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WHAT DRIVES HETEROGENEITY OF PROCYCLICALITY OF LOAN LOSS PROVISIONS IN THE EU?

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What drives heterogeneity of procyclicality of loan loss provisions in the EU?

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Abstract

Using the two step system GMM Blundell and Bond estimator this paper documents a large cross-bank and cross-country variation in the relationship between loan loss provisions (LLP) and the business cycle and explores bank management specific, bank-activity specific and country specific (institutional and regulatory) features that explain this diversity in the European Union. Our results indicate that LLP in large, publicly traded and commercial banks, as well as in banks reporting consolidated statements, are more procyclical. Better investor protection and more restrictive bank capital regulations reduce the procyclicality of LLP. We do not find support for the view that better quality of market monitoring mitigates the sensitivity of LLP to business cycle. Our findings clearly indicate the empirical importance of income smoothing, capital management and credit risk management for decreased procyclicality of LLP.

JEL Classification: *E32, E44, G21*

Keywords: loan loss provisions, procyclicality, income smoothing, investor protection, bank regulation, bank supervision

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Contents

1. Introduction

The procyclicality of loan loss provisions (LLP) varies from bank-to-bank as well as from country-to–country. In this study we aim to find out what factors explain such diversity of LLP procyclicality. To resolve this problem we resort to risk management hypothesis, according to which banks and supervisors define a specific level of protection against loan losses and banks keep reserves for expected losses. This hypothesis emphasizes that having properly measured provisions against expected losses is likely to lessen fluctuations in recorded bank profitability and could mean that bank behavior becomes less sensitive to the business cycle (Borio et al., 2001). In the same vein, Fonseca and Gonzalez (2008) state that provisions should move in step with income (increase when bank profitability increases and decrease in times of declining bank efficiency) and with economic cycle. Laeven and Majnoni (2003), Bikker and Metzemakers (2005) and Bouvatier and Lepetit (2008, 2010) analyze the influence of economic growth on LLP, arguing that the strength of this influence may be reduced through forward–looking provisioning (e.g. income-smoothing). Empirical evidence suggests that banks do engage in earnings management (i.e. income smoothing and capital management; see Beaver and Engel, 1996; Ahmed et al., 1999 for this distinction) as well as in credit risk management. At the same time, however, this research fails to prove any countercyclical behavior of LLP. On the contrary, it does prove that LLP are procyclical.

Analysis of results of the above mentioned papers shows that the relationship between LLP and the business cycle (as a proxy for procyclicality) as well as bank profits (as a proxy for income smoothing), bank capital (as a proxy for capital management) and loan growth (as a proxy for credit risk management) is marked by visible diversity. This research, however, focuses mainly on the drivers of heterogeneity of earnings management, in particular income smoothing, and not on the factors which may affect the sensitivity of LLP to the business cycle. For example, Fonseca and Gonzalez (2008) focus on both bank specific and country specific determinants of income smoothing and conclude that at the cross country level, negative effects of income smoothing seem to be affected by investor protection, accounting disclosure, supervision, financial structure and development.

This paper extends previous research by focusing on the determinants of LLP procyclicality in the EU banks' sample, and not on the drivers of the application of loan loss accounting to managing earnings and capital, as this issue has already been extensively investigated. Therefore, our research is substantially different from previous studies in several ways. First, we analyze differences in LLP procyclicality stemming from specific characteristics of a bank's activity, i.e. bank type (publicly traded versus commercial privately held), bank specialization (commercial, cooperative, savings, bank holding) and bank size (large, medium, small). In this area we also look at how the sensitivity of loan loss provisions to the business cycle in the case of banks which report their accounting information in consolidated financial statements differs from banks which report unconsolidated financial statements. Second, considering the fact that at the international level bank risk management, proxied by income smoothing, may be influenced by country-specific environment measured by political-economy variables (i.e. quality of investor protection, financial sector structure and development, efficiency of bank regulation and supervision in limiting bank risk; see e.g. Fonseca and González, 2008), we ask whether those determinants affect LLP sensitivity to the business cycle? Finally, as the sensitivity of individual bank's LLP to the business cycle is predicted to depend on the bank's risk management behavior (see e.g. Borio et al., 2001), we explore the relationship between procyclicality of LLP and income smoothing, capital management and risk management at the individual bank's level.

To test the hypotheses explaining the role of specific characteristics of banking activity and the impact of country specific determinants we apply the generalized method of moments (GMM) estimators developed for dynamic models of panel data by Blundell and Bond (1998). To explore the role of loan loss accounting in LLP procyclicality, we use the OLS estimation technique to individual banks' data and calculate individual bank measures of procyclicality of LLP, income smoothing, capital management and earnings management. Those indicators are applied in a

multiple OLS regression to test the impact of income smoothing, capital management and default risk management on procyclicality of LLP.

Our results indicate that LLP of large, publicly traded and commercial banks, as well as of banks reporting consolidated statements, are more procyclical than of banks in other subsamples. Better investor protection and more restrictive bank capital regulations reduce the procyclicality of LLP. We do not find support for the view that better quality of market monitoring mitigates the risk-taking behavior of banks resulting in procyclicality of LLP. Our findings suggest the importance of income smoothing, capital management and default risk management for reduced sensitivity of LLP to business cycle.

This study is relevant to the current policy debate on the role of a bank's size in its procyclical behavior of. In particular we provide new evidence that large systemically important banks should be regulated more restrictively, as they have tendency to take on more risks, as is evident in our results for banks who are obliged to report consolidated statements. This provides support to the Basel Committee capital standards for systemically important financial institutions (SIFIs), included in the Basel III framework. Our results are also important to current macroprudential policy proposals, promoting the forward looking provisioning (by the Basel Committee and other international institutions, such as International Monetary Fund). In particular, we find support for the view that more income smoothing and prudent risk management result in less procyclicality of LLP.

The rest of the paper is organized as follows. Section 2 discusses the hypotheses regarding determinants of LLP procyclicality. Section 3 describes the dataset and empirical methodology. Section 4 reports and discusses empirical results. Finally, Section 5 presents conclusions and implications for further research.

2. Literature review and hypotheses development

2.1. Bank determinants

According to Laeven and Majnoni (2003), Bikker and Metzemakers (2005), Bouvatier and Lepetit (2008) banks' accounting practices in the area of loan loss provisions (LLP) are procyclical when the relationship between loan loss provision and real GDP growth (GDPG) is negative. Whereas the above mentioned authors provide empirical evidence for the procyclicality of LLP, they also point up that its negative effects may be alleviated through usage of more forward looking provisioning instead of backward-looking one (see also Borio et al., 2001).

In the literature there seems to be a consensus that banks may be engaged in loan loss accounting to manage earnings and capital (Koch and Wall, 2000; Floro, 2010). Earnings management is aimed at reducing the volatility of banks income, and is extensively analyzed in the empirical literature focused on testing the hypothesis of income smoothing by both industrial firms and banks (Greenawalt and Sinkey, 1988; Collins et al., 1995; Healy and Whalen, 1999; Dechov and Skinner, 2000; Wall and Koch, 2000; Beatty et al., 2002; Kanagaretnam et al., 2003; Goel and Thakor, 2003; Liu and Ryan, 2006). Liu and Ryan (2006) posit that banks prefer their allowances for loan losses do not fluctuate too much, in order to avoid scrutiny by bank regulators, auditors and market participants. The primary way that banks can reconcile these preferences is by exercising discretion over LLP, for example by accelerating charge-offs when allowance for loan losses would otherwise be too low. Such behavior of banks leads to prudent calculation of expected losses which may reduce the impact of external economic conditions on bank loan loss provisions. Following this argument, we expect that the LLP of banks which apply more income smoothing will be less procyclical.

Banks may also use LLP to manage their capital. Traditional capital management hypothesis states that bank managers use LLP to reduce expected regulatory costs associated with violating capital requirements, a negative relationship being predicted between capital ratios and loan loss

provisions for the US (Beatty at al., 1995; Ahmed et al., 1999; Galai et al., 2003; El Sood, 2011). We posit that banks prefer to have a steadily increasing amount of capital, as it is a nominator of capital adequacy ratio, and with the expansion of their credit activity it helps them keep stable level of capital adequacy ratio. A stable capital adequacy ratio should make a bank's lending activity less sensitive to recessions and less procyclical. This may also result in a more stable level of the bank's income and henceforth LLP over the business cycle, making it less procyclical.

Changes in total loans outstanding or in loan growth rate are related to changes in credit default risk. Analysis of the sensitivity of LLP to loan growth rate is usually applied in the literature to explore the so called risk management hypothesis (Laeven and Majnoni, 2003; Bikker and Metzemakers, 2005; Fonseca and González, 2008). Banks which provision more when loan growth is stronger should be less prone to macroeconomic conditions. This argument leads us to prediction that in the case of such banks loan loss provisions will be less procyclical.

2.1.1. Specific features of a bank – bank type, bank specialization and bank size.

The literature has traditionally forecasted that publicly traded firms engage more in income smoothing (Burgstahler and Dichev, 1997; Degeorge et al., 1999). Beatty et al. (2002) investigate the validity of the earnings management explanation by examining the stream of earnings' changes and the components of these changes for publicly vs. privately held banks during 1988-1998. They posit that the public versus private distinction is of great importance because shareholders of public banks are more likely than those of private banks to rely on simple earnings–based heuristics, such as comparisons of current and prior period earnings, in assessing bank performance (see Beatty and Harris, 1998:302-303). Therefore it is very probable that public bank managers encounter more pressure to report consistently increasing earnings. This stronger reliance of public banks on income smoothing may make their LLP system less procyclical.

The role of bank specialization for procyclicality of loan loss provisions has not been formally tested thus far. However, we expect that specialization may matter for this phenomenon due to the fact that the business model of a bank determines the extent to which the bank responds to macroeconomic conditions. For example, commercial banks which operate at a country or international level may be more prone to business cycle fluctuations, and therefore their loan loss provisions may be more responsive to GDP changes. In contrast, cooperative banks, which usually operate on local markets and have a stronger relationship with their customers, both borrowers and depositors, are not so prone to external business cycle conditions. The same reasoning refers to savings banks. Considering this, we expect loan loss provisions of commercial banks to be more sensitive to business cycle.

Bank size may also have an impact on bank risk and therefore affect the loan loss provision responses to business cycle. There has been an increase in the average size of EU banks in 1996-2011, but there is little consistency in the literature in terms of the relation between bank size and bank risk. Large banks may have greater chances for diversification, and therefore could better reduce overall risk exposure as compared to smaller banks that do not have much opportunity to diversify their loan portfolio (Konishi and Yasuda, 2004; Stiroh, 2006). Government protection of larger banks could also result in large banks becoming "too big to fail" or "too interconnected to fail" (Schooner and Taylor, 2010; Stiglitz, 2010, De Haan and Poghosyan, 2012), in particular financial conglomerates operating in a few sectors of financial market (e.g. banking, insurance and other financial products), and as the economic theory predicts, such banks undertake too many risky investments (see also Freixas et al., 2007). Large banks could also be more sensitive to general market movements than small banks focusing on traditional loan extension activity, which may lead to positive relation between bank size and systemic risk (Anderson and Fraser, 2000; Haq and Heaney, 2012). In the EU context, the problem of bank size has been accounted for in the analysis

of factors determining bank risk (Haq and Heaney, 2012). In 15 EMU countries the relationship between systemic risk of the banking sector (proxied by bank equity market beta) and bank size has been found to be positive (Haq and Heaney, 2012). But can we state the same about the relationship between loan loss provisions and the business cycle? In other words, are loan loss provisions of large banks, in particular those operating in conglomerates and reporting consolidated financial statements, more negatively affected by the business cycle?

2.2. Country determinants

2.2.1. Quality of investor protection

A first set of country traits that can influence the relationship between loan loss provisions and the business cycle is the institutional framework in which banks conduct their business. The institutional framework which affects the quality of investor protection may have an effect on the scope of moral hazard by entrepreneurs. As Djankov et al. (2008) show, the improvement of regulation of investor protection, in particular in the area of self-dealing transactions leads to more developed financial markets. This improvement should consist in facilitating private enforcement of conduct for parties involved in self-dealing transactions. Such facilitating approach emphasizes extensive disclosure, approval procedures for transactions, and opening the door for private litigation when self-dealing is suspected. Djankov et al. (2008) find that high quality of investor protection in self-dealing transactions results in better development of stock markets. Moreover, Demirgüc-Kunt and Detragiache (2002) show that a sound legal system with proper enforcement of rules reduces the adverse effects of deposit insurance on bank risk-taking. As is suggested by Fonseca and González (2008) this lower risk taking in countries with better investor protection would also diminish bank incentives to smooth income which is stable *per se*. Therefore we predict that LLP of banks who operate in countries with high quality of investor protection framework is will be less sensitive to the business cycle.

2.2.2. Financial sector structure and development

A second important country characteristic that can influence the relationship between loan loss provisions and the business cycle is the structure and development of the financial system in which banks operate. The characteristics of the relation between the financial structure and LLP procyclicality may depend on a few factors which affect managerial decisions. If banks operate in countries which are more market oriented and in which bank ownership is more dispersed (La Porta et al., 1999; La Porta et al., 2002), their managers may have more incentives to apply prudent risk management practices, because the greater number of users of financial statements makes accounting data very important in the assessment of a bank's solvency (Fonseca and Gonzalez, 2008). In such a case, the procyclicality of LLP may be diminished. In the EU context, however, in which most countries have rather more bank oriented financial systems the influence of the structure of the financial sector on LLP procyclicality may also be negative. This argument predicts little impact of increased market orientation on LLP procyclicality in the EU. The direction of the impact of financial sector structure on the sensitivity of LLP to business cycle may also depend on the type of financial statements which banks prepare. For example, in the case of banks which report consolidated data, the role of the stock market is increased, due to greater transparency of their activities. This transparency induces bank managers to provide information on the sound capital adequacy of the bank, and therefore may result in prudent risk management. Such risk

management should reduce the procyclicality of LLP in banks which report consolidated statements. The opposite may be true in the case of banks whose financial data is published in unconsolidated statements.

We incorporate the influence of financial sector development on the procyclicality of LLP by analyzing the overall activity of the financial intermediaries and markets and the overall size of the financial sector. As in the case of financial sector structure, it is not straightforward to determine how financial development impacts on the sensitivity of LLP to the business cycle. The experience of financial (and in particular banking) crises suggests that banks operating in countries with better developed financial sectors are more prone to procyclicality. United Kingdom, Portugal and Spain are good examples of financially developed countries with banking sectors which went under strain in the crisis of 2007.

2.2.3. Quality of bank regulations and supervision

A third group of country traits that influence the relationship between loan loss provisions and the business cycle consists of regulation and supervision designed to prevent bank risk-taking behavior and therefore to protect bank charter values. The impact of regulations which restrict the range of activities which banks are allowed to engage in may induce a reduced risk appetite of banks and thus bank stability (Barth et al., 2006). Banks which are allowed to engage in a broader range of activities are difficult to monitor, by both official supervisory authorities and markets, and may therefore be more eager to invest in riskier assets. Moreover, financial conglomerates may become so powerful in political and economic terms that they become "too big to discipline" and thus take on more risk. We therefore expect that more stringent bank regulation, limiting the range of activities which banks are allowed to engage in, reduces the sensitivity of LLP to the business cycle.

Allen et al. (2011) show that bank borrowers prefer well capitalized banks, since these banks have greater motivation to undertake a monitoring effort, which results in improved performance of firms. Consequently, banks may choose to increase their charter value by lowering their risk appetite (Beck et al., 2011). These effects allow us to hypothesize that more stringent capital regulation may limit bank risk taking, and therefore have a diminishing impact on the procyclicality of LLP.

Even if regulations are perfectly designed with the aim of reducing risk-taking incentives of banks resulting from the moral hazard effect of deposit insurance, they may be not enough to prevent banks from engaging in risky investments. Therefore, besides regulations, great importance in influencing banking risk falls on supervision, conducted by both official supervisory authorities and private market monitoring (Fonseca and Gonzalez, 2008). We expect that if supervisors have greater powers to discipline banks and reduce their incentives to undertake risk, the procyclicality of loan loss provisions will be weakened.

Efficient regulation and effective supervisors obviously form an important part of the banking system whose aim is to counteract the negative side effects of deposit insurance. Their impact on bank risk taking may depend on whether or not a country has explicit deposit insurance and, if so, its features (Barth et al., 2006). Across EU countries, explicit deposit insurance is a common practice. However, this deposit insurance scheme framework is not uniform, as there are differences in the way the deposit insurer can intervene in a bank to protect the deposit insurance fund. If the deposit insurer has enough power to affect the risk appetite of a bank, than the procyclicality of LLP is reduced.

The issue who (and how) funds deposit insurance is important, since those involved in the payment have the greatest incentive to prevent losses (Barth et al., 2006) and reduce the risk taking resulting from moral hazard. Hellman et al. (2000) and Repullo (2004) show that risk-adjusted deposit insurance would help to control risk taking. Inappropriately priced deposit insurance or too generous deposit insurance schemes, however, might increase moral hazard in banking (see e.g. Demirguc-Kunt and Kane, 2002; Demirguc-Kunt and Huizinga, 2004), which leads banks to take

on more risk. In this context, it is worth to mention that the EU also lacks uniformity in the way the deposit insurance fund is collected. This lack of uniformity in the EU as well as the arguments above lead us to the prediction that banks operating in countries in which the moral hazard limiting framework is more effective in discouraging banks from risk-taking will exhibit reduced sensitivity of LLP to the business cycle.

3. Data and research methodology

3.1. Data

We use pooled cross-section and time series data of individual banks' balance sheet items and profit and loss accounts from 27 EU countries and country-specific macroeconomic indicators for these countries, over a period from 1996 to 2011. The balance sheet and profit and loss account data are taken from the Bankscope database, whereas the macroeconomic data were accessed from the World Bank and the IMF web pages. We conducted our study for both consolidated and unconsolidated data separately. As we are interested in the impact of the business cycle on LLP behavior our sample consists of banks for which we have financial information covering at least a ten years' time span. We exclude from our sample outlier banks by eliminating the extreme bank-specific observations when a given variable adopts extreme values. Since most of these institutions are located in Ireland, the number of countries included in the final sample drops to 26. Based on this selection strategy, the number of banks included in our sample ranges from a minimum of 357 in the case of consolidated data (3836 observations and 27 countries) to a maximum of 2219 in the case of unconsolidated data (22096 observations and 26 countries).

3.1.1. Indicators of the quality of investor protection

To measure the quality of investor protection we use two variables: the anti self-dealing index, drawn from Djankov et al. (2008), and the creditor protection index. The anti self-dealing index (ANTISELFDEALING), and its two subindices (ex-ante-control and ex-post-control), constitute a new measure of the legal protection of minority shareholders against expropriation by corporate insiders. This index specifically addresses the protection of minority shareholders against self-dealing transactions benefiting controlling shareholders (Djankov et al., 2008:461). The anti self-dealing index comprises ten variables and ranges from 0 (weak investor protection) to 10 (strong investor protection). As in Djankov et al. (2008) we use the first principal component of this variable.

As we have mentioned above, besides the anti-self-dealing index, we consider its constituent parts, i.e. EXANTECONTROL and EXPOSTCONTROL indices, which measure investor protection before the contract is signed and after the decision is made, respectively. Following Djankov et al. (2008) we apply first principal components of those indices, with higher values of these measures indicating stronger investor protection.

Creditor rights protection index (CREDITORP) is an index aggregating creditor rights and was constructed by La Porta et al. (1998), and updated by Djankov et al. (2007). This index ranges from 0 (weak creditor rights) to 4 (strong creditor rights) and measures four powers of secured lenders in bankruptcy: (1) whether there are restrictions, such as creditor consent, when a debtor files for reorganization; (2) whether secured creditors are able to seize their collateral after the petition for reorganization is approved, that is, whether there is no automatic stay or asset freeze imposed by the court; (3) whether secured creditors are paid first out of the proceeds of liquidating a bankrupt firm; and (4) whether an administrator, and not the management, is responsible for running the business during the reorganization.

3.1.2. Indicators of financial structure and financial development

To explore the relation between the sensitivity of LLP to the business cycle and the financial structure (FINSTR) we apply the aggregated indicator constructed by Beck and Levine (2002) which is the first principal component of two variables that measure the comparative activity and size of markets and banks. Each of the underlying variables is constructed so that higher values indicate more market based financial systems. The first variable equals the log of the ratio of value traded (equal to the value of stock transactions as a share of national output) to bank credit (which equals the claims of the banking sector on the private sector as a share of GDP). The second variable equals the log of the ratio of market capitalization to bank credit. Following Beck and Levine (2002) we define market capitalization as the value of listed shares divided by GDP, and it is our measure of the size of stock markets relative to the economy. We use data for FINSTR averaged over the period of 1996–2010. We take all values, i.e. value traded, bank credit and market capitalization from Beck et al. (2009) database updated for current data. The computed principal component ranges from -0.35 to 0.38 and the higher its value, the more important is the banking sector in the economy.

We follow Beck and Levine (2002) and use Finance-Aggregate (FINDEV), which equals the first principal component of the two underlying measures of financial development. The first underlying measure is a measure of the overall activity of the financial intermediaries and markets. It equals the log of the product of private credit (the value of credits extended by financial intermediaries, both bank and nonbank intermediaries, to the private sector divided by GDP) and value traded (the value of total shares traded on the stock market exchange divided by GDP). The second underlying measure of financial development is a measure of the overall size of the financial sector and equals the log of the sum of private credit and market capitalization. We aggregate data over the period of 1996–2010. We take all values, i.e. value traded, bank credit and market capitalization from Beck et al. (2009) database updated for current data. The values of the first principal component range between -0.7 and 0.2, with higher values suggesting more developed financial sector.

3.1.3. Indicators of restrictiveness of bank regulation and supervision

The characteristics of bank regulation in each country will be incorporated through a measure of the scope of activities permitted to banks (REGRESTR) constructed by Barth et al. (2004, 2006, 2008 and 2011). We measure the regulatory restrictiveness using an index comprising four variables and including restrictions on securities, insurance, real estate activities plus restrictions on bank ownership and control of non-financial firms. We use an overall bank restrictiveness variable, whose values are between 4 – 16, where higher values indicate higher restrictiveness. Following arguments for the usage of principal components of multidimensional variables, given by Barth et al. (2006), in our quantitative analysis we chose to use the first principal component of the above-mentioned variable. This variable ranges from -0.3 to 0.5 with higher values indicating wider range of activities permitted to banks.

We also incorporate the capital regulatory index constructed by Barth et al. (2006) as a measure of the stringency of capital requirements. We explore the role of two such indices. First, the overall capital regulatory index (CAPREG), which is simply the sum of two components: overall capital stringency and initial capital stringency. Its values range from 0 to 7, with higher values indicating greater stringency. The other, is the initial capital stringency index (INITCAPSTRINGENCY), which shows whether certain funds may be used to initially capitalize a

bank and whether they are officially verified. Higher values of this index, which range from 0 to 3, suggest more restrictive capital regulations.

As the supervisory effectiveness variable we incorporate two measures developed by Barth et al. (2006, 2008): the official supervisory power (OFFSUP) and the private sector monitoring (PRIVMON). The official supervisory power, ranging from 0 to 14, measures whether the supervisory authorities have the authority to take specific actions to prevent and correct problems in a bank, and indicates the power of banking supervisors to take prompt corrective action, to restructure and reorganize a troubled bank, and to declare a bank insolvent. Private monitoring is measured by private monitoring index, ranging between 0 and 11. The construction of this index is based on various types of information the public can rely on to influence bank behavior (see Barth et al., 2006). Higher values for both indices suggest higher supervisory powers.

The deposit insurance scheme prevailing in a given country is a very important determinant of banks' moral hazard, and therefore bank risk taking behavior. In our study we adopt the power of the deposit insurer index (DEPINSURANCE) developed by Barth et al. (2006), which captures the ability of this authority to protect the deposit insurance fund. It measures whether the deposit insurer has the authority to make the decision to intervene in a bank, to take legal action against bank directors or officials, and whether it has ever taken any legal action against bank directors or officers. The values for this index range from 0 to 4, with higher values indicating more power.

Due to the fact that deposit insurance schemes do vary across countries and across the EU countries in particular, we additionally include an index which incorporates various factors mitigating the moral hazard (MORALHAZARD) developed by Barth et al. (2006). This variable ranges from 0 to 3, with higher values indicating stronger risk-mitigating factors, and measures whether banks fund the deposit insurance scheme or risk-based premiums as well as whether there is a formal coinsurance component.

3.2. The econometric model and variables description

The variables chosen as possibly explanatory of LLP are variables traditionally used for the income smoothing hypothesis (see Greenawalt and Sinkey, 1988; Beatty et al., 2002; Liu and Ryan, 2006) modified by the inclusion of GDPG and other dummy variables (as in Laeven and Majnoni, 2003; Bikker and Metzemakers, 2005).

The basic model reads as:

$$\frac{\mathrm{LLP}_{i,t}}{\frac{(TA_{i,t}+TA_{i,t-1})}{2}} = \alpha_1 + \alpha_2 \frac{PROFIT_{i,t}}{\frac{(TA_{i,t}+TA_{i,t-1})}{2}} + \alpha_3 \Delta L_{i,t} + \alpha_4 \frac{CAP_{i,t}}{TA_{i,t}} + \alpha_5 GDPG_t + \alpha_6 UNEMPL_t + \alpha_7 \sum_{t=1996}^{2010} T_t + \alpha_8 \sum_{j=1}^{27\ or\ 72} Country_j + \vartheta_i + \varepsilon_{i,t} \quad (1)$$

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 (PROFIT), loan growth (ΔL), and capital ratio measured as the share of capital in total assets (CAP); and (2) some macroeconomic variables like real growth of Gross Domestic Product (GDPG) and the unemployment rate (UNEMPL).

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). All bank specific variables (LLP, PROFIT and CAP) are normalized by the bank total assets (TA, average assets in the case of LLP and PROFIT) to mitigate potential estimation problems with heteroscedasticity.
Elements and $\sum_{t=1996}^{2011} T_t$ relate to a set of dummy time variables. ϑ are unobservable bank-specific effects that are not constant over time but vary across banks. Finally, ε is a white-noise error term.

The relation between PROFIT and LLP is applied to track the income smoothing by banks. If banks use LLP to smooth earnings, then we expect a positive relationship between PROFIT and LLP. Empirical research on individual banks, both single and cross-country confirms that this variable and LLP are positively related (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). The higher the positive coefficient on PROFIT the more income smoothing there is. A negative impact of PROFIT on LLP suggests that banks do not apply LLP to smooth their earnings.

Changes in total loans outstanding are related to changes in default risk (and also credit risk). If banks use LLP (i.e. their portion set aside to cover expected losses) to manage credit risk, then the relationship between LLP and ΔL is positive. Otherwise, i.e. when banks show imprudent loan loss provisioning behavior, ΔL exerts a negative impact on LLP. Empirical results on this relationship vary. 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 ΔL (Laeven and Majnoni, 2003) which means that the hypothesis of prudent loan loss provisioning behavior should be rejected.

Capital normalized by total assets (CAP/TA) is introduced to test the capital management hypothesis. The capital management hypothesis emphasizes the role of loan loss provisions in capital ratio variation. The relationship between CAP 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 CAP may exert negative effect on LLP. Such negative coefficient on CAP 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 CAP on LLP is positive. For example, Liu and Ryan (2006) find a significantly positive coefficient on CAP, implying that better capitalized banks recorded charge-offs more quickly than did poorly capitalized banks. Shrieves and Dahl (2002) and Bouvatier and Lepetit (2008) find a positive coefficient on CAP and suggest that this observation is in line with capital management hypothesis, as poorly capitalized banks increase their LLP to increase their capital base. The above arguments notwithstanding, we are of the opinion that the interpretation of the impact of CAP on LLP depends on the regulations governing the inclusion of general provisions in bank capital in a particular country. As Olszak (2014) shows, banks in all EU countries compute LLP as a sum of both specific and general provisions. General provisions are not included in a bank's capital (with the exception of Spain, where a small part of statistical provision is a part of it), as they either reduce the level of bank loans or are put in other liabilities (reserves) of banks (e.g. in Poland). For this reason, we expect a negative impact of CAP on LLP in our EU sample.

The relation between LLP and GDP is the most interesting variable in our study, as it measures the degree of LLP procyclicality. Empirical research shows that GDP is negatively related to LLP (Laeven and Majnoni, 2003; Bikker and Metzemakers, 2005; Bouvatier and Lepetit, 2008; Fonseca and González, 2008). The stronger the negative coefficient of GDP the more procyclicality there is. Positive relationship between LLP and GDP would suggest countercyclical provisioning and therefore support the hypothesis of prudent loan loss provisioning behavior of banks emphasized by Laeven and Majnoni (2003).

We employ UNEMPL as macroeconomic determinant of LLP as other researchers did (Bikker and Metzemakers, 2005). We expect the coefficient on UNEMPL to be positive, suggesting that LLP increase as more employees get redundant. Such a relationship is consistent with the procyclicality hypothesis emphasizing that loan loss provisions decrease in economic upswings and increase in economic downswings.

Our econometric model involves explanatory variables that may not be exogenous. This means that variables are correlated with the error terms, both current and lagged. Also one may observe heteroskedasticity effects and autocorrelation within individuals. Additionally, the dataset which is analysed in the empirical part is definitely an example of a "short" panel, namely the panel with a few time periods and many individuals observed. Consequently, the nature of variables applied in the econometric model (1) may cause serious problems with properties of standard OLS estimators. Therefore, we apply an approach that involves instrumental variables. In order to limit the possible estimation bias we consider the system of generalised method of moments (GMM) proposed by Blundell and Bond (1998). This method has a proven track record and seems to be the best approach to address three relevant econometric issues, that are inherent to our analysis: (1) the presence of unobserved bank specific effects, which is eliminated by taking first differences of all variables; (2) the inclusion of lags of the dependent variable needed to capture the dynamic nature of LLP, which brings about the autoregressive nature of the data regarding the behavior of LLP; and (3) the likely endogeneity of the explanatory variables, mentioned above.

We control for the potential endogeneity of PROFIT, ΔL and CAP in the two step system GMM estimation procedure by the inclusion of up to four lags of 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 the test verifying the hypothesis of absence of second-order serial correlation in the first difference residuals (AR(2)) and the absence of first-order serial correlation in the differentiated residuals (AR(1)). In particular, it is important that in the models which we apply there is no second-order serial correlation in error terms. The second test which we apply is the Hansen's J statistic for overidentifying restrictions, which tests the overall validity of the instruments tests. When interpreting the p-values of Hansen's J statistics we follow Roodman's warning (2009, 2009a), that the Hansen test should not be relied upon too faithfully, as it is prone to weaknesses, the most serious of which is instrument proliferation. Usually a high p-value of the Hansen test is the basis of researchers' arguments for the validity of GMM results. Unfortunately, the instruments proliferation validates the test (see Roodman, 2009a, p. 141). We take account of this problem by including up to four lags of our explanatory variables. Such an approach should eliminate potential problems resulting from too many instruments relative to the number of observations. We also follow Roodman's recommendation (2009a, p. 156), and in the presentation of our results present both the p-value of Hansen's J statistics and the number of instruments.

3.3. Research strategy

3.3.1. Specific characteristics of banking activity and country determinants of LLP procyclicality

To measure the impact of specific characteristics of a bank activity on the procyclicality of loan loss provisions, i.e. bank type, bank specialization and bank size, we divide our sample into subsamples. To account for the role of bank type we identify two subsamples, one of which is made up of publicly traded banks whereas the other consists of privately held banks. The regression analysis will be conducted in each sample separately.

To explore the role of bank specialization we conduct separate regressions in commercial, cooperative, savings and holding banks' category.

As for the influence of bank size: we divide banks into three subsamples: large, medium, small (20% of banks with the largest assets constitute our largest banks' sample and 40% of banks with the smallest assets constitute the smallest banks' sample; 40% of banks with assets which are in between, are included in medium sized banks subsample). In this step we test the impact of different methods of division on the estimated results. We divide our banks according to the one-year-reference method (see e.g. Berger et al., 1995 and Zhou, 2008) and average-value-of-assets method (Beck and Levine, 2002). In the first method we consider a bank's assets as of the end of 2009 or 2010. In the second method we first calculate average assets of a bank in a whole period of 1996-2011, and then apply this average value at the next stage of division. This second method produces a larger sample of banks which can be analyzed, as it does not exclude banks for which the information on total assets failed to be reported in the Bankscope database in 2009 or 2010.

The role of bank size in the phenomenon of LLP procyclicality may also be captured by conducting a separate regression analysis for banks which report consolidated statements and for those banks which report only unconsolidated statements. As we have mentioned in previous section, banks consolidating financial data are usually large institutions operating in financial conglomerates which are more prone to excessive risk taking (Freixas et al., 2007).

To analyze the differences across countries, we estimate regression (1), incorporating an interaction term for each country variable and the GDP variable. The coefficient on each interaction term measures the influence of each country trait (i.e. investor protection, financial sector structure and development, bank regulations and supervision) on the procyclicality of loan loss provisions. Following the suggestion made by Barth et al. (2004, 2006:190-195) in their research on the impact of bank regulations on bank development, we use a sequential procedure to analyze the influence of country variables on procyclicality, by incorporating interaction terms separately rather than at the same time.

3.3.2. Income smoothing, capital management and risk management as determinants of procyclicality of LLP

The results of previous research indicate that there may be some connection between the income smoothing, capital management and credit risk management) and the procyclicality of loan loss provisions. However, the studies conducted thus far do not show precisely how procyclicality of loan loss provisions is impacted by the accounting of loan loss provisioning. This motivated us to address this question in a two stage procedure. At first, we calculate measures of LLP procyclicality, income smoothing, capital management and risk management for each bank separately. We identify these measures as sensitivity of LLP to business cycle (GDPG and GDPG per capita), profit before provisions and taxes (normalized by average assets), bank capital (normalized by total assets) and loans growth. To measure the sensitivity of LLP to the business cycle, we regress LLP against GDPG and GDPG per capita, respectively. To calculate the sensitivity of LLP to income smoothing we regress LLP against profit before provisions and taxes. To obtain the measure of the sensitivity of LLP to bank capital, we regress LLP against bank capital. And finally, to measure the sensitivity of LLP to loans growth, we regress LLP against loans growth. Following this approach we have five regressions for each bank, with regression coefficients measuring the sensitivities which we are looking for. We consider two types of regression models to be necessary to obtain the sensitivity measures. The first type, which we henceforth call regression type 1 (R1) is a single ordinary least squares model (OLS), which reads as follow:

$$\frac{LLP_{i,t}}{Average\,TA_{i,t}} = \alpha_{sensit} EV_{i,t} \qquad (2)$$

where:
LLP – loan loss provision;
Average TA – average total assets;
i – the number of the bank;
t – the number of observations for the i-th bank; t is not smaller than 10 years, and does not exceed 16 years;
α_{sensit} –the regression coefficient which is the measure of sensitivity of loan loss provisions (LLP/AverateTA) to:

- GDPG (the coefficient between LLP/AverageTA and GDPG is henceforth called procyclicality indicator 1, PROCI1 R1),
- GDPG per capita (the coefficient between LLP/AverageTA and GDPG per capita is henceforth called procyclicality indicator 2, PROCI2 R1),
- PROFIT (the coefficient between LLP/AverageTA and PROFIT is henceforth called income smoothing indicator, ISI R1); the PROFIT equals profit before provisions and taxes normalized by average assets,
- CAP (the coefficient between LLP/AverageTA and CAP is henceforth called capital management indicator, CMI R1); the CAP equals bank capital normalized by total assets,
- ΔL (the coefficient between LLP/AverageTA and ΔL is henceforth called risk management indicator, RMI R1); the ΔL equals loan growth rate.

EV - is the explanatory variable, i.e. GDPG, GDPG per capita, PROFIT, CAP, ΔL;

The second type is a multiple regression model, which we henceforth call regression type 2 (R2). In this model, besides the current values of the explanatory variable, we also include the lagged explanatory variable. This model reads as below:

$$\frac{LLP_{i,t}}{Average\ TA_{i,t}} = \alpha_{sensit} EV_{i,t} + \beta_{sensit} EV_{i,t-1} \qquad (3)$$

where:
LLP – loan loss provision;
Average TA – average total assets;
i- the number of the bank;
t- the number of observations for the i-th bank; t is not smaller than 10 years, and does not exceed 16 years;
α_{sensit}- the regression coefficient which is the measure of sensitivity of loan loss provisions (LLP/AverateTA) to:

- GDPG (the coefficient between LLP/AverageTA and GDPG is henceforth called procyclicality indicator 1, PROCI1 R2),
- GDPG per capita (the coefficient between LLP/AverageTA and GDPG per capita is henceforth called procyclicality indicator 2, PROCI2 R2),
- PROFIT (the coefficient between LLP/AverageTA and PROFIT is henceforth called income smoothing indicator, ISI R2); the PROFIT equals profit before provisions and taxes normalized by average assets,
- CAP (the coefficient between LLP/AverageTA and CAP is henceforth called capital management indicator, CMI R2); the CAP equals bank capital normalized by total assets,
- ΔL (the coefficient between LLP/AverageTA and ΔL is henceforth called risk management indicator, RMI R2); the ΔL equals loan growth rate.

β_{sensit} – the regression coefficient between LLP/AverageTA and $EV_{i,t-1}$;
EV_t – an explanatory variable, i.e. GDPG, GDPG per capita, PROFIT, CAP, ΔL;
$EV_{i,t-1}$ – a lagged explanatory variable.

In the second stage we run multiple ordinary least squares (OLS) regressions (with standard errors of estimated coefficients robust to heteroscedasticity) in which we relate measures of LLP procyclicality (PROCI) to income smoothing (ISI) capital management (CMI) and credit risk management (RMI). Our baseline model reads as:

$$PROCI_i = \beta_0 + \beta_1 ISI_i + \beta_2\, CMI_i + \beta_3\, RMI_i + \varepsilon_i \quad (4)$$

where:
PROCI, ISI, CMI and RMI stand for sensitivity of LLP to business cycle, income smoothing, capital management and risk management, respectively;
i – the i-th bank;
β_1– the regression coefficient measuring the impact of income smoothing on procyclicality of LLP;
β_2– the regression coefficient measuring the impact of capital management on procyclicality of LLP;
β_3 – the regression coefficient measuring the impact of capital management on procyclicality of LLP;
β_0 – a constant;
ε_i – an error term.

To gain an insight into the potential impact of earnings management on LLP procyclicality we look at values of β parameters. These parameters measure to what extent the procyclicality of LLP is influenced by income smoothing, capital management and risk management. For example, if banks engage more in income smoothing, or have stable income, exhibit a less procyclical behavior of LLP, than the association between PROCI and ISI is expected to be positive. As for the impact of capital management (CMI) we expect negative association with PROCI, as capital management in the EU banks is exhibited by the negative coefficient on CAP. Finally, the relationship between procyclicality of LLP and credit default risk management (RMI) is expected to be positive, as higher values of RMI suggest prudent loan loss provisioning accounting (see Laeven and Majnoni, 2003).

4. Empirical results

Table 1 provides some descriptive statistics about variables in our estimation sample. The mean loan loss provision (LLP) equals to 0.5 (with a standard deviation of 0.71 in unconsolidated data and 1.29 in consolidated data). The ratio of profit before taxes and provisions to average assets (PROFIT) equals 1.27 (in unconsolidated data) and 1.57 (in consolidated data). The average loans growth is relatively high (12.36 and 14.89) due to the fact that in our samples we have developing countries which went through economic transition. In such countries loans growth rates are relatively high. The average capital ratio (CAP) equals about 8% (i.e. 8.04% and 7.92%) and is close to Basel Committee standard capital adequacy ratio.

In Tables 2 and 3 we provide correlations of the regression variables (both bank specific and macroeconomic) as well as of country variables, respectively. The correlations indicate at statistically significant association between LLP and each of the explanatory variables. In particular, the correlation coefficient for PROFIT is positive (around 35% and 48% in unconsolidated and consolidated data, respectively), suggesting that banks do exercise income smoothing on average. The correlation between LLP and ΔL is negative in unconsolidated data, suggesting no risk management, and positive in consolidated data, which indicates prudent risk management behavior. The positive correlation between LLP and CAP indicates that there is no capital management with LLP across EU banks. The correlation between GDPG and LLP is positive in unconsolidated data, suggesting countercyclical provisioning, and negative in consolidated data, providing support for the procyclicality of LLP.

Table 1
Summary descriptive statistics of key regression variables (in percentage points).

	Mean	Std. Dev.	No. of obs.	No. of banks	No. of countries
			UNCONSOLIDATED		
LLP	0.50	0.71	28320	1770	26
PROFIT	1.27	1.35	32689	1770	26
ΔL	12.36	45.42	31623	1770	26
CAP	8.04	4.97	34398	1770	26
GDPG	1.58	2.37	39996	1770	26
UNEMPL	8.59	2.56	39980	1770	26
			CONSOLIDATED		
LLP	0.49	1.29	4791	357	27
PROFIT	1.57	2.47	4869	357	27
ΔL	14.89	27.73	4820	357	27
CAP	7.92	5.53	5059	357	27
GDPG	2.24	2.74	5712	357	27
UNEMPL	8.55	3.88	5694	357	27

LLP equals loan loss provisions over average assets, PROFIT equals profit before taxes and provisions over average assets, CAP equals capital over total assets, ΔL is loan growth rate, GDPG is real growth in GDP, UNEMPL is unemployment rate.

Table 2
Correlations of bank specific and macroeconomic variables.

	LLP	PROFIT	ΔL	CAP	GDPG	UNEMPL
				UNCONSOLIDATED		
LLP	1.0000					
PROFIT	0.3529 ***	1.0000				
ΔL	-0.0156 **	0.0684 ***	1.0000			
CAP	0.0648 ***	0.3201 ***	0.0716 ***	1.0000		
GDPG	0.0574 ***	0.0145 ***	-0.0082	-0.0537 ***	1.0000	
UNEMPL	-0.0941 ***	0.0332 ***	0.0615 ***	0.0218 ***	-0.0283 ***	1.000
				CONSOLIDATED		
LLP	1.0000					
PROFIT	0.4841 ***	1.0000				
ΔL	0.1026 ***	0.2187 ***	1.0000			
CAP	0.1090 ***	0.3231 ***	0.0219	1.0000		
GDPG	-0.2099 ***	0.0005	0.2199 ***	0.0169 ***	1.0000	
UNEMPL	0.0532 ***	0.0226	-0.0153	0.0618 ***	-0.0495 ***	1.0000

LLP equals loan loss provisions over average assets, PROFIT equals profit before taxes and provisions over average assets, CAP equals capital over total assets, ΔL is loan growth rate, GDPG is real growth in GDP,UNEMPL is unemployment rate.
*, **, *** denote significance at 10%, 5% and 1% level, respectively.

Table 3
Correlations of country specific variables.

	ANTISELFDEALING	EXANTECONTROL	EXPOSTCONTROL	CREDITORP	FINSTRUCT	FINDEV	REGRESTR	CAPREG	OFFSUP	PRIVMON	DEPISNURANCE	MORALHAZARD	INITCAPSTRINGENCY
ANTISELFDEALING	1												
EXANTECONTROL	0.933 ***	1											
EXPOSTCONTROL	0.198 ***	-0.050 ***	1										
CREDITORP	-0.116 ***	0.007	0.071 ***	1									
FINSTRUCT	-0.235 ***	-0.134 ***	-0.499 ***	0.367 ***	1								
FINDEV	-0.012 **	-0.094 ***	0.592 ***	-0.100 ***	-0.865 ***	1							
REGRESTR	-0.140 ***	-0.173 ***	0.346 ***	0.585 ***	0.088 ***	0.078 ***	1						
CAPREG	0.209 ***	0.419 ***	-0.386 ***	0.223 ***	0.147 ***	-0.092 ***	-0.406 ***	1					
OFFSUP	0.278 ***	0.451 ***	-0.270 ***	0.554 ***	0.188 ***	-0.127 ***	-0.140 ***	0.564 ***	1				
PRIVMON	0.379 ***	0.281 ***	0.156 ***	-0.109 ***	-0.075 ***	0.045 ***	-0.191 ***	-0.334 ***	0.220 ***	1			
DEPISNURANCE	-0.079 ***	-0.303 ***	0.268 ***	-0.393 ***	0.040 ***	-0.025 ***	0.321 ***	-0.528 ***	-0.792 ***	-0.078 ***	1		
MORALHAZARD	0.020 ***	-0.227 ***	0.645 ***	-0.073 ***	0.177 ***	-0.083 ***	0.491 ***	-0.408 ***	-0.475 ***	-0.0579 ***	0.7258 ***	1	
INITCAPSTRINGENCY	-0.277 ***	-0.121 ***	-0.164 ***	0.478 ***	0.014 ***	0.173 ***	0.049 ***	0.605 ***	0.248 ***	-0.5839 ***	-0.3415 ***	-0.240 ***	1

Values of ANTISELFDEALING, EXANTECONTROL, and EXPOSTCONTROL are taken from Djankov et al. (2008). Values of CREDITORP are from Djankov et al. (2007). Values of FINSTRUCT and FINDEV are calculated following Beck and Levine (2002) with updated financial information. Values of CAPREG, OFFSUP, PRIVMON, DEPSINURANCE, MORALHAZARD and INITCAPSTRINGENCY are drawn from Barth et al. (2006).
, * denote significance at 5% and 1% level, respectively.

4.1. Empirical results for diversity of procyclicality of LLP stemming from specific characteristics of banking activity

Before we go on to interpretation of our results in Tables 4 to 7, we have to say a few words about our specification tests. In the first step we look at the test of second-order serial correlation in the first-difference residuals (AR(2)). In our models, this hypothesis is almost always rejected (but for cooperative, savings and medium size banks). Next, let's comment on the Hansen's J-statistics. This test performs well in a few subsamples. Such result is due to relatively small number of instruments relative to the number of observations. This relatively small number of instruments, however, does not make our estimation results statistically insignificant, even if we account for Windmeijer correction of standard errors of coefficients.

In tables 4 and 5 we present results of diversity of procyclicality of LLP stemming from specific characteristics of banking activity. The results in the full sample of unconsolidated and consolidated data indicate a strong empirical evidence in favor of the hypothesis of procyclicality of LLP, as GDP has a negative regression coefficient (statistically significant at the 1% level). The signs of the remaining regression coefficients on the remaining variables are intuitive in most cases. The regression coefficient representing the strength of the relation of LLP with its two lagged values is positive (but for the second lag of consolidated data, where it is negative). This indicates the necessity of a dynamic specification when modeling bank LLP variability. PROFIT is positively related to LLP, which suggests that banks in the EU follow income smoothing (income stabilizing) strategy. The regression coefficient related with CAP is significantly negative in unconsolidated data, which may suggest that banks in the EU apply capital management. Finally, the regression coefficient related with ΔL is negative (and statistically significant in unconsolidated data), which may suggest that EU banks do not provision more when bank lending is rising (in terms of loan growth).

To analyze the impact of specific characteristics of banking activity, we estimate model (1) for each subsample of banks following the criteria of bank type, bank specialization and bank size. Our results in tables 4 and 5 confirm the diversity of LLP procyclicality across banks distinguished

by type, specialization and size. Contrary to what has been expected, the LLP procyclicality of publicly traded banks is stronger than the procyclicality of LLP in privately held banks subsample in both unconsolidated and consolidated data. In this context, it is worth looking at our results from the perspective of income smoothing, because we find out that publicly traded banks preparing consolidated statements apply this practice more frequently than publicly traded banks reporting unconsolidated data. In the case of unconsolidated data, it is privately held banks which smooth income more. On the whole, our research implies that the results of the study by Fonseca and Gonzalez (2008) are not necessarily binding – in particular in the EU countries.

The results in tables 4 and 5 also show that LLP of commercial banks seems to be more procyclical than LLP of cooperative and savings banks. Moreover, cooperative banks seem to employ income smoothing and capital management with the use of LLP more intensively than commercial and savings banks. If we account here for the fact that LLP of cooperative banks are evidently less sensitive to GDP than commercial and savings (as well as holding banks in the case of consolidated data) and at the same time they seem to smooth income more, we may infer that more income smoothing coexists with less procyclical LLP.

Large banks seem to provision the least prudentially, as their coefficient of GDP is negative and statistically significant in both unconsolidated and consolidated data. In all bank size subsamples (i.e. large, medium and small) the coefficients on GDPG in consolidated data are visibly higher than those coefficients in unconsolidated data. Given this, we may infer that the type of financial statement in which banks report matters for procyclicality. What is more, the type of financial statement in which banks are obliged to report also seems to be of great importance to income smoothing and capital management, as in our unconsolidated data sample we find that banks tend to stabilize their profit and capital with LLP more, because the coefficients for both PROFIT and CAP are considerably higher in this sample.

In general, if we look at both consolidated and unconsolidated data, we find that the regression coefficients for bank specific variables (i.e. PROFIT, CAP and ΔL) are higher (in absolute terms) and therefore represent stronger empirical relationship between LLP and those variables in the unconsolidated data sample, whereas the regression coefficients for macroeconomic variables (in particular the GDPG) are higher (in absolute terms) in consolidated data sample, which suggests that banks who are obliged to consolidate their financial statements are more sensitive to macroeconomic environment. In conclusion, it can be said that LLP of banks which stabilize their profits and manage capital are less procyclical. Such conclusion goes in line with our hypothesis than earnings management by banks may have an impact on procyclicality in banking, with more of, e.g., income smoothing applied by banks reducing the sensitivity of LLP to business cycle.

Table 4
Procyclicality of LLP vs. bank size, bank type and specialization in unconsolidated data.

Type of variable(s):		full sample		publ_trad=1		priv_held=1		commercial=1		cooperative=1		savings=1		large_a20=1		medium_a40=1		small_a40=1	
			t-stat		t-stat		t-stat		t-stat		t-stat		t-stat		t-stat		t-stat		t-stat
Bank specific variables	LLP(-1)	0.332 ***	4.8	0.518 ***	5.97	0.328 ***	4.32	0.471 ***	3.74	0.182 ***	3.06	0.502 ***	14.88	0.158 **	2.08	0.827 ***	3.45	0.328 ***	3.66
	LLP(-2)	0.151	1.28	0.069	1.59	0.156	1.3	0.057	0.68	0.113 ***	5.14	-0.064	-1.6	0.078 ***	4.2	0.001	0.01	0.042	0.53
	PROFIT	0.303 ***	3.94	0.095 **	2.51	0.337 ***	3.82	0.247 ***	4	0.542 **	2.54	0.114 **	1.98	0.617 ***	3.15	0.201 ***	3.78	0.217 ***	2.76
	ΔL	-0.001 ***	-2.86	-0.002	-1.52	-0.001 ***	-2.6	0.000 *	-1.67	0.000	0.37	0.000 *	1.92	-0.001 *	-1.69	0.000	-1.08	0.000	-1.09
	CAP	-0.027 ***	-3.85	0.002	0.2	-0.026 ***	-3.84	-0.020	-1.32	-0.050 ***	-3.15	-0.008	-1.37	-0.063 ***	-2.63	-0.021 ***	-2.59	-0.012 *	-1.65
Macroeconomic variables	GDPG	-0.016 ***	-7.92	-0.067 ***	-6.31	-0.014 ***	-6.76	-0.057 ***	-6.94	-0.005 **	-2.41	-0.015 ***	-6.36	-0.033 ***	-5.17	-0.015 ***	-5.9	-0.012 ***	-2.82
	UNEMPL	-0.006 *	-1.93	0.019 **	2.52	-0.007 **	-2.13	0.013	1.38	-0.014	-0.7	-0.010 ***	-4.29	-0.013	-1.42	-0.003	-0.91	0.005	0.81
Intercept		0.165 **	2.54	0.064	0.49	0.132 *	1.72	0.064	0.67	0.233 *	1.8	0.305 ***	9.37	0.213 ***	2.68	0.053	0.53	0.145	1.55
Specification tests	AR(1)	-3.56 ***		-3.07 ***		-3.55 ***		-3.22 ***		-3.08 ***		-8.75 ***		-2.45 **		-3.9 ***		-3.45 ***	
	AR(2)	-0.44		0.19		-0.49		0.12		-2.31 **		3.77 ***		-0.78		2.33 **		-0.19	
	Hansen test J statistic and p-value of Hansen statisitcs	895.23	0.00	115.38	1.00	867.71	0.00	283.64	0.00	645.64	0.00	454.86	0.00	352.08	0.00	526.57	0.00	428.91	0.00
No. of instruments		220		209		217		220		204		203		210		220		213	
No. of observations		22096		1247		20849		4443		10687		6928		5069		10088		6939	
No. of banks		2119		118		2001		452		1069		593		455		938		726	

All the models are estimated with the Blundell-Bond (1998) two step system-GMM estimator (with Windmeijer correction) for the period of 1996-2010 for panel data with a lagged dependent variable. In each regression the dependent variable is the ratio of LLP over average total assets. As explanatory variables, we include two lags of dependent variable, profit before taxes and provisions over average assets (PROFIT), the capital over total assets (CAP), the loan growth rate (ΔL), real growth in GDP (GDPG), unemployment rate (UNEMPL), year dummies and country dummies. The coefficient of GDPG is the measure of LLP procyclicality. Column 1 shows results for the full sample of unconsolidated data. Columns 2 to 9 show results for the interaction between all explanatory variables and a dummy taking the value of 1 if banks fall into one of the criteria describing specific characteristics of banking activity, and zero otherwise. Bank type refers to the banks' being publicly traded or not: publ_trad=1 is a dummy variable equal to 1 if a bank is a listed company; priv_held=1 is a dummy variable equal to 1 if a bank is privately held. Regressions are estimated for each subsample for 1996-2011. Bank specialization refers to four types of banking business models: commercial=1 is a dummy variable equal to 1 if a bank operates as a commercial bank; cooperative=1 is a dummy variable equal to 1 if a bank operates as a cooperative bank; savings=1 is a dummy variable equal to 1 if a bank operates as a savings bank. Bank holding companies have also been considered, but the results for them have not been reported, as due to the limited number of those banks in the sample, the calculated coefficients are statistically insignificant. Bank size is captured by total average assets in the whole research period: large_a20=1 is a dummy variable equal to 1 if a bank belongs to the 20% corresponding to the largest banks; medium_a40 is a dummy variable equal to 1 if a bank belongs to the next 40% of banks; small_a40=1 is a dummy variable equal to 1 if a bank belongs to the last 40% of banks with the smallest assets.
*, **, *** denote significance at 10%, 5% and 1% level, respectively.

Table 5
Procyclicality of LLP vs. bank size, bank type and specialization in consolidated data.

Type of variable(s):		full sample	t-stat	publ_trad=1	t-stat	priv_held=1	t-stat	commercial=1	t-stat	cooperative=1	t-stat	savings=1	t-stat	holding=1	t-stat	large_a20=1	t-stat	medium_a40=1	t-stat	small_a40=1	t-stat
Bank specific variables	LLP(-1)	0.1871 *	1.66	0.310 *	1.81	0.144	1.04	0.155	1.41	0.348 ***	3.86	0.426 ***	3.13	0.502 ***	3.64	0.196	1.4	0.649 ***	6.99	0.095 ***	0.64
	LLP(-2)	-0.0493 *	-1.88	-0.100	-0.65	-0.030	-0.9	-0.047	-1.32	0.194 ***	3.09	-0.113 **	-2.24	0.098	0.90	0.078	0.9	-0.116	-1.6	-0.051	-0.84
	PROFIT	0.0909 *	1.84	0.337 ***	2.58	0.067	1.64	0.085	1.58	0.128 **	2.17	0.243 ***	5.83	0.036	0.97	0.409 **	2	0.138 *	1.74	0.063 ***	1.46
	ΔL	-0.0006	-0.85	0.000	-0.39	-0.001	-1.3	-0.001	-0.78	-0.001	-0.8	0.001	0.27	0.003	1.55	-0.001	-1.2	0.000	-0.7	0.000	0.16
	CAP	0.0032	0.43	-0.051	-1.31	0.006	0.94	0.001	0.15	-0.016 ***	-2.6	-0.015 *	-1.71	0.015	0.86	-0.047	-0.8	-0.009	-0.67	-0.002 *	-0.23 0
Macroeconomic variables	GDPG	-0.0569 ***	-8.27	-0.065 ***	-8.02	-0.061 ***	-6.3	-0.072 ***	-6.99	-0.033 ***	-7.2	-0.053 ***	-4.54	-0.064 ***	-4.10	-0.085 ***	-7.2	-0.062 ***	0	-0.056 ***	-4.34
	UNEMPL	0.0060	1.06	0.010	1.36	0.005	0.62	0.013	1.43	-0.008	-1.2	-0.010 **	-2.12	-0.018 **	-1.10	0.005	0.5	0.002	0.21	-0.010 ***	-0.64
Intercept		0.3122 ***	4.34	0.285 *	1.80	0.372 ***	4.35	0.385 ***	3.54	0.239 ***	3.71	0.286 ***	2.91	0.220 **	2.21	0.202	1.4	0.229 ***	2.74	0.601	3.42
Specification tests	AR(1)	-2.710 ***		-1.320		-2.410 **		-2.620 ***		-2 **		-2.62 ***		-1.42		-1.33		-2.06 **		-1.9 *	
	AR(2)	1.350		0.720		1.070		1.220		-1.09		1.31		-0.78		-0.34		1.57		0.6	
	Hansen test J statistic and p-value of Hansen statisitcs	293.46	0.00	108.18	1.00	231.12	0.20	223.42	0.332	53.49	1.00	33.49	1.00	27.22	1.00	104.16	1.00	140.88	1.00	99.56	1.00
No. of instruments		223		217		222		223		201		201		203		217		218		216	
No. of observations		3836		1255		2581		2490		606		411		329		1213		1574		1049	
No. of banks		357		112		245		228		59		37		33		107		145		105	

All the models are estimated with the Blundell-Bond (1998) two step system-GMM estimator (with Windmeijer correction) for the period of 1996-2010 for panel data with a lagged dependent variable. In each regression the dependent variable is the ratio of LLP over average total assets. As explanatory variables, we include two lags of dependent variable, profit before taxes and provisions over average assets (PROFIT), the capital over total assets (CAP), the loan growth rate (ΔL), real growth in GDP (GDPG), unemployment rate (UNEMPL), year dummies and country dummies. The coefficient of GDPG is the measure of LLP procyclicality. Bank type refers to the banks' being publicly traded or not: publ_trad=1is a dummy variable equal to 1 if a bank is a listed company; priv_held=1 is a dummy variable equal to 1 if a bank is privately held. Regressions are estimated for each subsample for 1996-2011. Bank specialization refers to four types of banking business models: commercial=1 is a dummy variable equal to 1 if a bank operates as a commercial bank; cooperative=1 is a dummy variable equal to 1 if a bank operates as a cooperative bank; savings=1 is a dummy variable equal to 1 if a bank operates as a savings bank. Bank holding companies have also been considered, but the results for them have not been reported, as due to the limited number of those banks in the sample, the calculated coefficients are statistically insignificant. Bank size is captured by total average assets in the whole research period: large_a20=1 is a dummy variable equal to 1 if a bank belongs to the 20% corresponding to the largest banks; medium_a40 is a dummy variable equal to 1 if a bank belongs to the next 40% of banks; small_a40=1 is a dummy variable equal to 1 if a bank belongs to the last 40% of banks with the smallest assets.
*, **, *** denote significance at 10%, 5% and 1% level, respectively.

In Table 6 we present estimates of the coefficient representing relationship between LLP and GDPG across countries. Our results confirm the diversity of LLP procyclicality across EU countries. A negative relation between LLP and GDP in 18 countries in unconsolidated data, and in 19 countries in consolidated data, is consistent with the LLP procyclicality hypothesis. Only in the case of 5 (7) countries in unconsolidated (consolidated) data, this relationship is positive, but statistically insignificant in most cases. On account of this, the counter-cyclicality view of LLP is not supported in the sample of EU countries which we analyze.

Table 6
Heterogeneity of LLP procyclicality in the EU.

COUNTRY	Heterogeneity of procyclicality	t-value	Hansen test	No. of banks	No. of observations	Heterogeneity of procyclicality	t-value	Hansen test	No. of banks	No. of observations
	UNCONSOLIDATED					CONSOLIDATED				
AUSTRIA	-0.006	-0.86	101.3	107	1105	-0.039 **	-2.31	14.8	24	271
BELGIUM	-0.037	-1.11	13.3	22	234	-0.030 ***	-3.92	5.22	13	136
BULGARIA	-0.049	-1.38	3.03	11	107	-0.436 **	-2.47	0	4	46
CYPRUS				2	18	0.221	0.94	0	3	37
CZECH REPUBLIC	-0.031	-0.66	0	6	49	-1.048	-1.51	0	5	58
DENMARK	-0.143 ***	-10.97	65.07	70	821	-0.116 *	-1.91	12.4	17	202
ESTONIA	0.063	0.56		3	34	-0.147 **	-2.19	0	4	39
FINLAND	0.000	0.03		3	33	-0.050	-1.13	0	5	51
FRANCE	-0.037 ***	-3.05	137.4	142	1568	-0.025 **	-2.25	58	66	662
GERMANY	-0.003	-1.27	798.8	1157	13255	0.020	0.4	6.55	15	175
GREECE	0.056	0.44	0	7	64	0.033	0.53	1.58	10	112
HUNGARY	0.078	0.71	0	3	30	0.274	1.39	0	7	77
IRELAND						-0.330	-0.42	0	6	63
ITALY	-0.016 ***	-5.35	204.6	395	3075	-0.038 ***	-3.89	25	28	281
LATVIA	-0.077	-0.96	7.67	13	110	-0.160 **	-2.07	0	3	29
LITHUANIA	-0.269	-1	0	8	81	-0.102	-0.6	0	6	60
LUXEMBOURG	-0.010	-1.58	32.33	36	325	-0.135	-1.43	0	8	86
MALTA	0.240	1.37	0	2	19	0.179 **	2.18	0	2	26
NETHERLANDS				1	9	-0.033 *	-1.63	7.77	15	173
POLAND	-0.113 *	-1.82	12.42	19	173	-3.374	-1.33	0	7	72
PORTUGAL	0.008	0.18	0.61	8	69	-0.019	-0.6	8.24	15	162
ROMANIA	-0.240 *	-1.63	2.58	11	93				2	20
SLOVAKIA	-0.405	-1.19	0	6	49				5	54
SLOVENIA	-0.081 *	-1.7	0.89	10	97	-0.024	-0.2	0	7	85
SPAIN	-0.051 ***	-4.28	39.52	54	480	-0.043 ***	-3.48	35	38	414
SWEDEN	-0.012	-0.67	2.88	10	85	0.007	0.17	0	6	59
UK	-0.043	-0.23	4.78	13	113	-0.095 ***	-3.73	33.1	36	386

All the models are estimated with the Blundell-Bond (1998) two-step system-GMM estimator for the period of 1996-2010 for panel data with lagged dependent variable. In each regression dependent variable is the ratio of LLP over average total assets. As explanatory variables, we include two lags of the dependent variable, profit before taxes and provisions over average assets (PROFIT), capital over total assets (CAP), loan growth rate (ΔL), real growth in GDP (GDPG), unemployment rate (UNEMPL), year dummies and country dummies. The coefficient of GDPG is the measure of LLP procyclicality. Column 1 shows results for each country separately. Regressions are estimated for each country for 1996-2010. For Cyprus, Ireland and Netherlands (unconconsolidated data) and Slovakia and Slovenia (consolidated data) the results could not be obtained due to the insufficient number of observations.
T-value denotes the t-statistics. *, **, *** denote significance at 10%, 5% and 1% level, respectively.

The observed heterogeneity of sensitivity of LLP to the business cycle has two primary consequences. First, this heterogeneity shows how important it is to study national institutional environment (i.e. quality of investor protection, regulations and supervision, and financial sector structure and development) that may have an effect on how bank managers respond to changing macroeconomic conditions when designing the level of LLP in different economic cycle phases. Second, this heterogeneity points to the problem of biased estimations obtained with international data which fail to account for country specific institutional conditions that may influence bank managers to counteract the business cycle.

4.2. Empirical results of cross –country determinants

In Tables 7 and 8 we report results of cross-country determinants of heterogeneity of loan loss provisions procyclicality obtained using the two step system GMM estimator with country and time dummy variables as instruments. To save space we present results for unconsolidated data only, but in our inferences we also refer to consolidated data, in particular in those cases when there are differences between the two samples in the direction of coefficients on interaction terms.

The results presented in Table 7 show how sensitivity of LLP to GDPG is influenced by the quality of investor protection, financial sector structure and financial development in unconsolidated data. The impact of investor protection on procyclicality of LLP is unambiguous, as coefficients of ANTISELDEALING and EXANTECONTROL differ between unconsolidated and consolidated data. Better investor protection seems to increase the procyclicality of LLP in unconsolidated data sample, and decrease the negative impact of GDPG on LLP in consolidated data. Such result probably means that higher quality of investor protection influences decisions of managers of banks reporting consolidated statements and this leads to reduced procyclicality of LLP. However, in the case of banks reporting unconsolidated statements, better investor protection does little to reduce the procyclicality of LLP – maybe because it is not so important for the activities taken by banks that in most cases are not publicly traded. Of the constituent parts of ANTISELFDEALING considered in our study, only EXPOSTCONTROL has the expected positive impact on procyclicality, as it makes LLP less procyclical in both unconsolidated and consolidated data. The positive coefficient on GDPGxCREDITORP indicates that higher quality of protection of lenders' rights reduces the procyclicality of LLP (both in unconsolidated and consolidated data).

The sensitivity of LLP to GDPGxFINSTR differs between banks reporting unconsolidated and consolidated data. In the sample of unconsolidated data, the coefficient on FINSTRxGDPG is negative, which indicates that banks conducting their business in financial sectors with more banking oriented financial markets are more sensitive to the business cycle. The opposite result is found for banks reporting consolidated financial information, as the coefficient of FINSTRxGDPG is positive, suggesting that LLP of such banks are more sensitive to macroeconomic environment in financial sectors with a greater role of stock markets. The coefficient on GDPGxFINDEV is positive in banks reporting unconsolidated data and has the opposite direction in banks reporting consolidated data. This means that LLP of banks which consolidate financial statements and operate in more developed financial systems are more procyclical. Such negative effect of financial development on the procyclicality of LLP may stem from increased competition between banks and non-banks in better developed financial sectors. Following the widely known and in many cases positively verified "competition- fragility hypothesis" increased competition in banking sector is usually associated with increased risk taking by banks (see e.g. Keeley, 1990; Allen and Gale, 2004; Beck et al. 2007; Schaeck et al., 2009; Craig and Dinger, 2013; Fu et al. 2014), and such risk taking may bring about increased procyclicality in banking activity (see e.g. Borio and Zhu, 2012).

Table 8 shows that extending the scope of activities permitted to banks reduces the procyclicality of LLP, as the coefficient on GDPGxREGRESTR is positive. Opposite result is found for restrictive bank capital regulations (CAPREG) and initial capital stringency (INITCAPSTRINGENCY), as the more restrictive those regulations are, the less procyclical are LLP. On account of this, we infer that by enhancing the quality of bank capital (CAPREG and INITCAPSTRINGENCY) regulations it is possible to reduce the risk taking behavior by banks and make their activities less procyclical.

The negative coefficients on GDPGxOFFSUP and GDPGxPRIVMON indicate that both official supervision and private market monitoring are not able to affect risk taking by EU banks reporting unconsolidated statements. The opposite is found for the GDPGxOFFSUP in the consolidated data. Because of this, we infer that more restrictive official supervisory authorities are important in reducing procyclicality of LLP in this sample of banks. On the whole, our results suggest that more restrictive supervision (both private and public) is not effective in reducing risk appetite of banks operating in the EU.

Table 7

Impact of investor protection as well as the financial structure and development on the procyclicality of LLP in unconsolidated data

Type of variable(s):		1	t-stat	2	t-stat	3	t-stat	4	t-stat	5	t-stat	6	t-stat
Bank specific variables	LLP(-1)	0.347 ***	4.68	0.349 ***	4.73	0.335 ***	4.67	0.313 ***	3.82	0.280 ***	4.52	0.284 ***	4.64
	LLP(-2)	0.180	1.58	0.163	1.42	0.140	1.17	0.143	1.11	0.134	1.08	0.145	1.22
	PROFIT	0.332 ***	4.21	0.332 ***	4.21	0.318 ***	3.99	0.292 ***	3.37	0.306 ***	3.96	0.313 ***	4.1
	ΔL	0.000 *	-1.9	-0.001 **	-2.3	0.000 ***	-2.6	0.000	-1.6	0.000	-1.1	0.000	-0.9
	CAP	-0.039 ***	-4.5	-0.039 ***	-4.2	-0.031 ***	-3.7	-0.024 ***	-2.9	-0.025 ***	-3.4	-0.028 ***	-4.4
Macroeconomic variables	GDPG	-0.064 ***	-4.7	-0.039 ***	-5.1	-0.019 ***	-6.7	-0.089 ***	-4.5	-0.040 ***	-4.2	-0.054 ***	-5.8
	UNEMPL	-0.009 **	-2.5	-0.013 ***	-2.8	-0.008 **	-2.3	-0.001 ***	-0.4	-0.003 ***	-0.6	0.000 *	0.07
Intercept		0.351 ***	5.19	0.324 ***	5.03	0.211 ***	3.71	0.111 **	2.12	0.233 ***	3.25	0.276 ***	3.53
Interactions	ANTISELFDEALING	1.290 ***	4.21										
	GDPG x ANTISELFDEALING	-0.504 ***	-4.1										
	EXANTECONTROL			0.988 ***	4.03								
	GDPG x EXANTECONTROL			-0.359 ***	-3.9								
	EXPOSTCONTROL					-0.410	-1.5						
	GDPG x EXPOSTCONTROL					0.193 ***	2.68						
	CREDITORP							0.003	0.15				
	GDPG x CREDITORP							0.030 ***	3.97				
	FINSTRUCT									0.806 *	1.95		
	GDPG x FINSTRUCT									-0.313 ***	-2.8		
	FINDEV											-1.237 ***	-3.4
	GDPG x FINDEV											0.378 ***	4.79
Specification tests	AR(1)	-3.57 ***		-3.55 ***		-3.49 ***		-3.16 ***		-3.69 ***		-3.65 ***	
	AR(2)	-0.71		-0.61		-0.45		-0.54		-0.48		-0.55	
	Hansen test J statistic and p-value of Hansen statistics	911.12 0.000		908.21 0.000		882.81 0.000		813.48 0.000		881.76 0.000		903.59 0.000	
No. of instruments		216		216		216		216		220		220	
No. of obsevations		21928		21928		21928		21700		22096		22096	
No. of banks		2102		2102		2102		2076		2119		2119	

All the models are estimated with the Blundell-Bond (1991) two step system-GMM estimator (with Windmeijer correction) for the period of 1996-2011 for panel data with a lagged dependent variable. In each regression the dependent variable is the ratio of LLP over average total assets. As explanatory variables, we include two lags of the dependent variable, profit before taxes and provisions over average assets (PROFIT), capital over total assets (CAP), loan growth rate (ΔL), real growth in GDP (GDPG), unemployment rate (UNEMPL), year dummies and country dummies. The coefficient of GDPG is the measure of LLP procyclicality. ANTISELFDEALING is a new measure of legal protection of minority shareholders against expropriation by corporate insiders. EXANTECONTROL measures the investor protection before the contract is signed. EXPOSTCONTROL measures the investor protection after the decision is made. CREDITORP is creditor rights protection index aggregating creditor rights. FINSTR is the index corresponding to financial sector structure. FINDEV is the measure of financial sector development.

*, **, *** denote significance at 10%, 5% and 1% level, respectively.

Table 8
Impact of regulations and supervision on the procyclicality of LLP in unconsolidated data

Type of variable(s):		1	t-stat	2	t-stat	3	t-stat	4	t-stat	5	t-stat	6	t-stat	7	t-stat
Bank specific variables	LLP(-1)	0.343 ***	4.7	0.333 ***	4.86	0.322 ***	3.9	0.333 ***	4.82	0.328 ***	4.07	0.310 ***	5.1	0.354 ***	4.28
	LLP(-2)	0.153	1.2	0.157	1.31	0.185	1.6	0.140	1.18	0.193	1.55	0.046	0.7	0.070	1.14
	PROFIT	0.312 ***	4.1	0.309 ***	3.91	0.296 ***	3.5	0.303 ***	3.93	0.320 ***	2.97	0.275 ***	3.2	0.230 ***	2.68
	ΔL	-0.001 **	-2.3	-0.001 ***	-2.64	0.000	0.2	-0.001 ***	-3.16	0.000	-0.74	0.000 **	-2.1	0.000 *	-1.7
	CAP	-0.026 **	-2.3	-0.027 ***	-3.29	-0.024 ***	-3.3	-0.032 ***	-4.18	-0.042 ***	-2.77	-0.026 ***	-3.7	-0.023 ***	-3.04
Macroeconomic variables	GDP	-0.021 ***	-6.3	-0.064 **	-2.08	-0.277 ***	-4.8	0.130 ***	2.63	0.526 ***	3.75	0.003	0.5	-0.038 *	-1.91
	UNEMPL	-0.006 *	-1.7	-0.005 ***	-1.33	0.002	0.6	-0.006 **	-2.02	0.000	0.06	-0.007 ***	-2.2	-0.007 **	-1.98
Intercept		0.136 **	2.6	0.139	0.21	0.495 ***	4	-0.198 **	-2.3	-1.010 ***	-2.93	0.277 ***	4.6	0.311 *	3.69
Interactions	REGRESTR	-0.023	-0.2												
	GDPG x REGRESTR	0.074 ***	3.7												
	CAPREG			0.003	1.58										
	GDPG x CAPREG			0.008	1.35										
	INITCAPSTRINGENCY					-0.147 ***	-4								
	GDPG x INITCAPSTRINGENCY					0.095 ***	4.6								
	OFFSUP							0.037 ***	4.05						
	GDPG x OFFSUP							-0.013 ***	-2.95						
	PRIVMON									0.164 ***	3.4				
	GDPG x PRIVMON									-0.075 ***	-3.81				
	DEPSINSURANCE											-0.013	-1.1		
	GDPG x DEPISNURANCE											-0.017 ***	-2.8		
	MORALHAZARD													-0.040 **	-1.24
	GDPG x MORALHAZARD													0.017 **	1.31
Specification tests	AR(1)	-3.62 ***		-3.54 ***		-3.33 ***		-3.63 ***		-3.37 ***		-3.81 ***		-3.28 ***	
	AR(2)	-0.46		-0.46		-0.87		-0.35		-0.82		0.21		0.11	
	Hansen test J statistic and p-value of Hansen statisitics	902.83	0.00	866.88	0.00	826.70	0.00	893.72	0.00	828.16	0.00	882.24	0.00	878.16	0.00
No. of instruments		220		220		219		220		217		215		214	
No. of observations		22096		22096		21771		22096		18523		21613		21308	
No. of banks		2119		2119		2083		2119		1669		2070		2036	

All the models are estimated with the Blundell-Bond (1998) two step system-GMM estimator (with Windmeijer correction) for the period of 1996-2011 for panel data with a lagged dependent variable. In each regression the dependent variable is the ratio of LLP over average total assets. As explanatory variables, we include two lags of dependent variable, profit before taxes and provisions over average assets (PROFIT), capital over total assets (CAP), loan growth rate (ΔL), real growth in GDP (GDPG), unemployment rate (UNEMPL), year dummies and country dummies. The coefficient on GDPG is the measure of LLP procyclicality. REGRESTR is the measure of regulatory restrictions on bank activities. CAPREG is the measure of overall stringency of capital requirements. INITCAPSTRINGENCY is the initial capital stringency index. OFFSUP is the measure of official supervisory power. PRIVMON is measured by private monitoring index. DEPINSURANCE is the index measuring the power of the deposit insurer. MORALHAZARD is the index which measures various factors mitigating moral hazard.
*, **, *** denote significance at 10%, 5% and 1% level, respectively.

A negative statistically significant coefficient on GDPGxDEPSINSURANCE suggests that more power of deposit insurer does not limit moral hazard of banks in the EU and thus is not successful in limiting bank risk taking, which consequently leads to a procyclical pattern of LLP across EU banks. However, the negative impact of the power of deposit insurer seems to be alleviated by moral hazard mitigating factors, as the coefficient of GDPGxMORALHAZARD is positive.

4.3. Empirical results for the impact of income smoothing, capital management and credit risk management on the procyclicality of LLP

In this section we focus on banks reporting unconsolidated data, as in this sample we were able to obtain relatively large number of PROCI, ISI, CMI and RMI, which are our indicators measuring, respectively, the sensitivity of LLP to business cycle, income smoothing, capital management and risk management. In table 9 we show some basic descriptive statistics of PROCI, ISI, CMI and RMI. The statistics refer to all estimated indicators (both statistically significant and statistically insignificant) (left hand column of the table), and to those indicators which are statistically significant at the conventional level of at least 10% (right hand column of the table).

Table 9
Descriptive statistics of indicators

	PROCI1 R1	PROCI2 R1	ISI R1	CMI R1	RMI R1	PROCI1 R2	PROCI2 R2	ISI R2	CMI R2	RMI R2	PROCI1 R1	ISI R1	PROCI1 R1	RMI R1
	coefficients values of all individual bank's obtained with regression type 1 and 2 (both statistically significant and insignificant)										coefficient values of individual bank's (significant up to the 10% level)			
Mean	-0.016	-0.016	0.240	-0.029	0.001	-0.013	-0.014	0.313	-0.066	0.001	-0.039	0.288	-0.074	-0.005
Median	-0.005	-0.006	0.219	-0.015	0.001	-0.005	-0.006	0.300	-0.038	0.001	-0.038	0.332	-0.052	-0.005
Min.	-1.706	-1.941	-2.879	-1.356	-0.106	-1.873	-1.794	-3.810	-2.745	-0.112	-0.557	-2.879	-1.047	-0.091
Max.	0.930	1.226	2.557	1.741	0.032	0.827	0.559	4.318	2.781	0.030	0.172	2.190	0.172	0.032
S.E.	0.092	0.098	0.447	0.247	0.010	0.091	0.087	0.540	0.459	0.010	0.114	0.658	0.159	0.018
Skew	-6.498	-6.3068	-0.36	-0.3	-2.93	-7.488	-7.9341	-0.63	0.321	-2.94	-1.37711	-1.158	-3.05082	-1.723
Kurtosis	118.938	153.135	4.43	7.208	24.25	156.541	151.656	8.436	6.447	26.15	3.72781	4.7527	14.8635	5.5551
No. of banks	1120	1120	1120	1120	1120	1120	1120	1120	1120	1120	123	123	91	91

R1 and R2 stand for regression type 1 and regression type 2 measures of the sensitivity defined in section 3.3.2. PROCI – an individual bank's measure of the sensitivity of LLP to the business cycle. PROCI1 and PROCI2 denote the sensitivity of LLP to GDPG and GDPG per capita, respectively. ISI – an individual bank's measure of income smoothing, CMI – an individual bank's measure of capital management, RMI – an individual bank's measure of credit risk management. The results refer to banks which report banks which report unconsolidated data.

Loan loss provisions are procyclical in an average bank, as the mean values of all PROCI indicators are negative. Positive maximum values of some PROCI suggest that in our EU sample we have banks whose loan loss provisions are countercyclical. Positive mean and median values of

ISI indicators suggest that EU banks do apply earnings management. However, in the case of some banks the values of ISI are negative, suggesting no income smoothing. Individual EU banks also seem to apply loan loss accounting to manage capital, as the average and median value of CMI is negative. In our individual banks sample we also find some evidence of credit risk management, since the mean and median values of RMI are positive in the full sample of 1220 banks, and only slightly negative in the sample of 91 banks for which we could obtain statistically significant indicators at the 10% level, for both PROCI and RMI indicators.

Table 10
Effect of income smoothing, capital management and risk management on procyclicality of LLP.

1. Regression type 1 procyclicality and earnings managment measures													
Dep var.: PROCI	PROCI1 R1			PROCI 1 R1			PROCI2 R1			PROCI2 R1			
Indep. variables.	*coef.*	*t-stat.*		*coef.*	*t-stat.*		*coef.*	*t-stat.*		*coef.*	*t-stat.*		
ISI	0.042	5.112	***	0.042	5.092	***	0.042	5.019	***	0.042	5.008	***	
CMI	0.000	0.035					0.009	0.720					
RMI	1.939	2.831	***	1.940	2.846	***	1.817	2.539	**	1.828	2.570	**	
const	-0.028	-7.358	***	-0.028	-7.115	***	-0.027	-7.139	***	-0.028	-6.903	***	
R^2	0.095			0.095			0.080			0.079			
Adj. R^2	0.093			0.094			0.078			0.078			
F-statistic	9.629			14.343			9.538			14.296			
Prob(F-statistic)	0.000			0.000			0.000			0.000			
No. of banks	1120			1120			1120			1120			
2. Regression type 2 procyclicality and earnings managment measures													
Dep var.: PROCI	PROCI1 R2			PROCI1 R2			PROCI2 R2			PROCI2 R2			
Indep. variables.	*coef.*	*t-stat.*		*coef.*	*t-stat.*		*coef.*	*t-stat.*		*coef.*	*t-stat.*		
ISI	0.019	3.336	***	0.024	3.32	***	0.020	3.547	***	0.024	3.465	***	
CMI	-0.011	-2.424	**	-0.011	-2.31	**	-0.010	-2.207	**	-0.010	-2.123	**	
RMI	1.095	1.310					0.973	1.228					
const	-0.021	-5.991	***	-0.021	-5.62	***	-0.021	-6.393	***	-0.022	-6.018	***	
R^2	0.036			0.022			0.036			0.024			
Adj. R^2	0.034			0.021			0.033			0.022			
F-statistic	5.844			7.258			5.748			7.191			
Prob(F-statistic)	0.001			0.001			0.001			0.001			
No. of banks	1120			1120			1120			1120			

All the models are obtained with the use of an OLS estimator with standard errors of regression coefficients robust to heteroscedasticity. The dependent variable is PROCI which measures the sensitivity of an individual bank's LLP to the business cycle. PROCI1 and PROCI2 denote sensitivity of LLP to GDPG and GDPG per capita, respectively. Independent variables include: ISI – an individual bank's measure of income smoothing, CMI – an individual bank's measure of capital management, RMI – an individual bank's measure of credit risk management. R1 and R2 stand for regression type 1 and regression type 2 measures of the sensitivity defined in section 3.3.2, respectively. The results refer to banks which report banks which report unconsolidated data. **, *** denote significance at 5% and 1% level, respectively.

In Table 10 we present estimation of model (4) in which we regress individual bank's measures of sensitivity of loan loss provisions to the business cycle (PROCI) with individual bank indicators of income smoothing (ISI), capital management (CMI) and risk management (RMI Our results point to the positive impact of income smoothing and risk management on sensitivity of loan loss provisions to the business cycle, as the regression coefficients are positive and statistically significant for both ISI and RMI indicators estimated with regression type 1, and statistically significant for ISI in the case of regression type 2 indicators. The negative and statistically

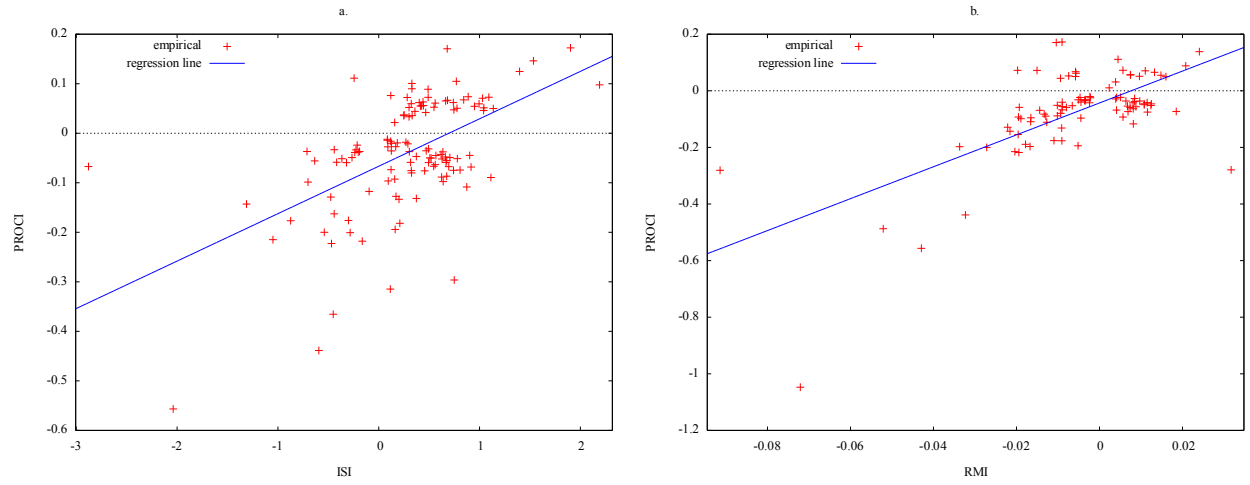
significant relationship between PROCI and CMI suggests that sensitivity of LLP to the business cycle is slightly reduced in the case of banks whose managers apply loan loss allowances (and general provisions) to manage capital (see panel 2 of Table 10). On the whole, our results in table 10 provide empirical support to our prediction that more income smoothing and more prudent risk management have alleviating impact on procyclicality of loan loss provisions.

Table 11
Impact of income smoothing and risk management on sensitivity of LLP to the business cycle for statistically significant values of ISI, RMI and PROCI

Dep var.:	PROCI1 R1			*Dep var.:*	PROCI1 R1		
Indep. variables:	*coef.*	*t-stat.*		*Indep. variables:*	*coef.*	*t-stat.*	
ISI	0.096	4.083	***	RMI	5.636	8.130	***
const	-0.067	-5.143	***	const	-0.043	-3.244	***
R^2	0.307			R^2	0.426		
Adj. R^2	0.301			Adj. R^2	0.420		
F-statistic	16.666			F-statistic	11.019		
Prob(F-statistic)	0.000			Prob(F-statistic)	0.001		
No. of banks	123			No. of banks	91		

All the models are obtained with the use of an OLS estimator with standard errors of regression coefficients robust to heteroscedasticity. The dependent variable is PROCI which measures the sensitivity of an individual bank's LLP to the business cycle. PROCI1 denotes sensitivity of LLP to GDPG. Independent variables include: ISI – an individual bank's measure of income smoothing and RMI – an individual bank's measure of credit risk management. R1 stands for regression type 1 measure of the sensitivity defined in section 3.3.2. Only the statistically significant values of PROCI, ISI and RMI were included in the models. The results refer to banks which report unconsolidated data. *** denotes significance at 1% level.

Figure 1
Regression plot of loan loss provisions sensitivity to the business cycle measure (PROCI) against income smoothing measure (ISI) (left graph, a) and risk management measure (RMI) (right graph, b) (for statistically significant values of PROCI, ISI and RMI).



Our results presented in Table 10 are further supported by estimation coefficients shown in Table 11, in which we run single OLS regression investigating the relationship between loan loss provisions sensitivity to the business cycle and income smoothing (left hand panel of Table 11) and risk management (right hand panel of Table 11) for those ISI, RMI and PROCI indicators which are statistically significant at the conventional level of at least 10%. The regression coefficient between PROCI and ISI shown in Table 11 is over two times higher than the respective coefficient in Table 10. The same can be inferred for the regression coefficient between PROCI and RMI. Thus our results in table 11 provide strong evidence for the view that banks which engage in earnings stabilizing strategies or set their loan loss prudently to account for changes in default risk of their loan portfolio, are less affected by macroeconomic environment. This conclusion is visualized in Figure 1, which presents the regression plot of loan loss provisions procyclicality as well as income smoothing and risk management.

4.4. Sensitivity Analysis

Our results are robust to several robustness checks. First, we rerun the regressions in Tables 4 and 5 using the real growth rate of GDP per capita instead of real GDP growth rate. Our results are not affected by this change. Second, we have also applied different methods of bank size identification, i.e. we adjusted percentiles for large, medium and small banks' identification – instead of 20%, 40% and 40% for large, medium and small banks we took, respectively, 30%, 40% and 30%. The conclusions for the role of bank size in the LLP procyclicality are supported in these additional estimations as well. Third, as our dataset covers years 1996-2011, and throughout this period Barth, Caprio and Levine have conducted four surveys on bank regulations and supervision around the world (Barth et al., 2013) we have also rerun regressions in Table 8 by applying indicators of regulatory and supervisory restrictiveness which were developed by Barth in 1999, 2003 and 2011, instead of indicators of 2006. Our estimations results are not significantly altered in those additional regressions.

5. Conclusions

We have used a panel database of banks from 27 EU countries to explore how loan loss provisions respond to the business cycle. We have applied the two step system GMM Blundell and Bond (1998) estimator, to control for potential endogeneity and unobserved heterogeneity of the explanatory variables. This paper documents a large cross-country and cross-bank variation in the relationship between loan loss provisions and the business cycle and explores country specific (institutional and regulatory) and bank specific features that explain this diversity.

The factors explaining differences in LLP sensitivity to the business cycle across EU banks and countries are many and varied. Our results indicate that LLP in large, publicly traded and commercial banks are more procyclical than in other subsamples.

Better investor protection and more restrictive bank capital regulations reduce the procyclicality of LLP. What is more, moral hazard resulting from deposit insurance results in more procyclicality of LLP. We do not find support for the view that better quality of market monitoring mitigates the procyclical behavior of banks.

This study is relevant to the current policy debate on the role of size in procyclical behavior of banks. In particular we provide new evidence that large systemically important banks should be regulated more restrictively, as they have a tendency to take on more risks, as is evident in our results for banks reporting consolidated statements. This gives support to the Basel Committee

capital standards for systemically important financial institutions (SIFIs), included in the Basel III framework.

Additionally, as our results suggest the importance of bank regulations in limiting the risk taking activity by banks, and therefore limiting procyclicality in banking, we provide strong support for contemporary attempts to make banking sector better regulated. Our results are also important to current macroprudential policy recommendations, promoting the forward looking provisioning (by the Basel Committee and other international institutions, such as the International Monetary Fund). In particular, we find support for the view that more income smoothing and prudent risk management leads to less procyclicality of LLP.

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