OESTERREICHISCHE NATIONALBANK
EUROSYSTEM

WORKING PAPER 244

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Publisher and editor *Oesterreichische Nationalbank*
Otto-Wagner-Platz 3, 1090 Vienna, Austria
PO Box 61, 1011 Vienna, Austria
www.oenb.at
oenb.info@oenb.at
Phone (+43-1) 40420-6666

Editor *Martin Summer*

Cover Design *Information Management and Services Division*

DVR 0031577

ISSN 2310-5321 (Print)
ISSN 2310-533X (Online)

The ECB Single Supervisory Mechanism: Effects on Bank Performance and Capital Requirements

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Abstract

Under the Single Supervisory Mechanism (SSM) introduced in 2014, the European Central Bank directly supervises significant euro area banks, which hold about 82% of total banking assets. We find that this important supervisory change has positive effects on the return on assets and the return on risk-weighted assets of SSM banks without increasing the risk weights used to calculate regulatory capital. Our findings indicate that these effects result from better risk management and increased confidence in the soundness of SSM banks. Our results therefore suggest that the SSM has strengthened the resilience of the euro area banking system.

Keywords: ECB Single Supervisory Mechanism; bank profitability; capital requirements; risk-weighted assets

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Non Technical Summary

The Single Supervisory Mechanism (SSM) was introduced in 2014 to strengthen the resilience of the euro area banking system. A key feature of the SSM is that significant euro area banks, which hold about 82% of total banking assets, are directly supervised by the European Central Bank. Using a sample of more than 2600 euro area banks, we empirically examine how this fundamental regulatory change affects the return on assets, the average risk weight, the average credit risk weight, and the return on risk weighted assets of SSM banks.

We distinguish between indirect SSM effects, which arise from adjustments of key bank-specific variables, direct SSM effects, and the total SSM effects, which result from the sum of the direct and indirect SSM effects. We identify these effects using the fact that selection into the SSM mainly depends on bank size. Other regulatory and macroeconomic changes have also happened since 2014, but these changes affected all banks in the euro area. The SSM is the only major regulatory change since 2014 that only applies to SSM banks.

We find that the SSM has a small positive impact on the return on assets and a negative impact on the risk weights that determine minimal regulatory capital ratios. The combined effects of the SSM on profitability and risk weights lead to increasingly positive total effects on the return on risk weighted assets. Our analysis shows that these positive SSM effects originate primarily from direct effects reflecting increased confidence in the soundness of SSM banks and better risk management in SSM banks.

Consistent with increased confidence in SSM banks, the SSM has a negative impact on the deposit rate and a positive impact on the non-bank deposit ratio. More confidence in the SSM banks also increase net non-interest related income such as net fee and commission income. Consistent with better risk management, SSM banks can charge higher lending rates without increasing loan loss reserves and reducing loan growth. On the contrary, the SSM has a negative impact on loan loss reserve ratio and a positive impact on loan growth.

Overall, our empirical results do not support the arguments put forward by some bankers and lobbyists that the SSM would impose unreasonably high capital requirements on banks, which in turn would reduce profitability. As intended, the SSM has restored confidence in SSM banks and therefore contributes to the stability and soundness of the euro area banking system.

1. Introduction

The Single Supervisory Mechanism (SSM) was introduced in November 2014 in response to the global financial crisis and the subsequent European debt crisis to restore the confidence in the European banking sector and to strengthen the resilience of euro area banks. A key feature of the SSM is that the significant euro area banks in each country are directly supervised by the European Central Bank (ECB) in collaboration with national regulators.[2] Since the launch of the SSM, around 110 large euro area banks, which together hold about 82% of all banking assets, are subject to this new regulatory regime. We refer to these banks as SSM banks.

Each SSM bank is supervised by a joint supervisory team composed of ECB supervisors and supervisors from national authorities. The team is led by the ECB and the national supervisors act independently as part of the SSM. Decisions are made by the ECB's Supervisory Board and approved by the Governing Council. SSM supervision is therefore more consistent and probably also stricter than supervision by national authorities.

Further regulatory and macroeconomic changes (e.g. Basel III and the negative interest rate environment) have taken place since 2014. However, all these changes have affected all euro area banks, and not just SSM banks. In particular, the Basel III reform packages, which include increased minimal capital requirements, macroprudential buffers and a leverage constraint, are enforced for all banks holding a banking license in the euro area. The changes at the macroeconomic level, such as the introduction of unconventional monetary policy measures, have also affected all banks in the euro area. This makes the SSM the only major regulatory change since 2014 that only applies to SSM banks.

Regulatory changes are rarely uncontroversial. In the context of the SSM, the impact of the SSM on profitability and on risk weights are two key issues. The two issues are related and are the subject of this paper. In particular, bankers often argue that stricter regulation and supervision would lead to higher capital requirements, thereby reducing profitability and ultimately financial stability (Suttle et al., 2010), while Admati and Hellwig (2014) and Barth et al. (2012) strongly criticize such arguments. Moreover, it is sometimes argued that banks "optimize" risk weights with their internal ratings-based models in order to reduce required regulatory capital (Beltratti and Paladino, 2016).[3]

The first question we therefore ask is the following. Does SSM supervision have an impact on the profitability of SSM banks and the risk weights used to calculate the required regulatory capital? The second question we ask goes one step further. If we find SSM effects on profitability and risk weights, what are the nature of these effects? For example, does the SSM affect the profitability of SSM banks mainly directly, perhaps because "better" and "tougher" supervision under the SSM increases the confidence in

[2] A bank is considered significant if it at least meets on of the following criteria: its assets exceed 30 billion euro, it is important for the country or the euro area as a whole, it has important cross-border activities, it has requested or received funding from the European Stability Mechanism or the European Financial Stability Facility.

[3] Some authors also find that the SSM inadvertently reduced lending (Fiordelisi et al., 2017) and shift investment away from knowledge-based intangible investment towards capital-based physical assets (Ampudia et al., 2021).

the soundness of SSM banks (Altavilla et al., 2020), or mainly indirectly because SSM banks respond to SSM regulation by adjusting key bank-specific variables?

Adequate bank profitability is a key prerequisite for a resilient banking system. However, since the financial crisis of 2008, the profitability of European banks has been weak (Kok et al., 2019; Detragiache et al., 2018) and has therefore become a matter of concern for the ECB (ECB, 2018). Although increasing the profitability of banks is not an explicit goal of the SSM, it is of course important to know whether the SSM contributes positively or negatively to bank profitability.[4]

The effect of the SSM on risk weights are also of key interest, as banks can use their own internal ratings-based models to compute risk weights for determining regulatory capital. This discretion in calculating risk weights could lead to strategic reporting of risk weights for different asset classes (Abbassi and Schmidt, 2018; Ferri and Pesic, 2017). In addition, it has been found that banks with low capital adequacy ratios tend to under-report the credit risk of their loan portfolio (Berg and Koziol, 2017; Mariathasan and Merrouche, 2014; Vallascas and Hagendorff, 2013). A common suggestion, therefore, is that supervisors allocate more resources to examining internal ratings-based risk models and simplify capital adequacy rules to avoid the under-reporting of risk. Against this background, we examine whether SSM supervision has an impact on the average risk weight reported by SSM banks.

As just mentioned, risk weights influence regulatory capital and can thus affect profitability. We therefore also investigate whether the SSM affects the return on risk weighted assets (also known as return on risk adjusted capital). The return on risk weighted assets is defined as net operating income before credit impairment and tax divided by risk weighted assets, which depend on regulatory risk weights and are proportional to capital requirements. Since Basel I, regulators have required banks to hold capital in excess of these capital requirements. Starting with Van den Heuvel (2008), quantifying the effect of capital requirements in optimal bank behavior is well established in the literature (Christiano and Ikeda, 2016; Martinez-Miera and Suarez, 2014; Corbae and D'Erasmo, 2019; Begenau, 2020). As shown in this literature, risk weights influence banks' optimal portfolio selection. The return on risk weighted assets should therefore capture the combined impact of the SSM on profitability and risk weights.

We empirically examine how the SSM affects profitability and risk weights for a large panel data set containing bank level data for over 2600 banks in the euro area over the period 2005–2019. We estimate three types of causal effects, namely indirect effects, direct effects, and total effects of the SSM on profitability and risk weights. We think of these effects in the following way. Indirect SSM effects are effects that are transmitted via the adjustment of key bank-specific variables. Direct effects are more general effects that do not arise from the adjustment of key bank-specific variables. These direct effects could include improved risk management of banks and the perception of SSM banks by other market participants. The total SSM effects are the sum of these two effects. We obtain our estimates of the direct, indirect, and total SSM effects from "long" and "short" fixed effects panel regressions. We explain this econometric strategy in detail in Section 3. We also perform a number of robustness checks and evaluate the stability of the estimated SSM effects with a resampling procedure.

[4] Dietrich and Wanzenried (2014) provide a recent survey of the literature on the determinants of bank profitability.

Our bank-level panel data set on euro area banks is probably the largest officially available data set used so far in empirically analyzing SSM effects. With this data set, we investigate the effects of the SSM on profitability and risk weights separately as well as in combination through its influence on the return on risk weighted assets. To the best of our knowledge, we are the first to provide estimates of combined SSM effects. To our knowledge, we are also the first to differentiate between direct, indirect, and total (or overall) SSM effects in order to identify possible channels for the impact of the SSM.

We find that the SSM has an economically relevant positive impact on the profitability of SSM banks. This finding is similar to Hirtle et al. (2020) who find for US banks that stricter supervision is not hurting their profitability. Furthermore, we find that the SSM has a negative impact on the risk weights that determine regulatory capital. The negative SSM effects on risk weights are, however, not driven by decreasing average credit risk weights for which we find slightly positive SSM effects. The combined impact of the SSM on the return on risk weighted assets is positive and increasing over time. These positive effects result mainly from direct effects of the SSM. In particular, we find evidence for an SSM-related confidence effect and improved risk management in SSM banks leading to lower deposit rates, a higher share of customer deposits, higher lending rates, higher net loan growth, higher net non-interest rate income, and lower loan loss reserves at SSM banks. Overall, our results suggest that stricter supervision improves SSM banks' profitability without increasing risk taking.

We proceed as follows. In the next section we describe the data. In Section 3, we describe the econometric models, define direct, indirect and total SSM effects, explain how we identify these effects, and outline the strategy for estimating these different effects. In the sections 4 and 5, we present the empirical findings. In the last section of the paper, we draw our conclusions. Appendices A - E provide additional summary statistics, estimation output for the total SSM effects, and the results of our robustness checks.

2. Data

Our panel data set consists of annual balance sheet, income statement and Common Reporting Framework data of euro area banks over the time period 2005-2019 from the SNL Financial's database. We include every bank that reports to SNL in our initial sample, which consists of 2,666 banks. Out of these banks, 116 are SSM banks.

To ensure that outliers and reporting errors do not influence our estimation results, we clean the data in four steps. First, under Basel II, the minimum regulatory Tier 1 ratio was 4%. This ratio was gradually increased to 6% as part of Basel III from 2014 onward. Technically, a Tier 1 ratio under 4% is possible, but in these cases regulatory authorities step in and take strict measures such as removing the bank's management, revoking the bank license and (or) forcing the bank into resolution. We therefore remove all the distressed banks that report a negative Tier 1 capital or a Tier 1 capital below 4%. Second, we remove a few banks that seem to report twice with slightly different bank identifiers.[5] Third, for variables

[5]These banks have the following SNL IDs/names: 4255652, 4242082, Citibank Europe Plc, JSC Bankas Finasta AB, Lietuvos bankas, Luminor Bank AS, RCB Bank Ltd., Rigensis Bank AS, Swedbank AS, 4242265, TCS Group Holding Plc,

that are ratios we calculate the interquartile range. To eliminate reporting errors, we discard values outside the four-fold interquartile range. In the fourth step, we drop banks that report data for less than three years in our sample period.

Not all of the 2,666 banks report the bank-specific variables that we require for our empirical analysis in all 15 observation periods. In our summary statistics in Table 1, we therefore report for each variable the data coverage percentage, which we calculate as follows. We count all reported values for each variable, divide that sum by the number of potential observations, which in our case are $2,666 \times 15 = 39,990$, and multiply the resulting ratio by 100.

We also use structural variables at the country-level and euro area level. These data are obtained from Bloomberg, the ECB, and the World Bank.

2.1. Dependent Variables

We measure bank profitability by return on assets (ROA) which is defined as operating income minus operating expenses before credit impairment and tax divided by total assets. Operating income is the sum of net interest income, net fee and commission income, net insurance income, realized and unrealized gains on securities, and net non-interest income. Operating expenses include labor costs, amortization of intangibles and other expenses.

According to the Basel regulation, risk weights are calculated by dividing the risk weighted assets by the exposure at default, which is not available in the SNL database. To obtain a proxy for the average risk weight (RW), we divide the total risk weighted assets by total assets (TA). Total assets serve as a proxy for the exposure at default, which also includes specific items from the off-balance sheet exposure. This proxy for the average risk weight is also frequently used by banks (Arroyo et al., 2012) and other market participants to analyze risk weighted assets in the context of solvency regulations (Vallascas and Hagendorff, 2013; Mariathasan and Merrouche, 2014; Beltratti and Paladino, 2016; Santos et al., 2020).

To obtain a proxy for the average credit risk weight (CRW), we divide the credit risk weighted assets by the total gross loans. To check if total gross loans are a good proxy for exposure at default, we use data from the European Bank Authority transparency exercises between 2014 and 2019, in which around 80 large European banks report their balance sheet exposure and their exposure at default for their individual credit portfolios (based on asset class, country, and risk weighted assets approach).[6] Based on about 900,000 observations, the correlation between the reported balance sheet exposure of the loans (which is equivalent to total gross loans) and exposure at default is 98%.

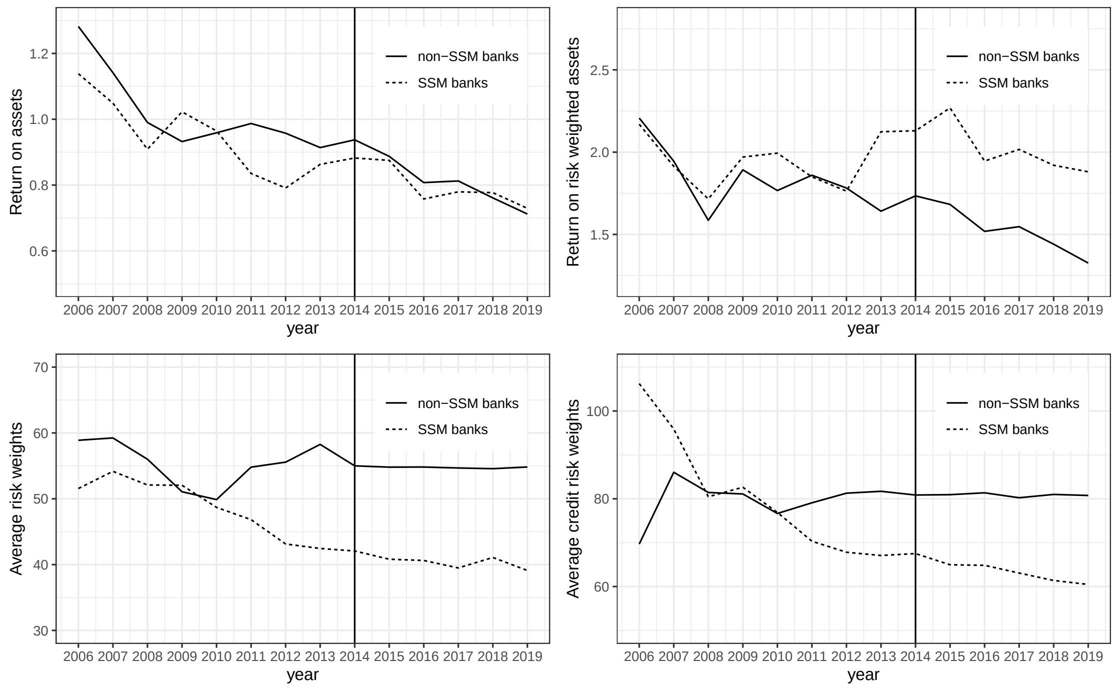
As already mentioned, we also want to estimate the combined SSM effects on profitability and risk weights. To this end, we calculate the return on risk weighted assets, which we define as net operating income before credit impairment and tax divided by risk weighted assets. In the numerator, net operating

UAB Medicinos Bankas, 4580293, 4569819, 4574631, 4782274 and 4257268.

[6]See EBA (2014, 2015, 2016a,b, 2017, 2018, 2019) for more details.

income before credit impairment and tax, is defined in the same way as in the calculation of return on assets. In the denominator, we use risk weighted assets as reported by SNL. Thus, for a given net operating income before credit impairment and tax, return on risk weighted assets decreases with increasing average risk weight.

Figure 1: Dependent variables: SSM vs. non-SSM banks.



The figure shows the evolution of the return on assets, the average risk weight, the average credit risk weight, and the return on risk weighted assets over the period 2006–2019 for SSM banks and non-SSM banks.

Figure 1 shows how the return on assets, the average risk weight, the average credit risk weight, and the return on risk weighted assets for SSM banks (dotted lines) and non-SSM banks (full lines) evolved over time. Three features stand out. First, for SSM and non-SSM banks return on assets declined steadily over the sample period, but between 2010 and 2015 the return on assets of SSM banks was lower than the return on assets of non-SSM banks. Second, the average risk weight and the average credit risk weight of SSM banks are clearly smaller than for non-SSM banks from 2010 onward, and the weights are decreasing over time. Third, the return on risk weighted assets has been noticeably higher for SSM banks than for non-SSM banks since 2013. This difference widened until 2015 and then stabilized.

2.2. Explanatory Variables

To identify and estimate direct, indirect, and total SSM effects we use two types of explanatory variables, namely structural variables and bank-specific variables. By far the most important reason for selection into the SSM is bank size. As will be explained in detail in Section 3.3, bank size (measured by the log of total assets) is therefore the critical control variable for identifying any kind of SSM effects.

To identify direct SSM effects on our dependent variables, we need a number of other firm-specific variables in addition to firm size. These variables include labor costs over total assets, the loan-to-deposit ratio, the leverage ratio, dummy variables indicating a bank's method for computing risk weights, and other bank-specific variables that are typically used in the literature to explain return on assets and risk weights. We turn to these variables in more detail in Sections 4.1, 4.2 and 4.3 where we discuss our empirical results.

The deposit rate, the lending rate, the net non-interest income ratio, the non-bank deposit ratio and the net loan growth are used in Section 6 to examine the origin of potential SSM effects. The deposit rate is defined as interest expenses from non-bank deposits divided by non-bank deposits. The lending rate is defined as interest income from non-bank loans divided by non-bank loans. The net non-interest income ratio is net non-interest income divided by total assets. The non-bank deposit ratio is defined as non-bank deposits divided by total assets. The net loan growth is the growth rate of non-bank loans net of loan loss reserves.

The structural explanatory variables capture the structure of a country's banking market and the macroeconomic environment in which banks operate. Banks must take these variables as given in the short run. As will be explained in Section 3.3, these variables are not required for the identification of SSM effects, but they may help to increase the precision of the estimated coefficients and improve the fit of the models. Our structural variables include the Herfindahl-Hirschman index to capture the banking market structure, GDP growth, inflation, the 3M-Euribor, 10 year government bond yields and dummy variables to capture the negative interest rates environment in which banks operated since the second half of 2014.

For later reference, Table 1 presents summary statistics for the variables in our data set. The upper part of the table contains the statistics for the dependent variables for which we estimate SSM effects. The middle and lower parts of the table contain the statistics for the bank-specific and structural explanatory variables. Appendix A provides separate summary statistics for SSM banks (Table A.7) and non-SSM banks (Table A.8). These statistics indicate that SSM banks are on average larger and report lower risk weights, as we have already seen in Figure 1. In addition, non of the SSM banks uses the Standardized Approach to compute risk weights, while about 80% of the non-SSM banks in our sample use the Standardized Approach. With respect to the other explanatory variables, SSM banks and non-SSM banks are broadly comparable.

Table 1: Summary statistics

	Min.	1st Qu.	Median	Mean	3rd Qu.	Max	Data Cov.
Dependent variables							
ROA	-1.56	0.57	0.85	0.88	1.15	3.27	58.10
RW	0.00	44.03	54.87	54.65	64.83	149.84	50.02
CRW	0.00	66.88	78.94	79.83	91.42	182.93	35.87
RORWA	-2.80	1.10	1.56	1.69	2.16	5.99	48.12
Bank-specific variables							
log(TA)	2.20	12.55	13.91	14.14	15.47	21.68	61.10
TA growth	-25.21	-0.19	2.98	3.12	6.37	31.63	51.30
Labor Costs over TA	0.01	0.79	1.08	1.05	1.30	3.14	57.88
Tier 1 capital ratio	4.05	11.62	14.64	15.87	18.53	43.92	48.37
Leverage ratio	1.07	6.04	8.00	8.46	10.19	25.11	48.00
Loans to TA	0.01	50.44	63.22	59.82	73.65	89.98	46.74
loan-to-deposit ratio	1.00	67.42	87.44	92.85	111.21	279.41	54.69
NPL ratio (bank level)	0.00	1.41	3.18	5.52	7.27	29.32	28.39
LLR ratio (bank level)	0.00	0.72	1.56	2.28	2.98	11.64	27.42
NIM	-1.50	1.37	1.85	1.79	2.25	5.41	59.25
Basel I	0.00	0.00	0.00	0.13	0.00	1.00	100.00
StA Approach	0.00	1.00	1.00	0.80	1.00	1.00	100.00
Mixed Approach	0.00	0.00	0.00	0.05	0.00	1.00	100.00
F-IRB	0.00	0.00	0.00	0.01	0.00	1.00	100.00
A-IRB	0.00	0.00	0.00	0.01	0.00	1.00	100.00
Deposit rate	0.00	0.57	1.25	1.74	2.29	9.53	54.70
Lending rate	0.00	3.44	4.56	5.02	6.08	15.97	46.48
Net non-interest income ratio	-0.82	0.46	0.63	0.65	0.81	2.14	58.33
Non-bank deposit ratio	0.00	52.26	70.76	62.40	79.43	89.99	58.04
Net loan growth	-29.57	-0.22	3.53	3.77	7.38	37.05	49.51
Structural variables							
Herfindahl index (ECB)	1.74	2.77	3.95	6.05	5.96	40.39	100.00
3M-Euribor	-0.36	-0.26	0.57	1.15	2.18	4.63	100.00
10Y gov bond yield	-0.25	0.96	2.74	2.60	3.98	22.50	99.62
GDP growth	-14.84	0.54	1.49	1.30	2.68	25.18	93.33
Inflation	-37.31	0.45	3.43	2.81	5.77	49.50	97.47

The table shows for all variables the minimum (Min.), first quantile (1st Qu.), median (Median), mean (Mean), third quantile (3rd Qu.), maximum (Max) and data coverage (Data Cov.), which refers to the percentage of available observations if the panel was balanced. The data are annual and cover 2,668 banks over the period 2005–2019 for the countries FR, DE, NL, ES, IE, BE, GB, GR, SI, LU, CY, IT, PT, AT, FI, SK, MT, LT, LV, RO and EE.

ROA is the return on assets. RW and CRW refer to risk weighted assets and credit risk weighted assets divided by total assets (TA). RORWA is the return on risk weighted assets. All ratios and returns are in percentage terms.

Log(TA) is the logarithm of total assets. TA growth refers to total asset growth. Labor costs over TA refers to labor costs divided by total assets. Leverage ratio is the Tier 1 capital divided by total assets. Loans to TA is non-bank loans divided by total assets. The loan-to-deposit ratio is the ratio of non-bank loans to non-bank deposits. The NPL ratio (bank level) refers to the non-performing loan ratio. The LLR ratio (bank level) is loan loss reserves divided by total gross loans. NIM is the net interest rate margin defined as interest income minus interest rate expenses divided by total assets. Basel I stands for the Basel I approach, StA for the Standardized Approach, F-IRB for the Foundation Internal Ratings Based Approach, and A-IRB denotes the Advanced IRB Approach. In the Mixed Approach banks use the StA, F-IRB and the A-IRB for different portfolios.

The deposit rate is defined as interest expenses divided by total deposits. The lending rate is defined as interest income divided by total gross loans. The net non-interest income ratio is net non-interest income divided by total assets. The non-bank deposit ratio is defined as deposits from non-banks divided by total assets. Net loan growth is the growth rate of non-bank loans net of loan loss reserves.

All bank-specific variables are from SNL. The Herfindahl index and the 3M-Euribor are from the ECB's statistical data warehouse. The 10Y gov bond yield is from Bloomberg. GDP growth and inflation are from the World Bank's World Development Indicators database.

3. Empirical Strategy

In this section, we outline our empirical strategy for identifying and estimating SSM effects. Since we are working with panel data on the individual bank level, we use fixed effects panel regression methods to estimate SSM effects. Using panel data methods allows us to control for observed and unobserved differences between SSM and non-SSM banks and to estimate direct, indirect, and total SSM effects. We first present our four econometric models for estimating SSM effects. Then we describe how we define direct, indirect, and total SSM effects and explain our strategy for identifying and estimating these different effects. In the last part of this section, we describe our resampling procedure for assessing the stability of the estimated SSM effects.

3.1. Econometric Models

For each outcome variable, we use four basic model specifications. We always start with a simple baseline model that assumes a constant SSM effect and common time effects for SSM and non-SSM banks. Then we extend the model in three directions. First, we consider the possibility that the time effects in the outcome variables are different for SSM and non-SSM banks. Next, we relax the assumption of a constant SSM effect and consider a model where the effects of the SSM may vary over time. This model also allows for an anticipatory effect of the SSM. Finally, in our most comprehensive model, the SSM can have time-varying effects on the outcome variable, and the time effects for SSM and non-SSM banks can be different.

Our baseline model for an outcome variable y_{it} for bank i at time t is given by the regression

$$y_{it} = \delta \cdot SSM_{it} + X_{it}'\beta + \mu_i + \lambda_t + \epsilon_{it} \ , \tag{1}$$

where X_{it} is a vector of explanatory variables, μ_i is a time-constant bank specific effect, λ_t is an aggregate time effect, and ϵ_{it} is an error term. The variable $SSM_{it} = (G_i \cdot I_t)$ is an indicator variable, where $G_i = 1$ when bank i is an SSM bank and $G_i = 0$ otherwise, and I_t is a dummy variable equal to 1 when the SSM is effective at time t, and zero otherwise. Hence, $SSM_{it} = 1$ when bank i is an SSM bank and the SSM is effective (or anticipated in later models). The coefficient δ in Eq. (1) captures the effect of the SSM on the outcome variable y_{it} for banks under SSM supervision.[7] This model can be estimated by using a standard fixed-effects estimator. Robust standard errors for the estimated model coefficients can be obtained by using a cluster robust variance matrix estimator with clustering at the bank level.

[7] In a counterfactual framework, Eq. (1) can be derived as in Angrist and Pischke (2009), chap. 5, or in Wooldridge (2010), chap. 21. Let $y_{it}(0)$ denote the potential outcome when a bank is not under SSM supervision and let $y_{it}(1)$ denote the potential outcome when a bank is under SSM supervision. The unconfoundedness assumption in fixed effects models implies $E[y_{it}(0)|\mu_i, X_{it}, t, SSM_{it}] = E[y_{it}(0)|\mu_i, X_{it}, t]$ where E denotes the expectation operator. Specifying $E[y_{it}(0)|\mu_i, X_{it}, t] = X_{it}'\beta + \mu_i + \lambda_t$ and $E[y_{it}(1)|\mu_i, X_{it}, t] = E[y_{it}(0)|\mu_i, X_{it}, t] + \delta$ and using the fact that the observed outcome in terms of potential outcomes can be expressed as $y_{it} = (1 - SSM_{it})y_{it}(0) + SSM_{it}y_{it}(1)$ yields Eq. (1) where $\epsilon_{it} = y_{it}(0) - E[y_{it}(0)|\mu_i, X_{it}, t]$.

In the baseline model we control for observed variables X_{it} and unobserved time-constant variables μ_i that could confound the effect of the SSM on the outcome variable, but the time effects λ_t are assumed to be equal for SSM and non-SSM banks. To take account for possibly different time effects for SSM and non-SSM banks we include the term $g_t = (G_i \cdot t)$ as an additional control variable. In the resulting model,

$$y_{it} = \delta \cdot SSM_{it} + X_{it}'\beta + \mu_i + \lambda_t + \theta g_t + \epsilon_{it} \ , \tag{2}$$

the indicator SSM_{it} can thus also be correlated with a specific trend g_t for SSM banks.[8]

In the first two models we assume that the effect of the SSM is constant. In the next model, we relax this assumption and allow for time-varying SSM effects. The model with time-varying SSM effects is

$$y_{it} = \sum_{\tau=1}^{q} \delta_{+\tau} \cdot SSM_{i,t+\tau} + \sum_{\tau=0}^{m} \delta_{-\tau} \cdot SSM_{i,t-\tau} + X_{it}'\beta + \mu_i + \lambda_t + \epsilon_{it} \ , \tag{3}$$

where the q leads (δ_{+1}, ..., δ_{+q}) capture possible anticipatory effects prior to the year 2014 and the m lags (δ_0, ..., δ_{-m}) measure the possibly time-varying effects from the year 2014 onward. Our model includes treatment effects from 2014 onward as well as an anticipatory effect in the year 2013 because the SSM became effective in November 2014, but had already been announced in September 2012. Fiordelisi et al. (2017) argue that in 2013 banks were already able to identify whether the SSM would apply to them.

In our fourth, and most comprehensive model,

$$y_{it} = \sum_{\tau=1}^{q} \delta_{+\tau} \cdot SSM_{i,t+\tau} + \sum_{\tau=0}^{m} \delta_{-\tau} \cdot SSM_{i,t-\tau} + X_{it}'\beta + \mu_i + \lambda_t + \theta g_t + \epsilon_{it} \ , \tag{4}$$

we allow for time-varying SSM effects and we control for observed confounders, unobserved time-constant confounders, and possibly different time trends for SSM and non-SSM banks.

3.2. Direct Effect, Indirect Effects and Total Effect of the SSM

As we have emphasized in the introduction, we distinguish between direct, indirect, and total effects of the SSM in order to learn more about the channels through which SSM supervision affects the dependent

[8] Unit-specific panel data approaches should not be confused with difference-in-differences approaches. Both approaches are related and can be equivalent in certain cases (i.e., two groups and two time periods), but in more general settings these approaches are not equivalent (Imai and Kim, 2021). In particular, in a difference-in-differences setting the parallel trends assumption would be critical, but with bank-specific panel data we can partial out different trends for SSM and non-SSM banks.

variables. To explain how we define total, direct and indirect effects of the SSM, we start with a general definition of the different effects and then give a simple example to illustrate the different effects.

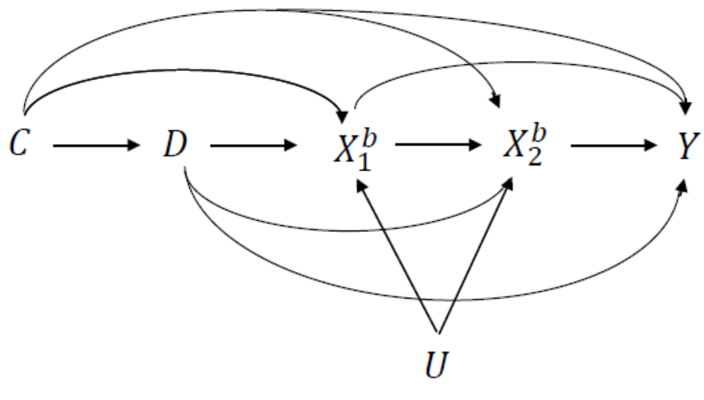
We define the direct effect of the SSM as an effect of the SSM on the dependent variable that is not mediated via the bank-specific variables that we include in our models. This effect therefore captures general effects such as improved risk management in SSM banks and the perception of SSM banks by other market participants. For example, market participants may think that SSM supervision is stricter than local supervision. SSM banks could therefore be seen as safer than non-SSM banks, which could help SSM banks to attract deposits and obtain cheaper funding.

The SSM may affect a dependent variable also indirectly via mediating variables. We think of mediating variables as key bank-specific variables that a bank can adjust in a timely manner in response to SSM supervision. For example, SSM supervisors may ask SSM banks to hold more capital or change the composition of their assets. We refer to effects on the dependent variable resulting from such SSM induced adjustments of bank-specific variables as indirect SSM effects.

In linear models, the total effect of a treatment is the sum of the direct effect and all indirect effects that are transmitted via mediating variables (VanderWeele, 2015). Hence, the total effect of the SSM on an outcome is simply the sum of the direct and the indirect SSM effects. The net indirect effect of the SSM can therefore be calculated as the difference between the total SSM effect and the direct SSM effect.

Figure 2 provides an example in which the SSM influences the dependent variable Y directly and indirectly.[9] In this graph, D indicates SSM supervision, X_1^b and X_2^b are bank-specific mediating variables, C is a confounder of D and Y, and U is an unobserved confounder of X_1^b and X_2^b. The SSM can affect Y via the direct path $D \rightarrow Y$ and the indirect paths $D \rightarrow X_1^b \rightarrow X_2^b \rightarrow Y$, $D \rightarrow X_1^b \rightarrow Y$, and $D \rightarrow X_2^b \rightarrow Y$.

Figure 2: Example for different effects of the SSM.



[9]The graph is is adapted from VanderWeele (2015), chap. 5.

The direct effect of the SSM is identified when all variables except D are held constant. Hence, the direct effect expresses by how much Y would change when treatment changes from $D = 0$ to $D = 1$, and the mediators X_1^b and X_2^b and control variable C are kept at the level that would prevail at $D = 0$. The total effect of the SSM can be identified by allowing X_1^b and X_2^b to vary and keeping only the control variable C constant. The total effect thus captures by how much the outcome would change overall when the treatment changes from $D = 0$ to $D = 1$, and the effect can run via the direct path and all indirect paths. Finally, the indirect effects can be understood as the effects on Y when $D = 0$ and the values of X_1^b and X_2^b change to the values they would have attained when $D = 1$. Note that unobserved confounders U of the mediators do not affect the identification of the effects of the SSM.[10]

3.3. Identification and Estimation of SSM Effects

The identifying assumptions for the SSM effects in our fixed effects panel data models is an unconfoundedness or strict exogeneity assumption (also known as ignorability or conditional independence). Strict exogeneity requires that the potential outcomes and the entire history of treatments $SSM_i = (SSM_{i1}, ..., SSM_{iT})$ are independent conditional on the unobserved fixed effect μ_i, the control variables X_{it}, and time t. As a result, past treatments must not directly affect current outcomes, and past outcomes must not affect current treatment.[11]

Both requirements are fulfilled in our context. First, SSM assignment in former years does not directly affect the outcome variables in later years since measures resulting from SSM supervision in previous years can only be enforced by SSM regulation in year t if the bank still is in the SSM. As far as mediating variables are concerned, this means that SSM related adjustments in year t do not directly depend on past SSM measures. Second, the assignment to the SSM does not depend on any of the outcome variables we examine. This implies that past outcomes do not affect current treatment. In addition, this also implies that current outcomes do not affect current treatment. Hence, there is also no reverse causality between treatment and potential outcomes. Finally, selection into the SSM is a non-random assignment, which rules out statistical problems related to defiance and self-selection into treatment.

To ensure unconfoundedness we also need to choose appropriate control variables. As already mentioned, selection into the SSM depends on bank size, economic importance for the specific country or the EU economy as a whole, the amount of cross-border activities, or direct public financial assistance requested or received from the European Stability Mechanism or the European Financial Stability Facility. All four determinants are potential confounders of the link between the treatment and the outcome. Bank size is, however, by far the most frequent reason for direct SSM supervision. In 2014, out of a total of 116 SSM

[10] U plays no role in identifying the direct effect because X_1^b and X_2^b are both held constant. In the case of the total effect X_1^b and X_2^b can vary, but both variables are outcomes of D and U and do therefore not transmit any effects of D to Y via U. See Pearl (2009) and VanderWeele (2015) for further details.

[11] The SSM is one of the two pillars of the euro area banking union. The other pillar is the Single Resolution Mechanism. The Single Resolution Mechanism regulation entered into force on 19 August 2014, and is directly applicable in all member states from 1 January 2016 onward for all euro area banks. Therefore, the Single Resolution Mechanism does not compromise the identification of SSM effects. The planned Common Deposit Guarantee Scheme has not yet been successfully implemented as a third pillar in European banking union.

banks, 112 banks were in the SSM because of bank size or bank size relative to GDP. Bank size is thus the critical control variable for the identification of SSM effects. Fortunately, we can measure bank size by the log of total assets. Therefore we can directly control for the the main reason for selection into the SSM. Our vector of explanatory variables X_{it} will therefore always contain bank size. In the very few cases where cross-border activities account for SSM participation, the bank fixed effect μ_i should capture possible confounding effects.

The example in Section 3.2 already foreshadows our strategy for estimating the different effects of the SSM. We estimate the direct effect of the SSM with a "long" regression and the total effect with a "short" regression. Both regressions contain bank size and bank fixed effects to control for selection into the SSM, but they differ in the additional explanatory variables.

The long regression that yields the direct SSM effect contains the controls for selection into the SSM and the bank-specific variables X_{it}^b. By including bank-specific variables, we control for indirect effects of the SSM. As a result, the δ coefficients on the treatment dummies measure only direct SSM effects. Of course, structural explanatory variables X_{it}^s that capture the economic environment and the market structure of the banking sector can also be added. As a result, the vector of explanatory variables in the long regressions is $X_{it} = (log(TA_{it}), X_{it}^b, X_{it}^s)$.

The short regression that yields the total effect of the SSM excludes the bank-specific variables X_{it}^b and otherwise contains exactly the same variables as the long regression. The vector of explanatory variables in the short regression is thus $X_{it} = (log(TA_{it}), X_{it}^s)$. By excluding the bank-specific variables we do not control for the indirect effects. In the short regression the coefficients on the treatment dummies therefore pick up the direct and the net indirect effect of the SSM. Finally, the indirect effect of the SSM can be obtained as the difference between the estimated total effect and the direct effect.[12]

Before we move on, a remark regarding the structural and bank-specific variables in the identification of the direct and indirect SSM effects is in order. For the identification of SSM effects the structural variables are not required. The additional structural variables may, however, increase the fit of the estimated model and reveal important correlations between the dependent variables and the structural variables. Furthermore, while the identification of the total SSM effect depends almost exclusively on bank size and possibly the fixed effects, the identification of the direct and net indirect SSM effects also depends on the bank-specific variables. Identifying total SSM effects is therefore easier than identifying direct and indirect SSM effects, as missing bank-specific variables do not affect the identification of total SSM effects. The identification of direct and indirect SSM effects can be impaired if an important bank-specific control variable is missing. In this case, the effect mediated through the missing bank-specific variable would become part of the estimated direct effect. We cope with this problem by including those bank-specific variables that have been found to be important in the literature, but we must keep this possibility in mind when we judge the importance of the direct and indirect SSM effects. Finally, it is important to note that the control variables for identifying SSM effects and the structural variables need not necessarily have a causal interpretation.

[12] See, also section 2.6.1 in VanderWeele (2015)

3.4. Resampling Procedure for Assessing the Stability of Estimated SSM Effects

To ensure that our estimation results are not driven by some influential observations, we examine the stability of our estimated SSM effects using a resampling procedure similar to cross validation (Hastie et al., 2009). In this procedure, we first randomly divide the sample into 10 groups with approximately the same number of banks. After this random assignment, we estimate a model 10 times, always dropping a different group, and store the coefficients. We repeat the randomized group assignment 1,000 times. Hence, in total every model is estimated 10,000 times with a different combination of 90% of the banks. We then compare the SSM effects estimated using the entire sample with the SSM effects obtained in our resampling procedure. A narrow distribution of the resampling-based SSM effects, centered on the estimated full sample SSM effects estimates, indicates that the full sample estimates are stable.

We emphasize that we do not stratify. The 9 groups used when estimating a model therefore do not necessarily include all or a fixed number of SSM-banks. In addition, in the 10 estimations for each assignment we always drop different banks. Thus, our stability check is tougher than a check that would in each run randomly drop 10% of all banks. As the number of random assignment growths, both checks would become more and more similar, however.

4. Empirical Results

In this section we present our empirical findings about the effects of the SSM on return on assets, the average risk weight, the average credit risk weight, and the return on risk weighted assets. In short, we find that the SSM has a small but economically relevant positive direct impact on the SSM banks' return on assets. Furthermore, we find that the SSM has a negative impact on average risk weights and slightly positive effects on average credit risk weights. The combined effect of the SSM on profitability and risk weights – estimated by using the return on risk weighted assets as dependent variable – is clearly positive and increasing over time. Our empirical results suggest that the SSM effects are mostly direct effects.

4.1. SSM Effects on the Return on Assets

In order to empirically examine how the SSM affects the return on assets of SSM banks, we estimate the four models outlined in Section 3.1 with return on assets as the dependent variable. As explained in Section 3.2, in the models the log of total assets and the fixed effects control for selection into the SSM. In addition, our vector of covariates X_{it} contains a number of other variables that have been found to be important in explaining return on assets (Maudos and de Guevara, 2004; Maudos and Solis, 2009; Athanasoglou et al., 2008, among others). The bank-specific variables in X_{it} are the loan loss reserve ratio, labor costs over total assets, the leverage ratio, the loan-to-deposit ratio, and the average risk weight. The structural variables in X_{it} that capture macroeconomic developments and banking market structure in SSM member countries include the short-term interest rate, a dummy variable for the negative 3-month euribor, the long-term government bond yield, inflation, GDP growth, the Herfindahl-Hirschman index, and interaction terms of the dummy variable for the negative 3-month euribor with the 3-month euribor and the long-term government bond yield.

Table 2 shows the estimation results for the long regressions that provide estimates of the direct effect of the SSM on the return on assets. In the simplest model (ROA 1), the SSM has a positive, statistically significant direct effect on the return on assets. The SSM effect becomes statistically insignificant in the model with different time-effects for SSM and non-SSM banks (ROA 2). In the model with time-varying SSM effects (ROA 3), the SSM has a positive and statistically significant impact in 2015 and from 2017 onward. In the time-varying SSM effects model with different time effects (ROA 4), the SSM effects are always positive but statistically insignificant. In both time-varying SSM effects models, the SSM effects increase over time. Depending on the model, the estimates imply up to 0.20 percentage points higher returns on assets due to direct effects of the SSM. These effects are economically important given that the average return on assets over the sample period is 0.88% (Table 1).

Figure 3 depicts the estimated direct SSM effects obtained with our most comprehensive model (ROA 4) and the total SSM effects obtained with with the corresponding short regression (ROA 8 in Table B.9 in Appendix B). The dashed bars indicate 90% confidence intervals for the direct effects from the long regression, and the solid bars indicate 90% confidence intervals for the total effects. The dots inside the bars indicate the point estimates of the effects. The positive SSM effects on the return on assets start to materialize in 2015 and peak in 2017. Furthermore, the total and the direct SSM effects are of similar magnitude and their confidence intervals largely overlap. Thus, the indirect effects of the SSM are rather small and the main impact of the SSM on the return on assets results from direct effects of the SSM. Most importantly, the results imply that SSM supervision is not detrimental to profitability, as we consistently find positive SSM effects on SSM banks' return on assets. This result is also consistent with findings in Hirtle et al. (2020) for a sample of US banks.

Our resampling procedure shows that the estimates of the SSM effects are stable. The mean of the estimated SSM effects in the resampling procedure, in which we always drop around 10% of the banks, is very close to the SSM effects obtained with the entire sample (Table C.13 in Appendix C). In addition, the interquartile range for the SSM effects obtained in the resampling procedure is small. Hence, the estimated SSM effects vary little across the different sub-samples and are therefore not driven by influential observations.

In Section 3.3, we argued that bank size is the critical control variable for identifying SSM effects. Therefore, the structural explanatory variables should play no role in identifying the total SSM effects. To verify this prediction, we estimate a "super short" version of Eq. (4) that includes only the log of total assets, bank fixed effects and time effects. If bank size correctly identifies the total SSM effects, the estimated SSM effects from the short regression and the super short regression should be similar. This is indeed the case. Both regressions provide very similar estimates of the total SSM effects (ROA 8 and ROA 9 in Table B.9 in Appendix B).

Two objections to our estimated SSM effects could be that smaller non-SSM banks drive our results and that all large banks, whether part of the SSM or not, would indirectly benefit from the SSM. To examine these issues, we estimate the models with a much smaller sample comprising only the 200 largest banks, based on total assets in 2013, for which all explanatory variables are available.[13] Of those banks, 80 are in the SSM in 2014. As one would expect, the SSM effects obtained with the smaller sample are less precisely estimated, but otherwise qualitatively similar (Table D.17 in Appendix D). Therefore, we conclude that smaller non-SSM banks and large bank size per se do not affect our results.

As mentioned in Section 3.3, the coefficients on the variables that help identify SSM effects and the coefficients of the additional structural variables need not necessarily have a causal interpretation. Against this background, we now discuss the estimation results for the other explanatory variables in our models.

We start with the bank-specific explanatory variables. The coefficients on bank size and labor costs over total assets are both negative and statistically significant. Thus, agency costs, costs of bureaucratic processes, other costs of managing very large banks, and high labour costs are negatively associated with bank's return on assets. The coefficient on the leverage ratio is positive but statistically insignificant, suggesting that banks that hold more Tier 1 capital with respect to their total assets generate slightly higher return on assets. The positive coefficient on the loan loss reserve ratio, a measure of credit portfolio quality, indicates that higher returns must compensate for taking more risk by lending to lower quality borrowers. The average risk weight, another measure of bank's risk taking, can be interpreted in a similar fashion. The latter two results are consistent with Heider et al. (2019), who find that banks take more risk to meet profit targets. The loan-to-deposit ratio itself has a positive impact on the return on assets.

With respect to market structure, we find that return on assets decrease slightly with concentration, as measured by the Herfindahl-Hirschman index. The dummy variable ("Dummy neg. Euribor") for a negative 3M-Euribor captures the negative interest rates environment in which banks operated since mid-2014 when the ECB introduced negative policy rates. Consistent with Borio and Gambacorta (2017) and Claessens et al. (2018), 3M-Euribor rates below zero reduce banks' return on assets. Rising 10 year government bond yields, capturing expected inflation, are negatively related to banks' return on assets in normal times and in times of negative interest rates. Realized inflation is also negatively related to banks' return on assets. GDP growth – a measure for demand growth – has a positive impact on banks' return on assets.

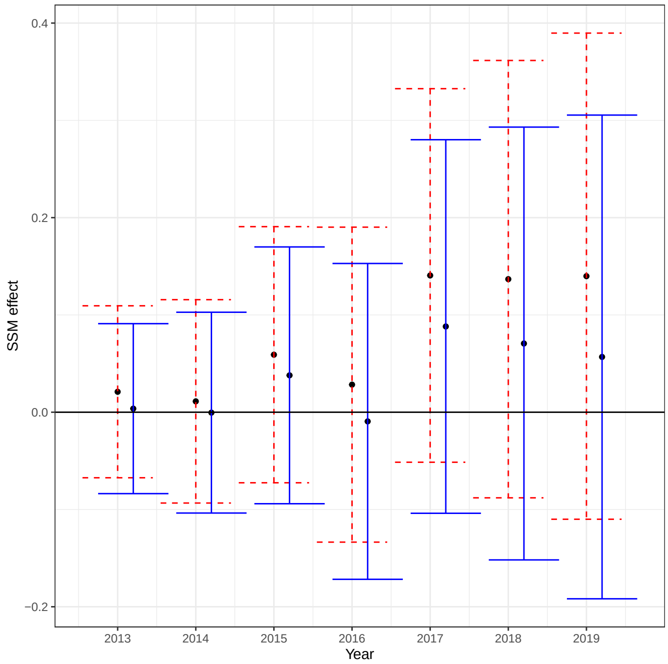
[13] For example, if the 168th largest bank did not report its loan loss reserve ratio, we would remove this bank and add the 201st biggest bank to our sample.

Table 2: Direct SSM effects on return on assets.

	ROA 1	ROA 2	ROA 3	ROA 4
log(TA)	-0.1155^{**}	-0.1120^{**}	-0.1078^{**}	-0.1083^{**}
	(0.0454)	(0.0453)	(0.0450)	(0.0448)
SSM dummy	0.1081^{***}	-0.0040		
	(0.0342)	(0.0426)		
SSM 2013			0.0397	0.0210
			(0.0448)	(0.0537)
SSM 2014			0.0364	0.0112
			(0.0502)	(0.0635)
SSM 2015			0.0906^{**}	0.0591
			(0.0444)	(0.0800)
SSM 2016			0.0663	0.0283
			(0.0480)	(0.0984)
SSM 2017			0.1849^{***}	0.1406
			(0.0477)	(0.1167)
SSM 2018			0.1874^{***}	0.1368
			(0.0536)	(0.1366)
SSM 2019			0.1969^{***}	0.1398
			(0.0506)	(0.1519)
$G_i \times t$		0.0197^{**}		0.0063
		(0.0078)		(0.0162)
Loan loss reserve ratio	0.0147^{***}	0.0151^{***}	0.0160^{***}	0.0159^{***}
	(0.0056)	(0.0056)	(0.0057)	(0.0057)
Labor Costs over TA	-0.1429^{**}	-0.1501^{**}	-0.1564^{***}	-0.1560^{***}
	(0.0598)	(0.0596)	(0.0600)	(0.0600)
Leverage ratio	0.0075	0.0077	0.0079	0.0079
	(0.0065)	(0.0064)	(0.0064)	(0.0064)
Loan-to-deposit ratio	0.0007^{*}	0.0008^{*}	0.0008^{*}	0.0008^{*}
	(0.0004)	(0.0004)	(0.0004)	(0.0004)
Average risk weight	0.0020^{**}	0.0020^{**}	0.0021^{**}	0.0021^{**}
	(0.0009)	(0.0009)	(0.0009)	(0.0009)
Herfindahl index	-0.0051	-0.0055^{*}	-0.0056^{*}	-0.0056^{*}
	(0.0033)	(0.0033)	(0.0033)	(0.0033)
3M-Euribor	-0.0799^{***}	-0.0923^{***}	-0.0812^{***}	-0.0848^{***}
	(0.0287)	(0.0295)	(0.0288)	(0.0299)
Dummy neg. Euribor	-0.7064^{***}	-0.8037^{***}	-0.7178^{***}	-0.7455^{***}
	(0.1315)	(0.1426)	(0.1326)	(0.1501)
Dummy neg. Euribor x Euribor	0.4606^{***}	0.4901^{***}	0.4660^{***}	0.4703^{***}
	(0.0665)	(0.0689)	(0.0692)	(0.0708)
10Y gov bond yield	-0.0409^{***}	-0.0435^{***}	-0.0423^{***}	-0.0430^{***}
	(0.0084)	(0.0084)	(0.0084)	(0.0084)
Dummy neg. Euribor x gov. bond yield	-0.0373	-0.0410^{*}	-0.0443^{*}	-0.0443^{*}
	(0.0245)	(0.0247)	(0.0258)	(0.0258)
GDP growth	0.0139^{***}	0.0132^{**}	0.0133^{**}	0.0132^{**}
	(0.0052)	(0.0051)	(0.0052)	(0.0052)
Inflation	-0.0116^{***}	-0.0115^{***}	-0.0118^{***}	-0.0118^{***}
	(0.0030)	(0.0030)	(0.0030)	(0.0030)
Bank Fixed effects	*yes*	*yes*	*yes*	*yes*
Time fixed effects	*yes*	*yes*	*yes*	*yes*
R-squared	0.69	0.69	0.69	0.69
Adj. R-squared	0.64	0.64	0.64	0.64
Number of obs.	8,727	8,727	8,727	8,727
Number of groups	1,170	1,170	1,170	1,170
Average. Obs. group	7.46	7.46	7.46	7.46
Min. Obs. group	3	3	3	3
Max. Obs. Group	14	14	14	14

Source: Own calculations. SNL. ECB. World Bank. Bloomberg. Eurostat.
The dependent variable is the return on assets before credit impairment and taxes (ROA).
SSM = 1 when the bank is an SSM bank and the SSM is active. SSM = 0 otherwise. The 2013–2019 SSM dummies take on the value 1 when the bank is an SSM bank and the SSM is active (or anticipated) in the corresponding year and are 0 otherwise. $G_i = 1$ when a bank is an SSM bank and $G_i = 0$ zero otherwise. t denotes time.
The bank-specific explanatory variables are the logarithm of total assets log(TA), the loan loss reserve ratio (loan loss reserves divided by total gross loans), Labor Costs over TA (labor costs divided by total assets), the leverage ratio (Tier 1 capital divided by total assets), the loan-to-deposit ratio and the average risk weight (risk weighted assets divided by total assets).
The structural explanatory variables are the Herfindahl index, the 3M-Euribor, Dummy neg. Euribor (a dummy which is 1 when the 3M-Euribor is negative and 0 otherwise, the interaction variable Dummy neg. Euribor x Euribor, 10Y gov bond yield (10 year zero coupon government bond yield from Bloomberg), the interaction Dummy neg. Euribor x gov. bond yield, GDP growth (year on year nominal GDP growth) and inflation (year on year growth of the consumer price index).
$^{***}p < 0.01$; $^{**}p < 0.05$; $^{*}p < 0.1$. We use cluster robust standard errors with clustering at the bank level.

Figure 3: Direct and total SSM Effects on return on assets.



The figure shows the estimated direct (red dashed line) and total (blue solid line) SSM effects together with 90% confidence intervals for the time period 2013-2019 from model ROA 4 in Table 2 and model ROA 8 in Table B.9.

4.2. SSM Effects on the Average Risk Weight

We now turn to the effects of the SSM on the average risk weight of SSM banks. As before, the four models outlined in Section 3 include bank-specific fixed effects, time effects, the log of total assets and a number of bank-specific and structural explanatory variables that are typically used in the literature (Mariathasan and Merrouche, 2014; Ferri and Pesic, 2017; Beltratti and Paladino, 2016).

The bank-specific variables include the growth of total assets, the ratio of gross loans to total assets, the loan loss reserve ratio, the leverage ratio (Tier 1 capital divided by total assets), the loan-to-deposit ratio, the return on assets before credit impairment and tax, and the bank's chosen Basel risk-weight approach. The loan loss reserve ratio approximates the default probability of loans times the loss given default. It is therefore a proxy for the expected loss of the loan portfolio. The leverage ratio indicates the level of capitalization, and better capitalized banks are able to hold assets with a higher average risk weight without breaching minimal capital requirements. The loan-to-deposit ratio and the return on assets before credit impairment and tax reflect the risk and return profile of a bank. We include the ratio of gross loans to total assets to capture a bank's business mix and the share of credit risk (Mariathasan and Merrouche, 2014; Barakova and Palvia, 2014).

We use dummy variables to account for the different Basel risk-weight approaches. As our sample starts in 2005, the first category is Basel I. Since the introduction of Basel II in 2007, banks can choose between the Standardized Approach (StA), the Foundation Internal Rating Based Approach (F-IRB), the Advanced Internal Rating Based Approach (A-IRB), and the Mixed Approach. Under Basel I and the StA approach, the risk weights are essentially fixed and depend on the type of risk and the portfolio structure. The F-IRB and the A-IRB allows banks to estimate default probabilities. The A-IRB also allows banks to estimate the exposure at default and loss given default for portfolios that are subject to credit risk. The estimated parameters are then inserted in the capital requirement formula (BIS, 2005) to calculate capital requirements. Under the Mixed Approach banks hold parts of their assets under different approaches. These risk-weight approaches differ essentially for credit risk.

The loan loss reserve ratio is a backward-looking approximation for the expected loss (probability of default times loss given default) of a portfolio. In contrast, risk weights are forward looking and depend on the interest rate environment. In particular, rising interest rates may lead to higher interest payments and thereby increase default probabilities and thus also risk weights (Jarrow and Turnbull, 1995; Duffie and Singleton, 1999). Moreover, the loss given default depends on the cash flows received during the workout process that is adjusted with a discount rate equal to the risk free interest rate at the time of default. To take account of this interest rate channel, we also include the 10 year government bond yield as a forward-looking determinant of the average risk weight.

We now turn to the estimated direct effects of the SSM on the average risk weight of SSM banks (Table 3). The SSM effect is negative in our simplest model (RW 1). When we allow for different time trends for SSM and non-SSM banks the effect becomes positive (RW 2) and statistically significant. In the models with time-varying SSM effects (RW 3) and (RW 4), the estimated effects are again negative, almost always statistically significant, and range between −0.5 bp and −7.3 bp. The effects are therefore relatively small compared to the average risk weight of around 55 bp for all banks (see Table 1). We also find negative SSM announcement effects in 2013.

Before we compare the estimated direct and total SSM effects, we need to discuss whether to keep or drop the 10 year government bond yields in the short regressions that yield the total SSM effects. The issue arises because the 10 year government bond yield is a structural variable that may also capture forward-looking components in the method a bank chooses to compute default probabilities. In this context, the 10 year government bond yield could also be viewed as a bank-specific variable. Since we do not have a definitive answer to this question, we keep the 10 year government bond yield in the short regressions (RW 5 to RW 8 in Table B.11 in Appendix B), but we also report the results without this variable for the short regression for our most comprehensive model (RW 9 in Table B.11 in Appendix B).

Figure 4 shows the direct SSM effects (RW 4) and the total SSM effects (RW 8 in Table B.10 in Appendix B) together with 90% confidence intervals. It is easy to see that the total SSM effects are more negative than the direct SSM effects, which are also negative but closer to zero. Hence, the SSM appears to have small positive indirect effects on the average risk weight. The negative direct effects of the SSM could result from stricter supervision in the SSM, which as a result induces less risky asset holdings. The total effects of the SSM on the average risk weight range between −2.5 and −10 percentage points and are economically relevant given the average risk weight of 55.65 percent in Table 1. Our resampling procedure in Table C.14 and the results for a much smaller sample, containing only the 200 largest banks, show that our estimates are robust (Table D.18 in Appendix D).

We now briefly discuss the results for the other explanatory variables, again bearing in mind the results may not necessarily be causal. We find a negative, statistically significant relationship between bank size and the average risk weight. Thus, whether or not they are in the SSM, larger banks tend to report a lower average risk weight. This might be explained as follows. Larger banks either invest in less risky assets or use IRB models that produce lower risk weights for the same assets. In the regressions we control for a bank's risk profile and for the chosen risk weight approach. Therefore, large banks appear to be using IRB models with lower risk weights. Note, however, that the coefficients of the loan-to-deposit ratio and the return on assets before credit impairment and tax are both positive. Therefore, other things being equal, riskier banks report a higher average risk weight.

As defined in BIS (2005), regulatory capital requirements are also a function of the probability of default and the loss given default. The product of these two variables should equal the expected loss, which we approximate by the loan loss reserve ratio. Therefore, one might expect a positive coefficient. However, the coefficient is sightly negative. There are two effects at play here that work in opposite directions. The coefficient of the loan loss reserve ratio, as a proxy for the future expected loss, should be positive, but for already defaulted loans there are 0% risk weight requirements. These two effects seem to cancel each other out.

The coefficient on the leverage ratio is positive and highly significant in all specifications, indicating that well capitalized banks can hold assets that require higher risk weights.[14] As to be expected, we also find a positive relationship between between the 10 year government bond yield and the average risk weight. Finally, the average risk weight also depends on a bank's methodology for determining risk weights. We find that the average risk weight is highest when banks use the Standardized Approach and lowest when banks use the A-IRB approach which is our reference category.

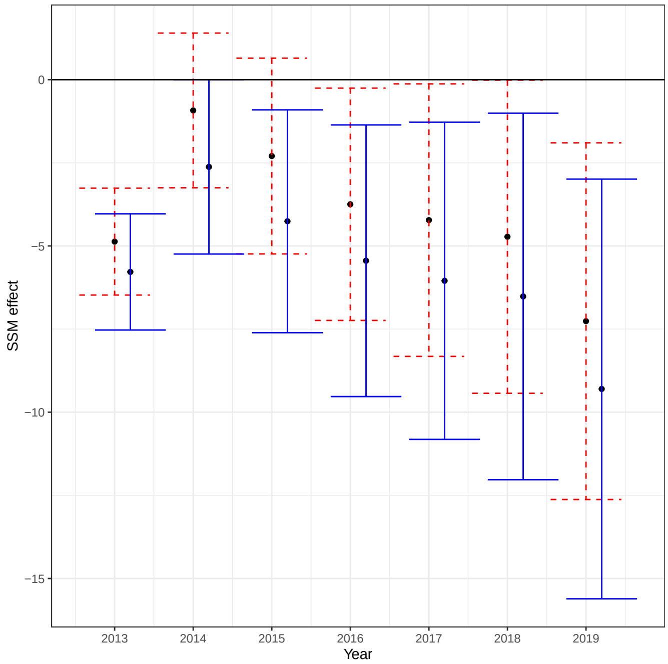
[14]We include the leverage ratio instead of the Tier 1 capital ratio to avoid an endogeneity problem since in the Tier 1 capital ratio the risk weighted assets are in the denominator.

Table 3: Direct SSM effects on the average risk weight.

	RW 1	RW 2	RW 3	RW 4
log(TA)	-3.9332^{***}	-4.1334^{***}	-4.3224^{***}	-4.3448^{***}
	(1.4697)	(1.4728)	(1.4841)	(1.4879)
SSM dummy	-1.2096	2.1874^{**}		
	(0.9895)	(0.9985)		
SSM 2013			-4.2340^{***}	-4.8698^{***}
			(0.9232)	(0.9768)
SSM 2014			-0.0509	-0.9248
			(1.0233)	(1.4136)
SSM 2015			-1.1833	-2.2965
			(1.1262)	(1.7889)
SSM 2016			-2.4057^{**}	-3.7475^{*}
			(1.2123)	(2.1233)
SSM 2017			-2.6528^{**}	-4.2238^{*}
			(1.2347)	(2.4910)
SSM 2018			-2.9135^{**}	-4.7232^{*}
			(1.3060)	(2.8622)
SSM 2019			-5.2204^{***}	-7.2622^{**}
			(1.3545)	(3.2603)
$G_i \times t$		-0.6172^{***}		0.2291
		(0.1926)		(0.3772)
TA growth	0.0170	0.0151	0.0124	0.0124
	(0.0204)	(0.0205)	(0.0208)	(0.0208)
Loans to TA	0.3803^{***}	0.3806^{***}	0.3827^{***}	0.3833^{***}
	(0.0467)	(0.0466)	(0.0464)	(0.0465)
Loan loss reserve ratio	-0.2112	-0.2115	-0.2277	-0.2343
	(0.1414)	(0.1414)	(0.1454)	(0.1465)
Leverage ratio	1.4902^{***}	1.4805^{***}	1.4648^{***}	1.4625^{***}
	(0.1893)	(0.1895)	(0.1893)	(0.1895)
Loan-to-deposit ratio	0.0279^{*}	0.0262^{*}	0.0249	0.0248
	(0.0155)	(0.0153)	(0.0152)	(0.0152)
ROA	0.5027	0.5396	0.5374	0.5314
	(0.4758)	(0.4754)	(0.4715)	(0.4676)
Basel I	5.2022^{**}	5.6760^{***}	5.6624^{***}	5.5870^{***}
	(2.0463)	(2.1072)	(2.0152)	(2.0521)
StA Approach	9.2833^{***}	9.9415^{***}	9.7481^{***}	9.5974^{***}
	(1.4756)	(1.4919)	(1.4150)	(1.4237)
Mixed Approach	3.6352^{**}	4.3065^{***}	4.1318^{***}	3.9836^{***}
	(1.4715)	(1.4850)	(1.4066)	(1.4468)
F-IRB	5.3905^{***}	5.9309^{***}	5.8516^{***}	5.7473^{***}
	(1.7215)	(1.7106)	(1.6496)	(1.6907)
10Y gov bond yield	0.1864	0.2504	0.1879	0.1642
	(0.1662)	(0.1695)	(0.1639)	(0.1708)
Bank Fixed effects	*yes*	*yes*	*yes*	*yes*
Time fixed effects	*yes*	*yes*	*yes*	*yes*
R-squared	0.88	0.88	0.88	0.88
Adj. R-squared	0.86	0.86	0.86	0.86
Number of obs.	7,979	7,979	7,979	7,979
Number of groups	1,135	1,135	1,135	1,135
Average. Obs. group	7.03	7.03	7.03	7.03
Min. Obs. group	3	3	3	3
Max. Obs. Group	14	14	14	14

Source: Own calculations. SNL. ECB. World Bank. Bloomberg. Eurostat.
The dependent variable is the average risk weight (RW).
SSM = 1 when the bank is an SSM bank and the SSM is active. SSM = 0 otherwise. The 2013–2019 SSM dummies take on the value 1 when the bank is an SSM bank and the SSM is active (or anticipated) in the corresponding year and are 0 otherwise. $G_i = 1$ when a bank is an SSM bank and $G_i = 0$ zero otherwise. t denotes time.
The bank-specific explanatory variables are the logarithm of total assets log(TA), TA growth (total asset growth), Loans to TA (loans divided by total assets), the loan loss reserve ratio, the Leverage ratio (Tier 1 capital divided by total assets), the loan-to-deposit ratio, and ROA, the return on assets before credit impairment and tax.
The structural explanatory variables are the dummies for Basel I, the StA Approach (Standardized Approach), the Mixed Approach (banks have different portfolios under different approaches) and the F-IRB (Foundation Internal Rating Based Approach). The 10Y gov bond yield refers to the 10 year zero coupon government bond yield from Bloomberg.
$^{***}p < 0.01$; $^{**}p < 0.05$; $^{*}p < 0.1$. We use cluster robust standard errors with clustering at the bank level.

Figure 4: Direct and total SSM effects on the average risk weight.



The figure shows the estimated direct (red dashed line) and total (blue solid line) SSM effects together with 90% confidence intervals for the time period 2013-2019 from model RW 4 in Table 3 and model RW 8 in Table B.10.

4.3. *SSM Effects on the Average Credit Risk Weight*

In this section, we discuss our empirical findings for the average credit risk weight. Our measure of the average credit risk weight (credit risk weighted assets divided by total gross loans) is a proxy for the true average credit risk weight because SNL does not provide data on exposure at default, which might also include some off-balance sheet exposure caused by undrawn credit commitments. The econometric models for the average credit risk weight contain essentially the same explanatory variables as the models for the average risk weight. We do not include the ratio of gross loans to total assets to avoid endogeneity problems, since the denominator of gross loans to total assets would be the numerator of our dependent variable.

Table 4 reports the estimated direct SSM effects on the average credit risk weight. We find small negative direct SSM effects in the models without separate time-effects for SSM and non-SSM banks (CRW 1 and CRW 3). When we allow for different time-effects (CRW2 and CRW 4) we find small positive SSM effects. A possible reason for the positive direct SSM effects could be the elimination of a regulatory home bias by the SSM (Doeme and Kerbl, 2017).[15]

[15]Doeme and Kerbl (2017) show that the regulator of the bank's headquarter has an impact on risk weights even after controlling for bank-specific and portfolio-specific variables.

The different time trends in the average credit risk weight for non-SSM and SSM banks are mainly due to the fact that non-SSM bank use the Standardized Approach, while almost all SSM banks use IRB approaches.[16] The annual EBA transparency exercises from 2014-2020 reveal large difference in the average credit risk weight between IRB approaches and the Standardized Approach for similar portfolios.[17] Since these approaches are not only bank-specific but also portfolio specific, our dummies for these different approaches may not fully capture these differences.

Figure 5 shows the direct SSM effects (CRW 4) from the short regression with the 10 year government bond yield included and the total SSM effects (CRW 8 in Table B.11 in Appendix B).[18] The direct effects are always slightly larger than the total effects, implying small negative indirect SSM effects. This suggests that banks are trying to reduce their average credit risk weight, which largely reverses the direct effect and results in a total effect of the SSM on the average credit risk weight closer to zero. Our robustness checks suggest that the empirical findings are stable (see Table C.15 and Table D.19).

For most of the other explanatory variables, the results are similar to those for the average risk weight models. Since Basel II, banks using the StA approach report a higher average credit risk weight. With the introduction of credit risk weights and even more so after the introduction of IRB models, banking regulators and academics (Ferri and Pesic, 2017; Mariathasan and Merrouche, 2014; Berg and Koziol, 2017; Beltratti and Paladino, 2016) have debated whether credit risk weights properly capture credit risk. In BCBS (2017), it was even suggested to implement an aggregate floor to ensure that the risk weighted assets calculated by IRB models are no lower than 72.5% of the risk weighted assets calculated using the Standardized Approach. Our findings underscore the importance of this discussion. Banks with fixed risk weights (i.e., Basel I and then the Standardized Approach) have a significantly higher average credit risk weight than banks with IRB approaches. Banks that use the A-IRB approach (the reference category) have the lowest average credit risk weight.

[16]The regulatory authority must first approve the chosen IRB approach. Only the A-IRB approach is permitted for retail loan portfolios. For non-financial corporate loan and mortgage loan portfolios, the F-IRB approach is also accepted.

[17]See EBA (2014, 2015, 2016b, 2017, 2018, 2019, 2020)

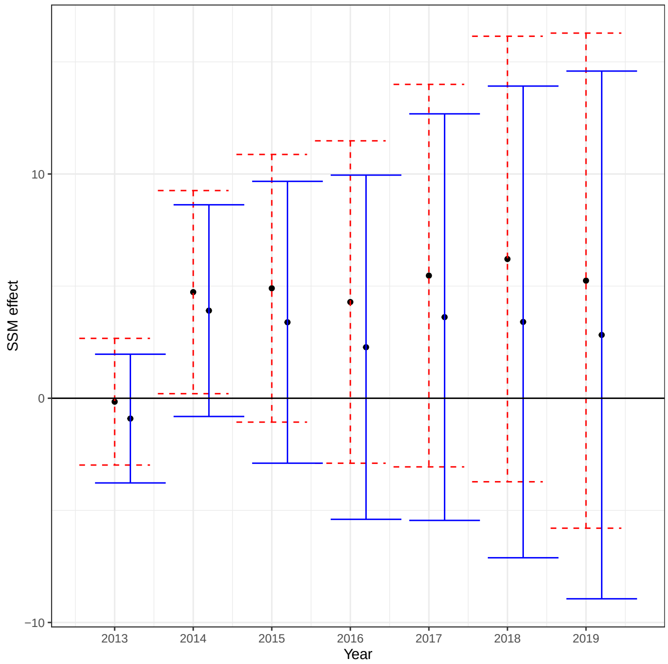
[18]The discussion concerning the inclusion of the 10 year government bond yield in the short regressions in Section 4.2 also applies to the average credit risk weight.

Table 4: Direct SSM effects on the average credit risk weight.

	CRW 1	CRW 2	CRW 3	CRW 4
log(TA)	-1.4110	-2.0373	-2.0746	-1.9966
	(2.8061)	(2.8467)	(2.8631)	(2.8579)
SSM dummy	-2.8763	4.4926^{***}		
	(1.8340)	(1.6337)		
SSM 2013			-4.0061^{***}	-0.1550
			(1.4754)	(1.7168)
SSM 2014			-0.7226	4.7326^{*}
			(1.7952)	(2.7528)
SSM 2015			-2.1433	4.9033
			(2.0682)	(3.6277)
SSM 2016			-4.2705^{*}	4.2906
			(2.2379)	(4.3695)
SSM 2017			-4.6486^{*}	5.4672
			(2.4259)	(5.1842)
SSM 2018			-5.4461^{**}	6.2091
			(2.5413)	(6.0388)
SSM 2019			-7.9724^{***}	5.2440
			(2.4446)	(6.7103)
$G_i \times t$		-1.4061^{***}		-1.5255^{*}
		(0.3213)		(0.7796)
TA growth	0.1258^{***}	0.1197^{***}	0.1209^{***}	0.1181^{***}
	(0.0374)	(0.0373)	(0.0376)	(0.0374)
Loan loss reserve ratio	-0.4643^{*}	-0.5037^{**}	-0.5156^{**}	-0.4978^{*}
	(0.2524)	(0.2542)	(0.2596)	(0.2581)
Leverage ratio	1.7650^{***}	1.7119^{***}	1.7216^{***}	1.7147^{***}
	(0.2854)	(0.2833)	(0.2861)	(0.2841)
loan-to-deposit ratio	-0.1179^{***}	-0.1230^{***}	-0.1219^{***}	-0.1231^{***}
	(0.0266)	(0.0271)	(0.0271)	(0.0271)
NIM	-2.2165^{*}	-1.9522^{*}	-1.9511^{*}	-2.0000^{*}
	(1.1500)	(1.1480)	(1.1472)	(1.1564)
Basel I	37.6173^{***}	38.7852^{***}	38.3122^{***}	38.8903^{***}
	(13.2124)	(13.1110)	(13.2797)	(13.1725)
StA Approach	14.7488^{***}	16.2864^{***}	15.2088^{***}	16.4609^{***}
	(4.9173)	(5.1766)	(4.9676)	(5.2712)
Mixed Approach	5.6850	6.9007	6.1778	7.0393
	(4.6074)	(4.8542)	(4.6565)	(4.9058)
F-IRB	5.7842	6.9269^{*}	6.3047	7.0479^{*}
	(3.8490)	(4.0581)	(3.9051)	(4.1201)
10Y gov bond yield	1.4126^{***}	1.5481^{***}	1.4086^{***}	1.5576^{***}
	(0.3828)	(0.3860)	(0.3821)	(0.3973)
Bank Fixed effects	*yes*	*yes*	*yes*	*yes*
Time fixed effects	*yes*	*yes*	*yes*	*yes*
R-squared	0.89	0.89	0.89	0.89
Adj. R-squared	0.87	0.87	0.87	0.87
Number of obs.	7,304	7,304	7,304	7,304
Number of groups	1,071	1,071	1,071	1,071
Average. Obs. group	6.82	6.82	6.82	6.82
Min. Obs. group	3	3	3	3
Max. Obs. Group	14	14	14	14

Source: Own calculations. SNL. ECB. World Bank. Bloomberg. Eurostat.
The dependent variable is average credit risk weight (CRW).
SSM = 1 when the bank is an SSM bank and the SSM is active. SSM = 0 otherwise. The 2013–2019 SSM dummies take on the value 1 when the bank is an SSM bank and the SSM is active (or anticipated) in the corresponding year and are 0 otherwise. $G_i = 1$ when a bank is an SSM bank and $G_i = 0$ zero otherwise. t denotes time.
The bank-specific explanatory variables are the logarithm of total asset log(TA), TA growth (total asset growth), the loan loss reserve ratio (loan loss reserves divided by total assets), the loan-to-deposit ratio, and NIM, the net interest margin.
The structural explanatory variables are the dummies for Basel I, the StA Approach (Standardized Approach), the Mixed Approach (banks have different portfolios under different approaches) and the F-IRB (Foundation Internal Rating Based Approach). The 10Y gov bond yield refers to the 10 year zero coupon government bond yield from Bloomberg.
$^{***}p < 0.01$; $^{**}p < 0.05$; $^{*}p < 0.1$. We use cluster robust standard errors with clustering at the bank level.

Figure 5: Direct and indirect SSM effects on the average credit risk weight.



The figure shows the estimated direct (red dashed line) and total (blue solid line) SSM effects together with 90% confidence intervals for the time period 2013-2019 from model CRW 4 in Table 4 and model CRW 8 in Table B.11.

4.4. SSM Effects on the Return on Risk Weighted Assets

In the introduction we argued that the return on risk weighted assets, due to its dependence on the risk weights for computing regulatory capital, captures the combined impact of the SSM on profitability and risk weights. We found positive SSM effects on return on assets (Section 4.1) and negative SSM effects for the average risk weight (Section 4.2). Therefore, we expect to find positive combined SSM effects on the return on risk weighted assets.

Table 5 reports the estimation results for the direct SSM effects. The direct effects of the SSM on the return on risk weighted assets are almost always positive, statistically significant, and increasing over time. Thus, as expected, the positive SSM effects on return on assets in combination with the negative SSM effects on the average risk weight translate into positive SSM effects on the return on risk weighted assets. The upper right chart in Figure 1 also reflects this development. Before the announcement of the SSM in 2012 the gap in the return on risk weighted assets between SSM and non-SSM banks was basically zero. Since the announcement of the SSM the gap widened to nearly 0.4 percentage points.

Figure 6 shows that the increasingly positive SSM effects originate mainly from direct SSM effects, as the direct and the total effects SSM effects are similar. The direct SSM effects are taken from RORWA 4 in Table 5 and the total SSM effects are taken from RORWA 8 in Table B.12. The positive SSM effects on profitability and the negative SSM effects on risk taking thus lead to statistically significant and economically relevant combined SSM effects on the return on risk weighted assets. Hence, under SSM supervision the profitability of SSM banks increased without more risk-taking as measured by the average risk weight.

Avgeri et al. (2021) differentiate between peripheral and core countries of the euro zone because of financial fragmentation. Therefore, as a robustness check, we split our sample into the same core countries (Austria, Belgium, Estonia, Germany, Finland, France, the Netherlands, and Slovakia) and periphery countries (Cyprus, Greece, Ireland, Italy, Malta, Portugal, Slovenia, and Spain) as in Avgeri et al. (2021).[19] When we run our regressions for the two subsamples, we find statistically significant SSM effects for both groups of countries (Table E.22 in Appendix E). Our resampling procedure, the regressions with the restricted sample of only large banks (Table D.20 in Appendix D), and the super short regression (RORWA 9 in Table B.12 in Appendix B) also suggest that the estimated positive effects of the SSM on SSM bank's return on risk weighted assets are robust.

We now briefly discuss the empirical results for the other explanatory variables. Most results agree with those obtained for the return on assets and the average risk weight. Two findings are worth mentioning, however. First, banks benefit most from using the A-IRB approach (our reference category for the risk weight approaches). Using an A-IRB model to calculate risk weights results in the smallest reduction of the return on risk weighted assets. Second, the interest rate environment has a significant impact on the return on risk weighted capital. In particular, negative interest rates below a certain threshold reduce the return on risk weighted assets. The 3M-Euribor threshold is around -0.29% in our most flexible model (RORWA 4).[20]

[19] The categorization into the two groups follows the European Commission's classification with respect to their levels of non-performing loans, as presented in Mesnard et al. (2016).

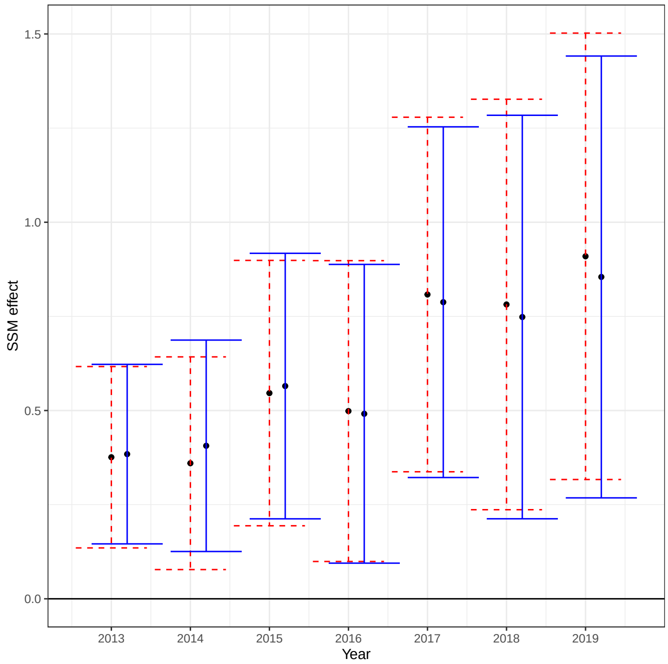
[20] The coefficient for "Dummy neg. Euribor x Euribor" is positive, but the "Dummy neg. Euribor" is 1 if the 3M-Euribor is negative. Therefore, the threshold for the 3M-Euribor would be $1.5015 + 5.2056 * \text{3M-Euribor} < 0$ which is around -0.29.

Table 5: Direct SSM effects on the return on risk weighted assets.

	RORWA 1	RORWA 2	RORWA 3	RORWA 4
log(TA)	−0.0902	−0.0862	−0.0742	−0.0701
	(0.0977)	(0.0981)	(0.0987)	(0.0988)
SSM dummy	0.2961***	0.1446		
	(0.0912)	(0.1132)		
SSM 2013			0.2481**	0.3760**
			(0.1223)	(0.1464)
SSM 2014			0.1872	0.3600**
			(0.1315)	(0.1717)
SSM 2015			0.3295**	0.5463**
			(0.1324)	(0.2142)
SSM 2016			0.2377**	0.4986**
			(0.1212)	(0.2428)
SSM 2017			0.5036***	0.8081***
			(0.1322)	(0.2862)
SSM 2018			0.4330***	0.7816**
			(0.1397)	(0.3313)
SSM 2019			0.5169***	0.9096**
			(0.1269)	(0.3603)
$G_i \times t$		0.0269		−0.0433
		(0.0187)		(0.0376)
Loan loss reserve ratio	0.0299**	0.0304**	0.0316**	0.0322**
	(0.0123)	(0.0123)	(0.0126)	(0.0127)
Labor Costs over TA	−0.3337***	−0.3434***	−0.3597***	−0.3623***
	(0.1268)	(0.1270)	(0.1283)	(0.1288)
loan-to-deposit ratio	−0.0008	−0.0007	−0.0007	−0.0007
	(0.0013)	(0.0012)	(0.0012)	(0.0012)
Leverage ratio	−0.0196	−0.0192	−0.0183	−0.0181
	(0.0149)	(0.0150)	(0.0150)	(0.0150)
Basel I	−0.2722	−0.2887	−0.2871	−0.2732
	(0.3457)	(0.3494)	(0.3488)	(0.3454)
StA Approach	−0.4020	−0.4307	−0.4258	−0.3959
	(0.3222)	(0.3245)	(0.3263)	(0.3254)
Mixed Approach	−0.0513	−0.0811	−0.0767	−0.0469
	(0.3233)	(0.3270)	(0.3276)	(0.3263)
F-IRB	−0.2772	−0.2983	−0.2990	−0.2811
	(0.3470)	(0.3498)	(0.3496)	(0.3479)
Herfindahl index (ECB)	−0.0228***	−0.0233***	−0.0241***	−0.0239***
	(0.0072)	(0.0072)	(0.0072)	(0.0072)
3M-Euribor	0.1992***	0.2261***	0.2118***	0.1744***
	(0.0538)	(0.0590)	(0.0541)	(0.0602)
Dummy neg. Euribor	1.3417***	1.4346***	1.5292***	1.5015***
	(0.4515)	(0.4670)	(0.4898)	(0.4883)
Dummy neg. Euribor x Euribor	4.6096***	4.8875***	5.2405***	5.2056***
	(1.3010)	(1.3461)	(1.4251)	(1.4230)
10Y gov bond yield	−0.0569***	−0.0605***	−0.0598***	−0.0553***
	(0.0190)	(0.0191)	(0.0189)	(0.0192)
Dummy neg. Euribor x gov. bond yield	−0.0143	−0.0193	−0.0245	−0.0248
	(0.0562)	(0.0568)	(0.0595)	(0.0595)
Inflation	−0.0275***	−0.0274***	−0.0276***	−0.0276***
	(0.0064)	(0.0063)	(0.0064)	(0.0065)
GDP growth	0.0401***	0.0390***	0.0370***	0.0377***
	(0.0131)	(0.0129)	(0.0131)	(0.0130)
Bank Fixed effects	*yes*	*yes*	*yes*	*yes*
Time fixed effects	*yes*	*yes*	*yes*	*yes*
R-squared	0.63	0.63	0.63	0.63
Adj. R-squared	0.57	0.57	0.57	0.57
Number of obs.	8,669	8,669	8,669	8,669
Number of groups	1,164	1,164	1,164	1,164
Average. Obs. group	7.45	7.45	7.45	7.45
Min. Obs. group	3	3	3	3
Max. Obs. Group	14	14	14	14

Source: Own calculations. SNL. ECB. World Bank. Bloomberg. Eurostat.
The dependent variable is return on risk weighted assets (RORWA).
SSM = 1 when the bank is an SSM bank and the SSM is active. SSM = 0 otherwise. The 2013–2019 SSM dummies take on the value 1 when the bank is an SSM bank and the SSM is active (or anticipated) in the corresponding year and are 0 otherwise. $G_i = 1$ when a bank is an SSM bank and $G_i = 0$ zero otherwise. t denotes time.
The bank-specific explanatory variables are the logarithm of total assets log(TA), the loan loss reserve ratio (loan loss reserves divided by total gross loans), Labor Costs over total assets, the leverage ratio (Tier 1 capital divided by total assets), and the loan-to-deposit ratio.
The structural explanatory variables are the Herfindahl index, the 3M Euribor, Dummy neg. Euribor (a dummy which is 1 when the 3M Euribor < 0%), the interaction variable Dummy neg. Euribor x Euribor, 10Y gov bond yield (10 year zero coupon government bond yield from Bloomberg), the interaction variable Dummy neg. Euribor x gov. bond yield, GDP growth (year on year nominal GDP growth) and inflation (year on year growth of the consumer price index).
Further structural explanatory variables are the dummies Basel I, StA Approach (Standardized Approach), Mixed Approach (banks have different portfolios under different approaches) and F-IRB (Foundation Internal Rating Based Approach).
$^{***} p < 0.01$; $^{**} p < 0.05$; $^{*} p < 0.1$. We use cluster robust standard errors with clustering at the bank level.

Figure 6: Direct and indirect SSM effects on the return on risk weighted assets.



The figure shows the estimated direct (red dashed line) and total (blue solid line) SSM effects together with 90% confidence intervals for the time period 2013-2019 from model RORWA 4 in Table 5 and model RORWA 8 in Table B.12.

5. Why does the SSM improve Return on Risk Weighted Assets?

We found that the SSM affects the return on assets and the return on risk weighted assets to a large extent directly. Indirect effects that result from adjustments of bank-specific variables appear to play a minor role. In Section 3.2 we argued that this direct effect could result from increased confidence in the soundness of SSM banks and better risk management. In this section, we present additional results that support these arguments.

If bank customers think that deposits are safer in SSM banks, then SSM banks can pay lower deposit rates than non-SSM banks. Furthermore, stricter supervision under the SSM could lead to improvements in the management of risks. Consequently, SSM banks may be able to charge higher lending rates without taking excessive risks. If this is true, we should find negative SSM effects on deposit rates and positive SSM effects on the lending rates of SSM banks.

To test for the presence of such effects, we estimate the total SSM effects on the deposit rates and the lending rates of SSM banks using regressions that only include bank size, bank fixed effects and time effects for SSM and non-SSM banks. We do not include structural variables and other bank-specific variables, as the former are not required for identifying SSM effects and the later could block possible indirect effects of the SSM. In the regressions, we use interest expenses divided by total deposits as a proxy for the deposit rate and interest income divided by gross loans a proxy for the lending rate.

Table 6 shows the results for the regressions. Consistent with increased confidence in SSM banks, the SSM has a negative impact on the deposit rate. Consistent with better risk management, we find a positive impact of the SSM on the lending rate. The findings for the deposit and lending rates are also consistent with the positive SSM effects that we found for the return on assets and the return on risk weighted assets of SSM banks. Taken together, the results therefore support the arguments of increased confidence and better risk management which positively contribute to the profitability of SSM banks.

The higher lending rates of SSM banks could be associated with higher risk taking and lower lending growth. To check for this possibility, we also estimate the total SSM effects on the loan loss reserve ratio and on net loan growth of SSM banks (third and sixth columns in Table 6). If higher lending rates were the result of more risk-taking we would observe positive SSM effects on lending rates and on loan loss reserves. We do not find any positive total SSM effects on the loan loss reserve ratio. On the contrary, we find negative effects. In addition, we also find positive total SSM effects on net loan growth.[21] These results therefore strengthen the argument for better risk management in SSM banks.

The deposit rate model in Table 6 suggests that SSM banks were able to lower their deposit rates. This may have reduced their non-bank deposits and thereby lowered their non-bank deposit ratio, calculated as the non-bank deposits divided by total assets. We therefore check whether the SSM has a negative impact on the non-bank deposit ratio. We find positive total SSM effects on the non-bank deposit ratio despite lower deposit rates. SSM banks have been able to attract relatively more non-bank deposits, which supports the argument of increased confidence in SSM banks.

More confidence in the SSM banks may also increase net non-interest related income such as net fee and commission income. To test this prediction, we estimate the total SSM effects on the net non-interest income ratio. We find positive and statistically significant SSM effects from 2013 onward.

As a robustness check, we run all regressions in Table 6 for the 200 largest banks only. The results of this check are collected in Table D.21 in Appendix D. All our results also hold for the smaller subsample.

[21] Net loans are defined as gross loans to non-banks minus loan reserves.

Table 6: Confidence and improved risk management. Total SSM effects on the deposit rate, lending rate, loan loss reserves, non-bank deposit ratio, net non-interest income ratio, and net loan growth.

	Deposit rate	Lending rate	LLR	Non-bank deposit ratio	Net non-interest income	Net loan growth
log(TA)	0.6340^{***}	-0.0251	-0.2301	-8.4101^{***}	-0.2081^{***}	1.9114^{**}
	(0.2316)	(0.1780)	(0.2122)	(2.0033)	(0.0276)	(0.9300)
SSM 2013	-0.1252	0.1453	0.2364	1.8692^{**}	0.0629^{**}	1.2474
	(0.1640)	(0.1510)	(0.2437)	(0.8278)	(0.0247)	(1.4706)
SSM 2014	-0.1570	0.2119	-0.1001	2.4957^{**}	0.1028^{***}	6.2402^{***}
	(0.2362)	(0.2206)	(0.3176)	(1.2286)	(0.0330)	(1.7594)
SSM 2015	-0.3329	0.3936	-0.4570	3.8623^{**}	0.1246^{***}	6.8589^{***}
	(0.3151)	(0.2717)	(0.3747)	(1.5181)	(0.0393)	(2.2980)
SSM 2016	-0.4165	0.4243	-0.8608^{*}	4.1038^{**}	0.1293^{***}	9.2178^{***}
	(0.3860)	(0.3400)	(0.4490)	(1.9656)	(0.0486)	(2.5109)
SSM 2017	-0.3914	0.6679^{*}	-1.5127^{***}	4.1918^{*}	0.1697^{***}	10.6978^{***}
	(0.4660)	(0.3972)	(0.5327)	(2.3396)	(0.0574)	(3.0695)
SSM 2018	-0.4436	0.7470^{*}	-2.1310^{***}	5.3920^{**}	0.2144^{***}	15.4885^{***}
	(0.5315)	(0.4529)	(0.6395)	(2.6679)	(0.0676)	(3.3456)
SSM 2019	-0.1888	0.9181^{*}	-3.0032^{***}	5.0744^{*}	0.2376^{***}	15.2921^{***}
	(0.6135)	(0.5174)	(0.7294)	(2.9910)	(0.0748)	(3.8275)
$G_i \times t$	-0.0436	-0.0200	0.3420^{***}	-0.1915	-0.0375^{***}	-1.4781^{***}
	(0.0649)	(0.0545)	(0.0790)	(0.3718)	(0.0090)	(0.4025)
Bank fixed effects	*yes*	*yes*	*yes*	*yes*	*yes*	*yes*
Time fixed effects	*yes*	*yes*	*yes*	*yes*	*yes*	*yes*
R-squared	0.91	0.90	0.83	0.94	0.92	0.42
Adj. R-squared	0.89	0.89	0.80	0.93	0.90	0.32
Number of obs.	8,357	8,357	8,357	8,357	8,357	8,357
Number of groups	1,158	1,158	1,158	1,158	1,158	1,158
Average. Obs. group	7.22	7.22	7.22	7.22	7.22	7.22
Min. Obs. group	3	3	3	3	3	3
Max. Obs. Group	14	14	14	14	14	14

Source: Own calculations and SNL.
The columns "Deposit Rate", "Lending Rate", "LLR", "non-bank deposit ratio", "Net non-interest income" and "net loan growth" report the estimation results for the deposit rate, the lending rate, the loan loss reserve ratio, the non-bank deposit ratio, the net non-interest income ratio and net loan growth.
The non-bank deposit ratio is calculated by dividing non-bank deposits by total assets.
The net non-interest income ratio is defined as net non-interest income divided by total assets.
Net loan growth is the growth rate of net loans which are defined as gross loans minus non-performing loans.
The variable log(TA) denotes the logarithm of total assets.
SSM = 1 when the bank is an SSM bank and the SSM is active. SSM = 0 otherwise. The 2013–2019 SSM dummies take on the value 1 when the bank is an SSM bank and the SSM is active (or anticipated) in the corresponding year and are 0 otherwise. $G_i = 1$ when a bank is an SSM bank and $G_i = 0$ zero otherwise. t denotes time.
$^{***}p < 0.01$; $^{**}p < 0.05$; $^{*}p < 0.1$. We use cluster robust standard errors with clustering at the bank level.

6. Conclusion

The introduction of the SSM in 2014 was a major regulatory change, as the supervision of large and economically important euro area banks was transferred from national authorities to the ECB. In this paper, we empirically investigated whether and how the SSM affects profitability and risk weights.

We found that the SSM has a positive impact on the return on assets of SSM banks and a negative impact on average risk weights. Importantly, the negative SSM effects on average risk weights are not due to a reduction in average credit risk weights. Since the credit risk weighted assets are part of the total risk weighted assets, this indicates that SSM banks have reduced the risk weighted assets for market risk and operational risk, suggesting that SSM have reduced their market and operational risks.

We also found that the SSM had an increasingly positive impact on the return on risk weighted assets – a measure that captures the combined impact of the SSM on profitability and risk weights. This result suggests that the SSM has helped to improve the impaired profitability of SSM banks. Overall, our results suggest that SSM banks benefit from SSM supervision because the SSM led to an increase in profitability and a reduction in risk.

In our resampling procedure, we compared 10,000 times different subsets of around 90% of SSM banks with around 90% of non SSM banks. The results of this resampling procedure show that our results are stable and indeed emanate from the SSM. There is no specific SSM bank, group of SSM banks, specific non-SSM bank or group of non-SSM banks that drive our results. In addition, robustness checks where we only included large banks, also show that our results are not driven by large SSM or large non-SSM banks.

To learn more about the origin of SSM effects, we distinguished between indirect SSM effects arising from adjustments of bank-specific variables, direct SSM effects, and total SSM effects. We find that the impact of the SSM results primarily from direct effects. Our empirical results suggest that these effects arise from increased confidence of market participants in the soundness of SSM banks and better risk management. Consistent with the presence of confidence effects, we find that the SSM has a negative effect on deposit rates, a positive effect on non-bank deposit inflows, and a positive effect on net non-interest income. In addition, we find that the SSM has a negative impact on loan loss reserves despite a positive effect on lending rates without reducing loan growth, which is consistent with improved risk management in SSM banks.

Finally, our empirical results do not support the arguments put forward by some bankers and lobbyists that the SSM would impose unreasonably high capital requirements on banks, which in turn would reduce profitability. It is true that the profitability of European banks is low for a number of reasons, but the SSM has helped to improve the profitability of SSM banks. As intended, the SSM has restored confidence in SSM banks and therefore contributes to the stability and soundness of the euro area banking system.

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Appendix A. Summary Statistics: SSM and Non-SSM Banks

In this section we provide separate summary statistics for SSM and non-SSM banks. For comparability, the summary statistics for the SSM banks in Table A.7 are computed over the entire sample period and not just for the period since 2014, when the SSM became active.

Table A.7: Summary statistics for SSM banks.

	Min.	1st Qu.	Median	Mean	3rd Qu.	Max	Data Cov.
Dependent variables							
ROA	-1.56	0.44	0.78	0.89	1.30	3.27	80.76
RW	1.45	28.95	44.00	45.26	59.97	110.79	78.72
CRW	0.00	52.83	69.39	69.44	82.65	181.36	59.03
RORWA	-2.80	1.23	1.93	1.97	2.63	5.82	76.63
Bank-specific variables							
log(TA)	2.20	17.25	17.93	18.03	19.01	21.51	82.17
TA growth	-24.98	-3.89	1.69	1.94	7.26	31.37	71.53
Labor Costs over TA	0.01	0.44	0.71	0.71	0.92	2.47	80.25
Tier 1 capital ratio	4.29	9.62	12.86	13.82	16.19	43.52	77.42
Leverage ratio	1.15	3.87	5.33	5.81	6.90	24.98	77.25
Loans to TA	0.01	45.22	60.92	56.88	71.12	89.46	75.55
loan-to-deposit ratio	1.10	89.75	115.71	118.30	144.58	279.41	72.38
NPL ratio (bank level)	0.00	1.96	4.32	6.33	8.85	29.00	34.41
LLR ratio (bank level)	0.00	0.96	2.08	2.71	3.66	11.63	71.82
NIM	-0.72	0.72	1.26	1.34	1.83	4.10	80.98
Deposit rate	0.00	1.19	2.73	3.17	4.47	9.53	64.69
Lending rate	0.00	3.74	5.11	5.56	6.98	15.94	72.61
Net non-interest income ratio	-0.23	0.26	0.56	0.61	0.90	2.14	80.42
Non-bank deposit ratio	0.00	29.23	48.49	47.19	63.66	89.95	77.82
Net loan growth	-29.08	-3.54	2.09	2.90	8.17	36.65	69.84
Basel I	0.00	0.00	0.00	0.10	0.00	1.00	100.00
StA Approach	0.00	0.00	0.00	0.46	1.00	1.00	100.00
Mixed Approach	0.00	0.00	0.00	0.41	1.00	1.00	100.00
F-IRB	0.00	0.00	0.00	0.03	0.00	1.00	100.00
A-IRB	0.00	0.00	0.00	0.01	0.00	1.00	100.00

The table shows for all variables the minimum (Min.), first quantile (1st Qu.), median (Median), mean (Mean), third quantile (3rd Qu.), maximum (Max) and data coverage (Data Cov.), which refers to the percentage of available observations if the panel was balanced. The data are annual and cover 2,668 banks over the period 2005–2019 for the countries FR, DE, NL, ES, IE, BE, GB, GR, SI, LU, CY, IT, PT, AT, FI, SK, MT, LT, LV, RO and EE.
ROA is the return on assets. RW and CRW refer to risk weighted assets and credit risk weighted assets divided by total assets (TA). RORWA is the return on risk weighted assets. All ratios and returns are in percentage terms.
Log(TA) is the logarithm of total assets. TA growth refers to total asset growth. Labor costs over TA refers to labor costs divided by total assets. Leverage ratio is the Tier 1 capital divided by total assets. Loans to TA is non-bank loans divided by total assets. The loan-to-deposit ratio is the ratio of non-bank loans to non-bank deposits. The NPL ratio (bank level) refers to the non-performing loan ratio. The LLR ratio (bank level) is loan loss reserves divided by total gross loans. NIM is the net interest rate margin defined as interest income minus interest rate expenses divided by total assets. Basel I stands for the Basel I approach, StA for the Standardized Approach, F-IRB for the Foundation Internal Ratings Based Approach, and A-IRB denotes the Advanced IRB Approach. In the Mixed Approach banks use the StA, F-IRB and the A-IRB for different portfolios.
The deposit rate is defined as interest expenses divided by total deposits. The lending rate is defined as interest income divided by total gross loans. The net non-interest income ratio is net non-interest income divided by total assets. The non-bank deposit ratio is defined as deposits from non-banks divided by total assets. Net loan growth is the growth rate of non-bank loans net of loan loss reserves.
All bank-specific variables are from SNL.

Table A.8: Summary statistics for non-SSM banks.

	Min.	1st Qu.	Median	Mean	3rd Qu.	Max	Data Cov.
Dependent variables							
ROA	-1.56	0.59	0.85	0.88	1.15	3.27	57.05
RW	0.00	45.06	55.33	55.35	65.06	149.84	48.69
CRW	0.00	67.91	79.61	80.64	91.89	182.93	34.80
RORWA	-2.80	1.09	1.54	1.67	2.11	5.99	46.80
Bank-specific variables							
log(TA)	3.22	12.46	13.73	13.90	15.12	21.68	60.12
TA growth	-25.21	-0.02	3.03	3.20	6.33	31.63	50.37
Labor Costs over TA	0.01	0.83	1.10	1.08	1.31	3.14	56.84
Tier 1 capital ratio	4.05	11.78	14.77	16.02	18.69	43.92	47.03
Leverage ratio	1.07	6.31	8.17	8.66	10.34	25.11	46.64
Loans to TA	0.01	50.74	63.36	60.05	73.85	89.98	45.41
loan-to-deposit ratio	1.00	66.76	86.17	91.27	108.57	279.37	53.88
NPL ratio (bank level)	0.00	1.39	3.11	5.47	7.22	29.32	28.11
LLR ratio (bank level)	0.00	0.70	1.50	2.22	2.89	11.64	25.36
NIM	-1.50	1.42	1.87	1.82	2.26	5.41	58.25
Deposit rate	0.00	0.56	1.21	1.66	2.19	9.53	54.24
Lending rate	0.00	3.42	4.53	4.98	6.01	15.97	45.28
Net non-interest income ratio	-0.82	0.47	0.63	0.65	0.80	2.14	57.31
Non-bank deposit ratio	0.00	54.65	71.64	63.36	79.76	89.99	57.12
Net loan growth	-29.57	-0.03	3.58	3.82	7.33	37.05	48.57
Basel I	0.00	0.00	0.00	0.13	0.00	1.00	100.00
StA Approach	0.00	1.00	1.00	0.81	1.00	1.00	100.00
Mixed Approach	0.00	0.00	0.00	0.04	0.00	1.00	100.00
F-IRB	0.00	0.00	0.00	0.01	0.00	1.00	100.00
A-IRB	0.00	0.00	0.00	0.01	0.00	1.00	100.00

The table shows for all variables the minimum (Min.), first quantile (1st Qu.), median (Median), mean (Mean), third quantile (3rd Qu.), maximum (Max) and data coverage (Data Cov.), which refers to the percentage of available observations if the panel was balanced. The data are annual and cover 2,668 banks over the period 2005–2019 for the countries FR, DE, NL, ES, IE, BE, GB, GR, SI, LU, CY, IT, PT, AT, FI, SK, MT, LT, LV, RO and EE.

ROA is the return on assets. RW and CRW refer to risk weighted assets and credit risk weighted assets divided by total assets (TA). RORWA is the return on risk weighted assets. All ratios and returns are in percentage terms.

Log(TA) is the logarithm of total assets. TA growth refers to total asset growth. Labor costs over TA refers to labor costs divided by total assets. Leverage ratio is the Tier 1 capital divided by total assets. Loans to TA is non-bank loans divided by total assets. The loan-to-deposit ratio is the ratio of non-bank loans to non-bank deposits. The NPL ratio (bank level) refers to the non-performing loan ratio. The LLR ratio (bank level) is loan loss reserves divided by total gross loans. NIM is the net interest rate margin defined as interest income minus interest rate expenses divided by total assets. Basel I stands for the Basel I approach, StA for the Standardized Approach, F-IRB for the Foundation Internal Ratings Based Approach, and A-IRB denotes the Advanced IRB Approach. In the Mixed Approach banks use the StA, F-IRB and the A-IRB for different portfolios.

The deposit rate is defined as interest expenses divided by total deposits. The lending rate is defined as interest income divided by total gross loans. The net non-interest income ratio is net non-interest income divided by total assets. The non-bank deposit ratio is defined as deposits from non-banks divided by total assets. Net loan growth is the growth rate of non-bank loans net of loan loss reserves.

All bank-specific variables are from SNL.

Appendix B. Total SSM Effects

This appendix shows the estimation results for the total SSM effects on the return on assets, the average risk weight, the average credit risk weight, and the return on risk weighted assets.

Table B.9: Total SSM effects on return on assets.

	ROA 5	ROA 6	ROA 7	ROA 8	ROA 9
log(TA)	-0.1079^{***}	-0.1040^{**}	-0.1012^{**}	-0.1019^{**}	-0.0894^{**}
	(0.0403)	(0.0406)	(0.0405)	(0.0403)	(0.0404)
SSM dummy	0.0910^{***}	-0.0003			
	(0.0340)	(0.0426)			
SSM 2013			0.0330	0.0037	0.0368
			(0.0434)	(0.0531)	(0.0514)
SSM 2014			0.0391	-0.0004	0.0347
			(0.0482)	(0.0627)	(0.0600)
SSM 2015			0.0872^{**}	0.0379	0.0853
			(0.0441)	(0.0802)	(0.0763)
SSM 2016			0.0499	-0.0095	0.0292
			(0.0479)	(0.0987)	(0.0950)
SSM 2017			0.1573^{***}	0.0881	0.1077
			(0.0476)	(0.1167)	(0.1120)
SSM 2018			0.1497^{***}	0.0706	0.1068
			(0.0522)	(0.1352)	(0.1300)
SSM 2019			0.1458^{***}	0.0568	0.1016
			(0.0505)	(0.1511)	(0.1463)
					(0.0355)
$G_i \times t$		0.0160^{**}		0.0098	0.0034
		(0.0077)		(0.0160)	(0.0157)
Herfindahl index (ECB)	-0.0059^{*}	-0.0063^{*}	-0.0063^{**}	-0.0063^{**}	
	(0.0032)	(0.0032)	(0.0032)	(0.0032)	
3M-Euribor	-0.0787^{***}	-0.0886^{***}	-0.0796^{***}	-0.0853^{***}	
	(0.0284)	(0.0291)	(0.0285)	(0.0295)	
Dummy neg. Euribor	-0.6816^{***}	-0.7600^{***}	-0.6912^{***}	-0.7348^{***}	
	(0.1250)	(0.1361)	(0.1260)	(0.1449)	
Dummy neg. Euribor x Euribor	0.4367^{***}	0.4597^{***}	0.4308^{***}	0.4380^{***}	
	(0.0645)	(0.0669)	(0.0667)	(0.0686)	
10Y gov bond yield	-0.0359^{***}	-0.0379^{***}	-0.0368^{***}	-0.0378^{***}	
	(0.0081)	(0.0080)	(0.0081)	(0.0081)	
Dummy neg. Euribor x gov. bond yield	-0.0378^{*}	-0.0408^{*}	-0.0421^{*}	-0.0423^{*}	
	(0.0227)	(0.0229)	(0.0236)	(0.0236)	
GDP growth	0.0125^{**}	0.0119^{**}	0.0119^{**}	0.0117^{**}	
	(0.0050)	(0.0049)	(0.0051)	(0.0050)	
Inflation	-0.0115^{***}	-0.0115^{***}	-0.0117^{***}	-0.0117^{***}	
	(0.0030)	(0.0030)	(0.0030)	(0.0030)	
Bank Fixed/Time effects	*yes*	*yes*	*yes*	*yes*	*yes*
R-squared	0.69	0.69	0.69	0.69	0.68
Adj. R-squared	0.64	0.64	0.64	0.64	0.63
Number of obs.	8,727	8,727	8,727	8,727	8,727
Number of groups	1,170	1,170	1,170	1,170	1,170
Average. Obs. group	7.46	7.46	7.46	7.46	7.46
Min. Obs. group	3	3	3	3	3
Max. Obs. Group	14	14	14	14	14

Source: Own calculations. SNL. ECB. World Bank. Bloomberg. Eurostat.
The dependent variable is the return on assets before credit impairment and tax (ROA).
SSM = 1 when the bank is an SSM bank and the SSM is active. SSM = 0 otherwise. The 2013–2019 SSM dummies take on the value 1 when the bank is an SSM bank and the SSM is active (or anticipated) in the corresponding year and are 0 otherwise. $G_i = 1$ when a bank is an SSM bank and $G_i = 0$ zero otherwise. t denotes time.
The structural explanatory variables are the Herfindahl index, the 3M-Euribor, Dummy neg. Euribor (a dummy which is 1 when the 3M-Euribor is negative and 0 otherwise, the interaction variable Dummy neg. Euribor x Euribor, 10Y gov bond yield (10 year zero coupon government bond yield from Bloomberg), the interaction Dummy neg. Euribor x gov. bond yield, GDP growth (year on year nominal GDP growth) and inflation (year on year growth of the consumer price index).
$^{***}p < 0.01$; $^{**}p < 0.05$; $^{*}p < 0.1$. We use cluster robust standard errors with clustering at the bank level.

Table B.10: Total SSM effects on the average risk weight.

	RW 5	RW 6	RW 7	RW 8	RW 9
log(TA)	-9.1810^{***}	-9.4532^{***}	-9.6481^{***}	-9.6610^{***}	-9.5896^{***}
	(1.8995)	(1.9101)	(1.9260)	(1.9294)	(1.9185)
SSM dummy	-3.1381^{***}	0.9790			
	(1.2107)	(1.1171)			
SSM 2013			-5.2809^{***}	-5.7813^{***}	-6.2720^{***}
			(1.0026)	(1.0620)	(1.0166)
SSM 2014			-1.9376	-2.6233^{*}	-3.5897^{**}
			(1.1804)	(1.5925)	(1.4817)
SSM 2015			-3.3882^{***}	-4.2577^{**}	-5.5328^{***}
			(1.2880)	(2.0365)	(1.8864)
SSM 2016			-4.3965^{***}	-5.4449^{**}	-6.8716^{***}
			(1.4568)	(2.4829)	(2.3096)
SSM 2017			-4.8220^{***}	-6.0481^{**}	-7.6540^{***}
			(1.5501)	(2.8991)	(2.7224)
SSM 2018			-5.1107^{***}	-6.5186^{*}	-8.3379^{***}
			(1.6724)	(3.3498)	(3.1548)
SSM 2019			-7.7147^{***}	-9.3007^{**}	-11.3191^{***}
			(1.7249)	(3.8360)	(3.6165)
$G_i \times t$		-0.7403^{***}		0.1777	0.3626
		(0.2401)		(0.4462)	(0.4278)
10Y gov bond yield	0.5832^{***}	0.6541^{***}	0.5752^{***}	0.5565^{**}	
	(0.2139)	(0.2142)	(0.2158)	(0.2241)	
Bank Fixed effects	*yes*	*yes*	*yes*	*yes*	*yes*
Time fixed effects	*yes*	*yes*	*yes*	*yes*	*yes*
R-squared	0.85	0.85	0.85	0.85	0.85
Adj. R-squared	0.83	0.83	0.83	0.83	0.83
Number of obs.	7,979	7,979	7,979	7,979	7,979
Number of groups	1,135	1,135	1,135	1,135	1,135
Average. Obs. group	7.03	7.03	7.03	7.03	7.03
Min. Obs. group	3	3	3	3	3
Max. Obs. Group	14	14	14	14	14

Source: Own calculations. SNL. ECB. World Bank. Bloomberg. Eurostat.
The dependent variable is the average risk weight (RW).
SSM = 1 when the bank is an SSM bank and the SSM is active. SSM = 0 otherwise. The 2013–2019 SSM dummies take on the value 1 when the bank is an SSM bank and the SSM is active (or anticipated) in the corresponding year and are 0 otherwise. $G_i = 1$ when a bank is an SSM bank and $G_i = 0$ zero otherwise. t denotes time.
The structural explanatory variables are the dummies for Basel I, the StA Approach (Standardized Approach), the Mixed Approach (banks have different portfolios under different approaches) and the F-IRB (Foundation Internal Rating Based Approach). The 10Y gov bond yield refers to the 10 year zero coupon government bond yield from Bloomberg.
$^{***}p < 0.01$; $^{**}p < 0.05$; $^{*}p < 0.1$. We use cluster robust standard errors with clustering at the bank level.

Table B.11: Total SSM effects on the average credit risk weight.

	CR RW 5	CR RW 6	CR RW 7	CR RW 8	CR RW 9
log(TA)	-3.9717	-4.6902	-4.7806^{*}	-4.7094	-4.5811
	(2.8284)	(2.8696)	(2.9038)	(2.8936)	(2.9151)
SSM dummy	-3.1163^{*}	4.1372^{**}			
	(1.8669)	(1.7020)			
SSM 2013			-4.0953^{***}	-0.9067	-2.5785
			(1.4578)	(1.7447)	(1.6986)
SSM 2014			-0.5700	3.9066	0.8673
			(1.8210)	(2.8692)	(2.6926)
SSM 2015			-2.3743	3.3876	-0.5882
			(2.1050)	(3.8198)	(3.5593)
SSM 2016			-4.7282^{**}	2.2751	-2.2478
			(2.2556)	(4.6655)	(4.4122)
SSM 2017			-4.6387^{*}	3.6170	-1.5199
			(2.4328)	(5.5103)	(5.2571)
SSM 2018			-6.0929^{**}	3.4037	-2.3610
			(2.5906)	(6.3932)	(6.1247)
SSM 2019			-7.9242^{***}	2.8229	-3.6762
			(2.5278)	(7.1527)	(6.8270)
$G_i \times t$		-1.3635^{***}		-1.2393	-0.6197
		(0.3451)		(0.8463)	(0.8200)
10Y gov bond yield	1.3866^{***}	1.4909^{***}	1.3598^{***}	1.4763^{***}	
	(0.4297)	(0.4278)	(0.4295)	(0.4418)	
Bank Fixed effects	*yes*	*yes*	*yes*	*yes*	*yes*
Time fixed effects	*yes*	*yes*	*yes*	*yes*	*yes*
R-squared	0.88	0.88	0.88	0.88	0.88
Adj. R-squared	0.86	0.86	0.86	0.86	0.86
Number of obs.	7,304	7304	7,304	7,304	7,304
Number of groups	1,071	1,071	1,071	1,071	1,071
Average. Obs. group	6.82	6.82	6.82	6.82	6.82
Min. Obs. group	3	3	3	3	3
Max. Obs. Group	14	14	14	14	14

Source: Own calculations. SNL. ECB. World Bank. Bloomberg. Eurostat.
The dependent variable is average credit risk weight (CRW).
SSM = 1 when the bank is an SSM bank and the SSM is active. SSM = 0 otherwise. The 2013–2019 SSM dummies take on the value 1 when the bank is an SSM bank and the SSM is active (or anticipated) in the corresponding year and are 0 otherwise. $G_i = 1$ when a bank is an SSM bank and $G_i = 0$ zero otherwise. t denotes time.
The structural explanatory variables are the dummies for Basel I, the StA Approach (Standardized Approach), the Mixed Approach (banks have different portfolios under different approaches) and the F-IRB (Foundation Internal Rating Based Approach). The 10Y gov bond yield refers to the 10 year zero coupon government bond yield from Bloomberg.
$^{***}p < 0.01$; $^{**}p < 0.05$; $^{*}p < 0.1$. We use cluster robust standard errors with clustering at the bank level.

Table B.12: Total SSM effects on the return on risk weighted assets.

	RORWA 5	RORWA 6	RORWA 7	RORWA 8	RORWA 9
log(TA)	0.0171	0.0222	0.0338	0.0371	0.0942
	(0.0920)	(0.0924)	(0.0929)	(0.0930)	(0.0950)
SSM dummy	0.3073***	0.1857*			
	(0.0931)	(0.1126)			
SSM 2013			0.2627**	0.3842***	0.4389***
			(0.1201)	(0.1449)	(0.1372)
SSM 2014			0.2421*	0.4063**	0.4248***
			(0.1324)	(0.1706)	(0.1566)
SSM 2015			0.3599***	0.5649***	0.6735***
			(0.1326)	(0.2143)	(0.1967)
SSM 2016			0.2443**	0.4914**	0.5636**
			(0.1213)	(0.2411)	(0.2226)
SSM 2017			0.4996***	0.7877***	0.7867***
			(0.1357)	(0.2831)	(0.2597)
SSM 2018			0.4191***	0.7483**	0.7929***
			(0.1385)	(0.3257)	(0.3003)
SSM 2019			0.4842***	0.8547**	0.9033***
			(0.1227)	(0.3566)	(0.3325)
$G_i \times t$		0.0213		−0.0408	−0.0457
		(0.0183)		(0.0375)	(0.0355)
Herfindahl index (ECB)	−0.0242***	−0.0246***	−0.0256***	−0.0254***	
	(0.0070)	(0.0071)	(0.0071)	(0.0071)	
3M-Euribor	0.1645***	0.1869***	0.1779***	0.1402***	
	(0.0449)	(0.0502)	(0.0449)	(0.0528)	
Dummy neg. Euribor	0.9696**	1.0422**	1.0971**	1.0664**	
	(0.4273)	(0.4426)	(0.4571)	(0.4564)	
Dummy neg. Euribor x Euribor	3.6296***	3.8432***	4.0565***	4.0135***	
	(1.2354)	(1.2788)	(1.3304)	(1.3297)	
10Y gov bond yield	−0.0560***	−0.0587***	−0.0581***	−0.0538***	
	(0.0181)	(0.0182)	(0.0181)	(0.0185)	
Dummy neg. Euribor x gov. bond yield	0.0447	0.0408	0.0395	0.0398	
	(0.0525)	(0.0531)	(0.0549)	(0.0548)	
Inflation	−0.0348***	−0.0347***	−0.0348***	−0.0349***	
	(0.0066)	(0.0066)	(0.0068)	(0.0068)	
GDP growth	0.0475***	0.0466***	0.0442***	0.0449***	
	(0.0124)	(0.0123)	(0.0125)	(0.0124)	
Bank Fixed effects	*yes*	*yes*	*yes*	*yes*	*yes*
Time fixed effects	*yes*	*yes*	*yes*	*yes*	*yes*
R-squared	0.62	0.62	0.63	0.63	0.61
Adj. R-squared	0.56	0.56	0.57	0.57	0.55
Number of obs.	8,669	8,669	8,669	8,669	8,669
Number of groups	1,164	1,164	1,164	1,164	1,164
Average. Obs. group	7.45	7.45	7.45	7.45	7.45
Min. Obs. group	3	3	3	3	3
Max. Obs. Group	14	14	14	14	14

Source: Own calculations. SNL. ECB. World Bank. Bloomberg. Eurostat.
The dependent variable is return on risk weighted assets (RORWA).
SSM = 1 when the bank is an SSM bank and the SSM is active. SSM = 0 otherwise. The 2013–2019 SSM dummies take on the value 1 when the bank is an SSM bank and the SSM is active (or anticipated) in the corresponding year and are 0 otherwise. $G_i = 1$ when a bank is an SSM bank and $G_i = 0$ zero otherwise. t denotes time.
The structural explanatory variables are the Herfindahl index, the 3M Euribor, Dummy neg. Euribor (a dummy which is 1 when the 3M Euribor < 0%), the interaction variable Dummy neg. Euribor x Euribor, 10Y gov bond yield (10 year zero coupon government bond yield from Bloomberg), the interaction variable Dummy neg. Euribor x gov. bond yield, GDP growth (year on year nominal GDP growth) and inflation (year on year growth of the consumer price index).
Further structural explanatory variables are the dummies Basel I, StA Approach (Standardized Approach), Mixed Approach (banks have different portfolios under different approaches) and F-IRB (Foundation Internal Rating Based Approach).
$^{***}p < 0.01$; $^{**}p < 0.05$; $^{*}p < 0.1$. We use cluster robust standard errors with clustering at the bank level.

Appendix C. Stability of the SSM Effects

Tables C.13 – C.16 report the results of the resampling procedure for ROA Model 4 in Table 2, RW Model 4 in Table 3, CRW Model 4 in Table 4, and RORWA Model 4 in Table 5. In the resampling procedure, we compare 10,000 times different subsets of around 90% of SSM banks with around 90% of non SSM banks. The results imply that no specific SSM bank, group of SSM banks, no specific non SSM bank or group of non SSM banks drives our results.

Table C.13: Stability of coefficients of ROA Model 4 in Table 2.

	Estimation	Q 0.05	Q 0.25	Mean	Median	Q 0.75	Q 0.95
log(TA)	-0.11	-0.13	-0.12	-0.11	-0.11	-0.10	-0.08
SSM 2013	0.02	-0.01	0.01	0.02	0.02	0.03	0.05
SSM 2014	0.01	-0.02	-0.00	0.01	0.01	0.03	0.05
SSM 2015	0.06	0.01	0.04	0.06	0.06	0.08	0.10
SSM 2016	0.03	-0.03	0.01	0.03	0.03	0.05	0.08
SSM 2017	0.14	0.07	0.12	0.14	0.14	0.17	0.21
SSM 2018	0.14	0.06	0.11	0.14	0.14	0.17	0.21
SSM 2019	0.14	0.05	0.11	0.14	0.14	0.17	0.22
$G_i \times t$	0.01	-0.00	0.00	0.01	0.01	0.01	0.02
LLR ratio (bank level)	0.02	0.01	0.01	0.02	0.02	0.02	0.02
Labor Costs over TA	-0.16	-0.19	-0.17	-0.16	-0.16	-0.14	-0.12
Leverage ratio	0.01	0.00	0.01	0.01	0.01	0.01	0.01
loan-to-deposit ratio	0.00	0.00	0.00	0.00	0.00	0.00	0.00
RW	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Herfindahl index (ECB)	-0.01	-0.01	-0.01	-0.01	-0.01	-0.00	-0.00
3M-Euribor	-0.08	-0.10	-0.09	-0.08	-0.08	-0.08	-0.07
Dummy neg. Euribor	-0.75	-0.83	-0.78	-0.75	-0.75	-0.71	-0.66
Dummy neg. Euribor x Euribor	0.47	0.43	0.45	0.47	0.47	0.49	0.51
10Y gov bond yield	-0.04	-0.05	-0.04	-0.04	-0.04	-0.04	-0.04
Dummy neg. Euribor x gov. bond yield	-0.04	-0.06	-0.05	-0.04	-0.04	-0.04	-0.03
GDP growth	0.01	0.01	0.01	0.01	0.01	0.01	0.02
Inflation	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01

Source: Own calculations. SNL. ECB. World Bank. Bloomberg. Eurostat.
The dependent variable is ROA.
The SSM 2013-SSM 2019 dummies are 1 when the SSM is active or anticipated in the corresponding year and 0 otherwise. The SSM dummies correspond to the respective variables D_{it} in Eq. (1) - Eq. (4). G_i is a dummy that is one when a bank belongs to the group of SSM banks and is zero otherwise, and t denotes time.
Column "Estimation" restates the estimation results of model ROA 4 in Table 2.
The columns Q 0.05, Q 0.25, Q 0.75 and Q 0.95 refer to the 5%, 25%, 0.75% and 0.95% quantiles based on 10,000 estimations with different subsets of 90% of the data.

Table C.14: Stability of coefficients of RW Model 4 in Table 3.

	Estimation	Q 0.05	Q 0.25	Mean	Median	Q 0.75	Q 0.95
log(TA)	-4.34	-5.11	-4.64	-4.34	-4.35	-4.05	-3.52
SSM 2013	-4.87	-5.34	-5.07	-4.86	-4.88	-4.67	-4.33
SSM 2014	-0.92	-1.61	-1.22	-0.92	-0.94	-0.63	-0.15
SSM 2015	-2.30	-3.18	-2.67	-2.29	-2.31	-1.92	-1.30
SSM 2016	-3.75	-4.81	-4.19	-3.74	-3.76	-3.30	-2.57
SSM 2017	-4.22	-5.45	-4.76	-4.21	-4.25	-3.70	-2.83
SSM 2018	-4.72	-6.13	-5.33	-4.71	-4.75	-4.13	-3.11
SSM 2019	-7.26	-8.87	-7.95	-7.24	-7.29	-6.59	-5.44
$G_i \times t$	0.23	0.02	0.15	0.23	0.23	0.31	0.42
TA growth	0.01	0.00	0.01	0.01	0.01	0.02	0.02
Loans to TA	0.38	0.36	0.37	0.38	0.38	0.39	0.41
LLR ratio (bank level)	-0.23	-0.31	-0.26	-0.23	-0.23	-0.20	-0.16
Leverage ratio	1.46	1.36	1.42	1.46	1.46	1.50	1.56
10Y gov bond yield	0.16	0.07	0.13	0.16	0.16	0.20	0.25
loan-to-deposit ratio	0.02	0.02	0.02	0.02	0.02	0.03	0.03
ROA	0.53	0.27	0.43	0.53	0.54	0.63	0.76
Basel I	5.59	4.42	5.12	5.57	5.58	6.02	6.74
StA Approach	9.60	8.70	9.30	9.59	9.62	9.91	10.36
Mixed Approach	3.98	3.08	3.68	3.97	4.00	4.29	4.79
F-IRB	5.75	4.67	5.44	5.74	5.77	6.05	6.76

Source: Own calculations. SNL. ECB. World Bank. Bloomberg. Eurostat.
The dependent variable is RW.
The SSM 2013-SSM 2019 dummies are 1 when the SSM is active or anticipated in the corresponding year and 0 otherwise. The SSM dummies correspond to the respective variables D_{it} in Eq. (1) - Eq. (4). G_i is a dummy that is one when a bank belongs to the group of SSM banks and is zero otherwise, and t denotes time.
Column "Estimation" restates the estimation results of Model 4 in Table 3.
The columns Q 0.05, Q 0.25, Q 0.75 and Q 0.95 refer to the 5%, 25%, 0.75% and 0.95% quantiles based on 10,000 estimations with different subsets of 90% of the data.

Table C.15: Stability of coefficients of CRW Model 4 in Table 4.

	Estimation	Q 0.05	Q 0.25	Mean	Median	Q 0.75	Q 0.95
log(TA)	-2.00	-3.36	-2.58	-2.00	-2.08	-1.48	-0.42
SSM 2013	-0.15	-1.08	-0.52	-0.16	-0.16	0.19	0.77
SSM 2014	4.73	3.24	4.16	4.73	4.73	5.30	6.21
SSM 2015	4.90	2.95	4.14	4.89	4.90	5.66	6.82
SSM 2016	4.29	1.92	3.38	4.28	4.31	5.20	6.62
SSM 2017	5.47	2.66	4.39	5.46	5.48	6.55	8.21
SSM 2018	6.21	2.92	4.96	6.20	6.24	7.47	9.38
SSM 2019	5.24	1.52	3.87	5.24	5.30	6.66	8.74
$G_i \times t$	-1.53	-1.93	-1.70	-1.53	-1.54	-1.37	-1.08
TA growth	0.12	0.10	0.11	0.12	0.12	0.13	0.14
LLR ratio (bank level)	-0.50	-0.64	-0.55	-0.50	-0.49	-0.44	-0.37
Leverage ratio	1.71	1.56	1.66	1.71	1.72	1.77	1.85
loan-to-deposit ratio	-0.12	-0.14	-0.13	-0.12	-0.12	-0.12	-0.11
NIM	-2.00	-2.60	-2.24	-2.00	-2.00	-1.77	-1.41
Basel I	38.89	29.01	36.29	38.80	39.24	41.33	47.98
StA Approach	16.46	11.30	15.85	16.42	16.60	17.47	19.37
Mixed Approach	7.04	1.76	6.74	6.99	7.17	7.93	9.58
F-IRB	7.05	3.23	6.65	7.03	7.08	7.64	9.75
10Y gov bond yield	1.56	1.28	1.51	1.56	1.57	1.63	1.75

Source: Own calculations. SNL. ECB. World Bank. Bloomberg. Eurostat.
The dependent variable is CRW.
The SSM 2013-SSM 2019 dummies are 1 when the SSM is active or anticipated in the corresponding year and 0 otherwise. The SSM dummies correspond to the respective variables D_{it} in Eq. (1) - Eq. (4). G_i is a dummy that is one when a bank belongs to the group of SSM banks and is zero otherwise, and t denotes time.
Column “Estimation” restates the estimation results of Model 4 in Table 4.
The columns Q 0.05, Q 0.25, Q 0.75 and Q 0.95 refer to the 5%, 25%, 0.75% and 0.95% quantiles based on 10,000 estimations with different subsets of 90% of the data.

Table C.16: Stability of coefficients of RORWA Model 4 in Table 5.

	Estimation	Q 0.05	Q 0.25	Mean	Median	Q 0.75	Q 0.95
log(TA)	-0.07	-0.12	-0.09	-0.07	-0.07	-0.05	-0.02
SSM 2013	0.38	0.30	0.35	0.38	0.38	0.41	0.45
SSM 2014	0.36	0.27	0.32	0.36	0.36	0.40	0.45
SSM 2015	0.55	0.43	0.50	0.55	0.55	0.59	0.66
SSM 2016	0.50	0.37	0.45	0.50	0.50	0.55	0.62
SSM 2017	0.81	0.65	0.75	0.81	0.81	0.87	0.95
SSM 2018	0.78	0.60	0.71	0.78	0.78	0.85	0.95
SSM 2019	0.91	0.71	0.84	0.91	0.91	0.99	1.09
$G_{i} \times t$	-0.04	-0.06	-0.05	-0.04	-0.04	-0.04	-0.02
LLR ratio (bank level)	0.03	0.03	0.03	0.03	0.03	0.03	0.04
Leverage ratio	-0.02	-0.03	-0.02	-0.02	-0.02	-0.01	-0.01
Labor Costs over TA	-0.36	-0.43	-0.39	-0.36	-0.36	-0.34	-0.30
loan-to-deposit ratio	-0.00	-0.00	-0.00	-0.00	-0.00	-0.00	-0.00
Basel I	-0.27	-0.46	-0.34	-0.27	-0.27	-0.21	-0.05
StA Approach	-0.40	-0.57	-0.44	-0.39	-0.39	-0.34	-0.19
Mixed Approach	-0.05	-0.22	-0.10	-0.04	-0.04	0.01	0.18
F-IRB	-0.28	-0.45	-0.35	-0.28	-0.28	-0.24	0.01
Herfindahl index (ECB)	-0.02	-0.03	-0.03	-0.02	-0.02	-0.02	-0.02
3M-Euribor	0.17	0.14	0.16	0.17	0.17	0.19	0.21
Dummy neg. Euribor	1.50	1.25	1.40	1.50	1.50	1.60	1.76
Dummy neg. Euribor x Euribor	5.21	4.48	4.91	5.21	5.20	5.50	5.96
10Y gov bond yield	-0.06	-0.07	-0.06	-0.06	-0.06	-0.05	-0.05
Dummy neg. Euribor x gov. bond yield	-0.02	-0.06	-0.04	-0.02	-0.03	-0.01	0.01
Inflation	-0.03	-0.03	-0.03	-0.03	-0.03	-0.03	-0.02
GDP growth	0.04	0.03	0.03	0.04	0.04	0.04	0.05

Source: Own calculations. SNL. ECB. World Bank. Bloomberg. Eurostat.
The dependent variable is RORWA.
The SSM 2013-SSM 2019 dummies are 1 when the SSM is active or anticipated in the corresponding year and 0 otherwise. The SSM dummies correspond to the respective variables D_{it} in Eq. (1) - Eq. (4). G_i is a dummy that is one when a bank belongs to the group of SSM banks and is zero otherwise, and t denotes time.
Column "Estimation" restates the estimation results of Model 4 in Table 5.
The columns Q 0.05, Q 0.25, Q 0.75 and Q 0.95 refer to the 5%, 25%, 0.75% and 0.95% quantiles based on 10,000 estimations with different subsets of 90% of the data.

Appendix D. Robustness Checks: Large Banks

This section shows the results from a robustness check where we only consider the 200 largest banks based on their total assets in 2013. We consider banks that report all explanatory variables we use to estimate our return on assets models. In case of the average risk weight, the average credit risk weight, and the return on risk weighted assets some banks and observations are lost due to missing data in the dependent or explanatory variables. For the return on assets (Table D.17), the average risk weight (Table D.18), the average credit risk weight (Table D.19), and the return on risk weighted assets

(Table D.20), we estimate Model 1-4 and Model 9. For the additional dependent variables from Table 6, we show the estimated total SSM effects in Table D.21. The results show that the estimated SSM effects for large banks and the full sample are very similar.

Table D.17: Direct SSM effects on ROA of large banks.

	ROA 1	ROA 2	ROA 3	ROA 4	ROA 9
log(TA)	−0.1132	−0.1114	−0.1131	−0.1133	−0.2322***
	(0.0780)	(0.0783)	(0.0779)	(0.0778)	(0.0637)
SSM dummy	0.1103**	0.0729			
	(0.0442)	(0.0499)			
SSM 2013			0.0771	0.0591	0.0384
			(0.0626)	(0.0722)	(0.0723)
SSM 2014			0.1293*	0.1057	0.0879
			(0.0734)	(0.0822)	(0.0823)
SSM 2015			0.1632***	0.1338	0.0968
			(0.0585)	(0.0880)	(0.0905)
SSM 2016			0.0475	0.0127	−0.0148
			(0.0633)	(0.1126)	(0.1175)
SSM 2017			0.1728***	0.1327	0.1081
			(0.0634)	(0.1293)	(0.1325)
SSM 2018			0.1084	0.0628	0.0451
			(0.0698)	(0.1481)	(0.1517)
SSM 2019			0.1202*	0.0692	0.0512
			(0.0618)	(0.1607)	(0.1675)
$G_i \times t$		0.0062		0.0054	0.0006
		(0.0085)		(0.0164)	(0.0179)
Loan loss reserve ratio	−0.0110	−0.0109	−0.0122	−0.0123	
	(0.0104)	(0.0104)	(0.0108)	(0.0108)	
Labor Costs over TA	0.2797**	0.2769**	0.2843**	0.2843**	
	(0.1201)	(0.1200)	(0.1180)	(0.1179)	
Leverage ratio	−0.0107	−0.0103	−0.0106	−0.0105	
	(0.0149)	(0.0150)	(0.0150)	(0.0150)	
loan-to-deposit ratio	0.0005	0.0005	0.0005	0.0005	
	(0.0005)	(0.0005)	(0.0005)	(0.0005)	
RW	0.0072***	0.0072***	0.0072***	0.0072***	
	(0.0020)	(0.0020)	(0.0020)	(0.0019)	
Herfindahl index (ECB)	−0.0148**	−0.0152**	−0.0154**	−0.0155**	
	(0.0063)	(0.0063)	(0.0063)	(0.0064)	
3M-Euribor	−0.0737**	−0.0778**	−0.0739**	−0.0773**	
	(0.0286)	(0.0307)	(0.0287)	(0.0320)	
Dummy neg. Euribor	−0.4736***	−0.5017***	−0.5103***	−0.5351***	
	(0.1369)	(0.1549)	(0.1383)	(0.1696)	
Dummy neg. Euribor x Euribor	0.5234***	0.5444***	0.3121*	0.3175*	
	(0.1216)	(0.1252)	(0.1664)	(0.1651)	
10Y gov bond yield	−0.0243**	−0.0251***	−0.0247**	−0.0253***	
	(0.0096)	(0.0096)	(0.0097)	(0.0098)	
Dummy neg. Euribor x gov. bond yield	−0.0400	−0.0418	−0.0339	−0.0336	
	(0.0411)	(0.0413)	(0.0438)	(0.0440)	
GDP growth	−0.0001	−0.0002	−0.0012	−0.0012	
	(0.0053)	(0.0052)	(0.0052)	(0.0052)	
Inflation	−0.0020	−0.0019	−0.0020	−0.0019	
	(0.0034)	(0.0034)	(0.0034)	(0.0034)	
Bank Fixed effects	*yes*	*yes*	*yes*	*yes*	*yes*
Time fixed effects	*yes*	*yes*	*yes*	*yes*	*yes*
R-squared	0.74	0.74	0.74	0.74	0.72
Adj. R-squared	0.71	0.71	0.71	0.71	0.69
Number of obs.	2,008	2,008	2,008	2,008	2,008
Number of groups	200	200	200	200	200
Average. Obs. group	10.04	10.04	10.04	10.04	10.04
Min. Obs. group	3	3	3	3	3
Max. Obs. Group	14	14	14	14	14

Source: Own calculations. SNL. ECB. World Bank. Bloomberg. Eurostat.
The dependent variable is the return on assets before credit impairment and tax (ROA).
SSM = 1 when the bank is an SSM bank and the SSM is active. SSM = 0 otherwise. The 2013–2019 SSM dummies take on the value 1 when the bank is an SSM bank and the SSM is active (or anticipated) in the corresponding year and are 0 otherwise. $G_i = 1$ when a bank is an SSM bank and $G_i = 0$ zero otherwise. t denotes time.
The bank-specific explanatory variables are the logarithm of total assets log(TA), the loan loss reserve ratio (loan loss reserves divided by total gross loans), Labor Costs over TA (labor costs divided by total assets), the leverage ratio (Tier 1 capital divided by total assets), the loan-to-deposit ratio and the average risk weight (risk weighted assets divided by total assets).
The structural explanatory variables are the Herfindahl index, the 3M-Euribor, Dummy neg. Euribor (a dummy which is 1 when the 3M-Euribor is negative and 0 otherwise, the interaction variable Dummy neg. Euribor x Euribor, 10Y gov bond yield (10 year zero coupon government bond yield from Bloomberg), the interaction Dummy neg. Euribor x gov. bond yield, GDP growth (year on year nominal GDP growth) and inflation (year on year growth of the consumer price index).
$^{***}p < 0.01$; $^{**}p < 0.05$; $^{*}p < 0.1$. We use cluster robust standard errors with clustering at the bank level.

Table D.18: Direct SSM effects on the average risk weight of large banks.

	RW 1	RW 2	RW 3	RW 4	RW 9
log(TA)	−1.3126	−1.3026	−1.3546	−1.3457	−10.3462**
	(1.9877)	(1.9966)	(2.0253)	(2.0245)	(3.2494)
SSM dummy	−1.6581	−1.7880			
	(1.1863)	(1.3528)			
SSM 2013			−1.0242	−2.2194	−2.7015*
			(1.1400)	(1.1899)	(1.2541)
SSM 2014			−1.0970	−2.6803	−3.3338
			(1.3126)	(1.8654)	(1.8742)
SSM 2015			−2.3822	−4.3706	−5.3663*
			(1.4263)	(2.2695)	(2.3594)
SSM 2016			−2.2838	−4.6569	−5.8451*
			(1.4797)	(2.6400)	(2.8605)
SSM 2017			−1.4358	−4.1840	−5.5044
			(1.4810)	(3.1500)	(3.4346)
SSM 2018			−1.1905	−4.3438	−5.9248
			(1.5764)	(3.5393)	(3.8209)
SSM 2019			−2.8941	−6.4230	−9.1208*
			(1.5510)	(4.0195)	(4.5208)
$G_i \times t$		0.0219		0.3822	0.3153
		(0.2268)		(0.4306)	(0.4766)
TA growth	0.0018	0.0019	−0.0002	−0.0014	
	(0.0278)	(0.0280)	(0.0287)	(0.0287)	
Loans to TA	0.4085***	0.4087***	0.4065***	0.4088***	
	(0.0721)	(0.0724)	(0.0724)	(0.0724)	
Loan loss reserve ratio	−0.0710	−0.0712	−0.0669	−0.0815	
	(0.2290)	(0.2290)	(0.2431)	(0.2469)	
Leverage ratio	2.0263***	2.0277***	2.0208***	2.0189***	
	(0.3300)	(0.3301)	(0.3336)	(0.3324)	
loan-to-deposit ratio	0.0122	0.0122	0.0118	0.0115	
	(0.0168)	(0.0168)	(0.0168)	(0.0168)	
ROA	2.7191**	2.7183**	2.7182**	2.7048***	
	(0.8297)	(0.8261)	(0.8333)	(0.8124)	
Basel I	4.9908*	4.9763*	5.0518*	4.9291*	
	(2.0750)	(2.1216)	(2.0907)	(2.1083)	
StA Approach	9.8672***	9.8460***	9.9238***	9.6824***	
	(1.4562)	(1.4578)	(1.4594)	(1.4327)	
Mixed Approach	3.8275**	3.8079**	3.8978**	3.6957**	
	(1.4179)	(1.4327)	(1.4136)	(1.4248)	
F-IRB	5.8371***	5.8226***	5.9060***	5.7880***	
	(1.7151)	(1.7409)	(1.7110)	(1.7223)	
10Y gov bond yield	0.0182	0.0148	0.0156	−0.0401	
	(0.2298)	(0.2337)	(0.2298)	(0.2450)	
Bank Fixed effects	*yes*	*yes*	*yes*	*yes*	*yes*
Time fixed effects	*yes*	*yes*	*yes*	*yes*	*yes*
R-squared	0.92	0.92	0.92	0.92	0.89
Adj. R-squared	0.91	0.91	0.91	0.91	0.87
Number of obs.	1,899	1,899	1,899	1,899	1,899
Number of groups	200	200	200	200	200
Average. Obs. group	9.49	9.49	9.49	9.49	9.49
Min. Obs. group	3	3	3	3	3
Max. Obs. Group	14	14	14	14	14

Source: Own calculations. SNL. ECB. World Bank. Bloomberg. Eurostat.
The dependent variable is the average risk weight (RW).
SSM = 1 when the bank is an SSM bank and the SSM is active. SSM = 0 otherwise. The 2013–2019 SSM dummies take on the value 1 when the bank is an SSM bank and the SSM is active (or anticipated) in the corresponding year and are 0 otherwise. $G_i = 1$ when a bank is an SSM bank and $G_i = 0$ zero otherwise. t denotes time.
The bank-specific explanatory variables are the logarithm of total assets log(TA), TA growth (total asset growth), Loans to TA (loans divided by total assets), the loan loss reserve ratio, the Leverage ratio (Tier 1 capital divided by total assets), the loan-to-deposit ratio, and ROA, the return on assets before credit impairment and tax.
The structural explanatory variables are the dummies for Basel I, the StA Approach (Standardized Approach), the Mixed Approach (banks have different portfolios under different approaches) and the F-IRB (Foundation Internal Rating Based Approach). The 10Y gov bond yield refers to the 10 year zero coupon government bond yield from Bloomberg.
$^{***}p < 0.01$; $^{**}p < 0.05$; $^{*}p < 0.1$. We use cluster robust standard errors with clustering at the bank level.

Table D.19: Direct SSM effects on the average credit risk weight of large banks.

	CRW 1	CRW 2	CRW 3	CRW 4	CRW 9
log(TA)	4.5508	4.1954	4.2863	4.2412	−0.4712
	(4.8899)	(4.9418)	(4.9869)	(4.9729)	(4.4685)
SSM dummy	−2.1944	1.6702			
	(2.2141)	(1.8077)			
SSM 2013			−1.7543	1.3944	1.0081
			(1.7100)	(1.9272)	(1.8583)
SSM 2014			−1.4108	2.8984	1.9902
			(2.1830)	(2.8991)	(2.8658)
SSM 2015			−2.2347	3.2268	1.5761
			(2.4725)	(3.7307)	(3.6548)
SSM 2016			−2.7018	3.8575	1.2594
			(2.6711)	(4.4011)	(4.3874)
SSM 2017			−1.7871	5.8799	3.1183
			(2.8404)	(5.2663)	(5.2789)
SSM 2018			−3.7625	5.0078	0.7499
			(3.2470)	(6.2974)	(6.3884)
SSM 2019			−4.0308	5.8599	1.3564
			(2.9297)	(6.8499)	(6.8087)
$G_i \times t$		-0.6912^{*}		−1.1108	−0.6561
		(0.3795)		(0.7827)	(0.7983)
TA growth	0.1172^{**}	0.1102^{*}	0.1122^{*}	0.1118^{*}	
	(0.0593)	(0.0584)	(0.0596)	(0.0591)	
Loan loss reserve ratio	−0.0134	−0.0488	−0.0390	−0.0343	
	(0.4004)	(0.4015)	(0.4260)	(0.4200)	
Leverage ratio	2.0831^{***}	1.9905^{***}	2.0254^{***}	1.9928^{***}	
	(0.5178)	(0.5228)	(0.5380)	(0.5299)	
loan-to-deposit ratio	-0.0980^{***}	-0.1010^{***}	-0.0996^{***}	-0.1013^{***}	
	(0.0353)	(0.0358)	(0.0356)	(0.0355)	
NIM	2.2306	2.3772	2.2954	2.2999	
	(1.6393)	(1.6214)	(1.6291)	(1.6396)	
Basel I	26.1446^{***}	27.0916^{***}	26.3846^{***}	27.4733^{***}	
	(8.5438)	(8.6717)	(8.5941)	(8.9025)	
StA Approach	15.0308^{***}	15.7350^{***}	15.2208^{***}	16.0533^{***}	
	(5.2924)	(5.4502)	(5.3235)	(5.5769)	
Mixed Approach	5.5589	6.1015	5.7376	6.3044	
	(4.9047)	(5.0173)	(4.9382)	(5.1181)	
F-IRB	5.7846	6.2680	6.0571	6.3951	
	(3.9690)	(4.0859)	(4.0111)	(4.1409)	
10Y gov bond yield	0.6559^{***}	0.7558^{***}	0.6615^{***}	0.8064^{***}	
	(0.2393)	(0.2389)	(0.2399)	(0.2485)	
Bank Fixed effects	*yes*	*yes*	*yes*	*yes*	*yes*
Time fixed effects	*yes*	*yes*	*yes*	*yes*	*yes*
R-squared	0.90	0.90	0.90	0.90	0.88
Adj. R-squared	0.88	0.88	0.88	0.88	0.86
Number of obs.	1,619	1,619	1,619	1,619	1,619
Number of groups	186	186	186	186	186
Average. Obs. group	8.70	8.70	8.7000	8.70	8.70
Min. Obs. group	3	3	3	3	3
Max. Obs. Group	14	14	14	14	14

Source: Own calculations. SNL. ECB. World Bank. Bloomberg. Eurostat.
The dependent variable is average credit risk weight (CRW).
SSM = 1 when the bank is an SSM bank and the SSM is active. SSM = 0 otherwise. The 2013–2019 SSM dummies take on the value 1 when the bank is an SSM bank and the SSM is active (or anticipated) in the corresponding year and are 0 otherwise. $G_i = 1$ when a bank is an SSM bank and $G_i = 0$ zero otherwise. t denotes time.
The bank-specific explanatory variables are the logarithm of total asset log(TA), TA growth (total asset growth), the loan loss reserve ratio (loan loss reserves divided by total assets), the loan-to-deposit ratio, and NIM, the net interest margin.
The structural explanatory variables are the dummies for Basel I, the StA Approach (Standardized Approach), the Mixed Approach (banks have different portfolios under different approaches) and the F-IRB (Foundation Internal Rating Based Approach). The 10Y gov bond yield refers to the 10 year zero coupon government bond yield from Bloomberg.
$^{***}p < 0.01$; $^{**}p < 0.05$; $^{*}p < 0.1$. We use cluster robust standard errors with clustering at the bank level.

Table D.20: SSM effects on return on risk weighted assets.

	RORWA 1	RORWA 2	RORWA 3	RORWA 4	RORWA 9
log(TA)	−0.2264	−0.2332	−0.2336	−0.2323	-0.2185^{*}
	(0.1562)	(0.1567)	(0.1569)	(0.1572)	(0.1202)
SSM dummy	0.2394^{**}	0.3840^{***}			
	(0.1090)	(0.1309)			
SSM 2013			0.2130	0.3817^{**}	0.3759^{**}
			(0.1605)	(0.1818)	(0.1757)
SSM 2014			0.3228^{**}	0.5458^{***}	0.5757^{***}
			(0.1640)	(0.1984)	(0.1877)
SSM 2015			0.4722^{***}	0.7498^{***}	0.7907^{***}
			(0.1531)	(0.2384)	(0.2168)
SSM 2016			0.1471	0.4748^{*}	0.5587^{**}
			(0.1489)	(0.2780)	(0.2530)
SSM 2017			0.3491^{**}	0.7287^{**}	0.8242^{***}
			(0.1647)	(0.3243)	(0.2929)
SSM 2018			0.1312	0.5627	0.7228^{**}
			(0.1728)	(0.3676)	(0.3363)
SSM 2019			0.1786	0.6618^{*}	0.8645^{**}
			(0.1582)	(0.3951)	(0.3632)
$G_i \times t$		−0.0242		−0.0513	-0.0699^{*}
		(0.0208)		(0.0387)	(0.0369)
Loan loss reserve ratio	−0.0291	−0.0296	−0.0349	−0.0340	
	(0.0221)	(0.0220)	(0.0235)	(0.0235)	
Labor Costs over TA	0.4602^{*}	0.4727^{*}	0.4915^{**}	0.4950^{**}	
	(0.2500)	(0.2491)	(0.2463)	(0.2456)	
loan-to-deposit ratio	−0.0001	−0.0001	−0.0001	−0.0001	
	(0.0019)	(0.0019)	(0.0019)	(0.0019)	
Leverage ratio	-0.0629^{**}	-0.0643^{**}	-0.0655^{**}	-0.0658^{**}	
	(0.0274)	(0.0273)	(0.0272)	(0.0270)	
Basel I	−0.2049	−0.1941	−0.1913	−0.1801	
	(0.3341)	(0.3305)	(0.3394)	(0.3315)	
StA Approach	−0.4780	−0.4517	−0.4775	−0.4389	
	(0.3084)	(0.3080)	(0.3140)	(0.3090)	
Mixed Approach	−0.1563	−0.1340	−0.1435	−0.1140	
	(0.3038)	(0.3033)	(0.3105)	(0.3059)	
F-IRB	−0.3360	−0.3208	−0.3247	−0.3094	
	(0.3393)	(0.3384)	(0.3471)	(0.3425)	
Herfindahl index (ECB)	−0.0197	−0.0185	−0.0200	−0.0194	
	(0.0154)	(0.0154)	(0.0156)	(0.0157)	
3M-Euribor	−0.1089	−0.0966	−0.1051	−0.0795	
	(0.0941)	(0.0943)	(0.0937)	(0.0969)	
Dummy neg. Euribor	−0.3932	−0.2998	−0.5110	−0.3031	
	(0.3886)	(0.3951)	(0.3917)	(0.4354)	
Dummy neg. Euribor x Euribor	1.0301^{***}	0.9535^{***}	0.4168	0.3750	
	(0.3189)	(0.3271)	(0.4021)	(0.4003)	
10Y gov bond yield	−0.0281	−0.0249	−0.0280	−0.0223	
	(0.0212)	(0.0214)	(0.0214)	(0.0218)	
Dummy neg. Euribor x gov. bond yield	−0.0515	−0.0443	−0.0266	−0.0293	
	(0.0944)	(0.0951)	(0.1039)	(0.1038)	
Inflation	−0.0022	−0.0025	−0.0017	−0.0025	
	(0.0069)	(0.0069)	(0.0070)	(0.0071)	
GDP growth	0.0042	0.0044	0.0005	0.0006	
	(0.0126)	(0.0126)	(0.0127)	(0.0127)	
Bank Fixed effects	*yes*	*yes*	*yes*	*yes*	*yes*
Time fixed effects	*yes*	*yes*	*yes*	*yes*	*yes*
R-squared	0.60	0.60	0.61	0.61	0.59
Adj. R-squared	0.55	0.55	0.55	0.55	0.54
Number of obs.	1,979	1,979	1,979	1,979	1,979
Number of groups	199	199	199	199	199
Average. Obs. group	9.94	9.94	9.94	9.94	9.94
Min. Obs. group	3	3	3	3	3
Max. Obs. Group	14	14	14	14	14

Source: Own calculations. SNL. ECB. World Bank. Bloomberg. Eurostat.
The dependent variable is return on risk weighted assets (RORWA).
SSM = 1 when the bank is an SSM bank and the SSM is active. SSM = 0 otherwise. The 2013–2019 SSM dummies take on the value 1 when the bank is an SSM bank and the SSM is active (or anticipated) in the corresponding year and are 0 otherwise. $G_i = 1$ when a bank is an SSM bank and $G_i = 0$ zero otherwise. t denotes time.
The bank-specific explanatory variables are the logarithm of total assets log(TA), the loan loss reserve ratio (loan loss reserves divided by total gross loans), Labor Costs over total assets, the leverage ratio (Tier 1 capital divided by total assets), and the loan-to-deposit ratio.
The structural explanatory variables are the Herfindahl index, the 3M Euribor, Dummy neg. Euribor (a dummy which is 1 when the 3M Euribor < 0%), the interaction variable Dummy neg. Euribor x Euribor, 10Y gov bond yield (10 year zero coupon government bond yield from Bloomberg), the interaction variable Dummy neg. Euribor x gov. bond yield, GDP growth (year on year nominal GDP growth) and inflation (year on year growth of the consumer price index).
Further structural explanatory variables are the dummies Basel I, StA Approach (Standardized Approach), Mixed Approach (banks have different portfolios under different approaches) and F-IRB (Foundation Internal Rating Based Approach).
$^{***}p < 0.01$; $^{**}p < 0.05$; $^{*}p < 0.1$. We use cluster robust standard errors with clustering at the bank level.

Table D.21: Total SSM effects: Confidence channel and better risk management for large banks.

	DR	LR	LLR	Non-bank deposit ratio	Net non-interest income	Net loan growth
log(TA)	0.6437	−0.3005	−0.1606	−8.8874**	−0.2208***	1.0464
	(0.5040)	(0.3255)	(0.3960)	(4.3115)	(0.0467)	(1.6611)
SSM 2013	0.0498	0.1041	0.3260	1.0160	0.0386	3.3306**
	(0.1941)	(0.1788)	(0.2540)	(0.9654)	(0.0293)	(1.6768)
SSM 2014	0.0429	0.0942	0.0579	1.1167	0.0803**	7.7902***
	(0.2833)	(0.2529)	(0.3282)	(1.3330)	(0.0397)	(1.9848)
SSM 2015	−0.1091	0.2028	−0.2843	2.4700	0.1086**	8.3692***
	(0.3739)	(0.3138)	(0.3690)	(1.8353)	(0.0436)	(2.5789)
SSM 2016	−0.2089	0.1708	−0.6601	3.4404	0.1139**	9.6860***
	(0.4626)	(0.3884)	(0.4463)	(2.2785)	(0.0522)	(2.7587)
SSM 2017	−0.1282	0.3280	−1.2911**	2.6341	0.1516***	11.2454***
	(0.5531)	(0.4549)	(0.5378)	(2.7535)	(0.0581)	(3.4094)
SSM 2018	0.0885	0.5035	−1.8809***	3.8779	0.1958***	16.4211***
	(0.6191)	(0.5186)	(0.6431)	(3.1051)	(0.0704)	(3.7210)
SSM 2019	0.3368	0.6095	−2.7728***	3.6985	0.2511***	17.9228***
	(0.7214)	(0.5934)	(0.7301)	(3.4767)	(0.0746)	(4.2703)
$G_i \times t$	−0.0382	0.0042	0.3632***	−0.2442	−0.0369***	−1.7998***
	(0.0738)	(0.0605)	(0.0773)	(0.4126)	(0.0085)	(0.4296)
Bank fixed effects	*yes*	*yes*	*yes*	*yes*	*yes*	*yes*
Time fixed effects	*yes*	*yes*	*yes*	*yes*	*yes*	*yes*
R-squared	0.87	0.86	0.79	0.93	0.92	0.42
Adj. R-squared	0.85	0.84	0.76	0.92	0.91	0.34
Number of obs.	1,775	1,775	1,775	1,775	1,775	1,775
Number of groups	195	195	195	195	195	195
Average. Obs. group	9.10	9.10	9.10	9.10	9.10	9.10
Min. Obs. group	3	3	3	3	3	3
Max. Obs. Group	14	14	14	14	14	14

Source: Own calculations and SNL.
The columns "Deposit Rate", "Lending Rate", "LLR", "non-bank deposit ratio", "Net non-interest income" and "net loan growth" report the estimation results for the deposit rate, the lending rate, the loan loss reserve ratio, the non-bank deposit ratio, the net non-interest income ratio and net loan growth.
The non-bank deposit ratio is calculated by dividing non-bank deposits by total assets.
The net non-interest income ratio is defined as net non-interest income divided by total assets.
Net loan growth is the growth rate of net loans which are defined as gross loans minus non-performing loans.
The variable log(TA) denotes the logarithm of total assets.
SSM = 1 when the bank is an SSM bank and the SSM is active. SSM = 0 otherwise. The 2013–2019 SSM dummies take on the value 1 when the bank is an SSM bank and the SSM is active (or anticipated) in the corresponding year and are 0 otherwise. $G_i = 1$ when a bank is an SSM bank and $G_i = 0$ zero otherwise. t denotes time.
$^{***}p < 0.01$; $^{**}p < 0.05$; $^{*}p < 0.1$. We use cluster robust standard errors with clustering at the bank level.

Appendix E. Robustness Checks: Core vs. Non-Core Countries

Table E.22 shows the results of a robustness check for the direct and total SSM effects on return on risk weighted assets when we split our data set into core and non-core euro area countries. The core countries are Austria, Belgium, Estonia, Germany, Finland, France, the Netherlands, and Slovakia. The periphery countries are Cyprus, Greece, Ireland, Italy, Malta, Portugal, Slovenia, and Spain. This categorization is based on the level of NPLs and follows the European Commission's classification as presented in Mesnard et al. (2016) and Avgeri et al. (2020).

Table E.22: SSM effects on the return on risk weighted assets: Core vs. Non-Core countries.

	Core: RORWA 4	Non Core: RORWA 4	Core: RORWA 9	Non Core: RORWA 9
log(TA)	−0.1587	0.2878	0.0369	0.1988
	(0.1044)	(0.2416)	(0.1004)	(0.1840)
SSM 2013	0.3461**	0.0672	0.5022***	−0.0113
	(0.1598)	(0.2664)	(0.1611)	(0.2586)
SSM 2014	0.0768	0.0944	0.3161*	−0.0057
	(0.1854)	(0.3053)	(0.1880)	(0.2813)
SSM 2015	0.2293	0.3044	0.6510**	0.2301
	(0.2421)	(0.3737)	(0.2591)	(0.3405)
SSM 2016	0.1676	0.4570	0.6542**	0.3142
	(0.2924)	(0.4136)	(0.3128)	(0.3659)
SSM 2017	0.2511	0.8503*	0.7116*	0.6967*
	(0.3591)	(0.4767)	(0.3796)	(0.4199)
SSM 2018	0.1443	0.9587*	0.5966	0.8437*
	(0.4114)	(0.5635)	(0.4321)	(0.5118)
SSM 2019	0.2074	0.6795	0.6825	0.5923
	(0.4434)	(0.6389)	(0.4764)	(0.5837)
$G_i \times t$	0.0160	−0.0878	−0.0199	−0.0748
	(0.0480)	(0.0550)	(0.0504)	(0.0519)
Loan loss reserve ratio	0.0440***	0.0010		
	(0.0165)	(0.0233)		
Leverage ratio	0.0085	−0.0015		
	(0.0155)	(0.0359)		
Labor Costs over TA	−0.4850***	−0.0098		
	(0.1344)	(0.3435)		
loan-to-deposit ratio	0.0003	−0.0026		
	(0.0017)	(0.0019)		
Basel I	−0.0451	−0.7305*		
	(0.4297)	(0.3897)		
StA Approach	−0.3209	−0.7486**		
	(0.3880)	(0.3068)		
Mixed Approach	0.0634	−0.4517		
	(0.3809)	(0.3333)		
F-IRB	−0.2557	0.0792		
	(0.3809)	(0.3853)		
Herfindahl index (ECB)	−0.0187**	−0.0156		
	(0.0080)	(0.0443)		
3M-Euribor	0.4988***	−0.1226		
	(0.1358)	(0.1167)		
Dummy neg. Euribor	−3.3456**	−3.4110		
	(1.5105)	(2.9870)		
Dummy neg. Euribor x Euribor	−8.0898*	−8.2337		
	(4.5527)	(8.5711)		
10Y gov bond yield	−0.3647***	0.0134		
	(0.1320)	(0.0285)		
Dummy neg. Euribor x gov. bond yield	1.0248***	−0.0338		
	(0.1876)	(0.1145)		
Inflation	−0.0251**	−0.0026		
	(0.0102)	(0.0115)		
GDP growth	−0.0080	0.0116		
	(0.0238)	(0.0191)		
Bank Fixed effects	*yes*	*yes*	*yes*	*yes*
Time fixed effects	*yes*	*yes*	*yes*	*yes*
R-squared	0.66	0.61	0.63	0.61
Adj. R-squared	0.61	0.53	0.57	0.53
Number of obs.	7,265	1,404	7,265	1,404
Number of groups	950	214	950	214
Average. Obs. group	7.65	6.56	7.65	6.56
Min. Obs. group	3	3	3	3
Max. Obs. Group	14	14	14	14

Source: Own calculations. SNL. ECB. World Bank. Bloomberg. Eurostat.
The dependent variable is return on risk weighted assets (RORWA).
SSM = 1 when the bank is an SSM bank and the SSM is active. SSM = 0 otherwise. The 2013–2019 SSM dummies take on the value 1 when the bank is an SSM bank and the SSM is active (or anticipated) in the corresponding year and are 0 otherwise. $G_i = 1$ when a bank is an SSM bank and $G_i = 0$ zero otherwise. t denotes time.
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The structural explanatory variables are the Herfindahl index, the 3M Euribor, Dummy neg. Euribor (a dummy which is 1 when the 3M Euribor < 0%), the interaction variable Dummy neg. Euribor x Euribor, 10Y gov bond yield (10 year zero coupon government bond yield from Bloomberg), the interaction variable Dummy neg. Euribor x gov. bond yield, GDP growth (year on year nominal GDP growth) and inflation (year on year growth of the consumer price index).
Further structural explanatory variables are the dummies Basel I, StA Approach (Standardized Approach), Mixed Approach (banks have different portfolios under different approaches) and F-IRB (Foundation Internal Rating Based Approach).
$^{***}p < 0.01$; $^{**}p < 0.05$; $^{*}p < 0.1$. We use cluster robust standard errors with clustering at the bank level.

Index of Working Papers:

February 26, 2020	Helmut Elsinger	228	Serial Correlation in Contingency Tables
March 2, 2020	Mariarosaria Comunale, Markus Eller, Mathias Lahnsteiner	229	Assessing Credit Gaps in CESEE Based on Levels Justified by Fundamentals –A Comparison Across Different Estimation Approaches
April 30, 2020	Martin Brown, Nicole Hentschel, Hannes Mettler, Helmut Stix	230	Financial Innovation, Payment Choice and Cash Demand – Causal Evidence from the Staggered Introduction of Contactless Debit Cards
July 30, 2020	Katharina Drescher, Pirmin Fessler, Peter Lindner	231	Helicopter Money in Europe: New Evidence on the Marginal Propensity to Consume across European Households
November 20, 2020	Michael Sigmund	232	The Capital Buffer Calibration for Other Systemically Important Institutions – Is the Country Heterogeneity in the EU caused by Regulatory Capture?
January 13, 2021	Maximilian Böck, Martin Feldkircher, Burkhard Raunig	233	A View from Outside: Sovereign CDS Volatility as an Indicator of Economic Uncertainty
May 20, 2021	Burkhard Raunig	234	Economic Policy Uncertainty and Stock Market Volatility: A Causality Check
July 8, 2021	Thomas Breuer, Martin Summer, Branko Uroševic	235	Bank Solvency Stress Tests with Fire Sales
December 14, 2021	Michael Sigmund, Kevin Zimmermann	236	Determinants of Contingent Convertible Bond Coupon Rates of Banks: An Empirical Analysis
February 14, 2022	Elisabeth Beckmann, Christa Hainz, Sarah Reiter	237	Third-Party Loan Guarantees: Measuring Literacy and its Effect on Financial Decisions
February 16, 2022	Markus Knell, Reinhard Koman	238	Pension Entitlements and Net Wealth in Austria

May 9, 2022	Nicolás Albacete, Pirmin Fessler, Peter Lindner	239	The Wealth Distribution and Redistributive Preferences: Evidence from a Randomized Survey Experiment
June 20, 2022	Erwan Gautier, Cristina Conflitti, Riemer P. Faber, Brian Fabo, Ludmila Fadejeva, Valentin Jouvanceau, Jan-Oliver Menz, Teresa Messner, Pavlos Petroulas, Pau Roldan-Blanco, Fabio Rumler, Sergio Santoro, Elisabeth Wieland, Hélène Zimmer	240	New Facts on Consumer Price Rigidity in the Euro Area
June 29, 2022	Svetlana Abramova, Rainer Böhme, Helmut Elsinger, Helmut Stix	241	What can CBDC designers learn from asking potential users? Results from a survey of Austrian residents
July 1, 2022	Marcel Barmeier	242	The new normal: bank lending and negative interest rates in Austria
July 14, 2022	Pavel Ciaian, Andrej Cupak, Pirmin Fessler, d'Artis Kancs	243	Environmental-Social-Governance Preferences and Investments in Crypto-Assets
October 18, 2022	Burkhard Raunig, Michael Sigmund	244	The ECB Single Supervisory Mechanism: Effects on Bank Performance and Capital Requirements