European Commission

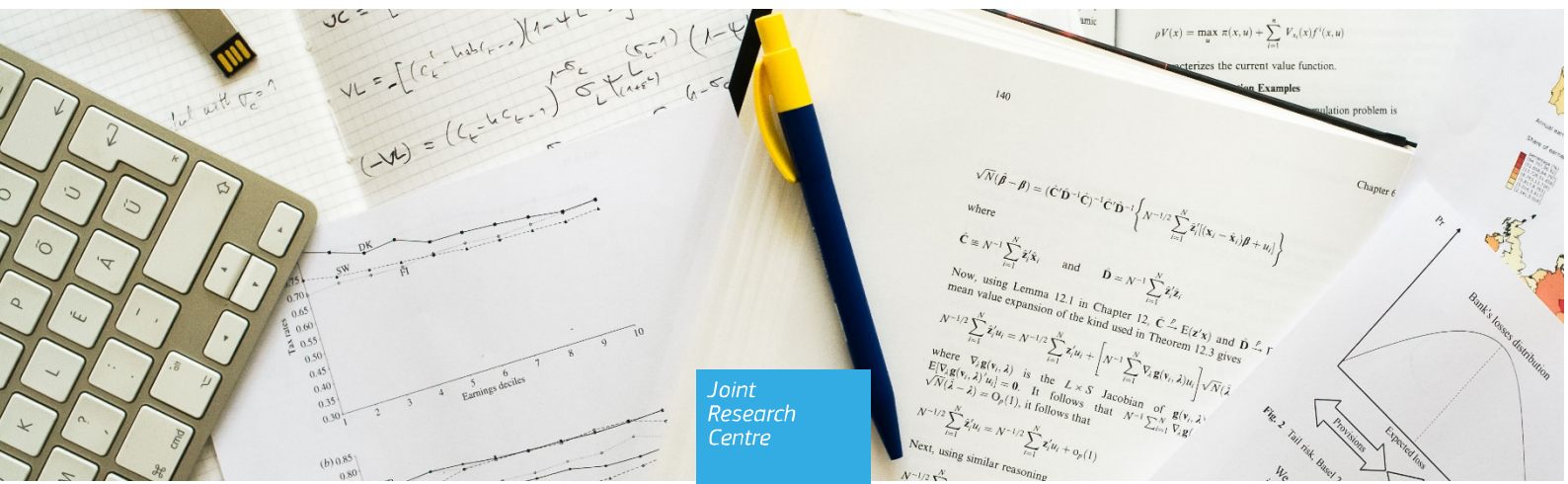
JRC TECHNICAL REPORT

Has the Comprehensive Assessment made the European financial system more resilient?

Calò, Silvia
Gregori, Wildmer Daniel
Petracco Giudici, Marco
Rancan, Michela

2021

JRC Working Papers in Economics and Finance, 2021/8



Contact information
Name: Wildmer Daniel Gregori
Address: via Enrico Fermi, 2749, Ispra (VA), Italy.
Email: Wildmer.GREGORI@ec.europa.eu

EU Science Hub
https://ec.europa.eu/jrc

JRC125898

Ispra: European Commission, 2021.

How to cite this report: Calò S., Gregori, W. D., Petracco Giudici, M. & Rancan M. (2021). Has the Comprehensive Assessment made the European financial system more resilient?, European Commission, Joint Research Centre, Ispra, JRC125898.

Has the Comprehensive Assessment made the European financial system more resilient?

Silvia Calò, Wildmer Daniel Gregori, Marco Petracco Giudici, Michela Rancan*

(this version: September 2021)

Abstract

What has been the impact of the Comprehensive Assessment (CA) carried out by the ECB on banks' resilience? Implementing a difference-in-difference approach, we analyse a non-risk based measure defined as the ratio of Tier 1 capital over total assets of European banks' balance sheets during the years 2007-2018. This wide time span, compared to previous literature, allows a better analysis of CA's medium-term effects. We find that banks under the CA have a higher ratio, suggesting that the CA has contributed to foster banks' resilience. Importantly, this seems to have been achieved by banks increasing their capitalization level without shrinking their assets. In addition, this impact appears to be driven by banks located in countries where the regulatory environment and property rights are relatively less strong.

Keywords: Comprehensive assessment, European banks, Financial stability, Regulation.

JEL codes: G21, G28.

*Silvia Calò, Central Bank of Ireland, New Wapping Street, North Wall Quay, Dublin 1, D01 F7X3; email: silvia.calo@centralbank.ie. Wildmer Daniel Gregori, Joint Research Centre, European Commission, Via Enrico Fermi 2749, 21027 Ispra, Italy; email: wildmer.gregori@ec.europa.eu. Marco Petracco Giudici, Joint Research Centre, European Commission; email: marco.petracco@ec.europa.eu. Michela Rancan, Marche Polytechnic University; email: m.rancan@univpm.it. We would like to thank Udichibarna Bose, Karin Casteleyn, Francesca Erica Di Girolamo, David Doran, Koen Jonkers, Caroline Mehigan, Pietro Moncada Paternò Castello, Anna Naszodi, Katja Neugebauer, Caterina Rho, and an anonymous referee for insightful comments and suggestions. We would also like to thank participants at the European Commission-Joint Research Centre seminar (Ispra - Italy, 2021), and 5th Conference in Banking and Corporate Finance - Essex Finance Centre (Essex - UK, 2021). Responsibility for any errors lies solely with the authors. The authors are listed alphabetically, and they made equal contributions to the study and the publication. The views expressed are purely those of the authors and may not in any circumstances be regarded as stating an official position of the European Commission and Central Bank of Ireland or the Eurosystem.

1. Introduction

In the last twenty years, the European banking system faced two large systemic shocks. The first one, the 2007-2008 global financial crisis hit an undercapitalized banking system and resulted in a large contraction in credit and a tightening in financial conditions (see, among others, Claessens et al. 2010). Ten years later, when the Covid-19 shock hit Europe, the banking system was much better capitalized and hence ready to react to the consequences of the pandemic crisis. While the first shock was endogenous to the banking system, and the fragility of the banking sector itself contributed to propagate the shock from one institution to the other (Claessens et al. 2010), the second one was exogenous and the resilience of the banking system contributed to partially absorbing the real economy shock thought an increase in lending in the short term (Lewrick et al. 2020).[1] This capacity is often attributed to the set of reforms put in place in response to the global financial crisis, that made room for the policy actions governments and central banks took in response to the Covid-19 crisis. The aim of this paper is to evaluate the effects of the Comprehensive Assessment (CA) – the set of financial health checks conducted by the European Central Bank (ECB) on the largest banks – on euro area banks' balance sheets. As the CA was a substantial change in banking supervision, we study its impact on the bank capitalization in a difference-in-difference setting.

The CA was implemented in the aftermath of the euro area crisis and aimed at strengthening financial stability, increasing transparency, and, to some degree, homogenizing the euro area banking system,[2] as a step towards the creation of the banking union. Indeed, it implied a transfer of authority from national supervisors to the ECB for the largest banks or those banks considered as systemic by the legislation. The CA – including the Asset Quality Review (AQR), the assessment of banks' assets, and stress tests[3] simulations of how banks can cope with unfavourable economic scenarios – ensures a rigorous and consistent assessment of banks' balance sheets, focusing on identification, measurement and recognition of impairments to avoid creating long standing deteriorated balance sheets. It was announced on October 23, 2013 and the first AQR was conducted on banks' balance sheets as of the end of 2013, while results were published on October 26, 2014. An important question is then to study the impact of this change in

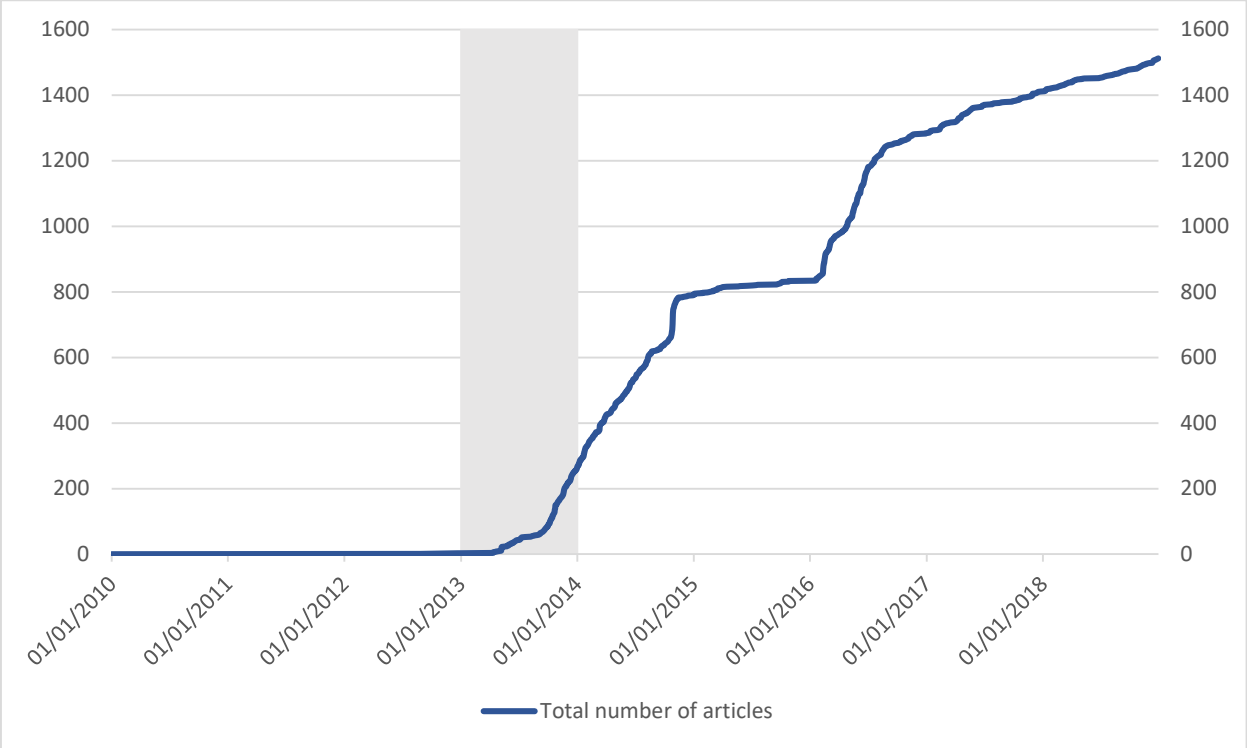
[1] See also the EBA Risk Dashboard Q4 2020, https://www.eba.europa.eu/risk-analysis-and-data/risk-dashboard.

[2] The presence of more homogenous banking systems across the euro area would have allowed a higher degree of cross-border risk sharing, which is one of the goals of the Banking Union. An example of these increased homogeneity across banking systems comes from the checks on the adequacy of asset and collateral valuation and related provisions which, assessed by a supranational entity during the CA, identified, and again to a degree lessened, heterogeneities idiosyncratic to each single banking system, and originating in the different standards, practices and valuations of national supervisors.

[3] These stress tests were considerably different from those conducted in 2010 and 2011.

bank supervision and whether the CA contributed to have a more resilient financial system. To this aim, we consider a large sample of banks' balance sheets for the period 2007-2018. The institutional framework allows us to implement a difference-in-difference setting to compare banks under the CA (treated group) and those that were not part of the CA, but continued to be under the national supervision (control group). For the empirical analysis, we choose 2013 as the first year of treatment, as discussed when we present the econometric model (see Section 3.1). Figure 1 displays the cumulative number of articles in the period 2010-2018 suggesting that, by the end of 2013, the CA was already of public domain.

Figure 1 Number of "Asset Quality Review" in the press. Cumulative number of articles containing the words "Asset Quality Review". Search was conducted on Proquest. for the period 1 January 2010 to 31 December2018. Source type: Historical Newspapers, Newspapers, language: English. The grey area indicates the period January 1, 2013 – December 31, 2013. The first article reporting the words "asset quality review" dates back to August 25, 2012, and it is in the reference to the EU/IMF programme in Ireland including an asset quality review exercise.



Our main variable of interest is capitalization, defined as the ratio of Tier 1 capital over total assets, as this is important both for bank funding (Myers 1977) and lending activities (Gambacorta and Shin 2018). In addition, well capitalized banks have more flexibility in responding to adverse shocks (Beltratti and Stulz 2012) and contribute less to systemic risk (Acharya et al. 2012). By estimating a panel model, we find that banks subject to the CA have a higher ratio due to the higher level of Tier 1 capital. Furthermore, this

result is remarkable in the subsample of those banks located in countries with low levels of regulatory quality and property rights indicators (as measured prior to the CA), while there are no significant differences for banks located in other countries. Our main results stand up to a set of robustness checks. To alleviate potential concern that findings are driven by differences between the control and treatment groups, we perform various estimations combining the difference – in – difference approach with a propensity score matching. In addition, we include in our main model further controls to account for potential confounding factors and consider alternative subsamples. Also, we estimate the model with a staggered difference – in – difference model.

Our paper contributes to two strands of literature. First, a growing area of research investigates the role of banking supervision and regulation. Theoretical models analyse the tradeoff between local and centralized supervision (see, e.g., Dell'Arriccia and Marquez 2006; Carletti et al. 2021), and the challenges of regulatory arrangements for cross-border banking (Beck et al. 2013). On the empirical side, Agarwal et al. (2014), exploiting some features of the state and federal supervisions in U.S., show that local supervisors are more lenient than federal ones. They also show that banks anticipate stricter supervision by undertaking window dressing adjustments of their balance sheet. A few works are closely related to our paper as they focus specifically on the CA. Fiordelisi et al. (2017), focusing on the period 2011-2014 find that banks directly supervised by the ECB, in the short term, reduced their lending activity with the aim of increasing capitalization. While our paper is similar in the spirit to this work, we differentiate by mainly focusing our analysis on the effects of CA on banks' resilience. In addition, we consider a wider sample of banks and extend the period of analysis to years 2007-2018. By evaluating the impact of the CA on banks' balance sheets in the medium term, we confirm an increase in capitalization, which however results from a higher Tier 1 capital and not from a contraction in lending. Bruno and Marino (2020) focus on the effects of non-performing loans on bank balance sheets, using as a treatment the AQR. Since the AQR, it has been applied a homogenous definition of non-performing loans (NPL), leading to changes in the share of NPLs in each bank balance sheet. The authors exploit this variation to identify the effect of higher NPLs on credit, using data on existing credit relationships. In a similar vein, Avignone et al. (2021), investigate whether the first step of the banking union has decreased the credit risk exposure of banks supervised by the Single Supervisory Mechanism (SSM), measured by loan loss reserves to gross loans and loan loss provisions to gross loan. Our study differs from theirs over some important dimensions. By using these measures, the authors focus on the ability of banks to face credit losses. While sufficient provisions for NPLs ensure that bank capital would not be eroded by an increase in insolvencies, loan losses are just one of the mechanisms which could cause this erosion. For instance, risks stemming from stress in the

sovereign debt market have the potential of eroding bank capital and force banks to recapitalize, maybe in a moment of high market turmoil.[4] Thus, we choose to focus our analysis on the effects of the CA on bank capitalization to provide insights on the overall stability of the euro area banking system, even during the sovereign debt crisis' years.

A related strand of literature investigates the effect on lending by using confidential data, such as syndicated loans or granular supervisory information. Results from this literature are not univocal. In the context of U.S. stress tests, Acharya et al. (2018) show that stress-tested banks reduce large corporate loan supply, this decrease can be partially offset by non-tested financial institutions (Connolly 2018). In contrast, Bassett and Berrospide (2018) and Cortés et al. (2020) do not find any negative impact of stress tests on lending. Still, Cortés et al. (2020) document that banks under stress tests charge higher interest rates and shorten the loan maturity. Pierret and Steri (2020) provide some evidence of the effectiveness of stress tests in limiting banks risk taking. Similar results are obtained by Cappelletti et al. (2019) investigating the effect of the 2016 ECB stress tests. Abbassi et al. (2017) document that German banks reduced the share of riskier assets in response to the AQR.

Another line of research considers market reactions of equity or credit default swaps (CDS) prices following announcement of regulatory and policy interventions or publications of stress testing results (Petrella and Resti 2013; Acharya et al. 2014; Sahin and de Haan 2015; Carboni et al. 2017; Fiordelisi and Galloppo 2018; Ahnert et al. 2020; Bellia and Maccaferri 2020; Pancotto et al. 2020). Among others, Petrella and Resti (2013) perform an event study on the 2011 European stress test that involved 90 banks, suggesting that the market reacted not only to the historical data released after the tests, but assigned high importance to variables measuring each bank's vulnerability, such as liquidity and model risks, to the simulated downturn scenario. Also, the CA caught the attention of a few researches. Research by the Bank of Italy (2014) shows that share prices decreased for those banks where a requirement for capital strengthening emerged, while Sahin and de Haan (2016) find that euro area members display a strong heterogeneity in terms of market reaction. Carboni et al. (2017) and Pancotto et al. (2020) investigate the impact of the various steps of the CA. They both find that, when the SSM was officially launched, banks directly supervised by the ECB were penalized by investors, at least in the short run, possibly because of the fear of regulatory inconsistency. Interestingly, in Pancotto et al. (2020) bank capitalization is positively

[4] For this reason, for instance, in 2011 the EBA issued a recommendation to national regulators to strengthen capital buffers (EBA 2011).

related to CDS spread for G-SIBs, while it is inversely related to CDS spread for the other banks. All these contributions suggest that the impact of the CA is far from obvious.

Our paper contributes also to the stream of work on the relationship between various features of the banking sector – i.e. efficiency, fragility, profitability – and cross-countries differences in regulatory and supervisory practices (see, e.g., Barth et al. 2004; Beck et al. 2006). Specifically, some works analyse the role of financial regulation and legal framework in the occurrence of banking crises (Kim et al. 2013), exploiting also the changes that followed the Global Financial Crisis (Cihak et al. 2013). Anginer et al. (2018) show that country-level institutional settings affect the relation between bank capital and systemic risk. With respect to this literature, our work highlights that the same supervisory setting may have different effects depending on the countries in which they are implemented.

Finally, our results inform policy makers about the effectiveness of the CA, studying its effect on a longer time span as compared to the previous literature. The evaluation of the impact of supervision on a longer time frame, despite being more challenging from an econometric point of view, is of primary importance to feed the policy debate and to monitor unintended effects. In this respect, our evidence is so far reassuring of the fact that the CA has improved the level of bank capitalization without shrinking their balance sheets.

The rest of the paper is as follows. Section 2 retraces the chronology of the European system of financial supervision, with a focus on the CA. Section 3 illustrates the identification strategy and the dataset. Section 4 discusses the results, while Section 5 implements a series of robustness checks. Section 6 concludes.

2. The creation of the European Systems of Financial Supervision

The Comprehensive Assessment, whose effects are at the centre of the investigation of this paper, is a fundamental component in the overall framework of shared supervision in the euro area, and as such it represented a fundamental step towards the achievement of the Banking Union. This section reports a short chronology of the events that led to the creation of the CA and illustrates the role it plays for the financial stability of the euro area banking sector.

2.1. The EU regulatory architecture after the global financial crisis

In 2008, the global financial crisis exposed the fragilities hidden in a financial system that had grown much more interconnected, and it had highlighted the inherent difficulties faced by regulators in containing risks both domestically and across borders. In response to this, the European Commission President José Manuel Barroso asked for the formation of an expert group to prepare an analysis and a set of proposals to improve the European System of Supervision.

The expert group, chaired by Jacques de Larosière, delivered its report in February 2009.[5] The report found that financial supervision in EU countries suffered from differences in interpretation or implementation of primary legislation, competencies of supervisors, and coordination mechanisms. The report hence recommended the creation of a European Systems of Financial Supervision (EFSF), including the creation of three European Supervisory Authorities (ESAs), as well as colleges of supervisors. The process to create the EFSF included "upgrading the quality of supervision" and the "strengthening of national supervisors", as well as developing a "more harmonized set of financial regulations, supervisory powers and sanctioning regimes". In this first report, micro-supervision of EU financial institution by the ECB, in the form of oversight and coordination of cross-border banks, was not considered a viable option, rather it was recommended a larger role in macro-prudential supervision.

Based on recommendations of the report, in the autumn of 2009 the European Commission set out proposals for the creation of a set of European Supervisory Authorities (including the European Banking Authority), a European System of Financial Supervision, and a European Systemic Risk Board. The proposals were adopted in November 2010.[6] In the same year, the European Banking Authority developed standards to create a single rule book for financial regulation and supervision. The European Supervisory Authorities, based on the previously existing financial services consultative committees, started their operations in January 2011. Another regulatory innovation that gained traction after the Global Financial Crisis was the use of macro-prudential policies and in particular of stress testing the financial sector. Through stress testing, regulators would gain information about individual institutions and financial stability in scenarios of low-probability, high-consequence events (see Demekas 2015). Moreover, stress-test results would be made public, to reduce issues of asymmetric information and to facilitate a correct pricing of risk in the markets (Oura and Schumacher 2012). Macro-economic stress testing was introduced in early 2009 in the United States. In Europe, in May 2009 the European Council, in its Economic and Financial Affairs configuration, gave mandate to the Committee of European Banking Supervisors to coordinate with the ECB and the Commission in order to conduct forward-looking stress tests (CEBS 2009).

[5] See https://ec.europa.eu/economy_finance/publications/pages/publication14527_en.pdf.
[6] See https://ec.europa.eu/info/business-economy-euro/banking-and-finance/financial-supervision-and-risk-management/european-system-financial-supervision_en.

The first large-scale coordinated stress testing exercise in the EU was conducted in 2009 on the 26 major cross-border banking groups. In 2010, it was expanded to include 91 banks, covering at least 65% of total assets in the EU banking sector (CEBS 2010). This was followed by another stress test in 2011. From 2014, the European Banking Authority (EBA) and the ECB re-designed the stress testing framework and a two-year frequency was established.[7]

2.2. The banking union and the role of the Comprehensive Assessment

The sovereign crisis of 2010-2012 highlighted the risk of fragmentation in the euro area, due to the impact on euro area banks reverberating back to the sovereign through what became known as the *doom loop*. As a consequence, the idea of consolidating and coordinating banking supervision gained further traction. Among the goals policymakers and academics set to improve the architecture of the Economic and Monetary Union, the creation of a Banking Union gained prominence as necessary step for breaking the sovereign-bank nexus and improving financial stability (Pisani-Ferry et al. 2012). The increased attention to the architecture of the EMU resulted in the Four Presidents' Report "Towards a genuine economic and monetary union" (Van Rompuy et al. 2012). This included a proposal for an integrated financial framework, based on the Single Rulebook (a unified regulatory framework for the EU financial sector), integrated supervision, and a single deposit insurance scheme. On the back of the request, the Council of the European Union adopted a proposal put forward by the European Commission, which included the creation of a SSM, taking up its role in November 2014. Immediately after the adoption of the proposal, the ECB announced the start of the CA in advance of the SSM starting operations.

The declared objectives of the CA were to ensuring transparency, improving information on the conditions of banks, rectifying problems and implementing correcting actions, and building confidence in stakeholders. At the same time, the CA would allow stakeholders to better understand how rules would be implemented by the SSM, and orientate expectations on the impacts of the new supervisory framework. Additionally, the CA contributed to increasing homogeneity across euro area banks and overcome the informational asymmetries, which were undermining the political and economic feasibility of a banking union by potentially jeopardizing the overall stability of the euro area. Only a few days passed between the creation of the SSM and the announcement of the CA. Yet, the policy debate in the academic arena, think tanks, and among policymakers was mature enough to implement a similar exercise already on the 2013 balance sheet without surprising the stakeholders.

[7] https://www.bankingsupervision.europa.eu/banking/tasks/stresstests/html/index.en.html.

The CA had three elements, which were retained over time, even if partially amended. The first element is a supervisory risk assessment, aimed at assessing quantitatively and qualitatively the key risks of the institution, including liquidity, leverage and funding. The second one is the AQR, aimed at fostering the transparency of bank exposures, especially through the identification and treatment of impairments, but also focusing on the adequacy of asset and collateral valuation and related provisions. The third element is a stress test, providing a forward-looking analysis of the resilience of bank balance sheets in case of weaker economic conditions. The assessments were based on a capital benchmark of 8% Common Equity Tier 1, using definitions of the Capital Requirements Directive IV and Capital Requirements Regulation.[8] The banks subject to the assessment, and thus to direct ECB supervision, are the ones classified as significant. The criteria for significance have changed over time. For the 2013 CA, the ECB used three criteria: i) the total value of the bank's assets exceed €30 billion; ii) the ratio of the bank's total assets to GDP of its country of establishment exceeds 20%, unless the total value of their assets is below €5 billion; iii) the institution is among the three largest credit institutions in a participating SSM Member State, regardless of size. Currently, a bank is significant upon meeting at least one out of four criteria covering size, economic importance, cross-border activities, and direct public financial assistance (for the details of each criterion, see Appendix, Table A1). The ECB also has the power of deeming any bank as significant. If a bank is one of the three largest banks established in a particular country, it can also be considered significant at any stage. As reviews are regularly carried out, banks that upon review meet one of the criteria are deemed significant, and hence supervised by the SSM. Banks can also change status from significant to less significant, and return to their domestic supervisor. Moreover, a CA can be carried out due to exceptional circumstance or if an EU Member State outside the euro area asks to join the SSM.

The first CA was conducted between November 2013 and October 2014. The ECB used the information from financial statements to define whether a bank was significant, ultimately including 130 banks from euro area countries. This represented about 82% of total banking assets in the euro area. According to the final CA report (ECB 2014), over 6,000 professionals were involved, working to a strict timeline set forth in the detailed manuals on the AQR. The sample of assets analysed included over 800 portfolios, within which almost 120,000 debtors, and 170,000 collateral items, were considered. 850 provisioning and counterparty values adjustment models were tested, and 5,000 securities were re-

[8] While leverage is mentioned as an element of the supervisory risk review, it is not an element driving the capital shortfall outcomes of the AQR and ST. A minimum leverage requirement was introduced in Basel III and adopted in CRR/CRD IV. The leverage requirement is defined as tier 1 capital divided by total exposure, in turn obtained as the sum of total assets, derivative assets and off balance sheet items (see https://www.risk.net/definition/leverage-ratio).

evaluated. The report includes a disclosure of results at country and bank level, together with recommendations for supervisory measures prior to the ECB assuming its supervisory role. The results highlighted two main outcomes. The AQR found the need for adjustments to assets valuations totalling €47.5 billion, with considerable variation across jurisdictions. In addition, non-performing exposure (NPE) stocks were increased by €135.9 billion, considering that NPE's definition has been harmonised and made compatible among different countries. The CA also exposed capital shortfalls for 25 banks, for an overall amount of €24.6 billion. About €9.5 billion of these had still to be raised at the end of the exercise, after consideration of capital increases happened since the start of the exercise, and these banks had to undertake actions to fill the capital shortfall by 2015.

The goal of this study is to investigate the CA effects on banks' resilience, identified using the ratio of total regulatory capital to total assets for each bank. Nevertheless, in line with the recent literature (see among others Fiordelisi et al. 2017; Kok et al. 2021) we exploit detailed information at the bank level to single out those financial institutions subject to the CA, while controlling for common shocks or other confounding factors.

3. Econometric model and Data

3.1. Econometric model

Our aim is to study the causal effect of the CA implemented by the ECB on non-risk-based capitalization of directly supervised euro area banks. Being this policy as a quasi-exogenous shock, our identification strategy relies on the difference-in-difference methodology (see, among others, Donald and Lang 2007). This approach considers the exogenous shock as a treatment, and requires the identification of the period from when the new policy is effective (treatment period). In addition, it needs two groups of banks, one composed by those banks subject to the new policy (treated group), and the other one consisting of those excluded by the CA (control group). We consider our treatment period to start in 2013. We base our choice on three pieces of evidence: the timeline of the SSM discussions, the ECB announcement date for the CA, and press discourse (as shown in Figure 1). From the SSM timeline, we can see that the European Commission started signalling an active interest in the banking union in 2012. The ECB announced that it would be initiating a comprehensive assessment on 130 banks, starting in one month, in October 2013.[9] Finally, to corroborate the choice of the first year of treatment, we search for the words "Asset Quality

[9] https://www.bankingsupervision.europa.eu/press/pr/date/2013/html/sr131023.en.html.

Review" on newspapers and publicly available sources exploiting Proquest.[10] The cumulative number of articles in the period 2010-2018 (as shown in Figure 1) confirms that, by the end of 2013, it was already of public domain that major banks' balance sheets would fall under the scrutiny of the ECB. All this evidence suggests that CA effects may have started to materialize on bank balance sheets already in 2013.[11] To identify the treated group, we rely on the list of significant banks under the ECB supervision. Euro area banks not subject to the CA constitute the control group. Therefore, our baseline model can be described as follows:

$$Y_{ijt} = \beta_0 + \beta_1 Treat_i + \beta_2 Post_t + \beta_3 (Treat_i * Post_t) + \boldsymbol{\gamma X_{ij,t-1}} + \boldsymbol{\delta M_{j,t-1}} + \omega_i + \mu_t + \epsilon_{ijt} \qquad (1)$$

where Y_{ijt} is the outcome variable of bank i in country j at time t. The outcome variable is the ratio of Tier 1 capital over total assets.[12] The centrality of the Tier1 capital ratio in the CA emerged clearly, with several banks receiving requests to adequate capitalisation levels, especially in some jurisdictions. Other measures, such as improvements in capitalization ratios, sensitive to the definition of Risk Weighted Assets, may fail to fully capture resilience to systemic event (see, e.g., Acharya and Steffen 2014). $Treat_i$ is a dummy variable to identify the treated group, therefore takes value 1 if bank i is subject to the CA, and 0 otherwise. $Post_t$ is the dummy for the treatment period, which is equal to 1 from the year 2013 onwards, and 0 otherwise. As in any difference-in-difference setting, β_3 is the coefficient of interest, which measures the causal effect of the CA on banks' capital ratio.

The difference-in-difference regression is augmented with further controls, lagged once to lower endogeneity issues. Specifically, we include the vector $\boldsymbol{X_{ij,t-1}}$ to consider time-variant bank-specific factors that could affect the dependent variable. Bank size is the logarithm of total assets, to consider differences related the size of each bank. Bank profitability, measured as net income over total assets, to control for differences in the Tier 1 to total assets ratio related to profitability. We expect that the higher profitability is, the more resilient is the bank, therefore the coefficient should be positive. Gross loans over

[10] A similar search was conducted for "Comprehensive Assessment" but results for this n-gram are omitted, since even after a further search refinement, the articles found by the algorithm included too many false positives (i.e., articles containing the n-gram but not related to the banking sector).

[11] Compared to other papers investigating the effects of CA, our choice is line with Fiordelisi et al. (2017). Differently, Bruno and Marino (2020) and Avignone et al. (2021) consider 2014 as the first year of the post-event period. However, Abbassi et al. (2017) using detailed supervisory information show that reviewed banks adjust their balance sheet as on December 31, 2013.

[12] This measure of bank capitalization does not consider regulatory risk-weights for different asset classes. While risk-weighted capital ratios are also informative, when banks adopt an "Internal rating based" approach these indicators suffer from greater discretion and variability (Mariathasan and Merrouche 2014), thus we opt for the unweighted measure of capitalization.

total assets takes into account differences in the bank asset structure. We expect that banks with a business model based more on traditional lending activities are more capitalised. Non-interest income ratio, computed as the amount of non-interest income divided by the sum of interest and non-interest income, is included to capture banks non-operating income (such as deposit and transaction fees). Considering the low interest rate environment, the ability of banks to find alternative ways to increase revenue could foster resilience, therefore we expect a positive sign. To control for the impact of different levels of NPL, we include the ratio of NPL over gross loans. We expect that the higher are the NPL, less resilient is the bank, therefore we expect a negative coefficient. We also include the vector $\boldsymbol{M_{j,t-1}}$, to control for time-variant macroeconomic dynamics at the country level, therefore to take into account potential difference in the economic development.[13] These variables are per capita GDP, inflation rate and per capita GDP growth. These variables are take into account difference. The specification is further augmented with bank fixed effects ω_i, to control for bank-level time-invariant characteristics, and year dummies μ_t which account for yearly exogenous common shocks. Finally, ϵ_{ijt} is the error term. In the regression, we cluster standard errors at bank level to address potential issues stemming from residuals correlation (Petersen 2009).

The difference-in-difference methodology is based on the parallel trend assumption, in order to claim for causal relationship. An additional concern of our identification strategy is that treated banks were not selected at random. We address these issues in Sections 4.1 and 5.1, respectively.

3.2. Data

Accounting data for banks located in countries for which the CA is relevant[14] are taken from BankScope (for 2007-2013 period) and from Orbis-Bank Focus (for 2014-2018 period), both products by Bureau van Dijk provide banks' standardized accounting data. We select consolidated balance sheets (code C2), when available (around 15% of our final sample), and unconsolidated balance sheets (U1).[15] Concerning the bank business model, we include commercial, cooperative and savings banks (using the available specialization variable). Banks subjected to the CA are identified using the online list published by the ECB/SSM available for each year for the period 2013-2018. We drop from our sample banks that

[13] In the empirical literature dealing with a multiple-country analysis, macroeconomic controls are generally added (see, among others, Fatica and Gregori 2020).

[14] The countries included in the analysis are Austria, Belgium, Cyprus, Estonia, Finland, France, Germany, Greece, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherland, Portugal, Slovenia, Slovakia, Spain.

[15] For those banks that were available we consider consolidated balance sheets as the CA is at the higher level of consolidation. Our main results (Table 2) are robust and similar in the economic magnitude when considering observations with code U2 (unconsolidated statement with a consolidated companion), instead of C2.

over the treatment period (2013-2018) are not subject the CA in all years. All bank-level variables are winsorized at the 1st top and bottom percentile.

After applying these selection criteria and cleaning the data from misreporting, we obtain a final sample of 11,871 bank-year observations corresponding to 2,288 unique banks, of which 236 are treated. In Appendix, Table A2, we provide the distribution of the control and the treated groups by country.

Table 1 Summary statistics. This table shows the summary statistics of the key variables used in the analysis for treated and control groups. Tier 1/TA stands for Tier 1 over total assets; Size is the logarithm of total assets; RoA is return on assets; Loans/TA is loans over total assets; NPL/loans is NPL over total loans. Macroeconomic variables refer to both treated and control groups. GDP per capita is the national GDP per capita in current prices; Inflation is the inflation rate measured by the consumer price index (%); GDP growth is the real yearly growth rate of national GDP.

	N	Mean	St. Dev.	P.le 50	P.le 5	P.le 95
Treated Group						
Tier 1/TA	1499	6.9408	3.4478	6.3365	2.5065	13.3897
Size	1499	9.9530	1.8809	9.8218	6.8575	12.7599
RoA	1499	0.3698	0.8193	0.4000	-1.2400	1.4800
Loans/TA	1499	64.8927	21.1318	69.5279	20.7844	95.6621
Non-interest income ratio	1499	39.0592	16.3359	39.0100	13.9500	65.4800
NPL/Loans	1499	7.2763	7.8982	4.4794	0.7143	25.8072
Control group						
Tier 1/TA	10372	9.2902	3.2788	8.6614	5.3853	15.4412
Size	10372	6.4277	1.5020	6.3008	4.2341	9.0076
RoA	10372	0.2905	0.5439	0.2500	-0.2200	1.0400
Loans/TA	10372	61.0056	14.7832	62.5520	34.2565	82.3928
Non-interest income ratio	10372	32.6119	12.6379	31.3100	15.3500	53.5800
NPL/Loans	10372	6.6759	7.2066	3.8805	0.1773	22.6502
Macroeconomic variables						
GDP per capita	11871	10.5592	0.2427	10.6247	10.0212	10.7781
Inflation	11871	1.1729	1.0697	0.9068	-0.0940	3.0414
GDP growth	11871	0.6875	2.2744	1.4009	-3.2421	3.3463

We augment the database with ownership information obtained from the Bureau van Dijk (BvD) historical Ownership Module. BvD gathers ownership data from firms' reports, stock exchange releases, company websites, press news, private correspondence, and national agencies. Despite some inconsistencies in the data and missing information, the dataset has been recently and widely used in the literature to identify controls (see, e.g., Aminadav and Papaioannou 2020; Fons-Rosen et al. 2017). Ownership information allows us to define whether a bank is a part of banking group or not.

In addition, we consider country variables to gauge a Member State's economic strength and macroeconomic condition. GDP growth, GDP per capita and inflation are from the World Bank while the debt-to-GDP ratio is from Eurostat. Summary statistics are reported in Table 1.

4. Results

4.1. Baseline analysis

This section presents the main results for the difference-in-difference analysis that investigates the impact of CA on the ratio of Tier 1 over total assets. Table 2 shows the main results based on Equation (1).[16] In specification 1, the main coefficient of interest, expressed by the interaction between the variables Treat and Post, is positive and statistically significant at the 1 percent level.[17] We hence find that the average ratio of Tier 1 over total assets for banks under the CA increased by 1.26 percentage points compared to those banks that were not under the scrutiny of the ECB.

In relation to the control variables, the coefficient of Size is significant with a negative sign, therefore on average a bigger bank has a lower financial strength compared to a smaller one. Return on asset positively affects the dependent variable, highlighting that bank profits foster bank capitalization. In fact, profit increases the capital, if not being payed to the shareholders in form of dividends. And also, provisions against expected losses are formed from capital. Loans over total assets are also positively related to the capital ratio, therefore the higher the core bank activity, the better is the bank's resilience. Non-interest income ratio does not appear to be relevant, suggesting that non-operating income has a marginal role in this framework. Non-performing loans over total loans presents a negative coefficient, yet this is not significant. By looking at macroeconomic controls, we can notice that GDP per capita has a positive and strongly significant coefficient, while inflation does not seem to play a role, probably because in the time span considered its variation over time is quite low. GDP growth is significant and with a negative sign.

[16] The variable *Treat* and *Post* included in equation (1) are collinear with firm-level and year fixed effects, therefore they are dropped from the results. When we estimate equation (1) without these fixed effects (table available upon request from the authors), the coefficients related to *Treat* and *Post* variables are statistically significant, in line with the fact that the choice of the treated banks is not random and mainly refers to the biggest ones (i.e. significant entities). In the robustness section we implement a series of checks to take into account this aspect (see, for instance, the propensity score matching estimation).

[17] Results are confirmed when estimating the model with beta regression model accommodating dependent variables with values greater than 0 and less than 1.

Table 2 CA effects on bank Tier 1 capital. This table includes results for the baseline analysis. The dependent variable is the ratio of Tier1 over total assets. Specification 1 shows results based on the implementation of Equation (1), as discussed in Section 3. Specification 2 adds year × country fixed effects, while specification 3 adds year × country × size basket fixed effects. Specification 4 focuses on the subsample of banks that are subsidiaries. Control variables are lagged by 1 year. Standard errors are clustered at the bank level. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% level respectively.

	(1) Tier 1/TA	(2) Tier 1/TA	(3) Tier 1/TA	(4) Tier 1/TA
Treat × Post	1.2677***	1.3459***	1.1800***	0.9781***
	(0.235)	(0.265)	(0.280)	(0.344)
Size	-0.2907***	-0.2231***	-0.2035***	-0.4075*
	(0.057)	(0.058)	(0.058)	(0.213)
RoA	0.3074***	0.3262***	0.3217***	0.1770
	(0.079)	(0.075)	(0.078)	(0.147)
Loans/TA	0.0322***	0.0267***	0.0298***	0.0230*
	(0.008)	(0.007)	(0.007)	(0.013)
Non-interest income ratio	-0.0046	-0.0052	-0.0031	0.0044
	(0.004)	(0.004)	(0.004)	(0.006)
NPL/Loans	-0.0097	-0.0168	-0.0272***	-0.0057
	(0.011)	(0.011)	(0.010)	(0.018)
GDP per capita	5.8425***			
	(1.344)			
Inflation	-0.0477			
	(0.062)			
GDP growth	-0.1078***			
	(0.024)			
Constant	-52.5793***	8.9635***	8.6454***	10.2239***
	(14.136)	(0.632)	(0.589)	(2.033)
Observations	11,871	11,865	11,821	3,343
R-squared	0.8855	0.8991	0.9051	0.9030
Bank FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Year × Country FE	No	Yes	No	Yes
Year × Country × Size basketFE	No	No	Yes	No

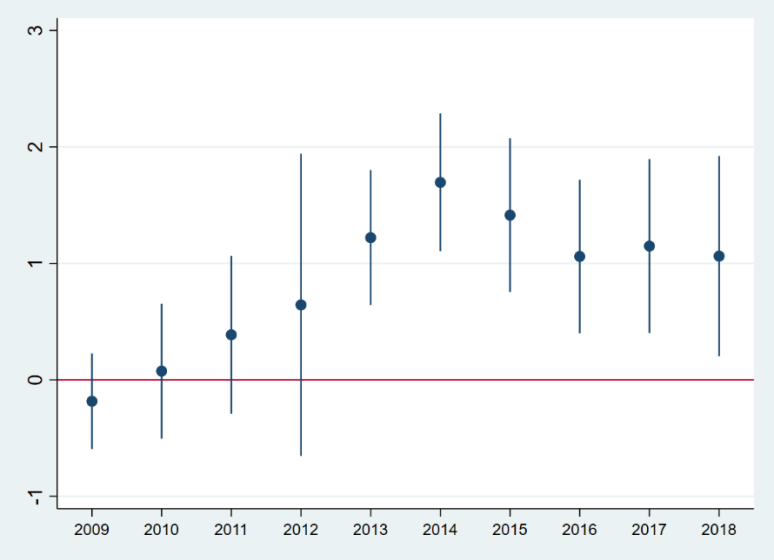
Accounting for time-varying country differences, by including country fixed effects interacted with years (specification 2), does not change our main results. Specification 3 replicates the previous regression but also interacting year and country fixed effects with a size basket, to further capture differences due to size among banks.[18] While our main results are confirmed, in this specification Non-performing loans over total loans becomes significant at the 5 per cent level with a negative sign, suggesting that the higher is the amount of NPL, the lower is the capital ratio.

[18] Banks are grouped by size basket defined on being below/above the national median size.

Differently from previous studies (Fiordelisi et al. 2017; Avignone et al. 2021), we do not limit our analysis to credit institutions and financial holding companies, thus our sample includes a quite large set of banks which allow us to study additional implications of the CA. In specification 4 we exploit the ownership information available in our dataset by restricting the sample to subsidiary banks only. In this way we can test whether the results reported in the previous specifications apply also to the subsample of subsidiaries or if they are driven by the group of parents. The positive and still significant coefficient suggests that the impact of CA on bank resilience propagates along the banking group to subsidiaries of banks under the CA and it is no limited to parent banks, which are under direct supervision of the ECB.

As mentioned in the introduction, by using for our analysis a sample with a longer timespan than the previous literature, we can check whether the CA affected the resilience of the treated banks only in the immediate aftermath, or if its effects are lasting. To investigate this issue, Figure 2 shows the estimated coefficients of the variable $Treat_i$ interacted with year dummies, obtained in a regression including all control variables and the set of fixed effects as in specification 3. While we observe that coefficients are positive and statistically significant for the 2013-2018 periods, there is no statistically significant evidence in the corresponding coefficients for the previous years. This result substantially reduces concerns about the potential presence of different pre-trends in the Tier1 capital over total assets, and, at the same time, corroborates the choice to consider as initial treatment date of the CA year 2013. The graph also shows that the impact of the supervisory reform in Europe may be long-lived, and it is not limited to the short-term when the CA started.

Figure 2 Dynamic difference – in – difference. The graph shows regression coefficients of the interaction term of treat with years and confidence intervals at 95% level from a regression with bank controls, bank fixed effects, and year × country × size basket fixed effects (the full set of estimated coefficients is reported in Appendix, Table A4).



4.2. Investigating the dynamics of Tier 1 capital over total assets

While in Table 2 we found that the CA has had a positive effect on Tier 1 over total assets, the improvement in the ratio could be due to different dynamics of its components, having different implications for financial stability. Table 3 shows the analysis investigating which components are driving the increase in the Tier 1 over total assets. These are obtained using an estimation of Equation (1) with country-year fixed effects, including as dependent variable each component separately.

In specification 1, we consider as dependent variable the logarithm of the Tier 1. We find that the coefficient of interest is positive and statistically significant. However, this is not driven by an increase in reserves and retained earnings (specifications 2 and 3). An important concern related to the CA is whether the restructuring of banks' balance sheets was done with sell-off of assets and a contraction of credit. Indeed, the deleveraging process, under certain conditions, may have negative consequences for the economy. In specification 4, we do not find a statistically significant effect on the logarithm of total assets suggesting that the increase in the ratio of Tier 1 over total assets is not driven by a shrinking in the balance sheet. Moreover, in specification 5 we consider as our dependent variable the logarithm of loans. The coefficient of interest is positive and statistically significant at 5%. This result shows that, in the period under consideration, treated banks after the CA have not decreased their lending but rather have increased the amount of loans. Since the starting level of Tier1 over total assets might drive the lending behaviour of the bank, we run separate models for banks with low level of Tier1 over total assets (in the 50th percentile or below) and for banks with high level (above the 50th percentile). We find that the increase in the amount of loans concerns those banks with larger share of Tier 1 over total assets, which were able to restructure their balance sheets while both preserving financial resilience and increasing lending. This result in contrast with previous findings in the literature (Fiordelisi et al. 2017), possibly due to differences in the period analysed. Specifically, we consider a larger period under which banks have been under the CA, therefore the medium-term effect may differ as compared to the short-term shock.

Table 3 Components. This table analyses the determinants of the Tier1 over TA after the introduction of the CA. All regressions include the same set of control variables as in Table 2, specification 2 (bank controls, bank and year × country fixed effects). The dependent variables are Tier 1 (specification 1), reserves (specification 2), and retained earnings defined as the ratio of retained income over after-tax profits (specification 3), total assets (specification 4), and loans (specification 5-7). All dependent variables are in natural logarithms. In specifications 6 and 7 we run separate regressions for those banks with low (5th percentile of below) and high level (above the 5th percentile) of Tier1/TA, respectively. Standard errors are again clustered at the bank level. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% level respectively.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Ln (Tier 1)	Ln (Reserves)	Ln (Retained Income)	Ln(TA)	Ln (Loans)		
					Overall	Low Tier1/TA	High Tier1/TA
Treat × Post	0.1882***	0.1618	-0.0966	0.0645	0.1566**	0.1131	0.2115**
	(0.057)	(0.148)	(0.177)	(0.053)	(0.066)	(0.082)	(0.102)
Size	0.4006***	0.3585***	-0.0327		0.4162***	0.4542***	0.2798***
	(0.031)	(0.041)	(0.024)		(0.032)	(0.067)	(0.038)
RoA	0.0789***	0.0246	0.0169	0.0339***	0.0295***	0.0147	0.0301
	(0.012)	(0.021)	(0.027)	(0.009)	(0.011)	(0.012)	(0.018)
Loans/TA	0.0034***	0.0000	0.0031	-0.0006			
	(0.001)	(0.002)	(0.003)	(0.001)			
Non-interest income ratio	0.0001	0.0035***	0.0006	0.0003	-0.0016	-0.0017	-0.0014
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
NPL/Loans	-0.0067***	0.0018	0.0052	-0.0028**	-0.0044***	-0.0102***	-0.0034**
	(0.001)	(0.003)	(0.004)	(0.001)	(0.002)	(0.003)	(0.002)
Constant	1.4635***	-0.5035	1.0626***	4.0220***	3.5797***	3.7030***	4.0446***
	(0.232)	(0.337)	(0.283)	(0.232)	(0.221)	(0.507)	(0.242)
Observations	11,814	8,500	6,907	11,821	11,753	5,674	5,577
R-squared	0.9815	0.9739	0.9020	0.9870	0.9854	0.9907	0.9806
Bank FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year × Country FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes

4.3. Country differences in regulatory quality and property rights

Since our analysis centres on the effects of the CA, which brought significant banks under a common supervisor at supranational level rather than leaving their supervision decentralised at national level, in this section we want to investigate the role of country-level heterogeneity on the effect of the CA. Previous literature recognizes regulation and institutional environment as a major driver of financial stability (see, e.g., Cihak et al. 2013; Anginer et al. 2018). Therefore, we investigate whether the CA had heterogeneous effects depending on the domestic institutional frameworks, focusing on two dimensions: regulatory quality and property rights.

To capture regulatory quality we use the indicator computed by the World Bank as part of the Worldwide Government indicators. Regulatory quality is calculated yearly since 1996 for more than 200 countries and it captures the extent to which private sector development is promoted by government's policies and regulations (see Kauffman et al. 2011 for a discussion of the indicators). In our analysis, we use the indicator to split the sample in two groups of countries, one below and the other one above the regulatory quality median of our sample in 2012.[19] Our aim in fact is to control for different effects of the CA depending on the comparative level of regulatory quality countries had before the CA took place, rather than controlling for the effect of this variable on banks' balance sheet. Table 4, specifications 1 and 2, report regression results for the two groups of countries. The coefficient of interest is positive and statistically significant only for countries below the regulatory quality median.

The second country dimension we investigate relates to property rights, as constructed by the Heritage foundation.[20] The property rights index, widely used in the literature (see, e.g., Ouattara and Standaert 2020), varies yearly for each country and captures the degree to which countries' laws protect private property rights, and the level of enforcement of these laws by the government. It ranges from 0 to 100, where the higher is the country's score, the better is the legal protection of property rights. As in the previous case, we split the sample between banks located in countries with a lower level of property rights (below the median value of property rights index as measured in 2012),[21] and banks located elsewhere. In Table 4, specifications 3 and 4, results suggest that the CA increases bank capitalization especially in countries with a level of property rights below the median. As the CA is an external shock to an existing condition, our results may highlight that countries with relatively worse property rights benefit the most from delegating supervision of significant banks to the ECB.

These findings highlight that the CA has increased bank resilience especially in those countries with a relatively less strong regulatory environment. Therefore, centralized supervision, as the one carried out by the ECB with the CA, could be particularly beneficial for entities originally supervised locally in countries with relatively weaker frameworks. While the coefficient is not significantly different from zero in countries with relatively stronger regulatory quality, the systemic nature of the banking system and the

[19] To split the sample, we consider the regulatory quality median in year 2012 and countries are classified above or below the median considering their level in 2012 (this is done to avoid confounding effects due to the implementation of the CA). We replicated the analysis by excluding the banks from those countries were the regulatory quality indicator is close to the median value, to deal with issues due to the imprecise measurement of the indicator. Results are confirmed (table available upon request from the authors).

[20] See: https://www.heritage.org/index/property-rights.

[21] We replicated the analysis by excluding the banks from those countries were the property rights index is close to the median value, to deal with issues due to the imprecise measurement of the indicator. Results are confirmed (table available upon request from the authors).

existence of strong cross-country spillovers, implies that even these countries may also benefit from an increase in the overall level of financial stability of the euro area.

Table 4 Regulatory quality and property rights. The dependent variable is the ratio of Tier1 over total assets. All regressions include the same set of control variables as in Table 2, specification 1 (bank controls, macro controls, bank and year fixed effects). Specifications 1 and 2 split the sample in two groups of countries based on the Regulatory quality, the former below to the Regulatory quality's median, and the latter equal or above the median. Specifications 3 and 4 follow the same approach for Property rights. Standard errors are clustered at the bank level. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% level respectively.

	Regulatory quality		Property rights	
	Low	High	Low	High
	(1)	(2)	(3)	(4)
	Tier 1/TA	Tier 1/TA	Tier 1/TA	Tier 1/TA
Treat × Post	1.4843***	0.2346	1.5518***	-0.3463
	(0.265)	(0.576)	(0.265)	(0.537)
Size	-0.8018***	-0.0459	-0.6988***	-0.0476
	(0.226)	(0.037)	(0.217)	(0.035)
RoA	0.3513***	0.1075	0.3529***	0.0528
	(0.077)	(0.216)	(0.078)	(0.242)
Loans/TA	0.0219**	0.0251**	0.0245**	0.0193***
	(0.010)	(0.011)	(0.010)	(0.007)
Non-interest income ratio	-0.0088*	0.0077	-0.0101**	0.0107**
	(0.005)	(0.005)	(0.005)	(0.005)
NPL/Loans	-0.0021	0.0096	-0.0002	0.0034
	(0.011)	(0.029)	(0.011)	(0.028)
Constant	-16.0080	37.2216	-12.1100	44.7681
	(20.889)	(36.929)	(18.881)	(45.631)
Observations	5,934	5,930	5,978	5,886
R-squared	0.8813	0.9088	0.8810	0.9114
Macro controls	Yes	Yes	Yes	Yes
Bank FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes

4.4. EFSF/ESM programme and banks' resilience

Due to sovereign tensions of 2010-2012, five countries of our sample (i.e., Cyprus, Greece, Ireland Portugal, Spain) applied for ESM supports, these implied a significant restructuring, recapitalisation and assessment of their banking system. Moreover, the ECB, as part of the so-called Troika, participated in some of these Programmes together with the EFSF (later to be ESM), and the IMF. In this section, we address the questions of whether the countries which received EFSF/ESM assistance are driving our results, and whether the CA has a different impact on treated banks based on being part of the EFSF/ESM.

We report the results in Table 5. Specification 1 addresses the first question by removing entirely the banks in EFSF/ESM Programme countries from the sample: we can see that our main result is confirmed.

Table 5 The EFSF/ESM programme countries. The dependent variable is the ratio of Tier1 over total assets. All regressions include the same set of control variables as in Table 2, specification 1 (bank controls, macro controls, bank and year fixed effects). Specification 1 excludes banks located in ESM countries. ESM is a dummy equal one if a bank is in a country under EFSF/ESM Programme in a given year, zero otherwise. Standard errors are clustered at the bank level. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% level respectively.

	(1)	(2)	(3)
	Tier 1/TA	Tier 1/TA	Tier 1/TA
Treat*Post	0.8052***	0.9582***	0.7048***
	(0.213)	(0.213)	(0.214)
ESM		2.2848***	1.9468**
		(0.449)	(0.959)
Treat*ESM			-0.6143
			(1.117)
Post*ESM			-0.3356
			(1.246)
Treat*Post*ESM			2.0300
			(1.457)
Size	-0.2618***	-0.2639***	-0.2637***
	(0.058)	(0.058)	(0.057)
RoA	0.3038***	0.3056***	0.2954***
	(0.080)	(0.079)	(0.076)
Loans over TA	0.0271***	0.0317***	0.0324***
	(0.007)	(0.007)	(0.007)
Non interest income ratio	-0.0020	-0.0033	-0.0032
	(0.004)	(0.004)	(0.004)
NPL over Loans	-0.0154*	-0.0090	-0.0108
	(0.009)	(0.011)	(0.010)
GDP per capita	6.2405***	6.9661***	7.2310***
	(1.411)	(1.317)	(1.357)
Inflation	0.0570	-0.0192	-0.0344
	(0.066)	(0.060)	(0.063)
GDP growth	-0.1389***	-0.1010***	-0.1025***
	(0.022)	(0.023)	(0.022)
Constant	-56.9885***	-64.7991***	-67.5708***
	(14.888)	(13.858)	(14.271)
Observations	11,035	11,871	11,871
R-squared	0.8912	0.8882	0.8887
Bank FE	Yes	Yes	Yes
Year FE	Yes	Yes	Yes

Specification 2 investigates the effect the role of having been in the EFSF/ESM Programme on capitalisation by introducing the dummy variable ESM equal to one since the first year in which a country applied to the EFSM/ESM Programme onwards. This variable captures whether at a certain point in time a country is, or has previously been, part of an EFSF/ESM Programme. Our main result is once again robust to this control. Furthermore, we find that the ESM did have a positive effect on the capitalisation of banks.

To further disentangle the mechanism by which being part of an EFSF/ESM Programme has affected banks later subject to the CA, in specification 3 we interact the CA dummy with the ESM variable. Overall, the results indicate that the EFSF/ESM had an overall positive effect on the banks in the countries subject to the Programme, but the CA did not have any different effect on similar banks in Programme and non-Programme countries, as implied by the not significant coefficient when the dummies ESM and CA are interacted. Overall, this evidence suggests that the EFSF/ESM Programmes affected the domestic banks, but did not interact with the Comprehensive Assessment and our main results are not led by the Programmes.

5. Robustness checks

In this section, we employ several robustness tests to ensure that the main results do not depend on differences between treated and non-treated banks before the CA. We also provide a strict test to account for the parallel trend assumptions and we make sure that our results are robust to different matching setups. In addition, we conduct a series of robustness checks on the dependent variable, additional controls, and different subsamples to ensure the reliability of the findings. Finally, we replicate our analysis in a staggered difference-in-difference setting. All these additional tests lend further support to the main results.

5.1. Matching

In this subsection, we implement a propensity score matching procedure to create a control group of banks with similar characteristics in the pre-treatment period to the treated banks. Results are presented in Table 6.

First, we run a probit regression for the sample 2012 using as dependent variable a dummy equal to one for the treated banks. As explanatory variables, we include the lagged variables of Tier1 over total assets, size basket, return on assets, loans over total assets, non-interest income ratio, and NPL over loans. The matching procedure is a nearest neighbour matching of propensity scores (Rosembaum and Rubin,

1983). We then use the predicted probabilities of the probit model to match each treated bank with its three nearest non-treated neighbours. The matching is done with replacement, such that each non-treated banks can be used as neighbour for multiple CA banks. This procedure allows us to have more balanced groups, which should limit the possibility that the measured change in Tier1 over total assets is due to other factors. After implementing this matching procedure, the final sample includes 154 treated banks and 248 non-treated banks. Summary statistics of the two sub-samples are reported in Table A5 in the Appendix. We then run our difference-in-difference model. Specification 1 shows that our main results hold.

Second, to complement previous results we return on the parallel trend assumption. Thus, as explanatory variables we add to the probit regression the lagged growth rate of the Tier1 over total assets in the pre-treatment period, which guarantees that the Tier1 over total assets has a similar trend for treated and non-treated banks before the CA. In specification 2, the coefficient of interest is positive and statistically significant at 10%.

Third, to further support our findings we consider different matching procedures. In specification 3, results of the difference-in-difference model are shown after each bank in the treated group was matched with six banks in the control group (instead of only three non-treated neighbours). In specification 4, the number of assigned nearest neighbours to each bank under the CA in the matching procedure is one but without replacement. Again, results are confirmed in both specifications. In specification 5, we adopt the reweighting approach based on the propensity score (see, e.g., Hirano et al. 2003; Busso et al. 2014), which provides an efficient estimate of the average treatment effect. Specifically, the weight for treated banks is 1, while for the non-treated banks we assign a weight equal to $p/(1-p)$ where p is the propensity score. Our result holds also using such approach.

Finally, we add to the explanatory variables in the probit model GDP growth, GDP per capita, and inflation to have a balanced match also in macroeconomic conditions that banks faced. Results are presented in specification 5 and once again, the coefficient of interest is positive and statistically significant.

Table 6 Robustness – Propensity Score Matching. This table includes six robustness checks for the difference-in-differences results. For each robustness check, the dependent variable is the Tier1 over TA. All regressions include the same set of control variables as used in Table 2 specification 2 (bank controls, bank and year × country fixed effects). In specification 1, control variables in the matching procedure are the lagged variables of Tier1 over TA, size basket, RoA, Loans over TA, non-interest income ratio, NPL over Loans. Each bank in the treatment group is matched with three non-treated banks. In specification 2 we add as control variables in the matching procedure the lagged growth rate of Tier1 over TA. In specifications 3 and 4 we match each bank in the treatment group with six non-treated banks and one non-treated bank (without replacement) instead of three. In specification 5 we use the reweighting approach (Hirano et al., 2003). In specification 6 we add as control variables in the matching procedure the lagged values of GDP per capita, Inflation, and GDP growth. Standard errors are clustered at the bank level. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% level respectively.

	(1)	(2)	(3)	(4)	(5)	(6)
Dependent variable:	Tier 1/TA	Tier 1/TA	Tier 1/TA	Tier 1/TA	Tier 1/TA	Tier 1/TA
Treat × Post	0.8628***	0.5129*	0.7940***	0.7401**	0.7184**	0.6703**
	(0.317)	(0.271)	(0.287)	(0.334)	(0.361)	(0.289)
Size	-0.5991**	-0.7061**	-0.4325**	-0.4894*	-0.8952***	-0.4048
	(0.266)	(0.310)	(0.208)	(0.273)	(0.321)	(0.248)
RoA	0.2581*	0.2438*	0.2573*	0.3115**	0.4342**	0.2296*
	(0.133)	(0.130)	(0.133)	(0.128)	(0.174)	(0.122)
Loans/TA	0.0333***	0.0278**	0.0293***	0.0241**	0.0180	0.0331***
	(0.012)	(0.011)	(0.010)	(0.011)	(0.014)	(0.011)
Non-interest income ratio	0.0023	0.0043	0.0042	-0.0025	-0.0015	0.0004
	(0.006)	(0.005)	(0.006)	(0.007)	(0.005)	(0.005)
NPL/Loans	0.0055	0.0125	0.0097	0.0270	0.0507**	0.0147
	(0.021)	(0.022)	(0.022)	(0.022)	(0.023)	(0.022)
Constant	9.2353***	10.3992***	7.8684***	8.8970***	12.6487***	7.5502***
	(2.725)	(3.155)	(2.259)	(2.746)	(3.357)	(2.529)
Observations	2,673	2,524	3,483	2,191	2,673	2,688
R-squared	0.8445	0.8385	0.8389	0.8353	0.8345	0.8279
Bank FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Country FE	Yes	Yes	Yes	Yes	Yes	Yes
Year × Country	Yes	Yes	Yes	Yes	Yes	Yes

5.2. Robustness on the baseline analysis

Table 7 presents a series of robustness checks on the baseline model (as shown in Table 2, specification 1). We firstly include an additional macroeconomic variable to control for the level of public debt. This indicator is computed for each country and year as the logarithm of total public debt over GDP,[22] and it is lagged by one year to reduce potential endogeneity bias. Specification 1 shows that the

[22] The percentage of "General government debt over GDP" is retrieved from Eurostat.

coefficient of interest is in line with the baseline results and that the level of public debt does not statistically affect bank resilience. In specification 2, we replicate specification 4 of Table 2 adding specialization dummies to control for differences among commercial, cooperative and investment banks, as defined by Bureau van Dijk.

Table 7 Robustness - baseline. This table shows results for a set of robustness of Table 2. Specification 1 adds the logarithm of public debt over GDP lagged by 1 year to the baseline. Specification 2 adds the specialization fixed effects to specification 3 of Table 2. Specification 3 excludes banks with total assets below 500 mln Euro. In specification 4 the dependent variable is the logarithm of Tier 1/TA, while in specification 5 the years of the financial crisis (2008-2009) are excluded. Standard errors are clustered at the bank level. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% level respectively.

	(1)	(2)	(3)	(4)	(5)
	Tier 1/TA	Tier 1/TA	Tier 1/TA	Ln(Tier 1/TA)	Tier 1/TA
Treat × Post	1.2600***	1.1440***	0.7872***	0.1267***	1.0658***
	(0.233)	(0.279)	(0.274)	(0.033)	(0.325)
Post	-0.1975				
	(0.187)				
Size	-0.2778***	-0.2225***	-0.3636**	-0.0156**	-0.1325***
	(0.056)	(0.065)	(0.145)	(0.007)	(0.051)
RoA	0.3018***	0.3144***	0.2469**	0.0377***	0.3366***
	(0.077)	(0.077)	(0.103)	(0.008)	(0.071)
Loans/TA	0.0331***	0.0301***	0.0453***	0.0041***	0.0276***
	(0.008)	(0.006)	(0.008)	(0.001)	(0.007)
Non-interest income ratio	-0.0039	-0.0022	-0.0002	-0.0005	-0.0024
	(0.004)	(0.004)	(0.005)	(0.001)	(0.004)
NPL/Loans	-0.0091	-0.0251**	-0.0075	-0.0039***	-0.0185
	(0.011)	(0.010)	(0.016)	(0.001)	(0.011)
GDP per capita	5.9828***				
	(1.380)				
Inflation	-0.0565				
	(0.062)				
GDP growth	-0.1069***				
	(0.024)				
Ln (Debt/GDP)	-0.0464				
	(0.545)				
Constant	-53.0988***	8.0458***	6.0828***	2.0030***	8.1799***
	(15.504)	(1.645)	(1.458)	(0.064)	(0.568)
Observations	11,864	11,814	6,910	11,814	10,946
R-squared	0.8845	0.9041	0.8734	0.8943	0.9094
Bank FE	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes
Year × Country FE	No	Yes	Yes	Yes	Yes
Year × Country × Size basket FE	No	Yes	Yes	Yes	Yes
Specialization FE	No	Yes	Yes	No	No

To control for potential bias due to the inclusion of small banks in our sample, in specification 3 we exclude banks with a limited size, i.e., total assets below EUR 500 million. The estimated coefficient is lower but still statistically significant. In specification 4 we estimate specification 4 of Table 2 using as dependent variable the logarithm of Tier 1 over total assets. In specification 5, we exclude the years of the Global financial crisis (2008-2009). In all these specifications, the main results are confirmed, with our coefficient of interest always positive and statistically significant at the 1% level.[23]

5.3. Staggered diff-in-diff

In our main analysis, we restrict the sample to banks that, based on the online information provided by the ECB, are under the CA for the entire period 2013-2018. However, there are banks affected by the CA at different point in time, specifically i) banks that are subjected to the CA after 2013, or ii) banks for which the CA treatment ends before the year 2018. Despite these cases concern a limited number of banks, we implement a staggered difference-in-difference approach, using the following specification:

$$Y_{ijt} = \beta_0 + \beta_1 TREAT_i + \beta_2 TREATEDActive_t + \boldsymbol{\gamma X_{ijt-1}} + \vartheta_i + \mu_t + \epsilon_{ijt} \qquad (2)$$

All variables are defined as before except for the variable *TREATEDActive* that is a dummy variable equal to one for the treatment group if the treatment is active in year t. In addition, μ_t are year dummies. Our coefficient of interest is hence β_2. Results are displayed in Table 8. We notice that in all specification the coefficient of *TREATEDActive* is positive and statistically significant, providing further evidence for our main results.

[23] Considering that all bank-level variables are winsorized at the 1st top and bottom percentile, we tested our baseline results to verify that they are robust to whether the data are winosirzed or not. Results are confirmed (table available upon request from the authors).

Table 8 Robustness - Staggered difference-in-difference. This table includes results for staggered difference-in-difference approach. The number of observation in Specification 1 increases as compared to the once in Table 2, Specification 1. This is due to the fact that we now include those banks that exit from the CA earlier than 2018 or enter later than 2013. Specification 2, on top of bank controls, bank and year fixed effects already present in Specification 1, also includes country macro-economic variables. Specification 3 includes year × country fixed effects. Specification 4 includes Size basket × year × country fixed effects. Standard errors are clustered at the bank level. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% level respectively.

	(1) Tier 1/TA	(2) Tier 1/TA	(3) Tier 1/TA	(4) Tier 1/TA
TreatedActive	1.1911***	1.2326***	0.9593***	0.8610***
	(0.207)	(0.216)	(0.224)	(0.276)
Size	-0.2968***	-0.2366***	-0.2152***	-0.4697**
	(0.058)	(0.060)	(0.060)	(0.232)
RoA	0.2849***	0.3360***	0.3369***	0.1751
	(0.073)	(0.073)	(0.077)	(0.144)
Loans/TA	0.0351***	0.0267***	0.0295***	0.0219*
	(0.007)	(0.007)	(0.006)	(0.012)
Non-interest income ratio	-0.0028	-0.0043	-0.0035	0.0054
	(0.004)	(0.004)	(0.004)	(0.006)
NPL/Loans	-0.0091	-0.0205*	-0.0317***	-0.0147
	(0.011)	(0.010)	(0.010)	(0.018)
GDP per capita	5.3866***			
	(1.380)			
Inflation	-0.0142			
	(0.068)			
GDP growth	-0.0984***			
	(0.024)			
Constant	-47.9509***	9.0304***	8.7730***	10.7498***
	(14.565)	(0.636)	(0.593)	(2.142)
Observations	12,141	12,137	12,096	3,522
R-squared	0.8800	0.8944	0.9020	0.8946
Bank FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Year × Country FE	No	Yes	Yes	Yes
Year × Country × Size basket FE	No	No	Yes	No

6. Conclusions

The 2007-2008 global financial crisis hit an undercapitalized banking system, leading to a large contraction in credit and a tightening in financial conditions (see, among others, Claessens et al. 2010). By contrast, when the Covid-19 shock hit Europe, the banking system was much better capitalized and hence ready to react to the consequences of the pandemic crisis. This capacity is often attributed to the set of

reforms put in place in response to the global financial crisis that made room for the policy actions that governments and central banks took in response to the Covid-19 crisis.

To better understand the extent to which these policy played a role, this paper focuses on the effects of the CA – the set of financial health checks conducted by the ECB on the largest European banks (i.e. significant banks) – on euro area banks' balance sheets. Therefore, we investigate whether the CA, effective since year 2013, improved bank resilience identified using the ratio of total regulatory capital to total assets for each bank. Implementing a difference-in-difference methodology for bank balance sheets in the years 2007-2018, we find that the CA contributed to increase banks' resilience of significant banks.

An important concern related to the CA is whether the restructuring of banks' balance sheets was done with sell-off of assets and a contraction of credit. Indeed, the deleveraging process, under certain conditions, may have negative consequences for the economy. Our results show that the increase in the ratio of Tier 1 over total assets is not driven by a shrinking in the balance sheet, such as a decrease of lending.

Our analysis also shows that, so far, the positive impact of the CA has persisted over time, and banks domiciled in countries with relatively weaker institutions seem to have benefited the most in terms of financial resilience from the delegation of supervision to a supranational authority. Centralized supervision seems therefore to have led to higher risk reduction in countries with less strong institutional systems, allowing the creation of a more level-playing field in the banking union. Moreover, we find that the results are not led by other policy interventions, such as the participation in the ESFS/ESM Programmes.

While in this paper we focus on Tier1 over Total Assets to capture bank resilience with a measure of capitalisation, future research on the effects of CA could investigate further the determinants of change in leverage, such as equity issuance or de-risking of loan portfolio, to complement our results with a better understanding of the dynamic of the whole balance sheet.

References

Abbassi, P., Iyer, R., Peydro, J. L., & Soto, P. E. (2017). Dressing up for the regulators: evidence from the largest-ever supervisory review. Working paper.

Acharya, V., Engle, R., & Richardson, M. (2012). Capital shortfall: A new approach to ranking and regulating systemic risks. American Economic Review, 102(3), 59-64.

Acharya, V., Engle, R., & Pierret, D. (2014). Testing macroprudential stress tests: The risk of regulatory risk weights. Journal of Monetary Economics, 65, 36-53.

Acharya, V. V., Berger, A. N., & Roman, R. A. (2018). Lending implications of US bank stress tests: Costs or benefits?. Journal of Financial Intermediation, 34, 58-90.

Acharya, V. V., & Steffen, S. (2014). Making sense of the comprehensive assessment. SAFE Policy Letter, 32. http://nbn-resolving.de/urn:nbn:de:hebis:30:3-350190.

Agarwal, S., Lucca, D., Seru, A., & Trebbi, F. (2014). Inconsistent regulators: Evidence from banking. The Quarterly Journal of Economics, 129(2), 889-938.

Ahnert, L., Vogt, P., Vonhoff, V., & Weigert, F. (2020). Regulatory stress testing and bank performance. European Financial Management, 26(5), 1449-1488.

Aminadav, G., & Papaioannou, E. (2020), Corporate Control around the World. The Journal of Finance, 75, 1191-1246.

Anginer, D., Demirgüç-Kunt, A., & Mare, D. S. (2018). Bank capital, institutional environment and systemic stability. Journal of Financial Stability, 37, 97-106.

Avignone, G., Altunbas, Y., Polizzi, S., & Reghezza, A. (2021). Centralised or decentralised banking supervision? Evidence from European banks. Journal of International Money and Finance, 110, 102264.

Bank of Italy (2014). Financial Stability Report. Bank of Italy, Rome. N. 2.

Barth, J. R., Caprio Jr, G., & Levine, R. (2004). Bank regulation and supervision: what works best? Journal of Financial intermediation, 13(2), 205-248.

Bassett, W. F., & Berrospide, J. M. (2018). The Impact of Post Stress Tests Capital on Bank Lending. Working paper.

Beck, T., Demirgüç-Kunt, A., & Levine, R. (2006). Bank concentration, competition, and crises: First results. Journal of banking & finance, 30(5), 1581-1603.

Beck, T., Todorov, R., & Wagner, W. (2013). Supervising cross-border banks: theory, evidence and policy. Economic Policy, 28(73), 5-44.

Bellia, M., & Maccaferri, S. (2020). Banks' bail-in and the new banking regulation: an EU event study. JRC working paper No. 7.

Beltratti, A., & Stulz, R. M. (2012). The credit crisis around the globe: Why did some banks perform better?. Journal of financial economics, 105(1), 1-17.

Bruno, B., & Marino, I. (2020). How Do Banks Respond to Non-Performing Loans? Centre for Studies in Economics and Finance, n. 513, University of Naples, Italy.

Busso, M., DiNardo, J., & McCrary, J. (2014). New evidence on the finite sample properties of propensity score reweighting and matching estimators. Review of Economics and Statistics, 96(5), 885-897.

Cappelletti, G., Melo Fernandes, C., & Ponte Marques, A. (2019). The Effects of the Stress-Testing Exercises on Banks' Lending, Profitability and Risk-Taking: Are There Unintended Side Effects? SSRN Working paper, http://dx.doi.org/10.2139/ssrn.3478913.

Carletti, E., Dell'Ariccia, G., & Marquez, R. (2021). Supervisory incentives in a banking union. Management Science, 67(1), 455-470.

Carboni, M., Fiordelisi, F., Ricci, O., & Lopes, F. S. S. (2017). Surprised or not surprised? The investors' reaction to the comprehensive assessment preceding the launch of the banking union. Journal of Banking & Finance, 74, 122-132.

Cihak, M., Demirgüç-Kunt, A., Peria, M. S. M., & Mohseni-Cheraghlou, A. (2013). Bank regulation and supervision in the context of the global crisis. Journal of Financial Stability, 9(4), 733-746.

Claessens, S., Dell'Ariccia, G., Igan, D. & Laeven, L. (2010). Cross-country experiences and policy implications from the global financial crisis. Economic Policy, 25(62), 267-293.

Committee of European Banking Supervisors (2009), "CEBS's press release on the results of the EU-wide stress testing exercise", press release.

Committee of European Banking Supervisors (2010), "CEBS's statement on key features of the extended EU-wide stress test", press release.

Connolly, M. (2018). The real effects of stress testing. Working paper SSRN 3069376.

Cortés, K. R., Demyanyk, Y., Li, L., Loutskina, E., & Strahan, P. E. (2020). Stress tests and small business lending. Journal of Financial Economics, 136(1), 260-279.

Demekas, M.D.G. (2015). Designing effective macroprudential stress tests: Progress so far and the way forward (No. 15-146). International Monetary Fund.

Donald, S. G., & Lang, K. (2007). Inference with difference-in-differences and other panel data. The review of Economics and Statistics, 89(2), 221-233.

Dell'Ariccia, G., & Marquez, R. (2006). Competition among regulators and credit market integration. Journal of Financial Economics, 79(2), 401-430.

EBA (2011). Recommendation on the creation and supervisory oversight of temporary capital buffers to restore market confidence. EBA/REC/2011/1.

European Central Bank (2014). Aggregate Report on the Comprehensive Assessment.

Fatica, S., & Gregori, W. D. (2020). How much profit shifting do European banks do? Economic Modelling, 90, 536-551.

Fiordelisi, F., & Galloppo, G. (2018). Stock market reaction to policy interventions. The European Journal of Finance, 24(18), 1817-1834.

Fiordelisi, F., Ricci, O., & Stentella Lopes, F. S. (2017). The unintended consequences of the launch of the single supervisory mechanism in Europe. Journal of Financial and Quantitative Analysis, 52(6), 2809-2836.

Fons-Rosen, C., Kalemli-Ozcan, S., Sorensen, B. E., Villegas-Sanchez, C., & Volosovych, V. (2017). Foreign investment and domestic productivity: identifying knowledge spillovers and competition effects. National Bureau of Economic Research. Working paper n. 23643.

Gambacorta, L., & Shin, H. S. (2018). Why bank capital matters for monetary policy. Journal of Financial Intermediation, 35, 17-29.

Hirano, K., Imbens, G. W., & Ridder, G. (2003). Efficient estimation of average treatment effects using the estimated propensity score. Econometrica, 71(4), 1161-1189.

Kaufmann, D., Kraay, A., & Mastruzzi, M. (2011). The Worldwide Governance Indicators: Methodology and Analytical Issues1. Hague journal on the rule of law, 3(2), pp.220-246.

Kim, T., Koo, B., & Park, M. (2013). Role of financial regulation and innovation in the financial crisis. Journal of Financial stability, 9(4), 662-672.

Kok, C., Müller, C., Ongena, S., & Pancaro, C. (2021). The disciplining effect of supervisory scrutiny in the EU-wide stress test. ECB Working Paper No. 2021/2551, https://ssrn.com/abstract=3846655.

Lewrick, U., Schmieder, C., Sobrun, J., & Takats, E. (2020). Releasing bank buffers to cushion the crisis-a quantitative assessment (No. 11). Bank for International Settlements.

Mariathasan, M., & Merrouche, O. (2014). The manipulation of basel risk-weights. Journal of Financial Intermediation, 23(3), 300-321.

Myers, S. C. (1977). Determinants of corporate borrowing. Journal of financial economics, 5(2), 147-175.

Ouattara, B., & Standaert, S. (2020). Property rights revisited. European Journal of Political Economy, 64, 101895.

Oura, H. and Schumacher, L.B. (2012). Macrofinancial stress testing-principles and practices. International Monetary Fund Policy Paper.

Pancotto, L., ap Gwilym, O., & Williams, J. (2020). Market reactions to the implementation of the Banking Union in Europe. The European Journal of Finance, 26(7-8), 640-665.

Petersen, M. A. (2009). Estimating standard errors in finance panel data sets: Comparing approaches. The Review of financial studies, 22(1), 435-480.

Pisani-Ferry, J., Sapir, A., Véron, N., & Wolff, G.B. (2012). What kind of European banking union? (No. 2012/12). Bruegel Policy Contribution.

Petrella, G., & Resti, A. (2013). Supervisors as information producers: do stress tests reduce bank opaqueness?. Journal of Banking & Finance, 37(12), 5406-5420.

Pierret, D., & Steri, R. (2020). Stressed Banks. Swiss Finance Institute Research Paper 17-58, Swiss Financial Institution.

Van Rompuy, H., Barroso, J.M., Juncker, J.C., & Draghi, M. (2012). Towards a genuine economic and monetary union.

Sahin, C., & de Haan, J. (2016). Market reactions to the ECB's Comprehensive Assessment. Economics Letters, 140, 1-5.

Appendix

Table A1 Significance Criteria for the inclusion in the 2013 Comprehensive Assessment

Significance criteria	
Size	the total value of its assets exceeds €30 billion
Economic importance	for the specific country or the EU economy as a whole
Cross-border activities	the total value of its assets exceeds €5 billion and the ratio of its cross-border assets/liabilities in more than one other participating Member State to its total assets/liabilities is above 20%
Direct public financial assistance	it has requested or received funding from the European Stability Mechanism or the European Financial Stability Facility

Table A2 Country distribution of banks in the control and treated group.

Country	Non-treated banks	Treated banks
Austria	19	9
Belgium	0	7
Cyprus	17	7
Estonia	5	2
Finland	14	20
France	17	73
Germany	1351	11
Greece	2	3
Ireland	2	4
Italy	461	45
Latvia	11	2
Lithuania	4	0
Luxembourg	3	7
Malta	4	2
Netherland	13	4
Portugal	85	11
Slovenia	7	6
Slovakia	5	6
Spain	32	17
Total	2052	236

Table A3 Summary statistics – Additional variables. This table shows the summary statistics of additional variables used in the analysis. Reserves, Retailed income and Loans are bank variables from BvD. Debt/GDP is the public debt divided by national GDP.

Variable	N	Mean	St. Dev.	P.le 50	P.le 5	P.le 95
Ln (Reserves)	8668	2.2038	1.8571	1.9459	0.0000	5.7462
Ln (Retained Income)	7120	1.0612	1.2688	0.2049	0.3270	3.0040
Ln (Loans)	11807	6.3787	1.9589	6.0799	3.7136	10.3372
Ln (Debt/GDP)	11871	4.4117	0.4835	4.3656	3.9474	4.9075

Table A4 Dynamic difference – in– difference. The table shows results from a regression with the treatment variable interacted with year dummies, bank controls, bank fixed effects, and year × country × Size basket fixed effects. Standard errors are clustered at the bank level. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% level respectively.

	(1) Tier 1/TA
Treat × Dummy (2009)	-0.1836
	(0.209)
Treat × Dummy (2010)	0.0750
	(0.295)
Treat × Dummy (2011)	0.3869
	(0.345)
Treat × Dummy (2012)	0.6436
	(0.662)
Treat × Dummy (2013)	1.2210***
	(0.296)
Treat × Dummy (2014)	1.6955***
	(0.302)
Treat × Dummy (2015)	1.4139***
	(0.337)
Treat × Dummy (2016)	1.0594***
	(0.336)
Treat × Dummy (2017)	1.1485***
	(0.380)
Treat × Dummy (2018)	1.0623**
	(0.439)
Size	-0.1906***
	(0.058)
RoA	0.3189***
	(0.077)
Loans over TA	0.0296***
	(0.007)
Non-interest income ratio	-0.0020
	(0.004)
NPL over Loans	-0.0261***
	(0.010)
Constant	8.5137***
	(0.584)
Observations	11,814
R-squared	0.9043
Bank FE	Yes
Year FE	Yes
Year × Country FE	No
Year × Country × Size basket FE	Yes

Table A5. Propensity score diagnostics. This table reports the mean for the treatment (1) and the control (2) groups after matching. Specification (3) reports the p-value for a t-test to check whether the average for the treated banks is equal to the average value the control banks. Specification (4) shows the standardized percentage bias.

	(1) Treated	(2) Control	(3) p-value	(4) % bias
Tier1/TA	6.6189	6.5334	0.789	2.6
Size basket	0.9415	0.9372	0.874	1.1
RoA	0.0600	0.0401	0.845	2.7
Loans/TA	66.225	65.766	0.829	2.4
Non-interest income ratio	38.207	38.285	0.962	-0.6
NPL/Loans	8.5286	8.5242	0.996	0.1

GETTING IN TOUCH WITH THE EU

In person

All over the European Union there are hundreds of Europe Direct information centres. You can find the address of the centre nearest you at: https://europa.eu/european-union/contact_en

On the phone or by email

Europe Direct is a service that answers your questions about the European Union. You can contact this service:

- by freephone: 00 800 6 7 8 9 10 11 (certain operators may charge for these calls),

- at the following standard number: +32 22999696, or

- by electronic mail via: https://europa.eu/european-union/contact_en

FINDING INFORMATION ABOUT THE EU

Online

Information about the European Union in all the official languages of the EU is available on the Europa website at: https://europa.eu/european-union/index_en

EU publications
You can download or order free and priced EU publications from EU Bookshop at: https://publications.europa.eu/en/publications. Multiple copies of free publications may be obtained by contacting Europe Direct or your local information centre (see https://europa.eu/european-union/contact_en).

The European Commission's science and knowledge service
Joint Research Centre

JRC Mission
As the science and knowledge service of the European Commission, the Joint Research Centre's mission is to support EU policies with independent evidence throughout the whole policy cycle.

EU Science Hub
ec.europa.eu/jrc

@EU_ScienceHub
EU Science Hub - Joint Research Centre
EU Science, Research and Innovation
EU Science Hub