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**Bad loans and resource allocation in crisis years:
Evidence from European banks**

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Bad loans and resource allocation in crisis years: Evidence from European banks

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Abstract

The aim of this study is to explore the relation between loan portfolio quality and lending in European banks over 2005-2014. We focus on lending behavior of banks from distressed countries since the Euro sovereign debt crisis. Our results confirm the existence of a negative nexus between poor loan quality and lending, since a higher NPL ratio explains a reduced loan growth and a lower allocation to loans at the advantage of government debt (as a percentage of total assets). Such an impact on lending and reallocation effect are strong and consistent across specifications and over and above other factors that may affect credit supply.

Keywords: bad loans, NPLs, non-performing loans, bank lending, crisis.

J.E.L. Classification: G20,G21, G01

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1. Introduction

Reducing the excessive level of banks' non-performing loans (NPLs) has become a priority on the agenda of policymakers in Europe.¹ As the European Parliament has recently claimed, the high level of NPLs on banks' balance sheets in the Banking Union weighs on their ability to lend to the real economy because of their impact on profitability, funding costs, and bank capital (European Parliament 2016). NPLs affect banks' profits because of higher provisioning needs and operating costs, due to the increased amount of human resources employed to monitor and manage poor quality loans. High NPLs (as well as high provisions) are not only a drag on banks' profitability. They also increase banks' opacity (Kishan and Opiela 2012) and the combination of the two effects reduce investors' willingness to lend to banks, leading to higher funding costs and a further negative impact on their ability to generate profits. Clearly, NPLs are risky assets, which attract higher risk weights than performing loans. Thus, a large bulk of NPLs ties up banks' capital. All these effects mutually reinforce each other and may dampen bank credit supply.

These concerns have become even more critical under the severe negative systemic shocks caused by the subsequent banking and sovereign crises. The prolonged downturn has strongly contributed to the deterioration of asset quality of European banks (Beck et al. 2013). Within the Euro area, NPLs are particularly elevated in Southern countries, notably Greece, Cyprus, Italy, and Portugal, with a NPL to total asset ratio of more 40% in the former two countries, and more of 15% in the latter two.²

Notwithstanding the large discrepancies across countries and across banks, bad loans remain a problem for European banks, who compare unfavorably with US banks (FT 2015). As a response, supranational institutions have released several reports to shed light on determinants and real effects of NPLs in Europe and to set out the possible solutions (Beck et al. 2013; IMF 2015; Klein 2013; ECB 2016). Academic research on the topic is instead relatively limited and mainly focused on the systemic impact of NPLs (see Bholat et al. 2016 for a review of this strand of literature), or on the link between loan loss provisioning and regulatory capital (Laeven and Majnoni 2003; Beatty and Liao 2011).³

We aim to fill this gap by exploring the relation between loan portfolio quality and lending in European banks. As stated by the theory, the main channel by which banks' balance-sheet weaknesses affect the economy is through a reduction of credit supply (Bernanke 1983). Credit supply is influenced by the banks' balance-sheet strength, the so-called bank lending channel (Kashyap and Stein 2000). In turn, the pro-cyclical attitude of bank lending could exert a disproportionate strain on the economy, making harder for bank dependent

¹ There is no global standard definition of non-performing loans. To reduce uncertainty in the NPL issues, the EBA has recently proposed harmonised forbearance and non-performing exposures definitions to apply to all loans and debt securities on-balance-sheet. The first EU-wide application of the harmonised definition of NPL was in 2014 for the Asset Quality Review exercise, and resulted in additional NPLs of EUR 136 billion, an increase by over 18% (EBA 2015). In this paper we use NPLs, impaired, troubled, and bad loans as synonyms, although we are aware of the fact that, across jurisdictions and even across banks, there might be different meanings associated to these definitions. See Bholat et al. (2016) on the divergences in the definitions of NPLs.

² As of 30 September 2015 according to European Parliament (2016).

³ In a recent contribution, Schiantarelli et al. (2016) analyze borrower runs motivated by concern about bank loan losses.

borrowers to keep on relying on external sources of funds (Berger and Udell 1995). In line with the banking channel view, we want to test the extent to which a poor loan portfolio quality weakens the bank lending channel in crisis years, and precisely whether a larger amount of impaired loans dampens lending, over and above other bank specific factors that commonly affect credit supply. We also want to understand whether a reallocation effect from (risky) loans to (safe) government exposures has taken place, motivated by the increased deterioration of bank loan quality. Risk-based capital requirements are notoriously pro-cyclical and can increase capital shortage in bad times.⁴ Because Euro-area prudential regulation gives a preferential treatment to sovereign debt compared to loans to businesses and households (since the former asset class has a zero risk weight and no quantity constraints on their sovereign debt portfolio),⁵ in times of uncertainty and slow economic recovery, banks may want to reduce their risk by having safer portfolios and higher capital (Berger and Udell 1994).

To address our research questions we use a continuous difference-in difference approach and look at the relation between balance sheet factors for loan quality and bank lending over 2005-2014, and specifically after the onset of the sovereign crisis in 2010.

We analyze bank lending behavior by looking at three indicators. We first want to explore how troubled loans affect the loan growth rate. Because in crisis years banks tend to deleverage, we also want to understand whether banks reduce lending more than they shrink their assets. Unlike most studies on the bank lending channel in crisis years which focus on total loans (Popov and van Horen 2015; Gennaioli et al. 2014), we use both total (gross) loans and the subcategories of corporate loans and residential mortgages over total assets. We examine both to address the concern that any results for total loans might be influenced by compositional effects (Kashyap and Stein 2000). We then examine whether a reallocation of bank credit from loans to government bonds took place in crisis years and whether it was driven by bad loans. In doing so, we account for alternative motivations (e.g. the moral suasion and the risk-shifting hypotheses) that might have caused an increase of resources allocated to government bonds in countries more exposed to sovereign risk (Becker and Ivashina 2014; Altavilla et al. 2016; Acharya et al. 2016; De Marco and Machiavelli 2016).

A novel feature of our paper is that we use interactive effects of bad loans and bank characteristics that can potentially mitigate/exacerbate the effect of NPLs on bank lending. To allow for heterogeneity in the definition and measurement of NPLs across countries and banks (Bholat et al. 2016) we look at the effect of NPLs in association with the bank's capital position and provisioning policies. In principle, the impact of bad loans on bank lending might be mitigated in banks adopting a more prudent approach in loan loss provisioning as well as in high-capitalized banks, compared to under-provisioned or less-capitalized institutions. This is because delays in loan loss recognition (i.e. under-provisioning) in pre-crisis years can lead banks to reduce lending during recessions, as further asset growth can increase their risk of insolvency (Beatty and Liao 2011).

⁴ The pro-cyclicality of bank capital regulation has been thoroughly assessed by a wide theoretical and empirical literature. See Laeven and Majnoni (2003) for a concise survey of this literature.

⁵ Altavilla et al. (2016), among the others, claim that the current regulatory risk-weight system may lead to the undesired effect of increase banks' exposure to sovereign risk, as recently happened during the Euro crisis.

In addition, according to the capital crunch hypothesis (Bernanke and Lown 1991), capital market imperfections make it difficult for banks to raise equity capital, which may reduce lending during recessions.

Our first results over the entire sample suggest that poor loan portfolio quality (proxied by the NPL to total loan ratio) affects bank allocation strategies, leading to a lower loan growth rate and a lower total loans over total asset ratio. A higher NPL ratio is also associated to a greater amount of resources allocated to government bonds, which may be suggestive of a flight to quality effect. Interestingly, the nexus between NPLs and government bonds turns negative when during 2010-2014, a period including the Euro sovereign crisis. It seems that when sovereign risk increases, prudently banks more exposed to credit risk (as proxied by a larger NPLs ratio) may want to reduce further sources of risk, thus cutting back their allocation to public debt.

To investigate the role played by bank capital and loan loss provisioning in influencing the effect of bank loan quality on credit supply, we distinguish banks by the level of their Tier 1 and coverage ratios measured *before* the onset of the sovereign crisis. Precisely, we test whether bank loan quality has a different impact on bank lending in highly capitalized and highly provisioned banks, relative to low-capitalized and low coverage ratio banks. We motivate this approach in light of the fact that, either increasing provisioning or raising capital in crisis years is challenging and costly (the more so in banks from countries more affected by the crisis). In particular, while higher ex-ante (pre-crisis) provisioning lowers bank profitability in the short term, over the long run it may reduce the need to raise equity during or after a crisis (Bholat et al. 2016). Hence, loan loss provisioning may have a countercyclical effect from a stability view point.

We find evidence of a shielding effect played by provisioning on lending, especially during the Euro crisis in banks from distressed countries. We also find that the negative impact of NPLs on the share of loans to total assets is more severe in low-coverage ratio banks. Consistently, the share of government bonds increases more for low-coverage institutions than for banks with more prudent provisioning. The role played by capitalization is instead ambiguous, and overall, we find only partial evidence of a different lending behavior of high- relative to low-capitalized banks.

Our study contributes to the vast bank lending channel literature placing an emphasis on the role of loan portfolio quality on credit supply as a relevant explanatory variable of a bank's balance sheet strength. In focusing on the Euro crisis years, we provide new evidence on the effect of the sovereign crisis on bank lending. A number of recent studies have found that credit supply by distressed banks was constrained during the global financial crisis and the Euro sovereign crisis. In most of these works, however, bank distress stems from low capitalization (Albertazzi and Marchetti 2010; Jimenez et al. 2014), greater market funding risk (Gambacorta and Marques-Ibanez 2011; Bonaccorsi and Sette 2016) as well as from a large exposure to sovereign risk (Popov and van Horen 2015; Acharya et al. 2016; Becker and Ivashina 2014; De Marco and Macchiavelli 2016).

While these works assess the impact of the 2008-09 or the Euro sovereign crisis on bank lending, taken individually, we examine how a prolonged downturn period (comprising both the banking and the Euro debt crisis) influences lending patterns. In addition, the inclusion in our sample period of two post-crisis years (i.e.

2013 and 2014) widens the perspective of the analysis and enables us to assess the strength of the banking channel through the cycle.

In looking at the role played by loan portfolio quality on banks' public debt holdings, we also contribute to the literature assessing the determinants of European banks' sovereign exposure (see Altavilla et al. 2016 among the others). We provide evidence a substitution effect in Euro-Periphery banks of bank credit from loans to government securities due to a worsening of banks' loan portfolio quality. Such an effect, however, is not exacerbated during the sovereign crisis. We also uncover that, in reshaping their loan portfolio in response to various constraints related to their activity, banks are more prone to adjust (by either cutting back or increasing) the portfolio of residential mortgages, relative to their holdings of corporate loans. This may suggest that loan categories are featured by different cyclicalities and/or by heterogeneous rates of stickiness, also in consideration of the greater informational (and relationship) content associated to some loan categories, e.g. corporate loans, relative to others, e.g. residential mortgages.⁶

Finally, our findings contribute to the current policy debate on the effects of NPLs, and complements the literature on the effects of NPLs which is mainly represented by institutional papers, based on aggregated data and focused on the macroeconomic effect of poor loan quality (Klein 2013; Nkusu 2011; Espinoza and Prasad 2010; EBA 2015). In particular, our evidence confirms the relevance of a timely provisioning (Borio et al. 2001; Laeven and Majoni 2003), and call for reserve practices to be an integral component of banking regulation.

The structure of the paper is as follows. In Section 2, we describe the data, present some stylized aggregate facts, and highlight the considerable cross-sectional and time-series variation present in our bank-level data. In Section 3, we discuss testable predictions. Section 4 investigates the nexus between banks' loan quality and lending behavior. Section 5 explores the role of provisioning and capitalization. Section 6 concludes.

2. Data and stylized facts

This section describes our data and provides some stylized facts about European banks' credit risk as proxied by loan portfolio quality and its relation with banks' asset allocation strategy. These stylized facts help understand the correlations present in the data at the aggregate level as well as the additional insights that can be gained by exploiting the variation present in the bank-level data.

⁶ Bridges et al. (2014) also find that changes in regulatory capital requirements affect bank lending but results vary across sectors. For instance they find that banks respond to increased capital requirements by reducing lending more to the real estate sectors (both residential and commercial) and less to other types of loans.

2.1 Data sources and descriptive statistics

Our main source of bank-level data is BANKSCOPE, a comprehensive commercial database of banks' financial statements provided by Bureau van Dijk Electronic Publishing (BvD). We start with the full sample of European banks in BANKSCOPE, by collecting unconsolidated balance sheet information over 2005-2014.⁷ We restrict our analysis to twelve Euro area countries and three Non-Euro countries (United Kingdom, Denmark and Sweden).⁸ We collect information from this source on a broad range of bank characteristics: bank size, capitalization, liquidity, loan quality, loan volumes and loan amounts by type of loan (corporate and residential mortgages), and the holdings of government bonds. The information in BANKSCOPE is suitable for international comparisons because BvD harmonizes the data.

We filter out duplicate records, and for our regression analysis we require that we observe the bank at least one year over 2005-2009 (i.e., the period *prior* to the sovereign crisis) and one year over 2010-2014 (i.e., the period *after* the sovereign crisis period). Thus, we are able to compare the before-after variation in bank lending. To neutralize the impact of outliers, all variables are winsorized at the 1st and 99th percentile. Our final dataset is an unbalanced panel of 4,033 banks over 2005-2014, representing 45% of European banks, 87% by total assets, and 82% by total loans, respectively.

Table 1 contains definitions of all the variables included in our analysis along with descriptive statistics. The average gross loan growth between 2005 and 2014 is 6.3% with a median of 3.3%. On average, total loans amount to 57% of total assets and the customer deposits to total assets is 60%. The average bank in our sample is therefore a traditional commercial bank, whose core business is lending and whose main source of funds is core deposits. The median bank in our sample is small, its assets amounting to 694 million Euro. There is however considerable cross-sectional variability within the sample, as indicated by the large between standard deviation of total assets. Looking at the loan portfolio composition, the average corporate loan to total asset ratio is 18.29% while the average residential mortgage to total asset ratio is 26.22%. Missing observations in both corporate loans and residential mortgages are due to the fact that banks are not obliged to report their loan composition details. This is not a major problem for our analysis because our empirical specification requires no-missing observations on non-performing loans, so we restrict both gross loans and corporate loans/residential mortgages to subsamples driven by completeness in non-performing loans variable.

Looking at our main variables, the average NPL to total gross loan ratio is around 7% and the average coverage ratio, i.e. the share of loan loss reserves on NPLs is around 50%, with important heterogeneity across countries and over time as for both indicators. These numbers are comparable to those reported in aggregate statistics (IMF 2015; ECB 2016). Our first indicator of bank capital is Tier 1 regulatory capital ratio, which

⁷ We obtain all data from the BANKSCOPE web interface. The main limitation of this strategy is that the web interface only keeps the most recent information for some variables (for example, the most recent bank ownership structure). However, this is not an issue for our study because we only consider financial statement variables that allow us to obtain a time series of all relevant variables.

⁸ We exclude from our sample countries that adopted Euro after the beginning of our time series: Cyprus, Estonia, Latvia, Lithuania, Malta, Slovakia and Slovenia. Nevertheless, results are robust to different sample procedures.

averages close to 16%, well above the 6% minimum requirement set up by Basel III.⁹ Note that the EU banking sector has taken a number of steps to strengthen its resilience since the onset of the Euro debt crisis. After the 2011 stress test, the EBA issued a capital recommendation for all banks to raise their capital levels to 9% (right above the 8.5% fully loaded capital requirements, including the capital conservation buffer). Since then onwards major EU banks have significantly strengthened their capital position. The pure (non risk weighted) equity to total asset ratio is, on average, 11%. Again, there exists large heterogeneity across banks as for both measures of capitalization. Another indicator of a bank's asset quality is the texas ratio, which is commonly used as a measure of a bank's likelihood of failure as it indicates whether a bank has enough buffers (made of either loan loss reserves or capital) to deal with its bad assets.¹⁰ Thus, banks with a higher texas ratio might have limited buffers against further credit losses. The average (revised) texas ratio in our sample is 40%, but the riskiest banks (corresponding to the top 10 percentile of the distribution) have a texas ratio over 80%.

To provide further evidence of the heterogeneity within the sample, Table 2 compares the average NPL ratios, by country, between the period “before” the Euro sovereign crisis (2005-09) and the period “after” (2010-14). We classify banks into Euro-Core, Euro-Periphery, and Non-Euro banks. The Table shows that banks' loan portfolio quality deteriorated across the board with few exceptions (e.g. German banks). Unsurprisingly, the greater increase of the NPL ratio is concentrated in Euro-Periphery countries, perhaps as a legacy of the more severe recession in this area triggered by the sovereign crisis. Table 3 reports correlations across our main explanatory variables.

2.2 Stylized facts

Figure 1 tracks the evolution of the NPL to total loan ratio in our sample over 2005-2014. The top figure shows how NPLs have skyrocketed since the global financial crisis and during the Euro sovereign crisis, staying at around 9% at the end of 2014, about double the level in 2007. The bottom figure shows that the increase in NPLs was much more pronounced in Euro-Periphery countries in the aftermath of the sovereign crisis. In particular, the evolution of NPLs by geographical area suggests that up to 2009 NPLs in Euro-Core and Euro-Periphery have a common pattern that starts diverging after 2009. Since 2010, the two groups experience an opposite trend: the average NPL ratio in Euro-Periphery significantly increases by around 85% between 2010 and 2014, while it decreases by around 60% in Euro-Core countries.

Figure 2 shows the trend of the average coverage ratios across banks in Europe and by geographical area. The Figure shows that different provisioning practices have been taking place in Europe over the sample period. Differences may reflect various levels of collateralization as well as heterogeneous accounting

⁹ The fully loaded capital requirement, comprehensive of the 2.5% conservation buffer, is however 8.5%, to be met, according to the Basel III phase-in arrangement, by 2019.

¹⁰ The texas ratio is commonly calculated as the ratio of NPLs to loan loss reserves and tangible equity. Due to lack of data for the tangible equity variable, we use a revised version of the texas ratio, by replacing tangible equity capital with Tier 1 capital.

practices (Bholat et al. 2016). Overall, banks from Euro-Periphery countries show a lower level of coverage ratio and a decreasing trend over 2007-2011. Over the same period, the NPL ratio in these countries has instead increased, which points to the fact that provisioning did not keep pace with the rise of NPLs, at least during the global financial crisis and at the beginning of the Euro sovereign crisis. This evidence raises great concern, because banks with moderate coverage ratios are more vulnerable to shocks affecting the borrowers' credit quality. A reverted trend has started since 2011, maybe related to the balance sheet repair process undertaken in many countries in preparation for the 2013 Asset Quality Review, and the following setup of the Single Supervisory Mechanism.¹¹

Figure 3 shows the pattern of the average Tier 1 regulatory capital ratio, in Europe (top panel) and in banks grouped by geographical area. Tier 1 ratio has dropped until the onset of the global financial crisis. A common opposite trend has started since 2008 onward. For less-capitalized banks, however, i.e. those belonging to Euro-Periphery countries, the capital ratio strengthened significantly since 2011, presumably following regulatory pressures and the Capital recommendation issued by EBA after the 2011 stress test.

Figures 4 explores the nexus between bank asset quality and lending over the sample period. The Figure shows overall a negative correlation between poor loan portfolio quality and loan growth over time. In particular, it shows that since the Euro crisis onwards a higher share of bad loans is associated to a lower loan growth rate.

Summarizing, the main stylized facts emerging from this preliminary analysis are the following:

- (1) NPLs in European banks have increased over time since the global financial crisis and even more so since the Euro crisis;
- (2) NPL ratios differ greatly from one country to another, with Euro crisis-hit countries suffering major increases in NPL ratios;
- (3) Also provisioning practices differ significantly, with crisis-hit countries reporting lower level of coverage ratio (relative to non-GIIPS banks) and an opposite trend to that of NPLs (at least over 2007-2011);
- (4) European banks have strengthened the Tier 1 ratio since 2011, but discrepancies across jurisdictions remain, being the less-capitalized banks located in the Euro-Periphery;
- (5) Overall, there is a negative nexus between loan growth rate and bad loans.

¹¹ For example Bank of Italy carried out in 2012-13 an asset quality review aimed to assess the adequacy of Italian banks' levels of NPL and coverage ratios. The inspections revealed deficiencies in provisioning policies and practices at several banks which were required to boost their provisions and make more homogeneous valuations within banking groups. See https://www.bancaditalia.it/media/approfondimenti/2013/analisi-prestiti-deteriorati/Asset_quality_review.pdf?language_id=1

3. Testable predictions

To explore to what extent banks' exposure to credit risk affects credit supply in crisis years, we measure the impact of bank loan portfolio quality on the gross loan growth rate as well as on the share of gross, corporate and residential mortgage loans over total assets. This enable us to gain insights on compositional effects, since it may be, for example, that real estate industry and residential mortgages move differently than corporate loans over the business cycle (Kashyap and Stein 2000). Moreover, since most of NPLs are concentrated in the corporate sector (EBA 2015), one may expect that a reallocation effect could take place, at the expense of the riskiest loan categories.

We also look at the government bond to total asset ratio to examine the possibility of a reallocation effect of bank credit from loans to securities motivated by the fact that, in theory, a risk-based capital regime should encourage substitution out of assets in the risky category (i.e. costumer loans) into assets in the zero-risk weight category (i.e. treasury securities). It would be expected that it is more so for weaker banks in crisis times, when raising new capital is more costly and prudent allocation strategies are more likely, in line with the voluntary risk-retrenchment credit crunch hypothesis (Berger and Udell 1994).

. We therefore expect a negative nexus in bad times between NPLs and the share of assets allocated to government bonds. On the other hand, since 2010 European banks' exposure to government debt has increased dramatically as an effect of the Euro sovereign crisis. The shift toward reliance on the domestic banking sector was largest for countries most affected by sovereign risk (Becker and Ivashina 2014), perhaps as an effect of moral suasion (or financial repression) exercised by national governments (Altavilla et al. 2016; Becker and Ivashina 2014) or as a consequence of risk shifting/carry trade strategies undertaken by weaker banks in search for high yield (Acharya and Steffen 2015; Acharya et al. 2016).¹² Against this background, the impact of bad loans on banks' allocation to public debt during a sovereign stress is hard to predict and deserves further analysis.

Our main explanatory variable of a bank's asset quality is the NPL over total loans ratio that is commonly used in the literature to measure a bank's loan portfolio quality (Berger and Udell 1994; Kishan and Opiela 2012).¹³ We complement this measure with the coverage ratio to proxy the bank's provisioning policies. Loan loss provisions are the periodical accounting deductions, corresponding to the amount the bank expect to lose on a given loan. The coverage ratio is the ratio of the loan loss reserves (i.e. the stock at a given year of loan loss provisions) to impaired loans. In general, it is desirable for banks to have provisioning commensurate with the expected recovery on loans. If this is not the case, the bank is exposed to the risk that larger losses than expected may reduce net profitability and possibly bring bank capital close or below the

¹² Both motivations lead to greater holding of public debt. It is beyond the scope of this work to disentangle the two mechanisms.

¹³ We precisely use the definition of "impaired" loans provided by BANKSCOPE, which cannot be harmonized across banks and jurisdictions. As already said, we are aware of the discrepancies about that impairment policies and also the NPLs across banks and jurisdictions. This is a well-known issue that only very recently led to a harmonized classification of non-performing loans within banks belonging to the European Union.

minimum requirement. As emerged from the stylized facts, coverage ratios differ significantly from Euro-Periphery banks to Euro-Core banks, with the former reporting lower ratios. In principle a low coverage ratio does not necessarily imply a risk of under-provisioning, since it may reflect rigorous lending practices or a strong insolvency frameworks (where for example repossession is easy for creditors). Nevertheless, in a context of poor bank loan quality and particularly in countries where the legal framework is notoriously weak and judicial efficiency is low,¹⁴ a low coverage ratio may be suggestive of a potential source of instability which can dampen credit supply especially in crisis years, when negative shocks further affect the credit quality of borrowers.¹⁵ Consistently, we consider a low coverage ratio as a symptom of under-provisioning or delay in the recognition of losses (Beatty and Liao 2011).

We also include the Tier 1 regulatory ratio which, together with the coverage ratio, may work as a buffer to absorb unexpected losses.¹⁶ The empirical evidence has largely shown that bank capital matters in the propagation of shocks to the bank credit supply (see Kishan and Opiela 2000 and Gambacorta and Mistrulli 2004 among the others). Recent evidence confirms the positive impact of bank capitalization on banks' ability to grant credit in crisis times (Popov and Udell 2010; Jiménez et al. 2014), although in the short run there might be a negative nexus (i.e. a temporary lending reduction), e.g. to restore the bank's original buffer above the minimum requirement (Bridges et al. 2014). We measure bank capital in terms of Tier 1 regulatory capital ratio because this indicator, better than a pure (non-risk based) leverage ratio, is more sensitive to either mitigate or exacerbate the role played by risky loans on lending, and ultimately to motivate a substitution effect between risky loans and zero-risk weighted assets such as Euro sovereign bonds (Altavilla et al. 2016; Berger and Udell 1994).

We finally control for bank characteristics that according to the bank lending channel literature may affect credit supply, i.e. bank size, core deposits, and asset liquidity. Size (log of total assets) is a common proxy for banks' ability to access external source of funds, with smaller banks (especially if illiquid and poorly capitalized) that are found unable to bypass a deposit shock and preserve lending by raising new funds (Kashyap and Stein 2000; Kishan and Opiela 2000). To capture the role played by bank funding structure we focus on the customer deposit to total asset ratio to measure the relevance of stable source of funds for the bank in crisis times. Indeed, the global financial crisis has emphasized that banks more relying on core deposits were less prone to contract lending, relative to banks dependent on unstable wholesale sources of funding (Cornett et al. 2011; Ivashina and Scharfenstein 2010). We also control for the share of liquid assets (cash and due from banks) that could act as a buffer to expand credit in presence of a shock on banks' liabilities (Kashyap and Stein 2000). The global financial crisis has reinforced the view of the relevance of asset liquidity, because

¹⁴ Large discrepancies exist across European countries and also within countries as for the legal enforcement system. See ECB (2016). See also Schiantarelli et al. (2016) for an analysis of the effect of the different degree of local judicial efficiency in Italy.

¹⁵ Bonaccorsi and Sette (2016) use write-offs and provisions on loans as an alternative measure of bank asset quality.

¹⁶ See Laeven and Majnoni (2003) for a description of analogies and differences of loan loss reserves and regulatory capital as buffers banks can resort to.

banks with more illiquid asset on their balance sheet hoarded liquidity and reduced lending in bad times more than liquid banks (Cornett et al. 2011). We use a restrictive measure of liquid asset (which only includes cash and due from banks) because securities that have proven marketable in pre-crisis times may turn illiquid during crisis years. This is what happened for instance during the bank crisis with asset backed securities and, in Europe, with government bonds from Euro-Periphery countries during the Euro sovereign crisis.

4. Impact of bank loan quality on bank lending

In order to identify the effect of loan quality on bank lending during the sovereign crisis, we regress our outcomes of interest (loan growth rate, loan to asset ratio, government bond to asset ratio, corporate loan to asset ratio, residential mortgage to asset ratio) on the NPL ratio of bank i in country j in year $t-1$ interacted with the dummy *Post*. This is a dummy variable equal to one starting the first year of the Euro sovereign crisis, 2010.¹⁷ We control for additional credit risk factors by including the coverage ratio (*Cov*) and the Tier1 regulatory capital ratio (*Tier1*). To control for country-year specific demand driven factors we include country-year fixed effects $\mu_{j,t}$, that absorb the impact on lending of changing country conditions¹⁸. We also include bank fixed effects λ_i to control for unobserved, time-invariant heterogeneity across banks. The baseline econometric model is:

$$Y_{ijt} = \alpha_0 Post_t + \beta_1 Post_t x NPL_{ijt-1} + \beta_0 NPL_{ijt-1} + \gamma_0 Cov_{ijt-1} + \delta_0 Tier1_{ijt-1} + \theta X_{ijt-1} + \mu_{jt} + \lambda_i + \varepsilon_{ijt} \quad (1)$$

The coefficient β_1 captures the response of the bank lending outcomes to changes in the NPL ratio since the onset of the sovereign crisis. X_{ij-1} denotes bank specific one year lagged controls, i.e. size (asset liquidity, and reliance on customer deposits).

Table 4 records our basic results for the simple relationship between bank loan quality and bank lending, without allowing for differential effects of all variables during the period of sovereign stress in Europe. Estimates show that banks with a poorer loan portfolio quality reduce their loan growth rate, as well as the

¹⁷ The first half of 2010 is commonly considered as the starting date of the Euro sovereign crisis, when Greece financial weakness became public and ECB and IMF agreed a first bail-out package to rescue the country. During 2010, the contagion spread out to other Euro countries (namely Ireland) and further bail-out measures were agreed by EU and IMF. Portugal agreed on a bail-out on May 2011, and Spain and Italy never became “program countries” but rather saw gradual deterioration of their government bond yields (Popov and van Horen 2015). For example, the deterioration of Greek economic conditions triggered contagion to Italy only in June 2011, when spreads on Italian sovereign debt rose abruptly (Bofondi et al. 2013).

¹⁸ We include country-year fixed effects in all specifications because this is the most tightening approach that allow us to control for several unobserved factors time varying at country level. Results are similar if we do not include country-year fixed effects but we control for time fixed effects and country GDP growth (results are available upon request).

level of gross loans as percentage of total assets. Moreover, a higher level of NPLs increases banks' exposure to sovereigns, being it associated to a greater percentage of government bonds to total assets. A similar substitution effect from loans towards government bonds is also explained by the coverage ratio. In line with our expectations, we find evidence of a strong positive correlation between the Tier 1 ratio and loan growth rate, with no (or limited) relation with the share of loans and government bonds to total assets.

Table 5 shows regression results that allow for differential effects of NPLs during the period 2010–2014, which includes the Euro sovereign crisis (odd columns). Even columns introduce a dummy indicating the differential effects of the Sovereign crisis in Euro-Periphery countries and interaction with NPLs that allow us to assess the effect of risky loans during the crisis period in stressed countries. Our specification becomes:

$$\begin{aligned}
Y_{ijt} = & \alpha_0 Post_t + \beta_1 Post_t x NPL_{ijt-1} + \\
& + \beta_0 NPL_{ijt-1} + \gamma_0 Cov_{ijt-1} + \delta_0 Tier1_{ijt-1} + \\
& + \alpha_1 Post_t x Peri_{ij} + \alpha_2 Peri_{ij} x NPL_{ijt-1} + \beta_2 Post_t x Peri_{ij} x NPL_{ijt-1} + \\
& + \theta X_{ijt-1} + \mu_{jt} + \lambda_i + \varepsilon_{ijt}
\end{aligned} \tag{2}$$

First, the effect of a higher NPL ratio on bank investment strategy confirms our previous findings: a poorer loan quality slows down lending, reduce the allocation of resources to loans and leads to higher holdings of government bonds. Focusing on the crisis years (variable *Post*), on average we find evidence over 2010–2014 of higher loan growth rate, no impact on the share of loans to total assets, and a slight increase in the allocation of resources to government bonds, as a percentage of total assets. In crisis years, the main effect of NPLs (*PostxNPL* variable) on banks' allocation strategy is the reduction of the sovereign exposure. Precisely, an increase in one standard deviation of the NPL ratio is associated to a reduction of 0.404 percentage points in government bonds ratio, corresponding to a decline of 23.8% for the average bank with an exposure to sovereign bonds of 11.46% and a standard deviation of NPL ratio of 6.74%. When we control for geographical heterogeneity, we find that the effect of NPLs is not different in Euro-Periphery relative to other countries in our sample in crisis years, being the coefficient of *PostxPerixNPL* not statistically significant.

In Table 6, we introduce the interaction of *Cov* and *Tier1* with the *Post* dummy (odd columns) to allow for differential effects of provision policies and capitalization during the sovereign crisis. Next, we ask whether during the sovereign debt crisis banks located in a Euro-Periphery country have behaved differently, relative to banks from non-distressed European countries. To this end, even columns present results from our full specification that also include periphery dummies. The Table shows that Euro-Periphery banks since the Euro debt crisis (*PostxPeri*) have slowed down their credit supply and reduced the allocation to gross loans as a percentage of total assets, given the negative coefficients of the *PostxPeri* variable as for the loan growth rate and the loan to total assets ratio. Although the impact on the whole loan portfolio is negative, in terms of composition, we uncover a strong and positive effect on the residential mortgages to total asset ratio,

suggesting that Euro-Periphery banks allocated to this loan category more resources than in the past and relative to non-Periphery banks.

The effect of capitalization and provisioning varies according to the time horizon considered. On average, over the entire period we find (as before) that a higher Tier 1 is associated to a higher loan growth rate (as before) and to a lower loan to total asset ratio. The negative impact on the share of loan to total assets seems to be driven by the reduction in the mortgage portfolio. If we allow for heterogeneous effects of our main treatment variables in peripheral countries in crisis years (*PostxTier 1* and *PerixTier1*), most coefficients lose significance. Focusing on provisioning policies, on average a higher coverage ratio is associated to a smaller loan portfolio, and conversely to a larger holding of government bonds, as a percentage of total assets. Interestingly, in crisis years (*PostxCov*), the nexus between a larger coverage ratio and the loan to total asset ratio turns positive. By interacting our main treatment variables with the Euro-Periphery dummy, most of results lose significant, as variability in the outcome variable is primarily driven by the *PostxPeri* dummy. This finding suggests that the explanatory power of country specificity in crisis years dominate bank specific factors.

Focusing on the effects of NPLs, the Table confirms our previous evidence. Particularly, we uncover as before a negative relation with our main bank lending variables. On the other hand, we find a positive nexus between NPLs and public debt, which, however, turns negative when we include the *PostxNPL* variable. Such an evidence suggests that in normal times, a deterioration of loan portfolio quality has a flight to quality effect, with a reallocation from “risky” loans to “safe” public securities (Berger and Udell 1994). When sovereign risk increases, as it occurs during a sovereign crisis, it is plausible that banks already exposed to credit risk may want to reduce further sources of risk by cutting back their allocation to public debt. Interestingly, there is no evidence of differential behavior for periphery banks, since the coefficient of the interaction *PostxPerixNPL* is not statistically significant. Plausibly, banks from distressed countries during the Euro crisis might have opposite incentives that compensate each other as for their asset allocation strategy. In principle, one may expect these banks to cut back their holdings of “risky” domestic public bonds by more than banks from less-hit countries.¹⁹ On the other hand, they might be persuaded by their governments to purchase domestic sovereign debt, in line with the moral suasion or financial repression hypothesis (Altavilla et al. 2016; Becker and Ivashina 2014). Or, consistently with the risk shifting hypothesis (Acharya et al. 2016) they may want to do so voluntarily, especially if they are weak banks in search for high yield to compensate lower profits due to their increased stock of bad loans.²⁰

¹⁹ Unfortunately, we are unable to measure banks’ exposure to more stressed countries because BANKSCOPE does not report the nationality of public bonds. However, the BANKSCOPE measure is a plausible proxy for the *domestic* public bonds held by banks in our sample according to Gennaioli et al. (2014), who find that about 75% of European banks’ bond holdings correspond to domestic bonds.

²⁰ Precisely Acharya et al. (2016) look at weak-capitalized GIIPS banks to test the risk-shifting hypothesis. Risky domestic sovereign bond holdings offer relatively high return and at the same time has a very high correlation with the banks’ portfolio. The latter is important since a proper “risk-shifting asset” generates large losses only when the bank is in

5. Role of provisioning and capitalization

We are interested at this stage in studying the role played by loan loss reserves and capitalization in mitigating the effect of higher NPLs. Precisely we want to explore to what extent “prudent” provisioning policies and “sound” regulatory capital position may act as buffers and shield lending when the loan portfolio deteriorates. Because previous results may be affected by the potential endogeneity of the coverage ratio and Tier 1 variables,²¹ we purge our specification of this variation by using only the level of coverage ratio and Tier 1 *prior* to the start of the Euro crisis, and sorting banks into high-coverage and high-capitalized banks relative to low-coverage and low-capitalized banks. We therefore re-estimate model (2) two sub-samples of banks defined by coverage ratio and Tier 1 ratio as pure “treatment” dummies in a difference-in-difference framework.²² We define the two treatment variables (*HCov* and *HTier1*) as time invariant dummies zero/one indicating whether the bank was below/above the median²³ of that ratio in the pre-crisis period (2005-2009), and estimate model (2) respectively in the treated and in the control groups. Again, we include Euro-Periphery dummies interacted with the NPL variable, and we control for bank FEs, country-year FEs, and observable measures of size, asset quality, liquidity, and reliance on customer deposits.²⁴

Tables 7 and 8 refer to this identification strategy and present new estimate results. Precisely, the Tables show results for the loan growth rate (Columns 1-2), the share of gross loans, government bonds, corporate loans, and residential mortgages to total assets (columns 3-4, 5-6, 7-8, and 9-10 respectively), before and after the onset of the Euro debt crisis, as a function of their loan portfolio quality and conditioning on the level of loan provisioning (*High Cov* vs. *Low Cov*) and capitalization (*High Tier1* vs. *Low Tier1*) calculated before 2010. We estimate simultaneously the effect of NPLs since the onset of the Euro debt crisis, and investigate the possibility of a heterogeneous impact of bad loans on lending and allocation strategy for high-coverage (High-Tier 1) ratio vs. low-coverage (Low-Tier1) banks.

Focusing on Table 7, we find partial evidence of a shielding effect on lending played by provisioning, especially during the Euro crisis in banks from distressed countries. To complement previous analysis on the impact of the dummy *PostxPeri*, we find a negative effect on loan growth rate and gross loan to total asset ratio in banks with a low coverage ratio. We also find an opposite allocation strategy between high- and low-coverage banks from distressed countries (relative to non-periphery banks), in that the former group increases

default anyway (which is true for the domestic sovereign bond holdings of GIIPS banks as they often exceed their core capital). In addition, Eurozone regulators consider these bonds to be risk-free and have removed the concentration limits for sovereign debt exposures, which allows large bets without having to provide equity capital.

²¹ In principle, a change in loan growth (and/or in the asset composition) may lead to a change of provisioning behaviour, and regulatory capital position.

²² See Duchin et al. (2010) for a similar approach.

²³ Main results are not driven by the choice of the threshold that determines treated and control groups. As robustness exercise we re-estimate our model using the “mean” of the coverage ratio and the Tier1 before 2010 to define *High Cov* and *Low Cov* banks, and main results are unaffected (results are available upon request).

²⁴ Unlike previous specifications, due to a drop in observations we cannot carry out this analysis on the subcategories of corporate and residential mortgages loans. We therefore focus only on the impact of bank loan portfolio quality on loan growth rate, gross loans to total assets, and government bonds to total assets.

their holdings of public debt while the latter reduces their sovereign exposure during the crisis years. Looking at the effect of poor loan quality on lending, the negative impact of NPLs on the share of loans to total assets is stronger for low-coverage ratio banks relative to high-coverage ratio banks. Consistently, the impact of bad loans on public bonds is stronger for the former than for the latter group, as the share of government bonds increases more for low-coverage institutions than for banks with more prudent provisioning. Overall, there are no significant heterogeneous effects during crisis years and/or in periphery countries, as the coefficients for the *NPLxPost*, *NPLxPeri*, and *NPLxPostxPeri* variables remain insignificant across our main specifications.

Finally, results on the role played by capitalization are ambiguous (Table 8). Overall, we do not see any remarkable heterogeneous behavior in the sub samples of high- *vis à vis* low- capitalized banks. We find only partial evidence of that in the subsample of low-capitalized banks there exists a negative impact on lending (i.e., on the share of loan to total assets) driven by geographical location and crisis years, as shown by the significantly negative coefficient of the dummy *PostxPeri*. Focusing on the effect of NPLs variables, there is some evidence of a more prudent investment strategy in banks with larger capital buffer. In fact, while insignificant for the low-tier 1 institutions, the relation between the NPL and the loan to total asset ratios is on average negative in the subsample of high-Tier 1 banks. Consistently, the relation between NPLs and sovereign exposures is significant, with a positive sign, only for banks with a larger capital buffer.

6. Conclusions

The process of repair the banking system in Europe is underway. Following regulators' pressures, banks have deleveraged and strengthened their capital positions. Nonetheless, the average poor quality of loan portfolio remains a key issue for several European banks. This paper analyzes the role of banks loan quality in explaining lending patterns in Europe before and after the onset of the Euro sovereign debt crisis. We study the growth of total gross loans and, separately, we examine banks' asset composition by looking at corporate and residential mortgage loan over total asset ratios, as well as at the share of government bonds over total assets. Although differences in the definition of NPLs as well in provisioning practices make it difficult the comparison across banks and countries, our results suggest that poor loan quality, capitalization, and loan loss provisioning matters in explaining asset allocation strategies of banks in crisis period. We uncover different behaviors across banks from distressed countries, relative to banks from countries with a sounder fiscal position.

Our results confirm the existence of a negative nexus between poor loan quality and lending, since a higher NPL ratio explains a reduced loan growth and a lower allocation to loans (as a percentage of total assets) at the advantage of government debt. Such an effect is strong and consistent across specifications.

We find some evidence of a shielding effect played by provisioning on lending, especially during the Euro crisis in banks from distressed countries. As for the role played by capitalization, results are mixed and

we cannot conclude that high-capitalized banks are better able to protect lending. Similarly, we uncover only limited evidence that a more prudent provisioning and larger capital buffer can mitigate the negative effect of poor loan quality on bank lending.

Overall, our analysis confirms the urgent need to tackle Europe's non-performing loan problem, being poor loan portfolio quality a drag on bank lending. This finding holds across different specifications and over and above other factors that may affect credit supply. Moreover, although beneficial *per se*, prudent provisioning and better capitalization does not seem sufficient tools to compensate for the negative impact of NPLs on lending. Particularly, holding a large capital buffer seems a less powerful strategy (compared to prudent provisioning) to shield bank lending in a context of poor loan quality.

Identifying what is at the heart of the differences in bank behavior across European regions is however difficult. We offer some explanations based on the evidence we are able to gather and point to the need of greater transparency and homogeneity to better understand the role played by bad loans in influencing European banks' resource allocation strategy.

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Figure 1: The evolution of NPLs in Europe

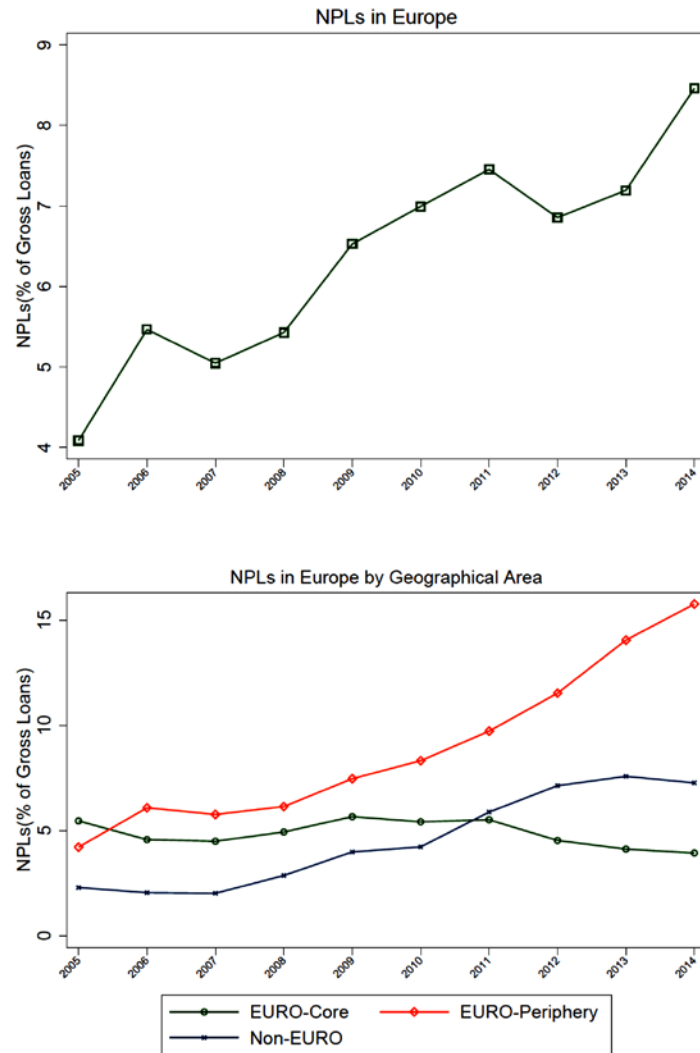


Figure 2: The evolution of coverage ratio in Europe

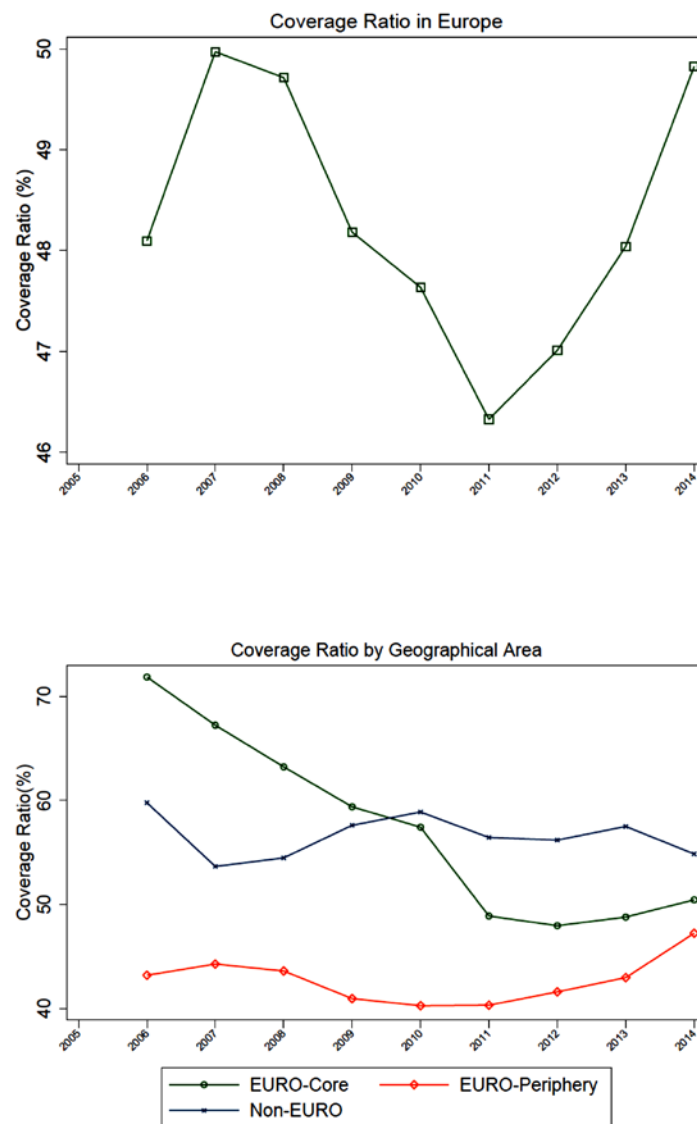


Figure 3: The evolution of Tier 1 capital ratio in Europe

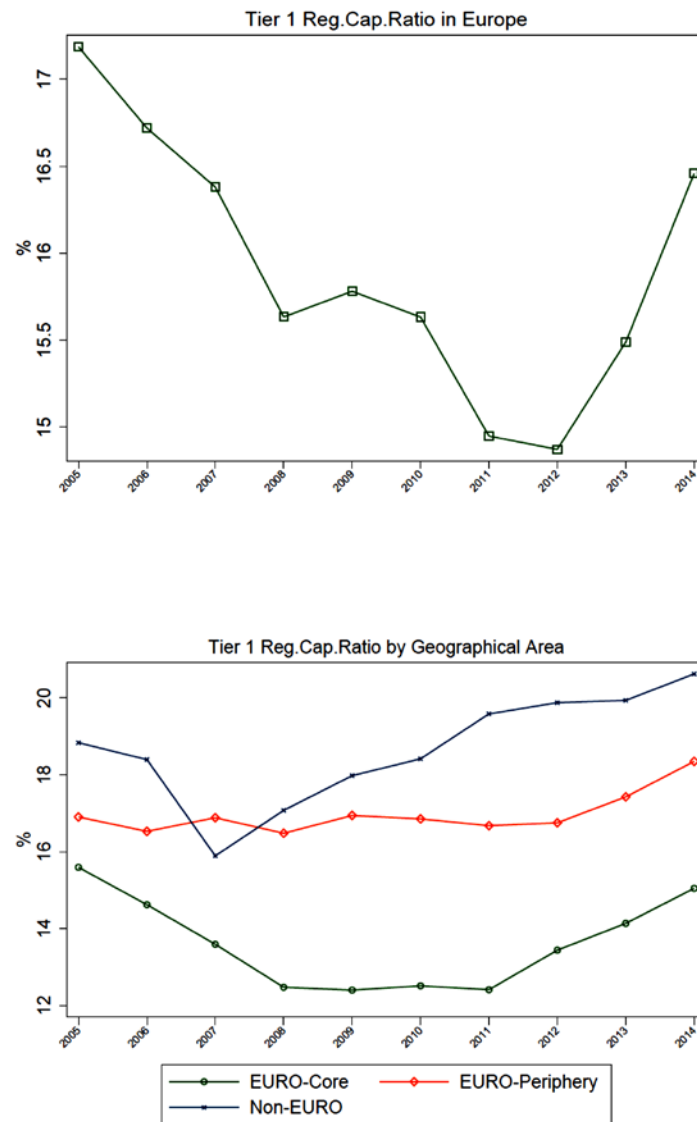


Figure 4: The association between NPL ratio and loan growth over time

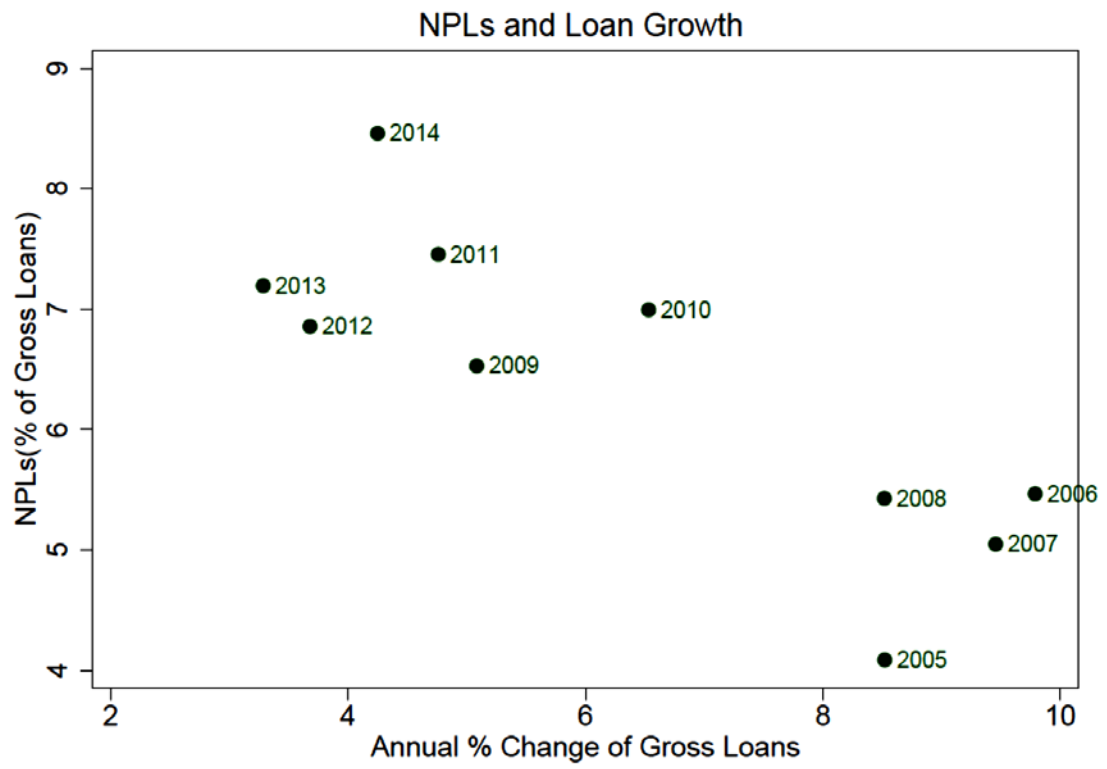


Table 1: Variable definitions and descriptive statistics

Variable	Definition	Mean	P10	P50	P90	St.Dev.	N. Bank-year obs.
Loan growth	Annual % change of gross loans (in local currency)	6.32	-7.05	3.33	20.20	25.05	34,749
Gross loans	Gross loans (as % of Assets)	56.96	20.02	60.91	82.88	23.70	36,889
Government bonds	Government bonds (as % of Assets)	6.07	0.00	2.03	18.57	9.78	25,191
Corporate loans	Corporate loans (as % of Assets)	18.29	0.17	3.15	69.71	27.79	16,713
Residential mortgages	Residential mortgages (as % of Assets)	26.22	3.63	26.48	45.00	16.95	12,141
NPL	Total non-performing loans (% of gross loans)	6.81	0.94	4.66	15.39	6.74	12,875
Coverage ratio (Cov)	Reserves for non-performing loans (as % of NPLs)	49.79	23.16	46.67	86.23	23.10	12,387
Tier1	Tier 1 regulatory capital ratio (%)	15.73	8.61	13.41	24.18	9.21	37,109
Total assets	Total assets (billion, in local currency)	12.02	0.09	0.69	11.57	73.37	37,120
Size	Log (Assets)	13.69	11.43	13.45	16.26	1.96	37,120
Customer Dep.	Total customer deposits (as % of Assets)	60.41	19.12	68.69	84.35	24.51	37,120
Liquidity	Cash and due from banks (as % of Assets)	2.24	0.11	1.40	3.10	5.59	35,052

Note: The table reports variable definitions and descriptive statistics for the whole sample of European banks over 2005-2014.

Table 2: Non-performing loans (% of gross loans) in Europe before and after the sovereign crisis

	BEFORE 2005-2009	AFTER 2010-2014
EURO-Core		
AUSTRIA	3.6	9.2
BELGIUM	2.6	8.1
FINLAND	0.7	0.8
FRANCE	5.3	6.1
GERMANY	5.2	3.9
LUXEMBOURG	3.6	4.2
NETHERLANDS	2.3	3.1
EURO-Periphery		
GREECE	5.9	17.9
IRELAND	5.7	14.7
ITALY	6.6	11.9
PORTUGAL	3.5	7.8
SPAIN	3.1	8.1
Non-EURO		
DENMARK	2.2	13.6
SWEDEN	1.7	1.9
UNITED KINGDOM	4.4	6.2

Note: The table reports simple average NPL to total gross loans ratios before and after the sovereign crisis, by country.

Table 3: Correlation matrix

	NPL	Cov	Tier1	Log (Assets)	Customer Dep.	Liquidity
NPL	1.00					
Cov	-0.18	1.00				
Tier1	0.06	0.05	1.00			
Log (Assets)	-0.15	0.28	-0.14	1.00		
Customer Dep.	-0.17	-0.06	-0.10	-0.30	1.00	
Liquidity	0.03	0.10	0.07	-0.06	0.03	1.00

Note: The table shows the matrix of correlations between main explanatory variables used in the regression analysis. Variables definition given in Table 1.

Table 4: Loan portfolio quality and bank lending

Dep. Var.	Loan growth (1)	Gross loans (2)	Government bonds (3)	Corporate loans (4)	Residential mortgages (5)
NPL	-0.409*** (0.084)	-0.197*** (0.058)	0.316*** (0.069)	-0.123 (0.096)	-0.079 (0.080)
Cov	0.008 (0.026)	-0.073*** (0.015)	0.038*** (0.013)	-0.018 (0.013)	0.028** (0.012)
Tier1	0.432*** (0.137)	-0.086 (0.071)	0.080 (0.056)	0.025 (0.107)	0.281* (0.167)
Log (Assets)	-13.937*** (3.301)	-2.342 (2.095)	5.879** (2.490)	6.186 (5.257)	1.000 (4.156)
Customer Dep.	-0.046 (0.088)	0.143*** (0.046)	-0.074** (0.032)	0.012 (0.048)	0.007 (0.059)
Liquidity	0.061 (0.281)	-0.021 (0.099)	-0.057 (0.062)	-0.019 (0.147)	0.349* (0.207)
Constant	192.755*** (48.464)	91.540*** (30.003)	-64.547* (34.958)	-72.032 (74.374)	21.945 (56.214)
Observations	7,745	7,769	6,750	2,674	2,551
N. banks	2,157	2,157	1,916	1,340	1,307
Country-Year FE	Yes	Yes	Yes	Yes	Yes
Bank FE	Yes	Yes	Yes	Yes	Yes
Mean (Y)	5.392	64.47	11.46	11.69	40.87
St. Dev. (Y)	14.67	18.23	12.30	23.83	20.67

Note: The table reports basic regression results for our dependent variables (Columns 1-5) over 2005-2014. All right-hand side variables are lagged one period with respect to left-hand side outcomes. Bank fixed effects, and country-year fixed effects are included. Variables * p<0.10, ** p < 0.05, *** p < 0.01.

Table 5: Loan portfolio quality and bank lending (sovereign crisis and stressed countries)

Dep. Var.	Loan growth		Gross loans		Government bonds		Corporate loans		Residential mortgages	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
NPL	-0.585*** (0.127)	-1.548 (1.065)	-0.252*** (0.072)	-0.563* (0.310)	0.452*** (0.104)	0.542*** (0.192)	-0.189 (0.188)	0.057 (0.090)	1.630 (1.215)	2.397 (1.677)
NPLxPost	0.213* (0.127)	1.272 (1.017)	0.066 (0.071)	0.284 (0.300)	-0.165** (0.073)	-0.404** (0.190)	0.067 (0.142)	-0.032 (0.086)	-1.725 (1.240)	-2.481 (1.695)
NPLxPeri		0.996 (1.069)		0.327 (0.316)		-0.085 (0.216)		-0.662 (0.576)		-2.931* (1.763)
NPLxPostxPeri		-1.106 (1.023)		-0.221 (0.310)		0.248 (0.205)		-0.073 (0.574)		2.735 (1.692)
Post	36.234** (15.412)	33.007** (15.892)	7.104 (6.877)	6.445 (7.095)	9.416* (4.931)	10.256** (4.673)	2.197 (2.073)	1.944 (1.918)	5.077 (7.746)	9.596 (10.778)
PostxPeri		-44.819** (18.114)		-19.221** (9.756)		-2.106 (5.315)		4.335 (4.469)		-18.760 (13.125)
Cov	0.005 (0.026)	0.008 (0.027)	-0.074*** (0.015)	-0.075*** (0.015)	0.041*** (0.013)	0.039*** (0.013)	-0.018 (0.013)	-0.013 (0.009)	0.027** (0.012)	0.026** (0.012)
Tier1	0.449*** (0.138)	0.450*** (0.138)	-0.080 (0.071)	-0.081 (0.071)	0.067 (0.056)	0.065 (0.056)	0.025 (0.107)	0.068 (0.125)	0.264* (0.150)	0.256* (0.145)
Log (Assets)	-13.696*** (3.325)	-13.733*** (3.310)	-2.266 (2.097)	-2.307 (2.095)	5.678** (2.468)	5.665** (2.474)	6.197 (5.253)	5.194 (4.407)	-0.394 (4.013)	-0.984 (4.089)
Customer Dep.	-0.046 (0.088)	-0.046 (0.088)	0.143*** (0.046)	0.144*** (0.046)	-0.074** (0.032)	-0.074** (0.032)	0.011 (0.047)	-0.018 (0.034)	-0.044 (0.081)	-0.071 (0.088)
Liquidity	0.063 (0.283)	0.058 (0.283)	-0.021 (0.099)	-0.020 (0.099)	-0.061 (0.065)	-0.055 (0.065)	-0.019 (0.146)	-0.045 (0.143)	0.342 (0.211)	0.382* (0.221)
Constant	152.718*** (49.047)	183.000*** (46.750)	83.249*** (30.637)	96.036*** (29.994)	-70.800** (35.724)	-69.966** (34.616)	-74.342 (74.129)	-59.462 (61.735)	39.702 (53.928)	45.738 (54.854)
Observations	7,745	7,745	7,769	7,769	6,750	6,750	2,674	2,674	2,551	2,551
N. Banks	2,157	2,157	2,157	2,157	1,916	1,916	1,340	1,340	1,307	1,307
Country-Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Bank FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Mean (Y)	5.392	5.392	64.47	64.47	11.46	11.46	11.69	11.69	40.87	40.87
St. Dev. (Y)	14.67	14.67	18.23	18.23	12.30	12.30	23.83	23.83	20.67	20.67

Note: All right-hand side variables (NPL, Cov, Tier1, Log (Assets), Customer Deposits, Liquidity) are lagged one period with respect to left-hand side outcomes. The dummy *Post* is equal to one since 2010, and zero otherwise. *Peri* is an indicator variable for banks located in Euro-Periphery countries (Greece, Ireland, Italy, Portugal, and Spain). Bank fixed effects, and country-year fixed effects are included. Variables * p<0.10, ** p < 0.05, *** p < 0.01.

Table 6: Loan portfolio quality and bank lending (Tier 1 and coverage ratios)

Dep. Var.	Loan growth		Gross loans		Government bonds		Corporate loans		Residential mortgages	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
NPL	-0.506*** (0.145)	-1.582 (1.075)	-0.230*** (0.073)	-0.527* (0.298)	0.468*** (0.105)	0.538*** (0.177)	-0.141 (0.149)	0.067 (0.076)	-1.692** (0.759)	-1.885** (0.834)
NPLxPost	0.134 (0.136)	1.154 (1.037)	0.072 (0.073)	0.417 (0.294)	-0.176** (0.072)	-0.470*** (0.176)	0.013 (0.117)	-0.026 (0.075)	1.631** (0.759)	1.827** (0.831)
NPLxPeri		1.138 (1.084)		0.291 (0.306)		-0.057 (0.205)		-2.101* (1.122)		3.487* (1.875)
NPLxPostxPeri		-1.072 (1.043)		-0.347 (0.304)		0.302 (0.190)		0.883 (0.899)		-3.483* (1.790)
Post	39.000** (15.545)	36.063** (17.897)	2.464 (7.094)	-0.134 (8.650)	9.361* (4.855)	12.363*** (4.766)	5.232* (3.120)	3.176 (2.429)	-41.644*** (9.738)	-47.984*** (7.746)
PostxPeri		-44.767** (20.111)		-17.856* (10.761)		-4.400 (5.558)		-2.787 (14.050)		78.186** (33.394)
PostxCov	-0.069** (0.030)	-0.053 (0.099)	0.057*** (0.015)	0.055 (0.045)	-0.004 (0.016)	-0.023 (0.029)	-0.021 (0.025)	-0.017 (0.013)	-0.286** (0.112)	-0.264** (0.120)
PostxTier1	0.079 (0.086)	0.030 (0.337)	0.094** (0.039)	0.207 (0.153)	0.027 (0.037)	-0.023 (0.097)	-0.100* (0.051)	0.024 (0.065)	4.392*** (0.849)	4.851*** (0.600)
PerixCov		0.071 (0.097)		-0.069 (0.049)		0.018 (0.034)		-0.266 (0.191)		0.456 (0.657)
PeriXTier1		0.039 (0.427)		0.052 (0.194)		0.026 (0.121)		0.962 (0.991)		1.259 (3.252)
PostxPerixCov		-0.011 (0.105)		-0.009 (0.048)		0.023 (0.034)		0.085 (0.174)		-0.529 (0.666)
PostxPeriXTier1		0.058 (0.347)		-0.114 (0.158)		0.053 (0.104)		-0.443** (0.201)		-1.618 (3.095)
Cov	0.043 (0.032)	-0.009 (0.090)	-0.104*** (0.016)	-0.052 (0.044)	0.043*** (0.015)	0.030 (0.028)	0.002 (0.027)	0.015 (0.012)	0.317*** (0.111)	0.297** (0.119)
Tier1	0.430*** (0.151)	0.397 (0.397)	-0.155** (0.072)	-0.210 (0.178)	0.054 (0.059)	0.032 (0.103)	0.122 (0.125)	-0.001 (0.054)	-4.173*** (0.840)	-4.635*** (0.593)
Log(Assets)	-13.526*** (3.337)	-13.453*** (3.308)	-2.236 (2.161)	-2.382 (2.126)	5.708** (2.464)	5.807** (2.446)	5.983 (5.164)	4.500 (4.216)	-1.253 (4.074)	-1.562 (4.179)
Customer Dep.	-0.048 (0.088)	-0.048 (0.088)	0.150*** (0.046)	0.151*** (0.046)	-0.074** (0.031)	-0.073** (0.031)	-0.001 (0.044)	-0.020 (0.040)	-0.002 (0.051)	0.002 (0.051)
Liquidity	0.084 (0.287)	0.084 (0.287)	-0.033 (0.096)	-0.036 (0.096)	-0.060 (0.065)	-0.051 (0.066)	-0.013 (0.145)	-0.063 (0.193)	0.450* (0.235)	0.436* (0.235)
Constant	148.134*** (49.122)	177.221*** (46.408)	85.290*** (31.530)	99.928*** (30.692)	-71.380** (35.684)	-72.159** (34.422)	-73.456 (73.332)	-50.302 (58.905)	94.861* (56.446)	103.106* (56.943)
Observations	7,745	7,745	7,769	7,769	6,750	6,750	2,674	2,674	2,551	2,551
N. Banks	2,157	2,157	2,157	2,157	1,916	1,916	1,340	1,340	1,307	1,307
Country-Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Bank FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Mean (Y)	5.392	5.392	64.47	64.47	11.46	11.46	11.69	11.69	40.87	40.87
St. Dev. (Y)	14.67	14.67	18.23	18.23	12.30	12.30	23.83	23.83	20.67	20.67

Note: The table reports regression results from specification (2) in section 4 for our dependent variables (Columns 1-10). Interactions of NPL, Cov, and Tier1 variables with the dummy *Post* and the dummy *Peri* are included. All right-hand side variables (NPL, Cov, Tier1, Log (Assets), Customer Deposits, Liquidity) are lagged one period with respect to left-hand side outcomes. The dummy *Post* is equal to one since 2010, and zero otherwise. *Peri* is an indicator variable for banks located in Euro-Periphery countries (Greece, Ireland, Italy, Portugal, and Spain). Bank fixed effects, and country-year fixed effects are included. Variables * p<0.10, ** p < 0.05, *** p < 0.01.

Table 7: Loan portfolio quality and bank lending: the role of provisioning policies

Dep. Var.	Loan growth		Gross loans		Government bonds		Corporate loans		Residential mortgages	
	High Cov (1)	Low Cov (2)	High Cov (3)	Low Cov (4)	High Cov (5)	Low Cov (6)	High Cov (7)	Low Cov (8)	High Cov (9)	Low Cov (10)
NPL	-1.759 (1.223)	-1.877 (1.219)	-0.701* (0.375)	-0.832** (0.409)	0.396*** (0.139)	0.993*** (0.346)	-0.520 (0.313)	-0.453** (0.189)	-0.182 (1.678)	0.058 (0.772)
NPLxPost	1.314 (1.142)	1.367 (1.196)	0.343 (0.326)	0.556 (0.370)	-0.182 (0.113)	-0.578 (0.383)	0.278 (0.256)	0.137 (0.094)	-5.153** (2.512)	-0.186 (0.723)
NPLxPeri	1.215 (1.226)	1.587 (1.238)	0.557 (0.385)	0.584 (0.424)	-0.017 (0.169)	-0.445 (0.391)	-0.589 (1.030)	3.912 (8.032)	-1.114 (1.903)	-0.303 (0.475)
NPLxPostxPeri	-1.145 (1.150)	-1.206 (1.212)	-0.277 (0.340)	-0.577 (0.393)	0.010 (0.129)	0.504 (0.395)	0.003 (1.221)	-3.516 (7.466)	5.248** (2.491)	
Post	24.900 (17.468)	23.069 (23.454)	6.005 (6.256)	6.310 (13.219)	3.120 (2.180)	22.006*** (5.003)	-2.773 (5.667)	5.286*** (0.962)	7.492 (16.464)	8.480 (14.351)
PostxPeri	-26.212 (19.046)	-54.192* (27.558)	-26.709 (8.404)	-13.684** (15.995)	9.503*** (3.358)	-13.961*** (5.243)	0.715 (9.342)	-29.530*** (8.820)	-15.395 (19.248)	-18.623* (10.067)
Cov	0.029 (0.039)	-0.013 (0.055)	-0.081*** (0.022)	0.001 (0.026)	0.033* (0.020)	0.067*** (0.026)	-0.104 (0.081)	-0.167** (0.062)	-0.154*** (0.054)	-0.072 (0.095)
Tier1	0.499*** (0.180)	0.583*** (0.165)	0.004 (0.089)	-0.554*** (0.103)	0.009 (0.068)	0.355*** (0.117)	0.313 (0.753)	0.172** (0.082)	1.090** (0.497)	-0.253 (0.246)
Log(Assets)	-13.130*** (3.962)	-13.170*** (3.850)	-0.827 (2.942)	-6.228* (3.591)	4.538 (3.208)	10.913*** (2.698)	12.748 (10.790)	-1.289 (1.402)	-4.564 (8.621)	0.271 (9.049)
Customer Dep.	-0.186* (0.100)	0.281 (0.183)	0.195*** (0.065)	0.071 (0.060)	-0.079* (0.041)	-0.042 (0.044)	-0.070 (0.139)	-0.158*** (0.021)	-0.050 (0.233)	-0.159 (0.295)
Liquidity	0.012 (0.402)	0.417 (0.573)	-0.002 (0.131)	-0.565*** (0.189)	-0.050 (0.074)	-0.420 (0.450)	-0.242 (0.221)	-0.303*** (0.088)	0.221 (0.504)	0.608 (0.914)
Constant	191.701*** (57.916)	180.942*** (64.643)	86.673** (42.615)	159.296*** (52.161)	-52.997 (45.064)	-138.391*** (37.658)	-130.419 (177.524)	82.248*** (24.567)	119.322 (136.757)	59.064 (137.590)
Observations	3,301	1,840	3,319	1,845	2,893	1,703	219	91	121	62
N. Banks	523	293	523	293	461	265	63	31	35	22
Country-Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Bank FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Mean (Y)	6.757	4.774	65.93	69.13	15.06	15.88	60.57	45.61	32.67	47.15
St. Dev. (Y)	18	13.32	21.56	14.34	13.55	10.94	37.46	42.62	24.94	34.11

Note: The table reports regression results from specification (2) in section 4 for our dependent variables (Columns 1-10) conditioning on pre-crisis bank loan provisioning (*High Cov* vs. *Low Cov*) banks' position. *Low Cov* (*High Cov*) is defined as time invariant dummy equal to zero (one) indicating whether the bank was below (above) the median of that ratio in the pre-crisis period (2005-2009). All right-hand side variables (NPL, Cov, Tier1, Log (Assets), Customer Deposits, Liquidity) are lagged one period with respect to left-hand side outcomes. The dummy *Post* is equal to one since 2010, and zero otherwise. *Peri* is an indicator variable for banks located in Euro-Periphery countries (Greece, Ireland, Italy, Portugal, and Spain). Bank fixed effects, and country-year fixed effects are included. * p<0.10, ** p < 0.05, *** p < 0.01.

Table 8: Loan portfolio quality and bank lending: the role of capitalization

Dep. Var.	Loan growth		Gross loans		Government bonds		Corporate loans		Residential mortgages	
	High Tier1 (1)	Low Tier1 (2)	High Tier1 (3)	Low Tier1 (4)	High Tier1 (5)	Low Tier1 (6)	High Tier1 (7)	Low Tier1 (8)	High Tier1 (9)	Low Tier1 (10)
NPL	-2.066 (1.496)	-0.426 (0.852)	-0.869** (0.382)	0.136 (0.334)	0.363** (0.159)	0.621* (0.330)	0.609 (0.719)	-0.091 (0.163)	-7.233 (6.294)	-0.800** (0.377)
NPLxPost	1.655 (1.445)	0.436 (0.792)	0.551 (0.411)	-0.372 (0.307)	-0.205 (0.149)	-0.581* (0.300)	-0.631 (0.712)	0.005 (0.135)	7.029 (6.406)	0.838** (0.371)
NPLxPeri	1.717 (1.500)	-0.340 (0.887)	0.620 (0.389)	-0.435 (0.362)	0.106 (0.215)	-0.135 (0.346)	-0.565 (0.900)	2.570 (1.652)	7.434 (6.607)	0.967* (0.546)
NPLxPostxPeri	-1.601 (1.453)	-0.117 (0.824)	-0.512 (0.423)	0.512 (0.330)	0.066 (0.176)	0.371 (0.315)	-0.474 (0.710)	-1.345 (0.871)	-6.541 (6.525)	11.153*** (3.631)
Post	60.219* (31.849)	27.339** (13.831)	-3.507 (8.797)	27.717*** (3.654)	18.721*** (4.885)	5.352 (4.651)	-1.545 (3.336)	1.061 (0.933)	-13.664* (7.168)	-10.911* (5.585)
PostxPeri	-73.107** (32.455)	-29.368** (14.126)	-10.778 (10.554)	-39.239*** (4.096)	-10.565* (5.963)	0.312 (4.824)	-0.313 (5.884)	-50.458** (20.904)	12.847* (6.716)	-41.234** (17.591)
Cov	0.040 (0.039)	-0.031 (0.039)	-0.059*** (0.019)	-0.128*** (0.026)	0.035* (0.018)	0.055** (0.021)	-0.050 (0.033)	-0.072** (0.032)	0.080 (0.062)	0.083*** (0.025)
Tier1	0.625*** (0.152)	0.063 (0.355)	-0.186** (0.084)	0.184 (0.134)	0.119 (0.073)	-0.173 (0.124)	0.636 (0.485)	0.210** (0.087)	-0.596 (0.526)	0.447** (0.185)
Log (Assets)	-11.774*** (4.005)	-13.914*** (3.442)	0.512 (2.501)	-11.000*** (2.379)	4.712 (3.439)	8.636*** (2.087)	16.753* (8.831)	-1.008 (1.980)	7.301 (7.182)	-11.827** (5.410)
Customer Dep.	-0.062 (0.134)	-0.008 (0.071)	0.121** (0.047)	0.095* (0.051)	-0.057 (0.044)	-0.092** (0.036)	0.018 (0.087)	-0.083 (0.054)	0.370* (0.192)	-0.002 (0.151)
Liquidity	-0.043 (0.492)	-0.176 (0.320)	-0.149 (0.209)	0.053 (0.119)	-0.069 (0.073)	0.009 (0.139)	-0.207 (0.249)	0.042 (0.081)	1.406* (0.843)	-0.227 (0.623)
Constant	154.603*** (56.319)	206.553*** (51.739)	65.226* (34.896)	233.054*** (35.360)	-51.505 (46.799)	-110.059*** (30.890)	-208.942 (127.225)	50.904 (32.523)	-70.120 (99.000)	210.868** (86.452)
Observations	3,404	2,202	3,414	2,215	3,019	1,938	388	279	293	234
N. Banks	623	415	623	415	548	363	160	121	132	107
Country-Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Bank FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Mean (Y)	6.466	5.013	62.58	72.41	17.30	10.35	33.20	31	43.35	41.34
St. Dev. (Y)	17.42	13.56	17.90	19.37	13.37	10.27	40.03	37.88	24.75	22.02

Note: The table reports regression results from specification (2) in section 4 for our dependent variables (Columns 1-10) conditioning on pre-crisis bank capitalization (*High Tier1* vs. *Low Tier1*). *Low Tier1* (*High Tier1*) is defined as time invariant dummy equal to zero (one) indicating whether the bank was below (above) the median of that ratio in the pre-crisis period (2005-2009). All right-hand side variables (NPL, Cov, Tier1, Log (Assets), Customer Deposits, Liquidity) are lagged one period with respect to left-hand side outcomes. The dummy *Post* is equal to one since 2010, and zero otherwise. *Peri* is an indicator variable for banks located in Euro-Periphery countries (Greece, Ireland, Italy, Portugal, and Spain). Bank fixed effects, and country-year fixed effects are included. * p<0.10, ** p < 0.05, *** p < 0.01.