Bank i Kredyt 47(4), 2016, 341-364

BANK I KREDYT
BANK & CREDIT

Market structure, business cycle and bank profitability: evidence on Polish banks

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Submitted: 13 January 2016. Accepted: 31 May 2016.

Abstract

The study examines the impact of banking-sector structure and macroeconomic changes on bank profitability in the Polish banking sector over the past fifteen years (i.e. prior to and during the global financial crisis of 2008). The model developed in this paper incorporates the traditional structure--conduct-performance (SCP) hypothesis, as well as the relative market power hypothesis (RMP). Furthermore, this paper examines the overall effect of financial structure and macroeconomic conditions to determine whether financial development and business cycles affect the profit of Polish banks. Finally, this paper tests the impact of foreign capital on the profitability of Polish banks.

Empirical results based on panel data set describing both micro-level and macro-level data find no evidence of the SCP hypothesis. However, this paper finds that foreign ownership and disintermediation have a positive effect on bank profitability in the period 1997–2012. As in other European countries, the profitability of commercial banks in Poland is contingent upon the business cycle.

Keywords: bank profitability, market power, market structure, business cycle, foreign banks

JEL: F36, G2, G21, G34, L1

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1. Introduction

The profitability of banks is a subject of great interest in bank management, financial markets, bank supervision and academics. This interest is driven by increasing consolidation within the banking sector, changes in production technology and macro-prudential policy. Identifying the determinants of bank performance is an important predictor of unstable economic conditions. Profitable banking systems are likely to absorb negative shocks, thus maintaining the stability of the financial system.

The aim of this study is to estimate the impact of market structure on the performance of banks in the Polish sector throughout the past fifteen years (i.e. prior to and during the financial crisis of 2008, after the failure of Lehman Brothers). In order to test the traditional structure-conduct-performance (SCP) hypothesis, this paper empirically investigates the effect of market structure as it relates to profitability, with a particular focus on whether banks that are operating in concentrated markets generate more profit or not. Besides the traditional SCP hypothesis, this paper tests the relative market power (RMP) hypothesis created by Smirlock (1985). He posited that there is no relationship between concentration and profitability, but rather between a bank's market share and its profitability. This paper also examines whether the business cycles affect the profit of Polish banks. Furthermore, due to that fact that the consolidation processes are correlated with the changing ownership structure in the Polish banking sector, this paper also tests the impact of foreign capital on the profitability of Polish banks.

In order to carry out a quantitative assessment of the impact of market structure on banking performance, this study conducted empirical analysis based on a panel data set consisting of yearly micro- and macro-level data. Panel data combines a statistical data set for Polish commercial banks and information about the macroeconomic environment for the period 1997–2012. Micro-level data for Polish commercial bank was received from Narodowy Bank Polski (balance sheets and profit and loss accounts). Macroeconomic data was received from Polish Central Statistical Office (CSO). The degree of competition within the Polish banking sector was estimated using the Lerner indices and Boone indicators for each bank and the change of concentration within the Polish banking industry was analysed using the Herfindahl-Hirschman indices (HHI). Profitability in the Polish banking sector was analysed using the return on assets ratios (ROA).

This study consists of two parts and a summary. The first part is a broad literature review concerning the relationship between bank profit, market structure and the degree of competition. The second part consists of two sections: the first section describes the structural and technological changes within the Polish banking sector that lead to changes in profitability. The second section presents the results of the analysis of panel data. The summary provides an overview of the empirical results and the conclusions that were drawn.

2. Relationship between bank profitability, market structure and degree of competition

In recent years there have been ongoing debates concerning the economic role of market structure and competition within the banking industry. Therefore, development in the banking sector does not affect banks alone, but is highly relevant for the economy as a whole. Accordingly, the competition between banks and profitability of the banking sector is of interest not just at the individual bank level; it is

also crucial at a broader macroeconomic level. A profitable banking system is likely to absorb negative shocks, thus maintaining the stability of the financial system.

Dramatic changes in regulation and technology modified the structure of the banking sectors. All those changes strengthened competition, especially in traditional lending activity, and encouraged banks to diversify their sources of revenue. Competition amongst banks is a broad concept that covers many aspects of the banking environment. The studies of the structure of individual banks, banking markets and their interactions are currently conducted as part of the industrial organisation approach to banking – IOAB (cf. Degryse, Kim, Ongena 2009; Van Hoose 2010; Bikker, Leuvensteijn 2014). The field of the industrial organization of banking, among others, is evaluating the competitive structure of banking markets and associated implications for the banking industry and society (Van Hoose 2010).

The literature on measuring competition amongst banks can be divided into two major streams: a structural approach developed on the basis of economic theories investigating the industrial organisation (IO)[1] and a non-structural approach on the basis of the new empirical industrial organisation theory (NEIO). The traditional IO theory is comprised of the following structural models: structure-conduct-performance paradigm (SCP) and a theory based on the efficient structure hypothesis (ES). In structural models, concentration ratios (i.e. Herfindahl-Hirschman) indices[2] and the k bank concentration ratios (CR_k)[3] are often used to explain competitive performance in the banking industry as a result of market structure (see Bikker 2004).

The structure-conduct-performance hypothesis still figures prominently among theories that relate market power to bank profitability (cf. Athanasoglou, Brissimis, Delis 2008; Van Hoose 2010). The SCP model was developed by Bain (1951). This theory states that in a market with higher concentration, banks are more likely to show collusive behavior and their oligopoly rents will increase their performance (profitability) (the SCP paradigm dominated until the late 1970s). The SCP model assumed that a more concentrated system leads to less competition and hence to higher profitability. Based on the traditional SCP paradigm, Berger (1995) advocated that banks set prices that are less favourable to consumers, as a result of imperfectly competitive markets. A whole new trend about structural effects on bank profitability started with the application of the market-power (MP) and the efficient-structure (ES) hypotheses. The MP hypothesis, which is sometimes also referred to as the structure-conduct-performance (SCP) hypothesis, asserts that increased market power yields monopoly profits. A special case of the MP hypothesis is the relative-market-power (RMP) hypothesis, which was created by Smirlock (1985). Smirlock (1985) posited that there is no relationship between concentration and profitability, but rather between bank market share and bank profitability and suggested that only banks with large market shares and well-differentiated products are able to exercise market power and earn non-competitive profits. However, subsequent results of analyses based on the SCP paradigm showed that the relationship between the structure of the market and conduct is even more complex.

The efficiency structure hypothesis (ES) was developed by Demsetz (1973). The ES theory states that if banks enjoy a higher degree of efficiency than their competitors, they can increase shareholder

[1] The above theory deals with market organisation and competition; therefore, the behaviour of the firms is investigated with certain limitations imposed by consumers and competitors. The central issue of this theory was the expansion of the micro-economic analysis with imperfectly competitive markets and the main model discussed in this theory is the oligopoly model.

[2] The HHI is calculated as the sum of the squared market shares of each firm in a market in terms of assets. It ranges from 0 to 1.

[3] This index is calculated as the market share of the k of largest banks in all banking assets.

value or gain market share by reducing their prices. According to the ES, concentrated markets are those where highly effective firms (banks) operate. Efficiency is not an effect but a determinant of market structure. The X-efficiency version of the ES hypothesis suggests that increased managerial and scale efficiency leads to higher concentration and, hence, higher profits. However, Hicks (1935) developed a theory opposite to the ES and it is known in literature as the quiet life (QL). According to the QL, banks with superior market strength and thus a privileged position suffer a lower cost efficiency due to the quiet life of their managers. This means that large banks could make less effort to maximize efficiency (Berger, Hannan 1998). Generally, QL hypothesis assumes that monopoly will reduce the pressure towards efficiency (see Bikker, Leuvensteijn 2014).

The modern theory is based on the new empirical industrial organization (NEIO) literature, which provided empirically applicable tests based on either aggregate industry data or individual firm data. Methods based on the NEIO do not take into account the direction of the change in the level of concentration and they presume that the degree of competition does not always depend on concentration measures, as other market characteristics including dynamic barriers to entry and exit are more important. The industrial organization approach to banking (IOAB) is a theory concerned with the issue of measuring competition in the banking sector and defines the following measures of competition: the Lerner index, the H-statistic and the Boone-indicator (cf. Degryse, Kim, Ongena 2009; Van Hoose 2010; Bikker, Leuvensteijn 2014). The Lerner index measures the so-called monopoly mark-up. Panzar and Rosse defined the measure of competition as the value of the sum of revenue elasticities, known in the literature as the H-statistic. The Boone method is based on the so-called efficient structure hypothesis – ESH (cf. Pawłowska 2011). The Lerner index and Boone indicator were used in this paper for evaluating competition within the Polish banking sector.

A large number of studies have already dealt with the determinants of bank profitability on the banking structure level and broader macroeconomic level. The analyses focused primarily on microeconomic or bank-specific drivers of profitability, based mainly on variables such as size and cost management (efficiency). A number of studies examined the influence of the market structure based on the SCP paradigm. A positive relationship between concentration and profitability was reported, e.g. by Demirgüç-Kunt and Huizinga (1999), Molyneux and Thornton (1992), and Goddard, Molyneux and Wilson (2004), which confirms the traditional SCP hypothesis. However, Mirzaei, Moore, Liu (2013) and Maudos and de Guevara (2004) confirmed the relative market-power hypotheses (RMP) in advanced economies. Furthermore, Mirzaei, Moore and Liu (2013) found that market share has no significant impact on bank profitability in emerging markets, providing little evidence in support of the RMP hypothesis. The effect of market concentration on profitability is either insignificant on emerging and advanced banking markets. In contrast, the ES hypothesis was confirmed by, for example, Claeys and Vander Vennet (2008).

The link between the ownership structure of banks and the impact on their profitability is ambiguous, with some studies finding that foreign banks do better and other studies reporting stronger performance of domestic banks (e.g. Molyneux, Thornton 1992; Cetorelli 2004; Degryse, Ongena 2008). The prior studies on the relationship between ownership structure and bank performance in transition economies provide mixed results. Hasan and Marton (2000) and Weill (2003) conclude that bank profitability is positively associated with foreign ownership as opposed to state-owned banks and domestic banks. In contrary to the above findings, Nikiel and Opiela (2002) argue that Polish domestic banks perform better in general than banks acquired or controlled by foreign investors. However,

La Porta, Lopez-de-Silanes and Shleifer (2002) concluded that a state bank follows a political rather than a social agenda.

Also, the recent research on the relationship between ownership structure and bank performance in transition economies provides mixed results. Havrylchyk and Jurzyk (2006) showed that foreign banks in Central and Eastern European countries, especially greenfield institutions, earn higher profits than domestic banks. Furthermore, Havrylchyk and Jurzyk (2011) compared banks that were acquired by foreign investors with comparable domestic banks that stayed in domestic ownership and showed that foreign banks (i.e. acquired by foreign investors) in Central and Eastern European countries are more profitable due to cost minimization and better risk management. However, Claessens and Van Horen (2012), based on the comprehensive database on bank ownership for 137 OECD countries (including Poland) over 1995–2009, find that foreign banks have higher capital and more liquidity, but lower profitability than domestic banks. Also, during the global crisis, foreign banks reduced credit more compared to domestic banks, except when they dominated the host banking systems.

Most of the studies focusing on macroeconomic influences on profitability of banks find that the business cycle has a positive influence on the development of bank profitability and also find a positive correlation between bank profitability and inflation (e.g. Albertazzi, Gambacorta 2009; Bikker, Hu 2002; Demirgüç-Kunt, Huizinga 2000). Albertazzi and Gambacorta (2009) found that banks' profits pro--cyclicality in the euro area, US and UK derives from the effect of the economic cycle. However, pro--cyclicality is slightly greater in Anglo-Saxon countries. Furthermore, the global financial crisis and the low interest rates in major advanced economies caused the intensification of research concerning how monetary policy affects bank profitability (cf. Borio, Gambacorta, Hofmann 2015). The results suggests that low interest rates erode bank profitability.

The majority of the studies analysing determinants of banks' performance focus on selected microeconomic and macroeconomic factors. The presented paper offers a broad view on the subject and takes into account many micro factors and also cyclical components. Similar, comprehensive studies, describing many micro factors and business cycles were published, among others, for the Austrian banking sector (cf. Rumler, Waschiczek 2010) and for Greek banks (cf. Athanasoglou, Brissimis, Delis 2008) and for emerging vs. advanced economies (cf. Mirzaei, Moore, Liu 2013). Despite this, there is not a lot of work taking into account the SCP paradigm and tests on the impact of foreign capital on the profitability of Polish banks in this context, and this paper fills this gap.

3. Banking structure, business cycle and profitability of banks – panel data analysis

3.1. Structural and technological changes in the Polish banking sector

The profitability of commercial banks in Poland in the past fifteen years (prior to and during the financial crisis) was influenced by a large number of internal and external factors: consolidation, technological processes, Poland's accession to the European Union and the real economy. Due to Poland's accession to the EU, the Polish financial law was harmonised with the EU regulations. It should be noted that as of the date of Poland's accession to the EU, one of the entry barriers for EU banks was removed as a single passport

law was introduced in Poland. Pursuant to the single passport rule, a credit institution that obtained a banking licence in one EU country may undertake and conduct activities in another EU country without having to undergo another licensing procedure. The credit institution is only required to notify the banking supervisor of the host country of its intention to undertake activity in its territory (see NBP 2004).

Due to changes in the external environment of banks, their profitability measured by return on assets and return on equity also changed. After a significant decrease in the profitability of commercial banks between 2001 and 2003 (related to the economic slowdown), there was a clear improvement in profitability. The improvement in banks' profitability ratios, return on assets and return on equity, was facilitated by, among others, a decrease in the share of non-performing loans. Since Poland's accession to the EU, the classification of non-performing loans changed to a less restrictive classification, for instance for sub-standard receivables from 1 to 3 months into 3 to 6 months, for doubtful receivables from 3 to 6 months into 6 to 12 months, for lost receivables from above 6 months to above 12 months (see NBP 2004). The slight decrease in profitability indicators within the period of 2008–2009 was caused by the global financial crisis. The period of 2010–2012 was the sovereign debt crisis in the Eurozone. However, in this period profitability of Polish commercial banks improved again (see Figure 2). Furthermore, in comparison to the other EU countries Polish banks performed very well (see Figure 6 and 7).

When analysing the processes that took place in the Polish banking sector over the past 15 years it should be noted that privatization led to an increase in the share of foreign capital in the Polish banking sector. As of the end of 2012, the share of banks with predominantly foreign capital was approximately 65%, whereas at the end of 1997 it was approximately 15% (see Figure 3 and 4). However the share of foreign capital between 2008–2014 decreased slightly. The fact that some banks on the list of G-SIFIs[4] are parent-banks of banks operating in Poland is significant for profitability of the Polish banking sector (e.g. Unicredit Group and Crédit Agricole Group).

The consolidation in the Polish banking sector led to changes in concentration measured with the CR5 and HHI ratios (see Figure 1). The analysis of the variability of concentration ratios in the Polish banking sector shows that in a portion of the analyses period (1998–2001) those ratios followed the upward trend. In turn, between 2002 and 2007 the concentration measures followed a slight decreasing trend. Finally, due to intensification consolidation process in the period 2008–2012 the concentration measures followed the increasing trend again.

All, above changes in the Polish banking sector led to changes in the level of competition measured with using the Lerner index and Boone indicator. It should be noted that lower concentration measures not always indicate higher competition and there was no trade-off between competition and concentration (e.g. Clerides, Delis, Kokas 2013; Pawłowska 2014). The results of the empirical analysis concerning competition measurement with the Lerner index demonstrate a slight increase in competition between 1997 and 2009. This means that the process of consolidation within the Polish banking system, which resulted in a slight increase in concentration measures, did not translate into a decrease in the degree of competition. Between 2008 and 2009 the Polish banking system was mainly affected by the financial crisis and therefore the level of competition decreased. However, in the fourth quarter of 2008 the "deposit war" created a different situation for the loans market than for the deposit market. Also, the Boone indicators presented the same trend (see: Pawłowska 2014).

[4] The list of G-SIFIs is updated each year in November by the Financial Stability Board.

Currently, the Polish banking sector is relatively small in comparison to the other EU countries, is worth 85% of the country's GDP (PFSA 2013) and has relatively simple traditional business models. Polish banks concentrate their activities on lending to local companies and households (housing and consumer loans).

3.2. Empirical results – the baseline model

In order to test the traditional SCP hypothesis and RMP hypothesis and the impact of the macroeconomic changes on profitability of banks in Poland, this study provides an investigation based on yearly data from 1997 to 2012 (covering the period of the financial crises). This data was obtained for all commercial banks operating in Poland (i.e. Polish banks, subsidiaries of foreign institutions and branches of foreign banking institutions).[5] Panel data sets combine micro-level data for Polish commercial banks and macro-level statistical data covering cyclical factors. This study uses a variety of microeconomic indicators stemming from the bank data to capture changes in the economic framework, including balance sheet and income statement figures from Narodowy Bank Polski balance sheet statistics.[6] Macroeconomic data on the growth of GDP and inflation in Poland come from the Polish Central Statistical Office.

In order to carry out a quantitative assessment of the impact of market structure on banking profitability in the Polish banking sector, the GMM estimator (the Generalized Method of Moments) was used (following Delis, Staikouras, Varlagas 2008; Athanasoglou, Brissimis, Delis 2008; Rumler, Waschiczek 2010).

The GMM estimator was proposed by Arellano and Bond (1991)[7] and was generalized by Arellano and Bover (1995) and Blundell and Bond (1998). This paper uses a system GMM that can fit the closely related, dynamic panel data models (the Arellano and Bond estimator and the Arellano and Bover estimator, as it was fully developed in Blundell and Bond (1998)). The original estimator is sometimes called a difference GMM and the augmented estimator is sometimes called a system GMM. However, xtabond2 implements both of these estimators. Being GMM estimators, the Arellano-Bond estimators include one- and two-step variants (Arellano, Bond 1991; Blundell, Bond 1998). However, using the two-step GMM estimator may impose a downward (upward) bias in standard errors (t-statistics) due to its dependence on the estimated residuals. This may lead to unreliable, asymptotic statistical inference (Bond 2002; Windmeijer 2005), especially in data samples with a relatively small cross-section dimension (Arellano, Bond 1991; Blundell, Bond 1998). However, the xtabond2 procedure allows for a finite-sample correction to the two-step covariance matrix derived by Windmeijer (2005).

Finally, taking into account the above factors, this paper uses a two-step robust estimator for the baseline model. The consistency of the GMM estimator depends on the assumption that the error term does not exhibit serial correlation and also on the assumed validity of the instruments. Therefore, we used several tests proposed by Arellano and Bond (1991) and Arellano and Bover (1995) to evaluate these assumptions. The first is the Hansen test of over-identifying restrictions, which tests the overall

[5] The numbers of banks fluctuated in the sample due to acquisitions, liquidations and new banks entering the market.

[6] Panel data sets take into account mergers and acquisitions in the Polish banking sector. The number of banks is presented after accounting for mergers and acquisitions, with the acquiring institution treated as a new entity.

[7] Use of a GMM estimator also accounts for possible correlations between any of the independent variables. For a thorough description of the various GMM estimators, see Baltagi (2001).

strength of the instruments (Arellano, Bond 1991; Arellano, Bover 1995; Blundell, Bond 1998). Then we used the Arellano-Bond tests for AR(1) and AR(2) in first differences.

Also, model estimation was performed separately to avoid any alignment of variables. In order to solve the problem arising from extreme outliers that affect estimation, all outliers are removed from each panel data set (i.e. any value below the first percentage point and also above the 99th percentage point in the sample distribution were removed).

In the model, return on assets (ROA) was used as profit indicator. In contrast, the estimations based on ROE produce inferior results (and hence they are not reported), as suggested by both the coefficients estimates and the specification tests. In order to test the traditional SCP hypothesis and RMP hypothesis the following regression with ROA as the dependent variable was calculated as follows:

$$ROA_{it} = \alpha + a_0 ROA_{it-1} + a_1 MS_{it} + a_2 RMP_{it} + a_3 BC_t + \sum_{j=1}^{N} b_j oth_{it} + \varepsilon_{it} \quad (1)$$

where ROA_{it} denotes the return on assets ratio for each bank i for each year t and ROA_{it-1} is the one--period lagged the return on assets ratio (ROA).

Market structure measures (*MS*) are determined by taking the concentration ratio, the Herfindahl--Hirschman index for assets (HHI_t) for each year t.[8] Additionally, as a proxy of market structure the regression also estimated the variable indicating the share of banks with a majority of foreign equity (FC_t) for each year t.

Market power measures (*RMP*) were calculated as:

– the share of bank assets in the total assets (MP_{it}) for each banks i for each year t,

– the Lerner index (LI_{it}) for each banks i for each year t,

– the Boone indicator (BI_{it})[9] for each banks i for each year t.

The model also tests the impact of the size on the banking sector profitability, as the relative market power measure:

– the size is calculated as the log of the total assets (LA_{it}) for each bank i for each year t.

Also, the model controls the impact of financial crisis on the relation between profitability and market structure and market power, therefore a control dummy variable was used in regression:

– the dummy CRI that takes the values of 1 if $t > 2007$ and zero elsewhere. The period of 2008–2009 was caused by the global financial crisis. The period of 2010–2012 was the sovereign debt crisis in the Eurozone.

The model also tests the impact of business cycle on banks' profitability defined as:

– CPI index (CPI_t) and GDP growth yoy (GDP_t) for each year t.

The model also tests the impact of the cost of the banks self-financing defined as:

– the 3 month WIBOR ($WIBOR3M_t$)[10] yearly average for each year t.

Control variables (oth_{it}) were used in regression such as:

– the ratio of total deposit to total assets (DTA_{it}), for each bank i for each year t,

– the ratio of total loans to total assets, as a measure of the magnitude of disintermediation tendencies (LTA_{it}), for each bank i for each year t,

[8] For robustness check in the regressions, also the CR5 concentration ratio was estimated.

[9] For more detail information of the estimations of the Lerner index and the Boone indicator see Pawłowska (2014).

[10] Yearly average based on Thomson Reuters database.

– the variable indicating efficiency of banks defined as interest cost divided by total interest income (CTI_{it}) for each bank i for each year t.

The variable α is a constant term, ε_{it} denotes the error and a_0, a_1, a_2, a_3 and b_j are the regression coefficients.

The results of all the above regressions using two-step robust GMM are presented in Table 3. Instrumental variables were used in the estimations. The lags of the dependent variable were instrumented by their available further lags and other possibly endogenous variables were instrumented also by their available further lags. Also, as a robustness check additional regressions were estimated that have only bank-level variables and time-dummies. The results of the above regressions using two--step robust GMM are presented in Table 4.

We also reported the Hansen test results for each model at the bottom of the Table as well as the results of the Arellano-Bond tests (AR[1] and AR[2]). The model seems to fit the panel data reasonably well, demonstrated by the fact that the Hansen test mostly shows no evidence of over-identifying restrictions (see Tables 3–4). Also, the highly significant coefficient of the lagged profitability variable confirms the dynamic character of the model specification.

In summing up all of the results obtained from the model, we found that the results corresponding to the role of market structure tend to be ambiguous.

The empirical results show that concentration affects bank profitability negatively, but this effect is relatively insignificant. In Table 3, the insignificant coefficient (a_1) is found in regressions A1 for *HHI*.[11] Also in Table 4, the negative and insignificant coefficient (a_1) is found in regressions A1. Hence, this study finds no evidence to support the SCP hypothesis. This outcome is in accordance with Berger (1995) and Athanasoglou, Brissimis, Delis (2008) which also found no evidence of SCP hypothesis. Furthermore, Athanasoglou, Brissimis, Delis (2008) for Greek banks found that concentration affects bank profitability negatively, but this effect was relatively insignificant in the period 1985–2001. Also, Mirzaei, Moore and Liu (2013) found no evidence of SCP hypothesis for East European countries. However, Rumler and Waschiczek (2010) found for Austrian banks that the degree of concentration had a positive effect on bank profitability from 1995 to 2009.

This paper finds that the size and relative market power have an impact on profitability on Polish commercial banks. In Table 3, the positive coefficient (a_2) is found in regressions A3. It means that banks with large market power and well-differentiated products are more efficient and can earn supernormal profits. Also this paper finds a positive impact of the size of banks, as the relative market power measure, on profitability of banks. The most estimated equations show that the effect of bank size on profitability is significant and positive (except estimations 1, 5 and 7). The explanation for this may be that large--sized banks can improve their profitability due to relative market share. Hence, this study finds evidence to support the relative market power hypothesis; however, this result is not strong. Also this paper finds a positive impact of market power measured by the Lerner index and by the Boone indicator (estimation 4 and 5 in Table 3). This may mean that high profitability can be attributed to less competitive market conditions. Also, Mirzaei, Moore and Liu (2013) found that RMP seems to perform a stabilising effect in emerging and advanced economies. However, Mirzaei, Moore and Liu (2013) found evidence to support the relative market power hypothesis in advanced economy.

This paper finds a positive impact of the share of foreign capital on the profitability of Polish banks (estimation 5 in Table 3 and estimation 4 in Table 4). However, the insignificant coefficient (a_1) is found

[11] To determine the robustness, additional estimations were calculated with CR5 ratios for each year t, as a dependent variable. The results were very similar.

in estimation 2 for FC. Generally, it seems that foreign banks bring large benefits to host countries' financial systems and economies. This outcome is in accordance with literature concerning Central and Eastern European countries (cf. Havrylchyk, Jurzyk 2011). However, Rumler and Waschiczek (2010) found for Austrian banks the negative effect of foreign ownership on the bank profits.

Furthermore, for all estimations this paper finds a negative and significant impact of cost to income ratio on profitability of banks. This means that better cost management leads to better profitability of banks, which may also support the efficiency structure hypothesis (ESH). It may mean that Polish banks also improved their efficiency during the examined period.

Furthermore, this paper finds a negative and significant impact of the ratio of total loans to total assets on profitability (estimations 4 and 5). The regression results show that banks in fact benefited from the disintermediation tendencies of the past 15 years. However, this paper finds a negative coefficient between the ratio of total deposits to total assets and profitability.

The important finding of this study is that the business cycle significantly affects bank profits and that profitability of banks is pro-cyclical. In order to test the connection between profitability and business cycle, we made an additional estimation with GDP growth without the CRI dummy. The effect of GDP growth is significant and positive. When GDP growth increases by 1%, profitability increases in the first year by 0.4%. It should be noted that this paper also finds the positive coefficients (a_3) between GDP growth in regressions A1–A2.

These results are in line with Mirzaei, Moore and Liu (2013) for Eastern Europe. However, Mirzaei, Moore and Liu (2013) found for selected big banks from Eastern Europe that when GDP growth increases by 1%, profitability measured by ROA increases in the first year by 0.03% in the period of 1999–2008. Rumler and Waschiczek (2010) found for Austrian banks that when GDP growth increases by 1%, profitability measured by ROE increases in the first year by 0.3%. Albertazzi and Gambacorta (2009) found for a full sample in the period of 1981–2003, that when GDP growth increases by 1%, profitability measured by ROE increases in the first year by 0.6%. However, Albertazzi and Gambacorta (2009) also found that in Anglo-Saxon countries profits made by banks tend to be more pro-cyclical.

Also, inflation positively and significantly affects profitability. Since during the period examined the Polish economy went through a disinflation process, the estimated positive relationship between bank profitability and inflation may mean that interest rates on bank deposits decreased at a faster rate than those on loans. However, a negative coefficient was found between the cost of the banks' self–financing and profit. Also, during the period examined the interest rates decreased, but profitability of banks generally increased. Finally (not surprisingly) the crisis had a negative impact on bank profitability. In order to test how directly the crisis affected the profitability of banks, an additional estimation was also made with the CRI dummy (without any macroeconomics variables). This paper finds a negative coefficient between the CRI dummy and profitability. However, the decrease in profitability indicators was observed only in the period 2008–2009, and in the period 2010–2012 profitability indicators improved again.

4. Conclusions

The global financial crisis resulted in a massive reduction in profitability for many banks in the EU. However, Poland experienced only a slight decrease in the profitability of its banking sector in the first part of the crisis (in 2009) – after this the profitability of the Polish banks increased.

An important element of the macro-prudential analysis is the study of the link between business cycle fluctuations and banking sector profitability and how this link is affected by structural characteristics. In order to test the traditional SCP hypothesis and the RMP hypothesis, as well as to test the impact of other bank-specific characteristics and the macroeconomic environment on the profitability of Polish banks, particularly the impact of foreign capital, this paper conducts an empirical investigation based on panel data using the GMM technique. Generally, the results of the comprehensive analysis concerning the profitability of Polish banks indicate that changes in the structure of the Polish banking sector during the past fifteen years had a positive impact on the profitability of banks. Furthermore, the results are consistent with the literature on the impact of market structure, the role of foreign capital and the cyclical factor on the profitability of banks in transition countries.

This study finds no evidence to support the SCP hypothesis. This paper demonstrates insignificant correlation between profitability and concentration for all estimations. Furthermore, the correlations between profitability and relative market power and size were positive and significant only for a few estimations, providing weak evidence in support of the RMP hypothesis. This result is in line with Mirzaei, Moore and Liu (2013) for the emerging economies and may support the efficiency structure hypothesis (ESH) for Polish banks. What is important, in each estimation this paper finds anegative and significant impact between the cost to income ratio and profitability. This means that better cost management leads to better profitability in banks. However, this paper also finds a positive impact of market power measured by the Lerner index and by the Boone indicator.

This paper also finds a negative coefficient between the ratio of total deposits to total assets and profitability. Also, this paper finds a negative coefficient between the ratio of total loans to total assets, as a measures of the magnitude of disintermediation tendencies.

The regression results showed that banks have generally benefited from a change of ownership structure during the past fifteen years. The increase of foreign capital prior to the crisis seems to have a positive impact on bank profitability. However, due to the fact that European financial institutions are the largest foreign investors in banks in Poland (having approximately 50% share in the Polish banking sector), the context of the parent banks and regulatory changes, including the implementation of the banking union project, will undoubtedly have an impact on the profitability of the Polish sector and will result in further structural changes in the Polish banking market.

Furthermore, as in other European countries, bank profitability is strongly influenced by cyclical developments and this paper finds a positive correlation between GDP growth and bank profit – the same effect was found for CPI indices. Also, this paper finds a negative correlation between WIBOR 3M and bank profit. Finally, the crisis had a negative impact on bank profitability.

The implication of this study concerning the results of market structure is that banks and regulatory agencies should focus more on how to improve efficiency and less on market concentration.

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Acknowledgements

The views expressed in this paper are the views of the author and do not necessarily reflect those of Narodowy Bank Polski. I would like to thank anonymous reviewers for helpful comments.

Appendix

Results of competition measurement on the Polish banking sector with the application of the Lerner index and the Boone indicator

Lerner index

An indicator of the degree of competition in banking markets is the estimation of the Lerner index (Lerner 1934), widely used in the specific case of banks. The Lerner index is the mark-up of price (average revenue) over marginal cost. The higher the mark-up, the greater the realized market power. The values of the index range from 0 (perfect competition) to 1 (monopoly). The Lerner index never exceeds 1 because marginal cost *MC* is never negative.

The Lerner index measures the monopolist's margin. According to the Lerner index, the market power of a monopolist depends on price elasticity of market demand. Algebraically, the Lerner index (*LI*) is presented as equation A1:

$$L = \frac{1}{|e|} = \frac{p - MC}{p} \tag{A1}$$

where: p – price, MC – marginal cost, e – price elasticity of demand.

In the case of perfect competition, price p is equal to marginal cost MC, Lerner index $L = 0$ (firms under perfect competition have no market power). Positive values of Lerner index L indicate the existence of market power. The higher the value, the greater the market power of a company/bank and the lower the market competition. In the case of monopoly, Lerner index $L = 1/e$, where e is the value of the price elasticity of demand.

The measurement of the Lerner index in the banking industry is based on the Monti-Klein model of oligopolistic competition on the deposit and credit market, pursuant to which the sensitivity of interest rates on deposits and loans to changes in inter-bank rates (regulated by the central bank) depends on the number of banks (cf. Pawłowska 2014).

Boone indicator

The alternative indicator of the degree of competition is the Boone model. The Boone method is based on the efficient structure hypothesis (ESH), which assumes that more efficient firms (with lower marginal costs) have greater market power and thus achieve higher profits. The stronger the competition, the stronger this effect. In order to support this quite intuitive market characteristic, Boone developed a broad set of theoretical models (see Boone 2008).

Boone proved that the market shares of more efficient banks (that is, with lower marginal costs *MC*) increase both under regimes of stronger substitution and amid lower entry costs. The above relationship may be expressed by the following equation:

$$\ln s_{it} = \alpha + \beta \ln MC_{it} + u_{it} \tag{A2}$$

where:

s_{it} – firm's market power defined as the market share of bank i in the period t,
MC_{it} – marginal cost of bank i in the period t,
β – estimated Boone indicator.

The measure of the degree of competition is the parameter β which takes on values below zero. The higher the degree of competition, the greater the absolute value of negative parameter β specifying the Boone indicator.

Results of competition measurement on the Polish banking sector with the application of the Lerner index and the Boone indicator

The calculation of the Lerner index in the Polish banking sector used equations (A3) and (A4) as well as a panel of annual data from balance sheets and profit and loss accounts of Polish banks for 1997–2012.

The marginal cost was estimated on the basis of translog cost function (Berger, Mester 1997) with one output (total assets) and three input prices. Symmetry and linear restrictions in input prices are imposed. The cost function was specified as follows:

$$\ln TC = \beta_0 + \beta_1 \ln y + 1/2 * \beta_2 (\ln y)^2 + \sum_{j=1}^{3} \beta_j \ln W_j + \sum_{j=1}^{3} \sum_{k=1}^{3} \beta_{jk} \ln W_j \ln W_k + \sum_{j=1}^{3} \gamma_j \ln y \ln W_j + v_{it} + z_i \quad \text{(A3)}$$

where TC denotes the firm's total costs including financial costs and operating costs, y total assets, W_i – input prices; W_1 – the price of labour (w_l), W_2 – the price of capital (w_c), W_3 – the price of funds (w_f).

The estimation of the costs function (and hence of the marginal costs) was done for all panel data. Next, the marginal cost (MC) was calculated as a derivative of the cost function against y:

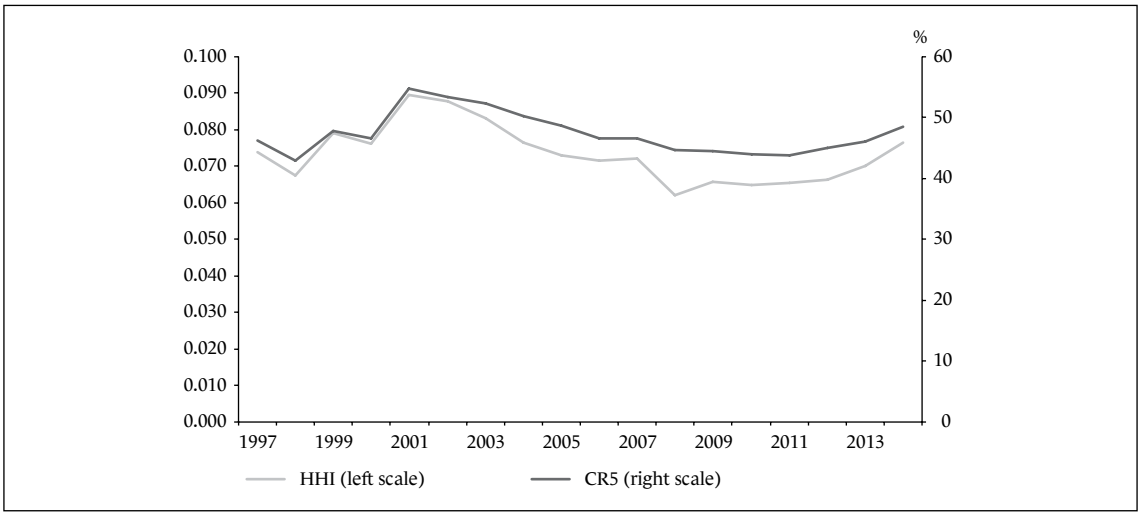
$$MC = \frac{TC}{y} \left(\beta_1 + \beta_2 (\ln y_{it}) + \sum_{j=1}^{3} \gamma_j \ln W_j \right) \quad \text{(A4)}$$

The Lerner index is calculated as the quotient of the difference between the input price and marginal cost to the input price (see equation A1). The input price in the banking sector is assumed to be interest revenue divided by assets for each bank i in the period t (cf. Pawłowska 2014). The calculated values of the Lerner index are presented in Table 1.

In order to measure the level of competition in the Polish banking sector with the Boone method (Boone 2008), the same panel of annual data from balance sheets and profit and loss accounts of commercial banks for 1997–2012 were also used.[12] As the first step to computing the Boone indicator, the marginal cost (MC) was estimated in accordance with equation A4, as in the case of the Lerner index calculation (cf. Leuvensteijn et al. 2007). In the second step, the relation between individual banks' market shares and marginal cost of production was estimated to obtain the Boone indicator as outlined in equation A2 (cf. Pawłowska 2011). Also, the average value of β coefficients, the Boone indicators, are presented in Table 1.

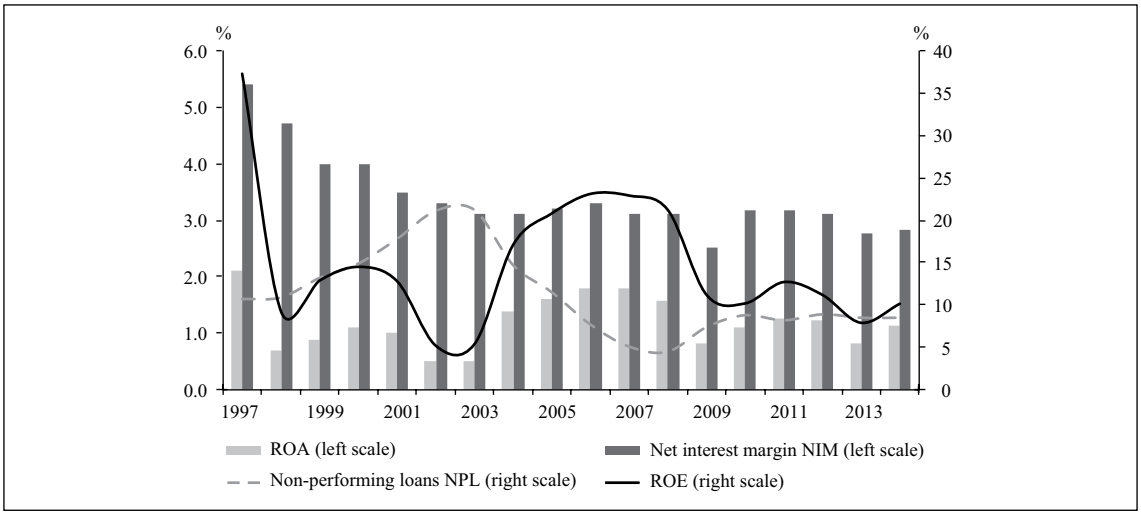
[12] Data panel included all commercial banks existing in a particular period (1997–2012), like in the case of the Lerner index calculation.

Figure 1
Concentrations in the Polish banking sector – CR5 and HHI



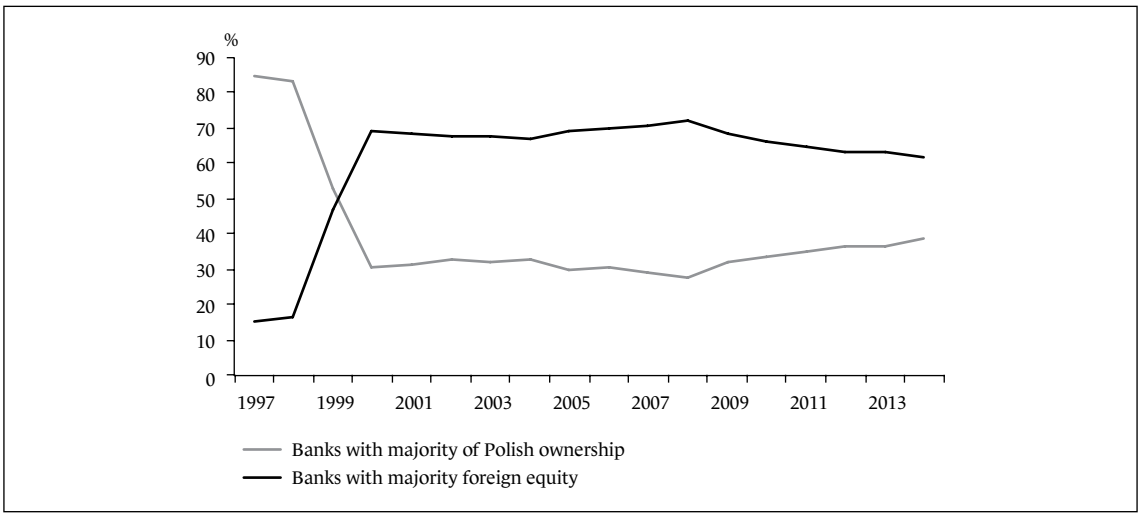
Source: PFS.

Figure 2
Commercial banking sector's profitability indicators in Poland



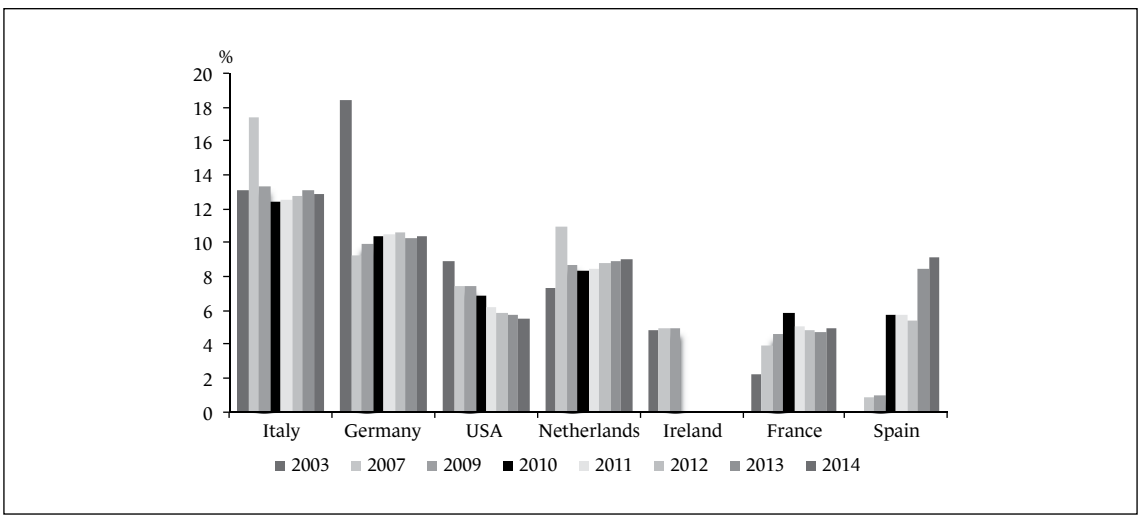
Source: NBP.

Figure 3
Share of foreign investors (in assets) in the Polish banking sector



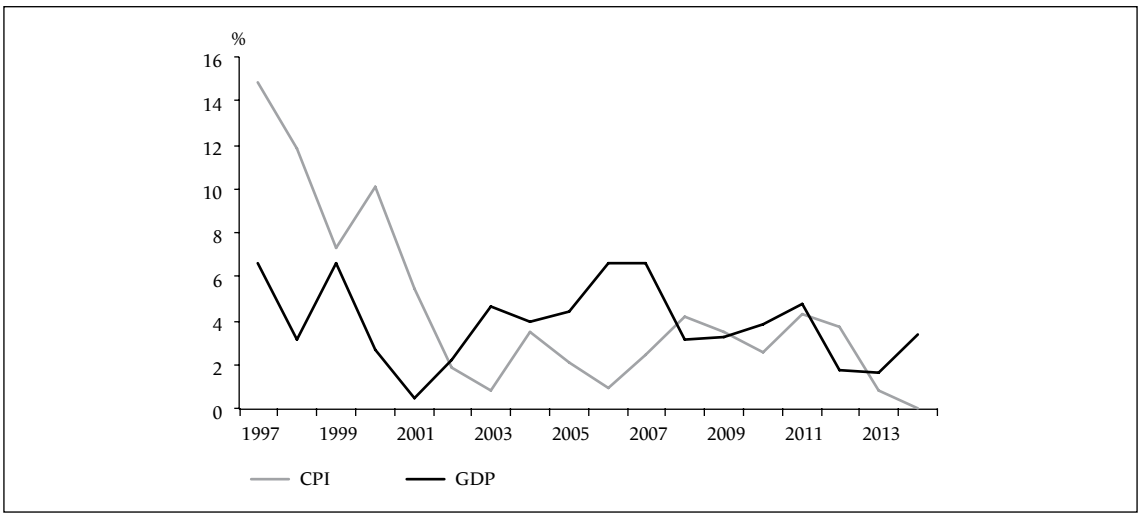
Source: CSO.

Figure 4
Share of foreign investors in assets of the Polish banking sector by country of origin



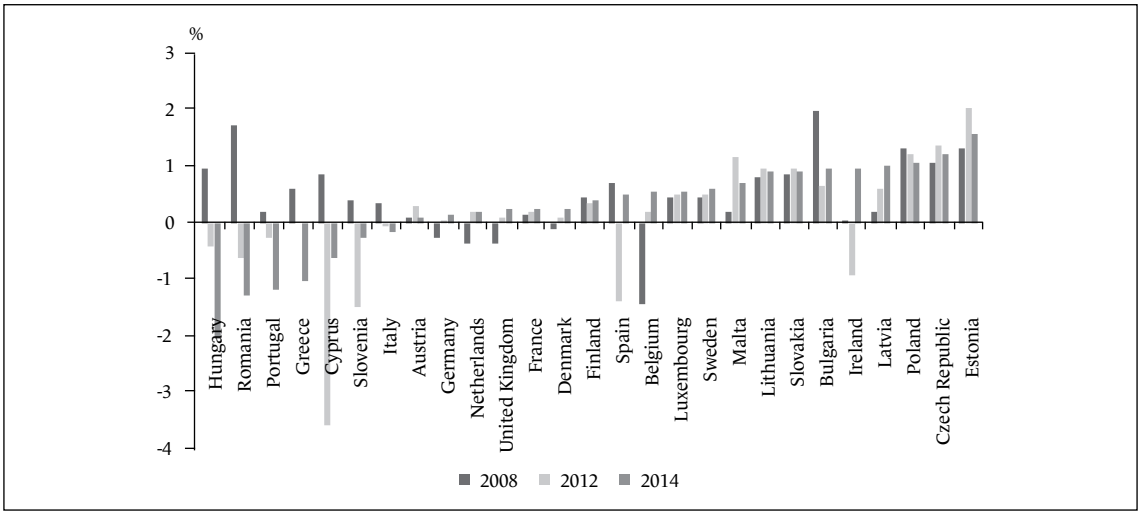
Source: PFS.

Figure 5
GDP growth and inflation rate (yoy)



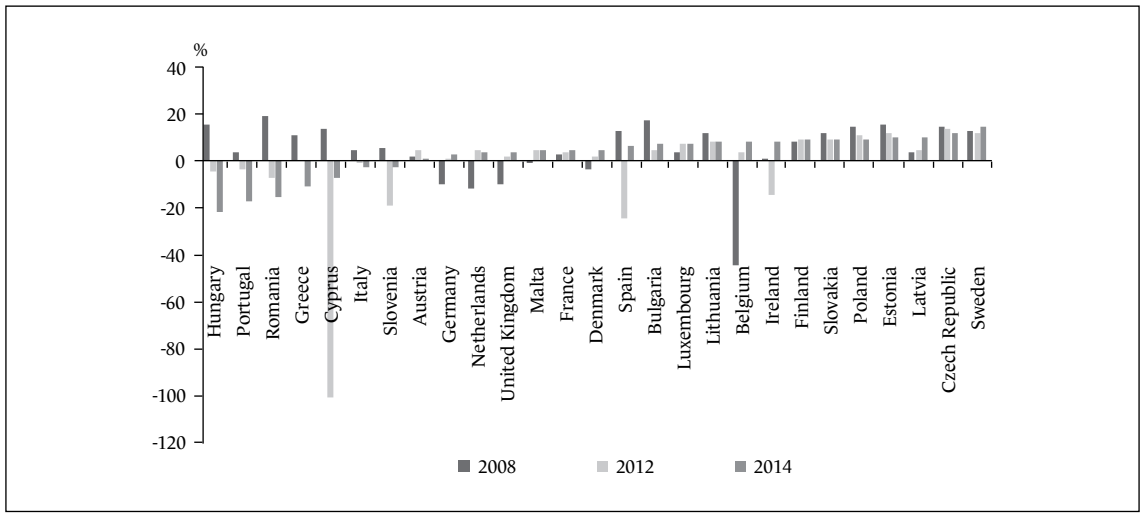
Source: CSO.

Figure 6
Profitability ratio in EU (ROA)



Source: ECB.

Figure 7
Profitability ratio in EU (ROE)



Note: ROE and ROA indicators are derived using profit after tax.
Source: ECB.

Table 1
Summary statistics on the characteristics of Polish banking sector structure and balance sheet data

	All banks			
	Mean	**SD**	**Min**	**Max**
Observations		1098		
Dependent variables				
Balance sheet data (for each bank *i* and year *t*)				
ROA ratio (%)	2.09	7.630	-117.2	114.8
ROE ratio (%)	9.04	20.51	-0.001	208.1
Independent variables				
Market structure				
Balance sheet data for each year *t*				
HHI	0.074	0.008	0.062	0.089
CR5 (%)	47.21	3.519	42.9	54.7
FC[1] (%)	58.29	19.26	15.3	72.3
Market power				
Balance sheet data (for each bank *i* and year *t*)				
MP ratio (%)	0.015	0.029	1.94e-06	0.198
Log assets (size)	14.371	2.102	6.864	19.08
Competition measure				
Lerner index (*LI*)[2]	0.194	0.228	0.013	3.913
Boone indicator (*BI*)	-1.801	1.264	-3.066	-0.285
Bank-specific variables				
Balance sheet data (for each bank *i* and year *t*)				
Total loans /assets (%)	15.23	3.213	6.865	25.35
Total deposit/assets (%)	0.417	0.413	0	6.482
Interest cost/interest income (%)	0.775	3.146	0	75.73
Macroeconomics				
Data for each year *t*				
GDP	4.05	1.819	0.5	6.6
CPI	5.48	4.166	0.8	14.9
WIBOR 3M[3]	10.46	7.041	3.84	23.91

Notes:
This table provides summary statistics – mean, min, max and standard deviation (SD) – for all variables in the model. Data are observed yearly between 1997–2012 for each Polish commercial bank and foreign bank branch.
[1] Share of foreign capital.
[2] Average of the Lerner index for each year was normalized (see Pawłowska 2014).
[3] As a proxy of the cost of credit own calculations based by Thomson Reuters database.

Source: calculations on the basis of NBP and CSO data.

Table 2
Spearman's rank correlation coefficients

	ROA	ROE	HHI	CR5	MP	Lerner	LA	CTI	DTA	LTA	FC	GDP	CPI	WIBOR	Boone
ROA	1														
ROE	0.865*	1													
HHI	-0.044	-0.071	1												
CR5	-0.075	-0.204*	0.860*	1											
MP	0.159*	-0.005	-0.061	-0.011	1										
Lerner	-0.035	0.152*	0.244*	-0.020	0.104*	1									
LA	0.131*	-0.028	-0.231*	-0.096*	0.959*	-0.033	1								
CTI	-0.247*	0.205*	0.135*	0.074	0.122*	0.437*	0.048	1							
DTA	-0.056	-0.021	-0.296*	-0.359*	0.312*	-0.076	0.387*	-0.037	1						
LTA	-0.096*	0.015	-0.396*	-0.278*	0.782*	-0.091*	0.891*	-0.035	0.566*	1					
FC	0.098	0.193*	-0.066	0.329*	0.058	-0.345*	0.162*	0.039	-0.281*	0.034	1				
GDP	0.108*	-0.095*	-0.057	-0.025	0.023	0.002	-0.021	-0.064	-0.054	-0.060	-0.144*	1			
CPI	0.088*	0.359*	-0.034	-0.392*	-0.092*	0.417*	-0.208*	0.230*	0.055	-0.207*	-0.505*	-0.101*	1		
Wibor	0.056	0.230*	0.471*	0.135*	-0.116*	0.482*	-0.328*	0.266*	-0.235*	-0.478*	-0.375*	-0.196*	0.741*	1	
Boone	0.036	0.234*	-0.611*	-0.786*	-0.004	0.112*	0.072	-0.001	0.361*	0.251*	-0.266*	0.006	0.514*	-0.074	1

* indicate significance at the 10% level.

Source: calculations on the basis of NBP and CSO data.

Table 3
Empirical results for baseline model[1]

Variables	Estimate (1)	Estimate (2)	Estimate (3)	Estimate (4)	Estimate (5)	Estimate (6)	Estimate (7)
L1.ROA	0.025*	0.023*	-0.028	0.012*	-0.128	0.023	0.024*
Market structure							
HHI	-0.014	–	–	–	–	–	–
FC	–	-0.01	–	–	0.001*	1	0.014*
Relative market power							
MP	–	–	0.047*	–	–		0.025
LA	-0.003	0.006*		0.021**	-0.004	-0.03	
Level of competition							
BI	–	–	–	0.006*	–	–	–
LI	–	–	–	–	0.007*	–	–
Macroeconomics							
GDP	–	0.13**	0.12*	–	–	0.4**	–
CPI	0.04*	–	–	–	–	–	–
Wibor			–	-0.02*	-0.01**	–	–
Bank-specific variables							
CTI	-0.076***	-0.077***	-0.057***	-0.069***	-0.055***	-0.059**	-0.068***
LTA	–	–	–	-0.026***	-0.012*	–	–
DTA	-0.001*	-0.001	-0.001	–	–	-0.001	–
Impact of the crisis (binary variable)							
CRI	-0.05*	-0.03	-0.07	-0.05*	-0.02*	–	-0.15*
Hansen test	0.907	0.747	0.810	0.830	0.848	0.876	0.703
AR(1)	0.437	0.621	0.366	0.452	0.305	0.375	0.134
AR(2)	0.325	0.288	0.467	0.337	0.336	0.452	0.266
Number of observations	963	963	963	896	896	896	896
Number of groups	117	117	117	111	111	111	111

[1] Dynamic panel-data estimation, two-step robust GMM.

Notes:
AR(1) – Arellano-Bond test for AR(1) in first differences, AR(2) – Arellano-Bond test for AR(2) in first differences. Hansen test for over-identifying restrictions in GMM dynamic model estimation.
***, ** and * indicate significance at the 1%, 5% and 10% level, respectively.

Table 4
Empirical results for robustness check[1]

Variables	**Estimate (1)**	**Estimate (2)**	**Estimate (3)**	**Estimate (4)**
L1.ROA	0.145***	0.145***	0.125***	0.203*
Relative market power				
MP	–	2.313**	–	–
LA	0.009***	–	–	–
Level of competition				
BI	–	–	0.871*	
LI	–	–	–	0.008*
Bank-specific variables				
CTI	-0.049***	-0.049***	-0.047***	-0.064***
LTA	-0.025**	-0.026***	-0.022**	-0.002**
DTA	-0.041***	-0.039***	0.039***	-0.018***
Time variables (binary variables)	Yes	Yes	Yes	Yes
Hansen test	0.893	0.923	0.963	0.902
AR(1)	0.434	0.445	0.295	0.319
AR(2)	0.335	0.337	0.348	0.356
Number of observations	963	963	896	896
Number of groups	117	117	111	111

[1] Dynamic panel-data estimation, two-step robust GMM.

Notes:
AR(1) – Arellano-Bond test for AR(1) in first differences, AR(2) – Arellano-Bond test for AR(2) in first differences. Hansen test for over-identifying restrictions in GMM dynamic model estimation.
***, ** and * indicate significance at the 1%, 5% and 10% level, respectively.