How binding is supervisory guidance?
Evidence from the European calendar provisioning

Franco Fiordelisi, Gabriele Lattanzio, Davide S. Mare*

Abstract

We exploit the staggered and distinct implementation of the European calendar provisioning reform to document that banks respond to supervisory guidance as if it was binding regulatory action. After documenting that the this reform achieves the goal of reducing European banks' non-performing loan ratios, we show that its effects materialized during the initial release as supervisory guidance. Conversely, its subsequent adoption as a Pillar 1 regulation has limited impact, while eliminating any residual flexibility in managing the stringency with which this reform could be enforced.

JEL Classifications: G21; G28; G32.

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* Franco Fiordelisi is at the University of Essex (UK) and University of Rome III, Gabriele Lattanzio is at the Nazarbayev University (Kazakhstan), and Davide S. Mare is at the World Bank (US) and University of Edinburgh (UK). We are grateful to Robert Cull, Bektemir Ismailov, Manju Puri, David Robinson, and Jerome Taillard, and seminar participants at Duke University, the 2022 Conference on The Effectiveness of Financial Regulation, International Risk Management Conference 2023 and Dolomites Summer Finance 2023 Conference for their comments and suggestions. We also thank Giulia Scardozzi for her excellent research assistance. Davide S. Mare acknowledges funding from the Knowledge for Change Program at the World Bank. This paper's findings, interpretations, and conclusions are entirely those of the authors and do not necessarily represent the views of the World Bank, their Executive Directors, or the countries they represent. All errors and omissions are ours. E-mails: Franco Fiordelisi (franco.fiordelisi@essex.ac.uk); Gabriele Lattanzio (gabriele.lattanzio@nu.edu.kz); and Davide Salvatore Mare (dmare@worldbank.org).

"The introduction of calendar provisioning represents one of the most disruptive and intrusive interventions among those made in recent years by European supervision, which certainly cannot be accused of timidity".

Italian Association of Financial Industry Risk Managers, Position paper n. 23, p. 7

1 Introduction

Since the release of the first capital framework in 1988, the work of the Basel Committee on Banking Supervision (BCBS) has been at the center of the process of international harmonization of regulatory practices in banking.[1] This framework, known as Basel I, and its subsequent developments (Basel Committee on Banking Supervision, 2006: also known as Basel II; Basel Committee on Banking Supervision, 2010 and 2011: also known as Basel III) have indeed established general principles and standards that each member country has independently adopted and enforced over the last three decades. The resulting regulatory environment is thus the product of a global cooperative effort exercised by regulatory agencies, supervisory authorities, banks, and financial companies, all involved in an almost continuous process of consultation and coordination effort aiming at perfecting the resulting framework (Pennacchi et al., 2021). Yet, 10 years after the initial enforcement of the second Basel Accord in Europe, the European Central Bank (ECB) first and the European Commission (EC) later set aside this international convention by introducing a *unilateral* regulatory change aiming at tackling the pressing issue of increasing levels of non-performing loans (NPLs) held by European banks.

This initiative, generally referred to as the *European calendar provisioning*, is peculiar for three main reasons. First, it leaves aside the existing arrangements characterized by a global harmonized effort toward banking regulation. Second, its

[1] The Basel Committee on Banking Supervision (BCBS) is a committee of banking supervisory authorities that was established by the central bank governors of the Group of Ten countries in 1974. Over time, BCBS expanded its membership, and, as of year 2021, it is composed by 45 members from 28 jurisdictions, consisting of central banks and authorities with responsibility of banking regulation and supervision.

underpinning idea subverts the principles established by the Basel capital agreements themselves. Indeed, rather than relying on banks' internal models and capital adequacy assessments, these new rules impose minimum loss coverage requirements to be achieved through write-downs or deductions from regulatory capital depending *mechanically* on the time elapsed since the default of the considered loan. Third, the complex process of adoption and enforcement of the European calendar provisioning (evolved from supervisory guidance to formal regulation)[2] represents a unique setting to analyze how effective is supervisory guidance in influencing bank behavior.

The introduction of the European calendar Provisioning sparked a heated international debate among regulators and practitioners concerning two major issues. First, the reform effectively brought regulation back in time by foregoing model-based analyses of the risk associated with loan exposures to relying on a *basic* measure of time elapsed (Pennacchi et al., 2019). Second, these interventions called into question the degree to which supervisory guidance issued under the comply or explain framework is perceived to be binding by commercial banks, as compared to the legally binding nature of regulatory actions.

Building on this debate, we contribute to these important discussions and to the broader literature assessing the differential impact of supervisory and regulatory initiatives by investigating the following research questions. Was this non-model-based regulatory initiative effective in reducing non-performing loan ratios? To what degree do banks perceive binding *de facto* supervisory guidance? Have *de iure* regulatory actions further contributed to achieving the goal of this reform?

To address these questions within a causal framework, our empirical strategy relies on a dynamic Difference-in-Differences (DID) approach allowing us to compare

[2] The European Caldendar provision was originally introduced in the form of supervisory guidance by the ECB in 2017. In 2018, the ECB provided banks with a clear statement of supervisory expectations about the provision of non-performing loans under the principle of "comply or explain". In 2019, the European Parliament and the European Council formalized the system of deduction from banks' common equity Tier 1 (CET1) in the legally binding Pillar 1 framework.

changes in the riskiness, performance, and loan policies of subsidiaries of European banks operating in developing countries[3] with that of matched domestic banks. Because European banks consolidate worldwide credit exposures under their domestic regulatory framework, their subsidiaries operating in developing countries are directly affected by the adoption of calendar provisioning rules. Conversely, matched banks operating in developing countries are not exposed to the effects of these supervisory and regulatory actions. By exploiting this setting, we lessen endogeneity concerns related to the passage of these supervisory and regulatory initiatives. European regulators are indeed at best unlikely to take any actions targeting directly and primarily European subsidiaries operating abroad. Furthermore, our approach allows us to ensure the comparability between the two groups of banks and restore the randomization conditions by adopting several matching approaches and resampling procedures.

We document that European banks reacted to the release of the ECB calendar provisioning supervisory guideline by treating it as a binding requirement by immediately decreasing their non-performing loan ratios. The recognition of these losses in banks' income statements as charge-offs induced an *immediate* reduction in their regulatory capital (Tier 1 capital) and impaired loans reserves, weakening their capitalization profile. Yet, we document that these persistently higher regulatory costs do not cause a reduction in loan origination. Rather, European banks appear to shift these increased costs to their customers by charging higher interest rates on new loans. We document that banks target primarily countries featuring weaker definitions of capital requirements and non-performing loans to implement this form of regulatory cost-shifting. This result is consistent with multinational banks exploiting the regulatory leniency of foreign countries to off-load – at least part of – the regulatory costs imposed by domestic regulations and apply lower bank lending standards (Ongena et al., 2013).

[3] We define as developing countries those jurisdictions classified by the World Bank as non-high income based on the Gross National Income per capita in current US dollars.

Our paper contributes to several strands of the literature. First, we complement previous work on the supervision and regulation of banks. The difference between regulatory and supervisory actions is often blurred, with the vast majority of existing studies focusing on the direct impact of regulatory intervention targeting capital requirements (Bridges et al., 2014) and merger and acquisition assessments (e.g., Morgan et al., 2004). Studies focusing on banking supervisory monitoring are limited and mostly analyze the information content of supervisory ratings (Hirtle and Lopez, 1999; Berger et al., 2000), and examinations (Berger and Davies, 1998). Recent work investigates specifically whether tougher supervisory standards cause lower loan growth or stricter origination standards, with most studies finding this to be the case (e.g., Bassett et al., 2015; Kiser et al., 2016; Bassett and Marsh, 2017). Other studies analyze the outcome of enforcement actions on bank risk (e.g., Delis and Staikouras, 2011; Pugachev, 2019) or the effect of cooperation among bank supervisors on the stability of international banks (Beck et al., 2022). More recently, Hirtle et al. (2020) explore the effects of bank supervision on the riskiness, profitability, and growth of U.S. banks, documenting that supervisory activity has a distinct role in mitigating banking sector risk. We contribute to this literature by documenting for the first time whether and how non-legally binding supervisory guidance affects banks' policies, as compared to the case of the passage of a specular regulatory intervention.

Second, our paper provides novel evidence to worldwide policymakers to assess whether non-risk-based regulations are effective in tackling the emerging NPLs phenomenon. The COVID-19 pandemic has renewed interest in the resolution and management of non-performing loans in the banking industry. Payment and enforcement moratoria have supported borrowers by allowing a temporary halt to their bank repayment obligations (Feyen et al., 2021). Yet, once support is removed, it is not clear which borrowers will be permanently affected and how debtors will adjust to the structural changes in the economy. Rising borrower distress is widely expected to translate into increases in non-performing loans in the banking sector, calling for immediate policy action (The World Bank, 2022). These policies, especially in advanced economies, may hurt the stability and functioning of the banking system

in developing countries. Our paper provides evidence for up to 91 countries on such a mechanism.

The rest of the paper is structured as follows. Section 2 provides background information on the introduction of calendar provisioning and formulates the hypotheses. Section 3 describes the data and variables employed in the estimation. Section 4 illustrates the empirical model. Section 5 discusses the results and section 6 concludes.

2 Institutional setting and hypotheses development

The problem of non-performing loans became particularly severe during the last decade in Europe (Figure 1), pressuring the European Central Bank to consistently set the reduction of NPLs among the supervisory priorities of the Single Supervisory Mechanism (SSM).[4] This growing concern and attention towards NPLs resulted in the development and adoption of calendar provisioning, which ultimately represents the most important supervisory effort exercised to tackle this issue.

< Insert here Figure 1>

The development of the European calendar provisioning occurred in various stages (Figure 2). In the first phase, the ECB, acting as the main supervisory entity within the single supervisory mechanism in the Euro area, issued supervisory guidance for the treatment of non-performing loans. This guidance was launched *in consultation* in September 2016 and published in March 2017. The document provided banks with realistic and ambitious strategies in a holistic approach, without declaring quantitative targets, to address the NPLs problem. A few months later, the European Council proposed an action plan to tackle non-performing loans in Europe where it considered, within the framework of the ongoing review of the Capital Requirement Regulation/Capital Requirement Directive IV (CRR/CRD IV), to set prudential backstops in the form of compulsory prudential deductions from own funds

[4] The Euro area, and particularly countries in Southern Europe (i.e., Greece, Spain and Italy) was first hit by the 2007-2009 Global Financial Crisis and then by the Sovereign Financial Crisis (Lane, 2012), bringing NPLs to 11.8% of total loans in 2016, corresponding to an outstanding amount of around €1 trillion.

of NPLs under the Pillar 1 framework addressing potential under-provisioning which would apply to newly originated loans. On October 4, 2017, the ECB reinforced its NPLs guidance for banks by publishing for consultation an addendum that set out supervisory expectations for minimum levels of prudential provisioning for new NPLs. The final text of the "Addendum" was released in March 2018. The ECB addendum provides "significant banks" (the ones under the ECB direct supervision) with minimum loss coverage requirements, depending only on the time *elapsed* since the default, to be achieved through write-downs or deductions from regulatory capital. The mechanism, originally meant to apply only to loans defaulting after April 2018, was extended in July 2018 – through a communication of the Single Supervisory Mechanism (SSM) – to preexisting NPLs, which would also be subject to full coverage by 2026.[5] The release of the addendum, only a few months after the European Council proposal, was due to the ECB's aim to urgently tackle the NPLs problem in a moment of favorable economic conditions in the Euro area,[6] while the time implied for a regulatory decision (from the European Commission and Parliament) were significantly longer. That is, banks were asked to respond to the release of the ECB supervisory guidance in 2017 and 2018 while discounting the possibility of a future similar regulatory intervention, whose timing and content was however unknown and unforecastable at the time.

< Insert here Figure 2>

The second phase of the adoption of the European calendar provisioning is represented by the *regulatory* change introduced by the European Commission in

[5] Individual banks are subject to different timeframes, to be defined in their annual Supervisory Review and Evaluation Process (SREP).

[6] The point is well clarified by Nouy (2017, page 2) "Obviously if the ECOFIN decides to go for a Pillar 1 measure, that's to say legislative measures, once it is applicable and once it is addressing all the portfolios, we will adapt our own measures. So regarding our measures, these relate to the new NPEs, which is indeed a difference with the ECOFIN, which is targeting new loans. But we think that now is the moment to address NPEs, in particular because we are enjoying good economic conditions in the euro area. If we wait until there is a Pillar 1 text first, and then it is covering only new loans, we have to keep in mind that the full rolling over of the existing loan book can take a decade. So we have also to address, in my view, the future NPLs until we have measures that will be implemented and fully rolled over the whole portfolio. So there is a sequence and we are ready to adapt our own guidance once there is something else. But still, there will stay room for Pillar 2."

April 2019, when the European Regulation 2019/630 amended Regulation 575/2013 (the CRR) by introducing a mandatory calendar provisioning system (also known as "backstop"). This regulatory action dictates Pillar 1 requirements for all loans granted after the measure came into force. With the inclusion in the CRR, the ECB calendar provisioning ruling thus changed its nature from supervisory expectations to binding regulatory requirements. Importantly, a few months after this regulatory change, the ECB revised in August 2018 its supervisory expectations for prudential provisioning for new NPLs to account for the sudden introduction of this new Pillar 1 requirement. The main changes concerned the scope of the ECB's supervisory expectations for new non-performing exposures (NPEs)[7] and the alignment of the relevant prudential provisioning time frames (the progressive path to full implementation and the split of secured exposures, as well as the treatment of NPEs guaranteed or insured by an official export credit agency) with the Pillar 1 treatment of NPLs set out in the new EU regulation. All other aspects, including specific circumstances, which may make prudential provisioning expectations inappropriate for a specific portfolio/exposure, remain as described in the original Addendum.

As one can infer from this complex adoption process, the European calendar provisioning does not only represent a regulatory and supervisory change, but also a turning point in banking regulation. Its underpinning idea is disruptive to the logic of the BCBS accords. Rather than relying on the Basel I convention of using banks' internal risk-based models, the ECB calendar provisioning rules provide banks with an old-fashion regulation based on minimum loss coverage requirements computed using simple rules (non-linked to banks' internal risk models, risk management sophistication, and the efficiency of judicial systems) depending only on the time *elapsed* since the default and to be achieved through write-downs or deductions from

[7] NPEs is a broader category of non-performing assets which comprehends non-performing loans. The scope of the ECB's supervisory expectations is limited to NPEs arising from loans originated before 26 April 2019 (not subject to Pillar 1 NPE treatment). NPEs arising from loans originated from 26 April 2019 onwards are subject to Pillar 1 treatment, with the ECB paying close attention to the risks arising from them.

regulatory capital. In this sense, the first crucial hypothesis to be tested is whether these shocks reached the desired outcomes.

H_1: The supervisory guidance and regulatory change, known as European calendar provisioning. were effective in reducing NPLs ratios.

The timeline and process followed for introducing calendar provisioning within the European supervisory and regulatory frameworks constitute a unique setting to test the marginal effect of banking supervision and regulation.[8] In particular, we expand on recent studies documenting the importance of addressing separately bank supervision from bank regulation (Hirtle, 2020) and assess for the first time if and how supervisory guidance issued under the "comply or explain" framework is binding for banks. That is, we exploit our unique setting to test the following research hypothesis:

H_2: The marginal effect of the European Commission's institutionalization of the ECB supervisory guidance within a regulatory framework is economically and statistically irrelevant.

We test H_1 and H_2 in conjunction to find whether the supervisory guidance issued by the ECB was effective in reducing NPLs ratios; and whether the regulatory intervention adds to this supervisory intervention. In particular, failing to reject H_1 and H_2 would imply that supervisory guidance issued under the "comply or explain" framework is perceived as binding as it would spur a decline in NPLs ratios, while its subsequent permutation into a regulatory action would not provide any statistically meaningful contribution.

Next, we focus on the mechanism through which European banks eventually respond to this policy by reducing the size of their NPL portfolios. We begin by identifying various economic channels that may have driven the NPLs drop. First, banks may decrease NPLs by using their impairment loan reserves ($H_{3.A}$). This would be the most immediate reaction to the ECB guidelines: banks use the equity reserves

[8] See, i.e., The World Bank (2020) and references therein for a review of the relevant literature.

made in the past for credit losses to comply with the ECB's expectations. In such a way, banks do not reduce their profits, but weaken their capitalization profile, thus limiting their ability to cope with sudden, large credit risk shocks. Second, banks can go further to decline their NPLs than using reserves by aggressively writing off all those NPLs that were potentially in conflict with the new calendar provisioning guidelines ($H_{3.B}$). By recognizing losses in their income statements, banks would indeed be able to rapidly shrink their NPLs ratios, ultimately reaching compliance with the new regulatory requirements. To sum up, the following research hypotheses enable us to identify the channel through which banks shrink their NPLs ratios:

$H_{3.A}$: The adoption of the European calendar provisioning induces banks to increase their charge-off.

$H_{3.B}$: The adoption of the European calendar provisioning induces banks to decline their impairment loan reserves.

We next recognize that calendar provisioning may free up resources for fresh lending by reducing the incidence of non-performing loans on bank balance sheets. Lower levels of NPLs may indeed influence permanently the provision of credit by relaxing regulatory restrictions and decreasing funding costs. Contrary, the increased regulatory costs imposed on European banks through more prudential and mechanical management of their NPL portfolio might have affected their ability and willingness to originate loans abroad. Thus, we investigate whether:

$H_{3.C}$: Both the supervisory guidance and the regulatory changes affect loan origination.

Similarly, since calendar provisioning represents a costly burden for European banks, we analyze whether European banks transfer to customers the higher regulatory costs. We hypothesize that treated banks might be responding to the shock by charging higher rates on newly originated loans.

$H_{3.D}$: Both the supervisory guidance and the regulatory changes generated an increase in lending rates.

Identifying an increase in lending rates in the proposed cross-country settings is an important results that requires further analyses and a proper contextualization. Globalized banks, while operating in multiple markets, are indeed known to adjust the allocation of financial resources according to regulatory circumstances (Chiuri et al., 2002, Claessens et al., 2015; Berrospide et al., 2016, Laeven and Popov, 2021). For example, Aiyar et al. (2014) show that changes in capital requirements imposed on UK-resident banks trigger a reduction in cross-border lending. Similarly, a recent stream of studies analyses how domestic macro-prudential regulation and monetary policy transmit to foreign countries via a change in the lending behavior of foreign subsidiaries (Morais et al., 2019). Thus, differences in domestic and host-country regulations correlate with lending standards (Ongena et al., 2013) and influence the association in risk-taking behavior of subsidiaries and their parent companies (Anginer et al., 2017). This leads us to our conclusive hypothesis:

H_4: Banks engage in regulatory cost-shifting behaviors more aggressively in countries featuring more lenient banking regulatory environments.

3 Data and variables

We gather information from different sources for the period between 2015 and 2019. Bank-level financial statements are obtained through Fitch Connect. Since the goal of our study is to assess the effect of changes in bank regulation that may affect bank behavior in countries where European foreign subsidiaries operate, we restrict our sample to banks that operate in developing countries where different standards and regulations apply. This allows us to use as a counterfactual the observed performance of banks in a country not subject to regulatory change.

We apply standard data cleaning procedures to control for the influence of outliers or inconsistent information. In detail, we drop information on banks for which loans over total assets are less than 10 percent and deposits over total assets are less than 5 percent. This filter is applied to ensure that the core business of banks in the sample is credit intermediation. Our final sample consists of 7,804 bank-year observations distributed across up to 66 countries (Table 1, panel A). Around 5

percent of observations are from subsidiaries of EU banks. The number of banks by country and year is reported in Table A1 in Appendix A.

As we aim to uncover new evidence on how subsidiaries of European banks react to the introduction of calendar provisioning, we employ different dependent variables in the estimations. The aim is to understand the effect of the regulatory reform on non-performing loans and whether this change is related to changes in reserves for impaired loans or net charge-off.[9] We compute three ratios: non-performing loans to total gross loans (*NPL ratio*); impaired loans reserves to total loans; and net charge-off to gross loans.

Our main variable of interest is a dichotomous indicator taking the value of 1 if a bank is a subsidiary of a European bank (EU bank) operating in one of the countries in the sample, 0 otherwise. We observe up to 86 EU subsidiaries over the sample period operating across 42 countries. The total number of observations of EU bank subsidiaries is 391. The economies with the largest number of observations of EU subsidiaries are China (41), Russian Federation (26), Brazil (22), and Bosnia and Herzegovina (20).

As control variables, we include a parsimonious set of bank-specific controls employed in previous studies investigating the determinants of non-performing loans (see, among many others, Berger and DeYoung, 1997; Louzis et al., 2012; Ghosh, 2015). Nonetheless, the direction of causation is not clear. Bank size may be related to excessive risk-taking as very large banks exploit their too-big-to-fail status (Kaufman, 2014). Yet, in principle, larger banks have more diversified bank loans which lower credit risk (Louzis et al., 2012). We account for the role of size in explaining non-performing loans by including the logarithm of total assets. Profitability may be also associated with non-performing loans as poor performance could be related to a lack of skills in the screening, selection, and monitoring of the

[9] Decreases in non-performing loans ratios may be achieved not only through write-offs, but also through other means. For example, increases in loan growth may dilute the relevance of non-performing exposures. Securitization and non-performing loans sales may be alternative mechanisms to reduce non-performing loan ratios.

borrowers. However, a too-high return on investment may also indicate moral hazard and greater exposure to credit risk. To control for bank performance, we compute bank returns on assets. Finally, we account for the role of bank capitalization by controlling for the level of bank capitalization measured as equity over total assets. Bank capital may work both as an incentive device to reduce the riskiness of the bank loan book (Furlong and Keeley, 1989) and increase risk-taking at higher levels of capital (Calem and Rob, 1999).

As shown in Table 1, Panel B, subsidiaries of European banks have lower non-performing loans over the studied period. The difference in the mean values between European subsidiaries and other banks is around 1.2 percentage points,[10] which is substantial as this value is approximately 16 percent of the sample mean of non-EU subsidiaries. European banks operating in emerging markets are on average larger than their domestic counterparts and show higher overall profitability (i.e., operating ROA). However, their interest income to total assets is lower because of their relatively smaller loan portfolios.

< Insert here Table 1 >

4 Identification

Our empirical setting is based on comparing financial outcomes between European subsidiaries and non-European banks operating in developing countries. In particular, we employ a difference-in-differences approach to isolate the causal effect of calendar provisioning on banks' management of non-performing loans. As previously discussed, the supervisory and regulatory interventions were introduced in two subsequent stages. To capture these staggering effects, we include dichotomous variables for each year starting from 2016 to closely follow each phase implementation in the introduction of calendar provisioning and control for any specific time trend affecting the studied dependent variable. The inclusion of a

[10] This difference is statistically significant at the 1 percent level according to a two-sample t-test imposing unequal variance.

dummy variable for 2016 enables us to verify if there are statistically significant differences in trends between banks in the treated and control groups before the first introduction of the calendar provisioning in 2017. The lack of statistical significance for the 2016 dummy interacted with the European Subsidiary dummy (*SUB EU*) would indeed support the hypothesis that the two groups follow statistically indistinguishable trends over the two years preceding the regulatory change. The remaining year's dummy variables enable us to capture the average treatment effects after the first issuance of the ECB guidelines (2017), the ECB's addendum (2018), and the EU introduction of the prudential backstop regulation within the Pillar 1 framework (2019). These considerations result in the following specification:

$$Y_{i,t} = \beta_1 EU_{i,t} + \beta_2 Sub\ EU_{i,t} \times 2016 + \beta_3 Sub\ EU_{i,t} \times 2017 + \beta_4 Sub\ EU_{i,t} \times 2018 + \beta_5 Sub\ EU_{i,t} \times 2019 + \gamma \boldsymbol{X}_{i,t-1} + \alpha_i + \alpha_t + \varepsilon_{i,t} \quad (1)$$

Where Y corresponds to one of the dependent variables employed in the analysis: the NPL ratio; impaired loans reserves to total loans; and net charge-off to gross loans. Sub EU is a dummy variable for European bank subsidiaries. $\boldsymbol{X}$ is a vector of bank controls lagged one year, namely the natural logarithm of total assets, return on assets (ROA), and equity over total assets. We also control for time-invariant bank-specific fixed effects (α_i) and for bank-invariant time-specific fixed effects (α_t). Standard errors are clustered at the individual bank level.

To provide broader support to the validity of our findings we employ three alternative samples. First, since EU bank subsidiaries tend to be larger than other banks operating in a country (see Table 1, panel B), we restrict the sample to large banks only (i.e., above the median of the distribution of total assets in a country in a year). Second, as mentioned above, EU subsidiary operates in only 42 countries out of the 90 countries included in our sample. For this reason, we consider a sample with countries and years where at least one EU subsidiary bank exists. Finally, we perform propensity score matching (PSM) to compare EU subsidiaries with a

matched sample of banks based on characteristics observed before the introduction of the European calendar provisioning. In particular, the matching is performed on total assets, NPL ratios, ROA, and equity to total assets and stratified by banks' country of activity. We exclude any observations lying outside of the region of common support, obtaining a matched sample of 4,370 bank-year observations including 61 EU bank subsidiaries. Table 1, Panel C reports summary statistics for the resulting propensity scored matched sample. Treated and control banks appear to be closely matched on most economic dimensions.

5 Results

We begin our analysis by examining whether the introduction of the European calendar provisioning caused the subsidiaries of European banks to reduce their NPLs ratios, as compared to that of their untreated peers (H_1). As reported in Table 2, we find this to be the case. European banks reacted immediately to the release of the initial guidance published by the ECB in March 2017 by shrinking their NPLs ratios. In particular, the 2017-year dummy interacted with the European Subsidiary dummy (*SUB EU*) included in our specifications captures an immediate relative decline in European banks' NPLs ratios ranging between 22% (Column 1) and 44% (Column 5), confirming that banks reacted immediately to the first release of regulatory guidance. As one would have expected, the estimated effect further increases for the calendar year 2018, when the ECB formalized its supervisory expectations. In the European banks' eyes, the ECB's Addendum provided new criteria that generated an additional and greater decline in the NPLs ratio. In particular, our estimates suggest that subsidiaries of European banks operating in developing countries decreased their NPLs ratios in 2018 by a further 10%-15%.

Overall, the supervisory guidance issued by the ECB was effective in reducing NPLs ratios. In this sense, these two non-binding initiatives appear to have acted as material shocks for European banks. These results are robust across specifications. In detail, consistent estimates are identified using either (1) the whole sample of available observations (Table 1, Column (1) – without controls – and Column (2) –

with controls), (2) the sample including large commercial banks, exclusively (Table 1, Column 3), (3) the sample including only those countries in which at least one European bank's subsidiary is operating (Table 1, Column 4), and (5) the propensity scored matched sample (Table 1, Column 5). Notably, in all models the 2016-year dummy interaction with the European Subsidiary dummy (*SUB EU*) is not statistically significant, supporting the argument that the two groups are statistically indistinguishable before the first supervisory change in 2017. Furthermore, the estimated economic effect increases as the matching requirements tighten, indicating that eventual endogeneity concerns are likely biasing the resulting coefficients towards 0.

Next, we focus on the European Commission's regulatory initiative institutionalizing calendar provisioning within the existent regulatory framework. Our estimates highlight an additional drop in the NPLs ratio in 2019 when the European Commission introduced the calendar provision within the Pillar 1 regulation. The coefficient estimates for the 2019-year dummy interacted with the EU subsidiary indicator are indeed negative and statistically significant, confirming the lasting material effect induced by the adoption of the European calendar provisioning, providing further support for the validity of H_1. That is, we document that the European calendar provisioning policy achieved the intended direct goal of reducing European banks' exposure to NPLs, despite its non-model-based nature.

< Insert here Table 2 >

Was the marginal effect of the European Commission's effort to institutionalize the ECB supervisory guidance within a regulatory framework economically and statistically material? Or did banks treat the initial non-binding supervisory guidance as if it was a regulatory intervention? To answer this question, we run a set of F-tests to assess whether the coefficient for the 2018 dummy interacted with the European Subsidiary dummy (*SUB EU*) is statistically indistinguishable from the coefficient for the 2019 dummy interacted with the European Subsidiary dummy (*SUB EU*). Finding these two coefficients are not statistically different would indeed

imply that the regulatory action through which the ECB supervisory guidance introduced the European calendar provisioning had no material effects. We show this to be the case. As reported in Table 2, these two coefficients are only significant in Column 1, with the p-value increasing as the quality of the matched samples increases. That is, we cannot reject H_2, thus leading us to the conclusion that banks react to the release of supervisory guidances issued under the "comply or explain" framework as if it was a regulatory action while providing banks and supervisors with some residual flexibility concerning the degree to which these initiatives should be enforced over time and in the cross-section.

To assess the robustness of our conclusions, we recognize that the identified reduction in NPLs ratios should necessarily pair with a reduction in banks' equity reserves for credit losses. In theory, this is indeed the most immediate and almost mechanical reaction to the ECB guidelines: banks use the equity reserves made in the past for credit losses to comply with ECB's expectations. To this aim, we focus on the ratio of Impaired Loan Reserves to Total Loans around the adoption of the ECB calendar provision discipline to evaluate if this change in European regulation affected banks' ability to absorb credit risk shocks. As documented in Table 3, our estimates suggest that the impaired loan reserves relative to total loans dropped significantly in 2017, 2018, and 2019. Once again, we show that banks reacted *immediately* to the disclosure of the ECB guidelines. Impaired Loan Reserves to Total assets further decline following the release of the Addendum in 2018 and the European Union act in 2019, but the bulk of the effect can be attributed to the 2017 supervisory initiative, confirming banks' perception of supervisory guidelines as virtually binding requirements. Indeed, the F-tests testing for the equality of the coefficient for the 2018 dummy interacted with the European Subsidiary dummy (*SUB EU*) and that for the 2019 dummy interacted with the European Subsidiary dummy (*SUB EU*) produce consistently high p-values, ultimately confirming that European banks are responding to supervisory guidance as if they were regulatory shocks.

These findings also corroborate our third research hypothesis ($H_{3.A}$). The European calendar provisioning induced an immediate deterioration of banks' reserves for impaired loans, which declined between around 15% (Column 1) and 30% (Column 5). Again, the average treatment effects increase as the matching conditions tighten, indicating that eventual biases are pushing our estimates towards the zero bound, rather than in our favor.

All in all, this finding – which appears to be robust to the use of the 5 proposed specifications – provides support for the materiality of the European calendar provisioning, further suggesting that while the passage of this new supervisory and regulatory discipline contributed to deflating European banks' NPLs ratios, it also caused a persistent weakening of their capitalization profile, thus limiting their ability to copying with sudden, large credit risk shocks. Finally, these results confirm the primary role played by the initial supervisory guidance issued by the ECB, indicating that banks are indeed treating these non-binding initiatives as if they were legally binding regulatory actions.

< Insert here Table 3 >

Next, we focus on the mechanism through which European banks immediately responded to the passage of this policy by reducing the level of their NPLs ratios. In particular, we evaluate whether banks wrote off aggressively all those NPLs that were potentially subject to the new calendar provisioning guidelines. By recognizing losses in their income statements, banks would indeed be able to rapidly shrink their NPLs, ultimately reaching compliance with the new regulatory requirements. As documented in Table 4, we identify support for this possibility. Consistent with the estimates reported in Table 2 and Table 3, we identify abnormally high levels of write-offs recognized by the subsidiaries of European banks.[11] In particular, this effect is concentrated in the year 2017, while it dissipates afterward – a finding that is again robust to all the five proposed specifications. This important result supports our

[11] This result is marginally insignificant in Column 5, possibly due to a reduction in power caused by the smaller sample size characterizing the matched sample.

fourth research hypothesis ($H_{3.B}$), further confirming that banks complied with the initial supervisory guidelines by exploiting the most direct tool at their disposal to comply with it – that is, recognizing losses in their income statements. Furthermore, this result may suggest that once the ECB explicitly stated its expectations in 2018 and the European Union introduced the new regulation as a Pillar 1 requirement, banks decreased NPLs using other more expensive tools, such as loan sales or securitization.[12]

< Insert here Table 4 >

The simultaneous deterioration of European banks' risk profile and NPLs portfolio size, paired with the temporary increase in write-offs, leads us to a second, crucial consideration: did European banks significantly change their loan origination policies abroad to adjust their credit risk profile to the new regulatory environment? Indeed, the increased regulatory costs imposed on European banks through more prudential and mechanical management of their NPL portfolio might have affected their ability and willingness to originate loans abroad. To test this hypothesis, we study the time-series dynamics of gross loans (Table 5) around the studied supervisory and regulatory change.[13] We identified no evidence that supports the hypothesis that these higher regulatory costs caused a reduction in loan origination by subsidiaries of European banks.

< Insert here Tables 5 >

How do European banks cope with the increase in these regulatory costs then? We hypothesize that treated banks might be responding to the shock by offsetting the increased compliance costs onto their customers by charging higher rates on newly originated loans. Building on the previously discussed results, such behavior should materialize in an increase in their interest income. As documented in Table 6, we find

[12] We are unable to directly test for this possibility as, hitherto, there is no systematic data collected across countries on these off-balance sheet transactions.

[13] As robustness test, we report in Table B1 in Appendix the results of the regressions with changes in gross loans. Results remain qualitatively the same.

this to be the case. Subsidiaries of European banks appear to systematically shift these increased regulatory costs to their customers by charging higher interest rate spreads on new loans.

< Insert here Table 6 >

How can European banks exercise this form of market power while keeping a constant level of new loans originations like their untreated peers? We hypothesize that subsidiaries of European banks might exploit the regulatory leniency characterizing certain emerging markets to offload their domestic compliance costs to foreign consumers. If this is the case, we should observe that the increased interest income documented in Table 6 is concentrated in banking systems featuring weaker regulatory environments. We find this to be the case. Using data from the World Bank's Bank Regulation and Supervision Survey, we identify countries featuring stricter overall restrictions on banking activities and providing stricter regulatory decisions for NPLs, we document that this regulatory cost-shifting mechanism is significantly stronger in countries with a weaker regulatory environment (Table 7). This result is consistent with multinational banks exploiting the regulatory leniency of foreign countries to off-load – at least part of – the regulatory costs imposed by domestic regulations.

< Insert here Table 7 >

6 Conclusion

The European calendar provisioning represents not only a major regulatory and supervisory change but also a turning point in banking regulation. Its underpinning idea is disruptive to the logic of the regulatory framework established by the Basel Committee on Banking Supervision. Rather than relying on banks' internal risk-based models, the European calendar provisioning imposes an old-fashion regulation that hinges on minimum loss coverage requirements based on simple rules depending only on the time *elapsed* since the default. Furthermore, the process of adoption and enforcement of this regulation is unique: originally introduced in the form of

supervisory guidance in 2017 by the ECB, it became stricter in 2018, and it turned into a new Pillar 1 regulation in 2019.

The regulatory process followed for the introduction of this new regulation enables us to assess for the first time how binding supervisory guidance issued under the comply or explain framework are as compared to the introduction of a similar regulatory intervention. Our empirical strategy relies on a Difference-in-Differences (DID) approach allowing us to compare changes in the riskiness, performance, and loan policies of subsidiaries of European banks operating in developing countries with that of matched domestic banks. Because European banks consolidate worldwide credit exposures under their domestic regulatory framework, their subsidiaries operating in developing countries are directly affected by the adoption of calendar provisioning rules. Conversely, matched banks operating in developing countries are not exposed to the effects of these supervisory and regulatory actions.

Our empirical analyses identify two novel and unique contributions to the ongoing academic and regulatory debate on banking supervision and regulation. First, non-model-based supervisory and regulatory shocks can achieve their intended goal - reducing European banks' NPLs ratios in this case. Second, supervisory guidance issued under the "comply or explain" framework is perceived by banks as binding while providing supervisors with some flexibility concerning the degree to which such actions should be enforced over time and in the cross-section. As such flexibility is valuable in a rapidly evolving industry. Regulatory and supervisory agencies should exercise coordinated efforts to minimize redundancy and to avoid inducing over-regulation costs which may ultimately result in negative social consequences. Finally, changes in regulatory and supervisory practices in advanced economies transmit to developing countries and should be monitored carefully by domestic financial authorities to ensure effective regulation and supervision

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References

Aiyar, S., Calomiris, C.W., Hooley, J., Korniyenko, Y., Wieladek, T., 2014. The international transmission of bank capital requirements: Evidence from the UK. J. financ. econ. 113, 368–382.

Basel Committee on Banking Supervision, 2011. Basel III: A global regulatory framework for more resilient banks and banking systems. Basel.

Basel Committee on Banking Supervision, 2006. International Convergence of Capital Measurement and Capital Standards. A Revised Framework. Basel.

Bassett, W.F., Lee, S.J., Spiller, T.P., 2015. Estimating changes in supervisory standards and their economic effects. J. Bank. Financ. 60, 21–43. https://doi.org/10.1016/j.jbankfin.2015.07.010

Bassett, W.F., Marsh, W.B., 2017. Assessing targeted macroprudential financial regulation: The case of the 2006 commercial real estate guidance for banks. J. Financ. Stab. 30, 209–228.

Beck, T., Silva-Buston, C., Wagner, W., 2022. The Economics of Supranational Bank Supervision. J. Financ. Quant. Anal. 1–42.

Berger, A.N., Davies, S.M., 1998. The information content of bank examinations. J. Financ. Serv. Res. 14, 117–144.

Berger, A.N., Davies, S.M., Flannery, M.J., 2000. Comparing Market and Supervisory Assessments of Bank Performance: Who Knows What When? J. Money, Credit Bank. 32, 641.

Berger, A.N., DeYoung, R., 1997. Problem loans and cost efficiency in commercial banks. J. Bank. Financ. 21, 849–870.

Berrospide, J., Correa, R., Goldberg, L., Niepmann, F., 2016. International Banking and Cross-border Effects of Regulation: Lessons from the United States (No. 22645), NBER Working Paper. Cambridge, MA.

Bridges, J., Gregory, D., Nielsen, M., Pezzini, S., Radia, A., Spaltro, M., 2014. The

impact of capital requirements on bank lending (No. 486), Bank of England Working Paper, Bank of England Working Paper. London, UK.

Calem, P., Rob, R., 1999. The Impact of Capital-Based Regulation on Bank Risk-Taking. J. Financ. Intermediation 8, 317–352.

Chiuri, M.C., Ferri, G., Majnoni, G., 2002. The macroeconomic impact of bank capital requirements in emerging economies: Past evidence to assess the future. J. Bank. Financ. 26, 881–904.

Claessens, S., Van Horen, N., Berger, A., Buch, C., Cerutti, E., De Haas, R., Gobat, J., Laeven, L., Lambert, F., Saldias, M., 2015. The Impact of the Global Financial Crisis on Banking Globalization 63, 868–918.

Delis, M.D., Staikouras, P.K., 2011. Supervisory effectiveness and bank risk. Rev. Financ. 15, 511–543.

Feyen, E., Alonso Gispert, T., Kliatskova, T., Mare, D.S., 2021. Financial sector policy response to COVID-19 in Emerging Markets and Developing Economies. J. Bank. Financ. 133.

Furlong, F.T., Keeley, M.C., 1989. Capital regulation and bank risk-taking: A note. J. Bank. Financ. 13, 883–891.

Ghosh, A., 2015. Banking-industry specific and regional economic determinants of non-performing loans: Evidence from US states. J. Financ. Stab. 20, 93–104.

Hirtle, B., Kovner, A., Plosser, M., 2020. The Impact of Supervision on Bank Performance. J. Finance jofi.12964. https://doi.org/10.1111/jofi.12964

Hirtle, B.J., 2020. Banking supervision: The perspective from economics. Federal Reserve Bank of New York, New York, NY.

Hirtle, B.J., Lopez, J.A., 1999. Supervisory information and the frequency of bank examinations. FRBNY Econ. Policy Rev. 5.

Kaufman, G.G., 2014. Too big to fail in banking: What does it mean? J. Financ. Stab. 13, 214–223.

Kiser, E.K., Prager, R.A., Scott, J.R., 2016. Supervisory ratings and bank lending to small businesses during the financial crisis and great recession. J. Financ. Serv. Res. 50, 163–186.

Lane, P.R., 2012. The European sovereign debt crisis. J. Econ. Perspect. 26, 49–68.

Louzis, D.P., Vouldis, A.T., Metaxas, V.L., 2012. Macroeconomic and bank-specific determinants of non-performing loans in Greece: A comparative study of mortgage, business and consumer loan portfolios. J. Bank. Financ. 36, 1012–1027.

Morais, B., Peydro, J.-L., Roldan-Pena, J., Ruiz-Ortega, C., 2019. The international bank lending channel of monetary policy rates and QE: Credit supply, reach-for-yield, and real effects. J. Finance 74, 55–90.

Morgan, D.P., Rime, B., Strahan, P.E., 2004. Bank integration and State business cycles. Q. J. Econ. 119, 1555–1584.

Pennacchi, G., Avramidis, P., Serfes, K., Wu, K. (2022). The Role of Regulation and Bank Competition in Small Firm Financing: Evidence from the Community Reinvestment Act. *Journal of Money, Credit, and Banking*, forthcoming.

Pennacchi, G., Iannotta, G., Santos, J. (2019). Ratings-Based Regulation and Systematic Risk Incentives. *Review of Financial Studies*, *32* (4), 1374-1415.

Pugachev, L., 2019. The risk-shifting value of payout: Evidence from bank enforcement actions. J. Bank. Financ. 105595.

The World Bank, 2022. World Development Report 2022. Finance for an Equitable Recovery. The World Bank, Washington, DC, USA.

Tables

Table 1: Summary Statistics

Table 1, Panel A reports the time-series distribution of the available observations. Panel B reports summary statistics for the 7,804 banks for which data is available over the period 2015-2019. Source: own elaborations using data from Fitch. Panel C reports summary statistics for the banks included in the propensity score matched sample. *, **, *** indicate that means are statistically different at the 10%, 5%, and 1% confidence level, respectively.

Panel A: Time-Series Distribution

Year	Number of Countries	Number of Banks	Number of Treated Subsidiaries (EU)
2015	54	1,810	86
2016	62	1,812	82
2017	64	1,525	79
2018	65	1,434	76
2019	66	1,362	68

Panel B: Bank-level data

	Non-EU subsidiary			**EU subsidiary**		
Variable	N	Mean	Std. Dev.	N	Mean	Std. Dev.
NPL Ratio	7,804	7.116	9.089	405	5.965	7.110
Net Charge-Off to Gross Loans	4,814	1.299	2.291	296	1.383	2.056
Reserve for Impaired Loans to Gross Loans	7,759	6.229	6.951	398	4.965	4.633
Log of Gross loans	7,804	6.389	2.219	405	7.347	1.612
Gross Loans growth	7,800	6.927	24.581	405	2.530	22.577
Total Regulatory Capital Ratio	5,886	21.022	15.950	312	19.491	6.448
Interest Income to Total Assets	7,585	6.764	4.236	397	4.555	3.560
Log of Total Assets	7,804	6.933	2.103	405	8.113	1.493
Operating ROA	7,804	1.590	2.467	405	2.074	2.082
Equity to Total Assets	7,804	14.705	10.318	405	13.450	6.076
Loans to Total Assets	7,804	57.105	17.414	405	49.073	19.174
Deposits to Total Assets	7,804	63.573	19.820	405	61.587	19.024

Panel C: Bank-level data – Propensity Score Matched Sample

	Non-EU subsidiary			EU subsidiary		
Variable	N	Mean	Std. Dev.	N	Mean	Std. Dev.
NPL Ratio	4,188	6.563	8.046	278	5.967	7.402
Net Charge-Off to Gross Loans	2,690	1.318	0.042	214	1.342	1.947
Reserve for Impaired Loans to Gross Loans	7,759	1.349	0.133	278	4.965	4.633
Log of Gross loans	4,188	6.654	0.036	278	7.680	1.598
Gross Loans growth	4,188	6.754	23.438	278	3.088***	1.317
Total Regulatory Capital Ratio	3,428	19.786	0.199	228	18.779	0.395
Interest Income to Total Assets	4,188	6.732	0.126	278	5.092***	0.311
Log of Total Assets	4,188	6.839	0.071	278	7.113*	0.226
Operating ROA	4,188	7.299	8.472	278	8.472**	0.096
Equity to Total Assets	4,188	14.222	9.386	278	13.196	5.607
Loans to Total Assets	4,188	55.860	17.659	278	49.039	18.216
Deposits to Total Assets	7,804	62.802	20.973	278	59.697	18.449

Table 2: Calendar provisioning and non-performing loans ratio of bank subsidiaries

This table reports the results of the estimates of equation (1). The dependent variable is the NPL ratio. The natural logarithm of total assets, Return on Assets (ROA), and equity over total assets, are lagged one year. In Column (3) we restrict the sample to banks above the median total assets in a year in a country. In Column (4) we consider instead countries where in each year at least one foreign-owned subsidiary operates. In Column (5) we employ propensity score matching to select a control group with similar characteristics to the treatment group pre-introduction of the calendar provisioning. Robust standard errors clustered at the bank level appear in parentheses. Subsidiary EU x 2018 indicates the p-value for an F-test for the equality between the two coefficients. ***p < 0.01, **p < 0.05, *p < 0.1.

	(1)	(2)	(3)	(4)	(5)
Subsidiary EU	1.081**	0.696	0.326	0.981	1.977
	(0.441)	(0.635)	(0.740)	(0.767)	(4.744)
Subsidiary EU x 2016	-0.200	-0.360	-0.305	-0.322	-0.699
	(0.359)	(0.356)	(0.363)	(0.361)	(0.799)
Subsidiary EU x 2017	-1.319*	-1.501**	-1.511**	-1.660**	-2.625***
	(0.709)	(0.711)	(0.716)	(0.727)	(0.829)
Subsidiary EU x 2018	-1.660**	-1.872***	-1.861***	-2.239***	-2.780***
	(0.685)	(0.665)	(0.680)	(0.683)	(0.841)
Subsidiary EU x 2019	-2.306***	-2.472***	-2.251***	-2.932***	-3.136***
	(0.756)	(0.753)	(0.773)	(0.778)	(0.865)
Natural logarithm of total assets		-0.895**	-0.702	-1.351**	-0.673
		(0.433)	(0.528)	(0.639)	(0.415)
Return on assets		-0.429***	-0.572***	-0.560***	-0.472***
		(0.100)	(0.157)	(0.120)	(0.055)
Equity over total assets		0.010	0.072	0.015	0.058**
		(0.039)	(0.072)	(0.039)	(0.024)
Constant	7.011***	13.947***	12.486***	17.383***	11.350***
	(0.009)	(3.253)	(4.561)	(4.906)	(3.208)
Subsidiary EU x 2018 = Subsidiary EU x 2019 ?	0.0675	0.1065	0.3254	0.3736	0.6840
Calendar Year FE	Yes	Yes	Yes	Yes	Yes
Bank FE	Yes	Yes	Yes	Yes	Yes
Sample	Full	Full	Only Large Banks	Only Countries with a Subsidiary	PSM Sample
Observations	7,644	7,644	4,540	5,981	4,370
R-squared	0.774	0.779	0.790	0.789	0.792

Table 3: Calendar provisioning and impaired loans reserves of bank subsidiaries

This table reports the results of the estimates of equation (1). The dependent variable is the ratio between Impaired Loans Reserves and Total Loans. The natural logarithm of total assets, Return on Assets (ROA), and equity over total assets, are lagged one year. In Column (3) we restrict the sample to banks above the median total assets in a year in a country. In Column (4) we consider instead countries wherein each year at least one foreign-owned subsidiary operates. In Column (5) we employ propensity score matching to select a control group with similar characteristics to the treatment group pre-introduction of the calendar provisioning. Robust standard errors clustered at the bank level appear in parentheses. ***p < 0.01, **p < 0.05, *p < 0.1.

	(1)	(2)	(3)	(4)	(5)
Subsidiary EU	1.682***	1.273***	1.188***	1.404***	1.406***
	(0.526)	(0.341)	(0.432)	(0.432)	(0.416)
Subsidiary (EU) x 2016	-0.130	-0.297	-0.114	-0.434	-0.536
	(0.394)	(0.389)	(0.402)	(0.399)	(0.507)
Subsidiary (EU) x 2017	-0.905**	-1.077***	-0.984***	-1.207***	-1.515***
	(0.362)	(0.372)	(0.370)	(0.413)	(0.481)
Subsidiary (EU) x 2018	-1.361***	-1.570***	-1.493***	-1.823***	-1.691***
	(0.428)	(0.423)	(0.433)	(0.455)	(0.508)
Subsidiary (EU) x 2019	-1.626***	-1.785***	-1.662***	-2.046***	-1.872***
	(0.505)	(0.503)	(0.530)	(0.540)	(0.595)
Logarithm of total assets		-0.697*	-0.402	-1.492**	-1.350**
		(0.411)	(0.539)	(0.616)	(0.635)
Return on assets		-0.453***	-0.439***	-0.533***	-0.586***
		(0.099)	(0.153)	(0.133)	(0.125)
Equity over total assets		0.026	0.067	0.016	0.051
		(0.035)	(0.084)	(0.044)	(0.053)
Constant	6.178***	11.512***	9.013*	17.825***	16.578***
	(0.023)	(2.976)	(4.716)	(4.674)	(4.899)
Subsidiary EU x 2018 = Subsidiary EU x 2019 ?	0.3565	0.4593	0.5685	0.4594	0.6026
Calendar Year FE	Yes	Yes	Yes	Yes	Yes
Bank FE	Yes	Yes	Yes	Yes	Yes
Sample	Full	Full	Only Large Banks	Only Countries with a Subsidiary	PSM Sample
Observations	7,644	7,644	4,540	5,981	4,370
R-squared	0.824	0.830	0.805	0.822	0.821

Table 4: Calendar provisioning and write-offs of bank subsidiaries

This table reports the results of the estimates of equation (1). The dependent variable is the ratio between Net Charge-Off and Gross Loans. The natural logarithm of total assets, Return on Assets (ROA), and equity over total assets, are lagged one year. In Column (3) we restrict the sample to banks above the median total assets in a year in a country. In Column (4) we consider instead countries wherein each year at least one foreign-owned subsidiary operates. In Column (5) we employ propensity score matching to select a control group with similar characteristics to the treatment group pre-introduction of the calendar provisioning. Subsidiary EU x 2018 indicates the p-value for an F-test for the equality between the two coefficients.Robust standard errors clustered at the bank level appear in parentheses. ***p < 0.01, **p < 0.05, *p < 0.1.

	(1)	(2)	(3)	(4)	(5)
Subsidiary EU	-0.165	0.022	-0.034	0.036	0.168
	(0.203)	(0.178)	(0.211)	(0.185)	(0.254)
Subsidiary (EU) x 2016	0.416*	0.227	0.172	0.246	0.016
	(0.217)	(0.208)	(0.211)	(0.210)	(0.172)
Subsidiary (EU) x 2017	0.854**	0.620*	0.654*	0.574*	0.235
	(0.382)	(0.332)	(0.382)	(0.333)	(0.379)
Subsidiary (EU) x 2018	0.309	0.117	0.116	0.085	0.145
	(0.369)	(0.314)	(0.378)	(0.318)	(0.444)
Subsidiary (EU) x 2019	0.223	0.118	0.150	0.107	-0.085
	(0.310)	(0.294)	(0.307)	(0.299)	(0.324)
Logarithm of total assets		-0.146	-0.115	-0.230	-0.267
		(0.160)	(0.249)	(0.203)	(0.345)
Return on assets		-0.182***	-0.302***	-0.159***	-0.272***
		(0.038)	(0.061)	(0.043)	(0.053)
Equity over total assets		0.013	0.006	0.004	0.025
		(0.012)	(0.027)	(0.014)	(0.025)
Constant	1.344***	2.520**	2.699	3.275*	3.594
	(0.005)	(1.261)	(2.171)	(1.671)	(2.752)
Calendar Year FE	Yes	Yes	Yes	Yes	Yes
Bank FE	Yes	Yes	Yes	Yes	Yes
Sample	Full	Full	Only Large Banks	Only Countries with a Subsidiary	PSM Sample
Observations	4,967	4,967	3,248	3,995	2,827
R-squared	0.616	0.607	0.603	0.639	0.659

Table 5: Calendar provisioning and gross loans

This table reports the results of the estimates of equation (1). The dependent variable is the Natural logarithm of gross loans. In Column (3) we restrict the sample to banks above the median total assets in a year in a country. In Column (4) we consider instead countries wherein each year at least one foreign-owned subsidiary operates. In Column (5) we employ propensity score matching to select a control group with similar characteristics to the treatment group pre-introduction of the calendar provisioning. Robust standard errors clustered at the bank level appear in parentheses. ***p < 0.01, **p < 0.05, *p < 0.1.

	(1)	(2)	(3)	(4)	(5)
Subsidiary EU	0.028	-0.035	-0.051**	-0.006	0.001
	(0.039)	(0.025)	(0.025)	(0.026)	(0.024)
Subsidiary (EU) x 2016	-0.140	-0.044	-0.045	-0.047	-0.086
	(0.026)	(0.024)	(0.024)	(0.024)	(0.069)
Subsidiary (EU) x 2017	-0.102***	-0.008	-0.007	-0.044	-0.022
	(0.039)	(0.032)	(0.033)	(0.033)	(0.039)
Subsidiary (EU) x 2018	-0.095*	0.000	0.003	-0.021	-0.021
	(0.051)	(0.039)	(0.040)	(0.039)	(0.041)
Subsidiary (EU) x 2019	-0.106*	-0.013	-0.004	-0.039	-0.027
	(0.057)	(0.049)	(0.050)	(0.049)	(0.041)
Natural logarithm of total assets		0.655***	0.637***	0.587***	0.5548***
		(0.047)	(0.063)	(0.031)	(0.037)
Return on assets		0.005	-0.000	0.009	0.013*
		(0.006)	(0.005)	(0.007)	(0.007)
Equity over total assets		-0.001	0.000	-0.002	-0.001
		(0.002)	(0.004)	(0.003)	(0.003)
Constant	6.521***	1.888***	2.364***	2.466***	2.641***
	(0.001)	(0.350)	(0.526)	(0.239)	(0.293)
Calendar Year FE	Yes	Yes	Yes	Yes	Yes
Bank FE	Yes	Yes	Yes	Yes	Yes
Sample	Full	Full	Only Large Banks	Only Countries with a Subsidiary	PSM Sample
Observations	7,644	7,644	4,540	5,981	4,370
R-squared	0.987	0.991	0.991	0.993	0.9937

Table 6: Calendar Provisioning and Interest Income

This table reports the results of the estimates of equation (1). The dependent variable is the ratio between Interest Income and Total Assets. In Column (3) we restrict the sample to banks above the median total assets in a year in a country. In Column (4) we consider instead countries where in each year at least one foreign-owned subsidiary operates. In Column (5) we employ propensity score matching to select a control group with similar characteristics to the treatment group pre-introduction of the calendar provisioning. Robust standard errors clustered at the bank level appear in parentheses. ***p < 0.01, **p < 0.05, *p < 0.1.

	(1)	(2)	(3)	(4)	(5)
VARIABLES	Interest Income to Total Assets				
Subsidiary EU	0.192	0.010	0.289	0.057	-1.987***
	(0.880)	(0.912)	(0.896)	(1.374)	(0.159)
Subsidiary (EU) x 2016	-0.016	0.084	-0.016	0.097	0.089
	(0.109)	(0.116)	(0.115)	(0.121)	(0.116)
Subsidiary (EU) x 2017	0.125	0.294	0.161	0.308	0.307
	(0.170)	(0.184)	(0.183)	(0.190)	(0.210)
Subsidiary (EU) x 2018	0.300	0.517**	0.252	0.568**	0.641***
	(0.191)	(0.215)	(0.212)	(0.223)	(0.228)
Subsidiary (EU) x 2019	0.337*	0.568***	0.261	0.580***	0.647**
	(0.176)	(0.199)	(0.198)	(0.208)	(0.260)
Natural logarithm of total assets		0.877***	0.856***	0.924***	1.183***
		(0.122)	(0.131)	(0.175)	(0.237)
Return on assets		0.034**	-0.003	0.041**	0.026
		(0.016)	(0.021)	(0.019)	(0.023)
Equity over total assets		-0.041***	-0.023*	-0.042***	-0.034***
		(0.009)	(0.012)	(0.010)	(0.012)
Constant	6.559***	1.158	-0.651	0.703	-1.148
	(0.041)	(0.865)	(1.093)	(1.273)	(1.726)
Calendar Year FE	Yes	Yes	Yes	Yes	Yes
Bank FE	Yes	Yes	Yes	Yes	Yes
Sample	Full	Full	Only Large Banks	Only Countries with a Subsidiary	PSM Sample
Observations	7,644	7,644	4,540	5,981	4,370
R-squared	0.910	0.915	0.920	0.916	0.919

Table 7: Calendar provisioning and bank regulation

This table reports the results of the estimates of equation (1). The dependent variable is the ratio between Interest Income and Total Assets. Bank controls are size (the natural logarithm of total assets), profitability (return on assets), and capitalization (equity over total assets). Robust standard errors clustered at the bank level appear in parentheses. ***p < 0.01, **p < 0.05, *p < 0.1.

	(1)	(2)	(3)	(4)
	w = Overall Restrictions on Banking Activities		*w* = Stringency in the definition of NPLs	
Subsidiary EU	-0.002	-0.002	0.015	0.021*
	(0.007)	(0.008)	(0.011)	(0.012)
Subsidiary (EU) x 2016	0.006	0.005	-0.009	-0.011
	(0.006)	(0.006)	(0.008)	(0.009)
Subsidiary (EU) x 2017	0.011	0.012	-0.009	-0.006
	(0.009)	(0.010)	(0.011)	(0.011)
Subsidiary (EU) x 2018	0.018**	0.021**	-0.016*	-0.017*
	(0.009)	(0.010)	(0.008)	(0.009)
Subsidiary (EU) x 2019	0.020**	0.026***	-0.001	-0.011
	(0.009)	(0.010)	(0.012)	(0.011)
w	-0.001***	-0.001***	0.001*	0.001*
	(0.000)	(0.000)	(0.000)	(0.000)
Subsidiary (EU) x 2016 x *w*	-0.001	-0.001	0.002	0.002
	(0.001)	(0.001)	(0.001)	(0.002)
Subsidiary (EU) x 2017 x *w*	-0.001	-0.001	0.002	0.002
	(0.001)	(0.001)	(0.002)	(0.002)
Subsidiary (EU) x 2018 x *w*	-0.002**	-0.002*	0.004**	0.004**
	(0.001)	(0.001)	(0.002)	(0.002)
Subsidiary (EU) x 2019 x *w*	-0.002*	-0.003**	0.004*	0.003*
	(0.001)	(0.001)	(0.002)	(0.002)
Constant	0.084***	0.038*	0.070***	0.020
	(0.003)	(0.022)	(0.002)	(0.021)
Additional Controls	No	Yes	No	Yes
Calendar Year FE	Yes	Yes	Yes	Yes
Bank FE	Yes	Yes	Yes	Yes
Sample	Full	Full	Full	Full
Observations	8,850	8,476	8,886	8,509
R-squared	0.922	0.909	0.922	0.908

Figures

Figure 1: The trend of non-performing loans in Europe

This figure plots the weighted mean level of the NPL ratio (non-performing loans to total gross loans) in percentage points between 2009 and 2020 for the following 17 European countries: Belgium, Bulgaria, Cyprus, Denmark, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Portugal, Spain, Sweden. The weights are computed for each country in a year using the information on GDP at the purchaser's prices (constant 2015 prices, expressed in U.S. dollars). Data source: IMF Financial Soundness Indicators and World Bank's World Development Indicators.

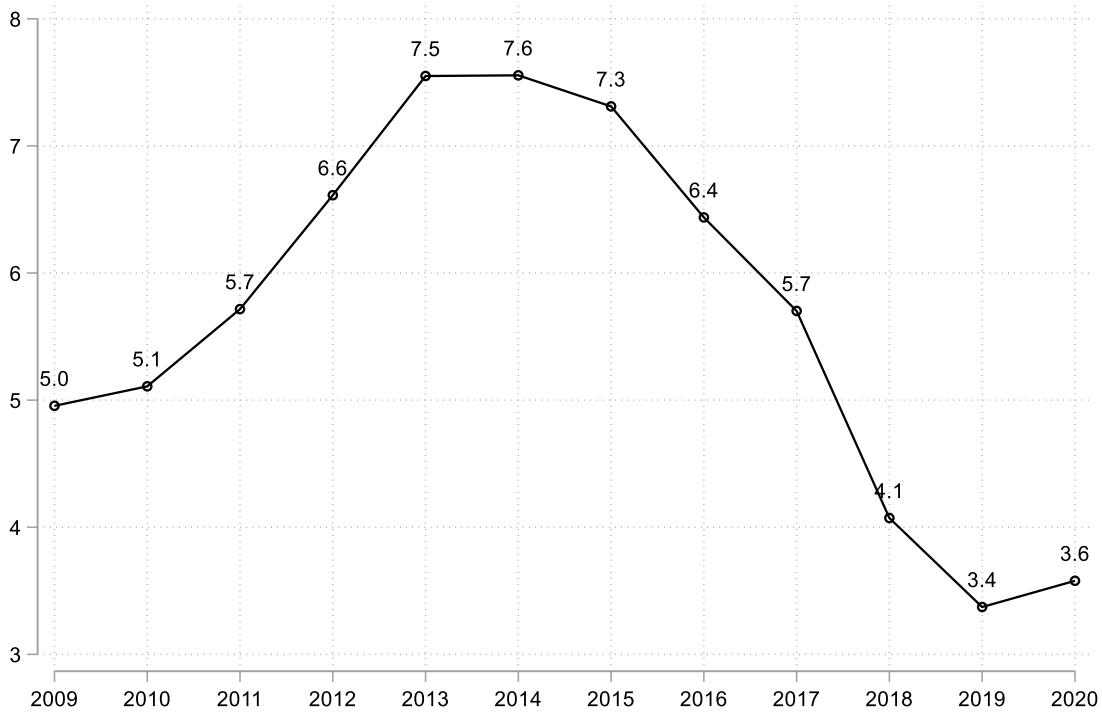
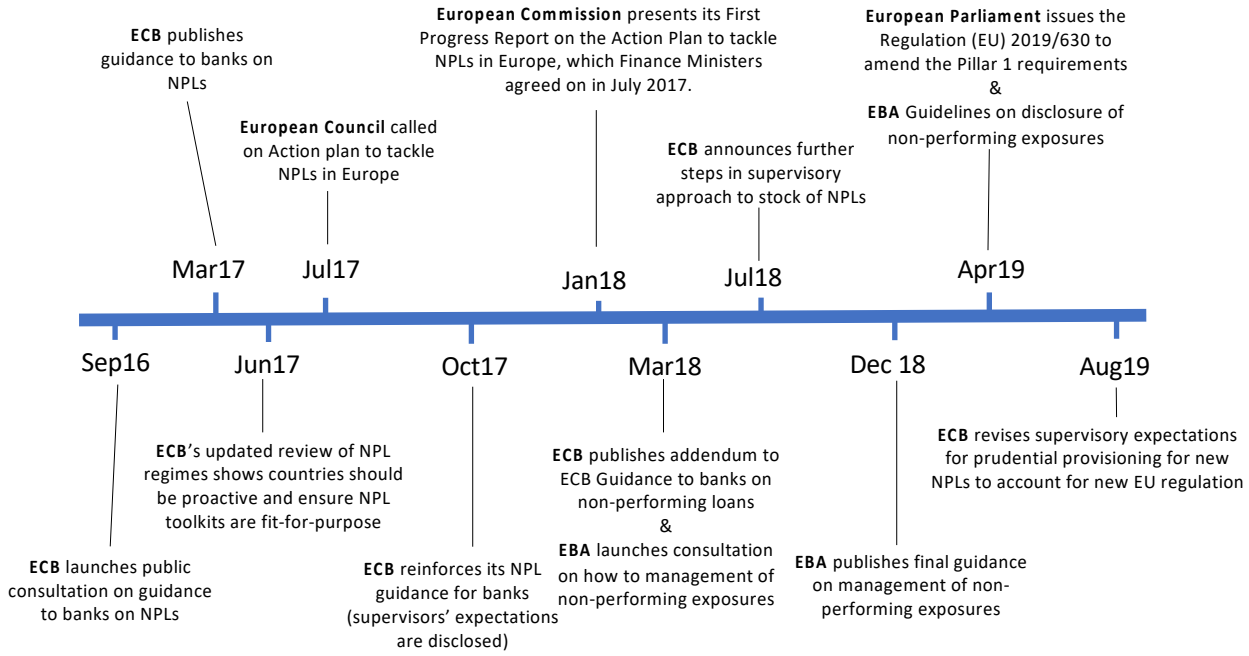


Figure 2: The Timeline of Non-Performing Exposures supervisory and regulatory reforms

This figure summarizes the formal announcements and publications of the main regulatory and supervisory reforms made in Europe to tackle the problem of non-performing exposures.



Appendix A: Descriptive statistics

Table A1: Number of banks by country and year

Table A1 reports information on the number of banks by country and year included in our sample.

Economy	2015	2016	2017	2018	2019	Total
Afghanistan	0	0	0	2	2	4
Albania	13	14	13	11	9	60
Algeria	4	5	4	3	3	19
Angola	12	9	11	13	10	55
Argentina	40	37	35	31	40	183
Armenia	15	12	13	13	12	65
Azerbaijan	21	14	16	14	13	78
Bangladesh	40	43	44	44	43	214
Belarus	19	21	20	21	20	101
Benin	0	0	2	1	1	4
Bhutan	2	3	3	3	2	13
Bolivia	7	6	8	9	9	39
Bosnia and Herzegovina	20	20	19	20	20	99
Botswana	6	5	6	4	5	26
Brazil	66	65	72	79	75	357
Bulgaria	17	16	16	16	14	79
Burkina Faso	3	3	2	0	2	10
Burundi	0	2	1	2	0	5
Cabo Verde	5	5	5	4	3	22
Cambodia	29	29	15	15	11	99
Cameroon	4	3	3	1	0	11
Chad	0	2	0	0	0	2
China	116	123	120	114	107	580
Colombia	37	35	38	39	38	187
Congo, Dem. Rep.	3	3	3	0	2	11
Costa Rica	18	18	18	16	16	86
Djibouti	0	0	0	2	0	2
Dominican Republic	15	37	40	36	33	161
Ecuador	17	17	19	18	18	89
Egypt, Arab Rep.	23	23	22	21	21	110
El Salvador	9	6	5	5	5	30
Eswatini	4	4	4	1	0	13
Ethiopia	5	9	11	12	11	48
Gabon	3	0	2	0	0	5
Gambia, The	2	0	2	2	0	6
Georgia	16	14	13	12	14	69
Ghana	20	18	15	15	15	83
Guatemala	13	13	15	16	13	70
Guinea	0	2	1	2	2	7
Guyana	6	6	6	6	6	30

Economy	2015	2016	2017	2018	2019	Total
Haiti	5	5	5	5	4	24
Honduras	12	12	16	22	22	84
India	67	72	78	72	53	342
Indonesia	85	96	95	93	87	456
Jamaica	3	4	5	5	5	22
Jordan	11	11	10	10	10	52
Kazakhstan	19	18	17	18	18	90
Kenya	33	35	31	32	31	162
Kosovo	2	2	2	2	2	10
Kyrgyz Republic	3	0	0	0	0	3
Lao PDR	5	6	5	5	4	25
Lebanon	26	26	27	23	11	113
Lesotho	2	2	1	0	0	8
Liberia	2	2	3	3	3	13
Macedonia, FYR	8	7	7	8	7	37
Madagascar	2	2	1	0	0	5
Malawi	6	5	5	4	4	24
Malaysia	24	25	24	24	23	120
Mali	3	3	3	2	2	13
Mauritania	2	2	2	1	1	8
Mexico	45	49	44	45	49	232
Moldova	9	9	9	9	8	44
Mongolia	3	4	4	4	4	19
Montenegro	9	9	9	8	10	45
Morocco	5	5	5	5	6	26
Mozambique	8	6	7	8	7	36
Namibia	3	3	4	3	3	16
Nepal	41	38	20	33	34	166
Nicaragua	3	4	4	4	4	19
Nigeria	18	17	15	15	13	78
Pakistan	24	25	25	23	24	121
Papua New Guinea	0	2	0	0	0	2
Paraguay	14	14	14	14	12	68
Peru	15	16	15	14	15	75
Philippines	18	19	19	19	18	93
Russian Federation	381	363	97	59	68	968
Rwanda	5	5	5	5	5	25
Senegal	3	3	2	0	0	8
Serbia	17	18	21	20	21	97
Sierra Leone	4	0	0	0	0	4
South Africa	13	14	13	16	12	68
Sri Lanka	16	17	18	22	21	94
Syrian Arab Republic	10	10	10	11	12	53
Tajikistan	2	0	0	0	0	2
Tanzania	21	22	23	13	9	88
Thailand	19	22	20	21	21	103
Togo	2	3	3	2	0	10
Tunisia	10	10	10	10	10	50

Economy	2015	2016	2017	2018	2019	Total
Turkey	28	28	26	26	25	133
Uganda	17	16	16	9	7	53
Ukraine	23	18	21	22	23	107
Uzbekistan	9	6	7	7	9	38
Venezuela, RB	22	21	22	5	3	73
Vietnam	20	19	20	17	17	93
West Bank and Gaza	2	0	0	2	2	6
Yemen, Rep.	0	0	2	0	0	2
Zambia	9	11	9	7	7	43
Zimbabwe	11	10	7	7	5	40
Total	1810	1812	1525	1434	1362	7804

Table A2: Number of countries by income level

Table A2 reports information on the number of countries by income level and year included in our sample.

Year	Low income	Lower-middle income	Upper-middle income	Total
2015	11	21	22	54
2016	13	24	25	62
2017	13	25	26	64
2018	13	26	26	65
2019	14	26	26	66
Total	76	122	125	311