Banking Supervisory Architecture and Sovereign Risk

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Abstract

This paper investigates whether the design of the banking supervisory architecture impacts sovereign risk. Exploiting the implementation of the Single Supervisory Mechanism (SSM) in Europe, we find evidence that sovereign risk – measured by sovereign ratings – is lower after the largest banks are supervised supranationally rather than nationally. The impact is shaped by the characteristics of the banking sector and the country's institutional setting. The existence of more resilient banks (banking stability) and less volatile bank funding in the economy (credit stability) after the implementation of the supranational supervisory framework are found to constitute the underlying channels shaping the relationship between banking supervision and sovereign risk. The results hold after considering CDS spreads as an alternative measure of sovereign risk and after conducting several robustness tests.

Keywords

Banking supervision, sovereign risk, ratings, bank stability.

JEL Codes

G21, G28, H63, G24

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1. INTRODUCTION

The Global Financial Crisis (GFC) highlighted the role of banking supervision in ensuring the stability of the financial system and protecting the banking sector from significant shocks or even collapse (Calvo et al., 2018). Banking supervision is crucial for the entire financial system as it seems to affect bank efficiency (Chortareas et al., 2012; Gaganis & Pasiouras, 2013), performance (Avgeri et al., 2021; Hirtle et al., 2020; Rezende & Wu, 2014), market value (Carboni et al., 2017; Loipersberger, 2018), risk-taking (Avignone et al., 2021; Tabak et al., 2016), credit supply (Altavilla et al., 2020; Fiordelisi & Ricci, 2017; Kupiec et al., 2017), and disclosure policies (Altunbaş et al., 2022). Moreover, the effects of banking supervision extend beyond the financial system as banking supervisory architecture also matters for the real economy (Ampudia et al., 2021; Beck et al., 2006; Danisewicz et al., 2018; Kilinc & Neyapti, 2012).

Within this context, the design of the banking supervisory architecture is crucial for the effectiveness of banking supervision (Beck, Todorov, et al., 2013; Dell'Ariccia & Marquez, 2006). As previous studies have highlighted, the desired optimal bank supervision may depend on several factors, including incentives, allocation of responsibilities, regulatory quality, and information collection. Even considering these factors, there seems to be a trade-off in determining the optimal supervisory arrangement (see, for instance, Karolyi & Taboada, 2015; Rezende & Wu, 2014). Specifically, in the search for an optimal supervisory design, prior studies have examined whether national (decentralized) supervision is superior to supranational (centralized) supervision (Beck & Wagner, 2016; Calzolari et al., 2019; Carletti et al., 2021; Colliard, 2020). At the policy level, the debate has focused on whether there is a need for greater cross-border integration of financial regulation and supervision.

Despite the key role of banking supervision in ensuring financial and banking stability, previous studies have not yet examined the extent to which the design of the supervisory architecture affects sovereign risk, which extends beyond financial and banking stability. This is relevant because, as the GFC revealed, inefficient banking supervision can cause sovereign troubles due to the sovereign–bank nexus (Acharya et al., 2014; Dieckmann & Plank, 2012; Fratzscher & Rieth, 2019). In this sense, there is also evidence of sovereign ratings' adjustments due to an exacerbated sovereign risk arising from the banking sector.[1] Moreover, the relevance of assessing the effectiveness of banking supervision as a factor influencing the degree of sovereign risk has been also highlighted.[2]

[1] BIS (2011) documented that some of the sovereign downgrades that took place in the eurozone during the GFC were originally caused by a deterioration of the national banking sectors.

[2] In their sovereign rating criteria, Fitch states that "*qualitative judgements are also made in conjunction with Fitch's Financial Institutions Group on the effectiveness of bank supervision and regulation*" to evaluate the risk to sovereign creditworthiness by the banking sector (Fitch, 2022).

In this paper, we empirically analyze the effect of the banking supervisory architecture on sovereign risk. Following prior studies (Ampudia et al., 2021; Avgeri et al., 2021; Fiordelisi et al., 2017; Loipersberger, 2018), we use the implementation of a supranational supervisory framework in Europe, the Single Supervisory Mechanism (SSM), as our empirical setting. Under this framework, the largest and systemically most important banks switched from a national to a supranational supervisor. This shift allows us to explore the implications of this change in banking supervision for sovereign risk. In addition, this paper also aims to identify how the change in the supervisory architecture impacts sovereign risk.

Using a difference-in-differences (DID) methodology, we compare the evolution of sovereign ratings, as a proxy for sovereign risk, across 31 European countries from 2011 to 2018. Unlike other measures, ratings provide a long-term view of sovereign risk and thus aim to respond to only the perceived permanent component of credit-quality changes (Altman & Rijken, 2004). Moreover, compared to market-based measures of sovereign risk, ratings also include information retrieved from economic, financial, and qualitative sources (Fitch, 2014; Moody's, 2015; Standard and Poor's, 2014). Specifically, we compare the sovereign ratings of European countries whose largest and most significant banks are supervised supranationally (treated group) with countries in which banking supervision is conducted exclusively by the national authorities (control group) before and after the implementation of the SSM.

After controlling for macroeconomic factors and the bank regulatory changes that have taken place during our sample period – e.g. implementation of Basel III, adoption of countercyclical capital buffers, establishment of limits to banks' exposures, etc. –, we find that, following the implementation of a supranational supervisory framework, sovereign ratings are higher for countries whose significant banks are under direct SSM supervision than for countries where all banking supervision remains at the national level. This finding provides additional evidence that the implementation of supranational banking supervision leads to lower sovereign risk. On average, the probability of being rated AAA increases by almost 10 percentage points (from 4.27% to 14.07%) for Fitch, 7.45 pp (from 7.77% to 15.23%) for Moody's and 6.84 pp (from 3.40% to 10.24%) for S&P following the implementation of the SSM. Moreover, we show that the impact of the banking supervisory architecture on sovereign risk is not homogeneous across countries but is shaped by the characteristics of the banking sector, specifically profitability and market structure, and the features of each country's legal and institutional environment. In particular, supranational supervision has a larger positive effect on sovereign ratings in countries with lower levels of legal enforcement and institutional quality. Furthermore, we provide evidence that the existence of a supranational supervisor in banking systems that are largely distressed and

characterized by higher competitive pressures leads to relatively higher increases in sovereign ratings and thus lower sovereign risk.

In order to provide evidence of the mechanism through which the change towards a supranational supervisory framework may affect sovereign risk, we examine banks' reactions following the implementation of the SSM using bank-level data. After the implementation of the SSM framework, banks supervised supranationally are more stable and less risky (*bank stability channel*) and provide more stable funding to the economy (*credit stability channel*) than banks supervised nationally, regardless of their level of significance in the banking system (less significant banks from SSM countries and significant banks from non-SSM countries). In particular, in line with Beck et al. (2022)'s findings, we demonstrate the link between supranational supervision and bank stability runs mainly through the reduction in assets risk. A higher banks' resilience – downsizing the consequences of bank failures for the sovereign – and a more stable source of funding for firms and consumers – supporting economic growth and funding profitable investment opportunities – would provide evidence on how the change in the supervisory framework leads to a reduction on sovereign risk. Moreover, the role of banking stability in reducing sovereign risk after the SSM is corroborated using an instrumental variable (IV) analysis at the country level.

These results are found to be robust when considering sovereign and banks' CDS spreads as an alternative measure of risk. We also ensure that the adoption of the SSM did not prompt alterations in the supervisory standards upheld by national authorities. Furthermore, our analysis confirms that post-SSM implementation, both treated and control countries exhibited analogous changes in macroeconomic conditions and banking regulation. Finally, the results are robust to placebo and falsification tests, subsample analyses, and other robustness tests.

This paper contributes to two main areas of the literature. Firstly, it contributes to the literature on banking supervisory architecture. There is broad consensus and suggestive evidence on the relevance of efficient banking supervision. Figure A1[3] shows that countries with more effective bank supervision – measured by the average tenure of bank supervisors – exhibit a higher degree of banking stability – measured by the Z-score value of the banking sector. However, there are several controversies regarding the optimal design of the banking supervisory architecture. Colliard (2020) finds that an optimal framework strikes a balance between centralized and decentralized supervision. A more centralized supervisory architecture allows banks to employ more foreign funding, while conversely, more foreign funding makes the local supervisor more lenient, which increases the benefits of centralized supervision. Carletti et al., (2021) show that a

[3] Using data from OECD countries, this figure shows plots the correlation between the average values of the tenure years of bank supervisors (X-axis) and the Z-score of the banking industry (Y-axis) from 2002 to 2016. The data is sourced from the Bank Regulation and Supervision Survey (World Bank) and the Global Financial Development Database (World Bank).

supervisory system in which a centralized supervisor has authority over banks but relies on local supervisors to collect actionable information could be beneficial in addressing principal–agent problems between central and local supervisors. Calzolari et al., (2019) demonstrate that supranational supervision solves the problem of coordination failures for multinational banks. Boyer & Ponce (2012) identify the distribution of supervisory responsibilities among different supervisors as an optimal organizational design. Beck et al., (2022) show that an effective supranational supervisory cooperation generally improves bank stability. In this context, our paper aims at contributing to this literature by providing empirical evidence about the optimality of a system in which a supranational supervisor oversees the largest and systemically most important banks for mitigating sovereign risk.

Secondly, this paper contributes to the literature on sovereign risk. Despite the sovereign–bank nexus (Acharya et al., 2014; Fratzscher & Rieth, 2019) and the evidence on the relationship between banking stability and sovereign risk, few papers have considered the soundness of the banking system as a determinant of sovereign risk, at least when employing sovereign ratings as a measure of risk (Boumparis et al., 2019; Brůha & Kočenda, 2018; Cuadros-Solas et al., 2021; Kallestrup et al., 2016). Using data from OECD countries, Figure A2[4] shows that countries with a more stable banking system – measured by the Z-score value of the banking sector – are associated with lower (higher) sovereign risk (ratings). Understanding how the characteristics of the banking system might explain changes in sovereign ratings is crucial as sovereign ratings affect the funding costs of not only states (Afonso et al., 2012) but also non-financial firms (Chava et al., 2019; Drago & Gallo, 2017). In fact, sovereign ratings constitute a ceiling for the ratings assigned to financial institutions – mainly investment and commercial banks – corporates, and regional governments within a country (Borensztein et al., 2013). Our paper contributes to this literature by demonstrating that, together with the legal and institutional framework, banking supervisory architecture impacts sovereign risk.

The remainder of the paper is organized as follows. Section 2 reviews the related literature and discusses the paper's main hypotheses. Section 3 describes the empirical setting, the data, and the methodology. The main results are presented in Section 4. Section 5 addresses the channels through which banking supervision may affect sovereign risk. Additional robustness checks are presented in Section 6. Finally, Section 7 concludes.

[4] Using data from OECD countries, this figure shows plots the correlation between the average value of the Z-score of the banking industry (X-axis) and the average sovereign ratings (Y-axis) from 2002 to 2016. The data is sourced from the Global Financial Development Database (World Bank) and the three main sovereign rating agencies (Fitch, Moody's and S&P).

2. THEORETICAL BACKGROUND AND HYPOTHESES

The banking sector is characterized by the need for official supervision conducted by the regulatory authorities alongside the private supervision exercised by the markets. The nature and opaqueness of banking activities as well as the distorting incentives that may be associated with deposit insurance schemes justify the existence of banking supervision (Anginer & Demirguc-Kunt, 2018). All the intervention policies that the authorities implement in the event of banking crises also justify the role of supervisory authorities. Safety nets may reduce the incentives for depositors to supervise bank performance. Furthermore, the lack of incentives for partially insured depositors means that official authorities have to replace private supervision with official and public supervision.

It has also been argued that there are detrimental effects of official supervision on the stability of the banking system. Shleifer & Vishny (1998) highlight that greater state intervention is positively associated with the level of corruption in decision-making and increases financial instability by reducing efficiency. Furthermore, certain regulations may be the consequence of the banks' own lobbying pressure and serve purposes other than controlling bank risk-taking. From a different perspective, Kane (1990) and Boot & Thakor (1993) focus on the agency problem between taxpayers and bank supervisors to demonstrate that supervisors are poorly incentivized to perform their functions when taxpayers cannot adequately assess quality. In particular, since supervisors do not have their own wealth committed to the bank, their incentives to supervise differ from those of private agents.

Regarding the different types of official supervisory architectures, namely supranational and national supervision, the literature remains sparse. Most of it centers on the GFC period, which is considered the catalyst that obliged policymakers to rethink deeply about the implications of different regulatory and supervisory designs. Within this context, it has been highlighted the existence of a trade-off when deciding on an optimal supervisory setup (see, for instance, Karolyi & Taboada, 2015; Rezende & Wu, 2014). According to Peek et al. (1999) show that assigning the responsibilities for supervision and monetary policy to a single authority can be beneficial. This is because confidential bank information can improve the accuracy of the supervisory board's forecasts of macroeconomic scenarios. More recently, the theoretical paper of Colliard (2020) underlines the agency problem between local and central supervisors. These authors underline that local supervisors have, by default, more information about domestic banks than supranational supervisors do. Hence, local supervisors may engage in forbearance and relax their supervision of domestic banks. Consequently, this theoretical model highlights that inadequate local supervision leads to frictions in the allocation of capital. Thus, switching to a more centralized supervisory

architecture should foster financial integration and reduce financial fragmentation. These results are consistent with Calzolari et al. (2019) and Carletti et al. (2021). These authors show that supranational supervision solves the coordination problems that arise from the supervision of multinational banks and decreases the public costs of a bank failure (Calzolari et al., 2019). Moreover, differences between central and local supervisors have been demonstrated to lead to poorer bank monitoring due to frictions in the allocation of risk between locally and centrally supervised banks (Carletti et al., 2021).

From an empirical perspective, several papers have found that banking supervisory architecture impacts the banking system and the real economy. Agarwal et al. (2014) analyze the effect of the U.S. dual supervisory system and show that local supervisors are more lenient in their supervision during periods of economic stress. Federal supervisors, however, are more concerned about systemic stability at the supranational level. According to them, a central supervisor should perform better than local supervisors, as they lack specific interests in favor of banks at the local level. Furthermore, local supervisors compete with one another and may wish to attract nearby banks or prevent their local banks from moving elsewhere. To achieve these goals, they may supervise less stringently. Within the EU context, Fiordelisi et al. (2017) show that changing the supervisory architecture affects the banking sector as the differing objectives of national and supranational supervisors can distort the incentives of the supervised banks. Specifically, these authors find that banks that were expected to be supervised directly by a supranational authority (the ECB) adjusted their lending activities relatively more than banks that were expected to remain supervised at the national level. More recently, and as a natural extension of the abovementioned research, Ampudia et al. (2021) show that firms borrowing from supranationally supervised banks have fewer intangible assets and more tangible assets and cash holdings than firms borrowing from nationally supervised banks. Altavilla et al. (2020) provide evidence consistent with the proposal that supranational supervision can reduce credit supply to firms with very high ex-ante and ex-post credit risk while stimulating credit supply to firms without loan delinquencies. Moreover, this result is stronger for banks operating in stressed countries.

Given the relevance of banking supervision – at either the national or supranational level – for bank risk-taking incentives and financial stability, sovereign risk may be expected to be affected by the supervisory scheme defined in each country. However, the effect of supranational versus national supervisors on sovereign ratings may a priori lead to contradictory predictions.

On the one hand, it could be argued that supranational supervision would foster a reduction in sovereign credit risk (*risk-reducing effect)*. Since there are economies of scale in bank supervision (Eisenbach et al., 2022), a large central authority may be more efficient in terms of information

collection than smaller national supervisors, which would reduce sovereign risk arising from the banking sector. As Ampudia et al. (2019) underline, supranational supervisors may be able to maintain a level-playing-field perspective, which leads to consistent supervisory standards, more effective enforcement, and less room for regulatory arbitrage. Similarly, Masciandaro (2007) highlights that a unified supervisory structure may create synergies among different supervisory functions and expertise. Moreover, as Beck, Todorov, et al., (2013) show, national supervisors' incentives are more biased than those of supranational supervisors when dealing with cross-border banks, which are commonly the largest and most systemic banks. A supranational supervisory framework could remove these biases, leading to more efficient supervision. These arguments are consistent with the positive view of Obstfeld (2015) on the contribution of supranational supervision to financial stability. In line with these arguments, the recent paper by Avignone et al. (2021) shows that supranationally supervised European banks have reduced credit risk exposure compared to nationally supervised banks. In the same vein, Farnè & Vouldis (2021) document an inverse relationship between bank size and non-performing loan growth for a sample of European banks. Using novel data on supranational agreements signed by 93 countries, Beck et al., (2022) show that supranational supervisory cooperation generally improves bank stability. This evidence is also consistent with the organizational efficiency derived from a supranational supervision. Hence, the establishment of a supranational supervisor would apparently decrease the level of risk in the banking sector, thereby reducing sovereign credit risk in countries with this type of supervisor. In other words, as the default risk of banking sectors can be transferred to sovereigns (Acharya et al., 2014; Böhm & Eichler, 2020; Farhi & Tirole, 2018), the existence of a supranational supervisor that monitors the level of risk for the whole banking sector would foster a reduction in sovereign credit risk (*risk-reducing effect).*

On the other hand, the establishment of a supranational supervisory scheme may also foster an increase in sovereign credit risk (*risk-increasing effect).* As Beck, Todorov, et al., (2013) point out, a supranational supervisor is more likely than a national supervisor to have imperfect knowledge. National supervisors may have information advantages compared to a supranational supervisor (Colliard, 2020). The supranational supervisor's imperfect information may cause them to make incorrect decisions that may increase sovereign risk. Thus, imposing supranational supervision could undermine the capability of national supervisors to improve banking sector stability and efficiency by using their more comprehensive knowledge of the specific characteristics of the banking sector under their supervision (Barth et al., 2004b, 2008, 2013). Boyer & Ponce (2012) find that dividing supervisory powers among different supervisors is preferable, in terms of social welfare, to concentrating these powers in a single supervisor when the capture of supervisors by

bankers is a concern. Moreover, the simple geographical proximity between banks and their supervisors seems to improve supervision. Using data from the closure of a U.S. bank supervisor's field offices, Gopalan et al. (2021) find that bank risk increases along with the physical distance between banks and their supervisory office. Consequently, having a remote (supranational) rather than a local (national) supervisor could increase risk in the national banking sector.

Opposing arguments can also be made on the basis of the theoretical papers that examine the optimal supervisory framework, which underline that there are trade-offs associated with allocating supervision to a supranational rather than a national authority (Beck, Todorov, et al., 2013; Boyer & Ponce, 2012; Calzolari et al., 2019; Carletti et al., 2021; Repullo, 2018). As these studies highlight, the bank supervisory structure that is optimal in relation to sovereign risk may depend on several factors, including incentives, allocation of responsibilities, regulatory quality, and information collection. Dell'Ariccia & Marquez (2006) state that a supranational supervisory framework is preferable to a national one only if its standards are higher than the highest individual country standards.

Consequently, the potential impact of banking supervisory architecture on sovereign ratings (*risk-reducing effect* vs *risk-increasing effect*) can be considered an empirical question. In this context, accounting for cross-country differences in banking sector characteristics and in the features of the legal and institutional environment could shed additional light on whether and to what extent these country-level factors may shape the relationship between the different supervisory schemes and sovereign ratings.

3. EMPIRICAL METHOD

3.1. The Single Supervisory Mechanism (SSM) framework

To examine the implications of the banking supervisory architecture on sovereign risk, we use the implementation of the SSM in Europe as a laboratory, as recent and expanding line of empirical research has also done (Ampudia et al., 2021; Avgeri et al., 2021; Fiordelisi et al., 2017; Loipersberger, 2018; Tziogkidis et al., 2020). While dual banking supervisory frameworks do exist in other jurisdictions,[5] the implementation of the SSM is a convenient laboratory for studying the impact of bank supervision on sovereign risk, as it involves a change of supervisor – from national

[5] For example, in the US, the supervisory system includes numerous regulators at the state and federal level. In this system, banks can be supervised by two kinds of authorities (state and federal supervisors). Several federal and state authorities regulate banks along with the Federal Reserve. The Office of the Comptroller of the Currency (OCC), the Federal Deposit Insurance Corporation (FDIC), the Office of Thrift Supervision (OTS), and the banking departments of various states also regulate financial institutions.

to supranational – for a significant fraction of the European banking industry after the onset of the GFC and the subsequent bank bailout processes.[6]

In November 2013,[7] the Council of the European Union assigned specific tasks to the European Central Bank (ECB) regarding the prudential supervision of credit institutions. The ECB assumed its supervisory tasks in full in November 2014, after completing a comprehensive assessment that ran between November 2013 and October 2014. The main purpose of this new supervisory architecture was to enhance the supervision of Europe's banking sector. Specifically, the new supervisory framework established a banking supervision mechanism composed of a supranational supervisor – the ECB – and national competent authorities (NCAs) – the national central banks – in participating EU Member States. Compared to the ex-ante regulation, the SSM entails that the ECB supervises the largest and most significant banks directly, while the national supervisors continue to monitor the remaining banks. This institutional setting is particularly interesting for exploring the impact of banking supervision on sovereign risk because, in the context of the European banking sector, it involved a switch for the largest and systemically most important banks of the euro area from a national to a supranational supervisor.

While several criteria must apply for a bank to be supranationally supervised, a bank's significance is assessed based mainly on its size, its importance to the economy of the EU or any participating Member State, and the significance of its cross-border activities.[8] The largest and systemically most important banks are those supervised by a supranational authority. In practice, this supranational supervision is conducted by Joint Supervisory Teams (JSTs). JSTs are formed of staff of the ECB, staff from the national supervisory institution, and staff from the other supervisory institutions of the Euro area. In terms of our research interest, it is important to notice that the JST coordinator, who leads the team and steers its supervisory activities, is not from the country where the supervised bank is located. Moreover, the JST coordinators and members rotate regularly. After the implementation of the SSM, the supervision that remained at the national level became responsible for overseeing smaller banks and conducting other day-to-day supervisory tasks related to consumer protection, money laundering, payment services, and the branches of third-country banks.

The SSM criteria aimed at determining which banks are supervised supranationally make our analysis appropriate for answering our research question for several reasons. Firstly, the

[6] In Table A1, we show that the European countries considered in the analysis (treated and control groups) do not differ in terms of their macroeconomics or their financial and banking conditions before the implementation of the SSM.
[7] Available at: https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex%3A32013R1024
[8] Art 6.4 of Council Regulation (EU) No 1024/2013 states all the criteria that determine whether a bank is considered significant. Practically, the ECB supervises banks with assets exceeding €30 billion, banks with assets that account for at least 20% of their home country's GDP, banks with cross-border activities, or the three largest banks of a country.

supranational supervision of systematic important banks performed by the ECB is not marginal compared to the remaining national supervision. Table A2 in the Appendix presents descriptive statistics on the supervision conducted by the ECB since full implementation of the SSM. Since November 2014, the ECB has supervised 148 banks, which represents approximately 2.5% of the total number of banks in Europe. In total, there has been supranational supervision of approximately €6.9 trillion annually, which means that from 2014 to 2018, the SSM supervised €107 trillion in total assets. These figures reveal the relevance of this supranational supervision. The largest and systemically most important banks, whose financial distress could negatively affect the entire economy, are supervised by a supranational authority. This is crucial because, as we are examining the impact of supervisory architecture on sovereign risk, the level of supranational supervision needs to be sufficiently relevant to affect risk at the country level. Secondly, the most significant banks in each jurisdiction are those for whom a deterioration in their financial situation – possibly due to ineffective bank supervision – could negatively affect the entire economy. This institutional setting is particularly interesting for exploring the impact of banking supervision on sovereign risk. Importantly, banks are unlikely to endogenously determine the decision to switch supervisors. Furthermore, the total number of banks supervised in each country is not endogenously determined at the national level. National authorities, governments, and other political structures cannot choose whether a specific bank is supervised by the ECB or determine the total fraction of the national banking sector to be supervised at a supranational level.

Despite the change in the supervisory framework, it should be acknowledged that other banking regulatory changes, which could also affect sovereign risk, were taking place around this post-GFC period – e.g. implementation of Basel III capital requirements and liquidity standards, adoption of countercyclical capital buffers, the establishment of limits to banks' exposures, among other measures. In our methodological approach, we account explicitly for these banking prudential regulations by including a set of different regulatory controls. Furthermore, we also account for the potential impact of the 12-month Comprehensive Assessment (CA) of the European banking system[9] conducted before the SSM by exploring a potential anticipation effect.

Overall, the implementation of the SSM seems to be an optimal setting to examine how the shift to supranational supervision of a country's largest and most significant banks affected the sovereign risk of these countries.

[9] The Comprehensive Assessment was a financial health check of 130 banks in the euro area (including Lithuania), covering approximately 82% of total bank assets. It was carried out by the ECB together with the national supervisors between November 2013 and October 2014 and was an important step in preparing the Single Supervisory Mechanism to become fully operational

3.2. Data

Our analysis relies on a panel data sample of 248 sovereign ratings issued by Fitch, S&P, and Moody's for 31 European countries (19 of which operate under the SSM framework) from 2011 to 2018.[10] Given our research question, we focus on a set of European countries because they are relatively homogeneous before the implementation of the SSM from an economic, financial, and democratic perspective.[11] Specifically, our sample includes all the countries in the EU (28) plus Iceland, Norway, and Switzerland.[12] While the latter three European countries are not part of the EU, they are part of the Schengen Area and the European Free Trade Association (EFTA), which allows them to participate in the European Single Market.[13] More importantly, their domestic banking systems are not significantly different from those of the EU countries.[14] This is why prior studies examining the European banking sector have included them (Beccalli et al., 2015; Distinguin et al., 2013; Lepetit et al., 2008).

Consistently with prior literature examining the consequences of the implementation of the SSM (Ampudia et al., 2021; Avgeri et al., 2021; Avignone et al., 2021; Fiordelisi et al., 2017), the period analyzed allows us to capture the impact of banking supervision on sovereign ratings. In particular, as Fiordelisi et al., (2017) underline, the consequences of changing supervisory architecture generally become visible over the medium to long term. For this reason, our analysis extends to 2018.

To measure sovereign risk, we use the long-term foreign currency sovereign credit ratings issued by the three main CRAs (Fitch, S&P, and Moody's), which we obtained from Thomson Reuters and checked against CRA publications.[15] Sovereign ratings as measures of sovereign risk tend to focus on long-term changes in credit quality (Altman and Rijken, 2004). As is standard in the credit ratings literature (Afonso et al., 2012; Boumparis et al., 2019; Cuadros-Solas et al., 2021;

[10] Austria, Belgium, Bulgaria, Croatia, Cyprus, the Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, the Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland, and the United Kingdom.

[11] To ensure that our empirical analysis is based on a panel of comparable countries, we examined whether treated and control countries were similar in terms of 1) macroeconomic factors, 2) the state of their financial markets, and 3) the relevance of their banking systems before the implementation of the SSM. In particular, we considered several macro-indicators (GDP Growth, GDP Per Capita, Inflation, Employment Rate, and Fiscal Balance), financial stress indicators (Stock Market Return and Stock Price Volatility), and banking indicators (Banking Credit to GDP and Banks' Deposits to GDP). Table A1 shows there are no significant differences for all these variables between countries before the implementation of the SSM.

[12] During our sample period, the United Kingdom was part of the EU. The country left the EU on 31 January 2020.

[13] For robustness purposes, we also exclude Iceland, Norway, and Switzerland from our sample. The results are qualitatively similar.

[14] For robustness purposes, we exclude Greece, Italy, Ireland, Portugal, and Spain (the GIPSI countries) because the banking systems of these European countries were most affected by the GFC. The results are presented in section 6.9 and are qualitatively similar.

[15] Although CRAs also issue Watchlists (short-term prospects regarding future ratings changes) and Outlooks (medium-term prospects regarding future ratings changes), we do not use these for two main reasons. The first relates to the main objective of the paper, which is to determine whether the architecture of banking supervision has significant rather than short-lived effects on sovereign risk. Secondly, most prior studies on sovereign rating modelling use only ratings (Afonso et al., 2011; Cuadros-Solas et al., 2021; De Moor et al., 2018; Reusens & Croux, 2017; among others).

among others), we transform the categorical ratings scale into a numerical scale and group it into 21 categories, so that higher values imply higher quality. As specified in Appendix A3, two broad groups of ratings can be differentiated depending on the degree of default risk. Investment grade (from AAA/Aaa to BBB-/Baa3) indicates a relatively low risk of default, while speculative grade (from BB+/Ba1 to D) indicates either a high default risk or that a default has already occurred. The investment-grade rating categories represent most of the ratings issued by the three CRAs (approximately 85%).

3.3. Empirical setting

3.3.1. Difference-in-differences (DID) analysis

We examine the effects of the official bank supervisory architecture on sovereign ratings using a DID analysis. The aim of the analysis is to compare the evolution of sovereign ratings across those countries that changed to a supranational supervisor (those supervised under the SSM framework) and those that are not. The DID estimates allow us to compare a treatment group (countries with supranational supervision of large and significant banks) with a control group (countries where banking supervision is conducted exclusively by national authorities) before and after the treatment, that is, the implementation of supranational supervision.[16] Thus, the treatment group comprises the European countries operating exclusively under the SSM framework (SSM countries) and the control group (non-SSM countries) comprises the European countries operating under a national supervisory framework. By employing this approach, we control for observable and unobservable factors that may affect both groups of countries.

Like other studies on sovereign ratings, we use an ordered probit model with country and time fixed effects to model sovereign ratings[17] (see among others, Broto & Molina, 2016; Cuadros-Solas & Salvador, 2022; Vernazza & Nielsen, 2015). We estimate the following equation (1):

$$SOVEREIGN\ RATING_{c,t+1} = \alpha + \beta_0\, SSM_{c,t} + \sum_{z=1}^{8} \emptyset_z\, MACROECONOMIC_{c,t} + \sum_{z=1}^{6} \Pi_z\, BANK\ REGULATION_{c,t} + \theta_c + \delta_t + \varepsilon_{c,t}$$

[16] Table A2 in the Appendix presents the list of treated and control countries.

[17] There is a large consensus in the ratings literature on using an ordered model rather than a linear probability model (OLS) to examine sovereign ratings. As prior literature has argued (Afonso et al., 2009; De Moor et al., 2018), the main disadvantages of employing an OLS are that i) these models ignore that ratings are not continuous in their distribution, ii) the distances between the different categories are not identical (especially at the investment grade border), and iii) linear probability models are sensitive to the presence of extreme values in the independent variables, which can lead to unstable and unreliable results. In any case, for robustness purposes we also re-run our models using a linear probability model. The results, available upon request, are consistent with our main findings.

[1]

where the dependent variable is the sovereign rating of country *c* at the end of the first quarter of year *t+1*. This allows us to account for potential endogeneity concerns, as CRAs issue their ratings based on qualitative and quantitative macroeconomic fundamentals, which are not immediately publicly disclosed at the end of each period.[18] Then, we lead the dependent variable by one quarter to ensure that the sovereign ratings, as measures of sovereign risk, include all the relevant public information (quantitative and qualitative) about the creditworthiness of the country analyzed.

$SSM_{c,t}$ is our variable of interest. Alternatively, it is defined as an indicator that equals 1 when and after a country's banking sector c becomes part of the SSM framework and 0 otherwise (*SSM Dummy*$_{it}$). This variable serves as the interaction of *Post-SSM*$_t$ and *Treated*$_{c,t}$ of a standard DID specification. We also account for the intensity of the SSM supervisory activity using a continuous variable that is computed as the ratio of total bank assets under the SSM framework to total assets of the banking sector in each country (*SSM Assets*$_{it}$). The slope β_0 reflects the effect of the SSM on sovereign ratings. Hence, this variable serves as the DID operator. A positive coefficient would indicate higher sovereign ratings for countries whose banks are supranationally supervised (the treatment group) compared to countries whose banks are not supranationally supervised (the control group) after the implementation of the SSM in the EU.

The vector $MACROECONOMIC_{c,t}$ includes the control variables that measure the creditworthiness, economic situation, and institutional quality of the countries rated by the CRAs and thus their sovereign risk. Following previous studies (Afonso et al., 2011, 2012; Cantor and Packer, 1996; De Moor et al., 2018; Reusens and Croux, 2017; Cuadros-Solas et al., 2021) and the CRAs' methodological reports (Fitch, 2014; Moody's, 2018; Standard and Poor's, 2014), we include GDP per capita (*GDPpc*), annual GDP growth rate (*GDP Growth*), inflation level (*Inflation*), unemployment rate (*Unemployment*), current account balance as a percentage of GDP (*Current Account Balance (%GDP)*), fiscal balance (*Fiscal Balance*), level of public debt as a percentage of GDP (*Public Debt (%GDP)*), liquid liabilities as a percentage of GDP (*Liquid Liabilities (%GDP)*), and level of institutional quality (*Inst. Quality*).[19]

To control for other changes in banking regulation that have taken place during our sample period – e.g. implementation of Basel III, adoption of countercyclical capital buffers, establishment

[18] This approach (leading or lagging variables) to avoid the endogeneity concerns related to the use of contemporaneous values of the dependent variable and the set of sovereign risk determinants has been used in the ratings literature (Caporale et al., 2012; Cuadros-Solas et al., 2021; De Moor et al., 2018; Hu et al., 2002; among others). Nonetheless, in section 6.8, we re-run our models without leading the ratings by one quarter, and the results are consistent.

[19] Table A4 in the Appendix describes all the variables employed in the regressions, as well as the main sources from which they were retrieved.

of limits to banks' exposures, etc. –, we include the vector $BANK\ REGULATION_{c,t}$. This vector includes a set of controls that aim at accounting for changes in bank regulation. In doing so, we control for the changes in the following banking regulations: i) sector-specific banks' capital buffers across the residential, consumer, and other sectors *(*Δ*ss_capbuffers*), ii) banks' capital requirements (Δ*cap_buffers*), iii) limits on banks' exposures to specific borrowers or sectors *(*Δ*ss_exposure*), iv) limits on banks' exposures to other banks (Δ*interbank_exposure*), v) reserve requirements on foreign (Δ*rr_foreingcurr*) and local (Δ*rr_localcurr*) currency-denominated accounts[20]. All these variables are retrieved from Cerutti et al., (2016)[21] and the IMF. These variables allow us to account for banking regulatory changes at the macro- and micro-prudential levels. For robustness purposes (Table A12), we also consider the cumulative changes of these same instruments since 2000 and changes in a banking regulatory index (Δ*Regulatory Index)*. In this case, the purpose is to capture the level of "tightness" ("looseness") of a banking regulation at a given point in time.

θ_c is a vector of country fixed effects that captures the individual effect of each country and allows us to account for unobservable time-invariant fixed effects. We also include year fixed effects (δ_t) to control for aggregate fluctuations in sovereign ratings over time. In particular, the year fixed effects difference away trends that affect treatment and control group countries. $\varepsilon_{c,t}$ is the error term. Lastly, to prevent potential heteroscedasticity and/or autocorrelation problems in the residuals, the equations are estimated considering clustered standard errors at the country level.

<Insert Table 1 about here>

<Insert Figure 1 about here>

3.3.2. Parallel trends assumption

Before using a DID estimation to examine the effect of implementing a supranational supervisory scheme on sovereign risk, we check whether, in the absence of treatment, the changes in sovereign ratings are similar for the treatment and control groups. This condition is the well-known *parallel trends assumption.*

Firstly, we explore the parallel trends assumption by examining whether changes in sovereign ratings are similar across the two groups of countries. In doing so, we compute the mean changes in sovereign ratings in the groups of countries – treatment and control groups – over the two years before the implementation of the SSM (2012 and 2013). Table 1 presents the t-tests of

[20] All these variables are defined in Table A4

[21] This database has been updated up to August 2021. It can be accessed at: https://drive.google.com/file/d/1mgoCsYPwLRbrPDEQ7fkkdxvicWw1p2G4/view?usp=drive_web

the differences in means. As can be observed, the t-test results are insignificant for the three CRAs' individual ratings and for the average rating across CRAs. This indicates that, in the absence of treatment (before the implementation of the SSM), changes in sovereign ratings were similar for the two groups of countries. Moreover, Figure 1 depicts the change in average sovereign ratings for the SSM countries (red line) and non-SSM countries (blue line) before and after the implementation of the SSM. As can be observed, before the SSM was implemented (2014), non-SSM countries had higher sovereign ratings than SSM countries. However, the variation in both groups of countries was similar before the implementation of the SSM. The tendency changed after the implementation of the SSM. For SSM countries, there is a clear increase in sovereign ratings that is not evident among non-SSM countries.

3.3.3. Ex-ante banking supervisory framework

Apart from examining whether sovereign ratings were evolving similarly across treated and control countries before the implementation of the SSM, it is important to ensure that the banking supervisory framework was similar across countries (national competent authorities) before the occurrence of the treatment. By doing so, we can ensure that the empirical analysis is based on a panel of comparable countries that had similar banking supervisory frameworks before supranational banking supervision was implemented.

To conduct this analysis, we examine the main features of banking supervisory frameworks as defined by Barth et al. (2013) based on the World Bank's Bank Regulation and Supervision Survey.[22] Firstly, we compute the average tenure of a professional bank supervisor (*Supervisory tenure).* This variable can be considered as a proxy for the national supervisory authorities' experience and know-how related to bank supervision. A large value of this variable implies that the supervisory staff is experienced in conducting its activities. We also consider the extent to which the supervisory authority is independent from political influence (*Political independence*). This variable, as defined in Barth et al. (2013), takes the value 1 (more independence) if the supervisor is only accountable to a legislative body (Parliament or Congress). Alternatively – if the supervisor is accountable to the President, Prime Minister, Finance Minister, or other cabinet levels – the variable takes the value 0. Higher values indicate greater independence. Moreover, we examine the extent to which the legal system protects the supervisory authority from the banking industry (*Banking independence*). This variable takes the value 1 when supervisory staff are not personally liable

[22] The Bank Regulation and Supervision Survey is a unique source of comparable economy-level data on how banks are regulated and supervised around the world. It provides information on bank regulation and supervision for 160 jurisdictions. Numeric answers from this survey cover the 2011–2016 period. In our case, we employ the 2011 survey, which was started in 2011 and completed in 2012, as we aim to determine whether there are differences in terms of banking supervision across the groups before the implementation of the SSM. More information is available at https://www.worldbank.org/en/publication/gfdr/data/the-bank-regulation-and-supervision-survey

for bank damages caused by actions or omissions occurring during the good-faith exercise of their duties. If the supervisors are legally liable for their actions, it implies a lower degree of independence of the supervisory authority. We also explore the extent to which the supervisory authority is able to make decisions independently of political considerations (*Fixed-term independence*). This variable takes the value 1 if the head of the national supervisory authority has a fixed term of 4 years or greater; otherwise, it takes the value 0. Having a minimum fixed term of 4 years shields the head of the national supervisory authorities from short-term political influence when fulfilling their mandate. In addition, we compute an index that reflects overall supervisory independence. This index (*Supervisory independence*) is the sum of *Political independence, Banking independence,* and *Fixed-term independence* (Barth et al., 2013). It ranges in value from 0 – not independent from political and banking influence – to 3 – totally independent from political and banking influence. Finally, we examine the supervisory power of the national supervisory authorities before the implementation of supranational banking supervision. In doing so, also following Barth et al., (2013), we examine the extent to which the supervisory authorities are authorized to take specific actions to prevent and correct problems. These authors compute an index (*Supervisory power*), ranging from 0 to 14, that is based on the supervisory competencies of each national supervisor (e.g., removing and replacing senior bank management and directors, forcing a bank to change its internal organizational structure, requiring a bank to constitute provisions to cover actual or potential losses, meeting with the external auditors and discussing their reports without the approval of the bank). Higher values indicate greater supervisory power.

Furthermore, while the supranational banking architecture in the eurozone became effective in 2014 with the adoption of the SSM, bank supervisors from different jurisdictions always had the opportunity to cooperate. All over the world, supervisors from different countries signed up (bilateral or multilateral) cooperation agreements – with differences in the intensity of the cooperation – with the aim of sharing information, conducting joint exercises on cross-border activities, or agreeing on homogeneous standards on resolutions. While the objectives and the implications of implementing a supranational banking supervision go beyond signing up cooperation agreements among national supervisors, it is also important to ensure that there were no significant differences in terms of supervisory cooperation across countries before the adoption of the SSM. An ex-ante higher intensity of supervisory cooperation by the treated countries would violate the assumption of having similar banking supervisory frameworks before the occurrence of the treatment. To further consider this aspect, we rely on the data on the supervisory cooperation collected by (Beck et al., 2022). These authors hand-collected data on supervisory cooperation agreements for 93 countries from 1995 until 2013. For each country, they provide the fraction of

agreements signed relative to the number of all possible agreements (*Sup_cooperation*). This variable would reflect the extent to which the supervisory authority of a given country has developed a more intense supervisory cooperation.

Table 2 presents the t-tests of the differences in means for the variables accounting for the banking supervisory framework and the intensity of supervisory cooperation. As can be observed, the t-test results are insignificant for all the supervisory features examined. This means that before the implementation of a supranational supervisory framework, the banking supervision executed by the national authorities was similar for the two groups of countries. Moreover, as could be observed, there were no ex-ante differences in terms of supervisory cooperation.

<Insert Table 2 about here>

4. RESULTS

4.1. The SSM and sovereign ratings

Table 3 reports the main descriptive statistics for the variables used in our analysis. As can be observed, the mean values obtained for each of the measures of sovereign risk are similar (16.19 for Fitch, 16.10 for S&P, and 15.81 for Moody's). On the rating scale, these numerical values represent a rating between A- (15) and A (16), which is consistent with investment-grade ratings for developed countries.

Table 3 also presents the means of all the variables for those countries whose banking sectors are not directly supervised by the SSM (non-SSM countries) and those whose banking sectors are (SSM countries) before and after the SSM came into force. The results indicate that the average sovereign rating value increased for the SSM countries after the implementation of the supervisory mechanism. Moreover, the t-test results confirm that the differences are statistically significant at conventional levels. Although non-SSM countries also underwent a rating increase during the post-SSM period compared to the pre-SSM period, this difference is not statistically significant at conventional levels. The results seem to be in line with a *risk-reducing effect*. However, a multivariate analysis is needed to clarify the relationship between the implementation of the SSM and sovereign risk. This analysis enables us to include country-level explanatory variables and control for potential endogeneity problems that may affect our main variables of interest.

<Insert Table 3 about here>

Table 4 presents the results for our baseline model [1] for the ratings issued by the three CRAs: Fitch in columns (1) and (4), S&P in columns (2) and (5), and Moody's in columns (3) and (6). In columns (1) to (3), we present the results for the impact of the SSM's implementation in 2014 and subsequent years, captured by the *SSM Dummy* variable. The positive and statistically significant

coefficients of *SSM Dummy* ($\beta_0 > 0$) for all the CRAs reveal that, following the implementation of a supranational supervisory framework, sovereign ratings are higher for countries whose significant banks are under direct SSM supervision than for countries where all banking supervision remains at the national level. These results suggest that the implementation of a supranational banking supervisor leads to relatively higher ratings and, thus, lower sovereign risk (*risk-reducing effect*).

Additionally, we examine the impact of the SSM on ratings, accounting for the intensity of the supervisory power. In columns (4) to (6) of Table 4, we present the empirical findings obtained using the share of banking sector assets that is directly supervised by the SSM (*SSM Assets*). We note that the larger the amount of banking assets under SSM supervision from 2014 onwards, the higher the rating provided by each of the three CRAs. Hence, the positive effect of the establishment of a supranational supervisor like the SSM does not emerge only from implementing this kind of supervisory mechanism; rather, the amount of assets supranationally supervised in each banking sector also matters. As sovereign ratings are higher for those countries that are under the SSM supervision and have larger the amount of banking assets under SSM supervision, these results provide evidence that the existence of a supranational supervisor is associated with a *risk-reducing effect*. In line with Ampudia et al. (2019) and Eisenbach et al. (2022), more effective supranational supervision may more efficiently mitigate banking-related risks to financial stability and may explain the reduction in sovereign credit risk.

Figure A1 plots the year-by-year coefficients of the DID analysis[23]. As could be observed, before the implementation of the SSM all the coefficients are not statistically significant different from zero. This result also confirms the parallel trends assumption. Before the SSM, there were no differences in the sovereign ratings between the across group the two groups of countries. Then, after the adoption of supranational banking supervision, the coefficients are positive and statistically significant.

In addition to testing the statistical significance of this relationship, we are interested in determining whether the result is economically significant. For instance, using the regression results for Fitch in column (1) of Table 4, we compute the predicted probability of obtaining the highest sovereign rating (AAA) for the two groups of countries (SSM vs non-SSM). On average, the probability of being rated AAA increases by almost 10 percentage points (from 4.10% to 14.01%) for SSM compared to non-SSM countries following the implementation of the SMM. A similar result is found for Moody's (7.88 pp, from 7.58% to 15.47%) and S&P (7.35 pp, from 3.20% to 10.56%).

<Insert Table 4 about here>

[23] The year of treatment, or relative year t = 0, is not included and is the implicit reference year for the other indicator coefficients.

4.2. The role of banking sector characteristics and the legal and institutional environment

We examine whether further characteristics of the banking sector and those from the legal and institutional environment shape the influence of supranational supervision on sovereign ratings by extending the baseline model [eq.1]. In particular, the extended model [eq. 2.a] and [eq. 2.b] includes a set of variables that define the national banking sectors, the features of the legal and institutional framework, and the interactions of these variables with the variable accounting for the role of the supranational supervisor, respectively. The model is defined as follows:

$$SOVEREIGN_{c,t+1} = \alpha + \beta_0 SSM_{c,t} + \beta_1 BANKING_{c,t} + \beta_2 SSM_{c,t} x\, BANKING_{c,t} + \sum_{z=1}^{8} \emptyset_z CONTROLS_{c,t} + \theta_c + \delta_t + \varepsilon_{c,t} \quad [2.a]$$

$$SOVEREIGN_{c,t+1} = \alpha + \beta_0 SSM_{c,t} + \beta_3 LEGAL_{c,t} + \beta_4 SSM_{c,t} x\, LEGAL_{c,t} + \sum_{z=1}^{8} \emptyset_z CONTROLS_{c,t} + \theta_c + \delta_t + \varepsilon_{c,t} \quad [2.b]$$

Where $BANKING_{c,t}$ is the country-level factor related to the characteristics of the banking sector in eq. [2.a]. In particular, and in line with prior studies in the banking literature (see, for instance, Barth et al., 2004a; Cuadros-Solas et al., 2021; Schaeck & Cihák, 2014, among others), we consider the most relevant banking sector characteristics, such as profitability, market structure, and the previous occurrence of bailouts. The level of profitability of each country's banking industry is proxied by the ROA ratio (*Profitability*). To account for the banking market structure, we consider the five largest banks' asset concentration ratio (*Concentration*). To account for the fact that previous bank bailouts may affect sovereign risk (Acharya et al., 2014; Cuadros-Solas et al., 2021; Stângă, 2014), we also consider the total amount of public funds injected to recapitalize the banking sector of each country (*Bailouts*). All the banking sector variables are collected from the World Bank Financial Development Dataset and Laeven & Valencia (2018).

In eq.[2.b], the set of variables related to the legal and institutional features of each country is included by means of the $LEGAL_{c,t}$ country-level factor. As in the case of the banking sector characteristics, including these variables allows us to eliminate the possibility that effects attributed

to the existence of a supranational banking supervisor are actually caused by alternative country characteristics related to the features of the legal and institutional environment. We consider three different variables that proxy for the characteristics of the legal and institutional setting in each country. Firstly, we consider the rule of law indicator (*Rule of Law*) and the regulatory quality indicator (*Regulatory Quality*). Both variables are retrieved from the World Bank Worldwide Governance Indicators Database. The *Rule of Law* indicator captures the perception of the extent to which agents have confidence in and abide by societal rules and, particularly, the quality of contract enforcement, property rights, the police, and the courts, as well as the likelihood of crime and violence. In the same vein, the *Regulatory Quality* indicator captures the perception of the government's ability to formulate and implement sound policies and regulations that enable and promote the private sector. Higher values of both variables are associated with higher quality of the institutional environment. Secondly, to capture the influence of specific bank regulatory characteristics, we use the variable *Bank Restrictions*, which measures whether banks are allowed to participate in activities that generate non-interest income. Specifically, this variable indicates whether bank activities in the securities, insurance, and real estate markets, as well as banks' participation in the ownership and control of non-financial firms, are (1) unrestricted, (2) permitted, (3) restricted, or (4) prohibited. This indicator is retrieved from the World Bank's Bank Regulation and Supervision database (Barth et al., 2013) and, theoretically, can range from a minimum value of 4 to a maximum value of 16. Higher values indicate more restrictions on bank activities. We also include the same set of quantitative and qualitative factors explaining ratings that is included in the baseline model [eq.1], as well as country and year fixed effects. Likewise, in all the estimates, standard errors are clustered at the country level. Table 3 provides the main descriptive statistics of these variables.

Table 5 reports the results of the regressions of the extended model [eq.2.a] testing the influence of banking sector characteristics on the relationship between SSM-supervised assets (expressed as a percentage of the total banking sector assets in each country) and sovereign ratings. [24] Columns (1)–(3) report the results using the sovereign ratings issued by Fitch as the dependent variable. The sovereign ratings issued by S&P and Moody's are the dependent variables in columns (4)–(6) and in columns (7)–(9), respectively. As can be seen, in all the estimates reported in Table 5, the coefficient of the variable *SSM Assets* remains positive and statistically significant (β_0>0). This result indicates that the *risk-reducing effect* associated with the existence of a supranational

[24] For the sake of brevity, we only report the results using the share of banking sector assets that is directly supervised by the SSM (*SSM Assets)*. The results using the *SSM Dummy* (available upon request) are qualitatively similar.

supervisor and the extent of its supervisory power holds completely after accounting for the characteristics of the banking sector.

As for the banking sector characteristics, our results indicate that the influence of the supranational supervisor on sovereign ratings is not homogeneous as it varies across countries depending on these characteristics (β_2). In particular, we find a negative and statistically significant coefficient for the interaction between the share of banking sector assets and the proxy for banking sector profitability in columns (1), (4), and (7). The *risk-reducing effect* is less relevant if the supervised banking sector is perceived as more profitable. In such environments, where banks are sufficiently profitable, this result suggests that the existence of a supranational supervisor that prevents the economy from suffering the worst consequences of a generalized bank-distress situation is less relevant because the banking sector is *per se* profitable (non-distressed). This insight aligns with the notion that the supranational supervisor's efficacy appears more pronounced in less profitable banking sectors, where its role in mitigating risks originating from a distressed banking industry might be more pronounced.

The negative coefficient obtained for the multiplicative term between the SSM-related variable and the measure of bank concentration (columns (2), (5), and (8)) also suggests that the positive effect of the supranational supervisor on sovereign ratings is reduced in more concentrated banking markets. Under the *competition-fragility view* (Allen & Gale, 2004; Hellmann et al., 2000; Matutes & Vives, 2000; among others), it could be argued that instability in more competitive (less concentrated) markets may be greater because banks might take greater risks to gain market share, thereby reducing their resilience to potential economic downturns.,. Hence, in more concentrated (less competitive) banking sectors, a reduced positive effect of supranational supervision on sovereign ratings may be expected. Lastly, we do not find that the variable accounting for previous bailouts in the banking sector (*Bailout*) significantly shapes the effect of the share of SSM-supervised assets on sovereign ratings. The effect of banking supervision on sovereign risk does not seem to differ for those banking sectors that were bailed out during the GFC. In a sense, this result suggests that all banking systems that changed to the SSM framework benefit similarly from a supranational supervision scheme, regardless of whether they were bailed out in the past.

<Insert Table 5 about here>

The results of the interaction terms reported in Table 6 suggest that the characteristics of the legal and institutional environment shape the relationship between the share of SSM-supervised banking assets and sovereign ratings. We obtain negative and statistically significant coefficients for the interactions between the *SSM Assets* variable and the *Rule of Law* indicator in the case of Fitch and Moody's (columns (1) and (7), respectively). Although negative, the coefficient is not

statistically significant at conventional levels in the case of S&P (column (4)). This result suggests that the positive effect of SSM supervision on sovereign ratings is less relevant in countries with higher levels of institutional quality, proxied by the strength of rule of law. According to the Law and Finance literature (La Porta et al., 1997, 1998), countries characterized by higher levels of institutional quality have higher levels of financial development, are safer, and suffer less from problems of information asymmetry. This more favorable context allows banks to target and price their investments more accurately, thereby reducing adverse selection problems and thus risk-taking behavior (Jappelli & Pagano, 2002). Hence, in these environments, the role of the SSM in promoting a *risk-reducing effect* is less relevant. These results and arguments are corroborated in columns (2), (5), and (8) when we use *Regulatory Quality* as the main proxy for institutional quality. As for the extent to which non-traditional banking activities are legally restricted in each banking sector, in columns (3), (6), and (9), we obtain a negative coefficient for the interaction of this indicator (*Bank Restrictions*) and the role of SSM supervision. This finding suggests that in countries where non-traditional banking activities (insurance, real estate, securities, and ownership and control of non-financial firms) are relatively more restricted, the *risk-reducing effect* of the SSM is less relevant. This finding aligns with the fact that the banking sectors of countries with more legal restrictions around involvement in activities outside of loans, credit, and deposits are perceived as less risky, thereby reducing the relevance of the SSM as a supranational mechanism through which to contain risk in the banking sector. Hence, the existence of these types of restrictions may serve as a substitutive mechanism through which sovereign risk is reduced. Nevertheless, we should be cautious in interpreting this result, as the coefficient of *SSM Assets x Bank Restrictions* is only statistically significant at conventional levels in the case of Fitch.

Taken together, these findings reveal that the main features of the banking sector, as well as those of the legal and institutional framework in each country, are relevant in determining sovereign credit ratings. We provide evidence that the existence of a supranational supervisor in banking systems that are largely distressed (i.e., that have low profitability) and characterized by higher competitive pressures lead to relatively higher increases (reductions) in sovereign ratings (sovereign risk). Furthermore, the supervisory role of a supranational authority seems to be more relevant in countries where the institutional quality and regulatory features do not assist in properly disciplining banking market participants.

<Insert Table 6 about here>

5. HOW DOES SUPRANATIONAL SUPERVISION AFFECT SOVEREING RISK?

5.1. The role of bank stability and bank lending

After demonstrating that the banking supervisory architecture impacts sovereign risk, we examine the mechanisms through which a supranational supervisory framework might reduce sovereign risk levels. To address this question, we focus on banks – using bank-level data – after the change in the supervisory framework, as previous studies have shown that the definition of the supervisory infrastructure affects banks' behavior. In fact, papers such as Abbassi et al. (2020), Calzolari et al. (2019), Fiordelisi et al. (2017), or Okolelova & Bikker (2022), among others, have empirically investigated banks' reactions to different types of supervision and have found that banks do react to the supervisory scheme and that these reactions have consequences for the banking system in terms of risk-taking, lending practices or competition. Calzolari et al. (2019), for instance, demonstrate that multinational banks strategically adjust their branch structure to supranational supervision. Avignone et al. (2021) find that supranational supervision leads banks to reduce their credit risk exposure, while Okolelova & Bikker (2022) observe that a change in the banking supervisory level may be reflected in the level of competition. According to the results found in Fiordelisi et al. (2017), under the SSM framework banks strategically adjusted their lending activities in an attempt to increase their capital ratios without raising new equity capital. In a similar vein, Abbassi et al. (2020) argue that an enhance in supervision can influence banks to adopt more conservative lending practices and risk management strategies, which may lead to a more prudent approach to lending.

Understanding the extent to which banking supervision affects bank-level behavior is crucial to properly examine the mechanisms through which changes in supervisory authority may affect sovereign risk. In fact, the BIS (2011) argues that there are two main channels through which the banking system can negatively affect the sovereign's strength. The failure of a single large bank can result in a collapse in confidence in the system, prompting deposit and capital flight and disrupting the ability of the sovereign to finance itself in domestic and international financial markets (*bank stability channel*). This channel suggests that a more stable and resilient banking system would impose lower risks for the well-functioning of the economy and the sovereign. Moreover, a weak banking system can reduce the availability of credit and impede economic growth, which can also negatively impact a country's creditworthiness and increase its sovereign risk (*credit stability channel*). These interlinkages may justify that the architecture of the banking supervision affects sovereign risk and,

particularly, why the rating agencies consider the situation of the banking sector for the sovereign in their methodologies.

Focusing on the *bank stability channel*, previous studies have shown that more intensive banking supervision results in reduced risk-taking incentives (Hirtle & Kovner, 2022) and strengthening official supervisory power reduces the likelihood of financial distress (Chortareas et al., 2012; Tabak et al., 2016). Exploiting an exogenous reduction in bank supervision during the '80s in U.S., Kandrac & Schlusche (2021) demonstrate a causal effect of supervisory oversight on banks' risk taking. These authors find that those banks that witnessed a reduction in supervision and examination took on much more risk than their counterparts that were subject to identical regulations but unaffected by the change in supervisory attention. In a similar vein, Beck et al. (2022) show that an effective supranational bank supervision improves bank stability.

The relationship between banking supervision and bank stability is of paramount importance because, as prior studies have shown and policymakers have underlined, sovereign risk is linked to the vulnerability of a country's banking system (Gerlach, Schulz and Wolff, 2010). Pagano & Sedunov (2016) find evidence that the systemic risk of a country's financial institutions and the risk of sovereign governments are interrelated. Dieckmann & Plank (2012) show that the situation of a country's financial system affects sovereign risk.[25] The GFC highlighted the existence of a negative feedback loop between banks and sovereigns (Acharya et al., 2014; Fratzscher & Rieth, 2019), as riskier and less stable banking sectors have negative consequences for the sovereign. Boumparis et al. (2019) find that increases in bank risk have a negative effect on sovereign ratings over and above the effects of the remaining economic and financial variables. Consistently, Brůha & Kočenda (2018) show that a more stable and well-capitalized banking sector is linked to lower sovereign risk in general.[26] Consequently, it is arguable that if the supervisory framework reduces sovereign risk, it should do so by increasing bank stability. In this context, greater stability in the banking system would mitigate a source of sovereign risk. In fact, in our context, the supranational supervisory framework was implemented in Europe to "*protect the safety and soundness of credit institutions and the stability of the financial system*" and to "*avoid moral hazard and the excessive risk-taking arising from it*".[27] Hence, bank stability should act as a channel through which the change to a supranational supervisory architecture decreases sovereign risk.

[25] For example, Moody's assessment of sovereign risk accounts for "*the size and strength of the banking system*" as "*the weaker and larger the banking system, the greater the potential for contingent liabilities to crystallise on the government's balance sheet and for a banking crisis to spill over to the functioning of the economy*" (Moody's, 2022).

[26] There is also anecdotal evidence of sovereign downgrades due to an exacerbated risk arising from the banking sector. For instance, in April 2012, Spain had its S&P credit rating downgraded two notches from A to BBB+ arguing that "*the downgrade reflects our view of the increasing likelihood that the government will need to provide further fiscal support to the banking sector due to its deterioration*".

[27] Council Regulation (EU) No 1024/2013 of 15 October 2013 conferred specific tasks on the European Central Bank concerning policies relating to the prudential supervision of credit institutions. Available at https://eur-lex.europa.eu/legal-content/EN/TXT/HTML/?uri=CELEX:32013R1024&from=EN

Regarding the *credit stability channel*, previous literature has traditionally shown that the development of the banking sector positively affects economic growth (e.g, Rajan and Zingales, 1998; Claessens and Laeven, 2003; Beck et al., 2000) by increasing the availability of funds to more financially dependent economic agents. However, another strand of literature (e.g., Arcand et al., 2012; Cournède & Denk, 2015; Law & Singh, 2014; 5) argue that the role of banks in fostering economic growth exhibits important heterogeneities and non-linearities. In this sense, Arcand et al. (2015) argue that an excessive growth of bank credit stops to promote economic growth because it may lead to imbalances (such as excessive leverage, riskier investments, overinvestment, and asset bubbles) that can increase economic volatility and sovereign risk, especially if regulation and supervision are inappropriate. At the same time, banking development and bank credit also could amplify the propagation of macroeconomic shocks and exacerbate economic downturns for several reasons (Fernandez et al., 2016). Credit market imperfections amplify a macroeconomic shock on a borrower's net worth because information asymmetries and agency costs reduce the borrower's ability to obtain credit following the shock. This balance sheet effect also reduces banks' net worth and ability to lend funds and thus, exacerbates business cycles (Bernanke and Gertler, 1989; Kiyotaki and Moor 1997). Asea and Blomberg (1998) and Dell'Ariccia and Marquez (2006) also argue that bank lending amplifies the business cycle when they tighten their lending standards during economic downturns and ease them during periods of growth modifying the availability of the credit in the economy. In this sense, an excessive credit availability can lead to overinvestment and potential asset bubbles, while a credit tightening can lead to reduced investment and consumer spending, exacerbating economic downturns (Schularick and Taylor, 2012). Furthermore, an increase in the credit volatility impacts on financial stability and market confidence leading uncertainty and dismissing the effective transmission of monetary policy to the economy in response to macroeconomic shocks (Kashyap and Stein, 2000). Consequently, as Fernández et al. (2016) find, an increase in bank credit volatility would increase economic growth volatility and sovereign risk through the *credit stability channel*.

Overall, this body of literature suggests that what matters for a well-functioning economy that fosters economic growth and alleviates potential imbalances for the sovereign is the existence of a stable source of funding from the banking sector. This stability entails avoiding extremes -neither excessively high nor excessively restrictive- access to credit. In our context, we examine explicitly this channel because prior studies have shown that the supervisory architecture has an impact on the credit provided by banks to the economy (Abbassi et al. 2020; Cerulli, Fiordelisi & Marques-Ibanez 2021; Eber & Minoiu 2016; Haselmann, Singla & Vig 2019, among others). A more stable

bank funding, which is not growing excessively after the implementation of the SSM, would provide evidence in favor of the *credit stability channel*.

5.2. Bank-level analysis

In this section, we analyze empirically the effects of the SSM framework on the *bank stability* and *credit stability channels*. To do this, firstly, using banks from all the European countries (SSM countries and non-SSM countries), we compare the bank stability and credit stability of those banks that are under the SSM supervision (significant supranationally supervised banks) with other significant banks in Europe that are nationally supervised (significant nationally supervised banks).[28] Secondly, within those European countries exposed to a supranational supervisory framework (SSM countries), we examine whether the supervisory change differentially affects the bank stability and credit stability of those banks that switched from national to supranational supervision (significant banks) and banks that remain nationally supervised (less significant banks) after the implementation of the SSM framework.[29]

5.2.1. Significant supranationally supervised versus significant nationally supervised banks

As mentioned above, to conduct this first empirical exercise, we focus on the comparison of bank stability and credit stability between significant supranationally supervised banks – from the treatment group of SSM countries (148 banks) – and significant banks that are supervised nationally from the control group of non-SSM countries (113 banks). The group of significant nationally supervised banks is formed by those banks which, according to the ECB criteria, would be under SSM supervision if they were in the euro zone.[30] This analysis is relevant because it allows us to shed light on the effectiveness of SSM supervision in significant banks.[31] To conduct this analysis, as in the previous analyses that were carried out at the country level, we consider the period 2011–2018 and use DID approach following linear regression model with bank and time fixed effects:

[28] For example, in this analysis, we compare the evolution of bank stability for BNP Paribas (treated – significant supranationally supervised) and Barclays (control – significant nationally supervised).
[29] For example, with this analysis, we compare the evolution of bank stability for BNP Paribas (significant bank) and Banca Popolare di Bari (less significant bank).
[30] This latter group is composed of significant banks from other European countries (Bulgaria, Croatia, the Czech Republic, Denmark, Iceland, Hungary, Iceland, Norway, Poland, Romania, Sweden, Switzerland, and the UK) that are considered systemically important following the criteria established by the SSM framework: 1) at least €30 billion of total assets and 2) a ratio of total assets to GDP greater than 20% and larger than €5 billion or 3) one of the three largest institutions in its country. More details can be found at https://www.bankingsupervision.europa.eu/banking/list/criteria/html/index.en.html.
[31] An example of a bank comparison in this type of analysis is Deutsche Bank AG (treated – significant supranationally supervised) and UBS (control – significant nationally supervised).

$$STABILITY_{bt}\ (CREDIT_{bt})$$

$$= \beta_0 + \beta_1\ SSM_{SNS\ bct} + \sum_{l=1}^{6} \delta_l\ BANK_{bt-1}$$

$$+ \sum_{h=1}^{3} \gamma_h\ MACROECONOMIC_{ct} + \sum_{h=1}^{6} \xi_h\ BANK\ REGULATION_{ct} + \mu_b$$

$$+ \lambda_t + \varepsilon_{b,t}$$

[5]

Where *b*, *c*, *t* refer to the bank, country, and year, respectively. To test the *bank stability channel* ($STABILITY_{bt}$), our main measure of bank stability is the Z-score at the bank level. This variable is computed as the natural logarithm of the return on assets plus the capital asset ratio divided by the standard deviation of asset returns. A three-year moving window is used to estimate standard deviations for each bank in each year. A higher Z-score indicates that a bank is more stable because this variable is inversely related to the probability of bank insolvency. We also aim to further explore the channel through which supranational supervision improves bank stability. Then, in separate regressions, we split the Z-score into the capital equity ratio and ROA (numerator) and the standard deviation of ROA over a rolling 3-year window (denominator). As it is argued by Beck et al. (2022) and Raykov & Silva-Buston (2022), which also followed this approach, bank stability could be improved in two main ways. On the one hand, banks could engage in less risky activities, which would reduce the variance of their returns and thus decreasing the likelihood of default. On the other hand, banks could become more stable by reducing their leverage or by taking on more profitable activities, which increases the buffer they have before they reach default. Finally, we also employ an alternative measure of stability, the ratio of total impairment charges to total equity. Total impairment charges are computed as the net impairment charge in relation to the bank's loans and advances and on other assets. A large volume of impairment charges could indicate that a bank is experiencing financial difficulties, as it suggests that the bank is expecting to incur significant losses on its loans or other assets, thereby affecting its stability negatively. Then, it could be also considered an inverse measure of bank stability.

In order to test how the change to a supranational supervisor affects bank credit ($CREDIT_{bt}$), we consider the standard deviation of the bank loans over total assets ratio. This variable examines directly the *credit stability channel* by checking to what extent the credit provided by the treated banks is stable and not volatile after the implementation of the SSM. Additionally, we employ the annual growth rate of the ratio of bank loans to total assets. This variable would indicate if the credit

provided by the supranationally supervised banks has increased, decreased, or remained unchanged. To be consistent with the *credit stability channel*, since an excessive increase or decrease of bank credit could have implications for the economy, we would expect this variable to remain unchanged after the SSM.

SSM_SNS_{bct} is a dummy variable equal to 1 for those banks *b* in country *c* that are supervised by the SSM at year t after the establishment of the SSM and 0 otherwise. Thus, a positive (negative) coefficient of β_1 would reflect higher (lower) bank stability or lower (higher) credit stability for significant supranationally supervised banks in SSM countries (the treatment group) compared to significant nationally supervised banks in non–SSM countries (the control group) following the implementation of the SSM. The vector $BANK_{bt-1}$ includes bank-level control variables that enter the regressions lagged by one period to reduce potential endogeneity concerns. Specifically, we consider the natural logarithm of total assets on the bank balance sheet as a proxy for bank size (*Size*). We also include the total capital to assets ratio (*Capital*), the cost-to-income ratio as an inverse proxy for bank entity efficiency (*Cost-to-Income*) and an inverse proxy of bank diversification defined as the operating revenues-to-total assets ratio (*Traditional*). Additionally, the vector $MACROECONOMIC_{jt}$ includes the set of country-level controls: the annual growth rate of GDP per capita (⊿*GDPpc*), the annual percentage change in consumer price index (*Inflation*), and the ratio of private credit by deposit money banks to GDP (*FinDev*).[32] In order to control for other regulatory changes, we also include changes in: sector-specific banks' capital buffers *(*Δ*ss_capbuffers*), banks' capital requirements *(*Δ*cap_buffers*), limits on banks' exposures to specific borrowers or sectors *(*Δ*ss_exposure*), limits on banks' exposures to other banks *(*Δ*interbank_exposure*), reserve requirements on foreign *(*Δ*rr_foreingcurr*) and local (Δ*rr_localcurr*) currency-denominated accounts.

We also include year fixed effects (λ_t) to control for aggregate fluctuations in bank stability and bank credit variables over time. In particular, the year fixed effects difference away trends that affect both the treatment and control groups. μ_i is a vector of bank dummy variables that reflect the individual effects of each bank and allows us to account for unobservable time-invariant fixed effects. ε_{it} is the error term. Lastly, we cluster heteroscedasticity-adjusted standard errors at the bank level to allow for serial correlation in the errors.

Panel A of Table A6 presents the main descriptive statistics for both groups of banks: significant supranationally supervised banks subject to SSM supervision (treated group) and the group of significant nationally supervised banks in non-SSM countries (control group). In this latter group, bank stability does not vary significantly across the pre- and post-SSM periods. In fact, bank

[32] Detailed definitions of all the variables and the sources from which they were retrieved can be found in Table A5.

stability increased for the control group, on average, by 1.34% (from 3.13 to 3.78). By contrast, for the treated group, bank stability increased by 26.44% from the pre-SSM period (2.95) to the post-SSM period (3.73). Moreover, the volatility of bank credit and the growth rate of loans decreases for the treated group across the pre- and post-SSM periods, while in the control group increases. Furthermore, the reduction of bank credit volatility is statistically significant for the treatment group.

Columns (1) to (4) of Table 7 provide the results for the effect of the supranational supervisor on the different measures of bank-level stability. The coefficient of the *SSM_SNS* dummy is positive and statistically significant when the proxies for bank stability are the Z-Score and the $log(roa+\frac{equity}{assets})$ variable. The results for the standard deviation of the bank ROA (*log(sd(roa))* and for the impairment charges over equity ratio $log(\frac{Impairment\ charges}{equity})$ are negative and statistically significant. These results indicate that after the implementation of the SSM framework, stability increased in significant supranationally supervised banks subject to SSM supervision more than in significant nationally supervised banks in non-SSM countries.

As for the *bank credit channel*, results in columns (5) and (6) of Table 7 show a negative and statistically significant coefficient for the *SSM_SNS* dummy in column (5). The coefficient of the *SSM_SNS* dummy in column (6), although negative, is not statistically significant at conventional levels. These results indicate that being supervised by the supranational supervisor does not increase neither reduce the amount of funds granted by SSM banks compared to significant nationally supervised banks outside of the SSM scope. However, it can be said that there is a higher level of credit stability in the case of banks under the SSM framework.

As it has been argued before, and according to the previous literature, these results are consistent with both the bank stability and the credit stability channels as the mechanisms through which the existence of a supranational authority would improve the banking sector functioning and thereby reduce sovereign risk.

<Insert Table 7 about here>

5.2.2. Significant supranationally supervised versus less significant nationally supervised banks

We now focus on a sample of European banks from countries where the SSM was enacted (SSM countries). The aim of this analysis is to determine, within the SSM countries, whether bank stability and credit stability changed after significant banks started to be supervised by the supranational supervisor. Hence, the treatment group comprises those significant supranational supervised banks under the SSM supervisory scheme. The control group comprises those banks

that remain subject to supervision by a national authority in SSM countries (less significant national supervised banks). Specifically, the bank sample spans from 2011 to 2018 and comprises 148 significant supranational supervised banks and 598 less significant national supervised banks. Consistently with the identification and econometric strategy employed in the previous analysis, we use a DID approach and define the following panel data linear regression model with bank fixed effects:

$$STABILITY_{bt}\ (CREDIT)_{bt} = \beta_0 + \beta_1 SSM\_LSB_{bct} + \sum_{l=1}^{6} \delta_l\ BANK_{bt-1} + \sum_{h=1}^{3} \gamma_h\ MACROECONOMIC_{ct} + \sum_{h=1}^{6} \xi_h\ BANK\ REGULATION_{ct} + \mu_b + \lambda_t + \varepsilon_{b,t} \quad [6]$$

We use the same measures of bank stability and credit stability as the ones used before as dependent variables. SSM_LSB is a binary variable equal to 1 when bank *b* in country *c* is supervised by the SSM and 0 when it is nationally supervised. The slope β_1 provides information about the average difference in bank stability and credit stability between those banks that switched to SSM supervision and banks that remained under the supervision of a national authority. Hence, this variable serves as the DID operator with the precise timing that the SSM has on the banks that are supranationally supervised. A positive coefficient ($\beta_1>0$) would indicate greater bank stability (lower credit stability) for supranationally supervised banks (the treatment group) compared to banks that remain subject to supervision by national authorities (the control group) following the implementation of the SSM in 2014. We include the same bank- and country-level variables considered in eq. [5], as well as bank and year fixed effects. Likewise, standard errors are clustered at the bank level.

In Panel B of Table A6, we report the main descriptive statistics for the variables used in this bank-level analysis for all the individual bank entities considered, differentiating between those banks subject to SSM supervision (treated group) and those banks that remain subject to supervision by a national authority (control group). As can be observed, after the implementation of the SSM, the mean value for the measure of bank stability (Z-score) increases in both the treated and control groups. This change is statistically significant at the 5% confidence level. Specifically, in the case of those banks that switched to SSM supervision in 2014, the level of bank stability rises from 2.95 to 3.73, representing a 26.44% increase. However, in the case of the banks that remain under the supervision of the national authority, bank stability only rises from 3.51 to 3.63 (a 3.4%

increase) after the SSM implementation. As in the previous analysis, the volatility and the growth rate of bank credit decreases for the treated group after the SSM, whereas increased in the control group. Nevertheless, these differences are only significant for the decrease in the volatility of bank credit for the treatment group.

Similarly, to the previously reported bank-level results, the empirical findings for the estimation of eq. [6] are reported in Table 8. As it can be seen, the coefficient of the *SSM_LSB* dummy variable (β_1) is positive and statistically significant in columns (1) and (2), when the dependent variables are the individual bank Z-score (column (1)) and the log(roa+equity/assets) variable (column (2)). In particular, the coefficient β_1 in column (1) indicates that with the adoption of the SSM framework, the average difference in bank stability is 0.64 points higher in those banks that switched to SSM supervision in comparison with those banks that remained nationally supervised. In columns (3) and (4) the results are reported using the standard deviation of the ROA and the total impairment charges to total equity ratio, respectively. Consistently with the results reported in Table 7, the coefficient of the *SSM_LSB* dummy is negative and statistically significant. These results highlight that those significant supranationally supervised banks experienced a greater increase in bank stability after the implementation of the SSM framework when compared to those less significant nationally supervised banks.

The results reported in columns (5) and (6) for the bank credit variables are again consistent with those presented in the case of the comparison between significant supranationally supervised in SSM countries and significant nationally supervised banks in non-SSM countries. It can be observed a negative and statistically significant coefficient for the *SSM_LSB* dummy in column (5), whereas the coefficient, although negative, is not statistically significant at conventional levels in column (6). These empirical findings would suggest that being supervised by the supranational supervisor does not increase neither reduce the amount of funds granted by SSM banks compared to less systemically important institutions. However, it can be said that there is a higher level of credit stability in the case of systemically important banks that are directly supervised by the supranational authority when compared to those banks under the SSM framework that remain domestically supervised.

<Insert Table 8 about here>

6. ADDITIONAL ANALYSES AND ROBUSTNESS CHECKS

6.1. Measuring sovereign and bank-level risk: CDS spreads

Throughout the paper, we employ sovereign ratings as the main variable measuring sovereign risk. We do so because, as previous studies have shown, sovereign ratings focus on the long term

and thus aim to respond only to the perceived permanent component of credit-quality changes (among others; Altman and Rijken, 2004). Moreover, as for the bank-level analyses, we have relied on traditional accounting-based measures of bank stability, such as the Z-Score and its components, as well as additional variables proxying for the level of stability of individual bank entities.

Previous studies have also considered market-based measures of both sovereign and bank-level risk (Acharya et al., 2014; Brůha & Kočenda, 2018; De Bruyckere et al., 2013; Kallestrup et al., 2016). Hence, in this section we present the results obtained when sovereign CDS spreads are employed as an alternative measure of sovereign risk, on the one hand, and bank CDS spreads as a proxy of individual bank-risk and inverse measure of bank stability, on the other hand. In an efficient market, the CDS spread should appropriately price and insure against the potential credit risk of the country and/or the individual bank entity. Furthermore, CDS spreads are considered a market-based measure that may reflect investor sentiment about changes in the creditworthiness of a country or about the financial health of a bank. Thus, employing CDS spreads allows us to examine whether and to what extent the market's perception of risk (both in terms of sovereign and individual bank risk) and bank stability is affected by the implementation of a supranational supervisory framework.

Following Acharya et al. (2014), we use the natural logarithm of the average of the five-year sovereign CDS spread (in basis points) as the dependent variable. Data on sovereign CDS are retrieved from Thomson Reuters Eikon.[33] The results for sovereign CDSs are presented in columns (1) and (2) of Table A7. As can be seen in column (1), the coefficient of *SSM Dummy* is negative and statistically significant indicating that, after the implementation of a supranational supervisory framework, CDS spreads are lower for countries (SSM countries) whose significant banks are under direct SSM supervision. Similarly, in column (2), the coefficient of the variable accounting for the percentage of bank assets under supranational supervision is negative and statistically significant. Therefore, supranational supervision is associated with lower sovereign risk (*risk-reducing effect*) as in the baseline model [eq.1].

Similarly, in terms of the bank-level analyses we use the natural logarithm of the average of the five-year bank CDS spread (in basis points) retrieved from Thomson Reuters Refinitiv as the dependent variable (columns (3) and (4)). As can be observed, both when we compare the group of significant supranationally supervised banks in SSM countries with the group of significant nationally supervised banks in SSM countries (column (3)), and when the SSM banks and non-SSM

[33] Thomson Reuters Eikon does not report the five-year sovereign CDS spreads for Luxembourg and Malta. These countries are not included in the regressions.

banks are compared (column (4)) in SSM countries, we obtain a negative and statistically significant coefficient for the *SSM dummy* indicating that CDS spreads are lower after the implementation of the SSM for the group of banks under the SSM framework. Hence, we confirm that sovereign risk is lower in the case of those banking sectors under the SSM infrastructure (SSM countries) as well as we confirm that risk (stability) is also lower (higher) in the case of significant banks that are supranationally supervised.

6.2. Post-SSM banking supervision at the national level

To ensure the robustness of our findings, it is also crucial to show that the implementation of the SSM did not lead to a change in the supervisory standards of the NCAs. As argued in Section 3.1, after the adoption of the SSM, the NCAs of the treated countries remained responsible for the supervision of less significant banks. Then it is important to show that, after losing their direct competence of supervising significant banks, these NCAs did not change their supervisory standards (e.g. by allocating part of their supervisory resources to other of their remaining competencies such as ensuring the efficiency and resilience of the payment, settlement, and currency systems and/or protecting the consumers of financial services). Furthermore, it is also important to show that the NCAs of the countries in the control group (non-SSM countries) - where bank supervision was always at the national level - did not change their supervisory standards influenced by the adoption of a new supervisory framework in the eurozone.

In doing so, we examine whether there was a change in the main features of the banking supervision conducted by the NCAs after the implementation of the SSM for both groups of countries. To conduct this analysis, we rely on those same characteristics of banking supervision in Section 3.3. All these variables are retrieved by the most recent wave of the World Bank's Bank Regulation and Supervision Survey, which provides information on bank supervision for the period 2017 to 2019. As it is highlighted in the survey, for all the countries (treated and control group), the information is referred to the supervisory role performed by the NCAs. Table A8 in the Appendix presents the t-tests of the differences in means for the all the variables. As can be observed, the t-test results are insignificant for all the features examined for the treated (column 3) and control countries (column 6). This means that after the implementation of a supranational supervisory framework, the banking supervision executed by the national authorities did not change significantly. These additional results could alleviate some potential concerns on the role of the NCAs after the SSM.

6.3. Post-SSM macroeconomic and regulatory environment

Similarly to the analyses previously presented, we also examine if, after the implementation of the SSM, there are changes in macroeconomic and additional regulatory variables when comparing

banking sectors under the SSM framework with banking sectors that are not under the SSM regulation. The potential existence of changes in the macroeconomic and regulatory environment after the implementation of the SSM and potential different paths followed by both groups of banking sectors could be a reason to think that our results could be, to some extent, biased. Hence, to ensure the robustness of our main findings, it is relevant to corroborate that the implementation of the SSM did not lead to other changes in the macroeconomic and regulatory environment.

To do this, we focus on the existence of potential changes in the main macroeconomic variables, institutional quality measures, and also in terms of the specific regulatory features affecting the banking sector after the implementation of the SSM for both the treated (SSM) and control (non-SSM) countries. The results are reported in Table A9 in the Appendix. For each variable, we compute the variation rate of its mean value for the post-SSM period compared to its mean value during the pre-SSM years. As it is a rate, we divide this difference for the mean value of each variable for the years correspondent to the pre-SSM period. As can be seen, the t-test reported are not statistically significant at conventional levels neither for the treated nor for the control group of countries. This means that after the implementation of the SSM framework, the macroeconomic conditions, the institutional environment, and the additional regulatory practices implemented in the banking sector did not change significantly. Hence, this evidence is consistent with our previous findings and supports the role of the SSM in influencing the sovereign risk.

6.4. Country-level analysis: bank stability channel

To provide further evidence on banking stability as a mechanism for the relationship between supranational banking supervision and sovereign risk, we examine whether potential changes in banking stability caused by the implementation of a supranational supervisory framework may influence a reduction in sovereign risk. This analysis requires an instrumental variable approach in a two-stage least squares (2SLS) procedure for panel-data models. We use the Z-score as the main dependent variable, as it has been widely used in the literature as a proxy for banking stability (Beck et al., 2022; Beck, De Jonghe, et al., 2013; Fang et al., 2014; Jiménez et al., 2013; Laeven & Levine, 2009, among others). In the first stage, we regress the Z-score of the banking sector on the *SSM Assets*$_{it}$ variable and the same country-level controls used in the baseline model [eq.1]:

$$ZSCORE_{c,t} = \alpha + \beta_0\, SSM_{c,t} + \beta_1\, Banking\ sector's\ exposure\ to\ Natural\ Disasters_{c,t} + \beta_2 Bank\ Market\ Power_{c,t} + \sum_{z=1}^{14} \emptyset_z\, CONTROLS_{c,t} + \theta_c + \delta_t + \varepsilon_{c,t} \quad [3]$$

This 2SLS procedure requires the inclusion of its own predetermined variables or instruments in the first-stage equation, which should affect the second-stage variable only through their effect

on the first-stage endogenous variable. Specifically, the Z-score is instrumented using a variable that accounts for the exposure of a country's banking sector to natural disasters and catastrophes (*Banking Sector Exposure to Natural Disasters)* and the degree of market power in the banking sector (*Bank Market Power).*

Previous studies have recognized that climate change is a major source of risk for the financial system (Battiston et al., 2021; Dafermos et al., 2018; Roncoroni et al., 2021), and banks increasingly view climate change as a relevant risk factor (Javadi & Masum, 2021; Nguyen et al., 2020). In this regard, previous studies have shown that natural disasters linked to climate change negatively impact the banking sector. Klomp (2014) shows that geophysical and meteorological disasters increase the likelihood of bank defaults. Brei et al. (2019) find that, after a natural disaster, banks face deposit withdrawals and experience negative funding shocks. Using U.S. data, it has been shown that natural disasters related to climate risk decrease bank stability (AhDo et al., 2022) and negatively impact performance and solvency (Walker et al., 2022).

While natural disasters directly affect banks, the impact of climate-related natural disasters is not directly included in credit ratings (Mathiesen, 2018). Using data from U.S. cities, Tran & Uzmanoglu, (2020) find that climate risk is not a significant factor in cities' credit ratings. These findings argue in favor of satisfying the exclusion restriction of the instrument. The negative impact of a natural disaster on financial and economic stability is what drives a change in creditworthiness (Beirne et al., 2021; Klomp, 2017; Koetsier, 2017). Consequently, we employ as an instrument the variable *Banking Sector's Exposure to Natural Disasters.* This variable reflects the total amount of damage caused by natural disasters[34] in each country over total banking sector assets. [35] The total number of natural disasters is collected from the Centre for Research on the Epidemiology of Disasters (CRED). [36]

We also employ the degree of market power in the banking sector (*Bank Market Power)* as an instrument. Market power at the bank-sector level is measured using the Lerner index, which is the difference between output prices and marginal costs (relative to prices). Prices are calculated as total bank revenue over assets, whereas marginal costs are obtained from an estimated translog cost function with respect to output.[37] An increase in the Lerner index indicates a deterioration in the competitive conduct of financial intermediaries. Previous studies have examined the

[34] Total damages are computed as the value of all damages and economic losses directly or indirectly related to the disaster.
[35] For robustness purposes, we also employ as an instrument the total reconstruction cost after natural disasters in each country over total banking sector assets. The reconstruction cost – the total cost of replacing lost assets – provides insight into the magnitude of the consequences of a natural disaster. Reconstruction costs differ from total damages, as they take into account present construction or purchase costs of goods as well as the additional cost of prevention and mitigation measures to reduce damage from future disasters. The results, available upon request, are qualitatively similar to those reported in Table 7.
[36] Available at https://www.emdat.be/
[37] Lerner index estimations follow the methodology described in Demirguc-Kunt & Martínez Pería (2010) and were conducted using underlying bank-by-bank data from Orbis Bank Focus.

relationship between bank market power and bank stability and found that changes in the former can affect the latter (Allen & Gale, 2004; Beck et al. 2013; Berger et al. 2009; Boot & Thakor, 2000; Boyd & Nicoló, 2005; among others). Berger et al. (2009) demonstrate that banks with more market power have less overall risk exposure. Using a large international sample of 79 countries, Beck et al. (2013) show that there is a positive relationship between market power and stability. In a similar vein, Turk Ariss (2010) documents the overall change in bank stability triggered by an increase in bank market power. This evidence justifies the widespread use of the Lerner index in the banking sector as an indicator of the degree of market power (see, for instance, Beck et al., 2013 and Maudos & Fernández de Guevara, 2004).

In the second stage, the fitted values of our variable measuring bank stability ($\widehat{ZSCORE}_{i,t}$) from equation [3] are used as the independent variable to estimate the impact of supranational supervision on sovereign ratings through bank stability. Therefore, the coefficient β_1 of equation [4] captures the extent to which the change in the banking supervisory framework influences sovereign ratings through changes in banking stability. Coefficient β_0 of equation [4] indicates the direct effect of the change in supervisory scheme on sovereign ratings regardless of changes in banking stability.

$$SOVEREIGN\ RATING_{c,t+1} = \alpha + \beta_0\, SSM_{c,t} + \beta_1 \widehat{ZSCORE}_{c,t} + \sum_{z=1}^{8} \emptyset_z\, CONTROLS_{c,t} + \theta_c + \delta_t + \varepsilon_{c,t} \quad [4]$$

In addition to selecting our instruments based on economic arguments, we require them to be econometrically relevant and valid. Firstly, to verify that the two-step estimator is needed, we perform a Durbin–Wu–Hausman test. Moreover, we test the validity of both instruments by running the Sargan–Hansen test of overidentifying restrictions (orthogonality conditions). The joint null hypothesis of this test is that the instruments are valid (i.e., uncorrelated with the error term) and that the excluded instruments are correctly excluded from the estimated equation. The *p*-values of both the Durbin–Wu–Hausman test and the Sargan–Hansen test, reported in Table 7, confirm that the instruments are needed and that the null hypothesis of the Sargan–Hansen test (i.e., that the instruments are valid) cannot be rejected, suggesting that our instruments do not run into overidentifying restrictions. We also compute the statistic of the Kleibergen-Paap rk LM (underidentification test) and the statistic of the Kleibergen-Paap rk Wald F-test (weak identification test) to determine whether the instruments are underidentified and/or weak. The statistics of the Kleibergen-Paap rk LM (underidentification test) and the Kleibergen-Paap rk Wald

F-test (weak identification test) are statistically significant, suggesting that our instruments are neither underidentified nor weak.

Table A10 presents the results of the 2SLS procedure. Regarding the first-stage regression (column (1)), we find a negative and statistically significant coefficient for *Banking Sector Exposure to Natural Disasters*, indicating that the greater the exposure of the banking sector to natural disasters caused by climate change, the lower the degree of bank stability. This result is consistent with the literature examining the consequences of natural disasters for bank stability. Also consistent with previous literature, we find a positive and statistically significant coefficient for bank market power, suggesting that in countries with banking sectors characterized by a higher degree of market power, the banking sector is more stable. The second-stage regressions [eq.4] reported in column (2) show that the coefficient of $\widehat{ZSCORE}_{i,t}$ (β_1) is positive and statistically significant for the three rating agencies. This result provides empirical evidence of the extent to which supranational banking supervision, as established by the SSM, could reduce the level of sovereign risk through banking stability. In particular, this finding suggests that the increase in banking stability caused by the implementation of a supranational supervisory framework positively affects sovereign ratings. Columns (2) to (5) also show that the coefficient of *SSM Assets* remains positive and significant in all the second-stage estimates. This finding demonstrates that part of the reduction in sovereign risk does not occur through bank stability. This could be expected as, in line with the argumentation of the BIS (2011), an additional *credit stability channel* seems also to play a role reducing sovereign risk.

6.5. Placebo experiments and falsification tests

As is standard in studies using a DID methodology, we conduct a series of placebo experiments. Firstly, we employ an algorithm to assign the treatment randomly, so that countries are randomly categorized as treated or controls, and we re-run the model. Table A11 in the Appendix (columns (1) to (3)) shows that the DID coefficients are not statistically significant after randomizing the treatment. Moreover, we conduct a placebo experiment in which the timing of the implementation of the SSM is altered (falsification test). As in previous studies using a DID methodology (Berger & Roman, 2017; Calderon & Schaeck, 2016; Fiordelisi et al., 2017), we impose an implementation of the SSM that is some years earlier than its real implementation while still distinguishing between the effective treated and non-treated countries. We run the model considering that the SSM was introduced four years before its actual implementation. To mimic our main analysis, we use an eight-year period, from 2007 to 2015 (placebo sample), and assume that the fictional post-SSM period begins in 2010. We rerun the regressions defining *PLACEBO POST SSM* as a dummy equal to 1 in 2010–2015, the period after the fictional SSM was initiated,

and 0 otherwise. The results of this placebo experiment, reported in columns (4) to (6) of Table A11 in the Appendix, confirm that there are no significant effects on sovereign ratings of the fictional SSM. The findings of both falsification analyses suggest that the results are not driven by chance.

6.6. Anticipation test

The implementation of the SSM was announced in November 2013, and it was effectively established one year later. Furthermore, a Comprehensive Assessment (CA) of the European banking system was conducted before the fully implementation of the SSM. As sovereign ratings focus on the long term and thus aim to respond only to the perceived permanent component of credit-quality changes, they are less likely to identify an anticipation effect associated with the announcement of the new supervisory architecture proposed in the SSM. In any case, we also check whether our results might be affected by an anticipation effect on sovereign ratings shortly after the announcement of the SSM and the realization of the Comprehensive Assessment.

In this case, we consider 2013 as the initial year of the post-treatment period. To be consistent with the number of years in the pre-treatment period, our sample period starts in 2010. Then, we have three years before the treatment period (2010, 2011, and 2012). Columns (7) to (9) of Table A11 in the Appendix show that the DID estimator is not statistically significant at conventional levels for any of the agencies. This result suggests that there was no anticipation effect on the impact of supranational supervision on sovereign risk.

6.7. Alternative measures of supranational banking supervision

While our key explanatory variable that aims to capture SSM supervisory activity is the ratio of total banking assets under the SSM framework to total assets of the banking sector ($SSM\ Assets_{it}$), we also consider alternative measures of the strength of supranational supervision following SSM implementation. In particular, we employ the ratio of total banking assets under SSM supervision to the GDP of each country ($SSM\ Assets\_GDP_{it}$) and the natural logarithm of the total number of SSM-supervised banks in each country ($\#SSM\ banks_{it}$). Both measures are continuous variables that provide additional information about the coverage of supranational supervision in each country. As can be observed in Panel A of Table A13 in the Appendix (columns (1) to (6)), our results hold after employing these alternative continuous measures.

6.8. Ratings scale and computation

We conduct our analysis employing the standard transformation of sovereign ratings into a 21-category numerical scale. However, as all of the countries in our sample are developed economies, there are some rating categories with few observations, in particular those categories belonging to the speculative grade (BB+ or below). To ensure that use of this rating scale is not driving our

findings, we re-run our model using a condensed scale (12 categories) that groups together those categories with few observations. Panel A of Table A13 in the Appendix (columns (7) to (9)) shows that the results are robust after employing an alternative sovereign rating scale. In the main specifications, we lead the dependent variable by one quarter to ameliorate potential endogeneity biases between sovereign ratings and the determinants of sovereign risk. For robustness purposes, we estimate the equations without leading the dependent variable. In doing so, we ensure that our results are not driven by leading the variable. Moreover, it is possible that sovereign ratings may respond rapidly to the change in the supervisory framework. We re-run our regressions using the sovereign rating of country *c* at the end of year *t*. As shown in Panel A of Table A13 in the Appendix (columns (10) to (12)), these findings remain consistent with the main findings.

6.9. Subsample analyses

To ensure that our results are not driven by a set of countries in our sample, we conduct several subsample analyses. Firstly, we re-run our baseline model excluding those countries that are not part of the EU – Iceland, Norway, and Switzerland. In Panel B of Table A13 in the Appendix (columns (1) to (3)), we show that the results are qualitatively similar to our previous findings. Secondly, we re-run the DID estimations excluding Greece, Ireland, Italy, Portugal, and Spain (the GIPSI countries) because these countries' banking systems were most affected by the European sovereign debt crisis in 2010. In doing so, we ensure that our results are not driven by the effect of supranational supervision on countries with more fragile banking systems, in which supranational supervision may be more beneficial for reducing sovereign risk. Moreover, we exclude those countries that received the largest bank bailouts during de GFC and sovereign debt crisis, for which the bailout amount in terms of GDP is above the 75th percentile (*Bailout Amount GDP%* >4.69%). After doing this, 23 (74.1%) countries remain in our sample (12 treated and 11 non-treated). Through these exclusions, we ensure that our findings are not driven by the tougher restrictions imposed on banks in those countries that received significant bank bailouts. Panel B of Table A13 in the Appendix (columns (4) to (9)) shows that the results are qualitatively similar to our previous findings. Thirdly, although the sample is largely homogeneous, there are differences across European countries in terms of financial soundness and economic growth. To further increase the homogeneity of our sample, we include only those European countries that belong to the OECD and can thus be considered the most advanced countries. After doing this, 25 (80%) countries remain in our sample (16 treated and 9 non-treated). Columns (10) to (12) of Table A13 in the Appendix (Panel B) show that the coefficients of the DID terms are still negative and statistically significant after considering only the OECD members.

7. CONCLUSIONS

This paper analyzed the effects of the banking supervisory architecture on sovereign ratings as a proxy for sovereign risk. In particular, we focused on the implementation of the SSM in Europe, as it involved a change in supervisor – from national to supranational authorities – for a significant fraction of the European banking industry. The empirical analysis relied on a panel dataset of 31 European countries (19 of them under the SSM framework) during the 2011–2018 period. Furthermore, we investigated whether the effect of SSM implementation depends on cross-country differences in banking sector characteristics and the features of the legal and institutional environment.

The results provide further evidence that the implementation of a supranational banking supervisory framework affects sovereign risk. In particular, they show that the implementation of a supranational banking supervisor leads to relatively higher sovereign ratings in countries subject to the SSM framework compared to countries where banking supervision is conducted exclusively by national authorities (*risk-reducing effect*). The greater the amount of banking assets that are directly supervised by the SSM, the stronger the positive effect on sovereign ratings. Moreover, we find evidence that this effect is shaped by the profitability and the market structure of the banking sector and the quality of the institutional environment. In particular, the positive effect of the SSM is more relevant in banking systems that are less profitable and less concentrated and in which the quality of institutions and regulatory features do not assist in properly disciplining banking market participants.

We also provide evidence of the mechanisms through which a supranational supervisory framework may affect sovereign risk. We examine banks' reactions following the implementation of the SSM using bank-level data. After the implementation of the SSM framework, banks supervised supranationally are more stable and less risky (*bank stability channel*) and provide more stable funding to the economy (*credit stability channel*) than banks supervised nationally, regardless of their level of significance (less significant banks from SSM countries and significant banks from non-SSM countries). A greater banks' resilience – downsizing the consequences of bank failures for the sovereign – and a more stable source of funding for firms and consumers – supporting economic growth and funding profitable investment opportunities – provide evidence on how the change in the supervisory framework leads to a reduction in sovereign risk.

Our results are robust when we use CDS spreads as alternative measure of sovereign and bank risk. The main results remain also after ensuring that the implementation of the SSM did not lead to a change in the supervisory standards of the national authorities. Moreover, changes in the macroeconomic conditions and in the bank regulations were similar for treated and control

countries after the implementation of the SSM. Furthermore, the results are robust to placebo and falsification tests, subsample analyses, and other robustness tests.

In terms of policy implications, the results of this paper shed light on the importance of the regulatory tightening imposed on banks following the GFC. In fact, the 2008 financial crisis launched a debate about the optimal design of bank supervision and the trade-offs between national and supranational supervision. Although national supervisors may have informational advantages over a supranational supervisor, supranational supervision may create synergies among different supervisory functions and expertise. At the same time, supranational supervision could mitigate the local biases of national supervisors. In this sense, our study highlights the positive effect of the SSM framework, which enhances bank stability and reduces sovereign risk in Europe. Indeed, our findings demonstrate that supranational supervision is more necessary in countries with distressed banking systems (i.e., with low profitability and highly concentrated markets) and lower institutional quality. Thus, international authorities should consider these results when designing policies (including those regarding the next steps in completing the European Banking Union) to prevent bank failures and ensuring the financial stability of the entire system.

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Table 1. T-tests for the parallel trends assumption

This table presents the t-tests for the assumption of parallel trends in changes in sovereign ratings between treatment group countries (SSM-countries) and control group countries (non-SSM countries) for the two years before the implementation of the SSM.

Fitch			
ΔSov. Rating	**Treated (SSM)**	**Control (Non-SSM)**	**T-test**
2012 (t-2)	-0.58	0.08	1.62
2013 (t-1)	0.00	-0.17	-0.71
S&P			
ΔSov. Rating	**Treated (SSM)**	**Control (Non-SSM)**	**T-test**
2012 (t-2)	-0.32	-0.17	0.21
2013 (t-1)	0.00	-0.08	-0.41
Moody's			
ΔSov. Rating	**Treated (SSM)**	**Control (Non-SSM)**	**T-test**
2012 (t-2)	-0.84	-0.17	1.13
2013 (t-1)	0.11	0.00	-0.49
Avg. Rating			
ΔSov. Rating	**Treated (SSM)**	**Control (Non-SSM)**	**T-test**
2012 (t-2)	-0.58	-0.08	0.95
2013 (t-1)	0.04	-0.08	-0.78

Figure 1. Evolution of sovereign ratings in SSM and non-SSM countries

This figure plots the evolution of sovereign ratings from the end of December 2011 to the end of December 2018 for treated (SSM) countries (red line) and control (non-SSM) countries (blue line). On the x-axis are the years before and after the implementation of the SSM in 2014. The Y-axis presents the average sovereign rating.

Table 2. T-tests for ex-ante supervisory framework characteristics across countries

This table presents the t-tests for the supervisory framework characteristics between treatment group countries (SSM countries) and control group countries (non-SSM countries) before the implementation of the SSM. All the variables are defined in Table A4 of the Appendix.

Variable	***Treated (SSM)***	***Control (Non-SSM)***	**T-test**
Supervisory tenure	7.18	8.39	-0.91
Political independence	0.74	0.58	-0.85
Banking independence	0.79	0.92	1.00
Fixed-term independence	0.79	0.75	-0.24
Supervisory independence	2.26	2.25	-0.05
Supervisory power	10.84	10.75	-0.12
Supervisory cooperation	0.23	0.20	-1.10

Table 3. Descriptive statistics for the baseline analysis

This table presents the descriptive statistics – number of observations, mean, standard deviation, 25th percentile, median, 75th percentile – of the main variables of interest. The *p*-values reported are obtained for the differences between the means across the pre-SSM and post-SSM periods for the SSM countries (column 9) and the non-SSM countries (column 12). All the variables are defined in Table A4 of the Appendix.

							Treated (SSM)		Test (p-value)	Control (Non-SSM)		Test (p-value)
	N	mean	sd	p25	p50	p75	Pre-SSM	Post-SSM		Pre-SSM	Post-SSM	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Fitch	248	16.19	4.23	13.00	17.00	21.00	15.78	16.13	0.07	16.33	16.40	0.75
S&P	248	16.10	4.34	13.00	16.00	20.50	15.47	16.23	0.00	16.28	16.40	0.56
Moody's	248	15.81	4.61	12.50	16.00	21.00	15.05	15.63	0.00	16.39	16.45	0.77
SSM Dummy	248	0.61	0.49	0.00	1.00	1.00	0.00	1.00	0.00	0.00	0.00	-
SSM Assets	248	0.18	0.26	0.00	0.00	0.36	0.00	0.46	0.00	0.00	0.00	-
Current Account Balance (%GDP)	248	1.69	4.22	-1.40	1.26	4.49	0.31	1.86	0.02	1.82	2.66	0.43
Fiscal Balance (%GDP)	248	-1.70	3.45	-3.37	-1.89	0.10	-4.05	-1.18	0.00	-1.81	-0.21	0.08
Public Debt (%GDP)	248	67.54	36.54	40.21	61.86	86.22	77.16	78.26	0.87	52.41	50.50	0.67
Unemployment Rate	248	8.93	5.01	5.65	7.56	10.93	11.31	9.48	0.04	8.46	6.08	0.01
GDP Growth	248	2.23	2.83	1.02	2.08	3.50	0.50	3.06	0.00	1.30	3.10	0.00
Log GDP pc	248	10.59	0.37	10.30	10.60	10.86	10.59	10.66	0.20	10.48	10.56	0.32
Inflation	248	1.36	1.42	0.30	1.29	2.20	2.02	0.86	0.00	2.11	1.05	0.00
Institutional Quality	248	69.65	5.85	65.65	70.05	74.15	68.79	69.04	0.79	69.84	71.32	0.21
Δ*ss_capbuffers*	248	0.03	0.46	0.00	0.00	0.00	0.04	-0.06	0.12	0.11	0.13	0.82
Δ*cap_buffers*	248	0.24	0.44	0.00	0.00	0.00	0.35	0.19	0.03	0.36	0.13	0.02
Δ*ss_exposure*	248	0.00	0.22	0.00	0.00	0.00	0.02	0.01	0.85	-0.03	-0.02	0.83
Δ*interbank_exposure*	248	0.03	0.24	0.00	0.00	0.00	-0.02	0.08	0.01	0.03	0.00	0.57
Δ*rr_foreingcurr*	248	-0.02	0.25	0.00	0.00	0.00	0.00	0.00	0.99	-0.03	-0.08	0.43
Δ*rr_localcurr*	248	-0.10	0.36	0.00	0.00	0.00	-0.35	-0.02	0.00	-0.03	-0.05	0.73
Profitability	248	0.42	2.21	0.23	0.59	1.12	-0.20	0.24	0.26	1.20	0.84	0.41
Concentration	248	73.94	16.85	60.88	76.55	87.76	72.56	77.31	0.07	69.97	72.30	0.57
Bailout	248	16.63	29.01	0.00	2.29	20.67	19.10	21.76	0.57	10.09	10.09	0.99
Rule of Law	248	1.19	0.61	0.76	1.16	1.79	1.23	1.22	0.86	1.13	1.16	0.86
Regulatory Quality	248	1.21	0.46	0.83	1.15	1.65	1.21	1.22	0.90	1.21	1.20	0.96
Bank Restrictions	248	7.23	4.03	4.21	7.23	9.52	6.95	6.78	0.69	7.72	7.93	0.85

Table 4. SSM and sovereign risk: baseline results

This table presents the results for the relationship between the implementation of the SSM in the EU and sovereign risk. Our dependent variables are the long-term foreign currency sovereign credit ratings issued by Fitch, S&P, and Moody's. *SSM Dummy* takes the value 1 during the years after the implementation of the SSM (2014 onwards) and 0 otherwise. *SSM Assets* is the share of banking sector assets supervised by the SSM over total banking sector assets. The other variables are defined in Table A4 in the Appendix. Year and country fixed effects are included but not reported. Z-statistics for the clustered standard errors are in parentheses. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

Dependent variable	***Fitch***	***S&P***	***Moody's***	***Fitch***	***S&P***	***Moody's***
	(1)	(2)	(3)	(4)	(5)	(6)
SSM Dummy	3.065***	4.001***	2.096***			
	(3.08)	(4.12)	(2.75)			
SSM Assets				2.991**	2.945***	2.489**
				(2.51)	(2.77)	(2.42)
GDPpc	7.639	15.790**	1.300	6.659	11.330*	3.142
	(1.17)	(2.13)	(0.28)	(1.05)	(1.88)	(0.70)
GDP Growth	0.071	0.095	0.045	0.039	0.047	0.0249
	(0.68)	(0.87)	(0.44)	(0.40)	(0.48)	(0.24)
Inflation	-0.263*	-0.426***	-0.122	-0.189	-0.257**	-0.0987
	(-1.71)	(-3.19)	(-0.95)	(-1.24)	(-2.25)	(-0.75)
Unemployment	-0.606***	-0.337**	-0.296**	-0.500***	-0.214*	-0.223*
	(-3.42)	(-2.45)	(-2.37)	(-3.13)	(-1.75)	(-1.79)
Current Account Balance (%GDP)	0.116	0.002	-0.035	0.118	0.004	-0.0282
	(1.02)	(0.03)	(-0.39)	(1.08)	(0.07)	(-0.30)
Fiscal Balance	-0.068	0.041	0.237**	-0.060	0.055	0.228*
	(-0.55)	(0.51)	(1.99)	(-0.49)	(0.76)	(1.94)
Public Debt (%GDP)	-0.094***	-0.104***	-0.091***	-0.073***	-0.079***	-0.0794***
	(-3.63)	(-4.60)	(-4.26)	(-3.26)	(-3.71)	(-3.67)
Liquid Liabilities (%GDP)	-0.095**	-0.106***	-0.034	-0.090**	-0.081**	-0.0432
	(-2.36)	(-4.51)	(-1.45)	(-2.00)	(-2.53)	(-1.45)
Inst. Quality	0.176*	-0.066	0.180*	0.163	-0.079	0.185*
	(1.69)	(-0.61)	(1.83)	(1.51)	(-0.72)	(1.87)
Δ*ss_capbuffers*	0.192	-0.121	0.665**	0.196	-0.047	0.597**
	(1.09)	(-0.47)	(2.26)	(1.10)	(-0.22)	(2.05)
Δ*cap_buffers*	-0.595**	-0.159	-0.447	-0.550*	-0.131	-0.428
	(-2.04)	(-0.47)	(-1.31)	(-1.95)	(-0.47)	(-1.24)
Δ*ss_exposure*	0.164	0.234	-0.321	-0.536	-0.461	-0.695
	(0.45)	(0.56)	(-0.56)	(-1.08)	(-1.21)	(-1.25)
Δ*interbank_exposure*	0.113	-0.535	-1.157	0.967	0.288	-0.326
	(0.18)	(-1.14)	(-1.45)	(1.16)	(0.86)	(-0.56)
Δ*rr_foreingcurr*	-0.648**	-0.497**	-0.186	-0.548*	-0.363**	-0.139
	(-2.01)	(-2.27)	(-0.75)	(-1.67)	(-2.02)	(-0.63)
Δ*rr_localcurr*	-0.331	-0.305	-0.121	-0.130	0.013	0.0218
	(-1.19)	(-0.99)	(-0.35)	(-0.45)	(0.04)	(0.06)
Year Dummies	Yes	Yes	Yes	Yes	Yes	Yes
Country Dummies	Yes	Yes	Yes	Yes	Yes	Yes
Clustered Standard Errors	Country	Country	Country	Country	Country	Country
Observations	248	248	248	248	248	248
Number of Countries	31	31	31	31	31	31
Log Pseudolikelihood	-116.91	-140.47	-121.52	-124.16	-159.08	-124.17
Pseudo R2	0.8028	0.7712	0.7986	0.7906	0.7409	0.7942
p-value (chi2)	0.00	0.00	0.00	0.00	0.00	0.00

Table 5. SSM and sovereign risk: the role of banking sector characteristics

This table presents the results for the relationship between the implementation of the SSM in the EU and sovereign risk. Our dependent variables are the long-term foreign currency sovereign credit ratings issued by Fitch, S&P, and Moody's. The same set of quantitative and qualitative controls included in our baseline model [1] are included in this model. All the variables are defined in Table A4 in the Appendix. Year and country fixed effects are included but not reported. Z-statistics for the clustered standard errors are in parentheses. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

	Fitch			***S&P***			***Moody's***		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
SSM Assets	3.386**	16.227***	3.420***	3.053***	14.252*	3.576***	2.723**	9.798**	3.397**
	(2.50)	(2.57)	(2.83)	(2.81)	(1.84)	(2.77)	(2.56)	(2.21)	(2.24)
SSM Assets x Profitability	-0.239**			-0.213*			-0.664***		
	(-1.97)			(-1.66)			(-5.04)		
SSM Assets x Concentration		-0.133**			-0.115			-0.088*	
		(-2.29)			(-1.49)			(-1.78)	
SSM Assets x Bailout			-0.021			-0.024			-0.034
			(-0.71)			(-0.99)			(-1.50)
Profitability	0.295***			0.157**			0.415***		
	(4.75)			(2.08)			(5.92)		
Concentration		0.044*			0.008			0.014	
		(2.02)			(0.26)			(0.84)	
Bailout			0.028			0.010			0.080
			(0.39)			(0.17)			(1.63)
Macroeconomic Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Regulatory Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year Dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country Dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Clustered Standard Errors	Country	Country	Country	Country	Country	Country	Country	Country	Country
Observations	248	248	248	248	248	248	248	248	248
Number of Countries	31	31	31	31	31	31	31	31	31
Log Pseudolikelihood	-115.62	-119.94	-123.38	-156.59	-155.84	-158.15	-111.93	-121.95	-120.17
Pseudo R2	0.8050	0.7977	0.7919	0.7450	0.7462	0.7424	0.8145	0.7979	0.8008
p-value (chi2)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Table 6. SSM and sovereign risk: the role of the legal and institutional environment

This table presents the results for the relationship between the implementation of the SSM in the EU and sovereign risk. Our dependent variables are the long-term foreign currency sovereign credit ratings issued by Fitch, S&P, and Moody's. The same set of quantitative and qualitative controls included in our baseline model [1] are included here. All the variables are defined in Table A4 in the Appendix. Year and country fixed effects are included but not reported. Z-statistics for the clustered standard errors are in parentheses. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

	Fitch			***S&P***			***Moody's***		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
SSM Assets	5.202**	6.087***	5.083***	4.467***	4.908***	4.701***	6.028***	7.986**	4.434***
	(2.59)	(2.87)	(2.62)	(3.17)	(3.65)	(2.90)	(3.51)	(2.55)	(3.37)
SSM Assets x Rule of Law	-2.869**			-1.599			-3.998**		
	(-2.02)			(-1.24)			(-2.46)		
SSM Assets x Regulatory Quality		-3.405**			-1.939*			-5.725*	
		(-1.95)			(-1.72)			(-2.47)	
SSM Assets x Bank Restrictions			-0.423*			-0.293			-0.386
			(-1.92)			(-1.30)			(-1.49)
Rule of Law	2.729			3.901**			0.581		
	(1.31)			(2.02)			(0.31)		
Regulatory Quality		4.494**			4.629***			1.424	
		(2.40)			(3.38)			(0.75)	
Bank Restrictions			0.269			0.397			-0.027
			(0.94)			(1.56)			(-0.11)
Macroeconomic Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Regulatory Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year Dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country Dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Clustered Standard Errors	Country	Country	Country	Country	Country	Country	Country	Country	Country
Observations	248	248	248	248	248	248	248	248	248
Number of Countries	31	31	31	31	31	31	31	31	31
Log Pseudolikelihood	-120.50	-119.71	-121.33	-154.06	-154.04	-155.58	-120.51	-119.50	-122.16
Pseudo R2	0.7967	0.7981	0.7953	0.7491	0.7491	0.7466	0.8003	0.8019	0.7975
p-value (chi2)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Table 7. The impact of bank supervision on bank stability and credit stability: Significant supranationally supervised versus significant nationally supervised banks

This table presents the results for the relationship between the implementation of the SSM in the EU and bank stability (columns 1 to 4) and credit stability (columns 5 and 6). All the variables are defined in Table A5 in the Appendix. Year and country fixed effects are included but not reported. Z-statistics for the clustered standard errors are in parentheses. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

	Significant supranationally supervised banks vs. Significant nationally supervised banks					
	Bank stability				***Credit stability***	
	Z-Score	$log(roa+\frac{equity}{assets})$	***log(sd(roa))***	$log(\frac{Impairment\ charges}{equity})$	***sd(loans)***	***Δloans***
	(1)	(2)	(3)	(4)	(5)	(6)
SSM_SSN	0.724***	0.005*	-3.365***	-0.029*	-0.014***	-0.860
	(4.80)	(1.87)	(-17.24)	(-1.69)	(-3.33)	(-1.18)
Bank-level Controls	Yes	Yes	Yes	Yes	Yes	Yes
Macroeconomic Contr.	Yes	Yes	Yes	Yes	Yes	Yes
Regulatory Controls	Yes	Yes	Yes	Yes	Yes	Yes
Year Dummies	Yes	Yes	Yes	Yes	Yes	Yes
Bank Dummies	Yes	Yes	Yes	Yes	Yes	Yes
Clustered Std. Errors	Bank level	Bank level	Bank level	Bank level	Bank level	Bank level
Observations	1,557	1,879	1,753	1,809	1,888	1,886
Number of Banks	261	261	261	259	265	265
Number of Countries	31	31	31	31	31	31
R2	0.6385	0.8598	0.7638	0.3981	0.4696	0.2003
p-value (chi2)	0.00	0.00	0.00	0.00	0.00	0.00

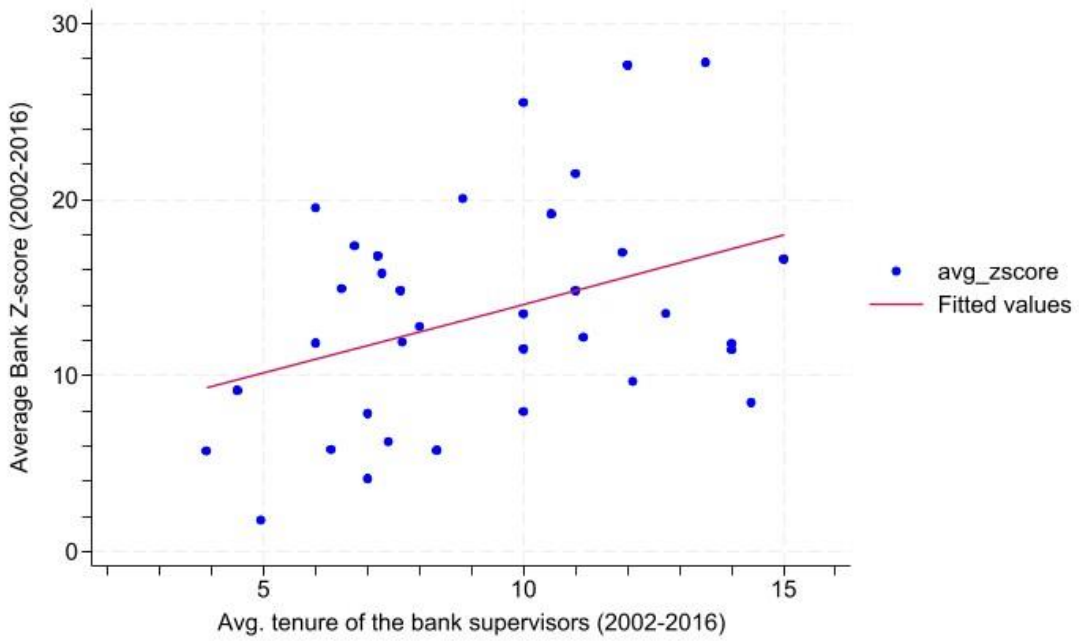
Table 8. The impact of bank supervision on bank stability and credit stability: Significant supranationally supervised versus less significant national supervised banks

This table presents the results for the relationship between the implementation of the SSM in the EU and bank stability (columns 1 to 4) and credit stability (columns 5 and 6). All the variables are defined in Table A5 in the Appendix. Year and country fixed effects are included but not reported. Z-statistics for the clustered standard errors are in parentheses. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

	Significant supranationally supervised versus less significant national supervised banks					
	Bank stability				***Credit stability***	
	Z-Score	$log(roa+\frac{equity}{assets})$	***log(sd(roa))***	$log(\frac{Impairment\ charges}{equity})$	***sd(loans)***	***Δloans***
	(1)	(2)	(3)	(4)	(5)	(6)
SSM_LSB	0.649***	0.008**	-3.370***	-0.054**	-0.009*	-1.722
	(5.25)	(2.37)	(-19.45)	(-2.43)	(-1.71)	(-1.33)
Bank-level Controls	Yes	Yes	Yes	Yes	Yes	Yes
Macroeconomic Contr.	Yes	Yes	Yes	Yes	Yes	Yes
Regulatory Controls	Yes	Yes	Yes	Yes	Yes	Yes
Year Dummies	Yes	Yes	Yes	Yes	Yes	Yes
Bank Dummies	Yes	Yes	Yes	Yes	Yes	Yes
Clustered Std. Errors	Bank level	Bank level	Bank level	Bank level	Bank level	Bank level
Observations	3,512	4,621	4,546	4,448	4,676	4,659
Number of Banks	747	824	827	811	827	825
Number of Countries	19	19	19	19	19	19
R2	0.6089	0.8769	0.8239	0.4713	0.6870	0.3430
p-value (chi2)	0.00	0.00	0.00	0.00	0.00	0.00

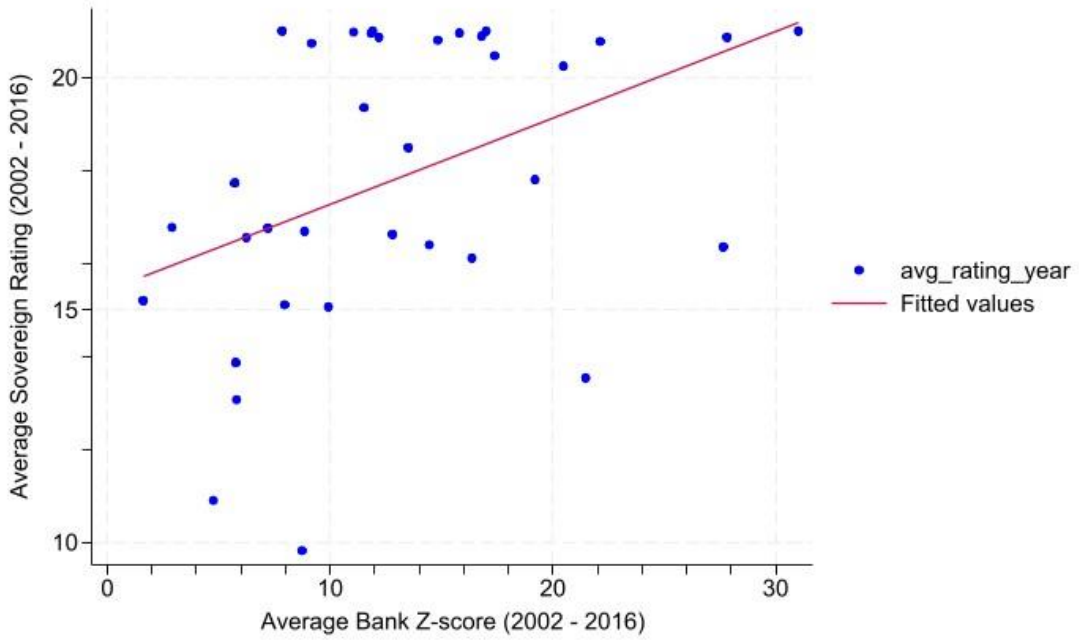
Appendix

Figure A1. Bank supervision and bank stability



Source: Bank Regulation and Supervision Survey, World Bank Financial Development Database and own elaboration

Figure A2. Bank stability and sovereign risk



Source: World Bank Financial Development Database and own elaboration

Table A1. T-test for ex-ante characteristics across countries

This table presents the t-test results for the comparison between treatment group countries (SSM countries) and control group countries (non-SSM countries) on certain macroeconomic factors, factors reflecting the state of the financial markets, and factors reflecting the relevance of the banking system before the implementation of the SSM.

Variable	*Treated (SSM)*	*Control (Non-SSM)*	T-test
GDP growth	*1.63*	*1.95*	*0.35*
GDP per capita	*42645.83*	*38627.47*	*-0.62*
Inflation	*2.99*	*2.58*	*-0.71*
Employment Rate	*10.58*	*8.34*	*-1.42*
Fiscal balance	*-4.84*	*-2.33*	*1.36*
Stock Market Return	*-4.27*	*3.11*	*1.55*
Stock Price Volatility	*23.03*	*20.87*	*-0.85*
Banking Credit to GDP	*103.71*	*101.16*	*-0.13*
Banking Deposits to GDP	*95.73*	*74.41*	*-1.04*

Table A2. Sample description

Country	**SSM-supervised assets (trillions €)**	**Total bank assets (trillions €)**	**# Supervised banks**	**% of SSM-supervised banks**
Austria	0.40	1.54	8	6.00%
Belgium	0.72	1.70	7	5.68%
Bulgaria	0.00	0.05	0	0.00%
Croatia	0.00	0.08	0	0.00%
Cyprus	0.02	0.11	4	3.20%
Czech Republic	0.00	0.32	0	0.00%
Denmark	0.00	1.45	0	0.00%
Estonia	0.02	0.03	3	1.79%
Finland	0.76	1.40	4	2.92%
France	6.44	16.70	13	9.65%
Germany	4.26	14.80	22	17.22%
Greece	0.29	0.30	4	3.25%
Hungary	0.00	0.11	0	0.00%
Iceland	0.00	0.03	0	0.00%
Ireland	0.30	0.69	5	3.68%
Italy	2.33	5.44	15	11.23%
Latvia	0.01	0.04	4	2.52%
Lithuania	0.02	0.02	3	1.94%
Luxembourg	0.12	0.98	6	4.10%
Malta	0.02	0.03	3	2.44%
Netherlands	2.20	4.25	7	5.32%
Norway	0.00	0.91	0	0.00%
Poland	0.00	0.37	0	0.00%
Portugal	0.24	0.47	4	3.08%
Romania	0.00	0.12	0	0.00%
Slovakia	0.04	0.11	3	2.44%
Slovenia	0.02	0.06	3	2.44%
Spain	3.20	4.63	15	11.27%
Sweden	0.00	1.75	0	0.00%
Switzerland	0.00	6.23	0	0.00%
United Kingdom	0.00	19.60	0	0.00%
Total since the launch of the SSM	113.00	422.00	148	2.46%

Table A3. Transformation of the categorical CRA ratings to a numerical scale and rating weights in the sample

	Ratings		Scale	# Ratings	% Sample
Investment	AAA	Aaa	21	197	26.48%
	AA+	Aa1	20	44	5.91%
	AA	Aa2	19	36	4.84%
	AA-	Aa3	18	29	3.90%
	A+	A1	17	55	7.39%
	A	A2	16	42	5.65%
	A-	A3	15	71	9.54%
	BBB+	Baa1	14	43	5.78%
	BBB	Baa2	13	51	6.85%
	BBB-	Baa3	12	68	9.14%
Speculative	BB+	Ba1	11	47	6.32%
	BB	Ba2	10	19	2.55%
	BB-	Ba3	9	7	0.94%
	B+	B1	8	6	0.81%
	B	B2	7	3	0.40%
	B-	B3	6	12	1.61%
	CCC+	Caa1	5	1	0.13%
	CCC	Caa2	4	5	0.67%
	CCC-	Caa3	3	5	0.67%
	CC	Ca	2	2	0.00%
	C	C	1	1	0.27%
	D/DD/RD	D	0	1	0.13%

Table A4. Definitions of the variables and data sources

This table describes the variables used in the paper and indicates the sources from which the data were retrieved.

Variable	Definition	Source
Panel A. Sovereign risk and Bank supervision		
Sovereign credit ratings	Long-term foreign currency sovereign credit ratings issued by the three main CRAs: Fitch, Moody's, and Standard & Poor's (S&P)	Thomson Reuters & rating agencies' publications
SSM $Dummy_{ct}$	Dummy taking the value 1 when and after a country's banking sector c becomes part of the SSM framework and 0 otherwise	Own calculation based on ECB reports on bank supervision
SSM $Assets_{ct}$	Ratio of total bank assets under the SSM framework to total assets of the banking sector in each country	Own calculation based on ECB reports on bank supervision
Panel B. Macroeconomic controls		
GDP per capita	Log GDP over the total population	IMF
GDP growth	Annual percentage growth rate of GDP	IMF
Inflation	Annual percentage change of end-of-period consumer prices	IMF
Unemployment	Number of unemployed persons as a percentage of the labor force	IMF
Current account balance (%GDP)	Current account balance in million US$ as % of GDP	IMF
Fiscal balance	General government net lending/borrowing, calculated as government revenue minus total government expenditure, as a % of GDP	IMF
Public debt (%GDP)	General public gross debt as % of GDP	IMF
Liquid liabilities (%GDP)	Ratio of liquid liabilities(M3) as % of GDP	IMF
Institutional quality	Economic freedom index	Heritage Foundation
Panel C. Regulatory controls		
Δss_capbuffers	Change in banks' sector specific capital buffers on their exposure on real estate credit, consumer credit, and other credit. This variable takes the value 1 if the required capital buffers increases, -1 if the required capital buffers decreases and 0 when there are no changes in the required capital buffers.	
Δcap_buffers	Change in banks' capital buffers. This variable takes the value 1 if the required capital buffers increases, -1 if the required	

	capital buffers decreases and 0 when there are no changes in the required capital buffers.	Cerutti et al., (2016) IBRN Prudential Database (updated in August 2021) and IMF
Δss_exposure	Change in the limits on banks' exposures to specific borrowers or sectors. This variable takes the value 1 if the limits increase, -1 if the limits decrease and 0 when there are no changes in the limits.	
Δinterbank_exposure	Change in the limits on banks' exposures to other banks. This variable takes the value 1 if the limits increase, -1 if the limits decrease and 0 when there are no changes in the limits.	
Δrr_foreingcurr	Change in banks' reserve requirements on foreign currency-denominated accounts. This variable takes the value 1 if the reserve requirements increase, -1 if the reserve requirements decrease and 0 when there are no changes in the reserve requirements.	
Δrr_localcurr	Change in banks' reserve requirements on local currency-denominated accounts. This variable takes the value 1 if the reserve requirements increase, -1 if the reserve requirements decrease and 0 when there are no changes in the reserve requirements.	
Panel D. Banking system characteristics and legal and institutional environment		
Profitability	Average return on assets (ROA)	Global Financial Development Dataset (World Bank)
Concentration	Assets of the five largest banks as a share of assets of all banks	
Bailout	The total capital injected ($ bn) by country c into its banking system in year t	Homar and van Wijnbergen (2017) and the IMF Country Reports
Rule of law	Index that captures the perception of the extent to which agents have confidence in and abide by societal rules, and in particular the quality of contract enforcement, property rights, the police, and the courts, as well as the likelihood of crime and violence.	World Bank Worldwide Governance Indicators Database
Regulatory quality	Index that captures the perception of the government's ability to formulate and implement sound policies and regulations that permit and promote private sector development.	World Bank Worldwide Governance Indicators Database
Bank restrictions	Index that captures whether bank activities in the securities, insurance, and real estate markets, as well as bank participation in the ownership and control of non-financial firms, are (1) unrestricted, (2) permitted, (3) restricted, or (4) prohibited. This indicator, theoretically, can range from 4 to 16, where higher values indicate more restrictions on bank activities.	World Bank Regulation and Supervision Survey
Panel E. Instrumental variable analysis (Section 6)		
Z-score	Natural logarithm of the bank-sector Z-Score. The Z-score is computed as (ROA + CAP)/sd(ROA), where ROA is the return on assets, CAP is the capital to asset ratio, and sd(ROA) is an estimate of the standard deviation of the rate of return on assets. To calculate the standard deviation of ROA, we use a three-year moving window.	Global Financial Development Database (World Bank)
Banking sector's exposure to natural disasters	Total amount of damages caused by natural disasters in each country over the total assets of the banking sector	Centre for Research on the Epidemiology of Disasters (CRED)
Bank market power	Lerner index. Calculated as the difference between the interest rate and marginal cost expressed as a percentage of the price. This index ranges between 0 (perfect competition) and 1 (perfect monopoly).	Own calculations using data from BankFocus
Panel F. Other variables (Section 6)		
Log (5yrs CDS spread)	Natural logarithm of the average of the five-year sovereign CDS spread (in basis points)	Thomson Reuters Eikon
Supervisory tenure	Average tenure of a professional bank supervisor at the national bank supervisor of each country	Bank Regulation and Supervision Survey (World Bank)
Political independence	Dummy taking the value 1 if the supervisor is only accountable to a legislative body (Parliament or Congress) and 0 otherwise (i.e., the supervisor is accountable to the President, Prime Minister, Finance Minister, or other cabinet levels).	
Banking independence	Dummy taking the value 1 if the supervisory staff cannot be held personally liable for damages to a bank caused by actions or omissions committed in the good-faith exercise of their duties.	

Fixed-term independence	Dummy taking the value 1 if the head of the national supervisory authority has a fixed term of 4 years or longer	
Supervisory independence	Index computed as the sum of political independence, banking independence, and fixed-term independence.	
Cumchange_ss_capbuffers	Cumulative changes in banks' sector specific capital buffers since 2000.	Cerutti et al., (2016) IBRN Prudential Database (updated in August 2021) and IMF
Cumchange_cap_buffers	Cumulative changes in banks' capital buffers since 2000.	
Cumchange_ss_exposure	Cumulative changes in the limits on banks' exposures to specific borrowers or sectors since 2000.	
Cumchange_interbank_exposure	Cumulative changes in the limits on banks' exposures to other banks since 2000.	
Cumchange_rr_foreingcurr	Cumulative changes in banks' reserve requirements on foreign currency-denominated accounts since 2000.	
Cumchange_rr_localcurr	Cumulative changes in banks' reserve requirements on local currency-denominated accounts since 2000.	
ΔRegulatory Index	Sum of the changes in banking regulations implemented by each country since 2000.	

Table A5. Definition of variables and sources. Bank-level

This table describes the variables used in the paper and indicates the sources from which the data were retrieved.

Variable	Definition	Source
PANEL A. Main variables		
ZSCORE	The natural logarithm of (ROA + CAP)/sd(ROA), where ROA is the return on assets, CAP is the capital to asset ratio, and sd(ROA) is an estimate of the standard deviation of the rate of return on assets. To calculate the standard deviation of ROA, we use a three-year moving window. A higher Z-score indicates that the bank is more stable because it is inversely related to the bank's default probability.	BankFocus
Total impairment charges/Total equity	Ratio of total impairment charges (net impairment charge in relation to the bank's loans and advances and on other assets) to total equity	BankFocus
Sd(loans)	Standard deviation of the bank loans over total assets ratio. To calculate the standard deviation of loans, we use a three-year moving window	BankFocus
Δloans	Annual growth rate of bank loans over total assets.	BankFocus
SSM_SMS	Dummy taking the value 1 after the implementation of the SSM for those banks supervised directly by the ECB and 0 otherwise.	Own calculation based on ECB reports on bank supervision
PANEL B. Bank-level control variables		
Size	Natural logarithm of total bank assets	BankFocus
Capital	Total bank equity to total bank assets	BankFocus
Cost-to-Income	Total operating expenses to total operating income. This ratio represents the efficiency of a bank's operations, with a lower ratio indicating that the bank is more efficient.	BankFocus
Traditional	Operating revenues-to-total assets ratio	BankFocus
PANEL C. Macroeconomic control variables		
Inflation	Annual percentage change of end-of-period consumer price index.	IMF
FinDev	Private credit by deposit money banks and other financial institutions to GDP.	Global Financial Development Database (World Bank)
⊿GDPpc	Annual percentage growth rate of GDP per capita.	IMF

Figure A3. Year-by-year coefficients (S&P sovereign ratings)

This figure plots the coefficient values and 95% confidence interval for the indicator variables for time periods from t = −3 to t = t + 4 around the implementation of the SSM.

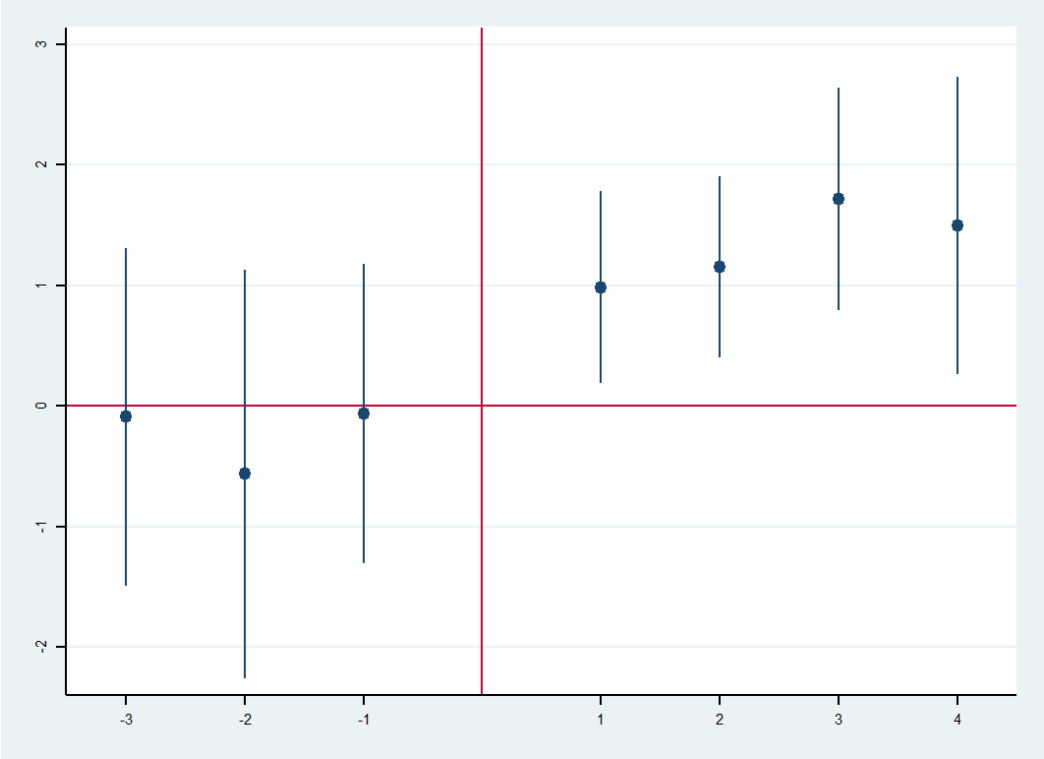


Table A6. Descriptive statistics for the bank-level variables

This table presents the descriptive statistics – number of observations, mean, standard deviation, 25th percentile, median, and 75th percentile – of the main variables of interest. The *p*-values reported are obtained for the differences between the means across the pre-SSM and post-SSM period for the SSM countries and non-SSM countries. All the variables are defined in Table A5 of the Appendix.

Panel A: Significant supranationally supervised banks (SSM Banks) in SSM countries versus significant nationally supervised banks (SNS banks) in non-SSM countries

							Treated (SSM banks)		Test (p-value)	Control (SNS in non-SSM countries)		Test (p-value)
	N	mean	sd	p25	p50	p75	Pre-SSM	Post-SSM		Pre-SSM	Post-SSM	
Zscore	1557	3.59	1.38	2.78	3.64	4.46	2.95	3.73	0.00	3.73	3.78	0.61
log(roa+equity/assets)	1876	0.09	0.07	0.05	0.08	0.11	0.06	0.09	0.00	0.09	0.10	0.00
log(sd(roa))	1746	-3.74	1.79	-3.48	-3.29	-3.00	-3.39	-5.54	0.00	-3.39	-2.38	0.00
log(Impairment charges)/equity)	1806	0.08	0.19	0.01	0.03	0.09	0.14	0.05	0.00	0.09	0.12	0.00
sd(loans)	1886	0.03	0.04	0.01	0.02	0.04	0.04	0.03	0.04	0.03	0.3	0.13
Δloans	1886	0.18	4.14	-0.04	0.00	0.04	0.52	0.17	0.41	0.07	0.00	0.00
SSM_SNS	1888	0.56	0.50	0	1	1						
Capital	1888	0.09	0.07	0.05	0.07	0.11	0.06	0.08	0.00	0.08	0.10	0.00
Cost-to-Income	1888	0.64	0.96	0.51	0.61	0.73	0.07	0.06	0.20	0.59	0.64	0.01
Size	1888	17.41	1.85	15.99	17.41	18.71	17.47	17.65	0.42	17.09	17.03	0.69
Traditional	1888	0.03	0.03	0.02	0.03	0.04	0.26	0.28	0.27	0.04	0.04	0.79

Panel B: Significant supranationally supervised banks (SSM Banks) in SSM countries versus Less Significant banks (LSB) in SSM Countries

							Treated (SSM banks)		Test (p-value)	Control (LSB in SSM countries		Test (p-value)
	N	mean	sd	p25	p50	p75	Pre-SSM	Post-SSM		Pre-SSM	Post-SSM	
Zscore	3512	3.56	1.33	2.77	3.59	4.37	2.95	3.73	0.00	3.51	3.62	0.04
Log(roa+equity/assets)	4625	0.11	0.11	0.06	0.08	0.12	0.06	0.09	0.00	0.09	0.12	0.00
log(sd(roa))	4546	-3.05	1.33	-3.41	-3.00	-1.97	-3.39	-5.54	0.00	-3.38	-2.37	0.00
log(Impairment charges)/equity)	4448	0.07	0.21	0.00	0.02	0.07	0.14	0.05	0.00	0.09	0.05	0.00
sd(loans)	4676	0.05	0.09	0.01	0.03	0.05	0.04	0.03	0.04	0.04	0.05	0.02
Δloans	4659	1.07	49.22	-0.05	0.00	0.07	0.52	0.17	0.41	0.14	1.73	0.21
SSM_LSB	4676	0.23	0.42	0	0	0						
Capital	4676	0.11	0.24	0.05	0.08	0.12	0.06	0.08	0.00	0.10	0.12	0.00
Cost-to-Income	4676	0.73	4.51	0.54	0.66	0.81	0.07	0.06	0.20	0.70	0.76	0.65
Size	4676	15.21	2.49	13.37	15.01	17.00	17.47	17.65	0.42	14.84	14.34	0.00
Traditional	4676	0.05	0.21	0.02	0.03	0.04	0.26	0.28	0.27	0.04	0.06	0.00

Table A7. Measuring sovereign and bank-level risk: CDS spreads

This table presents the results for the relationship between the implementation of the SSM in the EU and sovereign risk. In columns 1 and 2, the dependent variable is the natural logarithm of the average of the five-year sovereign CDS spread (in basis points). In columns 3 and 4, the dependent variable is the natural logarithm of the average of the five-year bank CDS spread (in basis points). Year and country fixed effects are included but not reported. Z-statistics for the clustered standard errors are in parentheses. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

Dependent variable	***Log(5-yrs Sovereign CDS spread)***		***Log(5-yrs Bank CDS spread)***	
	(1)	(2)	(3) Sign. Supran. Sup. (SSM) vs Sign. National Sup.	(4) SSM banks vs. non-SSM banks
SSM Dummy	-0.284***		-0.232***	-0.142***
	(-3.35)		(0.00)	(0.01)
SSM Assets		-0.390**		
		(-2.69)		
Macroeconomics Controls	Yes	Yes	Yes	Yes
Regulatory Controls	Yes	Yes	Yes	Yes
Bank-level Controls	-	-	Yes	Yes
Year Dummies	Yes	Yes	Yes	Yes
Bank Dummies	Yes	Yes	Yes	Yes
Clustered Standard Errors	Country	Country	Bank	Bank
Observations	219	219	404	650
Number of Countries /Banks	29	29	59	97
R2	0.8494	0.8472	0.4958	0.4362
p-value (chi2)	0.00	0.00	0.00	0.00

Table A8. Post-SSM banking supervision at the national level

This table presents the t-tests for the supervisory framework characteristics for the treatment group countries (SSM countries) and control group countries (non-SSM countries) after the implementation of the SSM. All the variables are defined in Table A4 of the Appendix.

Supervision by the NCAs	***Treated (SSM)***		***T-test***	***Control (Non-SSM)***		***T-test***
	Pre-SSM	***Post-SSM***		***Pre-SSM***	***Post-SSM***	
	(1)	(2)	(3)	(4)	(5)	(6)
Supervisory tenure	8.39	8.78	-0.34	7.18	8.84	-1.24
Political independence	0.74	0.58	1.01	0.58	0.50	0.39
Banking independence	0.79	0.84	-0.41	0.92	1.00	-1.00
Fixed-term independence	0.79	0.89	-0.87	0.75	0.92	-1.08
Supervisory independence	2.26	2.15	0.46	2.25	2.42	-0.63
Supervisory power	10.84	10.92	-0.13	10.75	11.25	-0.58

Table A9. T-tests for the macroeconomic and regulatory controls after the SSM

This table presents the t-tests for variation rate of the macroeconomic and regulatory controls after the implementation of the SSM between the treatment group countries (SSM-countries) and control group countries (non-SSM countries):

$$Variation\ rate = \frac{\overline{X_{post.ssm}} - \overline{X_{pre.ssm}}}{\overline{X_{pre.ssm}}}$$

Variation rate (Pre-SSM vs Post-SSM)			
Controls	**Treated (SSM)**	**Control (Non-SSM)**	**T-test**
GDP per capita	0.01	0.01	0.57
GDP growth	2.06	1.64	-0.20
Inflation	-0.61	-0.40	1.14
Unemployment	-0.13	-0.24	-1.45
Current account balance (%GDP)	-1.87	-0.37	0.88
Fiscal balance	-0.77	-0.49	0.63
Public debt (%GDP)	0.02	0.01	-0.13
Liquid liabilities (%GDP)	0.07	0.03	-0.75
Institutional quality	0.00	0.02	1.64
Δss_capbuffers	-0.07	-0.02	0.24
Δcap_buffers	-0.43	-0.56	-1.29
Δss_exposure	-0.18	-0.25	-0.35
Δinterbank_exposure	-0.21	-0.16	0.15
Δrr_foreingcurr	0.00	0.21	1.27
Δrr_localcurr	-0.77	-0.46	1.45

Table A10. Two-stage least squares (2SLS) procedure: banking supervision and bank stability

This table presents the results of the two-stage least squares (2SLS) analysis of the effect of the SSM on sovereign ratings, in which we examine the role of bank stability as a mechanism underlying this effect. In the first stage, the dependent variable is the bank Z-score (*Z-Score*). *Banking sector exposure to Natural Disasters* is an exogenous variable that measures the total damages caused by natural disasters over total bank assets. *Bank Market Power* is the Lerner index. *SSM Assets* is the share of banking sector assets supervised by the SSM over total banking sector assets. The second stage also includes the predicted value of the *Bank Z-score* of the first stage ($\widehat{Z\text{-}Score}$) as the mechanism explaining the relationship between bank stability and sovereign ratings. In both stages, we include the same set of quantitative and qualitative controls included in our baseline model [1]. Year and country fixed effects are included but not reported. Z-statistics for the clustered standard errors are in parentheses. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

	1st Stage	**2nd stage**		
Dependent variable	***Z-Score***	***Fitch***	***S&P***	***Moody's***
	(1)	(2)	(3)	(4)
Banking Sector Exposure To Natural Disasters	-0.062***			
	(-6.35)			
Bank Market Power	1.326*			
	(2.00)			
SSM Assets	0.758**	2.194*	2.478**	1.891*
	(2.12)	(1.62)	(2.19)	(1.68)
$\widehat{Z\text{-}Score}$		1.053***	0.587**	0.705***
		(3.94)	(3.77)	(3.08)
Macroeconomic Controls	Yes	Yes	Yes	Yes
Regulatory Controls	Yes	Yes	Yes	Yes
Year Dummies	Yes	Yes	Yes	Yes
Country Dummies	Yes	Yes	Yes	Yes
Clustered Standard Errors	Country	Country	Country	Country
Observations	248	248	248	248
Number of Countries	31	31	31	31
Log Pseudolikelihood	-	-119.82	-157.24	-122.09
R2 /Pseudo R2	0.41	0.7979	0.7439	0.7977
p-value (chi2)	0.00	0.00	0.00	0.00
Durbin-Wu-Hausman		7.81***	25.92***	3.99**
Sargan-Hansen (p-value)		0.11	0.16	0.11
Kleibergen-Paap underidentification F-Test		11.03***	11.03***	11.03***
Kleibergen-Paap weak identification F-Test		29.17***	29.17***	29.17***

Table A11. Placebo experiments and anticipation test

This table presents the results of various placebo experiments and an anticipation test for the relationship between the implementation of the SSM in the EU and sovereign risk. Our dependent variables are the long-term foreign currency sovereign credit ratings issued by Fitch, S&P, and Moody's. In columns (1) to (3), the treated countries are randomly assigned to the treatment using an algorithm. In columns (4) to (6), the treatment period begins in 2010 (four years before the real date). In columns (7) to (9), the treatment period begins in 2013 (the year before the real date). The same country control variables included in eq. (1) are included in this regression. All the control variables are defined in Table A4 of the Appendix. Year and country fixed effects are included but not reported. Z-statistics for the clustered standard errors are in parentheses. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

Dependent variable	***Random assignment of treated countries***			***Faked implementation of SSM***			***Anticipation test***		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	Fitch	*S&P*	*Moody's*	*Fitch*	*S&P*	*Moody's*	*Fitch*	*S&P*	*Moody's*
*SSM Dummy (Post-SSM * Treated)*	-0.207	0.269	-0.182	-0.550	-1.178	-1.346	0.853	1.079	0.907*
	(-0.29)	(0.35)	(-0.21)	(-0.76)	(-1.43)	(-1.52)	(1.29)	(1.56)	(1.66)
Macroeconomic Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Regulatory Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year Dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country Dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Clustered Std. Errors	Country	Country	Country	Country	Country	Country	Country	Country	Country
Observations	248	248	248	279	279	279	279	279	279
Number of Countries	31	31	31	31	31	31	31	31	31
Log Pseudolikelihood	-130.86	-166.55	-128.86	-237.36	-257.64	-247.47	-188.42	-228.22	-200.44
Pseudo R2	0.7793	0.7287	0.7864	0.6202	0.6084	0.6052	0.7135	0.6657	0.7014
p-value (chi2)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Table A12. Changes in banking regulation

This table presents the results controlling for changes in banking regulation. All the variables are defined in Table A4 in the Appendix. Year and country fixed effects are included but not reported. Z-statistics for the clustered standard errors are in parentheses. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

Dependent variable						
	(1) *Fitch*	(2) *S&P*	(3) *Moody's*	(4) *Fitch*	(5) *S&P*	(6) *Moody's*
Panel A. Cumulative changes in banking regulation						
SSM Dummy	2.734**	3.724***	2.470***			
	(2.67)	(4.06)	(2.85)			
SSM Assets				2.183*	1.835*	3.006***
				(1.80)	(1.77)	(3.13)
Cumchange_ss_capbuffers	-0.330	-0.305	-0.074	-0.293	-0.278	-0.0210
	(-1.28)	(0.92)	(-0.17)	(-1.09)	(-0.83)	(-0.05)
Cumchange_cap_buffers	-0.470	0.455	-0.539	-0.200	0.830*	-0.254
	(-0.97)	(1.00)	(-1.03)	(-0.49)	(1.73)	(-0.50)
Cumchange_ss_exposure	0.123	-0.459	-0.083	0.211	-0.236	-0.0334
	(0.24)	(-1.36)	(-0.17)	(0.38)	(-0.64)	(-0.06)
Cumchange_interbank_exposure	-0.224	-0.278	-1.622*	0.121	0.141	-1.493*
	(-0.31)	(-0.79)	(-1.76)	(0.15)	(0.42)	(-1.65)
Cumchange_rr_foreingcurr	0.350	0.449	-0.017	0.514	0.681*	0.121
	(1.17)	(1.29)	(-0.06)	(1.50)	(1.65)	(0.38)
Cumchange_rr_localcurr	-0.406	-1.207**	-0.374	-0.421	-1.126*	-0.272
	(-0.78)	(-2.34)	(-1.09)	(-0.69)	(-1.85)	(-0.71)
Macroeconomic Controls	Yes	Yes	Yes	Yes	Yes	Yes
Year Dummies	Yes	Yes	Yes	Yes	Yes	Yes
Country Dummies	Yes	Yes	Yes	Yes	Yes	Yes
Clustered Std. Errors	Country	Country	Country	Country	Country	Country
Observations	248	248	248	248	248	248
Number of Countries	31	31	31	31	31	31
Log Pseudolikelihood	-118.49	-131.37	-122.20	-125.28	-147.94	-124.78
Pseudo R2	0.8001	0.7860	0.7975	0.7887	0.7590	0.7932
p-value (chi2)	0.00	0.00	0.00	0.00	0.00	0.00
Panel B. ΔRegulatory index						
SSM Dummy	2.797***	4.026***	1.939**			
	(2.95)	(4.51)	(2.55)			
SSM Assets				2.793**	2.797***	2.474**
				(2.44)	(2.68)	(2.52)
Δ*Regulatory Index*	-0.033	-0.187***	-0.129	0.058	-0.025*	-0.037
	(-0.33)	(-2.20)	(-1.02)	(0.51)	(-0.25)	(-0.30)
Macroeconomic Controls	Yes	Yes	Yes	Yes	Yes	Yes
Year Dummies	Yes	Yes	Yes	Yes	Yes	Yes
Country Dummies	Yes	Yes	Yes	Yes	Yes	Yes
Clustered Std. Errors	Country	Country	Country	Country	Country	Country
Observations	248	248	248	248	248	248
Number of Countries	31	31	31	31	31	31
Log Pseudolikelihood	-120.56	-140.50	-125.92	-127.03	-160.16	-127.60
Pseudo R2	0.7966	0.7712	0.7913	0.7857	0.7391	0.7885
p-value (chi2)	0.00	0.00	0.00	0.00	0.00	0.00

Table A13. Additional robustness tests

This table presents the results of the robustness checks. Our dependent variables are the long-term foreign currency sovereign credit ratings issued by Fitch, S&P, and Moody's. Columns (1) to (3) of Panel A provide the results for the regressions using the total banking assets that are under the SSM framework in each country over GDP (*SSM Assets_GDP*$_{it}$) as the DID term. Columns (4) to (6) of Panel A provide the results for the regressions using the natural logarithm of the total number of banks supervised by the SSM in each country (*#SSM banks*$_{it}$) as the DID term. Columns (7) to (9) of Panel A provide the results for the regressions using as a dependent variable a rating scale with 12 categories. Columns (10) to (12) of Panel A provide the results for the regressions using as a dependent variable the sovereign rating of country *c* at the end of year *t*. Columns (1) to (3) of Panel B provide the regression results excluding non-EU countries: Iceland, Norway, and Switzerland. Columns (4) to (6) of Panel B provide the results for the regressions excluding the GIPSI countries (Greece, Italy, Ireland, Portugal, and Spain). Columns (7) to (9) of Panel B provide the results for the regressions excluding those countries for which the bank bailout amount in terms of GDP is above the 75th percentile (>4.69%). Columns (10) to (12) of Panel B provide the results for the regressions after restricting the sample to European countries that belong to the OECD. Country-level controls and country and year dummies are included but not reported. Z-statistics for the clustered standard errors are in parentheses. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

Panel A. Robustness: Rating adjustments, Placebo, and Subsample analyses												
	SSM = SSM Assets_GDP			**SSM = #SSM banks**			**Dep. Var.: Sov. Rating (12-rating scale)**			**Dep. Var.: Sov. Rating (t)**		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
	Fitch	*S&P*	*Moody's*	*Fitch*	*S&P*	*Moody's*	*Fitch*	*S&P*	*Moody's*	*Fitch*	*S&P*	*Moody's*
SSM Assets	1.470**	1.188***	1.950**	0.991**	1.372***	0.640*	4.605***	4.067***	0.702**	1.657**	1.714**	1.993**
	(2.07)	(3.33)	(2.43)	(2.19)	(3.31)	(1.92)	(3.89)	(3.03)	(2.12)	(2.51)	(2.24)	(2.55)
Macroeconomic Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Regulatory Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year Dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country Dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Clustered Std. Errors	Country	Country	Country	Country	Country	Country	Country	Country	Country	Country	Country	Country
Observations	248	248	248	248	248	248	248	248	248	248	248	248
Number of Countries	31	31	31	31	31	31	31	31	31	31	31	31
Log Pseudolikelihood	-128.81	-165.15	-125.18	-124.23	-152.97	-125.67	-98.260	-122.51	-101.50	-166.01	-182.42	-154.31
Pseudo R2	0.7827	0.7310	0.7925	0.7904	0.7509	0.7917	0.8254	0.7879	0.8191	0.7182	0.7018	0.7450
p-value (chi2)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Panel B. Robustness: Alternative measures of sovereign ratings and alternative measures of bank bailouts												
	Excluding non-EU countries: Iceland, Norway, and Switzerland			**Excluding GIPSI countries**			**Excluding countries with largely bailed-out banking systems**			**Treated OECD vs Non-treated OECD**		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
	Fitch	*S&P*	*Moody's*	*Fitch*	*S&P*	*Moody's*	*Fitch*	*S&P*	*Moody's*	*Fitch*	*S&P*	*Moody's*
SSM Assets	2.726**	3.061***	2.321**	4.038**	4.167***	3.316***	6.423***	5.921***	9.036***	4.414***	4.039**	1.784*
	(2.35)	(2.79)	(2.05)	(2.35)	(3.01)	(2.64)	(4.46)	(3.62)	(3.85)	(2.97)	(2.68)	(1.89)
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Regulatory Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year Dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country Dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	224	224	224	208	208	208	184	184	184	200	200	200
Number of Countries	28	28	28	26	26	26	23	23	23	25	25	25
Log Pseudolikelihood	-116.28	-152.80	-120.51	-67.20	-113.68	-65.445	-49.25	-88.54	-36.49	-69.30	-96.37	-78.79
Pseudo R2	0.7877	0.7313	0.7857	0.8547	0.7639	0.8614	0.8732	0.7866	0.9079	0.8454	0.7991	0.8323
p-value (chi2)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00