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BANK-SPECIFIC DETERMINANTS OF SENSITIVITY OF LOAN-LOSS PROVISIONS TO BUSINESS CYCLE

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Bank-specific determinants of sensitivity of loan-loss provisions to business cycle

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Abstract

In this paper we explore several new factors which may affect the procyclicality of loan-loss provisions. In particular, we test whether there are visible differences in sensitivity of loan-loss provisions to the business cycle between commercial and cooperative banks as well as between large, medium and small banks. We also aim to find out whether the level of bank capital ratio and the application of discretionary income-smoothing affect procyclicality of loan-loss provisions. Our results show that loan-loss provisions of banks are procyclical. This procyclicality is particularly visible and stronger in the sample of commercial banks. We also find that loan-loss provisions of large banks are more negatively affected by the business cycle than those of medium or small banks. We show that banks with low capital ratios exhibit increased procyclicality of loan-loss provisions. And finally, we also find empirical evidence that banks with a greater degree of discretionary income-smoothing have loan-loss provisions more negatively affected by the business cycle, and thus more procyclical.

Key words: loan-loss provisions, procyclicality, bank size, capital ratio, discretionary income-smoothing

JEL Classification: G21, G28, G32, M41

Contents

1. Introduction

The procyclicality of banking activity has become an important area both of contemporary research and the policy agenda after the recent financial crisis. Academics as well as policy makers are looking for tools which could potentially affect excessive procyclicality. However, if the policy is to be effective in its impact on procyclicality, decision-makers have to use instruments targeted at the sources of procyclicality. Procyclicality is present in many areas of the banking activity. However, the procyclicality of bank lending and the related concept of procyclicality of loan-loss provisions, are of huge importance from the perspective of the real economy, because bank lending is necessary to stimulate the investment which fuels economic growth. In this paper we look for bank-specific factors explaining the procyclicality of loan-loss provisions (henceforth denoted as LLP). Previous studies focus on the determinants of loan-loss provisions and the potential sensitivity of loan-loss provisions to business in a cross-country context (Laeven and Majnoni, 2003; Bikker and Metzemakers, 2005; Fonseca and González, 2008; Olszak et al., 2016a), applying bank-level annual data (usually the Bankscope database). In our study we explore several new factors which may affect the procyclicality of loan-loss provisions. In particular, we apply the quarterly individual bank dataset to test whether there are visible differences in sensitivity of loan-loss provisions to business cycle between commercial and cooperative banks as well as between large, medium and small banks. We also aim to find out whether the level of bank capital ratio and application of discretionary income-smoothing affect the procyclicality of loan-loss provisions.

Our study is related to two broad streams in the accounting and finance literature, highlighting determinants and consequences of bank risk-taking. The first is the literature on loan-loss provision accounting (for a thoroughreview refer to Beatty & Liao, 2014). The second is the literature focusing on the procyclicality of the financial sector, and banking activity (see e.g. Claessens, 2014), i.e. the"macroprudential policy" literature. The accounting literature focuses mainly on the determinants of loan-loss provisions and the factors explaining earnings management and capital management with application of loan-loss provisions (Koch & Wall 2000 ; Zhou 2008 ; Floro 2010 ; Norden & Stoian 2013; Bushman & Williams 2013; Fang et al. 2014; Illueca et al. 2015; Bertay et al. 2015). This literature shows that discretionary income-smoothing may be related to poor risk-management practices, thus making banking activity more prone to the business cycle in the long-run (Bushman and Williams, 2012). Additionally, income-smoothing obtained by means of dynamic provisions may also result in greater risk-taking (Illueca et al., 2015). The contemporary literature on macroprudential policy (and financial stability generally) stresses that ("physiological") procyclicality is a typical facet of banking activity (Borio et al., 2001; Borio & Zhu, 2012; Committee on the Global Financial System [CGFS], 2012; ESRB, 2014). However, from the perspective of economic policy the most troublesome feature is the so- called "excessive procyclicality" (Borio & Zhu, 2012.). Such procyclicality is basically perceived as being a side-effect of imprudent risk-management and related excessive risk-taking (Borio et al., 2001; CGFS, 2012; Claessens et al., 2014; Claessens, 2014; Cerutti et al., 2015). Thus, this literature suggests that banks should create buffers (e.g. capital buffers and loan-loss allowances) in good times which should help absorb the losses which will be borne by banks during economic downturns (Financial Stability Board [FSB], International Monetary Fund [IMF], Bank for International Settlements [BIS], 2011; European Systemic Risk Board [ESRB], 2014). In our paper, we look at two types of such buffer-like tools, in use applied by some banks before the recent crisis. The first is a capital ratio (here, of over 10% or of over 15%). In this respect we ask whether banks with a low capital-ratio exhibit increased procyclicality of loan-loss provisions as compared to other banks.

The second buffer-like tool is the use of discretionary income-smoothing. We test whether banks which apply more discretionary income-smoothing have loan-loss provisions which are more procyclical.

Our study contributes to the literature in following ways. Firstly, we show that procyclicality of loan-loss provisions at a country level, analyzed using quarterly data, differs significantly between commercial and cooperative banks. Previous studies apply annual cross-country data (see Olszak et al., 2016a). Secondly, we show that bank size does matter for the procyclicality of loan-loss provisions, but its relative importance depends on bank specialization (i.e. there is a difference between commercial and cooperative banks). Thirdly, we also test the view that the size of the capital ratio, which is a proxy for the solvency risk of a bank, affects the association between loan-loss provisions and the business cycle. The effect of the capital-ratio level has been tested for the link between loans growth and bank capital (Carlson et al., 2013; Olszak et al., 2016b), but not for the procyclicality of loan-loss provisions. Fourthly, we analyze the importance of a discretionary income-smoothing for the link between LLP and GDP growth. In the previous literature, the role of such income-smoothing has been analyzed in the context of bank risk-taking (see Bushman & Williams, 2012) and in the context of accounting conservatism (see Illueca et al., 2015).

In this paper we apply the two-step dynamic, Blundell and Bond (1998) approach, with robust standard errors and Windmeijer's (2005) finite-sample correction, to a sample of individual-bank quarterly data, covering the period of 2000-2012. Our results show, firstly, that loan-loss provisions of banks in are procyclical. Secondly, this procyclicality is particularly visible and stronger in the sample of commercial banks, than in the cooperative banks. Thirdly we find that the loan-loss provisions of large banks are more negatively affected by the business cycle than the loan-loss provisions of medium or small banks. Fourthly, we show that banks with low capital-ratios exhibit increased procyclicality of loan-loss provisions. Fifthly, we find empirical evidence that banks with a greater degree of discretionary income-smoothing have loan-loss provisions more negatively affected by the business cycle, and thus more procyclical.

Our results have implications for decision-makers in regulatory policy. Firstly, we show that regulations targeted at procyclicality should be tailored according to bank specialization and bank size. Secondly, we provide further support for the view that procyclicality in banking is related to solvency (or default) risk. To combat excessive procyclicality, regulators should, therefore, encourage banks to keep higher capital buffers. These buffers should not, however, be overly excessive, because at higher levels of capital ratios, the relative reduction in the procyclicality of loan-loss provisions is limited. And, finally, we provide empirical evidence for the fact that excessive discretionary income-smoothing may come at a cost of an increased procyclicality of loan-loss provisions. Consequently, regulations which promote solutions which stabilize banks' profits should be implemented along with requirements of greater transparency of loan-loss-provision accounting.

The rest of the paper is organized as follows. Section 2 puts our paper in the context of current research on bank loan-loss provisioning and procyclicality as important aspects of bank risk-taking. Section 3 presents the econometric methodology and data used in our study. Section 4 presents the main findings of our empirical analysis of the determinants of sensitivity of LLP to the business cycle, in particular looking at potential differences between commercial and cooperative banks. Finally, Section 5 offers conclusions.

2. Literature review and hypotheses development

The vast majority of studies on loan-loss provisions address the procyclicality of LLP in a cross-country context applying annual data (Laeven & Majnoni, 2003; Bikker & Metzemakers, 2005; Fonseca & Gonzalez, 2008; Bouvatier & Lepetit, 2008; Floro, 2010; Olszak et al., 2016a) and generally suggest that LLP are negatively affected by business cycle. In our study we focus on individual quarterly data of commercial and cooperative banks operating in Poland in 2000-2012 to find out whether the sensitivity of

LLP to the business cycle is negative, implying the procyclicality of LLP. Considering general findings of previous studies on LLP we *hypothesize that loan-loss provisions in banks are negatively associated with the GDP growth (hypothesis 1, henceforth denoted as "H1").*

2.1. Impact of business cycle on LLP of commercial verus cooperative banks

The literature also stresses the importance of bank specialisation for the association between loan-loss provisions and the business cycle. Although this literature usually focuses on earnings management in the banking sector, its inferences may be applied to make predictions about potential relationship between LLP and GDP growth in different bank categories. In particular, income-smoothing (or a stable level of bank profits) is expected to have a positive impact on procyclicality in the banking industry (Borio et al., 2001; Fonseca & Gonzalez, 2008; Olszak et al., 2016a). Some authors, however, argue that excessive income-smoothing may result in weakened risk-management in banks (Bushman & Williams, 2012). As for the income-smoothing, Ma (1988) shows that US commercial banks used LLP to smooth earnings, whilst there is no relationship between LLP and loan portfolio quality. Anandarajan et al. (2007), using a sample of Australian commercial banks, suggest that these banks are engaged in earnings-management practices. Additionally, Fernando and Ekanayake (2015) suggest that private domestic licensed commercial banks use loan-loss provisions to smooth income, while the public (i.e. state-owned) banks do not apply them for this purpose. Again, for commercial listed banks in the European Union, Leventis et al. (2012) find that, for risky banks, loan-loss provisions management behavior is more pronounced when compared to the less-risky banks, but is significantly reduced in the post-IFRS (International Financial Reporting Standards) period.

The role of bank specialization has also been studied in a different context, to test the role of capital ratio for bank lending in different monetary policy conditions (Gambacorta & Mistrulli, 2004). This research suggests that the bank-capital channel of monetary policy may be more pronounced in cooperative banks due to the greater maturity gap of these banks and the limited use of derivates to shield this maturity gap. However, it is also possible that the close relationship of cooperative banks with their members, makes their activity more resilient to business-cycle fluctuations. This relationship results from the fact that such banks operate locally, e.g. at a small village level. In contrast, commercial banks, whose branches are present in many regions of a country, may be more responsive to external financing conditions, and therefore may be responsive to business-cycle fluctuations in lending activity. Additionally, in a recent study, Olszak et al. (2016a) found that the loan-loss provisions of commercial banks are more negatively affected by GDPG than the LLP of cooperative banks. Following the above-mentioned evidence, which stresses the potentially higher risk-taking in commercial banks, *we predict that loan-loss provisions of commercial banks are relatively more procyclical than loan-loss provisions of cooperative banks (hypothesis 2, henceforth "H2").*

2.2. Association between LLP and business cycle – GDP growth and bank size

In the literature, bank size is an important determinant of risk-taking. In particular, large banks may be prone to the "too big to fail" phenomenon. Due to the fact that these banks receive implicit or explicit government protection, they invest in more risky assets (see e.g. Schooner & Taylor, 2010; Stiglitz, 2010; De Haan & Poghosyan, 2012, Freixas et al., 2007). Large banks could also be more sensitive to general market movements than smaller ones, meaning that the link between bank size and systemic risk may be positive (Anderson & Fraser, 2000; Haq & Heaney, 2012). Laeven et al. (2014) present descriptive evidence that large banks may have a more fragile business model (with higher leverage and more market-based activities) than small banks. Olszak et al. (2016 a) show that the loan-loss provisions of large banks, and in particular large banks consolidating financial statements, are more negatively associated with the business cycle, consistent with prediction of greater procyclicality of large banks. Following this evidence we predict that *loan-loss provisions of large banks are more negatively associated with GDP growth than loan-loss provisions of medium sized or small banks (hypothesis 3, "H3")*. Additionally, due to the fact that commercial banks may differ in their response to the business cycle from cooperative banks, we predict that

procyclicality of loan-loss provisions is stronger in the sample of large commercial banks relative to large cooperative banks, consistent with previous empirical findings, applying annual data, for EU banks (Olszak et al., 2016a).

2.3. Sensitivity of loan-loss provisions to business cycle and bank capital ratio

Before discussing the role of capital ratios in ensuring banks' soundness one must agree that its value at the level of an individual bank should mainly be determined by the bank's risk appetite – since the level of own funds should ensure the economic soundness of the bank and should be adjusted to the scale of its operations. A bank's capital should be regarded as own source of asset financing and should protect it from unsecured risks which may turn into losses. The volume of capital should therefore be regarded as an equivalent of the net asset worth, so the margin by which assets outweigh liabilities, meaning that assets equal to capital would be left for bank owners after all depositors and creditors have been discharged. Capital is, therefore, necessary to enable a bank to cover potential losses from its own sources.

As long as the total losses (reducing the capital of the bank) do not exceed the capital, the bank may maintain its liabilities covered by assets. Operating losses arising from banks' activities are a none too common phenomenon in banks, due to the fact that banks are trying to determine interest margins in such a way that the difference between the interest income and the cost of funds allow it to cover ordinary expenses. It should however be borne in mind that in the current situation of low (or even negative) interest rates this is becoming increasingly difficult. However, in general, operating losses at such a level that would lead to a significant reduction in capital (threatening the stability of bank) is somewhat improbable in the long run (Svitek, 2001). The key here is, of course, to keep the bank's own funds at the relevant level (exceeding the regulatory minimum). Therefore requirements for a bank just starting its activities are significantly higher than in the case of banks already operating which have been able to accumulate adequate capital resources. It is, moreover, worth noting that the banks, as providers of credit, play an important role in the economic cycle, as discussed below, and if being under a capital constraint may reduce the supply of credit in times of economic downturn (being pro-cyclical), this will lead to the strengthening of the trends in the economy. The change in the value of loans may of course be due to both a decrease in loan demand and a decline in credit supply. However bank-lending-channel theory says that monetary policy affects spending by changing the supply of bank credit (Bernanke & Gertler, 1995): thus the tightening of monetary policy causes a drop in banks' liabilities and leads to a credit crunch. However if the supply of credit falls mainly by reducing the banks' capital then we may talk about capital crunch (Bikker & Hu, 2002). So it is of the greatest importance for the banks as well as for the regulators to establish such capital requirements as would enable banks to operate in a dynamic environment, but having also in mind not making them refrain from granting loans to the economy.

An adequate level of capital can prevent the occurrence of so-called moral hazard of banks, which would, in a competitive environment, choose riskier portfolios, increasing the risk of falling. The bank may be economically insolvent, but it may continue to operate if expected losses are not properly stated in the books. In such a situation, the conservative strategy will not help the bank avoid insolvency. A risky strategy, however, can pay off. Even if investment in risky assets does not pay off, it may not be important to the bank's management, because either way the bank is insolvent. However, there is a non-zero probability that the investment will generate a return high enough to enable the bank to avoid insolvency. This is the only possible way out of this kind of situation, involving direct excessive risk-taking, which should be judged negatively by depositors, the owners or the supervisory authority (Gehrig, 1995; Mishkin, 1992). To sum up, it is important to try to establish rules for determining the appropriate level of capital requirements, which seems to be very difficult. Proponents of stricter regulation point to the risks that were to be observed during last financial crisis, while opponents argue that these significantly increase the cost of credit and therefore hinder economic activity. It is important, therefore, to assess capital benefits in terms of its loss absorption

abilities (in opposition to losses on bank creditors or public recapitalizations amongst other things) (Dagher et al., 2016).

The role of the size of the capital ratio has been tested for the effect of the capital ratio on loans' growth (Carlson et al., 2013; Olszak et al., 2016b), but not directly for the effect of business cycle on loan-loss provisioning. Having said that, we must stress that Floro (2010) analyzes the role of different types of capital ratios for the sensitivity of LLP to the business cycle in both economic upturns and downturns. This study, however, does not focus on the role of differences in the capital ratio for the relative impact of business cycle on LLP. Rather, the capital ratio, as stated above, informs us about the sensitivity of a bank to solvency risk. Banks with lower levels of capital ratios are perceived as riskier, because bank owners' stake in investments (assets) is low and insufficient to cover unexpected losses. Following this literature we expect that *in banks with lower capital ratio, the procyclicality of loan-loss provisions is strengthened (hypothesis 4, "H4")*

2.4. Income-smoothing and the procyclicality of loan-loss provisions

The banking literature posits that the procyclicality of LLP may be weakened by income-smoothing, according to the idea that smoothing allows a buildup in reserves when earnings are high and current period losses are low, that is to say a reserve to be drawn down in future periods, when earning are low and tend to decrease and current loan losses are increasingly high (Borio et al., 2001; Laeven and Majnoni, 2003; Bikker and Metzemakers, 2005; Olszak et al., 2016). In particular, the recent study by Olszak et al. (2016a) shows that income-smoothing does indeed result in a weakened procyclicality of LLP in the EU.

However, the degree of reduction in procyclicality seems to be related to the type of income smoothing, i.e. whether it is discretionary, or non-discretionary, income-smoothing. Non-discretionary income smoothing, related to prudent credit-risk management (as measured by using the association between LLP and loans growth) seems to be related to greater reductions in procyclicality of LLP in the EU. Discretionary income-smoothing (measured empirically as the association between current-period loan-loss provisions and current-period earnings before provisioning expenses and taxes), results in a definitely weaker reduction in the procyclicality of loan-loss provisions. Moreover, other evidence suggests that an increased level of discretionary income-smoothing may be related to a diminished transparency which does not allow to monitor banks properly (Bushman & Williams, 2012) or to a high level of accounting conservatism (Illueca et al., 2015), both of which result in increased risk-taking by banks. Bushman and Williams (2012) argued, and found, that forward-looking provisioning, designed to smooth earnings, dampens discipline over risk-taking, which is consistent with reduced transparency limiting market discipline. Illueca et al. (2015), investigate the impact of dynamic provisioning on the risk-taking incentives of Spanish banks differing in conditional accounting conservatism.They test and find support for a hypothesis that banks with relatively high accounting conservatism in the pre-adoption period (of the new accounting tool) had greater incentives to increase their ex-ante risk-taking in lending. Such banks loosened their lending standards and displayed a significantly higher loan growth in the post-adoption of dynamic provisions' period. Such effect was not found for banks with a lower accounting conservatism in the years before the adoption of the dynamic-provisioning rules. Thus this research implies that discretionary income-smoothing is related to increased risk-taking. Current macroprudential literature suggests that excessive risk-taking is associated with increased procyclicality in the banking activity (see e.g. Lim et al., 2011; Claessens et al., 204; Cerutti et al., 2015). *We therefore predict that in banks which apply more discretionary income-smoothing the association between LLP and GDP growth will be strengthened (hypothesis 5, "H5")*.

3. Empirical model and data

3.1. Estimation methods

The main purpose of the paper is to examine whether bank-specific variables have a significant impact on the sensitivity of LLP to the business cycle. To that end, the effects of bank-specific traits on the link between LLP and GDP growth must be specified within an econometric framework in a tractable way. We use the standard LLP panel data model to demonstrate the impact of GDP growth on LLP, in which we include variables traditionally applied in other studies, focusing on earnings management (see Greenawalt & Sinkey 1988; Beatty et al. 2002; Liu & Ryan 2006) and procyclicality (Laeven & Majnoni 2003; Bikker & Metzemakers 2005; Olszak et al., 2016a).

The basic model reads as:

$$\mathrm{LLP}_{i,t} = \alpha_0 + \alpha_1 \mathrm{LLP}_{i,t-1} + \alpha_2 \mathrm{LLP}_{i,t-2} + \alpha_3 PROFITBPT_{i,t} + \alpha_4 LLA_{i,t} + \alpha_5 L\ growth_{i,t} + \alpha_6 CAPR_{i,t-1} + \alpha_7 size_{i,t} + \alpha_8 GDPgrowth_{j,t} + \alpha_9 UNEMPL_{j,t} + \alpha_{10} \sum_{t=2000}^{2012} T_t + \vartheta_i + \varepsilon_{i,t} \quad (1.1)$$

The dependent variable (denoted as LLP) is the net loan-loss provision of a bank divided by this bank's average total assets (TA). The net loan-loss provision is the sum of net specific loan-loss provisions (covering potential loan-losses incurred by the bank, as well as loan write offs and loan recoveries) and of general provisions (usually applied to cover expected loan-losses).

The subindices i, j, t refer to the bank, voivodeship (i.e. province, in the case of cooperative banks) and the quarter – respectively.

The explanatory variables have been subdivided into (1) bank-specific variables, namely:

- earnings before LLP and taxes of a bank divided by the bank's average total assets (denoted as PROFITBPT),
- loan-loss allowance (LLA);
- loan growth (denoted as L growth),
- capital ratio (denoted as CAP); we apply capital adequacy ratio (CAPR), as proposed by the Basel Committee, measured as the total capital funds over total risk-weighted assets; we also use a Tier 1 capital adequacy ratio, denoted as CAPR1 and a simple unweighted capital ratio, denoted as CAP.

and (2) macroeconomic variables, which include:

- the real growth of Gross Domestic Product (denoted as GDP growth) – in the case of commercial banks we apply country level-GDP growth, and in the case of cooperative banks, which are active locally (in voivodeships or even poviats or districts), we apply local GDP growth at a voivodeship level;
- the unemployment rate (denoted as UNEMPL); – in the case of commercial banks we apply country level UNEMPL, and in the case of cooperative banks, which are active locally, we apply local UNEMPL at a voivodeship level;.

All bank-specific variables (LLP, PROFIT and CAP) are normalized by the bank's total assets (TA, average assets in the case of LLP, LLA and PROFITBPT) to mitigate potential estimation problems with heteroscedasticity. The first and second lag of the dependent variable is included in order to capture adjustment costs that constrain the complete adjustment of LLP to an equilibrium level (see Laeven & Majnoni 2003; Bikker & Metzemakers 2005 and Fonseca & González 2008).

Elements $\sum_{t=2000}^{2012} T_t$ 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 current period LLP and current period earnings realizations before provisions and taxes (PROFITBPT) is applied to track the income-smoothing by banks, in particular potentially-

discretionary income-smoothing (Bushman & Williams, 2012). A higher sensitivity of current provisions to current earnings is interpreted as higher discretionary income-smoothing (see Bouvatier & Lepetit, 2008; Bushman & Williams, 2012). Therefore, we predict that in banks which engage in discretionary income-smoothing, the regression coefficient for PROFITBPT is positive. After controlling for fundamental changes in default risk (measured with LLA and L growth), the α3 (i.e. the coefficient between LLP and PROFITBPT) picks up the extent to which banks record loan-loss provisions based solely on the levels of earnings without consideration of the risk and losses linked to the credit portfolio (Bushman & Williams, 2012, p. 8). Empirical research on individual banks, both singly and cross-country, confirms that this variable and LLP are positively related (Greenawalt & Sinkey 1988; Laeven & Majnoni 2003; Bikker & Metzemakers 2005; Liu and Ryan 2006; Fonseca and González 2008; and Bouvatier and Lepetit 2008, Bushman & Williams, 2012; Skała, 2015; Olszak et al., 2016). 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. Previous research shows that income-smoothing may be related to a weakened procyclicality of LLP (Olszak et al., 2016). However, Bushman and Williams (2012) find that banks which apply a high degree of discretionary income-smoothing, following the rule of recording large provisions because earnings are high and low provisions because earnings are low, are prone to excessive risk-taking, so this reduction in procyclicality comes at a cost of potentially excessive risk-taking.

The association between LLA and LLP is used to take into account non-discretionary loan-loss provisions, since this variable is related to changes in default risk (see Fonseca & Gonzalez, 2008). LLA in banks is strongly correlated with non-performing loans (NPL). LLA reflects expected loan losses identified with backward-looking rules based on indentified credit losses. Bouvatier and Lepetit (2008) use NPL to reflect the non-discretionary component of LLP. We take a slightly different approach, including loan-loss allowances (as in Fonseca & Gonzalez, 2008), because they are directly included as a cost in the profit-and-loss account of a bank, and thus constitute a direct non-discretionary charge to a bank's gross profits. Following Greenawalt and Sinkey (1998), Wahlen (1998), Bouvatier and Lepetit (2008), and Fonseca and Gonzalez (2008) we expect a positive coefficient for LLA, implying that banks which recorded a huge deterioration in the quality of loan portfolio and thus were forced to recognize increased losses on the portfolio, were at the same time increasing the level of net loan-loss provisions. Empirical findings on this relationship tend to be diversified, but generally support the prediction that non-discretionary component of LLP (i.e. LLA or NPL) is positively associated with LLP (Fonseca & Gonzalez, 2008; Bouvatier & Lepetit, 2008).

Changes in total loans outstanding are also related to changes in default risk (and also credit risk) (see Fonseca & Gonzalez, 2008 and Bouvatier & Lepetit, 2008) and in expected loan losses. If banks use some portion of LLP to cover expected loan losses, then the relationship between LLP and L growth is positive. In contrast, when banks do not set aside provisions to cover expected loan losses, then the association between LLP and L growth is negative. Empirical results on this link are diversified. Some papers find a positive influence of loan growth on LLP (Bikker & Metzemakers 2005; Fonseca & González 2008) implying that banks set aside provisions to cover expected losses related to credit risk, especially building this up in economic booms. Other studies document a negative coefficient on L growth (Laeven & Majnoni 2003), suggesting that the hypothesis of prudent loan-loss provisioning behavior is not supported by the evidence. Therefore, in our study we do not make predictions about the potential association between LLP and L growth.

Capital ratio (CAPR) is introduced to test the capital-management hypothesis. This hypothesis stresses the role of loan-loss provisions in capital-ratio variation. The relationship between CAPR and LPP may be both negative and positive. If capital variation is more related to retained earnings than to loan-loss reserves, as is the case in many accounting standards, the CAP may exert a negative effect on LLP. Such a 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 (see Liu & Ryan, 2006; Shrieves & Dahl, 2002; Bouvatier & Lepetit,

2008) In general, accounting regulations in Poland (as in other countries) distinguish between specific provisions, general risk provisions and general risk fund for unidentified banking risks – all aimed at covering risks associated with banking operations. Provisions for risks related to banking operations - both specific and general - secure the appropriate level of own funds, influencing banks' abilities to absorb losses and ensuring the solvency of the bank. Specific provisions are created to cover specific risks, namely incurred losses from receivables following the assessment of its repayment probability, or applying historical data regarding losses. Both general risk fund and the general risk reserve are used to cover general risks of the banking activity, so they are not attributable to any particular group of receivables and can therefore be regarded as an additional prudential write-down. Thus specific provisions are discounting value of assets as they relate to specific losses, so they are not included in the own funds. In the financial statements the amount of specific provisions is deducted from the gross loan portfolio to determine the actual net value of the loan portfolio. On the other hand, the general risk fund is one of the elements of capital and general risk provision is one of the liabilities items, recorded under own funds. Thus in Polish banks loan-loss provisions do not affect levels of capital-ratio directly. Their impact is indirect. Considering the fact that increases in loan-loss provisions decrease the amount of net profits which could be applied (as retained earnings) to increase the value of total capital, we expect the association between loan-loss provisions and capital ratio to be negative, i.e. increases in LLP will be related to decreases in capital and vice versa.

The regression coefficient on GDP growth is the most interesting link in our study, as it measures the sensitivity of LLP to the business cycle, and therefore gives us information about the potential procyclicality of LLP. Previous empirical research shows that GDP is negatively related to LLP (Laeven & Majnoni 2003; Bikker & Metzemakers 2005; Bouvatier & Lepetit 2008; Fonseca & González 2008; Olszak et al., 2016a). The stronger the negative coefficient on GDP growth is, the more procyclical is LLP. In contrast, a positive relationship between LLP and GDP would suggest the counter-cyclicality of LLP (see e.g. Laeven & Majnoni, 2003). In our study we predict the association between LLP and GDP growth to be negative. However, we do not make predictions about the statistical significance of this relationship. We generally expect this link to be diversified across banks differing in specialization, size of capitalization and income-smoothing.

We employ UNEMPL as an additional macroeconomic determinant (and thus business cycle indicator) of LLP as other researchers have done (Bikker & Metzemakers 2005). We expect the regression coefficient on UNEMPL to be positive, implying that LLP increases as more workers get made redundant. Such a relationship is consistent with the procyclicality hypothesis predicting that loan-loss provisions decrease in economic upswings (as the unemployment rate decreases) and increase in economic downswings (i.e. when the unemployment rate declines). However, if the association between LLP and UNEMPL is negative, than we will find evidence in favor of counter-cyclicality hypothesis of LLP.

The variables applied in our baseline econometric model 1.1 (as well as in models 1.2 and 1.5) may cause serious problems with the properties of standard OLS and FE estimators. In particular, standard estimators may be biased due to the presence of endogeneity of explanatory variables. Therefore, we apply an approach that involves instrumental variables, i.e. we consider the system of generalised method of moments (GMM) as proposed by Blundell and Bond (1998) with Windmeijer's (2005) finite-sample correction. This method has a proven track record and seems to be the best approach to address three significant econometric problems, that are inherent to our analysis: (1) the presence of unobserved bank-specific effects, which is eliminated by taking the 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, in particular bank-specific variables. We control for the potential endogeneity of PROFITPBPT, LLA, L growth and CAPR in the two-step system GMM estimation procedure by the inclusion of up to four lags of these variables as instruments. The GDPG and UNEMPL, as well as voivodeship (in the case of cooperative banks) and the time dummy variables are the only variables considered exogenous. However, in the

robustness checks section we consider the potential endogeneity of GDP growth, by applying additionally up to four lags of GDP growth.

Due to the fact that the consistency of the GMM estimator depends on the proper choice 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 that we employ there is no second-order serial correlation in error terms. The other test that we apply is Hansen's J-statistic for overidentifying restrictions, which tests the overall validity of the instruments sets. When interpreting the p-values of Hansen's J-statistics, however, we follow Roodman's suggestion (2009), that the Hansen test should not be relied upon too implicitly, as it is prone to weaknesses, the most serious of which is instrument proliferation. A high p-value of the Hansen test is usually the basis of researchers' arguments for the validity of GMM results. Unfortunately, the instrument's proliferation validates the test (see Roodman, 2009: 141). We resolve this problem by including only up to four lags of our explanatory bank-specific variables. Such an approach should eliminate potential problems resulting from too many instruments relative to the number of observations. Our data are quarterly and thus may be prone to seasonality. Therefore, in the robustness section, we additionally run regressions given by equations 1.1, 1.2 and 1.6, in which we include quarterly dummies. Additionally, the GDP growth variable, may also depend on other factors, thus may be endogenous. Therefore, in the robustness section, we also present estimations of results, in which we include up to four lags of GDP growth as instruments.

3.1.1. Strategy for testing the effect of capital-ratio size on procyclicality of loan-loss provisions.

To analyze the differences across banks which differ in the size of capital-ratio, we estimate regression (1.2), incorporating an interaction term for the bank, relative capital-ratio size (denoted in the regression as *CAPR size*) and the *GDP growth* variable. The coefficient on each interaction term measures the influence of capital ratio size (i.e. capital ratio below 10%, denoted as CAPR<10%; capital ratio between 10% and 15%, denoted as 10%<CAPR<15%; and capital ratio over 15%, denoted as CAPR>15%) on the sensitivity of loan-loss provisions to GDP growth. In our study, we divide banks into the three capital-ratio-level categories, because in banking practice and in the supervisory approach towards banks (in Poland, but also in other countries), these levels of capital ratios are considered as benchmarks.

Following current regulatory changes in the global banking system, in particular those proposed by the Basel Committee on Banking Supervision shortly after the recent crisis, banks are obliged to operate at higher capital ratios and apply more high-quality capital with a unified definition. The new set of limits – common equity Tier 1 – at least 4.5% of risk-weighted assets, Tier 1 – at least 6% of risk-weighted assets and Total Capital (Tier 1 + Tier 2) – at least 8.0% of risk-weighted assets – is supposed to strengthen both the qualitative and quantitative elements of the regulatory capital framework. Total capital adequacy ratio at a level of 8% is regarded as the regulatory binding minimum. However, banks should also maintain additional capital buffer (not necessarily regulatory-imposed) in order to be able to back their risk exposures by a high-quality capital base. The 2 percentage points "buffer" proposed – raising the minimum 8% to 10% seems to be legitimate, considering the necessity of banks to satisfy regulatory requirements at all times – so even during adverse market conditions. The next level of CAPR – 15% will be considered as generally safe enough to make the bank resilient to even severe adverse economic conditions – as for example depicted in 2016 EU-wide stress tests performed by European Banking Authority whose results were published on July 29, 2016. Both, the regulatory constraints and recommendations are, and should be, designed to protect the banking system and depositors. The rationale behind this is that capital-adequacy ratios minima result in a lower probability of a bank's default (however, as some previous studies showed, this had not always been the case, Blum, 1999; Koehn & Santomero, 1980; Peltzman, 1970).

Nevertheless, having the above in mind, in the years under analysis, Polish banks in particular were to operate at a capital adequacy ratio at least equal to 10%. Generally, a capital-adequacy ratio below 10% may imply that banks' solvency may be endangered by greater losses, particularly those in the lending market. Banks with a capital-ratio ranging between 10% and 15% are perceived as safe and optimally capitalized. Banks with a capital ratio above 15%, however, may be considered as excessively capitalized, thus potentially not exploiting all favourable investment challenges. Our model in which we include an interaction term between GDP growth and capital ratio size (CAPR size) reads as:

$$\begin{aligned} \mathrm{LLP}_{i,t} = {} & \alpha_0 + \alpha_1 \mathrm{LLP}_{i,t-1} + \alpha_2 \mathrm{LLP}_{i,t-2} + \alpha_3 PROFITBPT_{i,t} + \alpha_4 LLA_{i,t} + \alpha_5 \Delta L_{i,t} + \alpha_6 CAPR_{i,t-1} \\ & + \alpha_7 size_{i,t} + \alpha_8 GDPgrowth_{j,t} + \alpha_9 UNEMPL_{j,t} + \alpha_{10} \sum_{t=2000}^{2012} T_t + \alpha_{11} CAPR\ size_i \\ & + \alpha_{12} CAPR\ size_i * GDPgrowth_{j,t} + \vartheta_i + \varepsilon_{i,t} \end{aligned}$$

(1.2)

This model is different from the regression (1.1) in two respects, because we include two additional explanatory variables necessary to take account of the role of capital ratio size in the procyclicality of LLP. The first variable is the capital ratio below 10% (CAPR<10%), capital ratio between 10% and 15% (10%<CAPR<15%) and capital ratio over 15% (CAPR>15%). The regression coefficient on this variable tells us about the level of loan-loss provisions set aside by banks which differ in the levels of capital ratio. A positive coefficient implies that banks with a given level of capital ratio generally provision more, which may be a result of greater (credit) risk-taking. A negative coefficient implies that banks included in the capital-level group make less provisions than other banks. Such a negative coefficient would suggest that these banks potentially engage in less risk-taking.

The other variable is the double interaction term (CAPR size*GDP growth), which measures the impact of capital ratio size on the link between LLP and GDP growth. Generally, if this effect is positive, then the procyclicality of LLP is reduced. A negative impact would imply that capital ratio size increases procyclicality of LLP.

3.1.2. Strategy for testing the impact of income smoothing on procyclicality of loan-loss provisions

Our approach in testing the effect of income-smoothing on the procyclicality of the loan-loss provisions of commercial and cooperative banks consists of two stages. In the first one, we identify an individual bank income-smoothing level, by applying an approach designed by Olszak et al., (2016a) for EU banks, and by Bushman and Williams (2012), used at a country level, in an international sample of banks. In our approach we use three types of measures of income-smoothing per bank. The first is a simple Pearson correlation coefficient between LLP and PROFITBPT (denoted as *inc smooth corr*). The two other measures are identified with the regression coefficient obtained using an ordinary least squares (OLS) estimator. 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 below:

$$LLP_{i,t} = \alpha_i PROFITBPT_{i,t} \qquad \textbf{(1.3)}$$

where:
LLP – loan-loss provision divided by average assets;
Average TA – average total assets;
i – the number of the bank;
t – the number of quarterly observations for the i-th bank;;

α_i –the regression coefficient which is the measure of sensitivity of loan-loss provisions (LLP) to PROFITBPT (the coefficient between LLP and PROFITBPT is henceforth called income-smoothing measure, inc *smooth R1*); the PROFITBPT equals profit before provisions and taxes, normalized by average assets.

The second type is a multiple regression model, which we henceforth call regression type 2 (R2). In this model, besides PROFITBPT as the explanatory variable, we also include other explanatory variables, which in previous research have been found to affect loan-loss provisions of banks significantly (see Laeven and Majnoni, 2003; Bikker and Metzemakers, 2005; Fonseca and Gonzalez, 2008). This model is a reduced equation (1.1) and reads as below:

$$\mathrm{LLP}_{i,t} = \alpha_0 + \alpha_1 \mathrm{LLP}_{i,t-1} + \alpha_2\, PROFITBPT_{i,t} + \alpha_3\, \Delta L_{i,t} + \alpha_5\, CAPR_{i,t} + +\alpha_6\, GDPgrowth_{j,t}$$

(1.4)

In this model our measure of income-smoothing is α_2 , which tells us about the sensitivity of loan-loss provisions to the current level of bank earnings before taxes and provisioning expenses.

The three measures of the degree of income-smoothing are used to divide the sample of commercial and cooperative banks into two subsamples, applying the median value of respective income-smoothing measure (i.e. *inc smooth corr, inc smooth R1* and *inc smooth R2*). The first subsample includes banks which engage in more income-smoothing. The other subsample covers banks which engage in less income-smoothing.

The second stage of our approach consists in an analysis of the effect of income-smoothing on the sensitivity of LLP to GDP growth. To do this, we estimate regression (1.6), incorporating an interaction term for bank income-smoothing (denoted as *inc smooth*) and the GDP variable. The coefficient on each interaction term measures the influence of income-smoothing (in particular a high degree of income-smoothing, denoted as *inc smooth high*) on the sensitivity of loan-loss provisions to GDP growth. A positive coefficient on the double interaction would imply that in banks which were included in the high income-smoothing category, the procyclicality of LLP is reduced. The negative coefficient on inc smooth high*GDP growth suggests that in banks which engage in income-smoothing, the procyclicality of LLP is strengthened. Our model, in which we include the effect of income-smoothing reads as:

$$\begin{aligned}\mathrm{LLP}_{i,t} = {} & \alpha_0 + \alpha_1 \mathrm{LLP}_{i,t-1} + \alpha_2\, \mathrm{LLP}_{i,t-2} + \alpha_3\, PROFITBPT_{i,t} + \alpha_4\, LLA_{i,t} + \alpha_5\, L\ growth_{i,t} + \alpha_6\, CAPR_{i,t-1} \\ & + \alpha_7\, size_{i,t} + \alpha_8\, GDPgrowth_{j,t} + \alpha_9\, UNEMPL_{j,t} + \alpha_{10} \sum_{t=2000}^{2012} T_t + \alpha_{11}\, inc\ smooth\ high_i \\ & + \alpha_{12}\, inc\ smooth\ high_i * GDPgrowth_{j,t} + \vartheta_i + \varepsilon_{i,t}\end{aligned}$$

(1.5)

3.2. Data used for analysis

We use pooled cross-section and time-series quarterly data of individual banks' balance sheet items and profit-and-loss accounts from Poland over a period from 2000 to 2012. The balance-sheet and profit-and-loss account data are taken directly from the prudential reporting of banks. This is a unique set of data, which is gathered by the National Bank of Poland, because in accordance with Resolution No. 53/2011 of the Management Board of the National Bank of Poland of September 22, 2011 as amended (NBP Official Journal of 2011 No. 14, 2013 No. 6, No. 47, 2014 No. 40, 2015 No. 38, 2016, No. 2) and pursuant to Regulation of the European Parliament and Council (EU) No 575/2013 of June 26, 2013, (L 176, 06.27.2013 p.1) credit institutions are obliged to provide the NBP with prudential reporting on an individual and consolidated basis, among others, in the field of financial information (" FINREP") and on own funds

and own funds requirements ("COREP"). Also previous data are taken directly from the database of National Bank of Poland (i.e. Banking Reporting Information which is to some extent the predecessor of the FINREP and COREP packages).

The macroeconomic data were accessed from the Central Statistical Office of Poland (GUS). Due to the fact that our dataset consists of commercial banks and cooperative banks, and those banks differ in the reach of their services, in terms of the number of customers and number of voivodeships in which they operate, we apply two types of macroeconomic measures. The first one is the country-level GDP growth and unemployment rate, which is better suited for analysis of the business-cycle effects on commercial banks, which traditionally operate at the country-wide level. The other is local GDP growth and unemployment rate, typical for the major administrative districts in Poland, i.e. voivodeships. Such macroeconomic data for the voivodeship regions in Poland are better suited to analysis of sensitivity of LLP to GDP growth in cooperative banks, whose activity is concentrated in a geographically limited area. Due to the fact that regional GDP is available at an annual frequency only, we have applied quarterly dataset designed by Roszkowska and Pipień (2015). We conduct our study for unconsolidated data, to include the effects of the business cycle on LLP in traditional banking business (i.e. taking deposits and extending loans). We exclude outlier banks from our sample, by eliminating the extreme bank-specific observations. Based on this selection strategy, the number of banks included in our sample ranges from 83 in the case of commercial banks data (3267 quarterly observations for the LLP variable) to a maximum of 573 in the case of cooperative banks data (25725 observations for the dependent variable).

In Table 1 we present descriptive statistics of commercial and cooperative banks. Commercial banks are generally larger in terms of total assets. These banks also seem to make more provision than cooperative banks, because the loan-loss provisions to average assets ratio is generally higher in those banks. Therefore, these banks may be perceived as making more risky loans in the past or as setting aside more general provisions for expected loan losses, suggesting prudent risk-management. Cooperative banks seem to be definitely more profitable, because their profit before provisions and taxes over average assets ratio is nearly four times higher than the respective ratio in commercial banks. Other variables included in the study (i.e. loan-loss allowance divided by average assets, loans-growth rate, capital-adequacy ratio, tier 1 capital-adequacy ratio, equity capital divided by total assets) take higher values in the sample of commercial banks.

Table 2 presents correlation coefficients between all variables applied in this study. As can be seen from the Table, LLP is positively correlated with PROFITBPT, in both commercial and cooperative banks, implying potential for discretionary income-smoothing, which seems to be stronger in the sample of cooperative banks. LLA is positively and significantly linked with LLP only in cooperative banks, suggesting application of non-discretionary income-smoothing. Banks do not seem to apply prudent provisioning, because the statistically-significant correlation coefficient is negative and of comparable strength in both samples. Capital ratio is negatively correlated with LLP, as expected. Large banks seem to make less provision, because the LLP is negatively and significantly correlated with size. The negative (positive) correlation coefficient between GDP growth (UNEMPL) and LLP may imply that LLP in Polish banks is procyclical.

[insert table 1 and 2 around here]

4. Regression Results

This section presents regressions that estimate the impact of the business cycle on loan-loss provisions. In particular, we test the hypothesis (H1) that loan-loss provisions are procyclical. Then we look at potential differences between commercial and cooperative banks, i.e. we test the hypothesis that the LLP of commercial banks is more procyclical than LLP of cooperative banks (hypothesis H2). In the next stage we analyze differences in the sensitivity of LLP to the business cycle across large, medium and small banks

(H3). We also analyze the impact of the capital-ratio level on the link between LLP and GPP growth (and thus test H4). Finally, we consider the impact of income-smoothing on the effects of GDP growth on LLP (i.e. we examine hypothesis H5).

Firstly, we regress loan-loss provisions on bank-specific and macroeconomic variables, in particular GDP growth, to examine how the business cycle affects loan-loss provisioning expenses. Table 3 shows the coefficient estimates of baseline results given by regression 1.1 separately in commercial banks and cooperative banks. As can be seen from the Table, GDP growth affects LLP negatively and significantly in the sample of commercial banks, thus providing support for our prediction expressed in hypothesis H1, according to which LLP is procyclical. The procyclicality hypothesis is also verified in the sample of cooperative banks. However, the significantly negative regression coefficient on GDP growth is weaker than respective coefficient in commercial banks. Thus we find support for the expectation expressed in hypothesis H3, that is in commercial banks LLP is more procyclical than LLP in cooperative banks.

[insert table 3 around here]

As for the impact of bank-specific variables we find that LLP is positively associated with PROFITBPT in both commercial and cooperative banks, thus providing support to the view that banks tend to engage in income-smoothing (as has been proved by Fonseca and Gonzalez, 2008). However, PROFITBPT exerts a statistically-significant effect only in the sample of cooperative banks, with a value of over 0.074. The regression coefficient on PROFITBPT tells us about discretionary income-smoothing, which seems to be empirically significant in the case of cooperative banks. To consider the impact of non-discretionary income smoothing, we should look at the coefficients on loan-loss allowance (LLA). This coefficient estimates are also positive and statistically significant (as in other studies, e.g. Bikker & Metzemakers, 2005; Bouvatier & Lepetit, 2008; Fonseca & Gonzalez, 2008;) in the sample of cooperative banks, but their strength is weaker than respective coefficients' on PROFITBPT. Such a result implies that cooperative banks seem to be more involved in discretionary income-smoothing, and thus involved in more risk-taking, being the side-effect of poor market discipline. Therefore, potentially some of those cooperative banks which employ more earnings management, may have loan-loss provisions which are more procyclical.

The potentially imprudent risk-management behavior of cooperative banks is supported by the negative and statistically-significant coefficient on the L growth. According to previous evidence (Laeven & Majnoni, 2003), bank manages their risk prudently, when they increase LLP with increased loans growth (to cover the level of expected loan losses in a forward-looking fashion). In our study we do not find support for this view. Thus the expected loan-losses are poorly supported by LLP in Poland. This statement applies not only for cooperative banks, but also for commercial ones. However, in the sample of commercial banks the association between LLP and L growth is statistically insignificant (at least at conventional confidence levels).

As has been stated in section 2 and 3, banks may also use LLP to manage their capital ratios. As can be inferred from Table 3, the previous quarter capital-ratio exerts a negative and statistically-significant impact on the LLP of commercial banks, which seems to provide some evidence for the traditional capital-management hypothesis, i.e. banks with lower capital ratio in a previous period tented to increase loan-loss provisions in the next period. In this Table we present effects of three types of capital ratio (CAPR, CAPR1 and CAP), and find that in commercial banks, only capital adequacy ratios have a statistically-significant effect on the LLP. In contrast, in cooperative banks, the simple un-weighted capital ratio (CAP) exerts a positive and statistically-significant effect on LLP, suggesting that these banks do not use LLP to manage capital.

There is a visible diversity in the impact of the size variable. As commercial banks' assets are larger, the level of LLP is smaller. In particular, in estimations given in columns 1 and 2 in Table 3, the regression

coefficients are significantly negative, implying that large commercial banks make less provisions, and thus potentially have lower levels of buffers against loan losses. Specifically, the coefficient estimates are -0.248 and -0.238, in regression 1 and 2, respectively. This may result in, generally, the greater procyclicality of these banks. In contrast with this, cooperative banks with larger assets make more provisions. Specifically, in the cooperative banks sample, the regression coefficients on size are positive and statistically-significant (at 1%), and range between 0.329 and 0.439 in the models given in columns 4 – 6. Therefore, cooperative banks may be less prone to the business cycle, and thus less procyclical.

[insert table 4 around here]

Table 4 also shows that there is difference in sensitivity to the business cycle between commercial and cooperative banks, which differ in their size. In particular, large commercial banks exhibit the greatest procyclicality of LLP, because the regression coefficient on GDP growth is negative and statistically significant (at 5%) and relatively strong (in comparison to medium and small banks). In the medium-size banks, LLP is also procyclical, but the business cycle does not exert a negative impact on the LLP of these banks. In contrast, in small commercial banks, the effect of GDP growth is positive, thus implying counter-cyclicality of LLP. However, this effect is not statistically significant. Generally, these results are in support of H3. That is, the loan-loss provisions of large banks are more negatively associated with GDP growth than the loan-loss provisions of small banks. In the sample of cooperative banks we do not find support for the procyclicality of LLP, because the coefficients on GDP growth are not statistically-significant and negative (except for the subsample of small cooperative banks, where they are significantly negative). Additionally, the coefficients on UNEMPL are all negative and statistically significant. Thus, the results for cooperative banks in Table 4 are not in line with the prediction expressed in H3, that is loan-loss provisions of large cooperative banks are not more procyclical than the loan-loss provisions of medium and small cooperative banks. These results nevertheless still support the expectation presented in H2, that commercial banks loan-loss provisions are more procyclical than the LLP of cooperative banks.

[insert table 5 around here]

Next, we examine the empirical model given by equation 1.2 in Section 3 to assess the following research question: whether the relative level of capital ratio kept by a bank influences the sensitivity of LLP to the business cycle (hypothesis H4). In Table 5, we include three specifications for commercial banks, and three for cooperative banks, in which we include three dummy variables, representing three groups of banks. In the first category we include banks with capital ratio below 10%. The second group covers banks with a capital ratio between 10 and 15%. And, finally, the third category consists of banks whose capital ratio is above 15%. In the models labeled by numbers 1-3 (5-6) we have estimation results for commercial (cooperative) banks, in which column 1 (4) shows the effect of capital-ratio size on the association between LLP and GDP growth for banks whose capital ratio is below 10%, column 2 (5), presents this effect for banks with a capital ratio between 10% and 15%, and finally, column 3 (6) includes this effect for banks with a capital ratio above 15%. The double interaction term on GDP growth and CAPR<10% is negative in both commercial and cooperative banks, and statistically significant (at 1%) only in the case of commercial banks. This negative effect of low level of capital ratio size on the link between LLP and GDP growth implies that banks with relatively high (solvency) risk, have more procyclical loan-loss provisions. In contrast, commercial and cooperative banks with better capitalization, and thus with a reduced solvency risk, exhibit a weakened procyclicality of LLP. Therefore, our results for the effect of capital ratio size on procyclicality of LLP provide evidence in favor of hypothesis H4, that is in banks with lower capital ratio, the procyclicality of loan-loss provisions is strengthened.

[insert table 6 around here]

Finally, we turn to examine how discretionary income-smoothing affects the link between LLP and the GDP growth, by looking at interactions between GDP growth and *inc smooth high* dummy, and thus identifying banks with a high degree of discretionary income-smoothing, using the three different approaches described in Section 3.1.2. Table 6 presents the results of such analysis, separately for commercial and for cooperative banks. The coefficients on double interactions between *GDP growth* and *inc smooth high* are negative in 5 regressions out of 6. However, they are statistically significant only in the sample of cooperative banks, which we find in our study to engage in more discretionary income-smoothing (see the baseline results in Table 3). Specifically, the regression coefficients on double interaction of *GDP growth*inc smooth high* range between -0.69 (significant at 1%) and -0.8 (significant at 1%), denoting the increased procyclicality of LLP in those cooperative banks which use loan-loss provisions to shape earnings in a discretionary manner. This result thus gives us empirical support for the prediction expressed in hypothesis H5, which states that in banks which apply more discretionary income-smoothing the negative association between LLP and GDP growth will be strengthened, and thus the procyclicality of LLP is enhanced.

4.1. Robustness checks

To build more confidence in our results we conduct two types of robustness check. The first consists in running regression expressed by equation 1.1 and 1.5, and testing all hypotheses, with the inclusion of additional variables, i.e. quarterly dummies. Such analysis may give us some interesting insights because in our study we apply quarterly data and the seasonal component may play significant role in determining levels of LLP. In the other test we include the GDP growth variable as endogenous, and therefore we include up to four lags of GDP growth as instruments. To begin with, we must stress that all additional regressions perform well in terms of second-order serial-correlation tests and in terms of J-Hansen test for overidentifying restrictions.

Our analysis in Tables 7-9 presents the results of estimations in which all regressions include additionally quarterly dummies. For brevity, we do not include coefficients on these dummies in these tables, but we must stress that their impact on LLP is statistically significant. As we can see from Table 7, our predictions expressed in hypotheses 1, 2 and 3 are still supported. In particular, the regression coefficients on GDP growth in the full sample of commercial banks and cooperative banks are negative (thus supporting hypothesis H1), and stronger and statistically significant in the sample of commercial banks (consistent with hypothesis H2). The impact of the business cycle on the LLP of large commercial banks is definitely more enhanced in comparison to medium and small banks. Therefore we find empirical evidence in favor of hypothesis H3.

As can be seen from Table 8, the capital-ratio level does have impact on the sensitivity of the LLP to the business cycle. Banks with capital ratio below 10% have loan-loss provisions which are more procyclical than banks with higher capital ratios. In particular, our estimation given in regression 1 and regression 4 in Table 8 shows that the regression coefficient on the double interaction term (i.e. GDP growth*CAPR<10%) is negative, implying an increased procyclicality of LLP. Therefore this robustness check gives evidence in favor of hypothesis H4, that is banks with low capital ratios exhibit greater procyclicality of LLP.

The results presented in Table 9 provide further evidence consistent with hypothesis H5, predicting that in banks with greater discretionary income-smoothing, the procyclicality of LLP is

enhanced. As we have already shown in the previous section, cooperative banks engaging in more discretionary income-smoothing exhibit greater procyclicality of LLP.

[insert tables 7-9 around here]

Next, we consider whether the endogeneity of GDP growth potentially affects the association between LLP and its determinants, in particular the business cycle. Such robustness checks are presented in Tables 10 and 11. As can be inferred from Table 10, LLP are procyclical (consistent with hypothesis H1). The procyclicality is, moreover, enhanced in commercial banks relative to cooperative banks (which provides support to expectations expressed in hypothesis H2). As has been shown in the previous section, and in the previous paragraphs, the procyclicality of LLP is especially strong in the subsample of large banks. Such a result gives further support to hypothesis H3. Additionally, the results presented in Table 11 give provide strong evidence in favor of hypothesis H4. We still find that banks with capital ratios below 10% exhibit definitely more enhanced procyclicality of LLP than banks with capital ratio between 10% and 15%, and above 15%. This result is particularly evident in the sample of commercial banks.

[insert tables 10-11 around here]

5. Conclusions

In this paper we used pooled cross-section and time-series quarterly data of individual banks' balance sheet items and profit-and-loss accounts from Poland over the period from 2000 to 2012, to identify bank-specific determinants of procyclicality of loan-loss provisions. In the light of gaps existing in previous research on loan-loss provisions, we tested several predictions about the sensitivity of loan-loss provisions to the business cycle. Firstly, we predicted and found support for the view that loan-loss provisions are procyclical. Secondly, we expected that the loan-loss provisions of commercial banks are more procyclical than those of cooperative banks. Thirdly, considering the fact that bank size affects bank risk-taking, we predicted and found that the loan-loss provisions of large banks are more negatively affected by the business cycle than the provisions of medium or small banks. Fourthly, the default risk and thus risk-taking of a bank may be proxied by the level of the capital ratio, and we expected, therefore, that banks with low capital ratios would exhibit an increased procyclicality of loan-loss provisions. This expectation was supported by results of our study. Fifthly, we predicted and found empirical evidence that banks with a greater degree of discretionary income-smoothing have loan-loss provisions more negatively affected by the business cycle, and thus more procyclical.

Our results have implications for decision-makers in regulatory policy. Firstly, we show that regulations targeted at procyclicality should be tailored according to bank specialization and bank size. Secondly, we provide further support for the view that procyclicality in banking is related to solvency (or default) risk. Therefore, to combat excessive procyclicality, regulators should encourage banks to keep higher capital buffers. These buffers should, however, not be excessive, because at higher levels of capital ratios, the relative reduction in procyclicality of loan-loss provisions is limited. And, finally, we provide empirical evidence for the fact that excessive discretionary income-smoothing may come at a cost of an increased procyclicality in loan-loss provisions. Consequently, regulations which promote solutions which stabilize banks' profits should be implemented along with requirements of greater transparency of loan-loss provision accounting.

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References

Ahmed, A., Takeda, C., & Thomas, S. (1999). Bank Loan Loss Provisions: A Re-examination of Capital Management, Earnings Management and Signaling Effects. *Journal of Accounting and Economics*, 28, 1-25. http://dx.doi.org/10.1016/S0165-4101(99)00017-8

Anderson, R. C., & Fraser, D. R. (2000). Corporate control, bank risk-taking, and the health of the banking industry. *Journal of Banking and Finance* 24 (8), 1383-1398. http://dx.doi.org/10.1016/S0378-4266(99)00088-6

Arellano, M., & Bond, S. (1991). Some tests of specification for panel data: Monte Carlo evidence and application to employment equations. *Review of Econometrics Studies*, 58, 227-297. http://people.stern.nyu.edu/wgreene/Econometrics/Arellano-Bond.pdf

Bank for International Settlements (BIS), Financial Stability Board (FSB), International Monetary Fund (IMF) (2011) Macroprudential Policy Tools and Frameworks. *Progress Report to G20*, 27 October 2011. https://www.imf.org/external/np/g20/pdf/102711.pdf

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

Beatty, A., & Liao, S. (2014). Financial accounting in the banking industry: A review of the empirical literature. *Journal of Accounting and Economics*, 58, 339-383. http://dx.doi.org/10.1016/j.jacceco.2014.08.009

Berger, A., Miller, N., Petersen, M., Rajan, R., & Stein, J. (2005). Does Function Follow Organizational Form? Evidence from the Lending Practices of Large and Small Banks. *Journal of Financial Economics*, 76, 237-269. http://dx.doi.org/10.1016/j.jfineco.2004.06.003

Berger, A., & Udell, G. (2004). The institutional memory hypothesis and the procyclicality of bank lending behavior. *Journal of Financial Intermediation*, 13, 458-495. http://dx.doi.org/10.1016/j.jfi.2004.06.006

Berger, A., Herrig, R. J., & Szegö, G. P. (1995). The role of capital in financial institutions. *Journal of Banking and Finance*, 19, 393 – 430. http://dx.doi.org/10.1016/0378-4266(95)00002-X

Bernanke, B. S., & Gertler, M. (1995). Inside the black box: the credit channel of monetary policy transmission, *Journal of Economic Prospects*, 9, 27–48. http://web.calstatela.edu/faculty/rcastil/ECON_435/Bernanke.pdf

Bertay, A. C., Demirgüç-Kunt, A., & Huizinga, H. (2015). Bank ownership and credit over the business cycle: Is lending by state banks less procyclical? *Journal of Banking and Finance*, 50, 326-339. http://dx.doi.org/10.1016/j.jbankfin.2014.03.012

Bikker, J. A., & Hu, H. (2002). Cyclical Patterns in Profits, Provisioning and Lending of Banks. *DNB Staff Reports* No. 86. http://www.dnb.nl/binaries/ot039_tcm46-146052.pdf

Bikker, J. A., & Metzemakers, P. (2005). Bank provisioning behavior and procyclicality. *Journal of Financial Markets, Institutions and Money*, 15, 141–157. http://dx.doi.org/10.1016/j.intfin.2004.03.004

Blum, J. (1999). Do capital adequacy requirements reduce risks in banking? Journal of Banking and Finance 23:775–771 http://dx.doi.org/10.1016/S0378-4266(98)00113-7

Blundell, R., & Bond, S. (1998). Initial conditions and moment restrictions in dynamic panel data model. *Journal of Econometrics*, 87, 115-143. http://dx.doi.org/10.1016/S0304-4076(98)00009-8

Borio, C. (2009) Implementing the macroprudential approach to financial regulations and supervision. *Financial Stability Review 13 – The future of financial regulation*, Banque de France, 31-41.

https://www.banque-france.fr/fileadmin/user_upload/banque_de_france/publications/Revue_de_la_stabilite_financiere/etude04_rsf_0909.pdf

Borio, C., & Zhu, V. H. (2012). Capital Regulation, Risk-Taking, and Monetary Policy: A Missing Link in the Transmission Mechanism*? Journal of Financial Stability* 8:236-251. http://dx.doi.org/10.1016/j.jfs.2011.12.003

Borio, C., Furfine, C., & Lowe, P. (2001). Procyclicality of the financial system and financial stability: issues and policy options. *BIS Papers* 1, Bank for International Settlements. http://www.bis.org/publ/bppdf/bispap01a.pdf

Bouvatier, V., & Lepetit, L. (2008). Banks' procyclical behavior: does provisioning matter? *Journal of Financial Markets, Institutions and Money*, 18, 513-526. http://dx.doi.org/10.1016/j.intfin.2007.07.004

Bouvatier, V., & Lepetit, L. (2012). Effects of loan loss provisions on growth in bank lending: some international comparisons. *International Economics,* 132, 91–116. http://dx.doi.org/10.1016/S2110-7017(13)60059-1

Burgstahler, D., & Dichev, I. (1997). Earnings management to avoid earnings decreases and losses. *Journal of Accounting and Economics*, 24, 99-126. http://dx.doi.org/10.1016/S0165-4101(97)00017-7

Bushman, R., & Williams, Ch. D. (2012). Accounting discretion, loan-loss provisioning, and discipline of banks' risk-taking. *Journal of Accounting and Economics,* 54, 1-18. http://dx.doi.org/10.1016/j.jacceco.2012.04.002

Bushman, R., & Williams, Ch. D. (2013). Delayed Expected Loss Recognition and the Risk Profile of Banks. *Working Paper.* http://papers.ssrn.com/sol3/papers.cfm?abstract_id=2226964 http://public.kenan-flagler.unc.edu/faculty/bushmanr/Final%20JAR_FED.pdf

Cerutti, E., Claessens, S., Laeven, L., (2015). The Use and Effectiveness of Macroprudential Policies: New Evidence, *IMF Working paper* WP/15/61. https://www.imf.org/external/pubs/ft/wp/2015/wp1561.pdf

Claessens, S., Ghosh, S. R., Mihet, R. (2014). Macro-Prudential Policies to Mitigate Financial System Vulnerabilities. *IMF Working Paper* WP/14/155. https://www.imf.org/external/pubs/ft/wp/2014/wp14155.pdf

Claessens, S., (2014) An Overview of Macroprudential Policy Tools. IMF Working Paper No WP/14/214. https://www.imf.org/external/pubs/ft/wp/2014/wp14214.pdf

Committee on the Global Financial System (CGFS) (2010) Macroprudential instruments and framework: a stocktaking of issues and experiences. CGFS Papers 38, Bank for International Settlements. http://www.bis.org/publ/cgfs38.htm

Committee on the Global Financial System (CGFS), (2012). Operationalising the selection and application of macroprudential instruments. *CGFS Papers* No 48. Bank for International Settlements. http://www.bis.org/publ/cgfs48.pdf

Dagher, J., Dell'Ariccia, G., Laeven, L., Ratnovski, L., & Tong, H., (2016). Benefits and Costs of Bank Capital. *IMF Staff Discussion Note, SDN/16/04***. https://www.imf.org/external/pubs/ft/sdn/2016/sdn1604.pdf**

De Haan, J., & Poghosyan, T. (2012). Bank size, market concentration and bank earnings volatility in the US. *Journal International Financial Markets, Institutions, and Money,* 22, 35-54. http://dx.doi.org/10.1016/j.intfin.2011.07.002

European Systemic Risk Board. (2014) *The ESRB Handbook on Operationalising Macro-prudential Policy in the Banking Sector*, ESRB 2014. https://www.esrb.europa.eu/pub/pdf/other/140303_esrb_handbook_mp.en.pdf

Fang, Y., Hasan, I., & Li, L. (2014). Banking reform, risk-taking, and earnings quality – Evidence from transition countries. *BOFIT Discussion Papers* 19/2014, Bank of Finland. http://www.suomenpankki.fi/bofit_en/tutkimus/tutkimusjulkaisut/dp/Documents/2014/dp1914.pdf

Fernando, W.D.I., & Ekanayake, E.M.N.N, (2015) Do Commercial Banks Use Loan Loss Provisions to Smooth Their Income? Empirical Evidence from Sri Lankan Commercial Banks, *Journal of Finance and Bank Management* 3(1): 167-179. http://dx.doi.org/10.15640/jfbm.v3n1a15

Floro, D. (2010). Loan Loss Provisioning and the Business Cycle: Does Capital Matter? Evidence from Philippine Banks. *BIS Working Papers*, http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.225.6550&rep=rep1&type=pdf

Fonseca, A. R., & González, F. (2008). Cross-country determinants of bank income smoothing by managing loan-loss provisions. *Journal of Banking and Finance*, 32, 217-228. http://dx.doi.org/10.1016/j.jbankfin.2007.02.012

Foos, D., Norden, L., &Weber, M. (2010) Loan growth and riskiness of banks. *Journal of Banking and Finance* 34, 2929-2940. http://dx.doi.org/10.1016/j.jbankfin.2010.06.007

Freixas, X., Loranth, G., & Morrison, A. D. (2007). Regulating financial conglomerates. *Journal of Financial Intermediation* 16, 479-514. http://dx.doi.org/10.1016/j.jfi.2007.03.004

Gehrig, T. (1995). Capital Adequacy Rules: Implications for Banks' Risk-Taking. *Swiss Journal of Economics and Statistics*, Vol. 131, 747–764. http://www.sjes.ch/papers/1995-IV-12.pdf

Greenawalt, M. B., & Sinkey, J. F. (1988). Bank Loan-Loss Provisions and the Income-Smoothing Hypothesis: An Empirical Analysis, 1976-1984. *Journal of Financial Services Research* 1, 301-318.

Haq, M., & Heaney, R. (2012). Factors determining European bank risk. *Journal of Financial Markets, Institutions and Money* 22, 696-718. http://dx.doi.org/10.1016/j.intfin.2012.04.003

Healy, P. M., Whalen, J. M. (1999). A Review of the Earnings Management Literature and its Implications for Standard Setting. Accounting Horizons 13, 365-383. https://fisher.osu.edu/~young.53/Healy-Wahlen

Illueca, M., Norden, L., & Udell, G. F. (2015). Conditional Accounting Conservatism and Bank Risk-taking. Working Paper. http://www.greta.it/credit/credit2014/PAPERS/Talks/Thursday/06_Illueca_Norden_Udell.pdf

International Monetary Fund (IMF) (2011) Macroprudential Policy: An Organizing Framework. Paper prepared by the Monetary and Capital Markets Department, International Monetary Fund. https://www.imf.org/external/np/pp/eng/2011/031411.pdf

Kanagaretnam, K., Lobo, G. J., & Mathieu, R. (2003). Managerial Incentives for Income Smoothing Through Bank Loan Loss Loan-loss Provisions. *Review of Quantitative Finance and Accounting*, 20, 63-80. http://dx.doi.org/10.1023/A:1022187622780

Koch, T. W., & Wall, L. D. (2000). Bank Loan-Loss Accounting: a review of Theoretical and Empirical Evidence. *Federal Reserve Bank of Atlanta Economic Review*, 2/2000, Federal Reserve Bank of Atlanta. https://www.frbatlanta.org/-/media/Documents/research/publications/economic-review/2000/vol85no2_wall-koch.pdf

Koehn, M., & Santomero, A.M .(1980). Regulation of Bank Capital and Portfolio Risk. *The Journal of Finance*, Vol. 35, No.: 1235–1244. DOI: 10.2307/2327096, Stable URL: http://www.jstor.org/stable/2327096

Konishi, M., & Yasuda, Y. (2004). Factors affecting bank risk-taking: evidence from Japan. *Journal of Banking and Finance*, 28, 117-232. http://dx.doi.org/10.1016/S0378-4266(02)00405-3

Laeven, L., & Majnoni, G. (2003). Loan-loss provisioning and economic slowdowns: too much, too late? *Journal of Financial Intermediation*, 12, 178-197. http://dx.doi.org/10.1016/S1042-9573(03)00016-0

Leuz, Ch., Nanda, D., & Wysocki, P. (2003). Earnings management and investor protection. *Journal of Financial Economics*, 69, 505-527. doi:10.1016/S0304-405X(03)00121-1

Leventis, S., Dimitropoulos, P.E., & Anandarajan, A. (2011). Loan Loss Provisions, Earnings Management and Capital Management under IFRS: The Case of EU Commercial Banks. *Journal of Financial Services Research*, 40(1), 103–122. 10.1007/s10693-010-0096-1

Lim, C., Columba, F., Costa, A., Kongsamut, P., Otani, A., Saiyid, M., Wezel, T., & Wu, X. (2011). Macroprudential Policy: What Instruments and How to Use Them? *IMF Working Paper* WP/11/238. https://www.imf.org/external/pubs/ft/wp/2011/wp11238.pdf

Liu, Ch.-Ch., & Ryan, G. S. (2006). Income-Smoothing over the Business Cycle: Changes in Banks' Coordinated Management of Provisions for Loan Losses and Loan Charge-Offs from the Pre-1990 bust to the 1990s Boom. *The Accounting Review*, 81, 421-441. http://dx.doi.org/10.2308/accr.2006.81.2.421

Ma, C.K. (1988). Loan Loss Reserves and Income Smoothing: the Experience In the U.S. Banking Industry. *Journal of Business Finance and Accounting*, 15(4), 487-497. 10.1111/j.1468-5957.1988.tb00150.x.

Mishkin, F. S. (1992). An evaluation of the treasury plan for banking reform. *Journal of Economic Perspectives*, Vol. 6, No. 1:133–153. Stable URL: http://www.jstor.org/stable/2138377

Nichols, D. C., Wahlen, J. M., & Wieland, M. W. (2009). Publicly-traded versus privately held: implications for conditional conservatism in bank accounting. *Review of Accounting Studies*, 14, 88-122. 10.1007/s11142-008-9082-3

Norden, L., & Stoian, A. (2013). Bank earnings management through loan-loss provisions: a double edged sword? *Working Paper* N0. 404, De Nederlandsche Bank NV http://www.dnb.nl/binaries/working%20Paper%20404_tcm46-301517.pdf

Olszak, M., Pipień, M., Kowalska, I., & Roszkowska, S. (2016a). What drives heterogeneity of cyclicality of loan-loss provisions in the EU? *Journal of Financial Services Research*, DOI 10.1007/s10693-015-0238-6

Olszak, M., Pipień, M., & Roszkowska, S. (2016b). The Impact of Capital Ratio on Lending of EU Banks – the Role of Bank Specialization and Capitalization. *Equilibrium. Quarterly Journal of Economics and Economic Policy*, 11(1), pp. 43-59, DOI: http://dx.doi.org/10.12775/EQUIL.2016.002

Peltzman, S. (1970). Capital Investment in Commercial Banking and Its Relationship to Portfolio Regulation. *Journal of Political Economy*, Vol. 78, No.1:1–26. Stable URL: http://www.jstor.org/stable/1829616

Roodman, D. (2009). Practitioners Corner: A Note on the Theme of Too Many Instruments. *Oxford Bulletin of Economics and Statistics*, 71, 135-158.

Roszkowska S., & Pipień M. (2015) Szacunki kwartalnego PKB według województw w Polsce – zastosowanie estymacji funkcji parametrów modelu regresji liniowej [Estimations of quarterly GDP in voivodeships in Poland – application of parameters of ordinary least squares regressions model]. *Materiały i Studia* nr 315. Narodowy Bank Polski [National Bank of Poland]. https://www.nbp.pl/publikacje/materialy_i_studia/ms315.pdf

Schooner, H. M., & Taylor, M. W. (2010). *Global Bank Regulation. Principles and Policies*. Elsevier, Academic Press.

Shrieves, R. E., & Dahl, D. (2003). Discretionary accounting and the behavior of Japanese banks under financial duress. *Journal of Banking and Finance*, 27, 1219-1243. http://dx.doi.org/10.1016/S0378-4266(02)00252-2

Skała, D., (2015). Saving on a Rainy Day? Income Smoothing and Procyclicality of Loan-Loss Provisions in Central European Banks. *International Finance* http://dx.doi.org/10.1111/1468-2362.12058.

Soedarmono, W., Tarazi, A., Agusman, A., Monroe, G. S., & Gasbarro, D. (2015). Loan Loss Provisions and Lending Behavior of Banks: Do Information Sharing and Borrower Legal Rights Matter? *Working Papers*. https://hal.archives-ouvertes.fr/hal-01284978/document

Stiglitz, J. E. (2010). *Freefall. America, Free Markets, and the Sinking of the World Economy*. New York, Norton.

Svitek, M. (2001). Functions of bank capital, BIATEC – bankový časopis, ročník 9, No. 5:37–40. http://www.nbs.sk/_img/Documents/BIATEC/svitekan.pdf

Zilberman, R., &Tayler, W. (2015). Financial shocks, loan loss provisions and macroeconomic stability. *Lancaster University Economics Working Paper Series* 23(2015). https://www.lancaster.ac.uk/media/lancaster-university/content-assets/documents/lums/economics/working-papers/FinancialShocks.pdf

Appendix

Table 1. Descrptive statisitics

	Mean	Median	St dev	Min	Max	#banks	# observ.
	Full sample - commercial						
LLP	0.85	0.30	2.15	-20.69	47.24	94	3267
PROFITBPT	1.99	1.81	3.62	-54.80	42.73	94	3265
LLA	6.38	3.65	9.79	0.00	100.00	94	3275
L growth	7.20	3.10	28.55	-65.83	700.46	94	3212

CAPR	25.90	14.46	66.72	-158.86	1,538.23	83	2939
CAPR1	26.04	14.52	68.40	0.00	1,538.23	83	2939
CAP	11.77	9.04	8.89	0.79	70.09	83	2835
size	6.48	6.39	0.79	3.39	8.28	94	3267
GDP growth	3.86	4.00	2.04	-0.34	7.51	94	4888
UNEMPL	11.79	12.45	2.54	7.20	15.80	94	4888
	Full sample - cooperative						
LLP	0.18	0.06	0.63	-6.64	30.75	573	25725
PROFITBPT	8.01	7.38	2.54	-1.60	27.75	573	27522
LLA	2.01	1.30	2.49	0.00	42.51	573	27557
L growth	3.61	3.00	8.31	-38.92	561.59	573	27488
CAPR	17.04	15.15	7.37	-11.43	193.18	573	27577
CAPR1	16.55	14.84	7.02	0.03	153.36	573	27575
CAP	11.19	10.27	4.15	0.02	37.51	573	27519
size	4.67		0.41	3.40	6.35	573	27522
GDP growth	3.72	3.72	2.10	-0.43	10.09	573	29796
UNEMPL	14.90	14.60	4.46	5.80	30.60	573	29796

Notes: *LLP* – loan loss provisions divided by average assets of a bank; *PROFITBPT* – earnings before provisions and taxes normalized by average assets; *LLA* – loan loss allowance divided by average assets; *L growth* – loans growth rate; *CAPR* – capital adequacy ratio; *CAPR1* – tier 1 capital adequacy ratio; *CAP* – equity capital divided by total assets; *size* – logarithm of total assets; *GDP growth* – real growth of domestic product (in the case of commercial banks) or the real growth of voivodeship product (in the case of cooperative banks); *UNEMPL* – unemployment rate in Poland (in the case of commercial banks) or voivodeship unemployment rate (in the case of cooperative banks).

Table 2. Correlations

	LLP		PROFITBPT		LLA		L growth		CAPR		CAPR1		CAP		size		GDP growth		UNEMPL
	Full sample - commercial																		
LLP	1.000																		
PROFITBPT	0.094	***	1.000																
LLA	-0.001		0.059	***	1.000														
L growth	-0.052	***	-0.253	***	-0.104	***	1.000												
CAPR	-0.154	***	-0.066	***	0.320	***	0.164	***	1.000										
CAPR1	-0.139	***	-0.053	***	0.334	***	0.156	***	0.968	***	1.000								
CAP	-0.009		0.040	**	-0.090	***	0.195	***	0.544	***	0.558	***	1.000						
size	-0.052	***	0.193	***	-0.059	***	-0.137	***	-0.270	***	-0.263	***	-0.504	***	1.000				
GDP growth	-0.098	***	0.010		-0.022		0.093	***	-0.012		-0.014		-0.016		0.016		1.000		
UNEMPL	0.262	***	0.073	***	0.206	***	-0.018		0.095	***	0.094	***	0.064	***	-0.187	***	-0.087	***	1
	Full sample - cooperative																		
LLP	1.000																		
PROFITBPT	0.245	***	1.000																
LLA	0.365	***	0.128	***	1.000														
L growth	-0.046	***	0.077	***	-0.071	***	1.000												
CAPR	-0.073	***	0.045	***	0.004		-0.062	***	1.000										
CAPR1	-0.054	***	0.068	***	0.039	***	-0.062	***	0.955	***	1.000								
CAP	-0.051	***	0.110	***	-0.067	***	-0.032	***	0.802	***	0.815	***	1.000						
size	-0.023	***	-0.634	***	0.050	***	-0.056	***	-0.449	***	-0.440	***	-0.440	***	1.000				
GDP growth	-0.118	***	-0.195	***	-0.066	***	0.090	***	0.009		0.010	*	-0.011	*	0.063	***	1.000		
UNEMPL	0.086	***	0.423	***	0.156	***	0.023	***	-0.053	***	-0.007		-0.073	***	-0.284	***	-0.191	***	1

Notes: *LLP* – loan loss provisions divided by average assets of a bank; *PROFITBPT* – earnings before provisions and taxes normalized by average assets; *LLA* – loan loss allowance divided by average assets; *L growth* – loans growth rate; *CAPR* – capital adequacy ratio; *CAPR1* – tier 1 capital adequacy ratio; *CAP* – equity capital divided by total assets; *size* – logarithm of total assets; *GDP growth* – the real growth of domestic product (in the case of commercial banks) or the real growth of voivodeship product (in the case of cooperative banks); *UNEMPL* – unemployment rate in Poland (in the case of commercial banks) or voivodeship unemployment rate (in the case of cooperative banks).

Table 3. Baseline results – commercial versus cooperative banks

	Commercial banks			Cooperative banks		
	1	**2**	**3**	**4**	**5**	**6**
LLP(-1)	0.665 ***	0.674 ***	0.586 ***	0.515 ***	0.521 ***	0.512 ***
	(14.23)	(13.20)	(8.35)	(8.70)	(8.48)	(8.73)
LLP(-2)	0.165 *	0.155 *	0.191 ***	0.043	0.040	0.040
	(1.75)	(1.76)	(3.75)	(1.33)	(1.24)	(1.14)
PROFITBPT	0.015	0.020	0.023	0.075 ***	0.074 ***	0.087 ***
	(0.52	(0.77)	(0.81)	(4.94)	(5.13)	(5.30)
LLA	-0.007	-0.006	-0.004	0.049 ***	0.047 ***	0.050 ***
	(-0.66)	(-0.63)	(-0.74)	(3.96)	(4.13)	(4.36)
L growth	-0.003	-0.002	-0.002	-0.002 **	-0.002 **	-0.002 **
	(-1.35)	(-1.27)	(-1.53)	(-2.34)	(-2.28)	(-2.12)
CAPR	-0.005 **			0.004		
	(-2.03)			(1.00)		
CAPR1		-0.004 **			0.001	
		(-2.020)			(0.38)	
CAP			-0.001			0.018 **
			(-0.16)			(2.39)
size	-0.248 **	-0.238 *	-0.120	0.329 ***	0.320 ***	0.439 ***
	(-2.35)	(-1.74)	(-1.38)	(3.03)	(3.11)	(3.89)
GDP growth	-0.053 ***	-0.053 ***	-0.051 ***	-0.006 **	-0.005 **	-0.004
	(-3.24)	(-2.96)	(-3.60)	(-2.16)	(-2.10)	(-1.51)
UNEMPL	0.023	0.023	0.041 ***	-0.019 ***	-0.019 ***	-0.018 ***
	(1.20)	(1.41)	(2.57)	(-6.24)	(-6.49)	(-6.58)
intercept	1.814 **	1.693	0.668	-1.904 ***	-1.806 ***	-2.671 ***
	(2.07)	(1.58)	(0.96)	(-2.74)	(-2.82)	(-3.61)
Quarterly dummies	no	no	no	no	no	no
m1	-1.78 *	-1.80 *	-3.28 ***	-3.13 ***	-3.11 ***	-3.12 ***
m2	0.82	0.87	-0.84	1.39	1.4	1.4
Sargan test	2090.04 ***	2087.86 ***	2204.64 ***	15182.11 ***	15134.64 ***	15140.28 ***
Hansen test	74.02	72.5	77.72	567.4	565.42	567.6
#observ.	2713	2713	2668	24049	24047	24047
# banks	83	83	83	573	573	573

Notes: This table presents results of estimation of regression 1.1 obtained with a two step GMM dynamic Blundell and Bond approach (1998) with robust standard errors and Windmeijers (2005) finite sample correction. The dataset applied is quarterly for 2000–2012. The dependent variable is *LLP* – loan loss provisions divided by average assets of a bank. The explanatory variables include: up to two lags of the dependent variable (*LLP(-1), LLP(-2)*); *PROFITBPT* – earnings before provisions and taxes normalized by average assets; *LLA* – loan loss allowance divided by average assets; *L growth* – loans growth rate; *CAPR* – capital adequacy ratio; *CAPR1* – tier 1 capital adequacy ratio; *CAP* – equity capital divided by total assets; *size* – logarithm of total assets; *GDP growth* – real growth of domestic product (in the case of commercial banks) or the real growth of voivodeship product (in the case of cooperative banks); *UNEMPL* – unemployment rate in Poland (in the case of commercial banks) or voivodeship unemployment rate (in the case of cooperative banks); t statistics are given in brackets; ***Significant at 1%, **Significant at 5%, *Significant at 10%.

Table 4. Sensitivity of LLP to business cycle and bank size

	Commercial banks			Cooperative banks		
	large	medium	small	large	medium	small
	1	**2**	**3**	**4**	**5**	**6**
LLP(-1)	0.729 ***	0.608 ***	0.081	0.382 ***	0.635 ***	0.46 ***
	(6.37)	(3.75)	(0.30)	(4.04)	(25.75)	(4.31)
LLP(-2)	-0.025	0.004	-0.078	0.036	-0.015	0.119 **
	(-0.20)	(0.03)	(-0.17)	(1.28)	(-0.39)	(2.54)
PROFITBPT	-0.029	0.068	-0.006	0.111 ***	0.089 ***	0.041 ***
	(-0.53)	(1.23)	(-0.07)	(3.86)	(3.16)	(3.35)
LLA	-0.039	0.029	0.290	0.086 ***	0.022 ***	0.035
	(-1.16)	(0.61)	(0.55)	(2.97)	(4.65)	(1.64)
L growth	-0.001	-0.003	0.045 *	-0.002	-0.003	-0.001
	(-0.20)	(-1.35)	(1.78)	(-1.46)	(-1.55)	(-0.62)
CAPR	-0.003	-0.003	-0.014	-0.004	0.008	-0.001
	(-0.66)	(-0.82)	(-0.51)	(-0.63)	(1.18)	(-0.4)
size	-0.608	0.053	5.411	0.435 **	0.542 **	0.251 **
	(-0.64)	(0.09)	(0.56)	(2.28)	(2.37)	(2.57)
GDP growth	-0.060 **	-0.023	0.369	-0.002	0.000	-0.01 **
	(-2.26)	(-0.42)	(0.43)	(-0.28)	(0.02)	(-2.56)
UNEMPL	0.037	0.078	0.347	-0.021 ***	-0.013 ***	-0.012 **
	(0.69)	(1.37)	(0.53)	(-3.58)	(-6.07)	(-2.51)
intercept	5.354	-1.107	0.000 ***	-2.696 **	-3.12 **	-1.214 **
	(1.08)	(-0.25)	(0.00)	(-2.22)	(-2.23)	(-2.29)
Quarterly dummies	no	no	no	no	no	no
m1	-2.02 **	-2.16 **	-0.74	-1.57	-2.19 **	-2.51 **
m2	1.59	0.66	0.45	-0.19	1.23	0.74
Sargan test	1161.69 ***	1110.210 ***	216.940	5487.83 ***	7536.8 ***	4438.36 ***
Hansen test	22.09	31.92	4	180.47	238.15	132.77
#observ.	1194	1293	226	7273	10717	6059
# banks	30	38	15	185	246	142

Notes: This table presents results of estimation of regression 1.1 obtained with a two step GMM dynamic Blundell and Bond approach (1998) with robust standard errors and Windmeijers (2005) finite sample correction. The dataset applied is quarterly for 2000–2012. The dependent variable is *LLP* – loan loss provisions divided by average assets of a bank. The explanatory variables include up to two lags of the dependent variable (*LLP(-1), LLP(-2)*); *PROFITBPT* – earnings before provisions and taxes normalized by average assets; *LLA* – loan loss allowance divided by average assets; *L growth* – loans growth rate; *CAPR* – capital adequacy ratio; *size* – logarithm of total assets; *GDP growth* – real growth of domestic product (in the case of commercial banks) or the real growth of voivodeship product (in the case of cooperative banks); *UNEMPL* – unemployment rate in Poland (in the case of commercial banks) or voivodeship unemployment rate (in the case of cooperative banks); *large* denotes large banks, i.e. 30% of banks with largest assets; *medium* denotes medium size banks, i.e. the next 40% banks with medium assets; *small* denotes small banks, i.e. 30% banks with smallest assets; t statistics are given in brackets; ***Significant at 1%, **Significant at 5%, *Significant at 10%.

Table 5. Sensitivity to business cycle and capital ratio range

	Commercial banks			Cooperative banks		
	1	**2**	**3**	**4**	**5**	**6**
LLP(-1)	0.624 ***	0.668 ***	0.665 ***	0.511 ***	0.514 ***	0.515 ***
	(12.48)	(12.95)	(14.29)	(8.02)	(8.54)	(8.5)
LLP(-2)	0.157 *	0.167 *	0.164 *	0.043	0.044	0.042
	(1.71)	(1.89)	(1.76)	(1.38)	(1.36)	(1.33)
PROFITBPT	0.023	0.013	0.021	0.073 ***	0.075 ***	0.074 ***
	(0.86)	(0.45)	(0.75)	(4.97)	(5.29)	(5.12)
LLA	-0.016 *	-0.005	-0.007	0.047 ***	0.048 ***	0.049 ***
	(-1.89)	(-0.50)	(-0.78)	(4.4)	(4.05)	(3.93)
L growth	-0.002	-0.003	-0.003	-0.003 **	-0.002 **	-0.002 **
	(-1.02)	(-1.28)	(-1.37)	(-2.43)	(-2.32)	(-2.29)
CAPR	-0.004	-0.005 *	-0.004 **	0.006 *	0.002	0.004
	(-1.33)	(-1.67)	(-2.04)	(1.86)	(0.4)	(1)
size	-0.237	-0.200	-0.285 *	0.341 ***	0.340 ***	0.324 ***
	(-1.57)	(-1.48)	(-1.75)	(3.45)	(3.63)	(3.08)
GDP growth	0.008	-0.105 ***	-0.100 **	-0.003	-0.001	-0.010
	(0.50)	(-3.17)	(-2.34)	(-1.24)	(-0.21)	(-1.8)
UNEMPL	0.035 **	0.019	0.027 *	-0.019 ***	-0.019 ***	-0.019 ***
	(1.99)	(1.14)	(1.64)	(-7.05)	(-6.41)	(-5.9)
CAPR<10%	2.417 ***			0.303		
	(3.13)			(1.12)		
10%<CAPR<15%		-0.557 *			-0.012	
		(-1.89)			(-0.13)	
CAPR>15%			-0.656			-0.056
			(-1.55)			(-0.88)
GDP growth * CAPR<10%	-0.509 ***			-0.039		
	(-3.19)			(-1.46)		
GDP growth * 10%<CAPR<15%		0.126 *			-0.011	
		(1.90)			(-1.53)	
GDP growth * CAPR>15%			0.111			0.008
			(1.59)			(1.08)
intercept	1.344	1.763 *	2.285 *	-2.002 ***	-1.927 ***	-1.856 ***
	(1.19)	(1.63)	(1.67)	(-3.21)	(-3.02)	(-2.7)
Quarterly dummies	no	no	no	no	no	no
m1	-1.82 *	-1.79 *	-1.79 *	-3.13 ***	-3.13 ***	-3.12 ***
m2	0.73	0.81	0.83	1.40	1.38	1.39
Sargan test	1990.27 ***	2088.71 ***	2081.94 ***	15149.8 ***	15159.72 ***	15182.43 ***
Hansen test	72.95	68.95	74.31	563.21	562.46	565.02
#observ.	2712	2712	2712	24049	24049	24049
# banks	83	83	83	573	573	573

Notes: This table presents results of estimation of regression 1.2 obtained with a two step GMM dynamic Blundell and Bond approach (1998) with robust standard errors and Windmeijers (2005) finite sample correction. The dataset applied is quarterly for 2000–2012. The dependent variable is *LLP* – loan loss provisions divided by average assets of a bank. The explanatory variables include up to two lags of the dependent variable (*LLP(-1)*, *LLP(-2)*); *PROFITBPT* – earnings before provisions and taxes normalized by average assets; *LLA* – loan loss allowance divided by average assets; *L growth* – loans growth rate; *CAPR* – capital adequacy ratio; *size* – logarithm of total assets; *GDP growth* – the real growth of domestic product (in the case of commercial banks) or the real growth of voivodeship product (in the case of cooperative banks); *UNEMPL* – unemployment rate in Poland (in the case of commercial banks) or voivodeship unemployment rate (in the case of cooperative banks); *CAPR<10%* is a dummy variable taking

the value of 1 if the bank's capital ratio is below 10%; *10%<CAPR<15%* is a dummy variable taking the value of 1 if the bank's capital ratio is between 10% and 15%; *CAPR>15%* is a dummy variable taking the value of 1 if the bank's capital ratio is 15%; t statistics are given in brackets; ***Significant at 1%, **Significant at 5%, *Significant at 10%.

Table 6. Sensitivity to business cycle and income smoothing

	Commercial banks			Cooperative banks		
	1	**2**	**3**	**4**	**5**	**6**
	Inc smooth corr high	Inc smooth R1 high	Inc smooth R2 high	Inc smooth corr high	Inc smooth R1 high	Inc smooth R2 high
LLP(-1)	0.523 ***	0.552 ***	0.482 ***	0.487 ***	0.481 ***	0.500 ***
	(4.13)	(5.00)	(3.23)	(6.81)	(6.87)	(6.62)
LLP(-2)	0.256 **	0.220 **	0.210	0.073 *	0.065 *	0.078 *
	(2.46)	(2.56)	(1.00)	(1.91)	(1.73)	(1.88)
PROFITBPT	0.028	0.030	0.066	0.046 ***	0.048 ***	0.049 ***
	(0.39)	(0.52)	(1.08)	(5.33)	(5.52)	(5.28)
LLA	-0.012	-0.009	-0.014	0.040 ***	0.045 ***	0.034 ***
	(-0.38)	(-0.36)	(-0.64)	(3.59)	(3.56)	(2.81)
L growth	0.000	0.000	0.000	-0.001	-0.001	-0.002 **
	(-0.08)	(-0.12)	(0.15)	(-1.47)	(-1.44)	(-2.58)
CAPR	-0.002	-0.001	-0.002	0.001	0.001	0.002
	(-0.93)	(-0.58)	(-0.60)	(0.36)	(0.31)	(1.23)
size	0.116	0.000	0.188	0.146 ***	0.159 ***	0.174 ***
	(0.41)	(0.00)	(0.94)	(2.7)	(2.87)	(3.03)
GDP growth	-0.095	-0.019	-0.042	0.035 ***	0.038 ***	0.028 ***
	(-1.02)	(-0.40)	(-0.36)	(4.06)	(4.18)	(3.62)
UNEMPL	0.052 *	0.045	0.059 *	-0.015 ***	-0.015 ***	-0.014 ***
	(1.64)	(1.27)	(1.89)	(-5.95)	(-5.83)	(-5.43)
inc smooth high	-0.361	0.422	0.238	0.328 ***	0.293 ***	0.262 ***
	(-0.42)	(0.40)	(0.13)	(3.35)	(3.1)	(3.01)
GDP growth* inc smooth high	0.144	-0.048	-0.025	-0.082 ***	-0.088 ***	-0.069 ***
	(0.81)	(-0.39)	(-0.09)	(-5.05)	(-5.08)	(-4.49)
intercept	-0.725	-0.276	-1.548	-0.984 ***	-1.038 ***	-1.130 ***
	(-0.52)	(-0.13)	(-1.35)	(-2.68)	(-2.76)	(-3.00)
Quarterly dummies	no	no	no	no	no	no
m1	-2.36 **	-2.52 **	-2.00 **	-3.99 ***	-4.03 ***	-3.7 ***
m2	-1.38	-0.97	-0.34	0.82	0.92	0.77
Sargan test	1341.45 ***	1342.45 ***	1356.8 ***	9092.74 ***	9107.86 ***	8493.09 ***
Hansen test	30.4	31.38	30.39	370.61	377.99	324.97
#observ.	1662	1662	1678	17411	17411	15697
# banks	38	38	39	386	386	340

Notes: This table presents results of estimation of regression 1.6 obtained with a two step GMM dynamic Blundell and Bond approach (1998) with robust standard errors and Windmeijers (2005) finite sample correction. The dataset applied is quarterly for 2000–2012. The dependent variable is *LLP* – loan loss provisions divided by average assets of a bank. The explanatory variables include up to two lags of the dependent variable (*LLP(-1), LLP(-2)*); *PROFITBPT* – earnings before provisions and taxes normalized by average assets; *LLA* – loan loss allowance divided by average assets; *L growth* – loans growth rate; *CAPR* – capital adequacy ratio; *size* – logarithm of total assets; *GDP growth* – the real growth of domestic product (in the case of commercial banks) or the real growth of voivodeship product (in the case of cooperative banks); *UNEMPL* – unemployment rate in Poland (in the case of commercial banks) or voivodeship unemployment rate (in the case of cooperative banks); *inc smooth high* – is a dummy variable taking the value of 1 if the individual bank's measure of income smoothing is greater than the median; *inc smooth corr* high denotes

subsample of banks in which the degree of income smoothing (estimated with equation 1.3) is higher than the median; *inc smooth R1 high* denotes subsample of banks in which the degree of income smoothing (estimated with regression 1, given by equation 1.4) is higher than the median; *inc smooth R2 high* denotes subsample of banks in which the degree of income smoothing (estimated with regression 2, given by equation equation 1.5) is higher than the median; t statistics are given in brackets; ***Significant at 1%, **Significant at 5%, *Significant at 10%.

Table 7. Sensitivity of results to inclusion of quarterly dummies – the full sample results and bank size effect in commercial and cooperative banks

	Commercial banks				Cooperative banks			
	full sample	large	medium	small	full sample	large	medium	small
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**
LLP(-1)	0.673 ***	0.729 ***	0.631 ***	0.081	0.519 ***	0.385 ***	0.636 ***	0.467 ***
	(15.23)	(6.39)	(4.12)	(0.30)	(8.71)	(4.05)	(27.2)	(4.5)
LLP(-2)	0.166 *	-0.024	0.109	-0.078	0.043	0.038	-0.014	0.119 ***
	(1.94)	(-0.20)	(0.72)	(-0.17)	(1.3)	(1.31)	(-0.37)	(2.62)
PROFITBPT	0.022	-0.028	0.085 *	-0.006	0.073 ***	0.105 ***	0.079 ***	0.041 ***
	(0.84)	(-0.53)	(1.68)	(-0.07)	(4.81)	(3.6)	(2.8)	(3.52)
LLA	-0.007	-0.039	0.015	0.290	0.048 ***	0.086 ***	0.022 ***	0.031
	(-0.66)	(-1.16)	(0.23)	(0.55)	(4.06)	(2.97)	(4.71)	(1.52)
L growth	-0.003	-0.001	-0.002	0.045 *	-0.002 **	-0.002	-0.003	-0.001
	(-1.41)	(-0.20)	(-0.74)	(1.78)	(-2.32)	(-1.49)	(-1.62)	(-0.68)
CAPR	-0.004 *	-0.002	-0.002	-0.014	0.004	-0.006	0.007	-0.001
	(-1.67)	(-0.65)	(-0.66)	(-0.51)	(0.96)	(-0.9)	(1.04)	(-0.39)
size	-0.213	-0.611	0.083	5.411	0.322 ***	0.382 **	0.454 **	0.246 ***
	(-1.56)	(-0.64)	(0.14)	(0.56)	(2.85)	(2.07)	(1.97)	(2.69)
GDP growth	-0.050 ***	-0.060 **	-0.042	0.369	-0.003	0.000	-0.001	-0.009 **
	(-4.51)	(-2.27)	(-0.84)	(0.43)	(-1.41)	(-0.03)	(-0.35)	(-2.52)
UNEMPL	0.018	0.037	0.046	0.347	-0.016 ***	-0.019 ***	-0.011 ***	-0.011 **
	(1.04)	(0.69)	(0.91)	(0.53)	(-5.48)	(-3.37)	(-5.25)	(-2.32)
intercept	1.580	5.298	-0.989	0.000 ***	-1.902 ***	-2.392 **	-2.638 *	-1.202 **
	(1.50)	(1.06)	(-0.24)	(0.00)	(-2.64)	(-2.04)	(-1.87)	(-2.35)
Quarterly dummies	yes	yes	yes	yes	yes	yes	yes	yes
m1	-1.8 *	-2.02 **	-1.99 **	-0.74	-3.12 ***	-1.57	-2.19 **	-2.54 **
m2	0.85	1.58	0.03	0.45	1.37	-0.23	1.23	0.76
Sargan test	2116.81 ***	1171.47 ***	1130.94 ***	216.94	15229.07 ***	5507.13 ***	7621.5 ***	4449.66 ***
Hansen test	72.73	22.07	30.15	4	560.17	179.42	238.9	135.59
#observ.	2713	1194	1293	226	24049	7273	10717	6059

# banks	83	30	38	15	573	185	246	142

Notes: This table presents results of regression coefficients of regression 1.1 obtained with a two step GMM dynamic Blundell and Bond approach (1998) with robust standard errors and Windmeijers (2005) finite sample correction. The dataset applied is quarterly for 2000–2012. The dependent variable is *LLP* – loan loss provisions divided by average assets of a bank. The explanatory variables include up to two lags of the dependent variable (*LLP(-1), LLP(-2)*); *PROFITBPT* – earnings before provisions and taxes normalized by average assets; *LLA* – loan loss allowance divided by average assets; *L growth* – loans growth rate; *CAPR* – capital adequacy ratio; *size* – logarithm of total assets; *GDP growth* – the real growth of domestic product (in the case of commercial banks) or the real growth of voivodeship product (in the case of cooperative banks); *UNEMPL* – unemployment rate in Poland (in the case of commercial banks) or voivodeship unemployment rate (in the case of cooperative banks); *large* denotes large banks, i.e. 30% of banks with largest assets; *medium* denotes medium size banks, i.e. the next 40% banks with medium assets; *small* denotes small banks, i.e. 30% banks with smallest assets; t statistics are given in brackets; ***Significant at 1%, **Significant at 5%, *Significant at 10%.

Table 8. Sensitivity of results to inclusion of quarterly dummies – and capital ratio range in commercial and cooperative banks

	Commercial banks			Cooperative banks		
	1	**2**	**3**	**4**	**5**	**6**
LLP(-1)	0.639 ***	0.665 ***	0.664 ***	0.516 ***	0.519 ***	0.519 ***
	(13.05)	(15.19)	(13.68)	(8.17)	(8.63)	(8.66)
LLP(-2)	0.140 *	0.157 *	0.168 *	0.044	0.044	0.043
	(1.62)	(1.76)	(1.78)	(1.33)	(1.33)	(1.3)
PROFITBPT	0.016	0.019	0.022	0.073 ***	0.074 ***	0.073 ***
	(0.64)	(0.71)	(0.86)	(4.86)	(5.22)	(4.93)
LLA	-0.009	-0.009	-0.008	0.045 ***	0.046 ***	0.048 ***
	(-0.96)	(-0.82)	(-0.89)	(4.16)	(4.09)	(4.03)
L growth	-0.002	-0.002	-0.003	-0.002 **	-0.002 **	-0.002 **
	(-1.20)	(-1.00)	(-1.32)	(-2.4)	(-2.32)	(-2.29)
CAPR	-0.003	-0.005 *	-0.003	0.006 *	0.002	0.005
	(-1.19)	(-1.93)	(-1.44)	(1.81)	(0.49)	(1.07)
size	-0.162	-0.217 *	-0.242 *	0.347 ***	0.341 ***	0.318 ***
	(-1.44)	(-1.86)	(-1.76)	(3.21)	(3.37)	(2.84)
GDP growth	0.009	-0.118 ***	-0.093 **	-0.002	-0.001	-0.005
	(0.52)	(-3.64)	(-1.96)	(-0.78)	(-0.27)	(-0.99)
UNEMPL	0.024	0.015	0.029 *	-0.016 ***	-0.016 ***	-0.016 ***
	(1.16)	(0.72)	(1.77)	(-6.05)	(-5.6)	(-5.47)
CAPR<10%	1.999 ***			0.241		
	(2.76)			(1.21)		
10%<CAPR<15%		-0.666 ***			-0.031	
		(-2.84)			(-0.4)	
CAPR>15%			-0.665			-0.044
			(-1.50)			(-0.78)
GDP growth * CAPR<10%	-0.431 ***			-0.024		
	(-2.86)			(-1.04)		
GDP growth * 10%<CAPR<15%		0.152 **			-0.005	
		(2.52)			(-0.71)	
GDP growth * CAPR>15%			0.093			0.002
			(1.18)			(0.33)
intercept	0.950	1.953 **	1.966 *	-2.082 ***	-1.97 ***	-1.876 ***
	(1.03)	(1.99)	(1.71)	(-3.05)	(-2.95)	(-2.6)
Quarterly dummies	yes	yes	yes	yes	yes	yes
m1	-1.82 *	-1.8 *	-1.77 *	-3.13 ***	-3.13 ***	-3.13 ***
m2	0.83	0.85	0.79	1.38	1.37	1.39
Sargan test	2032.89 ***	2110.92 ***	2112.37 ***	15197.7 ***	15211.09 ***	15230.53 ***
Hansen test	67.6	71.78	74.61	564.67	566.63	564.43
#observ.	2,712	2,712	2,712	24049	24049	24049
# banks	83	83	83	573	573	573

Notes: This table presents results of regression coefficients of regression 1.2 obtained with a two step GMM dynamic Blundell and Bond approach (1998) with robust standard errors and Windmeijers (2005) finite sample correction. The dataset applied is quarterly for 2000–2012. The dependent variable is *LLP* – loan loss provisions divided by average assets of a bank. The explanatory variables

include up to two lags of the dependent variable (*LLP(-1), LLP(-2)*); *PROFITBPT* – earnings before provisions and taxes normalized by average assets; *LLA* – loan loss allowance divided by average assets; *L growth* – loans growth rate; *CAPR* – capital adequacy ratio; *size* – logarithm of total assets; *GDP growth* – the real growth of domestic product (in the case of commercial banks) or the real growth of voivodeship product (in the case of cooperative banks); *UNEMPL* – unemployment rate in Poland (in the case of commercial banks) or voivodeship unemployment rate (in the case of cooperative banks); *CAPR<10%* is a dummy variable taking the value of 1 if the bank's capital ratio is below 10%; *10%<CAPR<15%* is a dummy variable taking the value of 1 if the bank's capital ratio is between 10% and 15%; *CAPR>15%* is a dummy variable taking the value of 1 if the bank's capital ratio is 15%; t statistics are given in brackets; ***Significant at 1%, **Significant at 5%, *Significant at 10%.

Table 9. Sensitivity of results to inclusion of quarterly dummies – and income smoothing in commercial and cooperative banks

	Commercial banks			Cooperative banks		
	1 Inc smooth corr	**2** Inc smooth R1	**3** Inc smooth R2	**4** Inc smooth corr	**5** Inc smooth R1	**6** Inc smooth R2
LLP(-1)	0.523 ***	0.589 ***	0.483 ***	0.489 ***	0.484 ***	0.497 ***
	(4.13)	(5.22)	(3.24)	(6.72)	(6.98)	(6.56)
LLP(-2)	0.255 **	0.254 ***	0.206	0.071 *	0.065 *	0.080 *
	(2.45)	(2.91)	(0.98)	(1.86)	(1.76)	(1.91)
PROFITBPT	0.027	0.017	0.064	0.045 ***	0.047 ***	0.047 ***
	(0.38)	(0.28)	(1.05)	(5.12)	(5.58)	(5.28)
LLA	-0.012	-0.012	-0.014	0.040 ***	0.043 ***	0.034 ***
	(-0.4)	(-0.44)	(-0.65)	(3.58)	(3.48)	(2.86)
L growth	0.000	-0.001	0.000	-0.001	-0.001	-0.002 ***
	(-0.08)	(-0.67)	(0.13)	(-1.44)	(-1.44)	(-2.62)
CAPR	-0.002	0.000	-0.001	0.000	0.000	0.002
	(-0.9)	(-0.22)	(-0.58)	(0.24)	(0.2)	(0.83)
size	0.121	-0.156	0.190	0.129 **	0.149 ***	0.144 ***
	(0.43)	(-0.56)	(0.96)	(2.42)	(2.89)	(2.72)
GDP growth	-0.096	0.000	-0.041	0.036 ***	0.037 ***	0.029 ***
	(-1.04)	(-0.01)	(-0.35)	(4.3)	(4.23)	(3.47)
UNEMPL	0.052	0.029	0.058 *	-0.015 ***	-0.014 ***	-0.013 ***
	(1.63)	(0.7)	(1.88)	(-6.19)	(-5.95)	(-5.57)
inc smooth high	-0.378	0.803	0.224	0.322 ***	0.285 ***	0.266 ***
	(-0.45)	(0.88)	(0.13)	(3.18)	(3.05)	(3.06)
GDP growth* inc smooth high	0.151	-0.080	-0.023	-0.080 ***	-0.083 ***	-0.068 ***
	(0.85)	(-0.68)	(-0.08)	(-5.19)	(-5.12)	(-4.29)
intercept	-0.739	0.704	-1.552	-0.896 **	-0.989 ***	-0.968 ***
	(-0.54)	(0.38)	(-1.35)	(-2.45)	(-2.78)	(-2.73)
Quarterly dummies	yes	yes	yes	yes	yes	yes
m1	-2.36 **	-2.4 **	-2.02 **	-3.98 ***	-4.03 ***	-3.68 ***
m2	-1.37	-1.34	-0.32	0.85	0.92	0.73
Sargan test	1364.61 ***	1366.12 ***	1379.57 ***	9132.45 ***	9145.3 ***	8531.73 ***
Hansen test	30.4	31.81	30.4	373.32	377.15	328.38
#observ.	1662	1662	1678	17411	17411	15697
# banks	38	38	39	386	386	340

Notes: This table presents results of estimation of regression 1.6 obtained with a two step GMM dynamic Blundell and Bond approach (1998) with robust standard errors and Windmeijers (2005) finite sample correction. The dataset applied is quarterly for 2000-2012. The dependent variable is LLP - loan loss provisions divided by average assets of a bank. The explanatory variables include up to two lags of the dependent variable (LLP(-1), LLP(-2)); *PROFITBPT* – earnings before provisions and taxes normalized by average assets; LLA – loan loss allowance divided by average assets; *L growth* – loans growth rate; CAPR – capital adequacy ratio; size – logarithm of total assets; GDP growth – real growth of domestic product (in the case of commercial banks) or real growth of voivodeship product (in the case of cooperative banks); UNEMPL – unemployment rate in Poland (in the case of commercial banks) or voivodeship unemployment rate (in the case of cooperative banks); *inc smooth high* – is a dummy variable taking the value of 1 if the individual bank's measure of income smoothing is greater than the median; *inc smooth corr* high denotes subsample of banks in which the degree of income smoothing (estimated with equation 1.3) is higher than the median; *inc smooth R1 high* denotes subsample of banks in which the degree of income smoothing (estimated with regression 1, given by equation 1.4) is higher than the median; *inc smooth R2 high* denotes subsample of banks in which the degree of income smoothing (estimated with

regression 2, given by equation equation 1.5) is higher than the median; t statistics are given in brackets; ***Significant at 1%, **Significant at 5%, *Significant at 10%.

Table 10. Impact of endogeneity of GDP and bank size in commercial and cooperative banks

	Commercial banks				Cooperative banks			
	full sample	large	medium	small	full sample	large	medium	small
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**
LLP(-1)	0.677 ***	0.731 ***	0.633 ***	0.081	0.523 ***	0.391 ***	0.637 ***	0.468 ***
	(13.81)	(6.4)	(4.14)	(0.3)	(8.76)	(4.11)	(26.26)	(4.49)
LLP(-2)	0.157 *	-0.025	0.11	-0.078	0.041	0.041	-0.012	0.111 **
	(1.77)	(-0.2)	(0.72)	(-0.17)	(1.26)	(1.45)	(-0.32)	(2.36)
PROFITBPT	0.021	-0.028	0.085 *	-0.006	0.068 ***	0.1 ***	0.074 ***	0.04 ***
	(0.77)	(-0.52)	(1.67)	(-0.07)	(5.14)	(3.84)	(3.09)	(3.77)
LLA	-0.006	-0.039	0.015	0.29	0.046 ***	0.083 ***	0.021 ***	0.032 *
	(-0.7)	(-1.16)	(0.23)	(0.55)	(4.08)	(3.08)	(4.78)	(1.67)
L growth	-0.003	-0.001	-0.002	0.045 *	-0.002 **	-0.002	-0.003	-0.001
	(-1.49)	(-0.2)	(-0.7)	(1.78)	(-2.33)	(-1.49)	(-1.53)	(-0.55)
CAPR	-0.005 *	-0.002	-0.002	-0.014	0.004	-0.005	0.006	-0.001
	(-1.93)	(-0.63)	(-0.66)	(-0.51)	(1.2)	(-0.88)	(0.97)	(-0.39)
size	-0.256 **	-0.612	0.124	5.411	0.321 ***	0.392 **	0.423 **	0.258 ***
	(-2.05)	(-0.64)	(0.21)	(0.56)	(3.36)	(2.45)	(2.32)	(3.13)
GDP growth	-0.054 ***	-0.06 **	-0.042	0.369	-0.005 **	-0.003	-0.002	-0.008 **
	(-3.82)	(-2.27)	(-0.83)	(0.43)	(-2.22)	(-0.48)	(-0.48)	(-2.42)
UNEMPL	0.015	0.037	0.047	0.347	-0.012 ***	-0.015 ***	-0.01 ***	-0.008 **
	(0.73)	(0.68)	(0.93)	(0.53)	(-6.01)	(-3.31)	(-6.31)	(-2.34)
intercept	1.943 *	5.27	-1.256	0	-1.913 ***	-2.466 **	-2.454 **	-1.282 ***
	(1.88)	(1.05)	(-0.3)	(0)	(-3.15)	(-2.43)	(-2.17)	(-2.84)
Quarterly dummies	no	no	no	no	no	no	no	no
m1	-1.8 *	-2.02 **	-1.99 **	-0.74	-3.12 ***	-1.58	-2.2 **	-2.54 **
m2	0.88	1.58	0.03	0.45	1.41	-0.32	1.23	0.82
Sargan test	2122.17 ***	1172.07 ***	1139.4 **	216.94	15313.2 ***	5555.78 ***	7691.69 ***	4532.14 ***
Hansen test	77.27	22.07	30.12	4	562.41	178.84	241.1	133.32
#observ.	2713	1194	1293	226	24049	7273	10717	6059
# banks	83	30	38	15	573	185	246	142

Notes: This table presents results of estimation of regression 1.1 obtained with a two step GMM dynamic Blundell and Bond approach (1998) with robust standard errors and Windmeijers (2005) finite sample correction. The dataset applied is quarterly for 2000–2012. The dependent variable is *LLP* – loan loss provisions divided by average assets of a bank. The explanatory variables include up to two lags of the dependent variable (*LLP(-1), LLP(-2)*); *PROFITBPT* – earnings before provisions and taxes normalized by average assets; *LLA* – loan loss allowance divided by average assets; *L growth* – loans growth rate; *CAPR* – capital adequacy ratio; *size* – logarithm of total assets; *GDP growth* – real growth of domestic product (in the case of commercial banks) or real growth of voivodeship product (in the case of cooperative banks); *UNEMPL* – unemployment rate in Poland (in the case of commercial banks) or voivodeship unemployment rate (in the case of cooperative banks); l t statistics are given in brackets; ***Significant at 1%, **Significant at 5%, *Significant at 10%.

Table 11. Impact of endogeneity of GDP on the effect of capital ratio level on the sensitivity of LLP to business cycle

	Commercial banks			Cooperative banks		
	1	**2**	**3**	**4**	**5**	**6**
LLP(-1)	0.652 ***	0.676 ***	0.679 ***	0.520 ***	0.522 ***	0.522 ***
	(12.37)	(13.73)	(13.77)	(8.34)	(8.7)	(8.74)
LLP(-2)	0.151 *	0.164 *	0.157 *	0.040	0.041	0.040
	(1.79)	(1.83)	(1.84)	(1.25)	(1.26)	(1.23)
PROFITBPT	0.021	0.017	0.021	0.068 ***	0.068 ***	0.067 ***
	(0.87)	(0.64)	(0.77)	(5.26)	(5.41)	(5.23)
LLA	-0.013	-0.003	-0.008	0.044 ***	0.045 ***	0.046 ***
	(-1.4)	(-0.23)	(-0.78)	(4.33)	(4.07)	(3.97)
L growth	-0.002	-0.003	-0.003	-0.002 **	-0.002 **	-0.002 **
	(-1.21)	(-1.41)	(-1.51)	(-2.46)	(-2.28)	(-2.28)
CAPR	-0.004 *	-0.005 *	-0.003 *	0.006 **	0.004	0.006
	(-1.7)	(-1.89)	(-1.66)	(2.31)	(0.75)	(1.35)
size	-0.186	-0.184	-0.230	0.342 ***	0.325 ***	0.306 ***
	(-1.4)	(-1.52)	(-1.58)	(3.85)	(3.96)	(3.28)
GDP growth	-0.001	-0.106 ***	-0.074 *	-0.004	-0.004	-0.008 *
	(-0.06)	(-3.09)	(-1.79)	(-1.6)	(-1.34)	(-1.67)
UNEMPL	0.028 *	0.012	0.026	-0.012 ***	-0.012 ***	-0.013 ***
	(1.8)	(0.73)	(1.38)	(-5.94)	(-6.03)	(-5.65)
CAPR<10%	1.838 **			0.236		
	(2.53)			(1.31)		
10%<CAPR<15%		-0.617 **			-0.011	
		(-2.11)			(-0.15)	
CAPR>15%			-0.467			-0.078
			(-1.22)			(-1.39)
GDP growth * CAPR<10%	-0.390 ***			-0.022		
	(-2.73)			(-1.02)		
GDP growth * 10%<CAPR<15%		0.137 *			-0.002	
		(1.95)			(-0.34)	
GDP growth * CAPR>15%			0.064			0.004
			(0.98)			(0.6)
intercept	1.118	1.721 *	1.807 *	-2.076 ***	-1.928 ***	-1.827 ***
	(1.09)	(1.77)	(1.48)	(-3.7)	(-3.44)	(-3)
Quarterly dummies	no	no	no	no	no	no
m1	-1.84 *	-1.8 *	-1.8 *	-3.14 ***	-3.12 ***	-3.13 ***
m2	0.84	0.83	0.87	1.42	1.4	1.41
Sargan test	2044.76 ***	2115.4 ***	2114.89 ***	15279.85 ***	15309.08 ***	15309.2 ***
Hansen test	67.61	71.42	72.24	560.01	564.41	566.81
#observ.	2712	2712	2712	24049	24049	24049

# banks	83	83	83	573	573	573

Notes: This table presents results of estimation of regression 1.2 obtained with a two step GMM dynamic Blundell and Bond approach (1998) with robust standard errors and Windmeijers (2005) finite sample correction. The dataset applied is quarterly for 2000–2012. The dependent variable is *LLP* – loan loss provisions divided by average assets of a bank. The explanatory variables include up to two lags of the dependent variable (*LLP(-1), LLP(-2)*); *PROFITBPT* – earnings before provisions and taxes normalized by average assets; *LLA* – loan loss allowance divided by average assets; *L growth* – loans growth rate; *CAPR* – capital adequacy ratio; *size* – logarithm of total assets; *GDP growth* – real growth of domestic product (in the case of commercial banks) or real growth of voivodeship product (in the case of cooperative banks); *UNEMPL* – unemployment rate in Poland (in the case of commercial banks) or voivodeship unemployment rate (in the case of cooperative banks); *CAPR<10%* is a dummy variable taking the value of 1 if the bank's capital ratio is below 10%; *10%<CAPR<15%* is a dummy variable taking the value of 1 if the bank's capital ratio is between 10% and 15%; *CAPR>15%* is a dummy variable taking the value of 1 if the bank's capital ratio is 15%; t statistics are given in brackets; ***Significant at 1%, **Significant at 5%, *Significant at 10%.

Table A1. Descriptive statistics for commercial banks and bank size

	Mean	Median	St dev	Min	Max	#banks	#observ.
				Large			
LLP	0.94	0.43	1.67	-4.06	21.63	31	1341
PROFITBPT	2.37	2.27	2.77	-24.88	15.49	31	1341
LLA	6.95	4.89	9.63	0.00	93.10	31	1348
L growth	6.83	3.45	22.75	-44.12	297.65	31	1326
CAPR	17.34	12.59	28.31	-2.57	444.20	30	1275
CAPR1	18.31	12.12	38.44	0.00	866.93	30	1275
CAP	9.45	8.07	6.40	1.97	53.94	30	1251
size	7.11	7.26	0.68	4.75	8.28	31	1341
GDP growth	3.86	4.00	2.04	-0.34	7.51	31	1612
UNEMPL	11.79	12.45	2.54	7.20	15.80	31	1612
				Medium			
LLP	0.78	0.27	1.56	-6.41	19.12	45	1595
PROFITBPT	1.96	1.52	3.52	-54.80	42.73	45	1595
LLA	5.57	2.84	7.68	0.00	60.39	45	1592
L growth	6.86	2.86	26.01	-65.83	331.95	45	1571
CAPR	25.95	16.68	47.14	-158.86	680.81	38	1393
CAPR1	25.49	16.51	47.22	0.00	680.81	38	1393
CAP	12.56	9.98	9.43	0.79	70.09	38	1341
size	6.19	6.24	0.42	4.53	7.09	45	1595
GDP growth	3.86	4.00	2.04	-0.34	7.51	45	2340
UNEMPL	11.79	12.45	2.54	7.20	15.80	45	2340
				Small			
LLP	0.78	0.03	4.75	-20.69	47.24	18	331
PROFITBPT	0.58	1.68	6.03	-33.54	19.33	18	329
LLA	7.91	3.35	16.66	0.00	100.00	18	335
L growth	10.48	1.24	52.52	-55.93	700.46	18	315
CAPR	65.89	20.31	176.75	-58.98	1,538.23	15	271
CAPR1	65.22	20.31	174.98	0.00	1,538.23	15	271
CAP	19.35	17.08	11.54	1.96	61.89	15	243
size	5.35	5.45	0.43	3.39	6.03	18	331
GDP growth	3.86	4.00	2.04	-0.34	7.51	18	936
UNEMPL	11.79	12.45	2.54	7.20	15.80	18	936

Notes: *LLP* – loan loss provisions divided by average assets of a bank; *PROFITBPT* – earnings before provisions and taxes normalized by average assets; *LLA* – loan loss allowance divided by average assets; *L growth* – loans growth rate; *CAPR* – capital adequacy ratio; *CAPR1* – tier 1 capital adequacy ratio; *CAP* – equity capital divided by total assets; *size* – logarithm of total assets; *GDP growth* – real growth of domestic product (in the case of commercial banks) or the real growth of voivodeship product (in the case of cooperative banks); *UNEMPL* – unemployment rate in Poland (in the case of commercial banks) or voivodeship unemployment rate (in the case of cooperative banks).

Table A2. Descriptive statistics for cooperative banks and bank size

	Mean	Median	St dev	Min	Max	#banks	#observ.
				Large			
LLP	0.25	0.09	0.69	-2.69	30.75	185	7834
PROFITBPT	7.27	6.64	2.23	3.14	20.04	185	8524
LLA	2.38	1.69	2.61	0.00	33.80	185	8554
L growth	3.96	3.38	9.69	-38.92	561.59	185	8522
CAPR	13.12	11.96	4.67	-7.69	57.08	185	8555
CAPR1	12.86	11.70	4.86	0.39	56.90	185	8555
CAP	8.87	8.34	2.99	1.82	37.51	185	8524
size	5.05	5.06	0.32	3.95	6.35	185	8524
GDP growth	3.84	3.81	2.16	-0.43	10.09	185	9620
UNEMPL	14.75	14.40	4.50	5.80	30.60	185	9620
				Medium			
LLP	0.17	0.06	0.64	-6.64	29.72	246	11408
PROFITBPT	7.97	7.33	2.45	-1.60	23.55	246	12105
LLA	1.94	1.21	2.51	0.00	42.51	246	12110
L growth	3.49	2.88	7.07	-31.64	165.12	246	12081
CAPR	16.00	14.98	5.07	-11.43	41.88	246	12124
CAPR1	15.91	14.79	5.33	0.03	57.87	246	12123
CAP	10.54	10.13	2.84	0.02	32.56	246	12103
size	4.63	4.64	0.25	3.69	5.28	246	12105
GDP growth	3.66	3.70	2.06	-0.43	10.09	246	12792
UNEMPL	15.28	14.90	4.65	5.80	30.60	246	12792
				Small			
LLP	0.13	0.04	0.54	-5.07	11.00	142	6483
PROFITBPT	8.99	8.28	2.72	3.96	27.75	142	6893
LLA	1.65	0.96	2.21	0.00	32.00	142	6893
L growth	3.40	2.68	8.46	-29.81	151.32	142	6885
CAPR	2.58	1.99	8.36	-29.32	147.84	142	6885
CAPR1	23.73	22.19	8.89	-7.80	193.18	142	6898
CAP	22.26	20.71	8.23	3.58	153.36	142	6897
size	15.17	14.69	4.51	2.65	36.35	142	6892
GDP growth	4.25	4.26	0.25	3.40	4.82	142	6893
UNEMPL	3.66	3.68	2.10	-0.43	10.09	142	7384

Notes: *LLP* – loan loss provisions divided by average assets of a bank; *PROFITBPT* – earnings before provisions and taxes normalized by average assets; *LLA* – loan loss allowance divided by average assets; *L growth* – loans growth rate; *CAPR* – capital adequacy ratio; *CAPR1* – tier 1 capital adequacy ratio; *CAP* – equity capital divided by total assets; *size* – logarithm of total assets; *GDP growth* – real growth of domestic product (in the case of commercial banks) or the real growth of voivodeship product (in the case of cooperative banks); *UNEMPL* – unemployment rate in Poland (in the case of commercial banks) or voivodeship unemployment rate (in the case of cooperative banks).