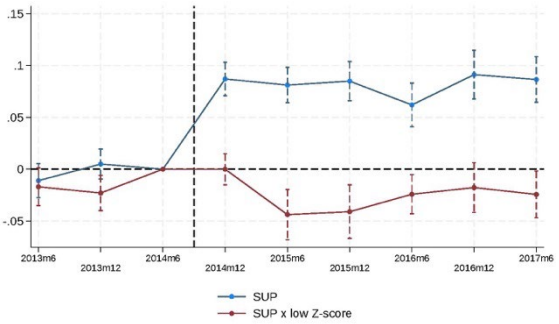
Low ROA



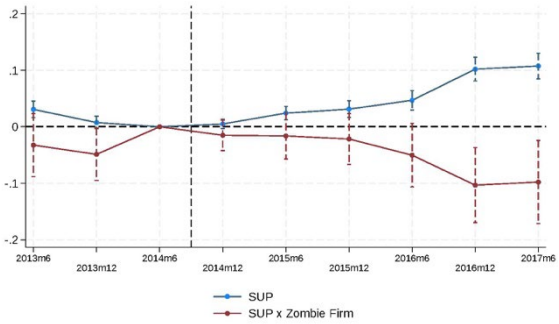
Low Sales to Employee Ratio



Low Z-Score

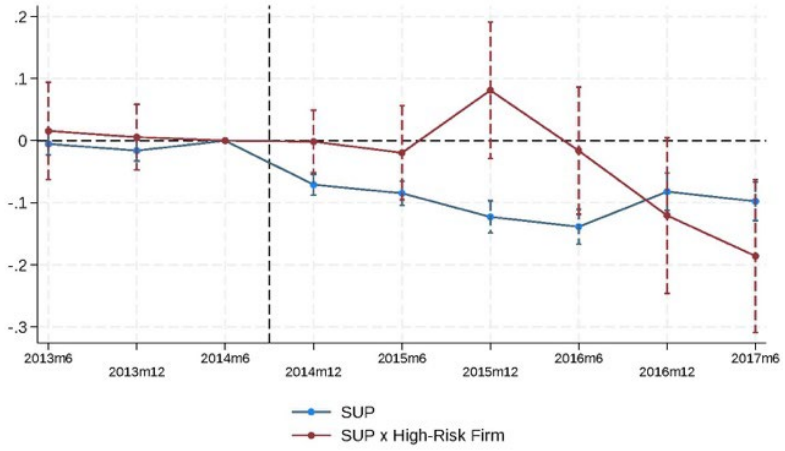


Zombie Firm

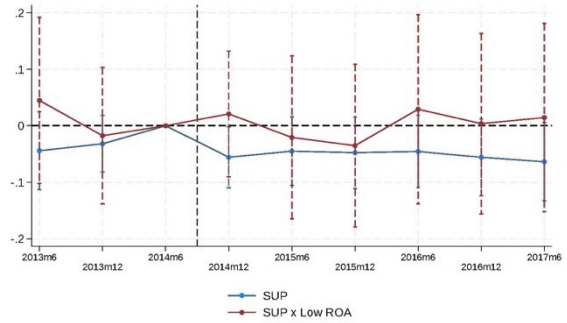


Panel (b): Non-Stressed Countries

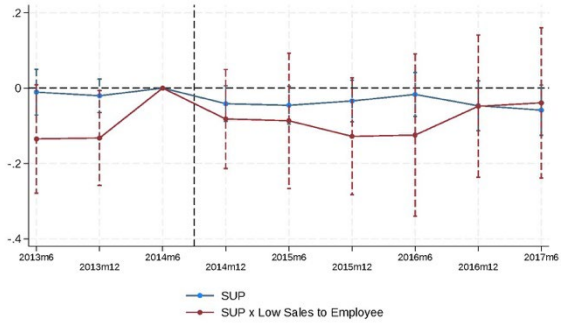
High Risk-Firm (Baseline)



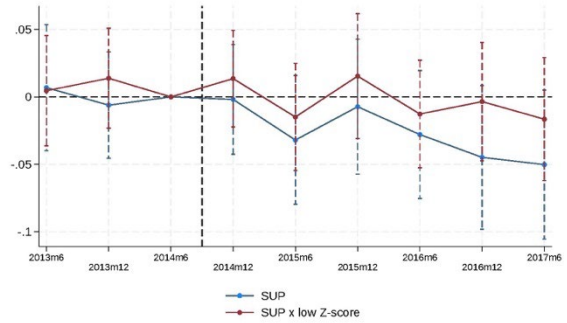
Low ROA



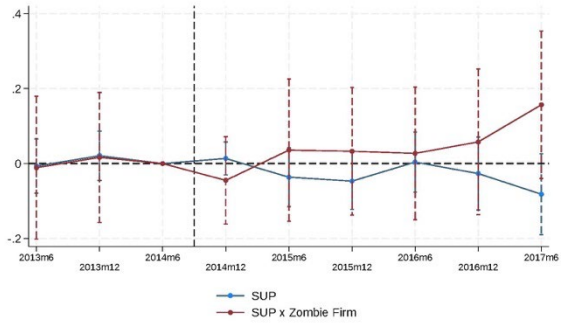
Low Sales to Employee Ratio



Low Z-score



Zombie Firm



Notes: This figure plots the sequence of coefficient estimates β^k and δ^k from estimating a dynamic version of Equation (1). The dependent variable is the total credit granted by bank b to firm f at time t. *Sup* (Centralized supervision) is a dummy variable that takes the value of one for banks supervised at supranational level (i.e., directly by the ECB) after November 2014, and zero otherwise. The figure shows differential response of bank credit supply to low-quality borrowers using firm-level proxies such as (i) the ratio between exposures in arrears and total exposures denoted as *High-risk firm,* (ii) low return-on-assets ratio (*ROA*), and (iii) low *sales-to-employee* ratio, (iv) low *z-score*, and (v) the indicator variable *Zombie firm* that takes the value of one if all three financial measures (ROA, sales-to-employee and z-score) rank below the median of their respective distributions in the same country and year, and zero otherwise. The vertical dashed line denotes the introduction of the centralized supervision. Poisson regressions are used to the estimate the models. Error bars represent 95% confidence intervals based on standard errors clustered at bank and firm level.

Table 1: Summary statistics

Variable	Description	Mean	S.D.	N	P10	P50	P90	Mean	S.D.	N	P10	P50	P90
		Stressed countries						Non-stressed countries					
Loan-level data													
Credit (total)	Total granted credit, in thousands EUR	548.83	11,976.0	40,621,335	0	75	717.6	2,076.63	13356.6	6,788,681	0	653.4	3,123
Credit (drawn)	Total drawn, in thousands EUR	428.65	9,244.29	39,105,096	0	55	571	2,032.88	12,114.1	6,379,646	0	58.3	3,077
Sup	Centralized supervision dummy (1=yes, 0=no)	0.31	0.462	40,621,335	0	0	1	0.43	0.496	6,788,681	0	0	1
High-Risk Firm	Ratio of credit in arrears to total credit	0.05	0.179	40,621,335	0	0	0.03	0.03	0.151	6,788,681	0	0	0.007
Firm-level data													
Nrel	Number of bank relationships per firm	2.15	1.952	18,909,078	1	1	4	1.49	1.860	4,542,826	1	1	2
High-Risk Firm	Ratio of credit in arrears to total credit	0.05	0.198	18,909,078	0	0	0.01	0.03	0.162	4,542,826	0	0	0.005
Z-score	Altman z-score	2.23	2.954	1,717,152	-1.1	1.7	6.3	2.75	3.247	261,971	-0.9	2.1	7.5
ROA	Return on assets. (Net income to total assets)	3.31	10.112	1,573,406	-4.2	2.1	13.3	5.49	11.447	180,800	-4.3	4.3	17.7
Sales to Employee	Sales to employee ratio, in ths. EUR	223.4	488.7	1,574,042	41.3	122	436.1	458.9	2,792.4	181,938	60.5	183.3	691.1
Zombie firm	=1 if z-score, ROA and sales to employee are all below median, 0=otherwise	0.18	0.384	1,226,923	0	0	1	0.19	0.396	136,843	0	0	1

Notes: The table presents summary statistics of all key variables for the main estimation sample.

Table 2: Supervision and bank credit supply

	Credit							
	Stressed countries				Non-stressed countries			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$Sup_{b,t-1}$	0.310***	0.536***	0.0411***	0.0764***	0.0758***	0.415***	-0.0696***	-0.0921***
	(0.0117)	(0.0182)	(0.00517)	(0.00639)	(0.00739)	(0.0127)	(0.00696)	(0.00987)
Sector-Time FE	No	Yes	Yes	-	No	Yes	Yes	-
Bank-Firm FE	No	No	Yes	Yes	No	No	Yes	Yes
Firm-Time FE	No	No	No	Yes	No	No	No	Yes
N	40,621,335	40,621,335	40,621,335	30,660,006	6,788,681	6,788,681	6,788,681	3,567,331
Pseudo R^2	0.004	0.138	0.955	0.967	0.003	0.219	0.948	0.963

Notes: This table reports regressions that relate bank lending to firms and centralized supervision.The dependent variable is the total credit granted by bank *b* to firm *f* at time *t*. *Sup* (Supranational supervision) is a dummy variable that takes the value of one for banks supervised at supranational level (i.e., directly by the ECB) after November 2014, and zero otherwise. Dash (-) symbol refers to the fact that the fixed effects are not applicable as they are nested in different (higher-order) fixed effects. Poisson regressions are used to the estimate the models. Standard errors clustered at bank and firm level in parentheses: * p<0.1, ** p<0.05, *** p<0.01.

Table 3: Supervision, bank credit supply and high-risk firms

	Credit			
	Stressed Countries		Non-Stressed Countries	
	(1)	(2)	(3)	(4)
$Sup_{b,t-1}$	0.0532***	0.07956***	-0.0601***	-0.091***
	(0.0053)	(0.0066)	(0.0071)	(0.0101)
High-Risk $Firm_{f,t-1}$	0.0591***		0.0324*	
	(0.0126)		(0.0182)	
$Sup_{b,t-1}$ x High-Risk $Firm_{f,t-1}$	-0.2620***	-0.1337***	-0.2107***	-0.0294
	(0.0151)	(0.0250)	(0.0186)	(0.0323)
Bank-Firm FE	Yes	Yes	Yes	Yes
Sector-Time FE	Yes	-	Yes	-
Firm-Time FE	No	Yes	No	Yes
N	40,621,335	30,660,006	6,788,681	3,567,331
Pseudo R^2	0.955	0.960	0.948	0.960

Notes: This table reports regressions that relate bank lending to firms, centralized supervision and borrower riskiness, as reported by Equation (1). The dependent variable is the total credit granted by bank *b* to firm *f* at time *t*. *Sup* (Supranational supervision) is a dummy variable that takes the value of one for banks supervised at supranational level (i.e., directly by the ECB) after November 2014, and zero otherwise. *High-risk firm* indicates, for each borrower, the ratio of exposures in arrears and total exposures. Dash (-) symbol refers to the fact that the fixed effects are not applicable as they are nested in different (higher-order) fixed effects. Poisson regressions are used to the estimate the models. Standard errors clustered at bank and firm level in parentheses: * p<0.1, ** p<0.05, *** p<0.01.

Table 4: Robustness - Sample restriction and drawn credit

	Credit (Sample of 6 banks per country)		Drawn Credit		Credit (harmonized to the highest reporting credit register threshold)	
	Stressed Countries	Non-Stressed Countries	Stressed Countries	Non-Stressed Countries	Stressed Countries	Non-Stressed Countries
	(1)	(2)	(3)	(4)	(5)	(6)
$Sup_{b,t-1}$	0.0656***	0.0630***	0.0831***	-0.0938***	0.0528***	-0.0677***
	(0.0168)	(0.0222)	(0.00728)	(0.0104)	(0.00935)	(0.0102)
$Sup_{b,t-1}$ x High-Risk $Firm_{f,t-1}$	-0.207***	-0.0823	-0.115***	-0.0268	-0.112***	0.0104
	(0.0395)	(0.148)	(0.0263)	(0.0326)	(0.0334)	(0.0250)
Bank-Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Firm-Time FE	Yes	Yes	Yes	Yes	Yes	Yes
N	1,355,265	185,172	28,949,171	3,266,448	1,852,335	678,839
Pseudo R^2	0.975	0.976	0.958	0.962	0.976	0.969
Sample	Restricted for 6 banks	Restricted for 6 banks	Full sample	Full sample	Harmonized at EUR 1,000,000	Harmonized at EUR 1,000,000

Notes: This table reports the results of the variants of the analysis of bank lending to firms, centralized supervision and borrower quality, as reported by Equation (1). Columns (1) and (2) present the coefficients using the restricted sample of banks around the threshold of supranational supervision, i.e., for each country, it includes the three smallest centrally supervised banks and the three largest non-centrally supervised banks. The dependent variable in Columns (1) and (2) is the total credit granted by bank *b* to firm *f* at time *t*. Columns (3) and (4) present the results using only drawn credit as a dependent variable. Columns (5) and (6) report the coefficient estimates using only total credit above the EUR 1,000,000 threshold, which is the threshold of the credit register of most restrictive credit register (Germany). In all specifications, *Sup* is a dummy variable that takes the value of one for banks supervised at supranational level after November 2014, and zero otherwise. *High-Risk Firm* indicates, for each borrower, the ratio of exposures in arrears and total exposures. Poisson regressions are used to the estimate the models. Standard errors clustered at bank and firm level in parentheses: * p<0.1, ** p<0.05, *** p<0.01.

Table 5: Supervision, bank credit supply and zombie lending

Panel (a): Profitability and productivity

Proxy:	Credit							
	Low ROA				Low Sales-to-Employee			
	Stressed Countries		Non-Stressed Countries		Stressed Countries		Non-Stressed Countries	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$Sup_{b,t-1}$	0.0265***	0.0436***	-0.0210	-0.0533*	0.0195***	0.0417***	-0.0347	-0.0449
	(0.00664)	(0.00632)	(0.0248)	(0.0285)	(0.00604)	(0.00610)	(0.0255)	(0.0276)
$Proxy_{f,t-1}$	0.00469		0.0325		0.0115		-0.0400	
	(0.00493)		(0.0221)		(0.0081)		(0.0516)	
$Sup_{b,t-1}$ x	-0.0366***	-0.0172**	-0.00336	0.0455	-0.0354***	-0.0490***	0.0696	0.0268
$Proxy_{f,t-1}$	(0.0112)	(0.00814)	(0.0335)	(0.0613)	(0.0128)	(0.0148)	(0.0666)	(0.112)
Bank-Firm FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Sector-Time FE	Yes	-	Yes	-	Yes	-	Yes	-
Firm-Time FE	No	Yes	No	Yes	No	Yes	No	Yes
N	3,706,263	2,853,567	327,995	197,817	3,707,673	2,853,567	327,993	197,817
Pseudo R^2	0.910	0.930	0.915	0.960	0.910	0.930	0.915	0.960

Panel (b): Z-score and Zombie firms

Proxy:	Credit							
	Low Z-score				Zombie Firm			
	Stressed Countries		Non-Stressed Countries		Stressed Countries		Non-Stressed Countries	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$Sup_{b,t-1}$	0.0237***	0.0502***	-0.0318*	-0.0514**	0.0330***	0.0521***	-0.0271	-0.0732**
	(0.00585)	(0.00516)	(0.0180)	(0.0246)	(0.00643)	(0.00678)	(0.0240)	(0.0360)
$Proxy_{f,t-1}$	0.0159***		-0.007		0.0429***		-0.00636	
	(0.00397)		(0.0081)		(0.00701)		(0.0263)	
$Sup_{b,t-1}$ x $Proxy_{f,t-1}$	-0.0109**	-0.00767*	-0.0053	0.0058	-0.0480***	-0.0353***	0.0526	0.127**
	(0.00509)	(0.00418)	(0.118)	(0.0236)	(0.0140)	(0.0118)	(0.0365)	(0.0541)
Bank-Firm FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Sector-Time FE	Yes	-	Yes	-	Yes	-	Yes	-
Firm-Time FE	No	Yes	No	Yes	No	Yes	No	Yes
N	3,893,224	2,947,782	455,372	267,386	2,806,758	2,156,869	239,481	146,037
Pseudo R^2	0.910	0.946	0.917	0.960	0.917	0.933	0.915	0.960

Notes: This table reports the results of the variants of the analysis of bank lending to firms, centralized supervision and borrower quality, as reported by Equation (1). Panel (a) uses borrower's profitability and productivity. *ROA* is an indicator variable for whether a borrower's ROA (net income to total assets) ranks in the bottom quartile of the variable's distribution within the same country and year. *Sales-to-employee* is an indicator variable for whether a borrower's productivity (sales per employee) ranks in the bottom quartile of the variable's distribution within the same country and year. Panel (b) presents the estimates using the z-score as a proxy to borrower riskiness. The Z-score estimates are standardized and inverted (i.e., for consistency, higher coefficient is associated with a lower z-score). Finally, *Zombie Firm* is a dummy that takes the value of one if all three measures (ROA, sales-employee and z-score) rank in below the median of their respective distributions in the same country and year. *Zombie Firm* indicator identifies 45,961 firms (16.65%) and 506,512(16%) loans. In all specifications, the dependent variable is the total credit granted by bank *b* to firm *f* at time *t*. *Sup* is a dummy variable that takes the value of one for banks supervised at supranational level after November 2014, and zero otherwise. Dash (-) symbol refers to the fact that the fixed effects are not applicable as they are nested in different (higher-order) fixed effects. Poisson regressions are used to the estimate the models. Standard errors clustered at bank and firm level in parentheses: * p<0.1, ** p<0.05, *** p<0.01.

Table 6: Control of corruption, regulatory quality and rule of law

Proxy:	Credit			
	Weaker control of corruption	Lower regulatory quality	Lower rule of law	Higher regional corruption
	(1)	(2)	(3)	(4)
$Sup_{b,t-1}$	-0.00423	-0.000404	-0.0145**	0.0492***
	(0.00593)	(0.00588)	(0.00616)	(0.00460)
$Sup_{b,t-1}$ x High-Risk $Firm_{f,t-1}$	-0.0577***	-0.0776***	-0.0513***	-0.0741***
	(0.0198)	(0.0200)	(0.0199)	(0.0259)
$Sup_{b,t-1}$ x $Proxy_{c/i}$	0.0695***	0.0632***	0.0670***	-0.00535
	(0.00498)	(0.00441)	(0.00480)	(0.00479)
$Sup_{b,t-1}$ x High-Risk $Firm_{f,t-1}$ x $Proxy_{c/i}$	-0.0451**	-0.0415***	-0.0425**	-0.0742**
	(0.0205)	(0.0152)	(0.0201)	(0.0331)
Bank-Firm FE	Yes	Yes	Yes	Yes
Firm-Time FE	Yes	Yes	Yes	Yes
N	34,227,337	34,227,337	34,227,337	3,997,120
Pseudo R^2	0.968	0.968	0.968	0.933

Notes: This table reports the results of the analysis that examines the role of corruption and governance on the effect of centralized supervision on bank credit supply. The dependent variable is the total credit granted by bank *b* to firm *f* at time *t*. *Sup* is a dummy variable that takes the value of one for banks supervised at supranational level after November 2014, and zero otherwise. *High-risk firm* indicates, for each borrower, the ratio between exposures in arrears and total exposures. Columns (1) – (3) present the results of ex-ante country-level corruption and governance variables based on 2012 World Bank WGI report. Regional corruption is based on 2013 EQI dataset and it is reported at NUTS-2 region. The variables are standardized and inverted (higher values reflect lower quality of governance). Poisson regressions are used to the estimate the models. Standard errors clustered at bank and firm level in parentheses: * p<0.1, ** p<0.05, *** p<0.01.

Table 7: Supervisor incentives and bank size

Panel (a): Globally systemically important banks

	Credit					
	Stressed Countries			Non-Stressed Countries		
	(1)	(2)	(3)	(4)	(5)	(6)
$Sup_{b,t-1}$	0.0513***	0.0813***		-0.043***	-0.0610***	
	(0.0056)	(0.0070)		(0.0071)	(0.0101)	
High-Risk $Firm_{f,t-1}$	0.0457***			0.0378**		
	(0.0125)			(0.0155)		
$Sup_{b,t-1}$ x High-Risk $Firm_{f,t-1}$	-0.2424***	-0.1242***	-0.0716***	-0.224***	-0.0740**	-0.0745**
	(0.0163)	(0.0256)	(0.0234)	(0.0182)	(0.0329)	(0.0335)
$Sup_{b,t-1}$ x $GSIB_{b,t-1}$	0.0102	-0.006		-0.1725***	-0.3952***	
	(0.0136)	(0.0102)		(0.0250)	(0.0306)	
$Sup_{b,t-1}$ x High-Risk $Firm_{f,t-1}$ x $GSIB_{b,t-1}$	-0.2147***	-0.2466***	-0.1261***	0.1363	0.4060*	0.3202
	(0.0399)	(0.0394)	(0.0442)	(0.0970)	(0.218)	(0.2035)
Bank-Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Sector-Time FE	Yes	-	-	Yes	-	-
Firm-Time FE	No	Yes	Yes	No	Yes	Yes
Bank-Time FE	No	No	Yes	No	No	Yes
N	40,621,335	30,660,006	30,660,006	6,788,681	3,567,331	3,567,327
Pseudo R^2	0.955	0.967	0.969	0.948	0.964	0.955

Panel (b): Robustness in stressed countries to other bank size cut-offs

Size Proxy:	Credit					
	GSIB	Large 500B	Large 400B	Large 300B	Large 200B	Largest bank
	(1)	(2)	(3)	(4)	(5)	(6)
$Sup_{b,t-1}$	0.0813***	0.0740***	0.0859***	0.0891***	0.0849***	0.0836***
	(0.0070)	(0.0069)	(0.00710)	(0.00707)	(0.00697)	(0.00703)
$Sup_{b,t-1}$ x High-Risk $Firm_{f,t-1}$	-0.124***	-0.108***	-0.130***	-0.0649**	-0.116***	-0.125***
	(0.0256)	(0.0261)	(0.0268)	(0.0274)	(0.0316)	(0.0265)
$Sup_{b,t-1}$ x $Size_{b,t-1}$	-0.006	0.0171*	-0.0124	-0.0187**	-0.0130	-0.0165
	(0.0102)	(0.0089)	(0.00858)	(0.00819)	(0.00857)	(0.0100)
$Sup_{b,t-1}$ x High-Risk $Firm_{f,t-1}$ x $Size_{b,t-1}$	-0.247***	-0.2443***	-0.194***	-0.363***	-0.0925	-0.161***
	(0.0394)	(0.0377)	(0.0370)	(0.0690)	(0.0575)	(0.0326)
Bank-Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Firm-Time FE	Yes	Yes	Yes	Yes	Yes	Yes
N	30,660,006	30,660,006	30,660,006	30,660,006	30,660,006	30,660,006
Pseudo R^2	0.967	0.967	0.967	0.967	0.967	0.967

Panel (c): Robustness in all countries to other bank size cut-offs

Size Proxy:	Credit					
	GSIB	Large 500B	Large 400B	Large 300B	Large 200B	Largest bank
	(1)	(2)	(3)	(4)	(5)	(6)
$Sup_{b,t-1}$	0.0411***	0.0345***	0.0409***	0.0429***	0.0506***	0.0429***
	(0.0058)	(0.0058)	(0.0059)	(0.0059)	(0.0059)	(0.00584)
$Sup_{b,t-1}$ x High-Risk $Firm_{f,t-1}$	-0.1091***	-0.0909***	-0.1082***	-0.0635***	-0.1137***	-0.114***
	(0.0202)	(0.0208)	(0.0213)	(0.0221)	(0.0247)	(0.0208)
$Sup_{b,t-1}$ x $Size_{b,t-1}$	-0.0619***	-0.0135	-0.0264***	-0.0305***	-0.0490***	-0.0639***
	(0.0110)	(0.0086)	(0.0081)	(0.0078)	(0.0074)	(0.00990)
$Sup_{b,t-1}$ x High-Risk $Firm_{f,t-1}$ x $Size_{b,t-1}$	-0.1315*	-0.1913***	-0.1266***	-0.2447***	-0.0285	-0.0565
	(0.0686)	(0.0466)	(0.0438)	(0.0579)	(0.0463)	(0.0560)
Bank-Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Firm-Time FE	Yes	Yes	Yes	Yes	Yes	Yes
N	34,227,337	34,227,337	34,227,337	34,227,337	34,227,337	34,227,337
Pseudo R^2	0.968	0.968	0.968	0.968	0.968	0.968

Notes: This table reports the results of the analysis that examines the role of the bank-level incentives on the effect of supranational supervision on bank credit supply. The dependent variable is the total credit granted by bank *b* to firm *f* at time *t*. *Sup* is a dummy variable that takes the value of one for banks supervised at supranational level after November 2014, and zero otherwise. *High-Risk Firm* indicates, for each borrower, the ratio between exposures in arrears and total exposures. Panel (a) reports the results for stressed and non-stressed countries, respectively. *GSIB* is a dummy variable that takes the value of one if the bank belongs to the globally systemically important banks, and zero otherwise. Panel (b) reports the coefficient estimates for different size cut-offs for stressed countries. Panel (c) reports the coefficient estimates for different size cut-offs using the full sample of all banks and countries. The additional size proxy variables take the value of one if the bank's total assets exceed EUR 500bn, 400bn, 300bn and 200bn, respectively, and zero otherwise. The final column indicates whether the credit is provided by the largest bank in country *c*. Poisson regressions are used to the estimate the models. Standard errors clustered at bank and firm level in parentheses: * p<0.1, ** p<0.05, *** p<0.01.

Table 8: Supervisor incentives and borrower employment

	Credit							
	Large employment share		Small employment share		Large employment share		Small employment share	
	Stressed Countries	Non-stressed Countries	Stressed Countries	Non-stressed Countries	Stressed Countries	Non-stressed Countries	Stressed Countries	Non-stressed Countries
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$Sup_{b,t-1}$	0.0788***	-0.0702***	0.0831***	-0.113***	0.0868***	-0.0384***	0.0813***	-0.0880***
	(0.00595)	(0.0134)	(0.00946)	(0.0158)	(0.00635)	(0.0138)	(0.00989)	(0.0156)
$Sup_{b,t-1}$ x High-Risk $Firm_{f,t-1}$	-0.215***	-0.107**	-0.110***	0.0127	-0.197***	-0.143***	-0.101***	-0.0300
	(0.0285)	(0.0464)	(0.0334)	(0.0469)	(0.0290)	(0.0473)	(0.0341)	(0.0473)
$Sup_{b,t-1}$ x $GSIB_{b,t-1}$					-0.0361***	-0.316***	0.0108	-0.431***
					(0.0117)	(0.0333)	(0.0136)	(0.0514)
$GSIB_{b,t-1}$ x High-Risk $Firm_{f,t-1}$					0.177***	-0.0654	0.275***	0.655
					(0.0354)	(0.154)	(0.0595)	(0.530)
$Sup_{b,t-1}$ x $GSIB_{b,t-1}$ x High-Risk $Firm_{f,t-1}$					-0.353***	0.374***	-0.234***	0.401
					(0.0421)	(0.116)	(0.0491)	(0.326)
Bank-Firm FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm-Time FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	14,423,214	1,624,824	15,949,189	1,835,723	14,411,579	1,624,824	15,961,048	1,835,723
R^2	0.957	0.961	0.970	0.967	0.957	0.961	0.970	0.967

Notes: This table reports the results of the analysis that examines the role of the supervisor incentives on the effect of supranational supervision on bank credit supply. The dependent variable is the total credit granted by bank *b* to firm *f* at time *t*. *Sup* is a dummy variable that takes the value of one for banks supervised at supranational level after November 2014, and zero otherwise. *High-Risk Firm* indicates, for each borrower, the ratio between exposures in arrears and total exposures. *GSIB* is a dummy variable that takes the value of one if the bank belongs to the globally systemically important banks, and zero otherwise. Columns (1) – (2) and (5) – (6) present the results using the sample of firms that belong to industries (NACE-2 level) with the large (above median) employment share in country *c* at time *t*, while Columns (3) – (4) and (7) – (8) present the results using the sample of firms that belong to industries (NACE-2 level) with the small (below median) employment share in country *c* at time *t.* Poisson regressions are used to the estimate the models. Standard errors clustered at bank and firm level in parentheses: * p<0.1, ** p<0.05, *** p<0.01.

Table 9: Ability of local supervisors

Low ability proxy:	Credit		
	Education	Lower supervisory Training	Examiner Ratio
	(1)	(2)	(3)
$Sup_{b,t-1}$	-0.0273***	0.0587***	-0.0541***
	(0.00670)	(0.00600)	(0.00859)
$Sup_{b,t-1}$ x High-Risk $Firm_{f,t-1}$	-0.0640***	-0.139***	-0.0149
	(0.0213)	(0.0201)	(0.0234)
$Sup_{b,t-1}$ x $Proxy_c$	0.183***	0.0674***	0.0899***
	(0.0125)	(0.00608)	(0.00727)
$Sup_{b,t-1}$ x High-Risk $Firm_{f,t-1}$ x $Proxy_c$	-0.0918*	-0.0422**	-0.0826***
	(0.0472)	(0.0170)	(0.0292)
Bank-Firm FE	Yes	Yes	Yes
Firm-Time FE	Yes	Yes	Yes
N	34,227,337	31,902,798	34,078,991
Pseudo R^2	0.968	0.968	0.968

Notes: This table reports the results of the analysis that examines the role of the ability of national supervisors on the effect of supranational supervision on bank credit supply. The dependent variable is the total credit granted by bank *b* to firm *f* at time *t*. *Sup* is a dummy variable that takes the value of one for banks supervised at supranational level after November 2014, and zero otherwise. *High-Risk Firm* indicates, for each borrower, the ratio between exposures in arrears and total exposures. The proxies for the country-level ability and human capital of regulators are based on 2019 Bank Regulation and Supervision Survey (BRSS) which covers the period of 2011–2016 and include: a ratio of supervisors with post-graduate degrees (MBA, CPA, CFA, etc.) in Column (1), hours of training at the regulatory agency in Column (2), and a share of the number of bank supervisors to the number of banks in each country in Column (3). The proxies are standardized and inverted (higher values reflect lower ability of supervisors). Poisson regressions are used to the estimate the models. Standard errors clustered at bank and firm level in parentheses: * p<0.1, ** p<0.05, *** p<0.01.

Table 10: Horse-race of channels

	Credit				
	(1)	(2)	(3)	(4)	(5)
$Sup_{b,t-1}$	0.00663	-0.0177***	-0.0225***	-0.0119	0.0235
	(0.00602)	(0.00672)	(0.00728)	(0.0074)	(0.0413)
$Sup_{b,t-1}$ x High-Risk $Firm_{f,t-1}$	-0.0681***	-0.0717***	-0.0921***	-0.01054***	-0.241***
	(0.0203)	(0.0215)	(0.0276)	(0.0282)	(0.0385)
$Sup_{b,t-1}$ x $Corruption_c$	0.0741***		0.0197*	0.0236**	0.0248**
	(0.00509)		(0.0105)	(0.0107)	(0.0107)
$Sup_{b,t-1}$ x High-Risk $Firm_{f,t-1}$ x $Corruption_c$	-0.0539**		-0.0637*	-0.0759*	-0.0523*
	(0.0209)		(0.0370)	(0.0414)	(0.0284)
$Sup_{b,t-1}$ x $GSIB_{b,t-1}$	-0.0727***	-0.0725***		-0.0729***	-0.0730***
	(0.0110)	(0.0109)		(0.01055)	(0.0110)
High-Risk $Firm_{f,t-1}$ x $GSIB_{b,t-1}$	0.301***	0.300***		0.3026***	0.302***
	(0.106)	(0.105)		(0.1055)	(0.106)
$Sup_{b,t-1}$ x High-Risk $Firm_{f,t-1}$ x $GSIB_{b,t-1}$	-0.123*	-0.123*		-0.1223*	-0.127*
	(0.0682)	(0.0682)		(0.0681)	(0.0682)
$Sup_{b,t-1}$ x Lower Sup $Ability_c$		0.194***	0.137***	0.1393***	0.154***
		(0.0127)	(0.0265)	(0.0266)	(0.0302)
$Sup_{b,t-1}$ x High-Risk $Firm_{f,t-1}$ x Lower Sup $Ability_c$		-0.107**	0.0267	0.0343	0.126
		(0.0477)	(0.0915)	(0.0920)	(0.0970)
Controls for CDS interactions	No	No	No	No	Yes
Bank-Firm FE	Yes	Yes	Yes	Yes	Yes
Firm-Time FE	Yes	Yes	Yes	Yes	Yes
N	34,227,337	34,227,337	34,227,337	34,227,337	34,227,337
Pseudo R^2	0.968	0.968	0.968	0.968	0.968

Notes: This table reports the results of the analysis that horse-races the corruption, incentive and ability channels reported in Tables 6, 7 and 9. The dependent variable is the total credit granted by bank *b* to firm *f* at time *t*. *High-Risk Firm* indicates, for each borrower, the ratio between exposures in arrears and total exposures. *Sup* is a dummy variable that takes the value of one for banks supervised at supranational level after November 2014, and zero otherwise. *Corruption* denotes Control of Corruption based reported for 2012 World Bank WGI report. *GSIB* is a dummy variable that takes the value of one if the bank belongs to the globally systemically important banks given by the Euro area classification, and zero otherwise. *Lower Sup Ability* is a ratio of supervisors with post-graduate degrees (MBA, CPA, CFA, etc.). Column (5) further controls for all interaction between Sup, High-Risk Firms and sovereign CDS spreads. All channel proxies are standardized and inverted (higher values reflect higher corruption, larger banks and lower ability of supervisors). Poisson regressions are used to the estimate the models. Standard errors clustered at bank and firm level in parentheses: * p<0.1, ** p<0.05, *** p<0.01.

Table 11: Resolutions of zombies – Differences in insolvency frameworks

Panel (a): Total credit

	Credit					
	High-Risk Firm		Zombie Firm		Zombie Firm (firms without loans in arrears)	
Insolvency proxy: (worse for higher value)	Insolvency score	Recovery rate score	Insolvency score	Recovery rate score	Insolvency score	Recovery rate score
	(1)	(2)	(3)	(4)	(5)	(6)
$Sup_{b,t-1}$	0.0996***	0.0446***	0.0624***	0.0264***	0.0714***	0.0326***
	(0.00736)	(0.00570)	(0.0109)	(0.00954)	(0.0141)	(0.00970)
$Sup_{b,t-1}$ x Insolvency $Proxy_{c,t-1}$	0.143***	0.122***	0.103***	0.0890***	0.113***	0.105***
	(0.0101)	(0.00884)	(0.0278)	(0.0233)	(0.0344)	(0.0295)
$Sup_{b,t-1}$ x High-Risk $Firm_{f,t-1}$	-0.126***	-0.107***				
	(0.0315)	(0.0225)				
$Sup_{b,t-1}$ x High-Risk $Firm_{f,t-1}$ x Insolvency Proxy	-0.0680*	-0.0972***				
	(0.0357)	(0.0321)				
$Sup_{b,t-1}$ x Zombie $Firm_{f,t-1}$			-0.0433***	0.00375	-0.0540***	-0.00189
			(0.0160)	(0.0151)	(0.0178)	(0.0150)
$Sup_{b,t-1}$ x Zombie $Firm_{f,t-1}$ x $Insolvency\ Proxy_{c,t-1}$			-0.123***	-0.104***	-0.135***	-0.120***
			(0.0436)	(0.0391)	(0.0506)	(0.0457)
Bank-Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Firm-Time FE	Yes	Yes	Yes	Yes	Yes	Yes
N	34,227,337	34,227,337	2,3029,06	2,302,906	1,902,932	1,902,932
Pseudo R^2	0.968	0.968	0.958	0.958	0.958	0.958

Panel (b): Loan terminations

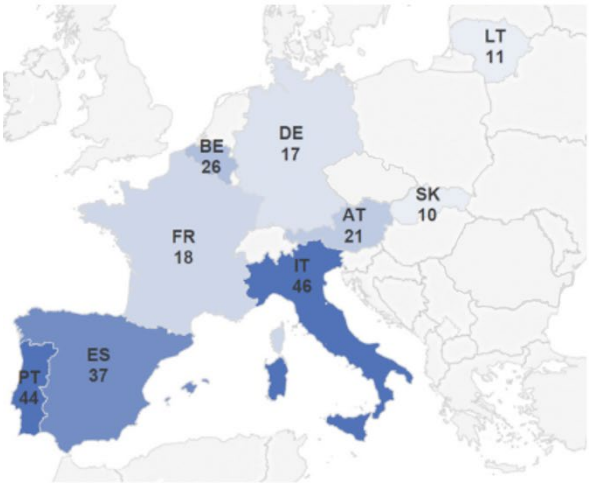
	Exit					
	High-risk Firm		Zombie Firm		Zombie Firm (firms without loans in arrears)	
Insolvency proxy: (worse for higher value)	Insolvency score	Recovery rate score	Insolvency score	Recovery rate score	Insolvency score	Recovery rate score
	(1)	(2)	(3)	(4)	(5)	(6)
$Sup_{b,t-1}$	-0.0153***	-0.0290***	-0.0264***	-0.0292***	-0.0298***	-0.0324***
	(0.000366)	(0.000281)	(0.00147)	(0.00125)	(0.00177)	(0.00141)
$Sup_{b,t-1}$ x Insolvency $Proxy_{c,t-1}$	0.0379***	0.0400***	0.00753**	0.00994***	0.00773*	0.00641*
	(0.000929)	(0.000554)	(0.00351)	(0.00266)	(0.00469)	(0.00345)
$Sup_{b,t-1}$ x High-Risk $Firm_{f,t-1}$	0.0247***	0.0694***				
	(0.00283)	(0.00159)				
$Sup_{b,t-1}$ x High-Risk $Firm_{f,t-1}$ x Insolvency Proxy	-0.100***	-0.00931**				
	(0.00467)	(0.00390)				
$Sup_{b,t-1}$ x Zombie $Firm_{f,t-1}$			-0.000358	0.000609	0.00316	0.00230
			(0.00331)	(0.00270)	(0.00389)	(0.00299)
$Sup_{b,t-1}$ x Zombie $Firm_{f,t-1}$ x Insolvency $Proxy_{c,t-1}$			-0.00329	-0.000389	0.00245	0.00380
			(0.00730)	(0.00607)	(0.00940)	(0.00741)
Bank-Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Firm-Time FE	Yes	Yes	Yes	Yes	Yes	Yes
N	28,213,575	28,213,575	1,839,811	1,839,811	1,387,601	1,387,601
Adj R^2	0.528	0.528	0.584	0.584	0.538	0.538

Notes: This table reports the results of the analysis that examines the role of the cross-country differences in insolvency resolution rules on the effect of supranational supervision on bank credit supply. Panel (a) present the estimates of Poisson regressions using the total credit granted by bank *b* to firm *f* at time *t* as the dependent variable. Panel (b) reports the estimates for loan terminations using OLS regression, where the dependent variable *Exit* is defined as one if the loan is not renewed and the bank-firm relationship from period *t-1* ceases to exist in period *t*, and zero otherwise. Sup is a dummy variable that takes the value of one for banks supervised at supranational level after November 2014, and zero otherwise. The insolvency proxies are taken from the World Banks' Doing Business Report. The proxies are standardized and inverted (i.e., for consistency, higher coefficient is associated with a weaker insolvency framework). *High-Risk Firm* indicates, for each borrower, the ratio between exposures in arrears and total exposures. Panel (a) report the results for stressed and non-stressed countries respectively. *Zombie Firm* is a dummy that takes the value of one if all three measures (ROA, sales-employee and z-score) rank in the below the median of their respective distribution in the same country and year. Standard errors clustered at bank and firm level in parentheses: * p<0.1, ** p<0.05, *** p<0.01.

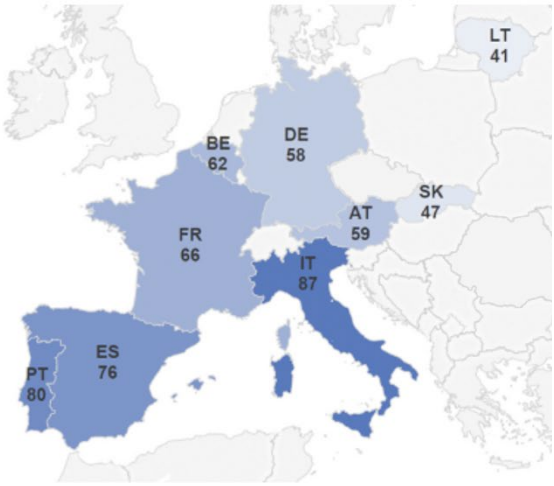
ONLINE APPENDIX

Figure A.1: Share of firms with multiple lending relationships

As % of total borrowers



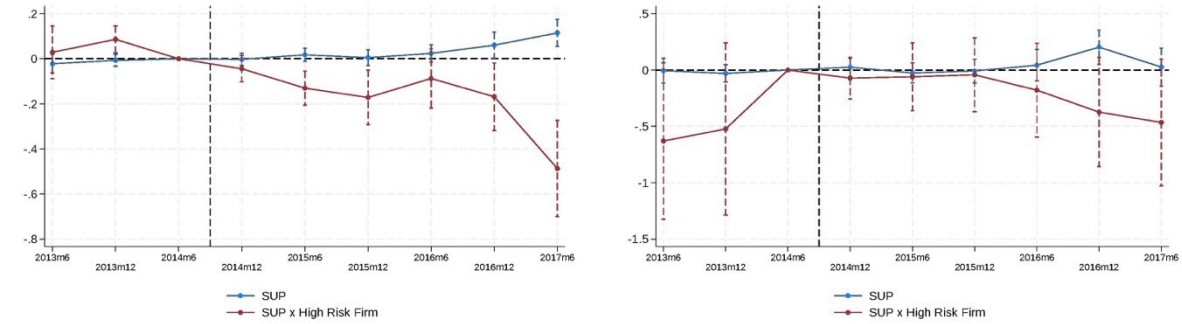
As % of total credit



Notes: The figure reports for each country included in the dataset the share of non-financial corporations with multiple lending relationships as a share of the total number of borrowers (left panel) and of total lending (right panel).

Figure A.2: High-risk firm and dynamic effects:
Robustness using the restricted sample of six banks per country around the centralized supervision cut-off

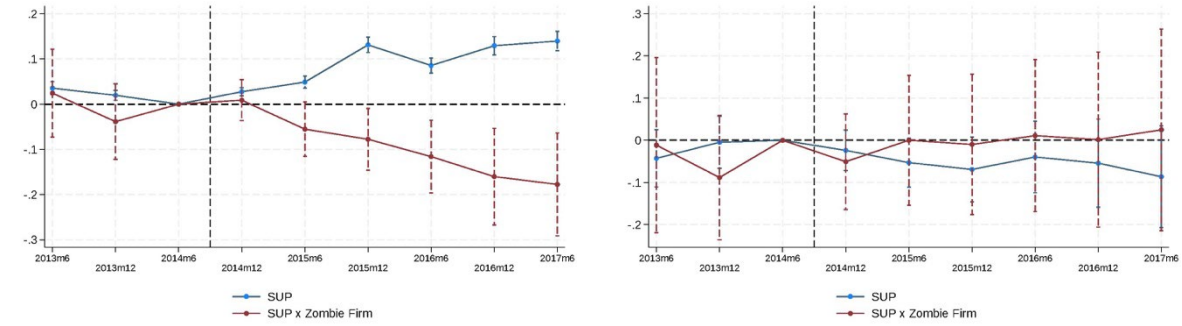
Stressed countries *Non-stressed countries*



Notes: This figure plots the sequence of coefficient estimates $\beta^k$and δ^k from estimating a dynamic version of Equation (1). It presents the robustness by plotting the coefficients using the restricted sample of banks around the threshold of supranational supervision, i.e., for each country, it includes the three smallest centrally supervised banks and the three largest non-centrally supervised banks. The dependent variable is the total credit granted by bank *b* to firm *f* at time *t*. The dependent variable is the total credit granted by bank *b* to firm *f* operating in sector *s* at time *t*. *Sup* (Centralized supervision) is a dummy variable that takes the value of one for banks supervised at supranational level (i.e., directly by the ECB) after November 2014, and zero otherwise. *High-Risk Firm* indicates, for each borrower, the ratio between exposures in arrears and total exposures. The vertical dashed line denotes the introduction of the centralized supervision. Poisson regressions are used to the estimate the models. Error bars represent 95% confidence intervals based on standard errors clustered at bank and firm level.

Figure A.3: Zombie firm by applying (alternative) bottom tercile cut-off for firm ROA *and* productivity *and* Z-score (worst 7.35% of firms)

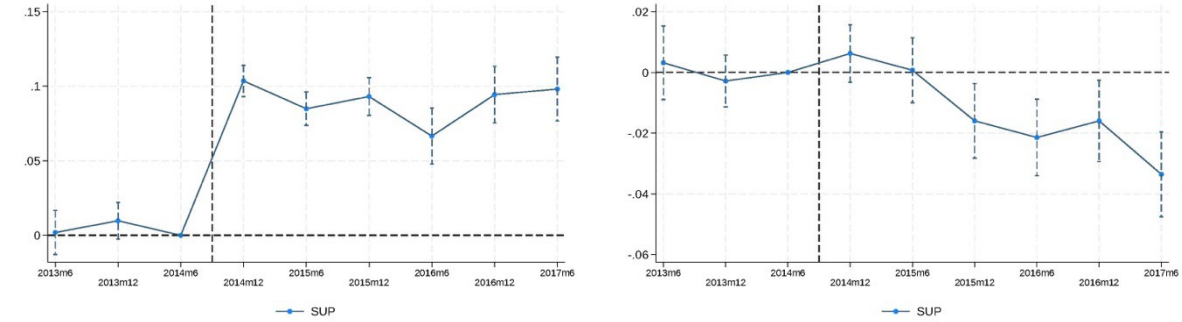
Stressed countries *Non-stressed countries*



Notes: This figure plots the sequence of coefficient estimates $\beta^k$and δ^k from estimating a dynamic version of Equation (1). The dependent variable is the total credit granted by bank *b* to firm *f* operating in sector *s* at time *t*. *Sup* (Centralized supervision) is a dummy variable that takes the value of one for banks supervised at supranational level (i.e., directly by the ECB) after November 2014, and zero otherwise. The figure shows differential response considering an alternative cut-off point for the definition of zombie firms. *Zombie Firm* indicator takes the value of one if all three measures (ROA, sales-employee and z-score) rank in the bottom tercile, and zero otherwise. This alternative cut-off identifies 20,281firms (7.35%) as zombie firms. The vertical dashed line denotes the introduction of centralized supervision. Poisson regressions are used to the estimate the models. Error bars represent 95% confidence intervals based on standard errors clustered at bank and firm level.

Figure A.4: Supervision and dynamic effects:

Stressed countries *Non-stressed countries*



Notes: This figure plots the sequence of coefficient estimates β^k from estimating a dynamic version of Equation (2) without the interaction term. The dependent variable is the total credit granted by bank *b* to firm *f* operating in sector *s* at time *t*. *Sup* (Centralized supervision) is a dummy variable that takes the value of one for banks supervised at supranational level (i.e., directly by the ECB) after November 2014, and zero otherwise. The vertical dashed line denotes the introduction of centralized supervision. Poisson regressions are used to the estimate the models. Error bars represent 95% confidence intervals based on standard errors clustered at bank and firm level.

Table A.1: Additional summary statistics

Panel (a): Stressed vs. Non-Stressed Countries

Variable	Description	Mean	S.D.	N	P10	P50	P90	Mean	S.D.	N	P10	P50	P90
		Stressed countries						*Non-stressed countries*					
SI	Centralized supervision dummy	0.15	0.36	1,829	0	0	1	0.16	0.36	2,582	0	0	1
Size	Log of total assets	10.5	1.2	880	9.1	10.5	12.4	10.4	1.4	1,835	8.6	10.4	12.3
NPL ratio	Net impaired loans / gross customer loans, in %	5.3	4.3	381	0.0	4.3	12.9	2.0	2.1	615	0.2	1.5	3.6
Capital ratio	Tier 1 Capital to total assets, in %	13.4	13.8	541	8.3	11.6	17.4	15.3	183	883	9.2	12.9	19.5
Liquidity ratio	Cash + government debt + MFI bonds to EA bank / total assets, in %	16.4	14.0	750	0.2	14.4	33.1	14.8	17.9	1,656	1.9	11.6	28.7
NFC credit	As a share of total assets, in %	26.3	18.1	910	6.3	23.0	47.7	16.4	13.1	1,944	0.4	14.7	34.3
ROA	Return on average assets, in %	0.13	0.97	370	-1.3	0.25	0.77	0.43	0.51	634	0.03	0.34	1.07

Panel (b): Exposed vs. Non-Exposed banks

Variable	Mean	S.D.	N	P10	P50	P90	Mean	S.D.	N	P10	P50	P90	Difference
	Banks subject to new supranational supervision (Exposed)						*Banks subject to only national supervision (Non-exposed)*						
Size	11.5	1.1	606	10.3	11.5	12.8	10.1	1.3	2,109	8.5	10.1	11.8	1.4***
NPL ratio	3.4	3.8	431	0.1	1.9	10.3	3.1	3.3	565	0.0	2.0	8.3	-0.3
Capital ratio	13.8	4.7	408	10.4	12.9	18.7	14.9	19.6	1,016	8.5	11.9	18.9	-0.7*
Liquidity ratio	15.0	9.5	572	4.3	14.4	24.8	15.4	18.4	1,834	1.0	11.9	31.7	-0.5
NFC credit	19.5	13.3	581	3.5	17.4	35.3	19.6	16.1	2,273	0.4	16.5	40.1	-0.1
ROA	0.3	0.7	427	-0.1	0.4	1.0	0.3	0.7	577	-0.2	0.3	1.0	0

Table A.2: Sample composition

Country	Reporting threshold	Initial sample (in million)	# of banks Initial sample	Final sample (in million)	# of banks Final sample
Austria	350,000	1.4	1,601	0.5	65
Belgium	0	13.3	144	6.2	36
Germany	1,000,000	11.1	1,828	4.7	498
Spain	6,000	23.6	283	16.7	133
France	25,000	37.7	522	24.8	295
Ireland	500	4.3	4	-	-
Italy	30,000	148.3	1,576	28.2	731
Lithuania	290	0.3	166	0.3	11
Latvia	0	12.7	109	-	-
Malta	5,000	0.1	26	-	-
Portugal	50	8.8	198	6.2	11
Slovenia	0	0.2	26	-	-
Slovakia	0	0.9	30	0.6	11

Notes: The table reports for each country the reporting threshold of the individual credit register, the initial number of observation available in the dataset and the final number of observations obtained after cleaning and harmonizing the data, as well as collapsing the data at the lender-borrower-time period. See Tables 4 and A.9 for robustness on harmonized results to the first and second highest reporting credit register thresholds.

Table A.3: Supervision and bank credit supply – Robustness using drawn credit

	Drawn Credit							
	Stressed countries				Non-stressed countries			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$Sup_{b,t-1}$	0.253***	0.477***	0.0353***	0.0792***	0.0805***	0.413***	-0.0732***	-0.0945***
	(0.0115)	(0.0190)	(0.00546)	(0.00692)	(0.00777)	(0.0131)	(0.00734)	(0.0101)
Sector-Time FE	No	Yes	Yes	-	No	Yes	Yes	-
Bank-Firm FE	No	No	Yes	Yes	No	No	Yes	Yes
Firm-Time FE	No	No	No	Yes	No	No	No	Yes
N	39,105,096	39,105,096	39,105,096	28,949,171	6,379,646	6,379,646	6,379,646	3,266,448
Pseudo R^2	0.003	0.124	0.942	0.958	0.003	0.228	0.946	0.958

Notes: This table reports regressions that relate bank lending to firms and centralized supervision, as reported by Equation (2). The dependent variable is the total credit granted by bank *b* to firm *f* operating in sector *s* at time *t*. *Sup* (Supranational supervision) is a dummy variable that takes the value of one for banks supervised at supranational level (i.e., directly by the ECB) after November 2014, and zero otherwise. Dash (-) symbol refers to the fact that the fixed effects are not applicable as they are nested in different (higher-order) fixed effects. Poisson regressions are used to the estimate the models. Standard errors clustered at bank and firm level in parentheses: * p<0.1, ** p<0.05, *** p<0.01.

Table A.4: Bank-time fixed effects

	(Total) Credit		Drawn Credit	(Total) Credit			
Borrower quality proxy:	High-risk firm	High-risk firm	High-risk firm	Low ROA	Low Sales / Employee	Low Z-score	Zombie firm
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
$Sup_{b,t-1}$ x High-Risk Firm $Proxy_{f,t-1}$	-0.0835***	-0.1105***	-0.0441*	-0.0136**	-0.0341**	-0.644*	-0.030***
	(0.0233)	(0.0417)	(0.0243)	(0.0078)	(0.0142)	(0.339)	(0.011)
Bank-Firm FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm-Time FE	No	Yes	Yes	Yes	Yes	Yes	Yes
Bank-Time FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	30,660,006	1,355,265	28,949,171	2,852,649	2,852,649	2,947,729	2,156,751
Pseudo R^2	0.97	0.98	0.97	0.95	0.95	0.94	0.94
Sample	Full	6 banks per country	Full	Orbis	Orbis	Orbis	Orbis

Notes: This table reports the results of robustness to the main analysis for stressed countries using expanded specification with bank-time fixed effects. Column (1) presents the baseline version, Column (2) presents the coefficients using the restricted sample of banks around the threshold of supranational supervision, i.e., for each country, it includes the three smallest centrally supervised banks and the three largest non-centrally supervised banks. The dependent variable considered in Columns (1) – (2) and (4) – (7) is the total credit granted by bank *b* to firm *f* at time *t*. Columns (1) – (3) report a *High-Risk Firm* defined as the ratio of exposures in arrears and total exposures. Columns (4) – (7) present the results using alternative proxies for firm riskiness: *ROA*, *Sales-to-employee ratio* and *Z-Score*. *Zombie firm* is a dummy that takes the value of one if all three measures (ROA, sales-employee and z-score) rank in below the median of their respective distributions in the same country and year. *Sup* is a dummy variable that takes the value of one for banks supervised at supranational level after November 2014, and zero otherwise. Poisson regressions are used to the estimate the models in all columns except for Column (3) where OLS estimates are reported. Standard errors clustered at bank and firm level in parentheses: * p<0.1, ** p<0.05, *** p<0.01.

Table A.5: Supervision, *changes* in high-risk firms and change in bank credit supply

	Symmetric Change in Credit			
	Stressed Countries		Non-Stressed Countries	
	(1)	(2)	(3)	(4)
$Sup_{b,t-1}$	0.0216***		0.324***	
	(0.000908)		(0.00320)	
$Sup_{b,t-1}$ x Δ High-Risk $Firm_{f,t-1}$	-0.0883***	-0.0879***	-0.0370	-0.0332
	(0.00967)	(0.00920)	(0.0353)	(0.0351)
Bank-Firm FE	Yes	Yes	Yes	Yes
Firm-Time FE	Yes	Yes	Yes	Yes
Bank-Time FE	No	Yes	No	Yes
N	24,896,151	24,896,151	2,799,819	2,799,819
Adj R^2	0.480	0.52	0.535	0.567

Notes: This table reports the coefficient estimates using an alternative OLS methodology that regresses the effect of the change in borrower riskiness on the change in total credit. The dependent variable is the symmetric growth rate of credit defined as $\frac{Credit_{f,b,t}-Credit_{f,b,t-1}}{0.5(Credit_{f,b,t}+Credit_{f,b,t-1})}$, which similarly to the Poisson regressions allows for the joint estimation of extensive and intensive margins of lending. Δ *High-Risk Firm* indicates, for each borrower, the change in the ratio of exposures in arrears and total exposures. *Sup* is a dummy variable that takes the value of one for banks supervised at supranational level after November 2014, and zero otherwise. OLS regressions are used to the estimate the models. Standard errors clustered at bank and firm level in parentheses: * p<0.1, ** p<0.05, *** p<0.01.

Table A.6: Robustness to zombie measure cut-off for bottom firm ROA *and* productivity *and* Z-score

	Credit							
	Median cut-off (baseline) (worst 16.65% of firms)				Tercile cut-off (robustness) (worst 7.35% of firms)			
	Stressed Countries		Non-Stressed Countries		Stressed Countries		Non-Stressed Countries	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$Sup_{b,t-1}$	0.0330***	0.0521***	-0.0271	-0.0732**	0.0300***	0.0510***	-0.0203	-0.0528
	(0.00643)	(0.00678)	(0.0240)	(0.0360)	(0.00633)	(0.00659)	(0.0234)	(0.0322)
Zombie $Firm_{f,t-1}$	0.0429***		-0.00636		0.0454***		0.00591	
	(0.00701)		(0.0263)		(0.0100)		(0.0258)	
$Sup_{b,t-1}$ x	-0.0480***	-0.0353***	0.0526	0.127**	-0.0537***	-0.0624***	0.0230	0.0440
Zombie $Firm_{f,t-1}$	(0.0140)	(0.0118)	(0.0365)	(0.0541)	(0.0180)	(0.0184)	(0.0512)	(0.0581)
Bank-Firm FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Sector-Time FE	Yes	-	Yes	-	Yes	-	Yes	-
Firm-Time FE	No	Yes	No	Yes	No	Yes	No	Yes
N	2,806,758	2,156,869	239,481	146,037	2,806,758	2,156,869	239,481	146,037
Pseudo R^2	0.917	0.933	0.915	0.960	0.917	0.933	0.915	0.960

Notes: This table reports the robustness to the cut-off point in the definition of the zombie firm variable in the analysis of bank lending to firms, centralized supervision and borrower quality, as reported by Equation (1). The dependent variable is the total credit granted by bank *b* to firm *f* at time *t*. *Sup* is a dummy variable that takes the value of one for banks supervised at supranational level after November 2014, and zero otherwise. In Columns (1) – (4), *Zombie Firm* is a dummy variable that takes the value of one if all three measures (ROA, sales-employee and z-score) rank in below the median of their respective distributions in the same country and year. The median cut-off identifies worst 45,961 (16.65%) firms as zombie firms. In Columns (5) – (8), *Zombie firm* indicator takes the value of one if all three measures rank (ROA, sales-employee and z-score) in the bottom tercile. The bottom tercile cut-off identifies worst 20,281 (7.35%) firms as zombie firms. Dash (-) symbol refers to the fact that the fixed effects are not applicable as they are nested in different (higher-order) fixed effects. Poisson regressions are used to the estimate the models. Standard errors clustered at bank and firm level in parentheses: * p<0.1, ** p<0.05, *** p<0.01.

Table A.7: Supervisor incentives and borrower employment.

Robustness using firm-level employment

	Credit							
	Large firms		Small firms		Large firms		Small firms	
	Stressed	Non-Stressed	Stressed	Non-Stressed	Stressed	Non-Stressed	Stressed	Non-Stressed
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$Sup_{b,t-1}$	0.0633***	-0.0667*	0.0454***	-0.0204	0.0698***	-0.0536	0.0524***	-0.0388
	(0.0101)	(0.0391)	(0.00768)	(0.0561)	(0.0105)	(0.0401)	(0.00821)	(0.0606)
$Sup_{b,t-1}$ x High-Risk $Firm_{f,t-1}$	-0.1000	-0.234	-0.0999***	0.346	-0.104	-0.249	-0.0937***	0.469
	(0.0652)	(0.158)	(0.0357)	(0.475)	(0.0664)	(0.159)	(0.0361)	(0.494)
$Sup_{b,t-1}$ x $GSIB_{b,t-1}$					-0.0321*	-0.163*	-0.0327***	0.471
					(0.0187)	(0.0852)	(0.0113)	(0.563)
$GSIB_{b,t-1}$ x High-Risk $Firm_{f,t-1}$					0.475***	-0.490	0.282***	0.527
					(0.121)	(0.389)	(0.0771)	(3.229)
$Sup_{b,t-1}$ x $GSIB_{b,t-1}$ x High-Risk $Firm_{f,t-1}$					-0.313***	0.435	-0.259***	-3.431
					(0.113)	(0.373)	(0.0687)	(3.558)
Bank-Firm FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm-Time FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	399,383	64,982	2,074,877	16,465	399,383	64,982	2,074,874	16,465
Pseudo R^2	0.920	0.945	0.931	0.969	0.920	0.945	0.931	0.969

Notes: This table reports the results of the robustness analysis that examines the role of the supervisor incentives on the effect of supranational supervision on bank credit supply. The dependent variable is the total credit granted by bank *b* to firm *f* at time *t*. *Sup* is a dummy variable that takes the value of one for banks supervised at supranational level after November 2014, and zero otherwise. *High-risk firm* indicates, for each borrower, the ratio between exposures in arrears and total exposures. *GSIB* is a dummy variable that takes the value of one if the bank belongs to the globally systemically important banks, and zero otherwise. Columns (1) – (2) and (5) – (6) present the results using the sample of large firms (above 50 employees), while Columns (3) – (4) and (7) – (8) present the results using the sample of small and medium firms (below 50 employees). Poisson regressions are used to the estimate the models. Standard errors clustered at bank and firm level in parentheses: * p<0.1, ** p<0.05, *** p<0.01.

Table A.8: Bank-level results

	Log(bank-level total credit$_{b,t}$)		Log(bank-level drawn credit$_{b,t}$)	
	(1)	(2)	(3)	(4)
$Sup_{b,t-1}$	-0.0532***	-0.122***	-0.0547***	-0.118***
	(0.0131)	(0.0149)	(0.0132)	(0.0151)
$Sup_{b,t-1}$ x $Stressed_c$	-0.0264	0.163***	-0.0393	0.160***
	(0.0464)	(0.0496)	(0.0459)	(0.0489)
Bank FE	Yes	Yes	Yes	Yes
Time FE	Yes	-	Yes	-
Country-Time FE	No	Yes	No	Yes
N	18,973	18,973	18,962	18,962
Adj R^2	0.988	0.989	0.987	0.989

Notes: This table reports regressions that relate bank lending to firms and centralized supervision at the bank-level. In Columns (1) – (2), the dependent variable is the log of total credit granted by bank *b* at time *t*, while in Columns (3) – (4) the log of drawn credit is reported. *Sup* (Centralized supervision) is a dummy variable that takes the value of one for banks supervised at supranational level (i.e., directly by the ECB) after November 2014, and zero otherwise. *Stressed* is the dummy variable that takes the value of one if the bank is located in stressed countries (Spain, Italy, Portugal), and zero otherwise. Dash (-) symbol refers to the fact that the fixed effects are not applicable as they are nested in different (higher-order) fixed effects. OLS regressions are used to the estimate the models. Standard errors clustered at bank and time level in parentheses: * p<0.1, ** p<0.05, *** p<0.01.

Table A.9: Supervision, bank credit supply and high-risk firms

Robustness to EUR 350,000 threshold (2nd highest reporting loan register threshold)

	Credit			
	Stressed Countries		Non-Stressed Countries	
	(1)	(2)	(3)	(4)
$Sup_{b,t-1}$	0.0242***	0.0507***	-0.0376***	-0.0655***
	(0.00606)	(0.00781)	(0.00701)	(0.0100)
High-Risk $Firm_{f,t-1}$	0.0180		0.0415**	
	(0.0137)		(0.0165)	
$Sup_{b,t-1}$ x High-Risk $Firm_{f,t-1}$	-0.120***	-0.137***	-0.118***	0.00655
	(0.0162)	(0.0313)	(0.0172)	(0.0243)
Bank-Firm FE	Yes	Yes	Yes	Yes
Sector-Time FE	Yes	-	Yes	-
Firm-Time FE	No	Yes	No	Yes
N	7,439,958	4,769,753	2,057,397	910,535
Pseudo R^2	0.979	0.980	0.955	0.971

Notes: This table reports the robustness to Table 3 in the paper using the credit threshold of EUR 350,000, which is the second highest threshold to the credit registers (the one of the credit register in Austria). The analysis relates bank lending to firms, centralized supervision and borrower riskiness, as reported by Equation (1). The dependent variable is the total credit granted by bank *b* to firm *f* operating in sector *s* at time *t*. *High-Risk Firm* indicates, for each borrower, the ratio of exposures in arrears and total exposures. *Sup* (Centralized supervision) is a dummy variable that takes the value of one for banks supervised at supranational level (i.e., directly by the ECB) after November 2014, and zero otherwise. Dash (-) symbol refers to the fact that the fixed effects are not applicable as they are nested in different (higher-order) fixed effects. Poisson regressions are used to the estimate the models. Standard errors clustered at bank and firm level in parentheses: * p<0.1, ** p<0.05, *** p<0.01.