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What drives bank coverage ratios: Evidence from Europe*

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Abstract

We analyze micro and macro drivers of coverage ratios, as well as of their components, in a cross-country sample of European banks. Among the former, we find that credit risk variables, including forward-looking indicators, are the most relevant bank-specific factors explaining bank coverage ratios, together with the level of capitalization in high-NPL banks. Among the latter, coverage ratios increase with GDP growth, suggesting they behave countercyclically, more stringent macro-prudential policies, and deeper NPL secondary markets. Finally, we find evidence of peer imitation behavior in banks with coverage ratios below the country average.

Keywords: loan loss reserves, non-performing loans, loan loss coverage

JEL Classification: G21, G28, M41

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1. Introduction

One of the most debated issues in Europe since the financial and sovereign debt crises concerns the accumulation of large stocks of non-performing loans (NPLs). Excessive stocks of NPLs can limit banks' lending ability and even impair the monetary policy mechanism (Draghi 2017; ESRB, 2019). To tackle this issue, a number of micro and macro policy initiatives have been adopted at both European and national level (ECB, 2016 and 2017a).[1]

Because NPLs represent a risk to banks' balance sheets insofar as they are not sufficiently covered (Constâncio, 2017), several of the recent actions entailed measures to enhance the coverage ratio, i.e., the share of loan loss reserves (LLRs) to total NPLs. Such ratio indicates how much the credit risk associated with the loan portfolio is covered through the accumulation of loan loss provisions. The higher the coverage ratio, the lower the net book value of the loan, hence the potential loss associated to the loan and ultimately, the impact on capital once the loss materializes.

Over the last years, the coverage ratio has gained relevance as a key supervisory metric to assess banks' soundness, if not as a fully-fledged supervisory tool, prompting the need for a more uniform loss coverage policy across banks and countries.[2] This has happened in parallel with a strengthening of prudential rather than accounting priorities as for the rules governing banks' loan loss reserves.

Despite the increased policy relevance of coverage ratios, the empirical evidence on determinants of coverage ratios remains scarce. Previous works on related topics have focused on explaining either NPLs or loan loss provisions (LLPs).[3] However, provisioning policies are virtually uncorrelated with coverage ratios (see Table 1) and, thus, previous findings on the determinants of provisioning or NPLs cannot fully explain the dynamics of coverage ratios, which is a more comprehensive indicator of balance-sheet strength. In this work we aim to fill this gap. In particular, we

[1] In 2017 and 2018, the European Central Bank (ECB) published for the first time guidelines on how banks should set internal NPL coverage thresholds (ECB, 2017b and ECB, 2018). In 2019, a new European Union (EU) regulation complemented existing prudential rules by requiring a deduction from own funds when NPLs are not sufficiently covered by provisions (see Stamegna, 2019 for a review of major initiatives).

[2] For example, large institutions have commonly reported lower coverage ratios than small and medium-sized banks. At the country level, the average coverage ratio in Europe is nearly 46%, but it ranges from 24% in Finland to nearly 70% in Hungary. What is more striking is that many of the countries with the highest level of NPLs report below-average coverage ratios (EBA, 2018).

[3] Previous studies on LLPs discuss the role of discretion (Liu and Ryan, 2006; Bushman and Williams, 2012; Norden and Stoian, 2013; Beatty and Liao, 2014, and literature therein), as well as their timeliness and contribution to procyclical lending (Huizinga and Laeven, 2019; Laeven and Majnoni, 2003; Beatty and Liao, 2011; Nicoletti, 2018). Berger and De Young (1997), Nkusu (2011), Klein (2013), and Beck et al. (2015) among others study the determinants of NPLs.

exploit the high variation of coverage ratios across banks and countries and investigate the main drivers of coverage ratios, as well as of their determinants, both at the micro and macro level.

We use a sample of around 440 large and medium-sized banks in Europe over the period 2010–2017. Europe provides an interesting case study, given the high level of NPLs and the substantial bank and country heterogeneity in the region (EBA, 2018). Time variation is ensured by the inclusion of the euro sovereign crisis and the post-crisis years, a relatively long period marketed with a slow recovery.

We start with analyzing the role of bank-specific factors related to credit risk, capitalization, and performance, among others. We find that credit risk considerations, and in particular asset quality, as measured by NPL levels and changes, and lending growth are the most relevant factors explaining coverage ratios. Higher NPLs induce banks to set aside higher reserves, but in a way that is not sufficient to determine higher coverage ratios. We also show that the relationship between coverage ratios and asset quality is non-linear, as high-NPL banks tend to be comparatively better covered as asset quality worsens. Moreover, we find that risky banks tend to have lower LLRs and coverage ratios if they are less capitalized. This supports the capital management hypothesis, indicating that weaker banks tend to under-reserve, possibly to limit the negative implications of higher provisioning on equity (Ristolainen, 2018).

Second, to better understand whether coverage ratios respond also to a prudential rationale, we investigate whether banks consider forward-looking considerations when setting them. We find that credit growth, although being accompanied by reduced NPLs in the very short run, is associated with both more prudent provisioning and higher coverage ratios. We also uncover that forward-looking measures of asset quality are associated with higher coverage ratios. This evidence suggests that coverage ratios work more as prudential (forward-looking) buffer than temporary (and backward-looking) booking accounts. It also suggests that even in an "incurred loss" model (ILM) for calculating bank provisions, banks tend to manage coverage ratios in a forward-looking manner.

Third, we find evidence of peer effects in setting coverage ratios. This is to be expected as benchmarking is a common practice among practitioners and supervisors. In particular, we find that banks with coverage ratios below their country average tend to increase their coverage ratios more than peers (or decrease them less), and this effect is stronger for banks that are farther away from the average.

In the second part of the analysis, we analyze the role of systematic macro determinants of coverage ratios related to the business and the financial cycle as well as to relevant structural characteristics of a given country. Our first key finding is that coverage ratios increase with GDP growth, and decrease in recession, pointing to a countercyclical behavior.

The second finding is that more stringent macroprudential policy is associated with higher coverage ratios. In particular, we find that interventions on time-varying/dynamic loan-loss provisioning and corporate taxation are generally the most effective tools to increase coverage ratios. We also find that increasing loan collateralization by setting limits to borrowers' loan-to-value ratios is associated with higher coverage ratio, indicating that collateral and coverage ratios are complementary rather than substitute tools.

The third finding is that in more risky countries actions to improve the rule of law are associated with lower NPLs and (to a lesser extent) coverage ratios. This evidence indicates that a stronger contract enforcement or more efficient courts help banks resolve NPLs.

Finally, when we investigate the role of the NPL secondary market, we uncover higher coverage ratios in banks located in countries where secondary markets for distressed debt are larger, and the more so if banks are located in high-NPL countries. This result corroborates the statements by European central authorities about the need to report adequate coverage ratios to make loan disposals more likely and limit actual losses for the seller (Fell et al., 2016; Constâncio, 2017).

Our results have a number of policy implications. First, the result that capital is positively associated with coverage ratios stresses the importance of linking capital regulation with coverage ratio policies, in particular in countries or banks with high NPL levels. Well capitalized banks should be better positioned to build higher coverage ratios, although, as our results suggest, tighter capital rules may delay the accumulation of LLRs. This result is in line with the finding in Gropp et al. (2019) that banks tend to deleverage in an attempt to comply with more stringent capital regulation.

Second, the analysis of the macro drivers of coverage ratios suggest that stricter supervision is relevant, but addressing structural factors (e.g., by developing the secondary market for loans or reinforcing the legal framework) is at least equally important to ease the disposal of legacy assets, hence reducing the denominator of the ratio more quickly and at a lower cost.

Finally, our empirical analysis pre-dates the entrance into force of the new accounting standard (IFRS 9). The introduction of a forward-looking and ideally countercyclical approach to calculate

provisions should lead to higher coverage ratios, by promoting a timelier and more prudent provisioning. In this respect, we provide evidence of a prudent behavior in setting coverage ratios already before the entry into force of IFRS 9. Hence, we expect our results to carry through the new approach.

Our work differs from the existing literature on bank provisioning in various respects. Our main variable of interest is the stock of LLPs accumulated over the years (LLR) in percentage of NPLs rather than the flow of LLPs. We therefore explore bank and country level factors by including a large set of micro and macro-level variables drawn from the literature on NPL determinants (e.g., Berger and De Young, 1997; Nkusu, 2011). Among the country variables, we analyze the importance of the institutional framework as well as the development of a secondary market for NPL assets, in addition to the typical focus on GDP growth and pro-cyclicality in previous studies (e.g., Laeven and Majnoni, 2003; Huizinga and Laeven, 2019). This allows us to exploit the richness of country characteristics and thus, better explain the large variation in coverage ratios across countries. As we investigate the dynamics of coverage ratio components, we are also able to explore the mechanisms through which banks protect themselves against credit losses in response to shocks. This allows us to draw some conclusions on whether coverage policies are driven by accounting rather than prudential considerations and which policy measures may help foster coverage ratios.

The remainder of the paper is structured as follows. Section 2 provides some background details on the main measures taken to enhance loss coverage for NPLs and the reasons why, in a context of high NPLs, it is important for banks to build up adequate coverage ratios. Section 3 illustrates the data and provides descriptive statistics for our sample. Section 4 and 5 investigate empirically the main sources of variation in coverage ratios and their components. We first focus on micro-level factors (Section 4) and then extend the analysis by using macro-level data (Section 5). Section 6 concludes.

2. NPLs and coverage ratios: institutional background

2.1. Recent measures to enhance loss coverage for NPLs

NPLs have recently become a key priority for macro-prudential authorities in Europe because of the potential negative externalities associated with large stocks of troubled assets (ESRB, 2019). High NPLs are potentially detrimental to individual banks and the financial system for several reasons. First, an unresolved stock of NPLs may have negative externalities on the perception of the health of the

financial system, making bank funding more expensive and discouraging banks from new lending. Second, lending can be impeded as banks with poorer asset quality may seek to regain adequate capital ratios by deleveraging and cutting back on lending rather than by raising new equity. Third, high NPL ratios can also distort managers' incentives if troubled loans increase moral hazard and favor excessive risk taking because of eroding bank capital (Bruno and Marino, 2019).

NPLs in European banks skyrocketed to unprecedented levels in the wake of the global financial crisis, making them more vulnerable than their international peers to the repercussions of poor asset quality. European supervisors have reacted fiercely to resolve the problem of legacy assets. As a result of these actions, according to the EBA, the NPL ratio of EU institutions has decreased from 6% as of mid-2015 to 3% as of mid-2019. Nevertheless, discrepancies across banks and countries still persist, the aggregate level of NPLs in EU banks remains very high (over 600 billion euros as of June 2019), and the gap versus international peers is striking (according to World Bank data, the NPL ratio was nearly 1% in the US as of end 2018).

As argued (Constâncio, 2017), one of the reasons behind this large variation has been the absence of common provisioning practices, motivating measures on how to both harmonize provisioning practices and enhance loss coverage (Stamegna, 2019; ECB, 2019). Promoting not only higher but also more homogeneous coverage ratios is important for supervisors who commonly rely on benchmarking and peer comparison.[4]

To strengthen the supervisory approach to NPLs, in March 2017, the ECB released guidelines on how to manage and provision for problem loans, complemented with quantitative indicators on the minimum levels of prudential provisions, based on the vintage and the degree of collateralization of the non-performing exposures (ECB, 2018). In July 2018, the ECB announced the decision to set bank-specific supervisory expectations for the provisioning of NPLs as part of the supervisory dialogue. The aim was to harmonize the degree of loss coverage over the medium term across comparable banks. In March 2018, the European Commission adopted a comprehensive package of measures that included a proposal to introduce common minimum coverage levels for newly originated loans that become non-performing. In April 2019, an amendment to the European capital regulatory framework, the 'prudential

[4] For example, in its guidance on NPLs (ECB, 2017a), the ECB claims that best practices "are intended to constitute ECB banking supervision's expectation" (p. 5) and that "where possible, indicators related to the NPL ratio/level and coverage should also be appropriately benchmarked against peers in order to provide the management body with a clear picture on competitive positioning" (p. 30).

backstop', required banks to have minimum loss coverage for non-performing exposures and to deduct from own funds (common equity tier 1 capital) those not sufficiently covered.

To complete the picture, the accounting standard IFRS 9, introduced as of January 2018, has changed the impairment recognition by requiring banks, in essence, to make larger and timelier provisions based on the amount of "expected losses".[5] Until the introduction of IFRS 9, banks in most European countries accumulated provisions according to a backward-looking approach, reflecting "incurred" credit losses (Cohen and Edwards, 2017). Ideally, under the new accounting standard, provisions should be better able to anticipate deteriorating economic conditions that may affect borrowers' ability to repay. In such a way, they could be effectively used to cover expected losses, while bank capital serves as a buffer against unexpected losses (Laeven and Majnoni, 2003).

The switch to the new standard has been an important step to reconcile the perspective of accounting standard setters and those of bank regulators and supervisors. Losses on NPLs are in fact subjected to both accounting standards and prudential regulation which (especially before the IFRS 9 introduction) adopt different perspectives. The former emphasizes transparency of financial statements, the latter emphasizes safety and soundness. Given the accounting rules, LLPs have an overall detrimental effect on earnings and regulatory capital.[6] Because LLPs are at the discretion of bank managers, there is potential for banks to provision more or less than necessary as a way to smooth their income and capital. From an accounting perspective, this would introduce discretionary modifications to earnings and reduce comparability across firms (Walter, 1991). On the other hand, from a prudential perspective, higher provisioning may reflect a more cautious approach to building up large reserves prior to future losses.

2.2. Coverage ratio as a prudential tool

The initiatives illustrated above show that the coverage ratio has gained relevance as a key prudential and monitoring tool to shield bank balance sheet. Why it is desirable for regulatory and

[5] There are some exceptions. Notably, Spanish bank regulators introduced a forward–looking provisioning regime in 2000, meant to address procyclicality issues, which led to more timely and higher general provisions (de Lis et al., 2001; Jiménez et al., 2017).

[6] The actual effect on bank capital of provisioning is hard to determine, because the regulatory implications of provisions varies according to the approach used by banks for calculating capital requirements, and on the nature of bank provisions. The Basel capital framework distinguishes between general provisions and specific provisions. General provisions are provisions held against future, presently unidentified losses that are freely available to meet losses which subsequently materialize. Provisions ascribed to identify deterioration of particular assets are specific provisions. By their nature, general provisions qualify for the inclusion in Tier 2, although with certain limitations (Bruno and Carletti, 2017).

supervisory purposes to promote high loan loss coverage? The answer is that adequate coverage ratios can help banks mitigate most of the concerns associated with high NPLs.

First, adequate loan loss allowances enhance banks' safety and soundness (Wheeler, 2019). Provisioning is a credit risk management tool through which banks alleviate credit risk by setting aside a given amount (LLPs) as a buffer to absorb expected losses associated with a loan. LLPs allow banks to recognize the estimated loss in their profit and loss account, even before the actual loss can be determined with accuracy and certainty. The stock of LLPs accumulated over years form LLRs. When loan losses eventually materialize, banks can ideally draw on these reserves, thereby absorbing the losses without impairing capital - to the extent that credit risk is not under-estimated and allowances eventually results adequate to cover for the actual loss. This preserves banks' capacity to provide credit to the economy (Beatty and Liao, 2011).[7]

It should be emphasized however, that in principle low coverage ratios do not necessarily imply under-provisioning or delayed recognition of losses, as they might reflect rigorous lending practices, strong insolvency frameworks, or high collateralization level (EP, 2016).

In practice, however, especially in a context of generalized poor asset quality, low coverage ratios represent a potential source of instability, in that any future loss on the loan portfolio, if not sufficiently provisioned for, would be covered by bank capital. This would occur also for collateralized loans, as the net-present value of the collateral is highly affected by the enforcement procedure that in several countries is lengthy and costly (Constâncio, 2017). In light of these considerations, banks with large volumes of NPLs and moderate coverage ratios would be more vulnerable to negative shocks affecting borrowers' credit quality, especially in crisis years.[8]

The second reason why high coverage ratios are important policy tools is that they contribute to make banks' balance sheet less opaque. In the traditional banking literature (e.g., Diamond and Dybvig, 1983), loans are illiquid and untraded contracts generating cash flows that are hard to predict. In the absence of a true market price, the loan fair value is approximated through the process of provisioning. The process of accumulating provisions is, in fact, equivalent to reducing the face value of the loan to its

[7] The NPL Guidance stresses the importance of timely provisioning related to NPLs, as "these serve to strengthen banks' balance sheets, enabling them to (re)focus on their core business, most notably lending to the economy" (ECB, 2018).

[8] Estimates report that net present value of NPLs may be as may be as low as 40-50% of the loan gross book value. Balance sheets are protected, and capital buffers remain impaired, as long as coverage ratios reflect this haircut. Of course, the estimates are affected by several factors, including the cost of enforcing collateral through the legal system and NPL investors' risk appetite (Fell et al., 2016).

present value, taking into account the allowance built up over time (Song, 2002). If loan loss allowances were underestimated, bank assets and capital ratios would be overvalued and balance sheets would be distorted.

Relatedly, because high loan loss coverage corresponds, *de facto*, to low loan net book value, it follows that reporting high coverage ratios is also a precondition to make the asset disposal more likely and reduce the bid-ask spread between sellers and buyers (Fell et al., 2016). However, anecdotal evidence and market practices show that, on average, coverage ratios in European banks are still inadequate if compared to actual recovery rates or haircuts applied as an effect of NPL resolution.[9] This points to the importance of increasing coverage ratios in order to reduce the negative impact of credit losses on capital.

3. Data and summary statistics

We collect annual bank-level data from the S&P Global Market Intelligence Platform (S&P Global). The dataset spans the years 2010–2017 and covers all EU countries as of 2017.[10] Following Eber and Minoiu (2016) we collect data at the highest consolidation level. To avoid including too small banks that could introduce noise, we only keep banks that are being classified as medium-sized and large according to the ECB definition.[11] Given the purpose of the analysis, we delete institutions whose commercial banking business is negligible.[12] All micro-level variables are winsorized at 2.5% and 97.5%, respectively.[13] The final sample contains 441 banks, representing around 70% of banking assets in Europe (see Table A.1 for a detailed breakdown of our sample).

Figures 1 to 4 explore trends in NPLs, loan loss reserves, and coverage ratios based on our sample. Figure 1 shows that the evolution of the average coverage ratio over all countries and in high-

[9] In the context of the NAMA, the asset management company established in Ireland in 2009, assets were priced with a 57% haircut, with an average haircut on loan portfolios ranging from 43% to 61%. In the case of SAREB, the Spanish asset management company established in 2012, total assets were valued with a 53% haircut, with large discrepancy by loan type (Medina Cas and Peresa, 2016). Looking at Italy, the recovery rate on NPLs is estimated between 41% (Carpinelli et al., 2016) and 47% (Ciavoliello et al., 2016), indicating an average haircut of about 60%.

[10] As common in the empirical literature on European banks (see Altavilla et al., 2017), German banks are over-represented in terms of number of institutions in our sample. However, this is not the case in terms of total banking-sector assets. This reflects the highly fragmented nature of the German banking system.

[11] The ECB labels as large those institutions with assets greater than 0.5% of total consolidated assets of European Union banks and medium–sized as those with assets between 0.5% and 0.005%.

[12] We delete institutions with a loan-to-asset ratio and a deposit-to-asset ratio smaller than 20%, those not classified as 'bank' or 'savings bank/thrift/mutual', as well as those that, although being classified as banks by S&P Global, may operate not in a pure commercial manner because for example of ownership (e.g., government-owned banks) or scope (e.g., asset management companies).

NPL countries, defined as those with NPL/TA above the sample mean.[14] In both groups of countries, coverage ratios have trended up since the sovereign debt crisis in 2010–2012 and, again, after the entry into operation of the SSM in 2014. Overall, European banks have progressively increased their coverage ratios, partly as a managerial response to asset quality deterioration, partly due to stricter supervisory and market scrutiny. [15] Throughout the period, high-NPL countries report coverage ratios below the sample average. The gap has progressively narrowed over time. Figure 2 shows the dynamics of the components of the coverage ratio, scaled by total assets. By comparing Figure 1 and Figure 2 on the evolution of coverage ratio and its components, it emerges that while the dynamics of LLRs and NPLs are similar, they are radically different from those of coverage ratios.

Figures 3 to 4 confirm the presence of large cross-sectional variability in asset quality and coverage ratios, respectively, both across countries and across banks within the same country (see also Table A.1).[16] Figure 3 shows that countries with higher average NPLs also have a larger dispersion in NPL/TA across banks. Looking at Figure 4, it is possible to detect some positive correlation between the size of the NPL stock and the dispersion of coverage ratios in a given country, but not as clear-cut. By comparing the two figures, no obvious country-level mapping emerges between the quality of bank loans and the level of coverage. This suggests that heterogeneity in European banks' coverage ratios is not explained by differences in asset quality.[17]

Descriptive statistics and correlations for all the variables are shown in Table 2 and Table A.2, respectively. The average sample bank is large according to the ECB definition with assets amounting to nearly euro 28 billion and is a traditional commercial bank, whose core business is lending (the average loan to asset ratio is 65%) and whose main source of funds are customer deposits (the deposits to assets ratio averages 66%). As far as bank asset quality is concerned, the NPL to total asset ratio averages at about 4%. The average coverage ratio is 51%, with large variation across banks, the minimum coverage

[14] Our definition of high-NPL countries is time-varying, with some countries coming in only for part of the sample. All countries in which the NPL ratio exceeds 10% in 2016 (in accordance with the definition of the ESRB, 2017b) are consistently covered. These countries are the following, in order of descending NPL ratio: Greece, Cyprus, Portugal, Italy, Slovenia, Ireland, Bulgaria, Hungary, Romania, and Croatia.

[15] This may have been due to stricter supervisory and regulatory scrutiny in relation to the AQR exercise, increased market pressure, as well as a deterioration of collateral values (Council of the European Commission, 2017).

[16] We are aware that across jurisdictions and banks there may be different definition of NPLs (Baudino et al., 2018). However, a common definition for non-performing exposures was introduced in 2014 by the EBA. Moreover, our regressions include bank and country fixed effects that should absorb the variation in coverage ratios due to possibly different definitions across banks and jurisdictions.

[17] An EBA report on NPLs also shows that the correlation between these assets and coverage ratios is low over time, with a correlation coefficient close to 0 at least since September 2014 (EBA, 2016).

ratio being 10% and the maximum 89%. These numbers are comparable to those reported in aggregate statistics (ECB, 2016; EBA, 2018).

Looking at measures of bank capitalization, the CET 1 regulatory capital ratio is on average 15%, well above the Basel III minimum requirement of 8.5% including the capital conservation buffer. Note that the European banking sector has taken a number of steps to strengthen its resilience since the onset of the euro debt crisis. The ROOA averaging around zero confirms that low profitability remains a major source of concerns for European banks and that high NPLs have been an important cause of low profitability in European banks (Altavilla et al., 2018).[18]

Table 3 also shows descriptive statistics for the set of macroeconomic and macrofinancial indicators we consider. These include business cycle indicators such as real GDP growth and the unemployment rate, as well as the short term interest rate, and variables related to the financial cycle, such as asset price growth (i.e. house and stock prices), and the private credit to GDP ratio. We also include two indices to account for the regulatory and judicial environment, namely the Regulatory Quality index and the Rule of Law index, both published by the World Bank. Finally, we consider some indicators from the Cerutti et al. (2017) macro-prudential policy dataset. A description of these macro variables is given in Section 5.

4. Exploiting the cross section of banks: micro-level analysis

In this section, we exploit the sample heterogeneity at the micro-level in order to explore the link between coverage ratios and bank-specific characteristics.

Because higher coverage ratios may entail larger provisions and/or lower NPLs, we first draw on the literature on determinants of LLPs and NPLs when investigating the drivers of coverage ratios. We illustrate all these factors and formulate hypotheses.

We then test which of the above bank-specific characteristics, together with other factors, can explain variation the coverage ratio. We will run three separate regressions, whose dependent variables are the coverage ratio and its components. Looking simultaneously at coverage ratios and its components will enable us to better understand the mechanisms by which banks set coverage ratios, over and above the accounting identification of impaired loans.

[18] "The return on equity remains below the cost of equity with legacy assets, cost–efficiency and banks' business models still being some of the main obstacles towards reaching sustainable profitability levels". (EBA, 2018)

4.1. Determinants of NPLs, provisioning and coverage ratios

We begin by discussing the main micro-determinants of NPLs, i.e., cost efficiency, bank capitalization and lending policy (see Klein, 2013 and literature review therein). Berger and De Young (1997) motivate the effects of cost efficiency on loan-portfolio quality under the bad management and the skimping hypotheses. The former argues that low cost efficiency is a signal of poor management practices, thus implying lower portfolio quality as a result of poor loan underwriting, monitoring and control. On the contrary, under the skimping hypothesis, high cost efficiency is associated with higher NPLs in the future, as it reflects little resources allocated to the monitoring of lending risks.

Capitalization is another important factor influencing bank risk taking. In principle, well-capitalized banks should be better able to expand their business and take on risk. On the other hand, the "moral hazard" hypothesis (Keeton and Morris, 1987) argues that undercapitalized banks are more prone to gamble for resurrection and respond to moral-hazard incentives by increasing the riskiness of their loan portfolio. Relatedly, undercapitalized banks are more likely to keep lending to zombie firms compared to stronger banks (Schivardi et al., 2018, and literature therein). This behavior in turn results in higher non-performing loans on average in the future.

Lending policy is a determinant of NPLs in that, *ceteris paribus*, banks more willing to invest their funds in loans (rather than, e.g., securities) are more exposed to credit risk (Keeton and Morris, 1987). Excessive credit growth may also be conducive to more risky lending, and hence to higher NPLs in the future (Jiménez and Saurina, 2006; Huizinga and Laeven, 2019).

Considering bank provisioning, the literature identifies (non-discretionary) factors related to credit risk considerations and (discretionary) factors accounting for different management objectives (Beatty and Liao, 2014). Concerning the former, the non-discretionary component of LLP would reflect losses emerging from the lending business. The first plausible driver affecting provisions and loan loss reserves is the quality of the loan portfolio. Both the level of NPLs and the change in the quality of the underlying loan portfolio may explain provisioning policies. *Ceteris paribus*, one may expect poorer asset quality to be associated with higher loan loss reserves, as banks with lower asset quality should be more prone to increase loss coverage for the reasons discussed in the previous sections. Relatedly, the relevance of the lending business as well as changes in the size of the loan portfolio are additional potential factors affecting loan loss reserves (Bouvatier and Lepetit, 2012; Nicoletti, 2018).

As far as the discretionary components of provisioning are concerned, previous studies argue that bank managers may exploit discretion in provisioning to smooth income and to manage capital (see, among others, Liu and Ryan, 2006 and Beatty and Liao, 2014, and literature therein). Including forward-looking judgments on future expected credit losses into LLP, however, is also considered a discretionary behavior (Bushman and Williams, 2012).

The income-smoothing hypothesis in loan loss provisioning states that banks provision during times of higher earnings in order to smooth profits over time: when earnings are low, provisions are deliberately understated to mitigate the adverse effect of other factors on earnings, in contrast to situations when earning are thought to be high. Therefore, under this income-smoothing behavior, banks' provisioning policy may be used to minimize the variance of reported earnings. The result would be a systematic under (over) provision in banks with low (high) profits.

As for capitalization, according to the traditional view on accounting discretion and capital management, capital-constrained banks may have an incentive to use provisions to achieve regulatory capital targets (Andries et al, 2017). This occurs because provisions, by reducing earnings, have a mechanical negative effect on banks' capital. Hence, this argument points to a positive relationship between capitalization and provisioning, as weak banks would have the incentive to hold back on LLPs in order to preserve regulatory capital. If this is the case, lower capitalization should be associated with reduced provisions. Capital management of this kind reduces provisioning procyclicality, as bank capitalization rates are more likely to be stressed during economic downturns (Huizinga and Laeven, 2019).

The above-mentioned factors draw on the literature on the determinants of NPLs and provisioning. There are, however, additional motives and bank characteristics that could possibly explain the variation in coverage-ratios.

Regarding the role played by capitalization, an alternative view to the capital-management hypothesis would justify the existence of a negative nexus between coverage ratios and regulatory capital. In this view, the two balance-sheet items are substitutable buffers against potential losses. When raising capital is too costly, lower-capitalized banks may have the incentive to increase LLRs to partly compensate for their lack of capital (Norden and Stoian, 2013). Or, to change perspective, better capitalized banks would be in a more comfortable position to absorb shocks prompted by the

deterioration of the loan portfolio. As such, these banks should have less incentives to report high coverage ratios.

Banks' funding structures could also influence coverage ratios in that low asset quality might compromise banks' ability to borrow by making them more risky and opaque (Bruno and Marino, 2019). As discussed in the institutional background section, higher coverage ratios can mitigate the concerns associated with NPLs by buffering risk and enhancing transparency. One therefore may expect that banks more exposed to market discipline have more incentives to report higher coverage ratios compared to banks less subjected to investors' scrutiny.

4.2. Baseline specification and main results

We now test how bank level characteristics influence banks' coverage ratios. To shed light on the mechanisms by which banks set coverage ratios, we estimate three sets of regressions. Our key dependent variable is the coverage ratio, i.e., the amount of LLRs over the stock of NPLs. We also use its components, the LLRs and the NPLs (both scaled by total assets), as additional dependent variables in separate models. In all three cases, we estimate the following panel fixed effects model:

$$Y_{ik,t} = \mu_i + \gamma_{k,t} + \beta X_{ik,t-1} + \varepsilon_{ik,t}, \qquad (1)$$

where $i = 1, \ldots, N$, $k = 1, \ldots, K$ and $t = 1, \ldots, T$, with i being the bank, k being the country, and t being the year. The vector $X_{ik,t-1}$ includes bank-level covariates to account for the factors discussed above (i.e., asset quality, lending policy, cost efficiency, profitability and capitalization) and other bank specific factors (i.e., size and funding structure) that can be relevant in determining the coverage ratio and its components. [19]

Our preferred measure of asset quality is the ratio of NPLs over total assets. We also test whether not only the NPL stock, but also the change in NPLs matters in explaining provisioning and coverage ratios. In the spirit of Bushman and Williams (2012), we distinguish non-discretionary from discretionary provisioning, by including the lagged asset quality variables (to account for observed changes in portfolio performance), as well as the change in NPLs in t + 1 (to account for potential future losses) in one specification.

[19] NPLs include the subcategories of bad loans, unlikely-to-pay exposures and past due exposures. Commonly, loan loss coverage differs according to the subcategory considered (being the highest for the riskiest sub-category made of bad loans). Unfortunately, the breakdown of the NPL aggregate is unavailable for most banks in our sample.

To gauge the effect of lending policy, we use gross loans to total assets, and the loan-growth rate to capture the speed of the credit expansion and the risk-taking motive (Huizinga and Laeven, 2019).

We assess the potential influence of profitability and test the income-smoothing hypothesis by using the return on average assets (ROAA). As a further measure of bank performance, we also include the cost-to-income ratio to proxy cost efficiency and test the bad management hypothesis vis-à-vis the skimping hypothesis.

To capture the capital-management motive, we use the CET 1 capital ratio. The ability to absorb unexpected losses makes common equity the highest quality and most costly component of banks' regulatory capital.

We control for size, measured by the natural logarithm of total assets, as aggregate statistics show that smaller banks tend to report higher coverage ratios (EBA, 2018). More generally, prior research has shown that size is a relevant determinant of lending and risk taking (see Kishan and Opiela, 2000, among others), and therefore it may also explain banks' coverage ratios and their components.

To capture the role of funding structure, we include the ratio of customer deposits to assets. In line with Calomiris and Kahn (1991), we assume that banks with a larger share of demandable debt are more exposed to market discipline and, therefore, have more incentives to report high coverage ratios compared to banks less relying on deposits.

All explanatory variables (with the exception of the change in NPLs and loan growth) are lagged by one year to mitigate concerns about reverse causality. The equation includes bank and country-time fixed effects (μ_i and $\gamma_{k,t}$, respectively). The latter accounts for country-time-specific characteristics, which we will investigate in depth in Section 5.

Table , presents the results for the baseline investigation on the main micro drivers of NPLs, LLRs and coverage ratios in Columns 1, 2 and 3, respectively. To start with determinants of NPLs (Column 1), lending policy, cost efficiency and profitability are important dimensions in explaining variation in asset quality. As expected, a larger size of the loan portfolio is associated with higher credit risk (Keeton and Morris, 1987; Klein, 2013). On the other hand, higher (contemporaneous) loan growth is associated with lower NPL ratios. This finding suggests that, in the short run, credit growth may be beneficial in terms of asset quality, possibly because credit expansion is more likely in boom periods (when NPLs tend to be lower), or because it can temporarily relax borrowers' financial constraints. Another explanation is that, *ceteris paribus*, an increase in the loan base may imply a simultaneous increase in banks' assets (the denominator of the NPL ratio), while the new loans will eventually become non-performing at a later stage. This would leave the *current* NPL stock unchanged in the short run. In line with this interpretation, evidence from previous studies points to a negative effect of *past* excessive lending (captured by *lagged* credit growth) on the quality of the loan portfolio. Specifically, Jiménez and Saurina (2006) and Klein (2013) show that the (detrimental) effect of credit growth on asset quality becomes significant after at least four and two years, respectively. This evidence suggests that rapid credit growth today results in lower credit standards that, eventually, bring about more problem loans only in the medium run.

We also find that higher profitability is strongly associated with lower NPLs. This finding suggests that better-managed banks report, on average, higher asset quality, corroborating overall the "bad management" hypothesis. At the same time, we find that lower costs are associated with higher NPLs, as predicted by the skimping hypothesis.

Focusing on Column 2, we find that asset quality, credit expansion and profitability have a key role in explaining banks' LLRs. As expected, and in line with e.g., Huizinga and Laeven (2019), there is a strong positive relationship between the stock and the change in NPLs and LLRs. Consistent with previous evidence (Bouvatier and Lepetit, 2012; Nicoletti, 2018), we also find that higher credit growth is associated with larger LLRs despite the fact that (at least in the short run) credit expansion is

associated with lower NPLs. This result suggests that, when the loan portfolio expands, banks prudently set loan-loss reserves aside by anticipating higher (potential) future losses, and this independently of the positive effect of credit growth on NPLs in the short run. In Columns 4 and 5, we investigate more directly whether banks incorporate forward-looking judgments into coverage ratios by include the change in NPLs at t + 1. We find a strong positive association between this forward-looking measure of asset quality and coverage ratios.[20]

Profitability is another important driver of LLRs. Contrary to the "income smoothing" hypothesis, we uncover a significantly negative relationship between profitability and LLRs. This result is in line with the "bad management" hypothesis: because better-performing banks report lower NPLs, there is less of a need for them to set aside higher LLRs. It also provides support for the procyclical behavior of bank provisions (see Huizinga and Laeven, 2019, among others).

Focusing on Column 3, we find that asset quality, credit growth, and profitability are significant explanatory variables for coverage ratios. Interestingly, banks with poorer asset quality and increasing NPLs generally exhibit lower coverage ratios. Although banks tend to react to higher NPLs by increasing LLRs, such an increase does not seem adequate to compensate for the larger amount of NPLs. On the contrary, banks experiencing higher credit growth report higher coverage ratios, in line with the results on the coverage ratio components.

Higher levels of profitability are associated with lower coverage ratios. It seems that banks with higher profits prefer to either distribute dividends or accumulate capital (through retained earnings) rather than increase provisioning and setting aside higher reserves. Because profitability and GDP growth tend to be positively related (Laeven and Majnoni, 2003), this finding may also reflect a procyclical behavior by which banks tend to increase coverage ratios when profits decrease, e.g. during recessions.

Finally, we find that capitalization and funding structure play a limited role in explaining the way banks shape coverage ratios. The effect of capitalization on coverage ratios and its components is insignificant, while we find a mildly positive effect of customer deposits on coverage ratios (significant at the 10% level) providing some support the 'market discipline' hypothesis (Calomiris and Kahn, 1991).[21]

[20] In untabulated results, available upon request, we replace the change in NPL at t+1 with the lead of the NPL to total asset ratios. The positive effect on coverage ratios is confirmed.

[21] A positive association between the deposit to asset ratio and coverage ratio is also in line with Drechsler et al. (2018). They argue that deposits effectively behave as term liabilities because banks are able to exert market power. They thus optimally

Overall, results from our baseline specifications outline the relevance of credit risk considerations for coverage ratio dynamics. High or increasing NPLs induce banks to set aside higher reserves, but in a way that is not sufficient to determine higher coverage ratios. On the contrary, credit growth as well as forward-looking NPLs are associated with more prudent provisioning and hence higher coverage ratios. This finding points to a forward-looking behavior of banks in setting coverage ratios. Profitability is also an important driver of coverage ratios and its components, but contrary to previous work on the discretionary components of bank provisioning, our evidence does not support the income-smoothing hypothesis. Likewise, we find no evidence supporting the capital-management motive.

Next, we explore the differential behavior of banks with very poor asset quality. Expected losses should be higher at banks that are already experiencing high-NPLs. As such, these banks should be more in need of setting up higher coverage ratios to protect their balance sheets. On the other hand, because provisions to loan-loss reserves would further reduce earnings and capital, weaker banks may have more incentives to under-provision for potential losses (Ristolainen, 2018). We include the high-NPL bank dummy indicating banks with the NPL/TA ratio in the top decile of the sample distribution, and its interaction with asset quality, CET1 ratio, and ROOA. Results in Columns 6 and 7 show that while lower asset quality is in general associated with reduced coverage ratios, in high-NPL banks this correlation is reversed, pointing to a non-linear relationship between asset quality and coverage ratios. While banks are generally unable (or unwilling) to adjust their loan-loss allowances at the same pace as asset quality deteriorates, banks facing a very high level of credit risk try more to restore an adequate level of coverage ratios, the worse the quality of their assets. This evidence is suggestive of the existence of a 'floor' for coverage ratios, which high-NPL banks try not to breach, possibly owing to supervisory pressure or peer effects (see Subsection 4.3).

Turning to profitability and capitalization, one would expect them to play a more important role for high-NPL banks. Given that higher provisions translate into lower earnings and, *ceteris paribus*, lower equity, restoring adequate levels of coverage ratios should be more costly for very risk banks, which are already threatened by the negative effects of NPLs on profits and capitalization. First, we uncover that the negative correlation between profitability and coverage ratios is significantly more negative for very risky banks. This implies that high-NPL banks tend relatively more to use profits in other ways than to increase LLRs, compared to the average bank, which results in more procyclical coverage ratios for these

invest into (risky) long-term assets. Hence, the positive correlation between deposits and coverage ratios could reflect some bank assets' characteristic not directly captured by our variables.

banks. Second, unlike in the baseline regression, capitalization plays a significant role in explaining LLRs and coverage ratios in very risky banks. Consistently with a capital-management (capital smoothing) hypothesis, this evidence indicates that banks facing a very high level of credit risk tend to accumulate higher LLRs, and hence higher coverage ratios, if they are better capitalized. Or, when capitalization decreases, high-NPL banks tend to reduce coverage ratios, possibly to limit the negative implications for equity of higher provisioning.

As robustness checks (see Table A.3), we replace our asset quality indicator with the NPLs to total loans ratio, the ROAA with the return on average equity (ROAE), the CET1 ratio with the Tier 1 ratio and the CET1 over NPLs ratio. Results remain unchanged.

4.3. Do banks catch up to their peers?

In this subsection, we explore whether banks adjust coverage ratios due to peer-imitation behavior. Anecdotal and empirical evidence suggests that banks adjust their coverage ratios "to catch up to their peers", and therefore, for reasons unrelated to the quality of their loan portfolios. Financial reports for banks are widely published, so determining the amount of reserves held by peer banks is a simple matter (Walter, 1991). Peer comparison is, in fact, one of the most widely used methods of assessment employed by professional analysts as well as by individual investors. Supervisors as well tend to monitor and assess banks against their peers. In doing so they favor imitating behavior. Empirical analysis also confirms that herding in financial markets is a common phenomenon (see Rajan 1994, among others).[22] If herding behavior occurs, one reason why banks adjust their coverage ratios is to be aligned to their peers.

To test this hypothesis, we replace our preferred dependent variable by the change in the coverage ratio. We measure peer-imitation behavior in terms of the absolute deviation of a given bank's coverage ratio to a benchmark represented by the average coverage ratio of the country that a bank is located in. To calculate the average coverage ratio in each country, we rely on official ECB statistics. In the same regression, we investigate whether banks from high-NPL countries behave differently in this respect.

The regression model therefore becomes:

[22] Rajan (1994) find evidence of herding behaviour in loan loss provisioning and charge offs in New England banks over 1986–1992, after correcting for changes in observable fundamentals.

$$\Delta\left(\frac{LLR}{NPL}\right)_{ik,t} = \lambda_t + \mu_i + \gamma_{k,t} + \beta_1\left|Dev_{ik,t-1}\right| + \beta_2 Below_{ik,t-1} + \beta_3\left|Dev_{ik,t-1}\right| \times Below_{ik,t-1} + \varepsilon_{ik,t}, \quad (2)$$

where $\Delta\left(\frac{LLR}{NPL}\right)_{ik,t}$ is the change in coverage ratio, defined as $\left(\frac{LLR}{NPL}\right)_{ik,t} - \left(\frac{LLR}{NPL}\right)_{ik,t-1}$. On the right hand side, $Below_{ik,t-1}$ is a dummy that equals 1 for banks with their coverage ratios below their respective country average; $|Dev_{ik,t-1}| \times Below_{ik,t-1}$ is the interacted term between the absolute deviation and the below-country average dummy.

As reported in Table 4, because banks may behave differently according to whether they are undercovered (relative to their peers), we include the absolute deviation from the country average and its interaction with the below-country average dummy. Our findings suggest that banks that compare more unfavorably to their peers try to catch up, by increasing their coverage ratio more or decreasing it less, and the more so the more they are distant from the target. To explore the mechanism, banks with below-average coverage ratios tend to conform by both increasing LLRs more (or decreasing them less) and resolving a larger stock of NPLs, the relevant coefficients being highly significant also in those cases.[23]

5. Exploring macro-level data

In this section we exploit the richness of country characteristics to better explain the large variation in coverage ratios across countries. We first consider a large set of macroeconomic and financial variables, as well as several measures of the stringency of the institutional framework. We then expand on the role of secondary markets for distressed loans.

5.1. Baseline specification and main results

The explanatory variables' set includes a broad range of macroeconomic and financial variables derived from the literature on NPL determinants (Nkusu, 2011; Klein, 2013; Beck et al., 2015) and provisioning procyclicality (Laeven and Majnoni, 2003; Beatty and Liao, 2014). In particular, GDP growth and the unemployment rate are used as indicators of general macroeconomic performance. Changes in

[23] It should be noted that the identification of peer effects is challenging, as it is subject to the reflection problem (see Le ary and Roberts, 2014). In essence, it is difficult to identify whether banks adjust their coverage ratios in response to their peers' coverage ratios, or in response to some other characteristics of their peers, or even owing to an omitted factor influencing the decisions of all banks in a given country. As for the latter case, we include a large set of country-specific variables to minimize the risk of omitting relevant factors. We leave to further research the distinction between the two channels through which herding behavior takes place.

house and stock prices would help explaining differences in asset quality, e.g. via wealth effects among borrowers or via a decreased value of collateral. The private sector credit-to-GDP ratio, measuring the aggregate debt burden of households and businesses, reflects to some extent banks' risk-taking behavior. Finally, monetary policy may also influence asset quality and loan loss coverage policy.

Since the quality of governance can affect provisioning behavior and the incentives for banks to set coverage ratios, we also consider the following three dimensions: macroprudential stringency, regulatory quality and rule of law.[24] To analyze the role played by macroprudential policy, we include the 2018 update of the country-specific prudential measures derived from the Cerutti et al. (2017) macro-prudential policy dataset. We start with the broadest index available in the dataset, the so-called Macroprudential Index. It covers three borrower-targeted and nine financial-institution-targeted instruments, therefore taking on values between 0 and 12, where 0 means that none of the instruments is in place and 12 means that all of them are in place. Hence, the higher the index, the more stringent the implementation of macroprudential measures in the respective country. We then replace the index by some of its subcomponents. Based on anecdotal evidence (Walter, 1991) and prior research on the effects of macro factors on banks provisioning (Jiménez et al., 2017 and Andries et al., 2017, among others), we focus on those ones that are more likely to affect banks' coverage ratios, namely measures on provisioning policies, capital buffers, taxation, and limits to borrowers' loan-to-value ratio.

In the spirit of Andries et al. (2017), we include a measure of regulatory quality capturing the government's ability to formulate and implement policies and regulations, as well as an index proxying the strength of the rule of law, which captures agents' confidence in rules, and the quality of contract enforcement, property rights and courts. Higher values of the indices indicate better regulatory quality and more effective enforcement of rules and provisions. Both indices are published by the World Bank, based on an annual survey. Table 2 reports aggregate statistics for all the macrovariables included in the analysis.

Again, we estimate the following regression having LLRs, NPLs and coverage ratios as dependent variables in separate models:

$$Y_{ik,t} = \lambda_t + \mu_i + \gamma_{k,t} + \beta_1 X_{ik,t-1} + \beta_2 Z_{k,t-1} + \varepsilon_{ik,t}, \qquad (3)$$

[24] An analysis on the role of micro-prudential supervision, focusing on the establishment of the Single Supervisory Mechanism is presented in Appendix B. In line with Ristolainen (2018), we find that SSM supervised banks have overall more incentives to recognize NPLs and adjust loan-loss coverage accordingly.

where $X_{ik,t-1}$ includes lagged bank-level variables as illustrated in previous sections and $Z_{k,t}$ comprises the lagged time-varying macro-level factors described above. We saturate the specification with time and bank-level fixed effects.

As far as micro-variables are concerned, for the sake of space, in Table 5 we only report the NPL to total asset ratio and the loan growth rate, which remain explanatory variables for the coverage ratio and its components also when accounting for systematic macro factors.

Looking at the macro variables, we find evidence of a decoupling of LLR and coverage ratio dynamics. In particular LLRs tend to be larger when NPL stocks are also larger, that is at times of high unemployment, in an effort to stabilize coverage ratios (Nkusu, 2011; Klein, 2013). However, coverage ratios show a countercyclical behavior, as they tend to be higher when GDP growth is higher.[25] Owing to the disconnect between growth and labor market dynamics, particularly evident in the 2008-2011 period, our finding points to a prudent banks' behavior in setting higher coverage ratios even before the economic conjuncture worsens. As expected, higher private indebtedness is associated with higher NPLs and coverage ratios, although the significance of this result is limited.

Macro-prudential regulation (see Columns 1, 3 and 5) turns out to be the most important factor shaping coverage ratio, together with the business cycle. Next, in Columns 2, 4 and 6 we focus on specific macroprudential tools. As expected, the indicator on time-varying/dynamic loan-loss provisioning is positive and significant, indicating that when specific measures to address pro-cyclical provisioning are in place, banks are better able to build up higher loan loss allowances and coverage ratios to face asset quality deterioration. Increasing taxation on financial institutions is also associated with higher coverage ratios, plausibly because the higher deductions associated with larger provisions can reduce taxable income (Andries et al., 2017).[26] Setting limits to borrowers' loan-to-value ratios, i.e., increasing loan collateralization, does not seem to influence banks' loan loss coverage.[27]

In Table 6 we include the high-NPL country dummy, to account for banks from countries with an above sample average level of NPLs. All things being equal, banks from countries affected by high levels of NPLs may behave differently from the average sample bank. In particular, most of the countries affected by high NPLs levels have weaker institutional frameworks, where for instance foreclosure procedures are particularly lengthy and costly (Aiyar et al., 2015; ECB, 2016). This translates into a

[25] In Appendix B, we show that during the euro sovereign crisis, banks reduce more or increase relatively less their loan loss reserves and coverage ratios when asset quality deteriorates.

[26] Although at different rates, the majority of EA countries "acknowledge tax deductions for LLPs, write-offs and collateral sales". (ECB, 2016 and 2017b).

[27] We are aware of the fact that the characteristics of collateral (Constâncio, 2017; Bruno and Carletti, 2017). Due to lack of data, we are unable to control for these aspects explicitly.

generally reduced ability to resolve NPLs. It follows that national and supranational supervisors may want to exercise a more severe scrutiny on banks from high-NPL jurisdictions, and require them to step up efforts to strengthen their balance sheet.[28] Any intervention to improve the institutional setting would result into a stronger reaction by banks located in these countries.

To investigate whether this is the case, we interact the high-NPL country dummy with our proxies for country governance. We do find support for a different behavior at banks from weaker countries. Unlike in the baseline specification, actions to improve the rule of law are associated with lower NPLs in banks from risky jurisdiction, indicating that that better quality enforcement or more efficient courts are relatively more beneficial for NPL resolution in high-NPL countries. In one specification (Column 6), stricter rule of law is also related to lower coverage ratio. This evidence suggests lower reserve needs or larger drawdowns associated with more intense NPL resolution.

Looking at the various macroprudential measures, the implementation of capital surcharges and loan-to-value caps seems to have a different impact in high-NPL countries. In particular, additional capital buffers in large institutions (SIFI) are associated with lower coverage ratios and lower NPLs (Columns 2, 4, and 6). This finding supports previous research on the effect of stricter capital rules on banks' behavior (Gropp et al., 2019). Complying with stricter capital rules make deleveraging and de-risking strategies more likely in banks from High-NPL countries. To reinforce the mechanism, banks subject to stricter binding capital rules (such as SIFIs) would have a higher incentive to retain earnings (to comply with the new rules) rather than to increase provisioning. Finally, we find that increasing loan collateralization by setting limits to the borrowers' loan-to-value ratio is associated with higher coverage ratios in high-NPL countries, indicating that collateral and coverage ratios are complementary rather than substitute tools to strengthen bank balance sheets.

5.2 The role of the NPL secondary market

One the responses most often cited by the banks as impediments to the NPL resolution is the lack of a market for NPLs (EBA, 2019). Although still underdeveloped, however, NPLs transactions have progressively increased over the last years, varying from 11 billion euros in 2010 to nearly 100 billion

[28] The policies and practices in jurisdictions not afflicted by high NPLs "are not expected to be as prescriptive or coordinated as those in jurisdictions currently reacting to high levels of NPLs". ECB (2016)

euros as of end 2017, according to PwC reports.[29] Transactions are concentrated in a few countries, i.e., the UK, Germany, Spain, Ireland, and more recently, Italy (the largest market place since 2016). Figure 5 shows the value of NPL transactions by countries in 2010–2017.

The level of development and liquidity of the secondary markets for distressed loans is another feature that may explain variation in coverage ratios. The secondary market for troubled assets is a market for lemons à la Akerlof, being characterized by high information asymmetries and large bid-ask spreads between sellers and buyers (Fell et al., 2016). We expect deeper markets to incentivize banks to accumulate larger reserves and henceforth higher coverage ratios, as a pre-condition to access the market (see also the discussion in Section 2).

To test this hypothesis, in Table 7, we expand our micro-macro baseline regression to account for the relevance of the NPL secondary market in a given country. We first measure the share of NPL transactions over the total banking assets at the country level to proxy the degree of development of the market (Columns 1 to 3). Because the volume of trades is concentrated only in some countries (Ireland, Spain, Germany and Italy)[30], we also include two categorical variables to account for medium and large secondary markets, by splitting the sample into terciles–based on the share of NPL transactions over the total banking assets at country level. We use the lowest tercile as the reference category and test whether the other categories are associated with higher coverage ratios.

We find that coverage ratios and LLRs are significantly higher in countries where the NPL secondary market is large enough, i.e. where markets are at least medium-sized (Columns 4 to 6). The effect is larger in countries that are characterized by both high NPLs and a large NPL secondary market (Columns 7 to 8). This is not surprising, as information asymmetries are accentuated in high-NPL countries and, therefore, banks may need higher coverage ratios to possibly access the market.

6. Conclusions

This paper explores the main determinants of coverage ratio, an indicator of bank balance sheet strength that has gained increasing importance in Europe in the last few years. Using a sample of over 440 medium and large sized banks in the EA, we try to disentangle micro and macro factors affecting coverage ratios and their components.

[29] The EC's package of measure to tackle high NPLs presented in March 2018 includes initiatives to encourage the development of secondary markets, such as a proposal for a directive aiming to harmonize requirements and create a single market for credit servicers and buyers.

[30] The dataset also includes transactions for France (2012), Belgium (2013), Netherlands (2013, 2015 and 2016), and Greece (2016) but for more limited amounts.

Our analysis reveals some interesting findings. Credit risk considerations are the most relevant bank-specific factors explaining coverage ratios. A deterioration in asset quality is associated with higher coverage ratios, but the relation is not linear, becoming positive when banks hold very large stock of troubled assets. Moreover, coverage ratios incorporate forward-looking indicators of credit risk. Independently of these characteristics, banks adjust their coverage ratios to catch up with their peers, and the more so, the more they are distant (below) from their target.

Coverage ratios increase with GDP growth, and decrease in recession, pointing to a countercyclical behavior. More stringent macroprudential policy is also associated with higher coverage ratios. Interventions on time-varying/dynamic loan-loss provisioning and corporate taxation are generally the most effective tools to increase coverage ratios. Structural factors such as the degree of development of NPL secondary markets also explain coverage ratio variation, where larger markets are associated with higher coverage ratios.

High-NPL banks as well as banks from high-NPL countries behave differently from banks less affected by credit risk issues. In banks more exposed to credit risk, capitalization and coverage ratio appear as being complementary (rather than substitute) tools, where one reinforces the other. In more risky countries actions to improve the rule of law are associated with lower NPLs, indicating that a stronger contract enforcement or more efficient courts help banks resolve NPLs. The role of developed NPL secondary market is more accentuated in banks from risky jurisdictions.

Our results are relevant for the current debate. They show that the role played by macro drivers of coverage ratios could help policy makers in clarifying which levers may be the most effective to reach the desired level of loss coverage. Stricter supervision is relevant, but addressing structural factors (e.g., by developing the secondary market for loans or reinforcing the legal framework) is at least equally important to ease the disposal of legacy assets, hence reducing the denominator of the ratio more quickly and at a lower cost. Another major policy implication is that in relatively more fragile banks complying with tighter capital rules could come at the expense of coverage ratios.

References

Aiyar, S., Bergthaler, W., Garrido, J. M., Ilyina, A., Jobst, A., Kang, K. H., Kovtun, D., Liu, Y., Monaghan, D. and Moretti, M. (2015). A strategy for resolving Europe's problem loans. IMF Staff Discussion Note, SDN/15/19, September.

Altavilla, C., Boucinha, M., and Peydró, J.L. (2018). Monetary policy and bank profitability in a low interest rate environment, Economic Policy, October: 531–586.

Andries K., Gallemore, J. and Jacob, M. (2017). The effect of corporate taxation on bank transparency: Evidence from loan loss provisions. Journal of Accounting and Economics, 63: 307–328.

Barth, J., Lin, C., Ma, Y., Seade, J. and Song, F. M. (2013). Do bank regulation, supervision and monitoring enhance or impede bank efficiency? Journal of Banking and Finance, 37(8):2879–2892.

Baudino, P, Orlandi J. and Zamil, R. (2018). The identification and measurement of non-performing assets: a cross-country comparison. FSI Insights on Policy Implementation No 7, Bank for International Settlements.

Beck, R., Jakubik, P. and Piloiu, A. (2015). Key determinants of non-performing loans: new evidence from a global sample, Open Economies Review, Vol. 26(3): pp. 525–550.

Beck, P.J., Narayanamoorthy, G.S. (2013). Did the SEC impact banks' loan loss reserve policies and their informativeness? Journal of Accounting and Economics, 56 (2–3): 42–65.

Berger, A. and R. DeYoung. (1997). Problem Loans and Cost Efficiency in Commercial Banks. Journal of Banking and Finance (21): 849–870.

Beatty, A. and Liao, S. (2011). Do delays in expected loss recognition affect banks' willingness to lend? Journal of Accounting and Economics, 52 (1): 1–20.

Beatty, A. and Liao, S. (2014). Financial accounting in the banking industry: A review of the empirical literature. Journal of Accounting and Economics, 58: 339–383.

Bouvatier, V. and Lepetit, L. (2012). Provisioning rules and bank lending: A theoretical model. Journal of Financial Stability, 8(1): 25–31.

Bruno, B. and Carletti, E. (2017). Provisioning policies for non-performing loans. How to best ensure a clean balance sheet? European Parliament, In-Depth Analysis requested by the ECON committee, October.

Bruno, B. and Marino, I. (2019). How Banks Respond to NPLs. Evidence from the Euro Area. CSEF Working Papers 513, Centre for Studies in Economics and Finance (CSEF), University of Naples.

Bushman, R.M. and Williams, C.D. (2012). Accounting discretion, loan loss provisions, and discipline of banks' risk taking. Journal of Accounting and Economics, 54: 1–18.

Calomiris, C. and Kahn, C. (1991). The Role of Demandable Debt in Structuring Optimal Banking Arrangements. American Economic Review, 81(3): 497-513.

Carpinelli, L., Cascarino, G., Giacomelli, S. and Vacca, V. (2016). The Management of Non-performing Loans : A Survey Among the Main Italian Banks. Questioni di Economia e Finanza, Occasional Papers 311, Bank of Italy, 1-32.

Ciavoliello, L. G., Ciocchetta, F., Conti, F. M., Guida, I.,Rendina, A. and Santini, G. (2016). What's the Value of NPLs? Notes on Financial Stability and Supervision 3, Bank of Italy, 1-8.

Cerutti, Eugenio; Claessens, Stijn; and Luc Laeven (2017). The Use and Effectiveness of Macroprudential Policies: New Evidence. Journal of Financial Stability, vol. 28, pp. 203–224.

Cohen, B. H. and Edwards, G. A. (2017). The new era of expected credit loss provisioning. BIS Quarterly Review.

Constâncio V. (2017). Resolving Europe's NPL Burden: Challenges and Benefits. Keynote speech at Bruegel Event: Tackling Europe's Non-performing Loans Crisis: Restructuring Debt, Reviving Growth, 3, February 2017.

Council of the European Commission (2017). Report of the FSC Subgroup on non-performing loans. General Secretariat of the Council, 31 May.

de Lis, S. F., Pagés, J. M. and Saurina, J. (2001). Credit growth, problem loans and credit risk provisioning in Spain. In: Marrying the macro- and micro-prudential dimensions of financial stability, B. for International Settlements, ed., volume 1 of BIS Papers chapters, pages 331–353. Bank for International Settlements.

Diamond, D. W. and Dybvig, P. H. (1983). Bank runs, deposit insurance, and liquidity. The Journal of Political Economy, 91 (3): 401–419.

Draghi, M. (2017). European Banking Supervision Three Years on. Welcome Remarks by Mario Draghi, President of the ECB, at the Second ECB Forum on Banking Supervision, Frankfurt am Main, 7 November.

Drechsler, I., Savov, A. and Schnabl, P. (2018). Banking on Deposits: Maturity Transformation without Interest Rate Risk. NBER Working Paper No. w24582

Eber, M. and Minoiu, C. (2016). How do banks adjust to stricter supervision? Technical report, mimeo.

European Banking Authority (2016). EBA report on the dynamics of non-performing exposures in the EU banking sector, 22 July.

European Banking Authority (2018). Risk dashboard data as of Q3 2018.

European Banking Authority (2019). EBA report on NPLs. Progress made and challenges ahead.

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

European Central Bank (2016). Stocktake of National Supervisory Practices and Legal Frameworks Related to NPLs, September.

European Central Bank (2017a). Guidance to banks on NPLs, March.

European Central Bank (2017b). Stocktake of National Supervisory Practices and Legal Frameworks Related to NPLs, July.

European Central Bank (2018). Addendum to the ECB Guidance to banks on nonperforming loans: supervisory expectations for prudential provisioning of non-performing exposures, March.

European Central Bank (2019). Communication on supervisory coverage expectations for NPEs, August.

European Commission (2012). A roadmap towards a Banking Union. COM (2012) 510 final, 12 September.

European Systemic Risk Board (2017a). Financial stability implication of IFRS 9, July.

European Systemic Risk Board (2017b). Resolving non-performing loans in Europe, July.

European Systemic Risk Board (2019). Macro prudential approaches to non-performing loans, January.

European Parliament (2016). Non-performing loans in the Banking Union: stocktaking and challenges, 18 March.

Fell J., Grodzicki M., Martin R. and E. O'Brien (2016). Addressing market failures in the resolution of non-performing loans in the euro area. ECB Financial Stability Review – Special features, November

Gallemore, J. (2018). Bank financial reporting opacity and regulatory intervention. SSRN Working Paper No 2838541.

Gropp, R., Mosk, T., Ongena, S., and Wix, C. (2019). Banks Response to Higher Capital Requirements: Evidence from a Quasi-Natural Experiment. The Review of Financial Studies, 32(1), pp. 266-299.

Huizinga, H., Laeven, L. (2012). Bank evaluation and accounting discretion during a financial crisis. Journal of Financial Economics 106: 614-634.

Huizinga, H., Laeven, L. (2019). The Procyclicality of Banking: Evidence from the Euro Area. IMF Economic Review, Palgrave Macmillan; International Monetary Fund, 67(3):496-527.

Jiménez, G., Ongena, S., Peydro, J.-L. and Saurina, J. (2017). Macroprudential policy, countercyclical bank capital buffers, and credit supply: Evidence from the Spanish dynamic provisioning experiments. The Journal of Political Economy, 125(6):2126 - 2177.

Jiménez, G. and Saurina, J. (2006). Credit Cycles, Credit Risk, and Prudential Regulation. International Journal of Central Banking, 2(2).

Keeton, W. and C. Morris. (1987). Why Do Banks' Loan Losses Differ? Federal Reserve Bank of Kansas City, Economic Review, May, pp. 3-21.

Klein, N. (2013). Non-Performing Loans in CESEE: Determinants and Impact on Macroeconomic Performance. IMF Working Paper No. 13/72.

Kishan, R.P., and Opiela, T.P. (2000). Bank Size, Bank Capital, and the Bank Lending Channel. Journal of Money, Credit and Banking, 32: 121-141.

Laeven, L. and Majnoni, G. (2003). Loan loss provisioning and economic slowdowns: too much, too late? Journal of Financial Intermediation, 12(2):178 - 197.

Laurin, A. and Majnoni, G. (2003). Bank Loan Classification and Provisioning Practices in Selected Developed and Emerging Countries. Number 15157 in World Bank Publications. The World Bank.

Leary, M. T. and Roberts, M. (2014). Do Peer Firms Affect Corporate Financial Policy? Journal of Finance, 69(1): 139-178.

Liu, C and Ryan, S.G. (2006). Income Smoothing over the Business Cycle: Changes in Banks' Coordinated Management of Provisions for Loan Losses and Loan Charge-Offs from the Pre-1990 Bust to the 1990s Boom. The Accounting Review, 81 (2): 421-441.

Medina Cas, S. and Peresa, I. (2016). What Makes a Good "Bad Bank"? The Irish, Spanish and German Experience. European Economy - Discussion Papers 2015 - 036, Directorate General Economic and Financial Affairs (DG ECFIN), European Commission.

Nicoletti, A. (2018). The effects of bank regulators and external auditors on loan loss provisions. Journal of Accounting and Economics, 66 (81): 244-265.

Nkusu, M. (2011). Non-Performing Loans and Macrofinancial Vulnerabilities in Advanced Economies. IMF Working Paper 1/27

Norden, L. and Stoian, A. (2013). Bank earnings management through loan loss provisions: A double-edged sword? DNB Working Paper 404/December.

Rajan, R. (1994). Why bank credit policies fluctuate: A theory and some evidence. The Quarterly Journal of Economics, 109: 399-441.

Ristolainen, K. (2018) Getting better? The effect of the single supervisory mechanism on banks' loan loss reporting and loan loss reserves. Bank of Finland Research Discussion Papers 11/2018.

Schivardi, F., Sette, E. and Tabellini, G. (2018). Credit Misallocation During the European Financial Crisis. EIEF Working Papers Series, Einaudi Institute for Economics and Finance (EIEF), No 1704.

Song, I. (2002). Collateral in loan classification and provisioning. IMF Working Paper 02/122.

Stamegna, C. (2019). Minimum loss coverage for non-performing loans. European Parliament Briefing.

Walter, J.R. (1991). Loan loss reserves. Economic Review, July/August.

Wheeler, P.B. (2019). Loan loss accounting and procyclical bank lending: The role of direct regulatory actions. Journal of Accounting and Economics, forthcoming.

Wintoki, M. Babajide, Linck, James S. and Netter, Jeffry M., (2012). Endogeneity and the dynamics of internal corporate governance. Journal of Financial Economics, 105(3):581-606.

Yang, L. (2017). Is Bank Supervision Effective? Evidence from the Allowance for Loan and Lease Losses. MPRA Working Paper, April.

Figures and Tables

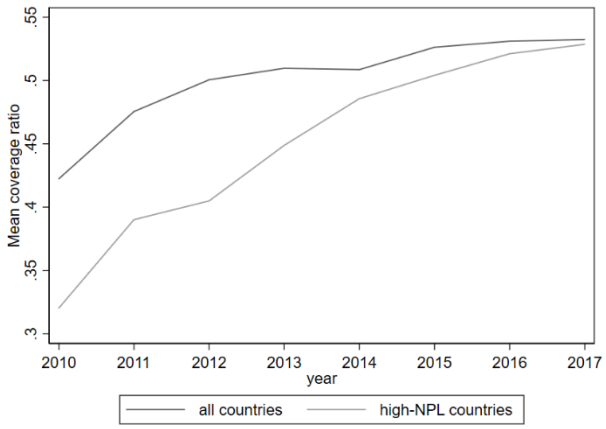

Figure 1: Average coverage ratio for all banks and banks from high-NPL countries (percentages, 2010 – 2017, source: Authors' calculations)

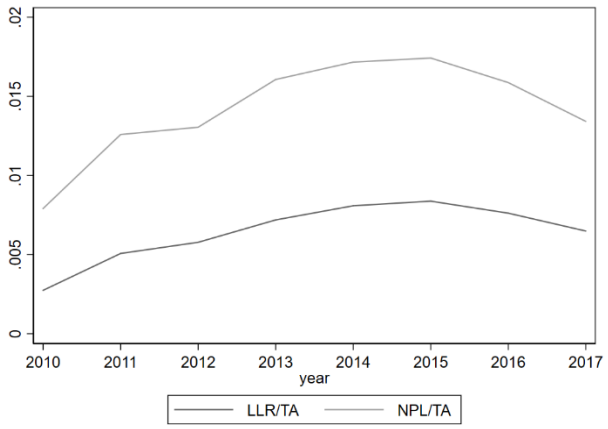

Figure 2: Average loan loss reserves over total assets (LLR/TA) and average non-performing loans over total assets (NPL/TA) (percentages, 2010-2017, source: Authors' calculations)

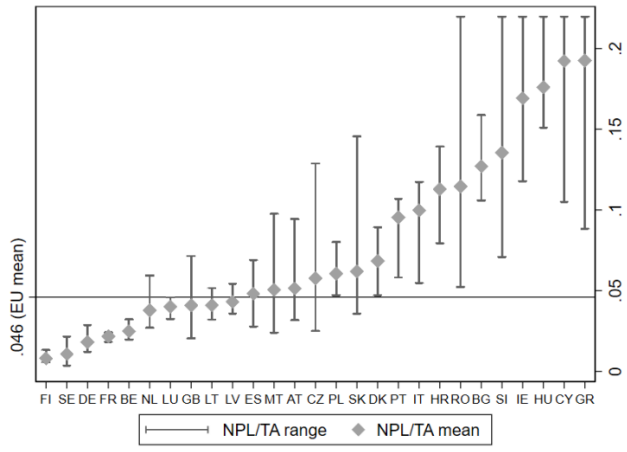

Figure 3: Range and average (unconditional mean, percentages) of non-performing loans over total assets (NPL/TA). The lines present the complete range of NPL/TA in a certain country. The diamond is the country mean (over the time period 2010-2017). (Source: Authors' calculations)

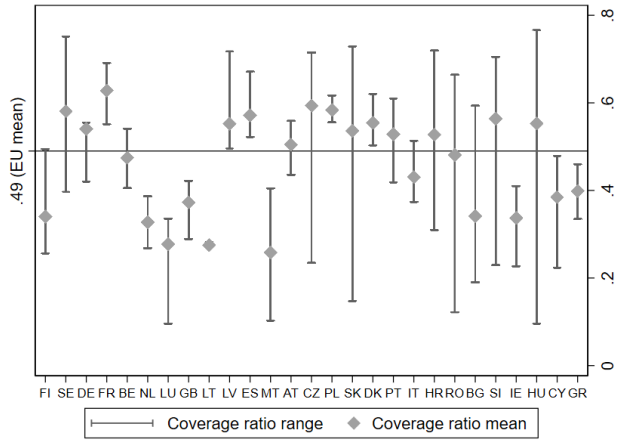

Figure 4: Range and average (unconditional mean, percentages) of the coverage ratio. The lines present the complete range of the coverage ratio in a certain country. The diamond is the country mean (over the time period 2010-2017). (Source: Authors' calculations)

Figure 5: Secondary loan market transaction data (2010–2017, € billions, source: PwC)

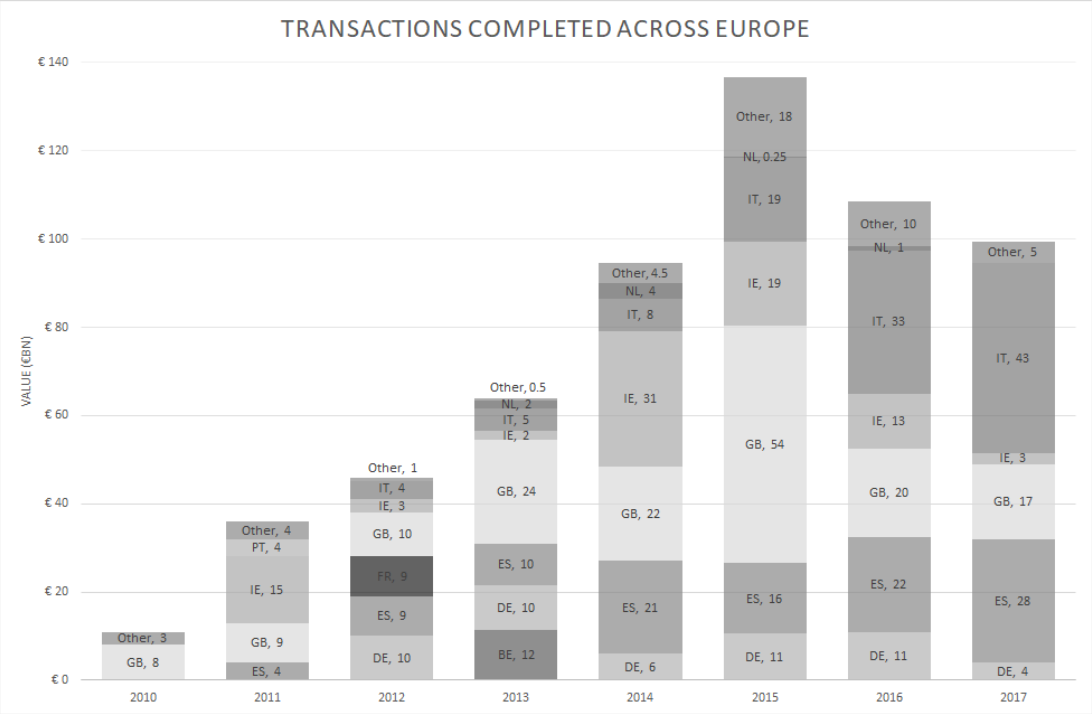

*Table 1: Correlations between LLP/TA and coverage ratio. Correlations with a * are significant at the 10% level.*

	LLPs	LLPs(t-1)	LLPs(t-2)	Coverage ratio	Coverage ratio (t-1)	Coverage ratio (t-2)
LLPs	1					
LLPs(t-1)	0.946*	1				
LLPs(t-2)	0.920*	0.942*	1			
Coverage ratio	-0.029	-0.033	-0.064	1		
Coverage ratio (t-1)	-0.025	-0.026	-0.050	0.922*	1	
Coverage ratio (t-2)	-0.063	-0.056	-0.049	0.869*	0.929*	1

Table 2: Summary statistics. This table gives summary statistics for the baseline regression sample.

	mean	sd	min	p10	p50	p90	max
Total Assets (in thousands)	27,938,084	50,759,773	1,681,596	2,018,164	5,777,488	117,200,765	174,314,000
Coverage ratio	0.51	0.17	0.10	0.29	0.51	0.72	0.89
LLR / TA	0.02	0.02	0.00	0.00	0.01	0.05	0.10
NPL / TA	0.04	0.05	0.00	0.01	0.02	0.11	0.22
Gross loans / TA	0.65	0.13	0.29	0.46	0.67	0.81	0.89
Deposits / TA	0.66	0.16	0.28	0.39	0.71	0.83	0.91
ROAA	0.00	0.01	-0.02	0.00	0.00	0.01	0.02
CET1	0.15	0.04	0.07	0.10	0.14	0.20	0.37
DELTA (NPL / TA)	0.00	0.01	-0.03	-0.01	0.00	0.01	0.04
Gross loan growth	0.03	0.07	-0.13	-0.05	0.02	0.09	0.27
Cost-to-income ratio	0.65	0.12	0.36	0.50	0.66	0.79	0.94
Real GDP growth rate	0.02	0.02	-0.09	0.00	0.02	0.03	0.25
Unemployment rate	0.07	0.05	0.03	0.04	0.05	0.12	0.28
House price change (y-o-y)	0.02	0.04	-0.08	-0.05	0.03	0.07	0.08
Stock price change (y-o-y)	0.09	0.12	-0.25	-0.07	0.09	0.27	0.29
Private sector credit / GDP	0.90	0.28	0.26	0.77	0.82	1.32	2.45
Short-term interest rate	0.00	0.01	-0.01	0.00	0.00	0.01	0.05
Rule of Law	1.40	0.55	-0.11	0.38	1.62	1.86	2.10
Regulatory quality	1.43	0.44	0.15	0.71	1.69	1.82	2.05
Macroprudential Index	3.15	1.10	0.00	2.00	3.00	4.00	6.00
Dynamic loan-loss provisioning	0.03	0.17	0.00	0.00	0.00	0.00	1.00
Capital Surcharges on SIFIs	0.39	0.49	0.00	0.00	0.00	1.00	1.00
Levy/Tax on FI	0.78	0.42	0.00	0.00	1.00	1.00	1.00
Loan-to-Value Ratio Caps	0.27	0.44	0.00	0.00	0.00	1.00	1.00
Size secondary loan mkt / TA	0.00	0.01	0.00	0.00	0.00	0.01	0.12

Table 3: Micro-level baseline regressions: Determinants of coverage ratios and components of coverage ratios. This table reports estimation results from the panel fixed-effects micro-level regressions. The dependent variables are the coverage ratio, LLRs/TA, and NPLs/TA at the bank level. Coverage ratio is defined as LLRs/NPLs. Country-time, and bank dummies are included in each regression. Robust standard errors are clustered at the bank-level and reported in parentheses. Significance at the 1, 5 and 10% level is denoted by ***, **, and * respectively.

	Baseline			Forward Looking		High NPL Banks	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	NPLs/TA	LLRs/TA	Coverage ratio	LLRs/TA	Coverage ratio	LLRs/TA	Coverage ratio
NPL/TA (t-1)		0.295***	-0.898***	0.355***	-0.028	0.331***	-1.617***
		(0.035)	(0.275)	(0.023)	(0.235)	(0.034)	(0.360)
DELTA (NPL / TA) (t)		0.295***	-1.266***	0.330***	-0.817***	0.310***	-1.274***
		(0.039)	(0.304)	(0.036)	(0.303)	(0.037)	(0.292)
Gross Loans/TA (t-1)	0.079***	0.010	-0.007	-0.003	-0.088	0.011	-0.003
	(0.021)	(0.007)	(0.097)	(0.005)	(0.074)	(0.007)	(0.097)
Deposits/TA (t-1)	-0.016	0.003	0.134*	0.009*	0.076	0.004	0.106
	(0.019)	(0.005)	(0.080)	(0.005)	(0.081)	(0.005)	(0.078)
ROAA (t-1)	-1.260***	-0.273***	-2.062***	-0.101	-0.415	-0.279***	-1.111
	(0.241)	(0.088)	(0.715)	(0.085)	(0.781)	(0.089)	(0.942)
CET1 (t-1)	0.032	0.011	0.275	0.015	0.274	0.003	0.270
	(0.026)	(0.009)	(0.172)	(0.011)	(0.168)	(0.009)	(0.171)
Log(TA) (t-1)	-0.004	-0.001	0.055	0.000	-0.034	-0.001	0.056
	(0.010)	(0.002)	(0.038)	(0.002)	(0.032)	(0.002)	(0.038)
Gross loan growth (t)	-0.031**	0.008**	0.176***	0.006	0.052	0.007*	0.178***
	(0.013)	(0.004)	(0.043)	(0.005)	(0.052)	(0.004)	(0.042)
Cost-to-income ratio (t-1)	-0.025***	-0.002	-0.059	-0.005*	-0.071	-0.001	-0.054
	(0.009)	(0.003)	(0.039)	(0.003)	(0.043)	(0.003)	(0.037)
DELTA (NPL / TA) (t+1)				0.016	1.119***		
				(0.028)	(0.266)		
High NPL dummy (t-1)						-0.005	-0.168***
						(0.006)	(0.059)
*High NPL dummy * NPL/TA (t-1)*						-0.080*	1.013**
						(0.044)	(0.397)
*High NPL dummy * ROAA (t-1)*						-0.152	-2.711**
						(0.176)	(1.266)
*High NPL dummy * CET1 (t-1)*						0.132***	0.717*
						(0.042)	(0.399)
Constant	0.076	0.016	-0.417	-0.004	1.068*	0.015	-0.393
	(0.169)	(0.038)	(0.629)	(0.040)	(0.544)	(0.039)	(0.639)
Observations	1845	1845	1845	1251	1251	1845	1845
No. of banks	441	441	441	348	348	441	441
Adjusted R-squared	0.944	0.968	0.837	0.977	0.870	0.969	0.840
Adjusted Within R-squared	0.133	0.520	0.060	0.615	0.057	0.543	0.078
FE Bank	Yes	yes	yes	yes	Yes	yes	yes
FE Country * Year	Yes	yes	yes	yes	Yes	yes	yes

Table 4: Micro-level regressions herding behavior: Determinants of coverage ratios and components of coverage ratios. This table reports estimation results from the panel fixed-effects OLS micro-level regressions. The dependent variables are the change in coverage ratio, LLRs/NPLs (t) – LLRs/NPLs (t-1), the change in LLRs/TA, LLRs/TA (t) – LLR/TA (t-1), and the change in NPLs/TA, NPLs/TA (t) – NPLs/TA (t-1). Country-time, and bank dummies are included in each regression. Robust standard errors are clustered at the bank-level and reported in parentheses. Significance at the 1, 5 and 10% level is denoted by ***, **, and * respectively.

	(1)	(2)	(3)
	Delta NPLs/TA	Delta LLRs/TA	Delta Coverage ratio
NPL/TA (t-1)		-0.036**	-0.177
		(0.016)	(0.147)
DELTA (NPL / TA) (t)		0.270***	-1.770***
		(0.031)	(0.246)
Gross Loans/TA (t-1)	-0.016	-0.009**	-0.055
	(0.011)	(0.004)	(0.058)
Deposits/TA (t-1)	-0.012	-0.009**	0.092*
	(0.015)	(0.004)	(0.053)
ROAA (t-1)	-0.025	-0.083	-0.792
	(0.174)	(0.074)	(0.547)
CET1 (t-1)	-0.041**	0.006	0.307***
	(0.020)	(0.006)	(0.114)
Log(TA) (t-1)	0.012**	-0.001	0.057***
	(0.006)	(0.002)	(0.022)
Gross loan growth (t)	-0.006	0.010**	0.161***
	(0.011)	(0.004)	(0.038)
Cost-to-income ratio (t-1)	-0.008	-0.005*	-0.023
	(0.007)	(0.003)	(0.026)
Below Country Avg. Dummy (t-1)	-0.002	0.001	0.016***
	(0.001)	(0.001)	(0.006)
Absolute Deviation from Country Avg. (t-1)	0.014***	-0.009***	-0.465***
	(0.004)	(0.002)	(0.038)
*Abs. Deviation * Below Country Avg. Dummy (t-1)*	-0.029***	0.028***	0.724***
	(0.010)	(0.004)	(0.075)
Constant	-0.166	0.032	-0.914**
	(0.101)	(0.027)	(0.372)
Observations	1814	1814	1814
No. of banks	436	436	436
Adjusted R-squared	0.428	0.643	0.300
Adjusted Within R-squared	0.039	0.351	0.305
FE bank	yes	yes	yes
FE country year	yes	yes	yes

Table 5: Micro-macro regressions: Determinants of coverage ratios and components of coverage ratios. This table reports estimation results from the panel fixed-effects micro-macro regressions. The dependent variables are the coverage ratio, LLRs/TA, and NPLs/TA at the bank level. A set of bank and time dummies are included in each regression. Robust standard errors are clustered at the bank-level (high-NPL countries). Significance at the 1, 5 and 10% level is denoted by ***, **, and * respectively

	(1)	(2)	(3)	(4)	(5)	(6)
	NPLs/TA	NPLs/TA	LLRs/TA	LLRs/TA	Coverage ratio	Coverage ratio
NPL/TA (t-1)			0.305***	0.301***	-0.746***	-0.809***
			(0.036)	(0.036)	(0.238)	(0.242)
Gross loan growth (t)	-0.033**	-0.029**	0,003	0,003	0.125***	0.128***
	(0.013)	(0.012)	(0.004)	(0.004)	(0.042)	(0.041)
Short-term interest rate (t-1)	-0.004	-0.005	0.000	0.000	-0.013	-0.018
	(0.007)	(0.007)	(0.002)	(0.002)	(0.023)	(0.023)
Real GDP growth rate (t-1)	0.000	-0.001	0.001*	0.001**	0.008**	0.008**
	(0.001)	(0.001)	(0.000)	(0.000)	(0.004)	(0.004)
Unemployment rate (t-1)	0.536***	0.460***	0.109***	0.094**	0.334	0.218
	(0.103)	(0.103)	(0.039)	(0.039)	(0.363)	(0.358)
House price change (y-o-y) (t-1)	-0.023	-0.013	-0.001	-0.005	-0.014	-0.033
	(0.031)	(0.030)	(0.011)	(0.011)	(0.132)	(0.129)
Stock price change (y-o-y) (t-1)	0.016**	0.014*	0.002	0.002	0.011	-0.001
	(0.007)	(0.007)	(0.002)	(0.002)	(0.029)	(0.030)
Private sector credit / GDP (t-1)	0.030*	0.034*	0.001	-0.005	0.119*	0.060
	(0.016)	(0.020)	(0.005)	(0.006)	(0.064)	(0.070)
Regulatory Quality	-0.005	0.001	-0.005**	-0.003	-0.054	-0.032
	(0.007)	(0.008)	(0.002)	(0.003)	(0.036)	(0.038)
Rule of Law	-0.016	-0.015	0.005	0.006*	0.015	0.027
	(0.010)	(0.010)	(0.004)	(0.003)	(0.036)	(0.036)
Macroprudential Index	0.001		0.001*		0.012**	
	(0.001)		(0.000)		(0.006)	
Dynamic loan-loss provisioning		-0.007		0.007***		0.069**
		(0.008)		(0.003)		(0.032)
Capital Surcharges on SIFIs		-0.002		0.002		0.002
		(0.003)		(0.001)		(0.015)
Levy/Tax on Financial Institutions		0.008***		0.002		0.028**
		(0.003)		(0.001)		(0.012)
Loan-to-Value Ratio Caps		0.007*		0.001		0.010
		(0.004)		(0.001)		(0.015)
Constant	-0.181	-0.160	0.011	0.017	-0.528	-0.519
	(0.157)	(0.156)	(0.041)	(0.040)	(0.580)	(0.571)
Observations	1845	1845	1845	1845	1845	1845
No. of banks	441	441	441	441	441	441
Adjusted R-squared	0.933	0.935	0.961	0.962	0.833	0.834
Adjusted Within R-squared	0.338	0.357	0.661	0.668	0.080	0.086
FE Bank	yes	yes	yes	yes	Yes	yes
FE Year	yes	yes	yes	yes	Yes	yes

Table 6: Micro-macro regressions: Determinants of coverage ratios and components of coverage ratios. This table reports estimation results from the panel fixed-effects micro-macro regressions. Macroeconomic indexes are interacted with an indicator for high-NPL countries. High-NPL countries are defined as countries with NPL/TA above the sample mean. A set of bank and time dummies are included in each regression. Robust standard errors are clustered at the bank-level (high-NPL countries). Significance at the 1, 5 and 10% level is denoted by ***, **, and * respectively.

	(1)	(2)	(3)	(4)	(5)	(6)
	NPLs/TA	NPLs/TA	LLRs/TA	LLRs/TA	Coverage ratio	Coverage ratio
NPL/TA (t-1)			0.289***	0.281***	-0.570**	-0.673***
			(0.037)	(0.038)	(0.237)	(0.244)
Gross loan growth (t)	-0.025**	-0.019**	0,004	0,004	0.124***	0.129***
	(0.010)	(0.009)	(0.004)	(0.004)	(0.041)	(0.041)
Short-term interest rate (t-1)	-0.003	-0.003	0.000	0.000	-0.016	-0.020
	(0.006)	(0.006)	(0.002)	(0.002)	(0.023)	(0.024)
Real GDP growth rate per country (t-1)	0.000	-0.001	0.001*	0.001**	0.009**	0.008**
	(0.001)	(0.001)	(0.000)	(0.000)	(0.004)	(0.004)
Unemployment rate (t-1)	0.519***	0.448***	0.116***	0.102**	0.173	0.116
	(0.088)	(0.089)	(0.039)	(0.040)	(0.352)	(0.350)
House price change (y-o-y) (t-1)	-0.012	0.003	-0.001	-0.004	-0.050	-0.055
	(0.029)	(0.028)	(0.011)	(0.010)	(0.132)	(0.128)
Stock price change (y-o-y) (t-1)	0.014**	0.010	0.002	0.001	0.014	-0.001
	(0.007)	(0.006)	(0.002)	(0.002)	(0.029)	(0.030)
Private sector credit / GDP (t-1)	0.036**	0.044***	0.002	-0.004	0.107*	0.051
	(0.014)	(0.017)	(0.005)	(0.007)	(0.063)	(0.071)
High NPL Country Dummy	0.041***	0.027***	0.005*	0.004*	0.011	-0.019
	(0.006)	(0.006)	(0.002)	(0.003)	(0.026)	(0.023)
Regulatory Quality	-0.004	-0.004	-0.004*	-0.003	-0.058	-0.050
	(0.007)	(0.008)	(0.003)	(0.003)	(0.039)	(0.041)
*High NPL Country Dummy * Reg. Quality*	-0.006	0.007	-0.003	-0.002	0.009	0.049
	(0.007)	(0.008)	(0.002)	(0.003)	(0.036)	(0.038)
Rule of Law	-0.014	-0.012	0.004	0.006	0.047	0.066*
	(0.010)	(0.010)	(0.004)	(0.004)	(0.038)	(0.039)
*High NPL Country Dummy * Rule of Law*	-0.011*	-0.018**	-0.001	-0.001	-0.043	-0.065**
	(0.006)	(0.007)	(0.002)	(0.003)	(0.030)	(0.032)
Macroprudential Index	0.002		0.001*		0.014**	
	(0.001)		(0.000)		(0.006)	
*High NPL Country Dummy * Macropru Index*	-0.001		0.000		-0.003	
	(0.001)		(0.000)		(0.005)	
Dynamic loan-loss provisioning		-0.017**		0.006		0.095**
		(0.007)		(0.004)		(0.042)
*High NPL Country Dummy * Dynamic LLP*		0.011		0.002		-0.049
		(0.008)		(0.003)		(0.046)
Capital Surcharges on SIFIs		0.000		0.001		0.008
		(0.003)		(0.001)		(0.015)
*High NPL Country Dummy * Capital Surcharges*		-0.006***		0.001		-0.021**
		(0.002)		(0.001)		(0.010)
Levy/Tax on Financial Institutions		0.006**		0.002		0.030**
		(0.002)		(0.001)		(0.013)
*High NPL Country Dummy * Levy/Tax on FI*		0.003		0.001		-0.004
		(0.004)		(0.001)		(0.014)
Loan-to-Value Ratio Caps		0.003		0.001		-0.004
		(0.004)		(0.002)		(0.016)
*High NPL Country Dummy * Loan-to-Value Caps*		0.013***		0.001		0.031**
		(0.004)		(0.002)		(0.016)
Constant	-0.147	-0.106	0.004	0.011	-0.447	-0.406
	(0.148)	(0.144)	(0.039)	(0.039)	(0.581)	(0.570)

Observations	1845	1845	1845	1845	1845	1845
No. of banks	441	441	441	441	441	441
Adjusted R-squared	0.944	0.948	0.962	0.963	0.839	0.841
Adjusted Within R-squared	0.448	0.485	0.668	0.675	0.110	0.121
FE Bank	yes	yes	yes	yes	Yes	yes
FE Year	yes	yes	yes	yes	Yes	yes

Table 7: Micro-macro regressions, secondary NPL market transactions: Determinants of coverage ratios and components of coverage ratios. This table reports estimation results from the OLS micro-macro regressions. The dependent variables are the coverage ratio, LLRs/TA, and NPLs/TA at the bank level. A set of time and bank dummies are included in each regression. Robust standard errors are clustered at the bank-level. Significance at the 1, 5 and 10% level is denoted by ***, **, and * respectively.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	NPLs/TA	LLR/TA	Coverage ratio	NPLs/TA	LLR/TA	Coverage ratio	NPLs/TA	LLR/TA	Coverage ratio
NPL/TA (t-1)		0.302***	-0.782***		0.303***	-0.747***		0.292***	-0.515**
		(0.035)	(0.236)		(0.035)	(0.237)		(0.036)	(0.238)
Gross loan growth (t)	-0.035***	0.003	0.127***	-0.033**	0,004	0.129***	-0.028**	0,004	0.126***
	(0.013)	(0.004)	(0.042)	(0.013)	(0.004)	(0.042)	(0.011)	(0.004)	(0.042)
Short-term interest rate (t-1)	-0.217	0.103	0.376	-0.383	0.075	-0.351	-0.207	0.095	-0.653
	(0.731)	(0.203)	(2.340)	(0.743)	(0.206)	(2.353)	(0.692)	(0.201)	(2.352)
Real GDP growth rate(t-1)	0.003	0.067**	0.837**	0.056	0.080**	0.920**	0.047	0.080**	0.982**
	(0.085)	(0.034)	(0.405)	(0.084)	(0.033)	(0.418)	(0.080)	(0.033)	(0.409)
Unemployment rate (t-1)	0.564***	0.090**	0.414	0.575***	0.104***	0.452	0.594***	0.114***	0.276
	(0.088)	(0.037)	(0.341)	(0.090)	(0.040)	(0.367)	(0.080)	(0.040)	(0.353)
House price change (y-o-y) (t-1)	-0.031	-0.012	-0.066	-0.012	-0.004	-0.021	0.004	-0.003	-0.054
	(0.031)	(0.010)	(0.134)	(0.031)	(0.011)	(0.135)	(0.029)	(0.011)	(0.136)
Stock price change (y-o-y) (t-1)	0.017**	0.002	0.007	0.018**	0.002	0.008	0.016**	0.002	0.008
	(0.007)	(0.002)	(0.029)	(0.007)	(0.002)	(0.030)	(0.007)	(0.002)	(0.030)
Private sector credit / GDP (t-1)	0.025	-0.001	0.103	0.032**	0.002	0.114*	0.036***	0.002	0.097
	(0.016)	(0.006)	(0.064)	(0.015)	(0.005)	(0.065)	(0.014)	(0.005)	(0.065)
Size secondary loan mkt / TA	0.315	0.160**	0.748						
	(0.252)	(0.069)	(0.717)						
Size secondary mkt / TA Tercile 2				0.004*	0.001**	0.019**	0.004*	0.002**	0.015
				(0.002)	(0.001)	(0.009)	(0.002)	(0.001)	(0.011)
Size secondary mkt/ TA Tercile 3				0.007***	0.002***	0.021**	0.006***	0.001*	0.010
				(0.002)	(0.001)	(0.008)	(0.002)	(0.001)	(0.010)
High NPL Country Dummy							0.015***	0.001	-0.050***
							(0.002)	(0.001)	(0.010)
*High NPL Country Dummy * Tercile 3*							0.001	0.000	0.008
							(0.002)	(0.001)	(0.011)
*High NPL Country Dummy * Tercile 3*							0.004	0.002**	0.024**
							(0.002)	(0.001)	(0.010)
Constant	-0.175	0.027	-0.301	-0.215	0.007	-0.625	-0.213	0.000	-0.568
	(0.159)	(0.041)	(0.559)	(0.156)	(0.039)	(0.558)	(0.144)	(0.039)	(0.559)
Observations	1845	1845	1845	1845	1845	1845	1845	1845	1845
No. of banks	441	441	441	441	441	441	441	441	441
Adjusted R-squared	0.933	0.961	0.831	0.933	0.961	0.832	0.942	0.962	0.837
Adjusted Within R-squared	0.340	0.663	0.066	0.342	0.660	0.077	0.423	0.665	0.103
FE Bank	yes	yes	yes	yes	yes	yes	yes	yes	yes
FE Year	yes	yes	yes	yes	yes	yes	yes	yes	yes

APPENDIX A1- Additional tables

Table A.1: Sample composition and average coverage, LLR/TA and NPL/TA ratios by country.

Country Code	Avg. Coverage Ratio	Avg. LLR/TA	Avg. NPL/TA
AT	53%	2%	4%
BE	47%	1%	2%
BG	32%	5%	13%
CY	41%	9%	20%
CZ	63%	3%	4%
DE	54%	1%	2%
DK	55%	4%	7%
ES	56%	2%	5%
FI	34%	0%	1%
FR	63%	1%	2%
GB	36%	1%	4%
GR	42%	9%	21%
HR	57%	6%	11%
HU	66%	9%	16%
IE	36%	6%	16%
IT	44%	5%	10%
LT	27%	1%	4%
LU	32%	1%	4%
LV	54%	2%	4%
MT	27%	1%	4%
NL	31%	1%	4%
PL	59%	3%	6%
PT	54%	5%	10%
RO	56%	4%	8%
SE	72%	1%	1%
SI	66%	6%	9%
SK	65%	3%	4%

Table A.2: Correlation matrix.

	Coverage ratio	*LLR / TA*	*NPL / TA*	*Log(Total Assets)*	*Gross loans / TA*	*Deposits / TA*	*ROAA*	*CET1*	*DELTA (NPL / TA)*	*Gross loan growth*	*Cost-to-income ratio*
Coverage ratio	1	0.02	-0.23	-0.12	-0.12	0.12	0.13	0.10	-0.16	0.07	-0.03
LLR / TA	0.02	1	0.94	0.09	0.21	-0.19	-0.20	-0.14	0.26	-0.26	-0.10
NPL / TA	-0.23	0.94	1	0.11	0.22	-0.24	-0.27	-0.17	0.34	-0.30	-0.10
Log(Total Assets)	-0.12	0.09	0.11	1	-0.07	-0.50	-0.04	-0.18	-0.01	-0.14	-0.08
Gross loans / TA	-0.12	0.21	0.22	-0.07	1	0.09	-0.04	-0.16	0.07	0.01	0.03
Deposits / TA	0.12	-0.19	-0.24	-0.50	0.09	1	0.07	0.19	-0.16	0.22	0.14
ROAA	0.13	-0.20	-0.27	-0.04	-0.04	0.07	1	0.23	-0.36	0.30	-0.41
CET1	0.10	-0.14	-0.17	-0.18	-0.16	0.19	0.23	1	-0.13	0.05	-0.18
DELTA (NPL / TA)	-0.16	0.26	0.34	-0.01	0.07	-0.16	-0.36	-0.13	1	-0.09	-0.01
Gross loan growth	0.07	-0.26	-0.30	-0.14	0.01	0.22	0.30	0.05	-0.09	1	-0.11
Cost-to-income ratio	-0.03	-0.10	-0.10	-0.08	0.03	0.14	-0.41	-0.18	-0.01	-0.11	1
Real GDP growth rate	0.08	-0.11	-0.15	-0.01	-0.04	0.22	0.24	0.16	-0.38	0.10	0.01
Unemployment rate	-0.09	0.55	0.55	0.29	0.06	-0.30	-0.08	-0.13	0.21	-0.12	-0.16
House price change	0.21	-0.39	-0.45	-0.18	-0.05	0.39	0.13	0.23	-0.39	0.10	0.11
Stock price change	0.10	-0.18	-0.20	-0.18	-0.04	0.17	0.09	0.11	-0.06	0.01	0.03
Private sector credit / GDP	-0.19	0.13	0.18	0.32	0.04	-0.24	-0.13	-0.07	0.14	-0.09	-0.10
Short-term interest rate	-0.11	0.13	0.15	0.19	0.01	-0.12	0.08	-0.23	0.13	0.01	-0.11
Rule of Law	0.09	-0.63	-0.62	-0.05	-0.08	0.18	0.02	0.13	-0.24	0.05	0.12
Regulatory Quality	0.05	-0.65	-0.63	-0.16	-0.05	0.29	-0.01	0.16	-0.20	0.09	0.16
Macroprudential Index	0.23	0.02	-0.06	-0.16	-0.01	0.13	0.11	0.19	-0.17	0.09	0.03
Dynamic LLP	0.02	0.09	0.06	0.11	0.01	-0.01	0.10	-0.06	-0.03	0.01	-0.13
Capital Surcharges on SIFIs	0.12	-0.14	-0.17	-0.11	0.01	0.18	0.09	0.23	-0.18	0.11	0.07
Levy/Tax on FI	0.26	-0.23	-0.30	-0.22	-0.11	0.20	-0.07	0.12	-0.22	0.00	0.22
Loan-to-Value Ratio Caps	-0.01	0.43	0.40	0.12	0.00	-0.20	0.18	-0.03	-0.01	-0.03	-0.18
Size secondary mkt / TA	-0.08	0.28	0.29	0.07	0.07	-0.07	0.02	0.00	-0.05	-0.04	-0.02

Continued (Table A.2: Correlation matrix)

	Real GDP growth rate	*Unemployment rate*	*House price change*	*Stock price change*	*Private sector credit / GDP*	*Short-term interest rate*	*Rule of Law*	*Regulatory Quality*	*Macroprudential Index*	*Dynamic LLP*	*Capital Surcharges on SIFIs*	*Levy/ Tax on FI*	*Loan-to-Value Caps*	*Size secondary mkt / TA*
Coverage ratio	0.08	-0.09	0.21	0.10	-0.19	-0.11	0.09	0.05	0.23	0.02	0.12	0.26	-0.01	-0.08
LLR / TA	-0.11	0.55	-0.39	-0.18	0.13	0.13	-0.63	-0.65	0.02	0.09	-0.14	-0.23	0.43	0.28
NPL / TA	-0.15	0.55	-0.45	-0.20	0.18	0.15	-0.62	-0.63	-0.06	0.06	-0.17	-0.30	0.40	0.29
Log(Total Assets)	-0.01	0.29	-0.18	-0.18	0.32	0.19	-0.05	-0.16	-0.16	0.11	-0.11	-0.22	0.12	0.07
Gross loans / TA	-0.04	0.06	-0.05	-0.04	0.04	0.01	-0.08	-0.05	-0.01	0.01	0.01	-0.11	0.00	0.07
Deposits / TA	0.22	-0.30	0.39	0.17	-0.24	-0.12	0.18	0.29	0.13	-0.01	0.18	0.20	-0.20	-0.07
ROAA	0.24	-0.08	0.13	0.09	-0.13	0.08	0.02	-0.01	0.11	0.10	0.09	-0.07	0.18	0.02
CET1	0.16	-0.13	0.23	0.11	-0.07	-0.23	0.13	0.16	0.19	-0.06	0.23	0.12	-0.03	0.00
DELTA (NPL / TA)	-0.38	0.21	-0.39	-0.06	0.14	0.13	-0.24	-0.20	-0.17	-0.03	-0.18	-0.22	-0.01	-0.05
Gross loan growth	0.10	-0.12	0.10	0.01	-0.09	0.01	0.05	0.09	0.09	0.01	0.11	0.00	-0.03	-0.04
Cost-to-income ratio	0.01	-0.16	0.11	0.03	-0.10	-0.11	0.12	0.16	0.03	-0.13	0.07	0.22	-0.18	-0.02
Real GDP growth rate	1	-0.27	0.57	-0.09	-0.17	-0.13	0.26	0.30	0.31	-0.06	0.30	0.28	0.11	0.31
Unemployment rate	-0.27	1	-0.55	-0.25	0.32	0.12	-0.66	-0.77	0.00	0.53	-0.21	-0.34	0.45	0.23
House price change	0.57	-0.55	1	0.11	-0.27	-0.45	0.55	0.61	0.39	-0.13	0.42	0.48	-0.18	-0.04
Stock price change	-0.09	-0.25	0.11	1	-0.24	-0.20	0.16	0.19	0.02	-0.10	0.03	0.24	-0.18	-0.02
Private sector credit / GDP	-0.17	0.32	-0.27	-0.24	1	0.09	0.13	0.05	-0.36	0.20	-0.15	-0.50	0.16	-0.04
Short-term interest rate	-0.13	0.12	-0.45	-0.20	0.09	1	-0.15	-0.21	-0.51	0.10	-0.51	-0.47	-0.03	-0.12
Rule of Law	0.26	-0.66	0.55	0.16	0.13	-0.15	1	0.92	-0.17	-0.19	0.01	0.28	-0.42	-0.22
Regulatory Quality	0.30	-0.77	0.61	0.19	0.05	-0.21	0.92	1	-0.08	-0.24	0.17	0.27	-0.48	-0.17
Macroprudential Index	0.31	0.00	0.39	0.02	-0.36	-0.51	-0.17	-0.08	1	0.10	0.68	0.50	0.39	0.09
Dynamic LLP	-0.06	0.53	-0.13	-0.10	0.20	0.10	-0.19	-0.24	0.10	1	-0.14	-0.20	0.21	0.02
Capital Surcharges on SIFIs	0.30	-0.21	0.42	0.03	-0.15	-0.51	0.01	0.17	0.68	-0.14	1	0.25	0.11	0.05
Levy/Tax on FI	0.28	-0.34	0.48	0.24	-0.50	-0.47	0.28	0.27	0.50	-0.20	0.25	1	-0.08	-0.01

Loan-to-Value Ratio Caps	0.11	0.45	-0.18	-0.18	0.16	-0.03	-0.42	-0.48	0.39	0.21	0.11	-0.08	1	0.26
Size secondary loan market / TA	0.31	0.23	-0.04	-0.02	-0.04	-0.12	-0.22	-0.17	0.09	0.02	0.05	-0.01	0.26	1.00

Table A.3: Micro-level regressions robustness: Determinants of coverage ratios and components of coverage ratios. This table reports estimation results from the OLS micro-level regressions with bank, and country-year fixed effects. The dependent variables are the coverage ratio, defined as LLR/NPLs. Robust standard errors are clustered at the bank-level and reported in parentheses. NPL/TA is replaced with NPLs over gross loans (NPL/GL), which is the most commonly used measure of lending portfolio quality. The CET1 ratio is replaced by the Tier 1 Capital ratio. ROAA is replaced with the return-on-equity (ROAE). Significance at the 1, 5 and 10% level is denoted by ***, **, and * respectively.

	(1)	(2)	(3)
	NPLs/TA	LLRs/TA	Coverage ratio
NPL/Gross Loans (t-1)		0.188***	-0.594***
		(0.024)	(0.172)
DELTA (NPL / TA) (t)		0.292***	-1.231***
		(0.039)	(0.293)
Gross Loans/TA (t-1)	0.076***	0.033***	-0.089
	(0.021)	(0.006)	(0.092)
Deposits/TA (t-1)	-0.012	0.004	0.135*
	(0.018)	(0.005)	(0.080)
ROAE (t-1)	-0.105***	-0.019***	-0.185***
	(0.019)	(0.007)	(0.055)
Tier 1 Capital (t-1)	0.029	0.009	0.216
	(0.028)	(0.010)	(0.173)
Log(TA) (t-1)	-0.003	0.000	0.049
	(0.010)	(0.002)	(0.038)
Gross loan growth (t)	-0.029**	0.009**	0.178***
	(0.013)	(0.004)	(0.044)
Cost-to-income ratio (t-1)	-0.025***	-0.001	-0.061
	(0.009)	(0.003)	(0.039)
Constant	0.061	-0.024	-0.262
	(0.165)	(0.041)	(0.634)
Observations	1842	1842	1842
No. of banks	441	441	441
Adjusted R-squared	0.944	0.967	0.836
Adjusted Within R-squared	0.144	0.505	0.059
FE Bank	yes	Yes	yes
FE Country * Year	yes	Yes	yes

APPENDIX B – The euro sovereign crisis and the advent of the SSM

In this part we consider whether coverage-ratio variation can be attributed to two major events that occurred in Europe between 2010 and 2016: the euro sovereign crisis years (2010–12) and the commencement of the SSM as of November 2014.

Table A4 (Columns 1 to 3), provides evidence on how a crisis shock affect loan loss coverage policy. In most countries affected by system-wide increases in NPLs, these were linked to the severe economic recession that followed the European sovereign debt crisis (ESRB, 2019). To account for the euro sovereign crisis, we remove the year fixed effects and include a crisis dummy (signaling the years 2010-2012) and its interactions with asset quality, capitalization, and profitability. In Columns 4 to 6, a negative and significant coefficient at the 1% level is attached to the interaction of asset quality and the crisis dummy. This implies that, compared to normal times, in crisis years banks reduced more or increased relatively less their loan loss reserves and coverage ratios when asset quality deteriorates.

This evidence suggests that in times of severe distress it is more difficult (costly) for banks to accumulate large provisions to offset increased bad loans, one may expect coverage ratios to decrease. It is also possible that regulators tend to be more lenient in bad times and that discretion over accounting rules combined with regulatory forbearance may lead banks to understate balance sheet stresses by under-reserving to preserve bank capital (Huizinga and Laeven, 2012).

Next, we investigate the role of the introduction of the single supervisory mechanism (SSM). This has been a significant institutional change in the euro area, resulting in a common and more stringent supervision (Ristolainen, 2018; Eber and Minoiu, 2016).

Several studies have investigated the role of supervision on the way banks build up loan loss coverages. Empirical evidence confirms that supervisory and regulatory practices influence provisioning and loan loss allowances (Barth et al., 2013; Laurin and Majnoni, 2003; Yang, 2017; Nicoletti, 2018; Gallemore, 2018). According to an IMF survey on obstacles to NPL resolution, the robustness of coverage ratios appears to be linked to the stringency of supervision (Aiyar et al., 2017).[36]

[36] The survey focuses on countries where the aggregate NPL ratio over 2008–2014 exceeded 10% and reflects the views of authorities as well as banks operating in those countries. See Aiyar et al. (2015) for the main outcomes of the survey.

In Table A4 (Columns 4 to 6), we show the results of a specification which includes the dummy POST SSM (taking the value of 1 from 2014 onwards) and the interacted term SSM x POST to account for ECB supervised banks since the inception of the single supervisor. [37] Our sample does not include the subsidiaries, parents, and ultimate parents of these banks, as they could have also changed their provisioning policies in anticipation of the assessment or after it, while not formally showing up as banks under SSM supervision. The dummy post enters with a positive and significant coefficient in the LLR-ratio regression, indicating a generalized, more prudent provisioning since the advent of the SSM. The estimated coefficient of the interacted term on the asset quality and the coverage ratio is positive and statistically significant (at the 5% and the 10% level, respectively). This finding confirms (e.g., Ristolainen, 2018) that supervised banks have overall more incentives to recognize NPLs and (to a lower extent) adjust loan-loss coverage accordingly, a plausible effect of the closer scrutiny and the application of more stringent classification criteria. [38]

However, we are aware that these coefficients need to be interpreted with caution, as we cannot include time fixed effects in this regression.

[38] An important step in the preparation of the SSM was the asset quality exercise carried out by the ECB in 2014 on a sub-sample of European banks that were subjected to stricter classification criteria and in-depth credit file scrutiny (Bruno and Marino, 2019). The review led to additional NPLs of euro 136 billion (+18%) and provisions of euro 48 billion (+12%), as an effect of the consistent application of the EBA restrictive approach to defining non performing exposures and the credit file review (ECB, 2014). More recently (see Section 2 for details), the ECB has introduced additional measures promoting more prudent provisioning and higher coverage ratios in supervised entities.

Table A4: Micro-level regressions extensions: Influence of the single supervisory mechanism and EA crisis. This table reports estimation results from the panel fixed-effects micro-level regressions. Robust standard errors are clustered at the bank-level and reported in parentheses. Robust standard errors are clustered at the bank-level and reported in parentheses. Significance at the 1, 5 and 10% level is denoted by ***, **, and * respectively.

	(1) NPLs/TA	(2) LLRs/TA	(3) Coverage ratio	(4) NPLs/TA	(5) LLRs/TA	(6) Coverage ratio
NPL/TA (t-1)		0.357***	-0.393**		0.348***	-0.519**
		(0.023)	(0.181)		(0.030)	(0.204)
DELTA (NPL / TA) (t)		0.276***	-1.270***		0.264***	-1.341***
		(0.037)	(0.255)		(0.041)	(0.269)
Gross Loans/TA (t-1)	0.018	-0.004	-0.079	0.017	-0.012**	-0.149*
	(0.021)	(0.006)	(0.077)	(0.021)	(0.006)	(0.078)
Deposits/TA (t-1)	0.003	0.009*	0.204***	0.008	0.013**	0.230***
	(0.018)	(0.005)	(0.063)	(0.019)	(0.006)	(0.070)
ROAA (t-1)	-1.862***	-0.199**	-2.046***	-1.890***	-0.224**	-2.175***
	(0.332)	(0.080)	(0.718)	(0.335)	(0.088)	(0.707)
CET1 (t-1)	-0.089***	0.005	0.387***	-0.072***	0.006	0.339**
	(0.025)	(0.010)	(0.140)	(0.026)	(0.011)	(0.135)
Log(TA) (t-1)	-0.004	-0.001	0.088***	-0.001	-0.002	0.078**
	(0.011)	(0.002)	(0.031)	(0.011)	(0.003)	(0.032)
Gross loan growth (t)	-0.040***	0.007	0.154***	-0.043***	0.004	0.124***
	(0.014)	(0.004)	(0.044)	(0.014)	(0.004)	(0.044)
Cost-to-income ratio (t-1)	-0.052***	-0.002	-0.066*	-0.051***	-0.002	-0.064*
	(0.010)	(0.003)	(0.039)	(0.010)	(0.003)	(0.039)
European Crisis Dummy	-0.012	0.001	0.013			
	(0.008)	(0.002)	(0.024)			
*European Crisis Dummy (t) * NPL/TA (t-1)*		-0.090***	-0.706***			
		(0.027)	(0.203)			
*European Crisis Dummy (t) * ROAA (t-1)*	-0.024	-0.251	-1.211			
	(0.464)	(0.167)	(1.788)			
*European Crisis Dummy (t) * CET (t-1)*	0.083	0.017	0.060			
	(0.066)	(0.016)	(0.197)			
Post SSM				-0.002	0.001**	0.009
				(0.002)	(0.001)	(0.008)
*SSM Bank Dummy * Post SSM*				0.011**	0.000	0.027*
				(0.005)	(0.001)	(0.015)
Constant	0.152	0.013	-0.965*	0.095	0.037	-0.785
	(0.169)	(0.037)	(0.499)	(0.167)	(0.049)	(0.525)
Observations	1845	1845	1845	1845	1845	1845
No. of banks	441	441	441	441	441	441
Adjusted R-squared	0.910	0.961	0.830	0.911	0.957	0.827
Adjusted Within R-squared	0.167	0.680	0.156	0.177	0.649	0.139
FE Bank	Yes	yes	yes	yes	yes	yes

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