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Macroprudential policy instruments and procyclicality of loan-loss provisions – cross-country evidence

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Abstract

We analyze the effectiveness of various macroprudential policy instruments in reducing the procyclicality of loan-loss provisions (LLPs) using individual bank information from over 65 countries and applying the two-step GMM Blundell-Bond (1998) approach with robust standard errors. Our research identifies several new facts. Firstly, borrower restrictions are definitely more effective in reducing the procyclicality of loan-loss provisions than other macroprudential policy instruments. This effect is supported in both unconsolidated and consolidated data and is robust to several robustness checks. Secondly, dynamic provisions, large exposure concentration limits and taxes on specific assets are effective in reducing the procyclicality of loan-loss provisions. And finally, we find that both loan-to-value caps and debt-to-income ratios, are especially effective in reducing the procyclicality of LLP of large banks. Off-balance-sheet restrictions, concentration limits and taxes are also effective in reducing the procyclicality of LLP of large banks. Dynamic provisions reduce the procyclicality of LLP independently of bank size.

Key words: macroprudential policy, loan-loss provisions, business cycle, procyclicality

JEL classification: E32, G21, G28, G32

Contents

1. Introduction

The procyclicality of banking activity, and the financial sector in general, has been of interest to the academic community for many years. The importance of this phenomenon has been highlighted e.g. by Keynes (1936). This problem has also been discussed by Minsky (1986), the proponent of the hypothesis of the inherent instability of the economy. However, in practice in the policy of governments, it had been largely ignored up to 2007, when the world financial crisis broke out. Nowadays – along with interconnectedness between financial intermediaries, in particular those deemed Too-Big-To-Fail – it has become one of the major areas of management of systemic risk, directed at reduction of financial instability and realized as a macro-prudential policy objective. This procyclicality is present in many dimension of banking activity (leverage, credit, liquidity as well as loan-loss provisions). However, the basic factor behind (particularly excessive) procyclicality is excessive risk-taking during economic booms, and increased risk-aversion in economic busts (Borio et al., 2001; Borio, 2009). In this paper we look at one dimension of banking activity, with the salient role in procyclicality of bank lending activity, i.e. loan-loss provisions and their sensitivity to business cycle.

Loan-loss provisions are accruals of fundamental importance to bank performance and due to the fact that they are estimates of loan losses, they reflect information asymmetry (Beatty and Liao, 2014) which matters for bank risk-taking. They are also an important channel through which a biased assessment of risk can weaken banks' balance sheets and amplify financial cycle (Galati and Moessner, 2011, Borio et al., 2001). Inadequate responses of banks to risk throughout the business (and financial) cycle are seen as an important driver of excessive procyclicality of the banking sector (Borio and Zhu, 2012), leading to disturbances in provision of financial services to non-financial sector with negative implications for the real economy. Loan-loss provisioning practices of banks are perceived as one of the very important sources of this procyclicality. Borio et al., (2001) argue that accounting practices, tax constraints and risk assessment methodologies cause provisions to increase during business-cycle downturns, thus creating a supply-side burden in lending extension activity. Beatty and Liao (2011) provide empirical evidence that late recognition of loan-loss provisions results in greater sensitivity of large banks loans growth to capital ratios. Therefore, loan-loss provisions, and their levels throughout the business cycle, and thus their sensitivity to business cycle, seem to be significant factor in explaining availability of bank lending to the non-financial sector. And access to credit is a very important driver of growth of non-financial firms (Volk and Trefalt, 2014).

Previous evidence on loan-loss provisions and their sensitivity to the business cycle shows that loan-loss provisions tend to be procyclical, because they increase in economic downturns and decrease in economic upturns (Laeven and Majnoni, 2003; Bikker and Metzemakers, 2005; Skała 2015; Olszak et al., 2016). This procyclicality is however diversified, and differs between OECD and EU countries (Bikker and Metzemakers, 2005), between several countries around the world (Laeven and Majnoni, 2003) as well as between each of the EU countries (Olszak et al., 2016). These differences may be explained to some extent by regulatory, supervisory as well as investor protection and financial sector structure and development. In this paper we ask about another factor in this diversity, that is the role of macroprudential policy instruments in procyclicality of loan-loss provisions.

As for macroprudential policy and its effects on procyclicality of banking activity, the evidence is increasing, but is still very fragmented (see Galati and Moessner, 2014 and Claessens, 2014). Some recent cross-country studies show that macroprudential instruments are effective in reducing the procyclicality of credit growth and leverage (i.e. the sensitivity of credit and leverage to the business cycle; see Lim et al., 2011), as well as being effective in taming credit growth, leverage and/or asset growth (Claessens et al., 2014; Cerutti et al., 2015; Alper et al., 2014; Vadenbusche et al., 2012). Taken together, the empirical evidence on the countercyclical effects of macroprudential policy is still preliminary. In particular, it does not focus on the role of macroprudential policies in the cyclicality of loan-loss provisions. We contribute to this existing research by studying the impact of a broad set of macroprudential policy instruments on the procyclicality of loan-loss provisions. Following Cerutti et al. (2015) we differentiate between borrowers and lender-based policies. Considering the fact that bank size matters for bank risk-taking (due to the too-big-too-fail problems) and thus procyclicality of loan-loss provisions, we look at the effects of macroprudential instruments on procyclicality of LLP in large, medium and small banks. We also capture the bank size by conducting separate analysis in banks reporting unconsolidated and consolidated financial statements, because this factor has been found to be an important determinant of procyclicality of LLP (Olszak et al., 2016). Studies on the use of macroprudential policies show that this use differs between advanced and emerging economies as well as between open-capital-account and closed-capital-account countries (see Cerutti et al., 2015). Therefore, we look at differences in the effects of macroprudential policies on the sensitivity of LLP to the business cycle in country groups classified by economic development and capital-account openness.

We analyze the effectiveness of various macroprudential policy instruments in reducing procyclicality of loan-loss provisions, using individual bank information from over 65 countries. Grouping macroprudential policy instruments into those affecting borrowers by restricting their access to new loans and into those related to balance sheets of banks, and thus having impact on bank risk-taking, we are able to propose several new observations. Firstly, borrower restrictions are definitely more effective in reducing procyclicality of loan-loss provisions than other macroprudential policy instruments. This effect is supported in both unconsolidated and consolidated data and is robust to several robustness checks. Secondly, of the instruments affecting risk-taking by banks and thus their resilience, we find that dynamic provisions, large exposure concentration limits and taxes on specific assets are effective in reducing the procyclicality of loan-loss provisions. And finally, looking the role of bank size, we find that both loan-to-value caps and debt-to-income ratios, are more effective in reducing the procyclicality of LLP of large banks. Of balance sheet restrictions, concentration limits and taxes are also more effective in reducing the procyclicality of LLP of large banks. Dynamic provisions reduce procyclicality of LLP in all banks and their impact is statistically significant independent of bank size. What's more it is small banks that benefit most from reduced procyclicality of LLP.

The rest of the paper is organized as follows. Section 2 reviews literature and presents hypotheses development. Section 3 describes the data set applied and the methodology used to test our hypotheses. Section 4 includes analysis of our empirical results, and their robustness checks. Section 5 presents conclusions.

2. Literature review and hypotheses development

Our study extends and complements two strands in the accounting and finance literature: studies on loan-loss provisions, especially the procyclicality of LLP, and studies on macroprudential policies, in particular the effectiveness of macroprudential policy instruments.

The vast majority of studies on loan-loss provisions address the procyclicality of LLP in a cross-country context (Laeven & Majnoni, 2003; Bikker & Metzemakers, 2005; Fonseca & Gonzalez, 2008; Bouvatier & Lepetit, 2008; Floro, 2010; Olszak et al., 2016) and generally suggest that LLPs are negatively affected by the business cycle. In a theoretical setting, the procyclicality of LLP, in particular total net loan-loss provisions (covering both net specific provisions and general provisions) is a symptom of inadequate risk-taking by banks throughout the business cycle. During favorable conditions banks perceive risk as low or negligible, thus relax lending standards, and

extend more loans to borrowers with overall poor creditworthiness (see Borio et al., 2001; Berger and Udell, 2004; Bikker & Metzemakers, 2005; Borio and Zhu, 2012). In effect, credit growth is increasing and financial leverage turns excessive (Bank of England, 2009). During this time the overall quality of the lending portfolio is also improving, due to the decreases in the non-performing loans ratio. However, as the background economic conditions worsen, more loans turn non-performing and the quality of the loan portfolio is decreasing (for empirical evidence on behavioral factors behind this refer to Rajan, 1994; Berger and Udell, 2004 and Röthelli, 2012; more general evidence is given in Dell' Ariccia et al., 2012b). Thus banks become unwilling to extend new loans, which affects negatively economic growth and, generally, investments in the real economy. In our study we focus on cross-country data set to find out whether the negative association between LLP and the business cycle is affected by macroprudential policy instruments. In particular, we are interested if macroprudential policy reduces the procyclicality of loan loss provisions.

The ultimate objective of macroprudential policy is to contribute to the safeguarding of the stability of the financial system as a whole. In practical terms, macroprudential policy aims at achieving two objectives (CGFS, 2010; FSB-BIS-IMF, 2011; CGFS, 2012). The first is to strengthen the resilience of the financial system to economic downturns and other adverse aggregate shocks. The second is to reduce the build-up of vulnerabilities (and financial risks). Although those two aims sound as if they were separate policy targets, they are not mutually exclusive, and they both go beyond the purpose of microprudential policy and supervision of assuring that individual firms (banks) have sufficient capital and liquidity to absorb shocks. To achieve theses aims, macroprudential policy needs to use tools, i.e. macroprudential instruments. Currently the available toolkit of macroprudential policy covers primarily prudential tools that are calibrated to target one or more symptoms of excessive vulnerabilities (and thus risks) such as excessive credit growth, excessive leverage, excessive liquidity risk due to liquidity mismatches or too much reliance on unstable short-term funding as well as interconnectedness.

Most tools considered today apply mainly to the banking sector, because of the existence of microprudential instruments adaptable to macroprudential policy objectives. They can be categorized in many different ways (see CGFS, 2010; IMF, 2011a,b; ESRB, 2014; Claessens et al., 2014; Claessens, 2014). For the purpose of our study it seems reasonable to classify them into two groups (see Cerutti et al., 2015). The first group includes instruments affecting borrowers, and is widely known as quantitative restrictions on borrowers. These instruments include loan-to-value caps (LTV cap) and debt to income ratios (DTI). The other group covers tools which reduce risk-taking by banks, and includes direct restrictions on balance sheets (such as reserve requirements,

limits on foreign currency mismatches as well as liquidity limits, i.e. the net stable funding ratio and liquidity coverage ratio), instruments enhancing resilience directly (i.e. countercyclical capital requirements, leverage restrictions, dynamic provisioning) and other tools (i.e. taxes or levies on specific assets or liabilities, regulations on institutional infrastructure, etc.). These distinctions notwithstanding, all macroprudential policy instruments should help achieve increased resilience of banks, through increased loss absorbency (capital requirements, dynamic provisions), increased liquidity buffers (liquidity limits), decreased probability of default (PD) and loss given default of borrowers (LGD) (LTV caps and DTI ratios) as well as through improved risk management (capital requirements, dynamic provisions, liquidity limits, LTV caps and DTI ratios).

The empirical evidence on the effectiveness of macroprudential policies consists mainly of studies analyzing the potential of macroprudential instruments to enhance the resilience of the banking sector. The research on the role of these policies in affecting financial (and credit) cycle, in particular proving that these policies may help lean against the financial cycle, does not provide us with convincing results, probably because the concept of the financial cycle and its sensitivity to regulatory interventions remain less well understood (see CGFS, 2012; Drehmann et al., 2012; and Borio, 2014). Thus the literature presenting empirical evidence on the effectiveness of macroprudential instruments basically focuses on their role in managing the resilience of banks, also looking at factors which may have an impact on this resilience (e.g. real estate prices). This literature may be divided into two groups, considering the number of countries included in the sample. The first group includes cross-country studies which use both aggregated and individual bank-level data. The other covers micro-level evidence mostly based on the use of one, or a few, macroprudential policy instruments in one country.

Most of cross-country studies offer evidence on the effects of borrower-targeted instruments (Crowe et al., 2011, 2013; Kutner and Shim, 2013, 2016; Zhang and Zoli, 2014, 2016), due to the fact that LTV caps and DTI ratios had been applied in many countries even before the crisis (see Cerutti et al., 2015). Some other studies present more general evidence, looking at a wider set of macroprudential policy instruments (Lim et al., 2011; Claessens et al., 2013, 2014; Cerutti et al., 2015). The last group of papers focuses on the link between vulnerabilities (e.g. credit growth) and tools limiting bank balance-sheets (Dell' Ariccia et al. 2012a, Vadenbusche et al., 2012, 2015). One of the first cross-country studies focusing mainly on borrower-restrictions research by Crowe et al. (2011, 2013), who use a simple cross-section of 21 (mostly) developed countries and find that maximum LTV limits are positively related to house price appreciation between 2000 and 2007. Back-of-the-envelope calculations suggest a 10 percentage point increase in the maximum LTV

allowed by regulations is associated with a 13 percent increase in nominal house prices. Additionally, regressions on a panel of U.S. regions from 1978 to 2008 deliver a smaller impact of LTV at loan origination of roughly 5 percent increase in house prices for a 10 percentage point increase in LTV. Thus lowering LTV or implementing LTV caps should be related with a decrease in house prices.

Kutner and Shim (2013, 2016) using data from 57 countries, spanning more than three decades, investigate the effectiveness of nine non-interest rate policy tools, including macroprudential measures, in stabilizing house prices and housing credit. They find, similarly to Crowe et al. (2011, 2013) that housing credit growth is significantly affected by changes in the maximum loan-to-value ratio. In contrast to Crowe et al. they also test the role of the maximum debt-service-to-income (DSTI) ratio and limits on the exposure to the housing sector and housing-related taxes in housing-credit growth. In this respect they find that introductions or reductions in the maximum debt-service-to-income ratio, and increases in housing-related taxes, have significant negative effects on housing credit, with a typical tightening action lowering the real credit growth rate by 4-6 percentage points and by 3-4 percentage points, respectively, over the subsequent four quarters. Increases in housing-related taxes moderate house price growth, with a typical increase slowing real house price appreciation by 3–4 percentage points over the same horizon.

Zhang and Zoli (2014, 2016), using a newly constructed database on macroprudential instruments and capital flow measures in 13 Asian economies and 33 economies in other regions for the period 2000–2013, find that Asian economies appear to have made greater use of macroprudential tools, especially housing-related measures, than their counterparts in other regions. Their experience with these tools may, therefore, provide us with guidance on their effects and potentially effectiveness. These effects of macroprudential policy are assessed through an event study, cross-country macro panel regressions, and bank-level micro panel regressions. The study suggests that housing-related macroprudential instruments – particularly loan-to-value ratio caps and housing tax measures – have helped curb housing price growth, credit growth, and bank leverage in Asia.

One of the first cross-country studies looking at a wider set of macroprudential policy tools was a paper by Lim et al. (2011), who use aggregated annual data from 49 countries in years 2000-2010. In this paper they explore the links between macroprudential policy instruments (LTV caps, dynamic provisions, DTI caps, limits on foreign currency, countercyclical capital buffers, limits on credit growth) and developments in leverage and credit as well as test the impact of macroprudential policy instruments on the procyclicality of leverage and credit. They find that the

presence of policies such as LTV and DTI limits, ceilings on credit growth, reserve requirements and dynamic provisioning rules can mitigate the procyclicality of credit and leverage (i.e. they reduce the positive sensitivity of credit and leverage to the business cycle, proxied by real GDP growth). Their study also shows that reserve requirements and dynamic provisions are significantly reducing credit growth during booms. Caps on LTV are associated with generally higher average loans growth through the cycle. However, this effect may be due to the limited range of the research sample. As for the leverage growth, they document that only reserve requirements reduce it in a significant way, both generally and in boom periods.

In a significant study, Claessens et al. (2013, 2014), using panel GMM regressions, investigate how changes in balance sheets – i.e. in leverage, assets and non-core liabilities growth, of some 2800 banks in 48 countries over 2000-2010 respond to specific macroprudential policy instruments. Controlling for endogeneity and country characteristics, as well as the macroeconomic environment, they find that borrower-targeted instruments – LTV and DTI caps, and balance-sheet restrictions, such as CG and FC limits – are effective in reducing the growth in bank's leverage, asset and non-core liabilities. Countercyclical instruments (such as RR and DP) also help mitigate increases in bank leverage, but they are of little effect thoroughout the cycle. Some of policies are counterproductive during downswings, serving to aggravate declines, which is consistent with the ex-ante nature of macroprudential tools.

Cerutti et al. (2015) document the use of macroprudential policies for 119 countries over the 2000-13 period, covering many instruments. They discover that emerging economies use macroprudential policies most frequently, especially foreign-exchange-related ones, while advanced countries use borrower-based policies more. Using the database covering these instruments for 119 countries and applying aggregated data in the period of 2000-2013 and applying the Arellano-Bond (1991) GMM estimator also, they find that the usage of macroprudential policies is generally associated with lower growth in aggregated credit, especially in household credit. However, these effects are less evident in financially more-developed and open economies, in which the usage of macroprudential policies comes with greater cross-border borrowing, suggesting that these countries face issues of avoidance. Generally, macroprudential policies can help manage credit growth, but they work better in the boom than in the bust phase of the financial cycle.

Dell' Ariccia et al. (2012a) focus mainly on policies affecting bank risk-taking, by restricting bank balance-sheets. They find that macroprudential instruments can reduce the incidence of general credit booms and decrease the probability that booms end badly. Using specific policies, such as credit and interest controls and open foreign-exchange-position limits, is found to

be effective in reducing the probability that booms ends up in a financial crisis or subsequent economic underperformance. Consistent with the focus of macroprudential tools on financial sector vulnerabilities, the reduction in the probability of a bad boom is found primarily for booms that end up in a financial crisis, although the effect on the probability of economic underperformance is not very different. Therefore, their study suggests that macroprudential policy can reduce the risk of a bust while simultaneously reducing the vulnerability of the rest of the economy to troubles in the financial system.

Vadenbusche et al. (2012, 2015) construct a comprehensive database of prudential instruments during the recent credit and housing boom and bust cycles covering 16 countries (in Central, Eastern and South-eastern Europe) at a quarterly frequency. They use this database to investigate whether the policy measures had an impact on housing price inflation. Applying Vector Error Correction model to unabalanced aggregated data covering the period of 2000-2011, they find that capital ratio requirements and non-standard liquidity measures (such as marginal reserve requirements on foreign funding or linked to credit growth) helped slow down house-price inflation in Central, Eastern and South-eastern Europe.

Besides these cross-country, usually aggregate studies, there are also microeconomic studies, often focused on specific risks and market segments. Jiménez et al. (2012) looking at the Spanish banking sector find that dynamic provisioning can be useful in taming credit-supply cycles, even though it did not suffice to stop the boom (see also Saurina, 2009). Additionally, during bad times, dynamic provisioning helps smooth the downturn, upholding firm credit availability and performance during recessions. Using sectoral data, Igan and Kang (2012) find LTV and DTI limits to moderate mortgage credit growth in Korea. These policies also appear to reduce real estate cycles in Hong Kong (Wong et al., 2011). Aiyar et al. (2013) show that bank-specific higher capital requirements dampened lending by banks in the United Kingdom, with quite strong aggregate effects: an increase in requirements of 1% reduced bank lending by between 5.7% and 7.6%, a high multiplier. Several recent papers on LLP focus specifically on the role of dynamic provisions in the procyclicality of LLP (Soedarmono et al., 2016; Zilberman and Tayler, 2015). In particular, Soedarmono et al. (2016) examine the role of information sharing and borrower legal rights in affecting the procyclical effect of bank loan-loss provisions. Based on a sample of Asian banks, their empirical results highlight that higher non-discretionary provisions reduce loan growth and hence, non-discretionary provisions are procyclical. This investigation also suggests that better information-sharing through public credit registries managed by central banks, but not private credit bureaus managed by the private sector, might substitute the role of a dynamic provisioning system

in mitigating the procyclicality of non-discretionary provisions. They also document that higher discretionary provisions in countries with stronger legal rights of borrowers may temper the procyclical effect of non-discretionary provisions. However, these findings only hold for small banks. This suggests that the implementation of a dynamic provisioning system to mitigate the procyclicality of non-discretionary provisions is more crucial for large banks, because such procyclicality cannot be offset by strengthening credit market environments through better information sharing and legal rights of borrowers.

In a theoretical study, Zilberman and Tayler (2015) analyze the interactions between loan-loss provisioning rules, business-cycle fluctuations and monetary policy in a model with nominal price rigidities, a borrowing-cost channel and endogenous credit-default risk. They show that empirically relevant specific provisioning regimes induce financial accelerator mechanisms and result in financial, price and macroeconomic instability. Dynamic provisioning systems, set to cover for expected losses over the whole business cycle, significantly reduce welfare losses, and in addition moderate the (otherwise optimal) anti-inflationary stance in the monetary policy rule. The optimal policy response to financial shocks calls for a combination of macroprudential dynamic provisions and standard Taylor rules, which exclude targeting financial indicators. Thus dynamic provisions may potentially reduce procyclicality of LLP.

To sum up, the analysis of the literature conducted thus far shows that LLPs are procyclical, however this procyclicality is diversified across countries (Laeven and Majnoni, 2003; Bikker and Metzemakers, 2005; Olszak et al., 2016). This literature also suggests that this procyclicality is a side effect of inadequate risk-taking throughout the business cycle (Borio et al., 2001; Borio and Zhu, 2012), and thus decreased resilience to financial and real aggregate shocks. The contemporary literature stresses the importance of macroprudential policy in increasing resilience, through affecting bank risk-taking or restricting borrowers' access to bank lending (CGFS, 2012; ESRB, 2014). We therefore are interested in how the use of macroprudential policies affects the link between loan-loss provisions and the business cycle. Empirical evidence suggests that macroprudential policy instruments have a potentially positive impact on resilience and that the increased range of such instruments is associated with enhanced resilience (Claessens et al., 2014; Cerutti et al., 2015) Therefore we hypothesize that:

H1: in countries in which macroprudential policy instruments are applied, the procyclicality of loan-loss provisions is weakened.

Previous empirical evidence finds that borrower-targeted instruments (LTV cap and DTI ratios) are effective in reducing overall credit growth and leverage (Lim et al., 2011; Cerutti et al., 2015; Claessens et al., 2014; Crowe et al., 2011, 2013; Kutner and Shim, 2013, 2016; Zhang and Zoli, 2014, 2016) as well as being effective in taming the procyclicality of credit (Lim et al., 2011). We therefore expect that the LLP of banks in countries applying more such instruments (i.e. at least one or both) should be less procyclical. Thus we put forward following hypothesis:

H2: borrower restrictions are relatively more effective in reducing the procyclicality of loan-loss provisions than instruments affecting the balance-sheets of financial institutions.

The previous literature stresses the empirical significance of bank size for risk-taking and thus the resilience of the banking sector. In particular, large banks may be prone to the "too-big-to-fail" phenomenon. Due to the fact that these banks receive implicit or explicit government protection, they invest in more risky assets (see e.g. Schooner and Taylor, 2010; Stiglitz, 2010; De Haan and Poghosyan, 2012, Freixas et al., 2007). Large banks could also be more vulnerable to general market movements than smaller ones, meaning that the link between bank size and systemic risk may be positive (Anderson and Fraser, 2000; Haq and Heaney, 2012). Laeven et al. (2014) present descriptive evidence that large banks may have a more fragile business model (with higher leverage and more market-based activities) than small banks. Olszak et al. (2016 a) show that the loan-loss provisions of large banks, are more negatively associated with the business cycle, consistent with the prediction of the greater procyclicality of large banks. Thus large banks and their resilience are of great interest for macroprudential policy decision-makers. However, there is no evidence on the role of macroprudential policies in the procyclicality of large banks. If macroprudential policies act more to reduce risk-taking by large banks, than we would hypothesize that :

H3a: macroprudential policy instruments exert stronger impact on the procyclicality of loan-loss provisions in large banks than in medium or small banks.

However, if macroprudential instruments were more effective in reducing risk-taking at small or medium size banks, then we would hypothesize that:

H3b: macroprudential instruments exert weaker impact on the procyclicality of LLP in large banks than in banks of other size.

3. Data and research methods

We use pooled cross-section and time series data of individual banks' balance-sheet items and profit and loss accounts from over 65 EU countries and country-specific macroeconomic indicators for these countries, over a period from 2000 to 2011. However, due to data shortages, we include only 65 countries in the analysis including interactions between macroprudential policy and business cycle. The balance-sheet and profit-and-loss account data are taken from unconsolidated financials available in the Bankscope database, whereas the macroeconomic data were accessed from the World Bank and the IMF web pages. As we are interested in the impact of the business cycle on the core banking institutions, a huge part of our study focuses on unconsolidated financial statements data. However, we also show results for consolidated data due to the fact that consolidation is a proxy for bank size (Freixas et al., 2007) and has been found to be a significant driver of the procyclicality of loan-loss provisions in the European Union (Olszak et al., 2016). We apply several filters to remove potential data errors and outliers. We exclude outlier banks from our sample by eliminating the extreme bank-specific observations when a given variable adopts extreme values (e.g. negative capital ratios which may be the result of misreporting or other data problems). Additionally, in order to conduct the analysis we apply only the data for which there were a minimum of 5 successive values of the dependent variable from the period 2000 to 2011. Such an approach is necessary to test the impact of business cycle on the LLP. Our final sample consists of over 80000 observations in the case of unconsolidated data and 9000 observations in consolidated data (for the loan loss provisions variable) (see Table 1, panel B).

As we are interested in the impact of macroprudential policy on the link between loan-loss provisions and the business cycle, we include indices designed by the IMF and presented in Claessens et al. (2014). In particular, we apply aggregated indices of macroprudential policy i.e.: *BORROWER* (which is an average value of a macroprudential index covering instruments aimed at borrowers' leverage and financial positions, see Cerutti et al., 2015,), and *FINANCIAL* (an average value of a macroprudential index which covers instruments targeted on taming risk-taking by financial institutions, basically aimed at financial institutions assets or liabilities). Our study focuses on the period of 2000-2011, because we do not want our results to be affected by post-crisis regulatory changes, whose effective implementation started around 2012. Therefore in constructing aggregated macroprudential policy instruments, we only look at those instruments which were applied across countries in the period of 2000-2011. BORROWER values range between 0 and 2, with higher values suggesting grater application of macroprudential policy instruments which restrict access to credit of borrowers, in particular real-estate lending. This index covers two instruments: loan-to-value cap ratios (LTV_CAP) and debt-to-income ratios (DTI). FINANCIAL in

our study covers eight instruments, ie.: debt-to-income ratio (DTI), dynamic loan-loss provisioning (*DP*), leverage ratio (LEV), limits on interbank exposures (*INTER*), limits on foreign currency loans (*FC*), limits on domestic currency credit growth (*CG*), levy/tax on financial institutions (TAX), and FX and/or countercyclical reserve requirements (RR_REV). We do not include instruments which have been used since 2012 (i.e. higher capital charges for systemically-important financial institutions (SIFI) and general countercyclical capital requirements or buffers, CTC). Thus the values of FINANCIAL range between 0 and 8, with higher values indicating more intense application of macroprudential policy instruments, i.e. the fact that more instruments are used as a policy tool in the analysed period in a given country.

We also test the impact of individual macroprudential policy instruments included in the data-set collected by Cerutti et al. (2015). As we have mentioned in the previous paragraph, we focus on instruments applied in years 2000-2011, because we are interested in their role for the link between loan-loss provisions and the business cycle, through the cycle, i.e. during both non-crisis period (up to 2007) and during the recent crisis and its direct aftermath period (2008-2010). These instruments include: *LTV_CAP*, DTI, *DP*, LEV, *INTER*, *FC*, reserve requirements ratios (RR), *CG*, TAX, reserve requirement ratio (RR) and RR_REV. To test our hypotheses, for each country we construct a dummy variable which takes the value of 1 if the instrument was applied at least since 2005, and 0 otherwise. As is shown in Table 2, *LTV_CAP* was applied in 13 countries, *DTI* in 6 countries, *DP* in 2 countries, *LEV* in 6 countries, *INTER* in 16 countries, *CONC* in 35 countries, *FC* in 7 countries, *RR_REV* in 5 countries, *CG* in 5 countries and *TAX* in 8 countries.

Previous evidence on macroprudential policy effects shows that there are differences between advanced economies and emerging markets, as well as between closed and open-capital-account economies in many areas of banking activity (e.g. bank asset growth, bank size, leverage, deposits to loans, see Claessens et al., 2014) and macroeconomic factors (such as GDP per capita real growth). Therefore, we conduct separate analyses in those subsamples, and present these results in the robustness-checks section. To classify countries into emerging versus advanced economy we apply the IMF database (source IMF, as presented in Cerutti et al., 2015). As for the classification into open- versus closed-capital-account countries we use the Chinn-Ito index (source Chinn-Ito Index 2008, as presented in Cerutti et al., 2015)[2]. A country is defined as an open-capital-account country if its Chinn-Ito index is larger than the global median in 2005, and a closed-capital-account country if its Chinn-Ito index is smaller than the global median in 2005. Using these classifications our sample covers 31 advanced economies, 31 emerging economies, 3 Low-income developing economies, 28 open-capital-account countries and 37 closed-account countries. Due to the very

[2] For country classification refer to table A1 in appendix

small number of observations and thus potential for huge estimation bias, we do not present results for low-income developing countries.

Insert table 1 around here

Insert table 2 around here

The variables chosen as possibly explanatory of LLP are variables traditionally used for testing the earnings-management and capital-management hypotheses (see Greenawalt and Sinkey, 1988; Beatty et al., 2002; Liu and Ryan, 2006, Fonseca and Gonzalez, 2008) modified by the inclusion of business-cycle and other dummy variables (as in Laeven and Majnoni, 2003; Bikker and Metzemakers, 2005). We also include the first and second lag of the dependent variable in order to capture adjustment costs that constrain the complete adjustment of LLP to an equilibrium level (see Laeven and Majnoni, 2003; Bikker and Metzemakers, 2005 and Fonseca and González, 2008). The basic model reads as:

$$\begin{aligned} \mathrm{LLP}_{\mathrm{i,t}} = \ & \alpha_0 + \alpha_1 \mathrm{LLP}_{\mathrm{i,t-1}} + \alpha_2 \mathrm{LLP}_{\mathrm{i,t-2}} + \alpha_3 PROFITBPT_{i,t} + \alpha_{45} \Delta L_{i,t} + \alpha_{56} CAPR_{i,t-1} \\ & + \alpha_6 size_{i,t} + \alpha_7 GDPG_{j,t} + \alpha_8 Unempl_{j,t} + \alpha_9 \sum_{t=2000}^{2011} T_t + \alpha_{10} \sum_{j=1}^{67} Country_j \\ & + \vartheta_i + \varepsilon_{i,t} \end{aligned}$$

(Eq. 1)

The dependent variable is the loan loss provision (LLP) of a bank divided by this bank's average total assets (TA). The subindices i, j, t refer to the bank, the country and the year - respectively. The explanatory variables have been subdivided into:

(1) bank-specific variables, namely:

- earnings before LLP and taxes (PROFITBPT),
- loans-growth rate (ΔL),
- capital ratio measured as the share of capital in total assets (CAPR);

(2) macroeconomic variables like:

- real growth of Gross Domestic Product per capita (GDPG),
- unemployment rate (Unempl).

(3) other elements, ie.:

- elements $\sum_{j=1}^{67} \text{Country}_j$ relate to a set of country dummy variables and $\sum_{t=2000}^{2011} T_t$. to a set of time dummies. Following Foos et al., (2010), Norden and Stoian (2013) and Fang et al. (2014) we include a full set of interacted country-year dummies to indirectly control for macroeconomic conditions;

- $\vartheta_{i,t}$ are unobservable bank-specific effects that are not constant over time but vary across banks; ε_t is a white-noise error term.

Our dependent variable is the total net loan-loss provision, covering net-specific provisions and general provisions (as reported in the Bureau Van Dijk Bankscope database). Thus it covers information on the changes in the loans quality (i.e. the specific portion of provision) and about the approach taken to cover expected loan-losses (in the general-provision portion). In terms of right-hand side variables, all regressions include up to two lags of the dependent variable, to allow for natural convergence. We control for individual bank conditions by including bank-specific variables. All bank-specific variables (LLP, PROFITBPT and CAPR) are normalized by the bank total assets (average assets in the case of LLP and PROFITBPT) to mitigate potential estimation problems with heteroscedasticity. Equation (1) involves bank-specific variables that may be endogenous. Therefore, we apply an approach that involves instrumental variables, i.e the generalised method of moments (GMM) developed by Blundell and Bond (1998) with robust standard errors and Windmeijer's (2005) correction. We also report OLS and FE estimations for the base results, but in the remainder of the paper only report GMM estimates. We control for the potential endogeneity of PROFITBTP, ΔL and CAPR by the inclusion of up to four lags of these explanatory variables as instruments. The GDPG and Unempl, as well as the country and the time dummy variables are the only variables considered exogenous. As the consistency of the GMM estimator depends on the validity of the instruments, we consider two specification tests. The first is Hansen's J statistic for overidentifying restrictions, which tests the overall validity of the instruments tests (see Roodman, 2009). The second is the test verifying the hypothesis of absence of second-order serial correlation in the first difference residuals (m2). Such an approach gives us estimates of standard errors robust with respect to heteroscedasticity and autocorrelation in the dataset.

The relation between LLP and current-period earnings realizations(PROFITBTP) is applied to track the discretionary income smoothing by banks (Greenawalt and Sinkey, 1988; Laeven and Majnoni, 2003; Bikker and Metzemakers, 2005; Liu and Ryan, 2006; Fonseca and González, 2008; and Bouvatier and Lepetit, 2008; Bushman and Williams, 2012). The higher the positive coefficient on PROFIT the more discretionary income smoothing there is. A negative impact of PROFITBPT

on LLP suggests that banks do not apply LLP to smooth their earnings. The association between LLP and ΔL is included to test the application of LLP to cover expected loss on loans (Laeven and Majnoni, 2003; Bikker and Metzemakers, 2005; Fonseca and González, 2008). Some papers find positive influence of real loan growth on LLP (Bikker and Metzemakers, 2005; Fonseca and González, 2008) implying that banks set aside provisions to cover risks which build up during economic booms. Other studies document a negative coefficient on ΔLoans (Laeven and Majnoni, 2003) which implies the rejection of the hypothesis of prudent loan-loss provisioning behavior. Such differences in the association of loans growth on LLP are not germane to our study as we are interested in the procyclicality of LLP, after controlling for loans growth. The same is about capital ratio (CAPR), which is used to control for the possibility that banks may engage in capital management through loan-loss provisions. As previous evidence documents, the relationship between CAPR and LPP may be both negative and positive. If capital variation is more related to retained earnings than to loan-loss reserves, as is the case in many accounting standards, the CAPR may exert negative effect on LPP. Such a negative coefficient on CAPR is found by Ahmed et al. (1999) and Bikker and Metzemakers (2005). On the other hand, if the capital level is more affected by the loan-loss allowances set aside by banks, than the influence of CAPR on LLP is positive. For example, Liu and Ryan (2006) find a significantly positive coefficient on CAPR, implying that better capitalized banks recorded charge-offs more quickly than did poorly capitalized banks. Shrieves and Dahl (2002) and Bouvatier and Lepetit (2008) document a positive coefficient on CAPR and suggest that this observation is in line with the capital-management hypothesis, as poorly capitalized banks increase their current period LLP to increase their capital base in the next year. These observations notwithstanding, the interpretation of the impact of CAPR on LLP depends on the regulations governing the inclusion of general provisions in bank capital in a particular country, following capital-adequacy standards (i.e. previously used Basel I, and more recent Basel II standards). These standards are quite diversified across countries which we include in our sample. Therefore, we do not expect to find a consistent result for this variable.

The relation between LLP and GDPG is our measure of procyclicality of LLP, and as such is the most interesting in our study. Previous empirical research documents that GDP is negatively related to LLP (Laeven and Majnoni, 2003; Bikker and Metzemakers, 2005; Bouvatier and Lepetit, 2008; Fonseca and González, 2008, Olszak et al., 2017). The stronger the negative coefficient of GDP, the more procyclicality there is. Positive relationship between LLP and GDP would suggest countercyclical provisions. In our study we expect that LLP are procyclical, i.e. they are negatively related with GDPG. We also expect this association to be heterogeneous across countries (for previous evidence on this e.g. in the EU refer to Olszak et al., 2016), i.e. in some countries banks

will have more procyclical LLPs, whereas in others they will be less procyclical. This procyclicality should be affected by the macroprudential policy. Following the fact that macroprudential policies increase the resilience, their usage should reduce the procyclicality of LLP, by making LLP less negatively related with GDPG.

We include Unempl as additional an exogenous macroeconomic control variable and expect the respective regression coefficient to be positive, suggesting that LLP increase as more employees get made redundant (i.e. which happens in economic downswings) (see Bikker and Metzemakers, 2005; Olszak et al., 2016). Such a relationship is consistent with the procyclicality of LLP.

To analyze the differences in sensitivity of LLP to GDPG across countries and the role of macroprudential policy instruments in this sensitivity, we estimate regression (1.2), incorporating an interaction term between macroprudential policy assessed at a country level and the GDP variable. The coefficient on each interaction term measures the influence of macroprudential policy instruments on the procyclicality of loan-loss provisions.

$$\begin{aligned} \mathrm{LLP_{i,t}} = {} & \alpha_0 + \alpha_1 \mathrm{LLP_{i,t-1}} + \alpha_2 \mathrm{LLP_{i,t-2}} + \alpha_3 PROFITBPT_{i,t} + \alpha_4 \Delta L_{i,t} + \alpha_5 CAPR_{i,t-1} \\ & + \alpha_6 size_{i,t} + \alpha_7 GDPG_{j,t} + \alpha_8 Unempl_{j,t} \\ & + \alpha_9 MaPI_j + \alpha_{10} MaPI_j * GDPG_{j,t} + \alpha_{11} \sum_{t=2000}^{2011} T_t + \alpha_{12} \sum_{j=1}^{67} Country_j + \vartheta_i \\ & + \varepsilon_{i,t} \end{aligned}$$

(Eq. 2)

In this regression we include also macroprudential policies variable (denoted as *MaPI*), which covers aggregated indices of macroprudential policy (denoted in the next sections as *BORROWER* or *FINANCIAL*) and individual macroprudential policy instruments (denoted in the next sections as MaPI individ) – computed for each country separately using data from the period of 2000-2011 available in Cerutti et al. (2015). Secondly, we introduce interaction terms between GDPG and macroprudential policy variable which gives information about the impact of macroprudential policies on the association between loans loss provisions and business cycle. A positive regression coefficient on double interaction of *GDPG*MaPI* implies that in countries with a larger set of macroprudential policy instruments or in which an individual instrument has been applied in the years of the study, the procyclicality of LLP is attenuated. In contrast, a negative coefficient would imply increased procyclicality of LLP.

4. Estimation results

4.1. Full sample results and role of macroprudential policy instruments

Table 3 reports the base results. Specifications 1-4 present the results of regressing the loans-loss provisions on only its own lags and bank-specific and macroeconomic variables in the full sample of banks reporting unconsolidated data, using four different estimation techniques, i.e. OLS, FE and two-step system GMM with interacted country and year dummies (consistent with approach of Foos et al., 2010; Norden and Stoian, 2013; and Fang et al., 2014) and two-step system GMM with interacted country and year dummies in which we reduce the number of lagged bank-specific variables up to one. In the remaining columns 5-8 we show results obtained for banks reporting consolidated statements, following the same four approaches. The coefficients on bank-specific variables are largely as expected when significant. Specifically, in all specifications the coefficient on PROFITBPT is positive and statistically significant at 1%. This supports the view that in a cross-country banks tend to engage in discretionary income smoothing (Bushman and Williams, 2012). This income smoothing seem to be stronger in the case of banks reporting unconsolidated data, which consistent with previous empirical findings (e.g. Olszak et al., 2016). The negative coefficients on ΔL imply that banks do not apply a prudent approach to management of expected loan-losses (see the statistically significant coefficients in columns 1-4). Generally, changes in total loans outstanding or in loan growth rate are related to changes in expected loan-losses. Banks which provision more when loan growth is stronger should be less prone to macroeconomic conditions (Laeven and Majnoni, 2003; Bikker and Metzemakers, 2005; Fonseca and González, 2008). In our sample we do not find support for the view that banks set aside provisions to cover expected losses. Rather, they seem to use them to manage their earnings before provisions and taxes.

The positive and statistically significant coefficient of the previous year's capital ratio *(CAPR*) implies that banks in our sample could have applied capital management with LLP (see the results in columns 3 and 4 for unconsolidated data). Such a result is consistent with explanation and findings of Liu and Ryan (2006), who suggest that positive coefficient on CAPR implies that better capitalized banks recorded charge-offs more quickly than did poorly capitalized banks (see also Shrieves and Dahl, 2002; and Bouvatier and Lepetit, 2008). Some authors, however, argue that if capital variation is more related to retained earnings than to loan loss reserves, as is the case in many accounting standards, than the capital management hypothesis is verified if the link between LLP and CAPR is negative (Ahmed et al., 1999; Bikker and Metzemakers, 2005). In our study we

do not find support for this view. The significant, and in all specification statistically significant, impact of size on loan-loss provisions in the sample of banks reporting unconsolidated data is consistent with the view that when bank assets are larger, the bank tends to take more risks and thus has to provision more.

Banks' loan-loss provisions are procyclical because in all specifications in Table 3 the coefficient on *GDPG* is negative and statistically significant at 1%. In particular, looking at GMM estimations (columns 3-4 and 7-8), we find that regression coefficients range between -0.06 and -0.07. This procyclicality view is further supported with the estimations of regression coefficients of Unempl. Specifically, the link between LLP and unemployment rate is positive and statistically significant (depending on the estimation this significance ranges between 1% and 10%). Thus our results are consistent with previous empirical evidence (see Laeven and Majnoni, 2003; Bikker and Metzemakers, 2005; Foos et al., 2010; Olszak et al., 2016).

[insert table 3 around here]

4.2. Results for the impact of borrower restrictions and financial institutions targeted macroprudential policies on the link between loan-loss provisions and business cycle

In Table 4, we first investigate the question of whether macroprudential policies reduce the procyclicality of loan-loss provisions and thus test hypothesis H1. We present the results separately for unconsolidated (estimations 1-4) and consolidated (estimations 5-8) data. To test the sensitivity of results to the number of instruments, we show estimations with up to four lags (columns 1-2, and 5-6), and with a collapsed number of instruments (i.e. up to one lag, in columns 3-4 and 7-8). The results for the full-sample (see specifications 1, 3, 5 and 7) confirm the view that borrower restrictions (BORROWER) reduce the procyclicality of loan-loss provisions, because the coefficient on the double interaction of *MaPI* GDPG* is positive and statistically significant at 1% in both unconsolidated and consolidated data. To start, in the full sample estimation of loan-loss provisions analyzing the impact of macroprudential indices on the association between LLP and GDPG in four regressions (1, 3, 5 and 7), the interaction of *MaPI and GDPG* obtains positive coefficients ranging between 0.038 and 0.046, indicating that the impact of business cycle on loan-loss provisions is significantly attenuated in countries applying macroprudential policies. Comparing these effects with impact of macroprudential policies affecting banks' balance sheets (FINANCIAL), we find that their impact is in most cases insignificant and, when significant, they do not reduce the procyclicality of loan-loss provisions. Such a result is consistent with hypothesis H2, according to which borrower restrictions are relatively more effective in reducing the

procyclicality of loan-loss provisions than instruments affecting balance-sheet of financial institutions.

[insert table 4 around here]

In Table 5, we present effects of interactions between macroprudential policy indices (*MaPI*) and GDP per capita in banks which differ in size, i.e. in large banks (specifications 1 and 4), medium banks (specifications 2 and 5) and small banks (specifications 3 and 6). Estimated positive coefficients of double interactions, significant in case of borrower-targeted macroprudential policies (see regressions 1, 2 and 3) and stronger in the subsample of large banks (coefficient on *Borrower*GDPG* is 0.064), relative to medium (coefficient on *Borrower * GDPG* equals 0.029), suggest that large banks benefit the most from increased resilience resulting from macroprudential approach. From regression1 (large banks), for instance, we infer that the impact of GDPG on loan-loss provision in countries applying more borrower targeted instruments is -0.017 (-0.081+0.064). In the medium banks' regression, the overall effect of GDPG on loan-loss provisions in countries applying macroprudential instruments reducing demand for lending and increasing banking sector resilience (e.g. by improving the quality of loans through lower PD and LGD ratios) (i.e. in which BORROWER is higher), is relatively less attenuated than in the large banks and equals -0.031 (-0.060+0.029). As for the small banks sample we do not find a statistically significant effect of BORROWER on the link between GDPG and LLP. This result notwithstanding, the general implication of this analysis seems to support hypothesis H3, that is macroprudential policy instruments exert stronger impact on the procyclicality of loan-loss provisions in large banks than in medium or small banks.

In terms of the effects of restrictions on financial institutions balance sheet we find further support for hypothesis H2, because the double interaction term on FINANCIAL*GDPG is negative and statistically insignificant (see specifications 4-6 in Table 5).

[insert table 5 around here]

4.2.1. Impact of individual macroprudential policy instruments

Regression results in Tables 6 and 7consider individual macroprudential policy instruments one-by-one, separately for unconsolidated (Table 6) and consolidated data (Table 7). We find that of borrower-based instruments, *LTV caps* and *DTI* ratios reduce the procyclicality of loan-loss provisions. More importantly, after controlling for the bank-specific and other macroeconomic factors, the coefficient on double interaction term of *MaPI * GDPG* is positive and significant at 1%, indicating that macroprudential instruments (*LTV cap* and *DTI*) weaken the negative

association between loan-loss provisions and GDP growth per capita. Of the borrower-based measures, the coefficient on *LTV CAP *GDPG* is strongly significant and positive, with an effect of 0.053 in unconsolidated data and 0.056 in consolidated data. As for the *DTI* ratio, we find the effect to be of almost the same strength, because the coefficient on double interaction is 0.065 in unconsolidated data and of 0.053 in consolidated data. However, in terms of the overall sensitivity of LLP to GDPG after recognition of these borrower-based restrictions, we find that the reduction of the procyclicality of LLP is stronger in unconsolidated than in consolidated data. As for the former sample, the effect of business cycle on LLP is -0.016(=0.053-0.069) if we take into account LTV CAP, and -0.011(=0.056-0.067) if we consider the role of DTI. As for the latter sample (i.e. consolidated data), we find that for LTV CAP regression, the effect of GDPG on LLP is -0.034(=0.056-0.09), and for DTI regression, this effect is -0.033(0.053-0.086). Generally, our results for borrower restrictions are consistent with the view that macroprudential policy instruments increase the resilience of banks (and potentially affect the credit cycle) and with our prediction that macroprudential policies reduce the negative impact of business cycle on loan-loss provisions, as expressed in hypothesis H2.

Of measures aimed at addressing bank resilience in a direct way, the dynamic provisioning rules seem to weaken the effect of business cycle on loan-loss provisions, with the significant coefficient on double interaction of *DP*GDPG* of 0.062 (0.073) in unconsolidated (consolidated) data. The overall reduction in the procyclicality of LLP through the use of DP is stronger in the case of unconsolidated data, than in consolidated data. As for unconsolidated data, we find that a 1 % increase in GDPG leads to reduction of LLP of -0.4% (-0.004=0.062-0.066). This means that LLP of banks in countries using DP are almost insensitive to the business cycle. However, the overall GDPG sensitivity of LLP of banks consolidating financial statements is more negatively stronger and equals -0.013 (=0.073-0.086).

In terms of measures aimed at banks' assets and liabilities sides, the leverage ratio's impact on the procyclicality of LLP differs between banks reporting unconsolidated financial statements and those reporting consolidated data. In particular, we find that countries which applied LEV(at least three years before the last global financial crisis) as a tool affecting bank's balance, experienced reduced procyclicality of LLP, but only in the sample of consolidated data. The overall impact of double interaction of LEV*GDPG equals 0.047 and is statistically significant. As for unconsolidated data, we do not find LEV to be a significant determinant of the cyclicality of LLP. Looking further at banks' balance sheet restrictions, we find that reduction in the negative association between LLP and GDPG is also achieved through the use of concentration limits (CONC) and taxes on bank revenues (TAX). Specifically, in regression 6 in Tables 6 and 7, we find

that the coefficient of double interaction on CONC *GDPG is positive, but significant in the sample of banks reporting consolidated data, implying that instruments affecting diversity of the lending portfolio reduce the procyclicality of LLP. In regression 10, the interaction of GDPG and TAX variable obtains coefficients of 0.048 (unconsolidated data in Table 6) and 0.045 (consolidated data in Table 7) that are significant at 5%, implying that loan-loss provisions are less procyclical in countries which use taxes as a tool affecting banks' risk-taking. Thus, such taxes have an advantageous effect on the resilience of banks to financial shocks. Our results seem to be related to previous evidence by Cerutti et al. (2015) who show that LEV, CONC and TAX reduce overall credit growth. Having said this, we must stress that we provide extension of this evidence, by showing that these macroprudential instruments are a statistically significant factor in reducing the procyclicality of LLP. However, if we take into account other individual macroprudential policy instruments (i.e. interbank exposure limits, foreign currency restrictions, credit growth limits and reserve requirements), we only find that they are not able to reduce the procyclicality of loan-loss provisions, because they strengthen the negative link between LLP and GDPG. So, even if interbank limits (INTER), foreign currency lending restrictions (FC), credit growth limits (CG) and reserve requirements (RR_REV) reduce the overall credit growth (as shown by Cerutti et al., 2015; Claessens et al., 2014; and for reserve requirements by Tovar et al., 2012; Glocker and Towbin, 2012; Alper et al., 2014; Pérez-Forero and Vega, 2014), they seem not to be able to affect the overall credit risk taken by banks, which results in more procyclical LLP.

[insert table 6 around here]

[insert table 7 around here]

Differentiating banks by size, in Table 8, and for brevity showing only those estimations in which the impact of individual macroprudential instruments on procyclicality of LLP is statistically significant, we find again that both borrower-targeted restrictions (LTV_CAP and DTI) weaken the association between loan-loss provisions and the business cycle. This effect is, moreover, stronger and significant in large banks relative to medium or small banks, which confirms our prediction expressed in H3a, that macroprudential policy instruments impact on the link between loan-loss provisions and GDPG is strongest in the sample of large banks. In large banks, the reduction of procyclicality is 0.07 (for LTV_CAPS) and 0.077 (for DTI) percentage points, whereas in medium and small banks it ranges between 0.029 and 0.047. It seems that in countries in which these

macroprudential policy instruments are applied, the LLP turn a-cyclical (i.e. they are insensitive to GDPG). From regression 4, for instance, we infer that a 1% increase in GDP per capita growth leads to a change in LLP by 0.0% (= 0.077-0.077).

In terms of the impact of instruments affecting the resilience of banks, we find that dynamic provisions reduce the procyclicality of LLP, and their impact is statistically significant, independent of bank size (see Table 9). In particular, the coefficient on DP*GDPG in large banks is 0.066, in medium banks is 0.054 and in small banks is 0.138, implying that dynamic provisions have the potential to reduce the overall level of credit risk in all banks. What's more, in the sample of small banks, their usage makes LLP countercyclical, because from regression 3 we infer that a 1% increase in GDPG leads to an increase of 2.9% (0.029=0.138-0.109) in LLP. This result seems to partially support hypothesis H3b, because it is small banks (not so much medium banks) that benefit from the reduced procyclicality of LLP due to application of dynamic provisions. The results for dynamic provisions should be interpreted with caution as we have only two countries in which LLP are applied.

Turning to macroprudential instruments affecting the balance sheets of banks which were effective in reducing the procyclicality of LLP (see Tables 6 and 7), we find that concentration limits and tax measures' impact on procyclicality is particularly strong in large banks. This impact ranges between 0.043 (see regression 4) and 0.069 (see regression 7). Comparing the countercyclical impact of these two instruments, we find that tax measures usage is related with a mild countercyclicality of LLP. From regression 7 in Table 9, for instance, we infer that a one percentage increase in GDPG brings about a 0.4% (0.004 =0.069-0.065) increase in LLP. The countercyclical effect of CONC and TAX on sensitivity of LLP to GDPG is statistically insignificant and relatively weak.

[insert table 8 around here]

[insert table 9 around here]

4.3. Robustness checks

To build more confidence into our main findings, we employ robustness checks. Firstly, we estimate our regressions with individual macroprudential policy tools with significantly reduced numbers of lags of bank-specific variables (PROFITBPT, ΔL, *CAPR*, *Size*), to check the sensitivity of our estimation to the number of GMM-style instruments (consistent with suggestion of Roodman, 2009). Secondly, we test the sensitivity of our results to country-specific traits, resulting from economic development or financial capital account openness, by running regression given by

equation 2 separately for advanced and emerging countries as well as for open-capital-account and closed-capital-account countries. Such tests seem necessary, considering the fact that economic development and capital-account-openness has been found to be a significant determinant of effectiveness of macroprudential policy (see Cerutti et al., 2015 and Claessens et al., 2014).

[insert table 10 around here]

[insert table 11around here]

The results for the effect of a reduced number of instruments are presented in Table 10 (for unconsolidated data) and in Table 11 (for consolidated data). These results give further support to our empirical findings presented in Tables 6 and 7. In particular, macroprudential policies restricting borrower's access to bank lending reduce the procyclical link between LLP and GDPG (see regressions 1 and 2). The double interaction term between LTV CAP and GDPG as well as between DTI ratio and GDPG is positive and statistically significant at 1%, and reduces the procyclicality of LLP by around 0.05 in the unconsolidated data, and by around the same range of 0.055 in the case of banks consolidating financial statements. Such a result corresponds with effects obtained in the previous section in Tables 6 and 7. What's more, the total effect of borrower-based policies on procyclicality of LLP, resulting from Tables 10 and 11, is comparable to that obtained in Tables 6 and 7. In particular, in the unconsolidated data we find that procyclicality is reduced to -0.019 (= 0.05-0.069) in the case of LTV CAP, and to -0.009 (= 0.058-0.067) for the DTI ratio. Again, the overall reduction in consolidated data is relatively weaker. In terms of the effect of LTV CAP on the procyclicality of LLP we find that the overall effect is again -0.034 (= 0.055-0.089). As for the DTI ratio, we find this effect to be of -0.031 (= 0.055-0.086), meaning that a 1% decrease in GDPG is associated with a 3.1% increase in LLP.

Consistent with results presented in the previous section, dynamic provisioning rules seem to weaken the effect of business cycle on loan-loss provisions, with the significant coefficient on double interaction of *DP*GDPG* of 0.061 (0.069) in unconsolidated (consolidated) data. The overall reduction in the procyclicality of LLP through the use of DP is again stronger in the case of unconsolidated data, than in consolidated data (see regression 3 in Tables 10 and 11). Looking next at banks' balance-sheet restrictions, we find that reduction in the negative association between LLP and GDPG is also achieved through the use of concentration limits (CONC) (see regression 7) and taxes on bank revenues (TAX) (see regression 10) is comparable to that presented in Tables 6 and 7. Our robustness tests for other individual macroprudential policy instruments (i.e. interbank

exposure limits, foreign currency restrictions, credit growth limits and reserve requirements), support the implications presented in the previous section, because we find that they are not able to reduce the procyclicality of loan-loss provisions. So our results are consistent with the view that instruments which are not directed at specific types of risks, but only on the general level of bank activity, e.g. credit volumes, are not able to increase the resilience of banks, and thus are not effective in reducing procyclicality of LLP.

[insert table 12 around here]

In Table 12 we compare the effects of macroprudential policies on the association between loan-loss provisions and GDPG in advanced versus emerging and open-capital-account versus closed-capital-account countries. We do this by running separate regression (given by equation 2) for each subsample of countries. In terms of borrower restrictions, we find that they are effective in reducing procyclicality of LLP in all subsamples, i.e. in advanced, emerging, open-capital-account and closed-capital-account countries. We find that the statistically significant impact of macroprudential policies on the association between loan-loss provisions and GDPG is stronger in emerging and closed-capital account countries than in advanced and in open-capital account countries. In particular, in the regression including interaction of borrower-targeted macroprudential policies (columns 1, 3, 5 and 7), the coefficient on double interaction of BORROWER*GDPG is 0.03 (0.032) in advanced (open-capital) countries, whereas in emerging (closed-capital account) countries it is 0.054 (0.046). However, based on regressions 1 and 3, we infer that the overall impact of business cycle on LLP is -0.029 in advanced markets and -0.041 in emerging economies, which implies that advanced economies benefit more from the borrowers' restrictions in terms of the reduced procyclicality of LLP. The same overall effect is found in open-capital-account countries in comparison with closed-capital-account countries.

In terms of balance-sheet restrictions, we find that such macroprudential policies do not reduce the procyclicality of LLP in emerging and closed-capital-account countries. In contrast, they seem to be a significant factor in the reduced procyclicality of LLP in advanced and open-capital-account economies. In regressions 2 and 6, the interaction of GDP per capita and FINANCIAL obtains coefficients of around 0.02 that are statistically significant at 1%, indicating that LLP in economically-advanced and open-capital-account countries are less procyclical due to macroprudential policies reducing risk-taking by financial institutions. The estimated coefficient of impact of GDPG on LLP in advanced countries in regression 2 is -0.072, implying that a 1%

increase of GDPG is associated with a 7.2% decrease in LLP. The double interaction on FINANCIAL*GDPG in this regression is 0.023, thus the overall impact of the business cycle on LLP in advanced economies is reduced to -0.049, implying that a 1% decrease in GDPG is associated with a 4.9% increase in LLP. The same overall effect of the business cycle on LLP is found in open-capital-account countries.

Comparing the effects of borrower-targeted policies with balance-sheet restrictions in all regressions in Table 12 we find further support for the view expressed in hypothesis H2, that is that borrower restrictions are more effective in reducing the procyclicality of LLP than restrictions directly affecting risk-taking by banks. In particular, if we look at regressions 1, 2 and 5 and 6, we infer that advanced markets as well as open-capital-account countries benefited definitely more from borrower restrictions than from balance-sheet restrictions in terms of the reduced procyclicality of LLP. In particular, the overall impact of GDPG on LLP due to borrower restrictions is -0.029 (-0.031) in regression 1 (5), whereas in the case of restrictions on bank-risk taking this impact of GDPG on LLP is of -0.049 in regressions 2 and 6.

5. Conclusions

This paper finds that macroprudential policy instruments applied in the period preceding the global financial crisis were effective in reducing the procyclicality of loan-loss provisions. We group macroprudential policy instruments into those affecting borrowers by restricting their access to new loans and into those related to the balance sheets of banks, and thus having impact on bank risk-taking. Such an approach gives us opportunity to propose several new insights. Firstly, borrower restrictions are definitely more effective in reducing the procyclicality of loan-loss provisions than other macroprudential policy instruments. This effect is supported in both unconsolidated and consolidated data and is robust to several robustness checks. Borrower restrictions are also effective in reducing the procyclicality of LLP in advanced, emerging, open-capital-account and closed-capital-account countries. The statistically significant impact of macroprudential policies on the association between loan-loss provisions and GDPG is stronger in emerging and closed-capital-account countries than in advanced and in open-capital-account countries. In contrast, balance-sheet restrictions do not reduce the procyclicality of LLP in emerging and closed-capital-account countries.

Secondly, of the instruments affecting risk-taking by banks and thus their resilience, we find that dynamic provisions, large exposure concentration limits and taxes on specific assets are effective in reducing the procyclicality of loan-loss provisions. However, if we take into account other individual macroprudential policy instruments (i.e. interbank exposure limits, foreign

currency restrictions, credit growth limits and reserve requirements), we find that they are not able to reduce the procyclicality of loan-loss provisions. Although these instruments have been found effective in reducing credit (or asset) growth, they do not seem to be good enough at curbing the procyclicality of LLP. Therefore, reduced credit growth is not necessarily equivalent to reduced procyclicality.

And finally, looking at the role of bank size, we find that both loan-to-value caps and debt-to-income ratios, are more effective in reducing the procyclicality of LLP of large banks. Off-balance-sheet restrictions, concentration limits and taxes are also more effective in reducing procyclicality of LLP of large banks. Dynamic provisions reduce the procyclicality of LLP in all banks and their impact is statistically significant, independent of bank size. What's more it is small banks that benefit most from the reduced procyclicality of LLP.

The results are of significance for the macroprudential policy decision-makers. In particular, they matter for the practical use of borrower-targeted restrictions. Due to the fact that we show that loan-to-value caps and debt-to-income ratios are effective in reducing procyclicality, and their effects are stronger in the case of large banks, we lend empirical support to the view that these instruments are beneficial to the overall resilience of the banking sector, and not only to real-estate lending. Additionally, borrower restrictions are found to be better at affecting the procyclicality of LLP in all subsamples of countries, i.e. advanced and emerging as well as open-capital-account and closed-capital-account countries. In contrast, macroprudential policies affecting risk-taking by banks are less effective in reducing the procyclicality of LLP.

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Macroprudential policy instruments and pro-cyclicality of loan-loss provisions – cross-country evidence

Appendix

Table 1. Descriptive statistics by country (Panel A) and descriptive statistics and correlations in the full sample (Panel B) in unconsolidated and consolidated data

	Unconsolidated							Consolidated						
Country name	median LLP	median PROFITBPT	median ΔL	median CAPR	median Size	# obs	# banks	median LLP	median PROFITBPT	median ΔL	median CAPR	median Size	# observ	# banks
Argentina	0.671	2.483	0.774	12.117	12.514	597	56	0.666	3.041	17.275	10.728	6.455	137	14
Australia	0.137	1.254	4.429	6.110	15.988	195	20	0.170	1.505	8.842	5.994	7.318	140	14
Austria	0.276	1.196	2.005	8.749	12.991	520	57	0.434	1.117	4.269	6.872	6.787	137	15
Belgium	0.041	0.565	1.908	5.379	14.557	233	25	0.057	0.797	4.338	4.865	6.881	95	10
Bolivia	1.011	2.167	-0.975	9.323	12.973	116	10						0	0
Brazil	0.855	3.596	2.610	14.590	13.548	802	82						0	0
Bulgaria	0.374	1.818	3.435	12.043	12.444	192	19	0.660	2.880	23.996	12.843	6.061	39	4
Canada	0.139	0.788	3.798	11.405	13.100	105	11	0.188	1.271	5.615	6.058	6.811	226	23
Chile	0.543	2.014	2.655	9.899	14.286	181	21	0.664	2.363	13.000	8.189	6.726	115	12
China	0.348	1.392	6.424	5.114	15.624	416	53	0.352	1.629	15.663	5.224	8.096	126	13
Colombia	1.194	3.384	1.023	11.550	14.375	189	17	1.687	4.650	13.145	10.229	6.943	31	4
Croatia	0.496	1.666	4.408	12.689	12.439	295	29	0.376	2.153	13.402	9.537	6.757	54	5
Cyprus	0.308	1.435	4.468	7.157	13.030	46	7	0.533	1.202	9.727	6.937	6.582	39	4
Czech Rep.	0.165	1.141	8.456	7.657	14.626	100	13	0.204	1.880	6.528	8.047	7.151	64	6
Denmark	0.385	1.937	3.968	11.204	13.315	510	45	0.385	1.383	6.888	6.725	6.707	156	15
Ecuador	0.551	1.952	1.503	10.225	11.600	239	27	0.474	2.607	5.853	8.470	6.325	22	2
Egypt	0.774	1.642	-0.369	8.673	14.346	220	22						0	0
El Salvador	0.982	1.508	0.949	10.841	12.890	95	10	1.175	2.384	3.303	10.838	6.316	36	4

Estonia	0.254	1.478	4.657	10.826	12.753	51	6	0.387	1.907	24.336	8.555	6.293	38	4
Finland	0.010	0.803	5.940	5.317	16.368	56	5	0.037	0.938	10.035	5.396	7.437	38	4
France	0.205	1.228	2.593	6.783	14.078	1015	101	0.184	0.923	4.893	5.551	7.035	353	36
Germany	0.276	1.046	2.246	7.037	13.516	1173	113	0.202	0.552	-0.174	4.731	6.632	175	20
Ghana	0.949	4.324	1.044	10.859	11.924	139	16	1.717	6.479	14.665	11.255	5.627	40	4
Greece	0.475	1.064	5.097	7.687	15.483	137	15	0.630	1.466	15.479	7.129	7.034	131	13
Hong Kong	0.232	1.385	1.479	10.816	15.702	50	7	0.126	1.531	6.913	9.921	7.023	217	21
Hungary	0.616	1.514	1.364	9.726	13.138	74	10	0.556	2.249	14.087	8.210	6.824	87	9
Iceland	0.382	1.765	-0.923	6.236	15.176	5	1	0.418	2.158	32.320	6.566	6.670	21	3
India	0.424	1.930	2.555	5.679	15.464	641	54	0.414	2.351	17.153	6.208	7.218	83	11
Indonesia	0.340	2.281	1.636	10.647	13.466	395	41	0.560	2.687	15.210	9.263	6.714	133	13
Ireland	0.022	0.520	3.069	4.750	16.677	13	2	0.125	1.001	12.773	5.113	7.578	76	8
Israel	0.357	0.906	1.448	6.098	16.300	101	9	0.375	1.174	2.975	5.609	7.066	110	10
Italy	0.310	1.283	4.966	8.233	14.691	797	80	0.340	1.244	8.385	7.320	7.074	167	19
Jamaica	0.216	2.596	0.109	11.778	13.358	59	6	0.158	3.056	10.557	11.554	5.982	45	5
Japan	0.310	0.578	7.884	4.760	16.811	1482	120	0.300	0.622	0.943	4.939	7.332	1240	111
Jordan	0.273	1.911	1.420	9.836	15.776	24	2	0.424	2.445	6.223	12.784	6.161	88	9
Kazahkstan	0.481	2.437	2.313	13.944	12.301	84	9	2.229	4.392	52.445	10.464	6.321	72	7
Kenya	0.718	3.238	0.651	14.473	11.479	219	28	0.634	3.878	7.809	12.103	5.765	92	9
Latvia	0.290	1.574	5.085	9.261	12.679	220	20	0.415	1.968	21.613	8.324	5.966	98	13
Lithuania	0.349	1.119	6.452	9.263	13.373	112	10	0.429	1.537	26.449	9.942	6.085	71	7
Luxembourg	0.031	0.777	1.001	4.469	14.845	580	62	0.015	0.906	3.112	5.287	7.475	59	6
Malaysia	0.323	1.885	2.543	8.871	15.547	268	24	0.421	2.017	6.501	7.741	7.017	185	17
Malta	0.090	1.593	3.142	7.633	14.403	27	3	0.089	1.479	5.910	6.855	6.249	22	2
Mexico	0.653	1.194	0.529	11.561	13.387	169	22	1.009	2.560	12.513	10.716	6.706	157	16
Morocco	0.497	2.092	4.588	8.235	15.330	78	7	0.449	2.418	12.964	9.119	6.901	66	8
Netherlands	0.059	1.122	4.315	8.235	14.670	59	10	0.140	0.730	6.222	6.563	7.054	133	14
New Zealand	0.082	1.254	2.432	4.716	15.907	79	8	0.099	1.621	7.822	5.854	7.375	47	5
Nigeria	0.714	3.833	1.371	12.852	13.816	189	19	0.771	4.082	21.173	11.670	6.398	86	10
Norway	0.110	0.863	3.560	6.627	14.809	100	11	0.063	0.862	9.803	6.529	7.004	42	5
Pakistan	0.469	1.683	0.671	7.677	14.078	194	18	0.597	2.471	3.970	7.889	6.491	80	11
Panama	0.407	1.616	2.397	10.045	12.451	185	31	0.473	1.976	10.869	10.818	5.874	125	16
Peru	1.060	2.954	3.044	9.994	13.753	99	11	0.807	3.465	10.027	9.486	6.925	37	4
Philippines	0.515	1.799	0.968	12.134	13.998	219	23	0.411	1.955	2.184	11.221	6.548	123	13
Poland	0.312	1.353	4.200	10.133	13.771	308	34	0.465	1.778	6.263	9.353	7.067	91	9
Portugal	0.352	1.126	4.710	6.762	14.979	127	14	0.312	1.208	8.850	7.472	6.749	85	9
Romania	0.576	1.759	1.187	13.664	12.727	177	19	0.920	3.088	27.095	11.575	6.213	57	7
Russian Federation	0.327	2.473	1.118	15.415	11.102	2997	557	1.061	3.536	24.409	13.519	6.119	455	54
Singapore	0.083	1.432	1.977	11.897	15.096	66	7	0.138	1.698	4.512	11.719	7.675	48	5
Slovak Rep.	0.436	1.202	2.815	8.291	13.725	89	9	0.241	1.431	8.340	8.434	6.561	59	6
Slovenia	0.610	1.437	2.229	8.818	14.346	122	12	0.712	1.900	11.955	8.697	6.366	86	8
South Africa	0.612	2.350	1.962	8.500	12.443	156	14	0.813	2.225	6.116	6.997	7.305	58	7
South Korea	0.618	1.471	2.386	5.291	16.951	162	15	0.648	1.751	8.025	5.452	7.697	135	13
Spain	0.271	0.970	4.201	6.388	14.691	361	37	0.316	1.196	7.951	6.397	7.006	190	20
Sri Lanka	0.543	2.023	0.353	7.330	13.379	135	12	0.582	2.474	5.411	6.633	6.109	85	8
Sweden	0.096	1.574	6.626	10.611	13.478	160	16	0.063	0.703	11.069	4.272	7.123	50	5
Switzerland	0.111	1.054	5.450	11.582	12.634	1055	114	0.105	1.237	2.249	15.485	5.941	128	15
Taiwan	0.593	0.992	2.498	6.493	16.029	399	35						0	0
Thailand	0.588	1.333	2.368	8.750	15.656	193	18	0.676	1.663	3.630	8.719	7.121	118	11
Tunisia	0.939	1.935	1.492	8.881	14.152	153	15	1.180	2.045	5.864	9.789	6.420	56	8
Turkey	0.852	3.022	0.166	11.987	15.096	72	8	0.603	3.069	15.943	11.442	6.734	206	21
Uganda	0.421	4.441	1.909	14.574	11.359	101	11	0.205	5.994	23.313	12.030	5.113	26	3
Ukraine	1.075	2.702	2.694	12.664	12.548	238	25	1.989	3.563	35.643	10.551	6.067	114	12
United Kingdom	0.082	0.912	2.909	8.947	14.403	452	60	0.294	1.252	9.642	6.438	7.223	330	36
United States	0.193	1.461	1.068	9.751	11.598	66770	6520	0.233	1.602	6.390	9.480	6.327	544	56

Uruguay	0.507	1.351	-0.013	8.612	12.750	177	18						0	0
Venezuela	0.581	3.848	0.317	11.180	13.585	238	26	0.868	5.502	27.060	10.875	6.633	50	5
Zimbabwe	1.094	10.780	-1.477	10.316	12.692	36	5						0	0

Panel B. Descriptive statistics and correlations in unconsolidated and consolidated data

	LLP	PROFITBPT	ΔL	CAPR	Size	GDPG	Unempl
	Descriptive statistics						
	Unconsolidated						
mean	0.496	1.585	3.353	11.115	12.265	1.542	6.593
median	0.214	1.457	1.233	9.750	11.908	1.681	5.900
sd	1.247	3.545	13.232	5.685	1.872	2.819	2.473
min	-18.902	-254.546	-49.857	0.005	3.745	-17.952	0.700
max	49.670	315.416	199.473	50.000	21.855	30.344	27.200
# obs	82356	93731	91789	93121	94388	109968	109968
	Consolidated						
mean	0.730	2.029	13.822	9.297	6.802	2.481	7.363
median	0.377	1.555	6.479	7.814	6.803	2.180	6.750
sd	1.298	2.368	35.711	5.911	0.920	3.689	3.648
min	-9.634	-9.068	-53.133	0.078	3.892	-16.589	0.700
max	19.654	40.153	884.389	49.468	9.486	30.344	27.200
# obs	9454	9668	8951	9968	10080	11892	11892
	Correlations						
	Unconsolidated						
LLP	1						
PROFITBPT	0.177***	1					
ΔL	-0.045***	-0.030***	1				
CAPR	0.087***	0.157***	0.113***	1			
Size	0.008***	-0.020***	0.052***	-0.324***	1		
GDPG	-0.081***	0.018***	0.000	0.041***	-0.007***	1	
Unempl	0.126***	-0.002	-0.013***	0.000	0.121***	-0.087***	1
	Consolidated						
LLP	1						
PROFITBPT	0.339***	1					
ΔL	-0.004	0.172***	1				
CAPR	0.170***	0.421***	0.096***	1			
Size	-0.150***	-0.253***	-0.134***	-0.528***	1		
GDPG	-0.133***	0.142***	0.253***	0.108***	-0.133***	1	
Unempl	0.140***	0.135***	0.034***	0.175***	-0.217***	-0.040***	1

This table presents the summary descriptive statistics of variables included in the study: LLP – loan loss provisions over average total assets; PROFITBPT – profit before provisions and taxes over average assets; ΔL – loans growth; *CAPR* – equity capital divided by total assets; size – logarithm of total assets; GDPG – real GDP growth per capita; Unempl – annual unemployment rate; obs – denotes observations; # - denotes the number of.

Table 2. Macroprudential policy instruments and their use across countries included in the study

	Type of macroprudential policy instrument											
	MaPI index											
Country	borrower	financial	LTV_CAP	DTI	DP	LEV	Inter	CONC	FC	RR_REV	CG	TAX	Country classification

Argentina	0	4.6	0	0	0	0	1	1	1	1	1	0	Closed	Emerging
Australia	0	1	0	0	0	0	1	0	0	0	0	0	Open	Advanced
Austria	0	0.1	0	0	0	0	0	0	0	0	0	0	Open	Advanced
Belgium	0	2	0	0	0	0	0	1	0	0	0	1	Open	Advanced
Brazil	0	2	0	0	0	0	0	1	0	1	0	0	Closed	Emerging
Bulgaria	0.5	2.2	0	0	0	0	0	1	0	0	0	0	Closed	Emerging
Canada	0.5	3	0	0	0	1	1	1	0	0	0	0	Open	Advanced
Chile	2	4	1	1	0	1	1	1	0	0	0	1	Open	Emerging
China	1.3	2	1	1	1	0	0	1	0	0	0	0	Closed	Emerging
Colombia	2	4.4	1	1	0	0	1	1	1	0	0	1	Closed	Emerging
Croatia	0	1.1	0	0	0	0	1	0	0	0	0	0	Open	Emerging
Cyprus	0.7	0	1	0	0	0	0	0	0	0	0	0	Open	Advanced
Czech Republic	0	1	0	0	0	0	0	1	0	0	0	0	Open	Advanced
Ecuador	0.8	3.8	0	1	0	1	0	1	0	0	1	1	Closed	Emerging
El Salvador	0	1	0	0	0	0	0	1	0	0	0	0	Closed	Emerging
Estonia	0	0	0	0	0	0	0	0	0	0	0	0	Open	Advanced
Finland	0	0	0	0	0	0	0	0	0	0	0	0	Open	Advanced
France	0	2	0	0	0	0	1	1	0	0	0	0	Open	Advanced
Germany	0	0.2	0	0	0	0	0	0	0	0	0	0	Open	Advanced
Ghana	0	2.6	0	0	0	0	0	1	0	0	1	1	Closed	Low-Income Developing
Hong Kong	2	1	1	1	0	0	0	1	0	0	0	0	Open	Advanced
Hungary	0.2	0.1	0	0	0	0	0	0	0	0	0	0	Open	Emerging
Iceland	0	1.9	0	0	0	0	0	1	1	0	0	0	Open	Advanced
India	0	1.4	0	0	0	0	0	1	0	0	0	0	Closed	Emerging
Indonesia	0	0.5	0	0	0	0	0	0	0	0	0	0	Open	Emerging
Ireland	0	0	0	0	0	0	0	0	0	0	0	0	Open	Advanced
Israel	0.1	1	0	0	0	0	0	1	0	0	0	0	Open	Advanced
Italy	0	2	0	0	0	0	1	1	0	0	0	0	Open	Advanced
Jamaica	0	1.5	0	0	0	1	0	0	0	0	0	1	Open	Emerging
Japan	0	1	0	0	0	0	0	1	0	0	0	0	Open	Advanced
Jordan	0	2.6	0	0	0	1	0	1	1	0	0	0	Open	Emerging
Kazakhstan	0	1	0	0	0	0	0	0	0	1	0	0	Closed	Emerging
Kenya	0	0	0	0	0	0	0	0	0	0	0	0	Closed	Low-Income Developing
Latvia	0.4	0	0	0	0	0	0	0	0	0	0	0	Open	Advanced
Lithuania	0	0	0	0	0	0	0	0	0	0	0	0	Closed	Emerging
Malaysia	1	1	1	0	0	0	0	0	0	0	1	0	Closed	Emerging
Malta	0	0	0	0	0	0	0	0	0	0	0	0	Open	Advanced
Mexico	0	1.8	0	0	0	0	1	1	0	0	0	0	Open	Emerging
Morocco	0	3	0	0	0	0	1	1	1	0	0	0	Closed	Emerging
Netherlands	0	0	0	0	0	0	0	0	0	0	0	0	Open	Advanced
New Zealand	0	0	0	0	0	0	0	0	0	0	0	0	Open	Advanced
Norway	0.2	1	0	0	0	0	0	1	0	0	0	0	Open	Advanced
Pakistan	1.5	4.4	1	0	0	0	1	1	1	0	0	1	Closed	Emerging
Peru	0	3.3	0	0	0	0	1	1	0	1	0	0	Closed	Emerging
Philippines	0	1.8	0	0	0	0	0	1	0	0	0	1	Closed	Emerging
Poland	0.1	1	0	0	0	0	0	1	0	0	0	0	Closed	Emerging

Portugal	0	0.2	0	0	0	0	0	0	0	0	0	0	Open	Advanced
Romania	1	1.7	1	1	0	0	1	1	0	0	0	0	Closed	Emerging
Russian Federation	0	1	0	0	0	0	0	1	0	0	0	0	Closed	Emerging
Singapore	1	0.8	1	0	0	0	0	1	0	0	0	0	Open	Advanced
Slovakia	1	0	1	0	0	0	0	0	0	0	0	0	Open	Advanced
Slovenia	0	0	0	0	0	0	0	0	0	0	0	0	Open	Advanced
South Africa	0	0	0	0	0	0	0	0	0	0	0	0	Closed	Emerging
South Korea	1.4	0.4	1	0	0	0	0	0	0	0	0	0	Closed	Advanced
Spain	1	2	1	0	1	0	0	1	0	0	0	0	Open	Advanced
Sri Lanka	0	1	0	0	0	0	0	1	0	0	0	0	Closed	Emerging
Sweden	0.1	0	0	0	0	0	0	0	0	0	0	0	Open	Advanced
Switzerland	0	1	0	0	0	0	0	0	0	0	0	0	Open	Advanced
Thailand	0.7	0	1	0	0	0	0	0	0	0	0	0	Closed	Emerging
Tunisia	0	0	0	0	0	0	0	0	0	0	0	0	Closed	Emerging
Turkey	0.4	1.3	0	0	0	0	0	1	0	0	0	0	Closed	Emerging
Uganda	0	0.7	0	0	0	0	1	0	0	0	0	0	Closed	Low-Income Developing
Ukraine	0	3.6	0	0	0	0	1	1	1	1	0	0	Closed	Emerging
United Kingdom	0	0	0	0	0	0	0	0	0	0	0	0	Open	Advanced
United States	0	2.9	0	0	0	1	1	1	0	0	0	0	Open	Advanced
													closed= 28 countires open= 37countries	advanced= 31 countries Emerging = 31 countries Low-income developing = 3 countries

This table includes values of macroprudential policy indices and of individual macroprudential policy instruments per country as given in the Cerutti et al., (2015) database. Macroprudential policy index (MaPI) covers one of two types of macroprudential policy indices: *BORROWER* and *FINANCIAL*. This index measures the range of application of macroprudential policy instruments in the period preceding and covering the Global Financial Crisis and is the average value of the number of macroprudential policy instruments in the years 2000-2010. E.g in the US there were three different instruments limiting risk-taking by banks used in the period of 2000-2010, thus the value of FINANCIAL is almost 3 (i.e. 2.9). Individual macroprudential policy instruments include: loan-to-value ratio caps (*LTV_CAP*) debt-to-income ratio (*DTI*), dynamic loan-loss provisioning (*DP*), leverage ratio (*LEV*), limits on interbank exposures (*INTER*), limits on foreign currency loans (*FC*), reserve requirements ratios (*RR*), limits on domestic currency growth (*CG*), levy/tax on financial institutions (*TAX*), and *FX* and/or countercyclical reserve requirements (*RR_REV*). To test our hypotheses, for each country we construct a dummy variable which takes the value of 1 if the instrument was applied at least since 2005, and 0 otherwise.

Table 3. Baseline results for unconsolidated and consolidated data

	Unconsolidated				Consolidated			
Dependent variable: LLP	ols	fe	gmm 2 step robust country and year dummies	gmm 2 step robust (reduced #lags up to 1)	ols	fe	gmm 2 step robust country and year dummies	gmm 2 step robust (reduced #lags up to 1)
	1	2	3	4	5	6	7	8
LLP(-1)	0.359***	0.226***	0.640***	0.799***	0.392***	0.139***	0.432***	0.501***
	(83.89)	(47.59)	(11.53)	(9.41)	(34.33)	(11.51)	(5.72)	(10.06)
LLP(-2)	0.108***	-0.008	0.136***	0.117	0.142***	0.026**	0.141*	0.067
	(23.98)	(-1.54)	(3.17)	(1.23)	(11.86)	(2.16)	(1.94)	(1.49)
PROFITBPT	0.079***	0.050***	0.069**	0.047**	0.125***	0.114***	0.145***	0.164***
	(33.51)	(16.44)	(2.48)	(2.32)	(18.58)	(10.85)	(3.38)	(3.64)
ΔL	-0.008***	-0.010***	-0.008***	-0.007***	0.001***	-0.002***	0.001	0.001**
	(-25.26)	(-29.22)	(-7.69)	(-8.58)	(3.27)	(-5.7)	(1.47)	(2.15)
CAPR (-1)	0.007***	-0.007***	0.012**	0.016***	-0.003	-0.011**	0.001	0.007
	(6.78)	(-4.75)	(2.25)	(3.72)	(-1.25)	(-2.50)	(0.17)	(0.96)
Size	0.042***	0.108***	0.043***	0.029***	-0.05***	0.222***	-0.011	0.030
	(12.87)	(11.00)	(9.23)	(6.18)	(-3.36)	(4.43)	(-0.28)	(0.62)
GDPG	-0.073***	-0.079***	-0.060***	-0.063***	-0.071***	-0.085***	-0.071***	-0.070***
	(-49.12)	(-47.97)	(-16.11)	(-19.74)	(-23.33)	(-25.30)	(-10.71)	(-11.70)
Unempl	0.046***	0.064***	0.017***	0.008*	0.011***	0.065***	0.008**	0.007*
	(25.01)	(29.01)	(4.17)	(1.83)	(3.51)	(9.38)	(2.32)	(1.8)
Constant	-0.601***	-1.238***	-0.657***	-0.487***	0.547***	-1.302***	0.204	-0.171
	(-13.32)	(-9.82)	(-8.43)	(-5.90)	(4.54)	(-3.47)	(0.61)	(-0.45)
interacted country and year dummies	no	no	yes	yes	no	no	yes	yes
Hansen			1862	825			880	825
p-Hansen			0.00	0.00			0.99	0.91
m1			-6.778	-5.025			-4.21	-5.74
p-val			0.00	0.00			0.00	0.00
m2			-0.872	-0.001			-1.64	-1.10
p-val			0.38	0.99			0.10	0.27
#Obs	64068	64068	64221	64221	7427	7427	7427	7427

This table presents the baseline coefficient estimates of LLP on bank – specific determinants and macroeconomic variables separately for unconsolidated and consolidated data. The bank-specific determinants include: PROFITBPT – profit before provisions and taxes over average assets; ΔL – loans growth; *CAPR* – equity capital divided by total assets; size – logarithm of total assets; Macroeconomic variables include: GDPG – real GDP growth per capita; Unempl – annual unemployment rate. Reported regressions are estimated with ordinary leaset squares (ols), fixed effects (fe) and the dynamic two-step system-GMM estimator as proposed by Blundell-Bond (1998) with Windmeijer's (2005) finite-sample correction for the period of 2000-2011 for panel data with lagged dependent variable (up to two lags of dependent variable are included). All regressions include country and year dummies and interactions between country and year dummies. T-statistics are given in parentheses. ***, ** or * next to coefficients indicate that coefficients are significantly different from zero at the 1%, 5%, or 10% levels, respectively. # - denotes the number of.

Table 4. Impact of macroprudential policy on procyclicality of LLP in unconsolidated and consolidated data

	Unconsolidated				Consolidated			
	Up to 4 lags		Up to 1 lag		Up to 4 lags		Up to 1 lag	
Type of macropdential index	BORROWER	FINANCIAL	BORROWER	FINANCIAL	BORROWER	FINANCIAL	BORROWER	FINANCIAL
Dependent variable: LLP	1	2	3	4	5	6	7	8
LLP(-1)	0.533***	0.537***	0.508***	0.513***	0.407***	0.405***	0.481***	0.481***
	(7.69)	(6.48)	(6.33)	(6.22)	(4.93)	(4.92)	(8.96)	(8.5)
LLP(-2)	0.147***	0.142***	0.199***	0.189***	0.158*	0.156*	0.073	0.066
	(3.00)	(2.82)	(3.05)	(3.09)	(1.90)	(1.87)	(1.52)	(1.32)
PROFITBPT	0.126***	0.132***	0.127***	0.138***	0.183***	0.191***	0.196***	0.206***
	(2.82)	(3.29)	(2.60)	(3.05)	(4.13)	(4.13)	(3.91)	(3.91)
ΔL	-0.003*	-0.002	-0.002	-0.002	0.002**	0.001**	0.002***	0.002***
	(-1.95)	(-1.58)	(-1.54)	(-1.11)	(2.50)	(2.27)	(2.94)	(2.70)
CAPR (-1)	-0.015**	-0.015*	-0.016***	-0.014**	-0.004	-0.003	-0.002	-0.001
	(-2.47)	(-1.82)	(-2.67)	(-1.97)	(-0.46)	(-0.34)	(-0.29)	(-0.11)
Size	-0.065***	-0.049***	-0.060***	-0.043***	-0.045	0.002	-0.036	0.012
	(-3.88)	(-3.10)	(-3.29)	(-3.76)	(-0.85)	(0.04)	(-0.61)	(0.20)
GDPG	-0.070***	-0.049***	-0.069***	-0.052***	-0.089***	-0.085***	-0.088***	-0.083***
	(-8.46)	(-5.86)	(-9.22)	(-6.05)	(-10.55)	(-8.23)	(-11.17)	(-8.46)
Unempl	0.002	-0.001	0.001	-0.001	0.007*	0.008**	0.005	0.006
	(0.57)	(-0.12)	(0.37)	(-0.12)	(1.79)	(1.97)	(1.35)	(1.64)
MaPI	-0.081*	0.034	-0.091*	0.026	-0.103***	-0.059*	-0.098***	-0.057*
	(-1.69)	(1.31)	(-1.70)	(0.94)	(-2.73)	(-1.94)	(-2.71)	(-1.86)
MaPI*GDPG	0.045***	-0.009*	0.046***	-0.008	0.039***	0.007	0.038***	0.006
	(5.27)	(-1.68)	(5.19)	(-1.36)	(4.92)	(0.82)	(4.91)	(0.72)
Constant	1.250***	0.976***	1.171***	0.875***	0.448	0.132	0.352	0.030
	(3.89)	(3.23)	(3.34)	(4.76)	(1.06)	(0.30)	(0.75)	(0.06)
Hansen	1159	1164	1052	1083	761	763	712	706
p-Hansen	0.000	0.000	0.000	0.000	1.00	1.00	0.97	0.98
m1	-5.433	-5.135	-4.668	-4.665	-3.80	-3.78	-5.29	-5.16
p-val	0.000	0.000	0.000	0.000	0.00	0.00	0.00	0.00
m2	-1.290	-1.188	-1.725	-1.659	-1.46	-1.49	-0.89	-0.87
p-val	0.197	0.235	0.085	0.097	0.15	0.14	0.38	0.39
#Obs	12990	12990	12990	12990	6317	6317	6317	6317

This table presents the coefficient estimates of LLP on bank – specific determinants, macroeconomic variables and macroprudential policy instruments. separately for unconsolidated and consolidated data. The bank-specific determinants include: PROFITBPT – profit before provisions and taxes over average assets; ΔL – loans growth; *CAPR* – equity capital divided by total assets; size – logarithm of total assets; Macroeconomic variables include: GDPG – real GDP growth per capita; Unempl – annual unemployment rate. Macroprudential policy indices (denoted as MaPI) include – borrower restrictions (denoted as BORROWER) and restrictions on financial sector balance sheet (denoted as FINANCIAL). Reported regressions are estimated with the dynamic two-step system-GMM estimator as proposed by Blundell-Bond (1998) with Windmeijer's (2005) finite-sample correction for the period of 2000-2011 for panel data with lagged dependent variable (up to two lags of dependent variable are included). Estimations in columns 1-2 and 5-6 are obtained with up to four lags of bank-specific variables, whereas in columns 3-4 and 7-8 with up to one lag of these variables, All regressions include country and year dummies and interactions between country and year dummies. T-

statistics are given in parentheses. ***, ** or * next to coefficients indicate that coefficients are significantly different from zero at the 1%, 5%, or 10% levels, respectively. # - denotes the number of

Table 5 Effect of borrower restrictions and financial institutions balance sheet restrictions on sensitivity of LLP to business cycle and the role of bank size (unconsolidated data)

	BORROWER			FINANCIAL		
	large	medium	small	large	medium	small
Dependent variable: LLP	1	2	3	4	5	6
LLP(-1)	0.439***	0.409***	0.428***	0.452***	0.412***	0.417***
	(4.72)	(7.42)	(3.97)	(4.98)	(7.56)	(4.11)
LLP(-2)	0.198***	0.073**	0.239***	0.191***	0.070**	0.228***
	(3.93)	(2.44)	(3.29)	(3.67)	(2.34)	(3.12)
PROFITBPT	0.095**	0.155***	0140*	0.093**	0.151***	0.140*
	(2.19)	(3.96)	(1.80)	(2.13)	(3.77)	(1.88)
ΔL	-0.002**	-0.003**	-0.001	-0.001	-0.003*	-0.001
	(-2.33)	(-2.06)	(-0.23)	(-1.47)	(-1.81)	(-0.19)
CAPR (-1)	0.013	-0.018***	-0.012	0.010	-0.019***	-0.006
	(1.46)	(-2.82)	(-1.20)	(1.21)	(-2.98)	(-0.62)
Size	-0.040*	-0.049**	-0.126***	-0.022	-0.047**	-0.103**
	(-1.73)	(-2.50)	(-2.63)	(-0.99)	(-2.52)	(-2.06)
GDPG	-0.081***	-0.060***	-0.115***	-0.048***	-0.047***	-0.082***
	(-7.98)	(-6.83)	(-5.41)	(-3.50)	(-3.90)	(-3.90)
Unempl	0.001	0.003	0.018	-0.002	0.001	0.011
	(0.10)	(0.45)	(1.15)	(-0.42)	(0.22)	(0.82)
BORROWER	-0.188***	-0.002	0.014			
	(-4.16)	(-0.03)	(0.06)			
BORROWER*GDPG	0.064***	0.029**	0.046			
	(6.19)	(2.45)	(1.08)			
FINANCIAL				0.010	0.036	0.173*
				(0.32)	(1.02)	(1.79)
FINANCIAL*GDPG				-0.010	-0.006	-0.022
				(-1.20)	(-0.76)	(-1.10)
Constant	0.806*	1.051***	1.997**	0.503	1.012***	1.504*
	(1.75)	(2.96)	(2.45)	(1.16)	(3.04)	(1.69)
Hansen	584	721	330	575	725	330
p-Hansen	1.00	0.84	1.00	1.00	0.81	1.00
m1	-3.84	-4.22	-2.94	-3.86	-4.22	-2.96
p-val	0.00	0.00	0.00	0.00	0.00	0.00
m2	-2.18	-0.63	-1.12	-2.12	-0.55	-1.05
p-val	0.03	0.53	0.26	0.03	0.59	0.29
#Obs	5018	5938	2034	5018	5938	2034

This table presents the coefficient estimates of LLP on bank – specific determinants, macroeconomic variables and macroprudential policy instruments. separately for unconsolidated and consolidated data. The bank-specific determinants include: PROFITBPT – profit before provisions and taxes over average assets; ΔL – loans growth; *CAPR* – equity capital divided by total assets; size – logarithm of total assets; Macroeconomic variables include: GDPG – real GDP growth per capita; Unempl – annual unemployment rate. Macroprudential policy indices (denoted as MaPI) include – borrower restrictions (denoted as BORROWER) and restrictions on financial sector balance sheet (denoted as FINANCIAL). Reported regressions are estimated with the dynamic two-step system-GMM estimator as proposed by Blundell-Bond (1998) with Windmeijer's (2005) finite-sample correction for the period of 2000-2011 for panel data with lagged dependent variable (up to two lags of dependent variable are included); Large is a dummy variable equal to 1 if a bank belongs to the 30% corresponding to the largest banks; medium is a dummy variable equal to 1 if a bank belongs to the next 40% of banks; small is a dummy variable equal to 1 if a bank belongs to the last 30% of banks with the smallest assets. All regressions include country and year dummies and interactions between country and year dummies. T-statistics are given in parentheses. ***, ** or * next to coefficients indicate that coefficients are significantly different from zero at the 1%, 5%, or 10% levels, respectively. # - denotes the number of.

Table 6. Role of individual macroprudential policy instruments in procyclicality of LLP in unconsolidated data

Macroprudential instrument type:	LTV CAP	DTI	DP	LEV	INTER	CONC	FC	CG	TAX	RR REV
Dependent variable: LLP	1	2	3	4	5	6	7	8	9	10
LLP(-1)	0.532***	0.530***	0.529***	0.537***	0.529***	0.530***	0.525***	0.527***	0.534***	0.530***
	(7.74)	(7.58)	(7.60)	(7.54)	(8.13)	(7.84)	(7.71)	(8.93)	(8.52)	(7.80)
LLP(-2)	0.147***	0.144***	0.144***	0.146***	0.151***	0.139***	0.143***	0.144**	0.148***	0.145***
	(2.97)	(2.82)	(2.82)	(2.92)	(3.01)	(2.72)	(2.93)	(2.49)	(2.94)	(2.77)
PROFITBPT	0.126***	0.126***	0.126***	0.130**	0.12637**	0.127**	0.129***	0.131*	0.132**	0.132***
	(2.74)	(2.71)	(2.82)	(2.51)	(2.50)	(2.54)	(2.58)	(1.94)	(2.47)	(3.02)
ΔL	-0.003*	-0.003**	-0.003**	-0.002	-0.003*	-0.002	-0.003*	-0.003*	-0.003*	-0.002*
	(-1.94)	(-2.08)	(-2.04)	(-1.64)	(-1.73)	(-1.60)	(-1.74)	(-1.72)	(-1.75)	(-1.73)
CAPR (-1)	-0.017***	-0.015***	-0.014**	-0.015*	-0.013**	-0.015**	-0.015**	-0.013**	-0.015**	-0.022***
	(-2.71)	(-2.59)	(-2.29)	(-1.92)	(-2.04)	(-2.35)	(-2.17)	(-2.15)	(-2.29)	(-3.01)
Size	-0.069***	-0.063***	-0.061***	-0.051***	-0.043**	-0.051**	-0.043**	-0.038	-0.050**	-0.053***
	(-3.92)	(-3.57)	(-3.58)	(-2.65)	(-2.39)	(-2.57)	(-2.12)	(-0.89)	(-2.24)	(-3.06)
GDPG	-0.069***	-0.067***	-0.066***	-0.060***	-0.051***	-0.073***	-0.047***	-0.051***	-0.062***	-0.043***
	(-8.19)	(-8.41)	(-8.83)	(-6.16)	(-6.97)	(-8.30)	(-7.09)	(-4.40)	(-6.09)	(-6.75)
Unempl	0.002	0.002	0.003	0.002	0.004	0.003	0.002	0.002	0.003	-0.002
	(0.65)	(0.55)	(0.77)	(0.36)	(0.87)	(0.77)	(0.52)	(0.43)	(0.55)	(-0.43)
MaPI individ	-0.053	-0.092	-0.101*	-0.025	0.007	-0.002	0.335***	0.225*	-0.216***	0.418***
	(-0.91)	(-0.74)	(-1.76)	(-0.21)	(0.16)	(-0.04)	(2.69)	(1.86)	(-2.58)	(4.02)
MaPI individ * GDPG	0.053***	0.056***	0.062***	-0.024	-0.037***	0.019	-0.097***	-0.080***	0.048**	-0.099***
	(4.89)	(3.43)	(7.53)	(-0.61)	(-2.65)	(1.63)	(-3.69)	(-3.02)	(2.21)	(-4.41)
Constant	1.319***	1.223***	1.180***	1.037***	0.881**	1.044***	0.894**	0.814	1.029**	1.101***
	(3.92)	(3.61)	(3.59)	(2.81)	(2.54)	(2.77)	(2.37)	(1.15)	(2.40)	(3.41)
Hansen	1164	1156	1149	1174	1149	1170	1146	1158	1184	1104
p-Hansen	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
m1	-5.49	-5.42	-5.39	-5.37	-5.42	-5.47	-5.41	-5.54	-5.53	-5.33
p-val	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
m2	-1.29	-1.22	-1.20	-1.24	-1.36	-1.13	-1.29	-1.19	-1.28	-1.18

p-val	0.20	0.22	0.23	0.22	0.17	0.26	0.20	0.23	0.20	0.24
#Obs	12990	12990	12990	12990	12990	12990	12990	12990	12990	12990

This table presents the coefficient estimates of LLP on bank – specific determinants, macroeconomic variables and macroprudential policy instruments. The bank-specific determinants include: PROFITBPT – profit before provisions and taxes over average assets; ΔL – loans growth; *CAPR* – equity capital divided by total assets; size – logarithm of total assets; Macroeconomic variables include: GDPG – real GDP growth per capita; Unempl – annual unemployment rate. Macroprudential policy instruments (denoted as MaPI individ) include – i.e.: loan-to-value ratio caps (*LTV_CAP*) debt-to-income ratio (*DTI*), dynamic loan-loss provisioning (*DP*), leverage ratio (*LEV*), limits on interbank exposures (*INTER*), limits on foreign currency loans (*FC*), limits on domestic currency growth (*CG*), levy/tax on financial institutions (*TAX*), and *FX* and/or countercyclical reserve requirements (*RR_REV*). Reported regressions are estimated with the dynamic two-step system-GMM estimator as proposed by Blundell-Bond (1998) with Windmeijer's (2005) finite-sample correction for the period of 2000-2011 for panel data with lagged dependent variable (up to two lags of dependent variable are included).). Large is a dummy variable equal to 1 if a bank belongs to the 30% corresponding to the largest banks; medium is a dummy variable equal to 1 if a bank belongs to the next 40% of banks; small is a dummy variable equal to 1 if a bank belongs to the last 30% of banks with the smallest assets. All regressions include country and year dummies and interactions between country and year dummies. T-statistics are given in parentheses. ***, ** or * next to coefficients indicate that coefficients are significantly different from zero at the 1%, 5%, or 10% levels, respectively. # - denotes the number of.

Table 7. Reduced number of lags of bank-specific variables and the role of individual macroprudential policy instruments in procyclicality of LLP in consolidated data

Macroprudential instrument type:	LTV CAP	DTI	DP	LEV	INTER	CONC	FC	CG	TAX	RR REV
Dependent variable: LLP	1	2	3	4	5	6	7	8	9	10
LLP(-1)	0.406***	0.408***	0.405***	0.405***	0.406***	0.409***	0.391***	0.406***	0.406***	0.371***
	(4.94)	(4.94)	(4.89)	(4.91)	(4.97)	(4.94)	(4.92)	(4.96)	(4.94)	(4.80)
LLP(-2)	0.158*	0.156*	0.154*	0.152*	0.159*	0.156*	0.166**	0.158*	0.154*	0.148*
	(1.90)	(1.87)	(1.85)	(1.83)	(1.91)	(1.87)	(2.02)	(1.89)	(1.86)	(1.79)
PROFITBPT	0.182***	0.181***	0.179***	0.190***	0.188***	0.185***	0.178***	0.185***	0.187***	0.171***
	(4.09)	(4.13)	(4.05)	(4.24)	(4.12)	(4.16)	(4.09)	(4.10)	(4.10)	(3.97)
ΔL	0.002**	0.002**	0.002**	0.001**	0.002**	0.002**	0.001**	0.001**	0.001**	0.001
	(2.58)	(2.40)	(2.40)	(2.17)	(2.45)	(2.32)	(2.36)	(2.02)	(2.15)	(1.64)
CAPR (-1)	-0.004	-0.004	-0.002	-0.003	-0.004	-0.004	-0.003	-0.002	-0.002	-0.002
	(-0.50)	(-0.48)	(-0.28)	(-0.37)	(-0.47)	(-0.51)	(-0.35)	(-0.29)	(-0.3)	(-0.28)
Size	-0.051	-0.052	-0.053	-0.011	-0.011	-0.014	-0.005	-0.013	-0.015	-0.012
	(-0.92)	(-0.96)	(-0.93)	(-0.20)	(-0.20)	(-0.26)	(-0.09)	(-0.26)	(-0.29)	(-0.24)
GDPG	-0.09***	-0.086***	-0.086***	-0.080***	-0.073***	-0.094***	-0.068***	-0.074***	-0.080***	-0.069***
	(-10.68)	(-10.92)	(-11.17)	(-10.75)	(-10.32)	(-8.63)	(-10.37)	(-10.21)	(-10.69)	(-10.61)
Unempl	0.008**	0.006	0.008*	0.007*	0.007*	0.006	0.005	0.005	0.006*	0.004

	(1.97)	(1.63)	(1.83)	(1.86)	(1.78)	(1.50)	(1.15)	(1.24)	(1.69)	(1.14)
MaPI individ	-0.137***	-0.091	-0.160***	-0.277***	-0.022	-0.066	0.512***	0.110	-0.212**	1.032***
	(-2.91)	(-1.22)	(-2.87)	(-2.80)	(-0.34)	(-1.37)	(3.29)	(0.79)	(-2.31)	(4.32)
MaPI individ * GDPG	0.056***	0.053***	0.073***	0.047**	-0.033**	0.024*	-0.109***	-0.068**	0.045**	-0.109***
	(5.54)	(4.30)	(6.57)	(2.05)	(-2.05)	(1.94)	(-4.18)	(-2.16)	(2.11)	(-4.13)
Constant	0.482	0.497	0.486	0.191	0.187	0.261	0.140	0.210	0.225	0.222
	(1.10)	(1.15)	(1.09)	(0.45)	(0.44)	(0.61)	(0.34)	(0.52)	(0.54)	(0.55)
Hansen	761	765	761	764	762	761	757	762	763	759
p-Hansen	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
m1	-3.82	-3.80	-3.81	-3.80	-3.82	-3.76	-3.82	-3.80	-3.80	-3.84
p-val	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
m2	-1.43	-1.47	-1.45	-1.47	-1.48	-1.51	-1.46	-1.53	-1.47	-1.30
p-val	0.15	0.14	0.15	0.14	0.14	0.13	0.14	0.13	0.14	0.19
#Obs	6317	6317	6317	6317	6317	6317	6317	6317	6317	6317

This table presents the coefficient estimates of LLP on bank – specific determinants, macroeconomic variables and macroprudential policy instruments. The bank-specific determinants include: PROFITBPT – profit before provisions and taxes over average assets; ΔL – loans growth; *CAPR* – equity capital divided by total assets; size – logarithm of total assets; Macroeconomic variables include: GDPG – real GDP growth per capita; Unempl – annual unemployment rate. Macroprudential policy instruments (denoted as MaPI individ) include – i.e.: loan-to-value ratio (*LTV*), loan-to-value ratio caps (*LTV_CAP*) debt-to-income ratio (*DTI*), dynamic loan-loss provisioning (*DP*), leverage ratio (*LEV*), limits on interbank exposures (*INTER*), limits on foreign currency loans (*FC*), reserve requirements ratios (*RR*), limits on domestic currency growth (*CG*), levy/tax on financial institutions (*TAX*), and *FX* and/or countercyclical reserve requirements (*RR_REV*). Reported regressions are estimated with the dynamic two-step system-GMM estimator as proposed by Blundell-Bond (1998) with Windmeijer's (2005) finite-sample correction for the period of 2000-2011 for panel data with lagged dependent variable (up to two lags of dependent variable are included). In this Table we include estimations with one lag of bank-specific variables (instead of four included in the Table 7). Large is a dummy variable equal to 1 if a bank belongs to the 30% corresponding to the largest banks; medium is a dummy variable equal to 1 if a bank belongs to the next 40% of banks; small is a dummy variable equal to 1 if a bank belongs to the last 30% of banks with the smallest assets. All regressions include country and year dummies and interactions between country and year dummies. T-statistics are given in parentheses. ***, ** or * next to coefficients indicate that coefficients are significantly different from zero at the 1%, 5%, or 10% levels, respectively. # - denotes the number of.

Table 8. Effect of individual macroprudential instruments targeted at borrowers (borrower restrictions) and bank size

Macroprudential instrument type:	LTV CAP			DTI		
Dependent variable: LLP	large	medium	small	large	medium	small
	1	2	3	4	5	6
LLP(-1)	0.438***	0.412***	0.430***	0.440***	0.405***	0.425***
	(4.73)	(7.54)	(3.87)	(4.77)	(7.27)	(4.02)
LLP(-2)	0.194***	0.073**	0.237***	0.195***	0.069**	0.233***
	(3.80)	(2.41)	(3.17)	(3.82)	(2.29)	(3.20)
PROFITBPT	0.094**	0.154***	0.141*	0.947**	0.152***	0.139*
	(2.14)	(4.07)	(1.82)	(2.19)	(3.96)	(1.84)
ΔL	-0.002**	-0.003**	-0.001	-0.002**	-0.003**	-0.001
	(-2.22)	(-1.97)	(-0.22)	(-2.31)	(-2.07)	(-0.21)
CAPR (-1)	0.013	-0.018***	-0.013	0.012	-0.018***	-0.010
	(1.44)	(-2.92)	(-1.27)	(1.37)	(-2.85)	(-1.00)
Size	-0.041*	-0.051***	-0.131***	-0.041*	-0.051**	-0.116**
	(-1.71)	(-2.59)	(-2.60)	(-1.76)	(-2.57)	(-2.37)
GDPG	-0.079***	-0.061***	-0.115***	-0.077***	-0.060***	-0.111***
	(-7.93)	(-6.93)	(-5.38)	(-7.90)	(-7.01)	(-5.54)
Unempl	0.001	0.004	0.018	-0.000	0.003	0.018
	(0.22)	(0.62)	(1.09)	(-0.00)	(0.50)	(1.13)
MaPI individ	-0.138**	-0.041	0.163	-0.226**	0.105	0.190
	(-2.56)	(-0.57)	(0.57)	(-2.00)	(0.59)	(0.31)
MaPI individ * GDPG	0.070***	0.043***	0.047	0.077***	0.029	0.034
	(5.80)	(3.12)	(0.81)	(4.39)	(1.43)	(0.35)
Constant	0.799*	1.079***	2.064**	0.818*	1.095***	1.855**
	(1.71)	(3.06)	(2.38)	(1.77)	(3.05)	(2.21)
Hansen	582.28	722.79	330.97	574.82	726.17	327.10
p-Hansen	1.00	0.82	1.00	1.00	0.80	1.00
m1	-3.86	-4.22	-2.91	-3.86	-4.22	-2.96
p-val	0.00	0.00	0.00	0.00	0.00	0.00
m2	-2.12	-0.60	-1.06	-2.16	-0.55	-1.08
p-val	0.03	0.55	0.29	0.03	0.58	0.28
#Obs	5018	5938	2034	5018	5938	2034

This table presents the coefficient estimates of LLP on bank – specific determinants, macroeconomic variables and macroprudential policy instruments. The bank-specific determinants include: PROFITBPT – profit before provisions and taxes over average assets; ΔL – loans growth; *CAPR* – equity capital divided by total assets; size – logarithm of total assets; Macroeconomic variables include: GDPG – real GDP growth per capita; Unempl – annual unemployment rate. Macroprudential policy instruments (denoted as MaPI individ) include: loan-to-value ratio caps (*LTV_CAP*) debt-to-income ratio (*DTI).* Reported regressions are estimated with the dynamic two-step system-GMM estimator as proposed by Blundell-Bond (1998) with Windmeijer's (2005) finite-sample correction for the period of 2000-2011 for panel data with lagged dependent variable (up to two lags of dependent variable are included); Large is a dummy variable equal to 1 if a bank belongs to the 30% corresponding to the largest banks; medium is a dummy variable equal to 1 if a bank belongs to the next 40% of banks; small is a dummy variable equal to 1 if a bank belongs to the last 30% of banks with the smallest assets. All regressions include country and year dummies and interactions between country and year dummies. T-statistics are given in parentheses. ***, ** or * next to coefficients indicate that coefficients are significantly different from zero at the 1%, 5%, or 10% levels, respectively. # - denotes the number of.

Table 9. Effect of individual macroprudential instruments targeted at bank risk-taking (financial institutions balance sheet restrictions) and bank size

Macroprudential instrument type:		DP			CONC			TAX	
Dependent variable: LLP	large	medium	small	large	medium	small	large	medium	small
	1	2	3	4	5	6	7	8	9
LLP(-1)	0.436***	0.410***	0.427***	0.445***	0.407***	0.425***	0.448***	0.411***	0.429***
	(4.70)	(7.53)	(3.93)	(4.78)	(7.48)	(4.03)	(4.83)	(7.50)	(4.02)
LLP(-2)	0.188***	0.072**	0.238***	0.190***	0.071**	0.236***	0.192***	0.072**	0.242***
	(3.64)	(2.41)	(3.29)	(3.66)	(2.38)	(3.29)	(3.72)	(2.39)	(3.29)
PROFITBPT	0.093**	0.154***	0.139*	0.0932**	0.154***	0.138*	0.095**	0.153***	0.138*
	(2.13)	(3.99)	(1.83)	(2.13)	(3.88)	(1.80)	(2.17)	(3.95)	(1.83)
ΔL	-0.002**	-0.003**	-0.002	-0.002*	-0.003*	-0.001	-0.002	-0.003*	-0.001
	(-2.46)	(-2.09)	(-0.28)	(-1.75)	(-1.81)	(-0.21)	(-1.58)	(-1.86)	(-0.24)
CAPR (-1)	0.014	-0.018***	-0.009	0.008	-0.019***	-0.005	0.006	-0.019***	-0.007
	(1.58)	(-2.75)	(-0.84)	(0.98)	(-3.08)	(-0.46)	(0.71)	(-2.90)	(-0.71)
Size	-0.040*	-0.048**	-0.109**	-0.024	-0.046**	-0.101*	-0.035	-0.046**	-0.099*
	(-1.69)	(-2.40)	(-2.14)	(-1.12)	(-2.31)	(-1.66)	(-1.49)	(-2.41)	(-1.95)
GDPG	-0.076***	-0.059***	-0.109***	-0.092***	-0.062***	-0.110***	-0.065***	-0.054***	-0.107***
	(-8.06)	(-7.04)	(-5.47)	(-5.95)	(-4.78)	(-5.22)	(-7.97)	(-7.06)	(-5.42)
Unempl	0.001	0.005	0.022	0.001	0.004	0.023	-0.002	0.002	0.020
	(0.22)	(0.69)	(1.27)	(0.13)	(0.62)	(1.42)	(-0.46)	(0.38)	(1.16)
MaPI individ	-0.044	-0.146	-0.556***	-0.083	0.021	0.179	-0.343***	-0.038	-0.175
	(-0.76)	(-1.43)	(-3.04)	(-1.07)	(0.29)	(1.02)	(-6.25)	(-0.22)	(-0.71)
MaPI individ * GDPG	0.066***	0.054***	0.138***	0.043**	0.013	0.002	0.069***	0.036	0.087
	(5.63)	(3.39)	(3.85)	(2.39)	(0.81)	(0.04)	(5.78)	(0.75)	(1.13)
Constant	0.777*	1.028***	1.726**	0.603	1.005***	1.455	0.785*	1.022***	1.586*
	(1.67)	(2.86)	(1.97)	(1.38)	(2.90)	(1.42)	(1.66)	(2.98)	(1.79)
Hansen	578.73	725.80	329.08	579.44	724.91	332.97	578.84	726.37	330.13
p-Hansen	1.00	0.80	1.00	1.00	0.81	1.00	1.00	0.80	1.00

m1	-3.87	-4.22	-2.92	-3.93	-4.22	-2.96	-3.90	-4.22	-2.94
p-val	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
m2	-2.09	-0.59	-1.09	-2.06	-0.57	-1.10	-2.13	-0.59	-1.13
p-val	0.04	0.56	0.28	0.04	0.57	0.27	0.03	0.56	0.26
#Obs	5018	5938	2034	5018	5938	2034	5018	5938	2034

This table presents the coefficient estimates of LLP on bank – specific determinants, macroeconomic variables and macroprudential policy instruments. The bank-specific determinants include: PROFITBPT – profit before provisions and taxes over average assets; ΔL – loans growth; *CAPR* – equity capital divided by total assets; size – logarithm of total assets; Macroeconomic variables include: GDPG – real GDP growth per capita; Unempl – annual unemployment rate. Macroprudential policy instruments (denoted as MaPI individ) include: dynamic loan-loss provisioning (*DP*), leverage ratio (*LEV*), limits on interbank exposures (*INTER*), limits on foreign currency loans (*FC*), limits on domestic currency growth (*CG*), levy/tax on financial institutions (*TAX*), and *FX* and/or countercyclical reserve requirements (*RR_REV*). Reported regressions are estimated with the dynamic two-step system-GMM estimator as proposed by Blundell-Bond (1998) with Windmeijer's (2005) finite-sample correction for the period of 2000-2011 for panel data with lagged dependent variable (up to two lags of dependent variable are included); Large is a dummy variable equal to 1 if a bank belongs to the 30% corresponding to the largest banks; medium is a dummy variable equal to 1 if a bank belongs to the next 40% of banks; small is a dummy variable equal to 1 if a bank belongs to the last 30% of banks with the smallest assets. All regressions include country and year dummies and interactions between country and year dummies. T-statistics are given in parentheses. ***, ** or * next to coefficients indicate that coefficients are significantly different from zero at the 1%, 5%, or 10% levels, respectively. # - denotes the number of.

Table 10. Impact of individual macroprudential instruments on procyclicality of LLP in unconsolidated data – effect of reduced number of lags

Macroprud instrum type:	LTV CAP	DTI	DP	LEV	INTER	CONC	FC	CG	TAX	RR REV
Dependent variable: LLP	1	2	3	4	5	6	7	8	9	10
LLP(-1)	0.507***	0.505***	0.504***	0.513***	0.501***	0.501***	0.525***	0.502***	0.515***	0.503***
	(6.66)	(6.07)	(6.09)	(6.91)	(5.73)	(6.65)	(7.71)	(6.55)	(6.99)	(6.34)
LLP(-2)	0.186***	0.194***	0.193***	0.195***	0.203***	0.192**	0.143***	0.192***	0.198***	0.193***
	(2.91)	(2.98)	(3.08)	(3.16)	(3.30)	(2.56)	(2.93)	(3.05)	(3.13)	(2.76)
PROFITBPT	0.133**	0.127***	0.126***	0.137***	0.133***	0.138*	0.129***	0.136**	0.131***	0.140***
	(2.32)	(2.84)	(3.01)	(3.60)	(3.15)	(1.80)	(2.58)	(2.58)	(3.03)	(2.78)
ΔL	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.003*	-0.002	-0.002	-0.002
	(-1.38)	(-1.57)	(-1.57)	(-1.07)	(-1.32)	(-1.22)	(-1.74)	(-1.34)	(-1.27)	(-1.33)
CAPR (-1)	-0.016**	-0.016**	-0.014**	-0.015	-0.012	-0.015*	-0.015**	-0.013*	-0.017***	-0.023**
	(-2.36)	(-2.40)	(-2.10)	(-1.42)	(-1.55)	(-1.70)	(-2.17)	(-1.72)	(-2.63)	(-2.54)
Size	-0.058***	-0.059***	-0.056***	-0.043***	-0.035***	-0.040	-0.043**	-0.034**	-0.043***	-0.049
	(-2.92)	(-3.60)	(-3.55)	(-2.71)	(-3.29)	(-0.62)	(-2.12)	(-1.97)	(-4.20)	(-1.43)
GDPG	-0.069***	-0.067***	-0.066***	-0.062***	-0.053***	-0.077***	-0.047***	-0.052***	-0.061***	-0.045***
	(-7.11)	(-8.98)	(-9.75)	(-8.35)	(-7.37)	(-5.51)	(-7.09)	(-7.16)	(-9.49)	(-5.23)
Unempl	0.003	0.001	0.002	0.001	0.003	0.003	0.002	0.002	0.002	-0.002
	(0.67)	(0.41)	(0.62)	(0.33)	(0.55)	(0.61)	(0.52)	(0.40)	(0.42)	(-0.53)
MaPI individ	-0.028	-0.115	-0.093*	-0.034	0.015	-0.006	0.335***	0.113	-0.224**	0.349***
	(-0.42)	(-1.05)	(-1.66)	(-0.31)	(0.12)	(-0.10)	(2.69)	(1.06)	(-2.56)	(2.90)
MaPI individ * GDPG	0.050***	0.058***	0.061***	-0.021	-0.035	0.020	-0.097***	-0.052**	0.048**	-0.086***
	(4.14)	(3.93)	(7.91)	(-0.41)	(-1.09)	(1.60)	(-3.69)	(-1.98)	(2.12)	(-4.01)
Constant	1.111***	1.151***	1.091***	0.897***	0.741***	0.848	0.894**	0.732**	0.928***	1.036
	(2.94)	(3.68)	(3.60)	(3.33)	(4.34)	(0.78)	(2.37)	(2.18)	(4.20)	(1.62)
Hansen	1050	1057	1051	1096	1081	1107	1146	1057	1071	1010
p-Hansen	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
m1	-4.80	-4.61	-4.65	-4.79	-4.53	-4.70	-5.41	-4.68	-4.76	-4.49
p-val	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
m2	-1.58	-1.67	-1.69	-1.72	-1.88	-1.50	-1.29	-1.71	-1.73	-1.53
p-val	0.11	0.10	0.09	0.09	0.06	0.13	0.20	0.09	0.09	0.13

#Obs	12990	12990	12990	12990	12990	12990	12990	12990	12990	12990

This table presents the coefficient estimates of LLP on bank – specific determinants, macroeconomic variables and macroprudential policy instruments. The bank-specific determinants include: PROFITBPT – profit before provisions and taxes over average assets; ΔL – loans growth; *CAPR* – equity capital divided by total assets; size – logarithm of total assets; Macroeconomic variables include: GDPG – real GDP growth per capita; Unempl – annual unemployment rate. Macroprudential policy instruments (denoted as MaPI individ) include – i.e.: loan-to-value ratio (*LTV*), loan-to-value ratio caps (*LTV_CAP*) debt-to-income ratio (*DTI*), dynamic loan-loss provisioning (*DP*), leverage ratio (*LEV*), limits on interbank exposures (*INTER*), limits on foreign currency loans (*FC*), reserve requirements ratios (*RR*), limits on domestic currency growth (*CG*), levy/tax on financial institutions (*TAX*), and *FX* and/or countercyclical reserve requirements (*RR_REV*).. Reported regressions are estimated with the dynamic two-step system-GMM estimator as proposed by Blundell-Bond (1998) with Windmeijer's (2005) finite-sample correction for the period of 2000-2011 for panel data with lagged dependent variable (up to two lags of dependent variable are included). In this Table we include estimations with one lag of bank-specific variables (instead of four included in the Table 6). Large is a dummy variable equal to 1 if a bank belongs to the 30% corresponding to the largest banks; medium is a dummy variable equal to 1 if a bank belongs to the next 40% of banks; small is a dummy variable equal to 1 if a bank belongs to the last 30% of banks with the smallest assets. All regressions include country and year dummies and interactions between country and year dummies. T-statistics are given in parentheses. ***, ** or * next to coefficients indicate that coefficients are significantly different from zero at the 1%, 5%, or 10% levels, respectively. # - denotes the number of.

Table 11. Impact of individual macroprudential instruments on procyclicality of LLP in consolidated data – effect of reduced number of lags

Macroprud instrum type:	LTV CAP	DTI	DP	LEV	INTER	CONC	FC	CG	TAX	RR REV
Dependent variable: LLP	1	2	3	4	5	6	7	8	9	10
LLP(-1)	0.481***	0.483***	0.478***	0.479***	0.485***	0.486***	0.467***	0.486***	0.481***	0.446***
	(8.92)	(8.82)	(8.79)	(8.61)	(8.75)	(8.63)	(8.92)	(8.70)	(8.75)	(9.14)
LLP(-2)	0.073	0.070	0.067	0.063	0.069	0.069	0.080*	0.066	0.065	0.062
	(1.53)	(1.53)	(1.46)	(1.27)	(1.42)	(1.44)	(1.77)	(1.28)	(1.33)	(1.28)
PROFITBPT	0.195***	0.195***	0.192***	0.204***	0.204***	0.198***	0.192***	0.199***	0.201***	0.181***
	(3.86)	(3.93)	(3.91)	(4.02)	(3.9)	(3.79)	(3.82)	(3.74)	(3.96)	(3.56)
ΔL	0.002***	0.002***	0.002***	0.002**	0.002***	0.002***	0.002***	0.001**	0.002**	0.001**
	(2.99)	(2.74)	(2.86)	(2.45)	(2.93)	(2.75)	(2.84)	(2.47)	(2.40)	(2.20)
CAPR (-1)	-0.003	-0.002	0.000	-0.001	-0.002	-0.003	-0.001	0.000	0.000	0.000
	(-0.35)	(-0.32)	(-0.04)	(-0.09)	(-0.28)	(-0.38)	(-0.09)	(-0.06)	(-0.03)	(0.00)
Size	-0.042	-0.044	-0.045	0.001	0.004	-0.004	0.010	-0.001	-0.003	-0.001
	(-0.71)	(-0.72)	(-0.73)	(0.01)	(0.06)	(-0.06)	(0.17)	(-0.02)	(-0.05)	(-0.02)
GDPG	-0.089***	-0.086***	-0.085***	-0.078***	-0.073***	-0.093***	-0.067***	-0.073***	-0.078***	-0.068***
	(-11.17)	(-11.53)	(-11.95)	(-11.34)	(-11.09)	(-9.00)	(-11.05)	(-11.27)	(-11.23)	(-11.74)
Unempl	0.006	0.004	0.005	0.006	0.006	0.004	0.003	0.003	0.005	0.003
	(1.52)	(1.14)	(1.32)	(1.49)	(1.45)	(1.08)	(0.73)	(0.78)	(1.35)	(0.77)

MaPI individ	-0.126***	-0.114	-0.140**	-0.279***	-0.042	-0.076	0.491***	0.116	-0.215**	1.014***
	(-2.83)	(-1.56)	(-2.48)	(-2.74)	(-0.65)	(-1.59)	(3.32)	(0.84)	(-2.41)	(4.28)
MaPI individ * GDPG	0.055***	0.055***	0.069***	0.049**	-0.028*	0.025**	-0.104***	-0.067**	0.045**	-0.106***
	(5.52)	(4.55)	(6.13)	(2.00)	(-1.76)	(2.02)	(-4.03)	(-2.09)	(2.15)	(-4.11)
Constant	0.396	0.411	0.403	0.075	0.052	0.166	-0.003	0.086	0.100	0.116
	(0.85)	(0.86)	(0.84)	(0.16)	(0.11)	(0.34)	(-0.01)	(0.18)	(0.22)	(0.25)
Hansen	710	712	711	710	709	697	700	696	711	701
p-Hansen	0.97	0.97	0.97	0.97	0.97	0.99	0.98	0.99	0.97	0.98
m1	-5.29	-5.28	-5.30	-5.22	-5.25	-5.18	-5.31	-5.20	-5.23	-5.33
p-val	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
m2	-0.86	-0.91	-0.88	-0.85	-0.85	-0.94	-0.87	-0.88	-0.86	-0.63
p-val	0.39	0.36	0.38	0.40	0.39	0.35	0.38	0.38	0.39	0.53
#Obs	6317	6317	6317	6317	6317	6317	6317	6317	6317	6317

This table presents the coefficient estimates of LLP on bank – specific determinants, macroeconomic variables and macroprudential policy instruments. The bank-specific determinants include: PROFITBPT – profit before provisions and taxes over average assets; ΔL – loans growth; *CAPR* – equity capital divided by total assets; size – logarithm of total assets; Macroeconomic variables include: GDPG – real GDP growth per capita; Unempl – annual unemployment rate. Macroprudential policy instruments (denoted as MaPI individ) include – i.e.: loan-to-value ratio (*LTV*), loan-to-value ratio caps (*LTV_CAP*) debt-to-income ratio (*DTI*), dynamic loan-loss provisioning (*DP*), leverage ratio (*LEV*), limits on interbank exposures (*INTER*), limits on foreign currency loans (*FC*), reserve requirements ratios (*RR*), limits on domestic currency growth (*CG*), levy/tax on financial institutions (*TAX*), and *FX* and/or countercyclical reserve requirements (*RR_REV*). Reported regressions are estimated with the dynamic two-step system-GMM estimator as proposed by Blundell-Bond (1998) with Windmeijer's (2005) finite-sample correction for the period of 2000-2011 for panel data with lagged dependent variable (up to two lags of dependent variable are included). In this Table we include estimations with one lag of bank-specific variables (instead of four included in the Table 7). Large is a dummy variable equal to 1 if a bank belongs to the 30% corresponding to the largest banks; medium is a dummy variable equal to 1 if a bank belongs to the next 40% of banks; small is a dummy variable equal to 1 if a bank belongs to the last 30% of banks with the smallest assets. All regressions include country and year dummies and interactions between country and year dummies. T-statistics are given in parentheses. ***, ** or * next to coefficients indicate that coefficients are significantly different from zero at the 1%, 5%, or 10% levels, respectively. # - denotes the number of.

Table 12. Role of borrower restrictions and financial institutions based instruments and economic development and capital account openess (unconsolidated data).

	advanced		emerging		open		closed	
LLP	BORROWER	FINANCIAL	BORROWER	FINANCIAL	BORROWER	FINANCIAL	BORROWER	FINANCIAL
	1	2	3	4	5	6	7	8
LLP(-1)	0.580***	0.563***	0.397***	0.374***	0.550***	0.529***	0.400***	0.389***
	(5.36)	(5.31)	(4.87)	(4.50)	(5.95)	(5.68)	(4.79)	(4.36)
LLP(-2)	0.091	0.070	0.128**	0.124**	0.118*	0.106*	0.112**	0.115**
	(0.98)	(0.76)	(2.56)	(2.47)	(1.92)	(1.72)	(2.16)	(2.08)
PROFITBPT	0.030	0.030	0.191***	0.185***	0.032	0.0367	0.191***	0.183***
	(1.35)	(1.40)	(3.12)	(3.22)	(1.31)	(1.41)	(3.22)	(3.26)
ΔL	-0.002	-0.002	-0.002**	-0.002	-0.002	-0.002	-0.003**	-0.002*
	(-0.97)	(-1.16)	(-2.00)	(-1.22)	(-0.99)	(-1.24)	(-2.57)	(-1.95)
CAPR (-1)	-0.014	-0.011	-0.024***	-0.020***	-0.018	-0.014	-0.014*	-0.014*
	(-1.59)	(-1.27)	(-2.97)	(-2.66)	(-1.61)	(-1.51)	(-1.76)	(-1.87)
Size	-0.066***	-0.041**	-0.052**	-0.008	-0.075***	-0.049**	-0.026	0.011
	(-3.12)	(-2.01)	(-2.35)	(-0.39)	(-2.94)	(-2.34)	(-1.07)	(0.43)
GDPG	-0.059***	-0.072***	-0.095***	-0.031**	-0.063***	-0.070***	-0.091***	-0.035***
	(-7.79)	(-6.01)	(-8.12)	(-2.38)	(-7.72)	(-7.24)	(-8.00)	(-2.59)
Unempl	0.013*	0.028***	-0.007	-0.005	0.009	0.020**	-0.003	-0.004
	(1.89)	(2.92)	(-1.36)	(-0.89)	(1.26)	(2.55)	(-0.62)	(-0.75)
BORROWER	-0.081		-0.170***		-0.009		-0.067	
	(-1.10)		(-2.71)		(-0.17)		(-0.71)	
BORROWER*GDPG	0.030*		0.054***		0.032***		0.046***	
	(1.89)		(4.14)		(2.62)		(2.96)	
FINANCIAL		-0.113***		0.085**		-0.086***		0.088**
		(-4.19)		(2.39)		(-3.59)		(2.35)
FINANCIAL*GDPG		0.023***		-0.022***		0.021***		-0.022***
		(2.86)		(-3.10)		(3.52)		(-3.00)
Constant	1.215***	0.845**	1.412***	0.526	1.434***	1.020**	0.881*	0.193
	(2.94)	(2.10)	(3.14)	(1.21)	(2.77)	(2.41)	(1.80)	(0.36)
Hansen	560	583	613	602	616	612	601	593
p-Hansen	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
m1	-3.35	-3.43	-4.42	-4.22	-3.32	-3.29	-4.49	-4.29
p-val	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
m2	-0.83	-0.63	-1.18	-1.15	-0.92	-0.80	-0.87	-0.92
p-val	0.40	0.53	0.24	0.25	0.36	0.42	0.38	0.36
#Obs	6371	6371	6301	6301	6905	6905	6085	6085

This table presents the coefficient estimates of LLP on bank – specific determinants, macroeconomic variables and macroprudential policy instruments. separately for unconsolidated and consolidated data. The bank-specific determinants include: PROFITBPT – profit before provisions and taxes over average assets; ΔL – loans growth; *CAPR* – equity capital divided by total assets; size – logarithm of total assets; Macroeconomic variables include: GDPG – real GDP growth per capita; Unempl – annual unemployment rate. Macroprudential policy indices (denoted as MaPI) include – borrower restrictions (denoted as BORROWER) and restrictions on financial sector balance sheet (denoted as FINANCIAL). Reported regressions are estimated with the dynamic two-step system-GMM estimator as proposed by Blundell-Bond (1998) with Windmeijer's (2005) finite-sample correction for the period of 2000-2011 for panel data with lagged dependent variable (up to two lags of dependent variable are included); Large is a dummy variable equal to 1 if a bank belongs to the 30% corresponding to the largest banks; medium is a dummy variable equal to 1 if a bank belongs to the next 40% of banks; small is a dummy variable equal to 1 if a bank belongs to the last 30% of banks with the smallest assets. All regressions include country and year dummies and interactions between country and year dummies. T-statistics are given in parentheses. ***, ** or * next to coefficients indicate that coefficients are significantly different from zero at the 1%, 5%, or 10% levels, respectively. # - denotes the number of.