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DO COMPETITION AND MARKET STRUCTURE MATTER FOR SENSITIVITY OF BANK PROFITABILITY TO BUSINESS CYCLE?

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Do competition and market structure matter for sensitivity of bank profitability to business cycle?

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Abstract

The aim of this paper is to determine what is the effect of competition on cyclicality of bank profitability. To answer this question we apply robust fixed effects estimator to unbalanced panel of individual bank level data covering the period of 2004-2015 in over 100 countries. In our study we control for market power and market structure, as proxies for competitive environment and for net interest margin (NIM), return on assets (ROA) and return on equity (ROE) to proxy bank profitability. Our results show that decreased competition is related with an increase in procyclicality of net interest margin. This effect, however, does not hold in high-income countries. As for the ROA and ROE we find comparable results, but the effect is not always statistically significant. Market structure does affect profitability in a statistically signficant way, but seems to be important for procyclicality of ROA and ROE. We also find that the link between competition and procyclicality of profitability is non-linear and inversely U-shaped. Thus, both high and low competition intensity may reduce procyclicality of profitability.

Key words: profitability, procyclicality, competition, market structure

JEL Classification: E32, G21, G28, G32

1. Introduction

Despite the extensive debate on the determinants of profitability (see Bongini et al., 2019 and Vera Gilces et al., 2020 for the review) and on the role of business cycle (Albertazzi and Gambacorta, 2009) in bank profitability, there is no evidence of the factors driving the procyclicality of profitability. To the best of our knowledge, little is known of the links sensitivity of profitability to business cycle and competition and/or market structure. This paper aims to fill in this gap, by investigating the role of competition and of the market structure in procyclicality of profitability.

The effect of competition on cyclicality of profitability goes from initial impulse in the credit market – which is shaped by the level of competition for bank loans, than through changes in the quality of loans, to the profit and loss account, and then, as the profitability fluctuates in the business cycle, it affects the level of bank capital adequacy, and finally as a feedback effect bank lending. Changes in the supply and demand in the loan market affect the profitability. Decreases in lending

reduce the levels of interest income, which is one of the most important sources of overall profitability of banks. Retained profit creates bank capital base, which drives directly capital adequacy and risk-taking activity of banks.

This study is related to two research streams of the literature: the literature on the factors driving procyclicality in banking and the research on the role of competition in bank stability. The literature on the procyclicality in banking shows its huge diversity across-countries and banks, and suggests that it is affected by regulations, supervision, investor protection, risk perceptions and responses (in particular inadequate responses) to risks, and competition (Borio et al., 2001). The other line of research shows the linkage between competition and stability (bank risk-taking) and depending on the market analyzed (deposit versus loan market) offers several explanations for the impact of competition on bank risk-taking (Beck, 2008). This research therefore offers explanations about the potential link between competition and procyclicality in the "risk-taking channel" of procyclicality.

Procyclicality in banking is a phenomenon which may be analyzed from two perspectives, i.e. the "macro-macro" and "macro-micro approach". The macro-macro approach consists in analysis of link between aggregated variables describing real – economy and the banking sector (e.g. the growth in bank credit). This approach shows how the general economic conditions affect the aggregated measures of banking sector activity. However, it says nothing about individual responses of financial intermediaries to changing macroeconomic environment. The "macro-micro approach", on the other hand, merges the aggregated real-economy measures (e.g. business cycle) and the individual bank-level variables. Its definite benefit is the insight in the responses of individual institutions to changes in macroeconomic activity. Several papers dealing with procyclicality in banking apply this approach (Bertay et al., 2015; Olszak et al., 2017; Huizinga and Laeven, 2019, Leroy and Lucotte, 2019). In our study we also use such a strategy because we are interested in the responses of individual-bank profitability to business cycle in countries which differ in terms of competition intensity. Therefore, to investigate whether the data support the view that competition might drive the effects of business cycle on profitability, we must apply accurate indicators of banking competition and of procyclicality of profitability. The empirical procedure is as follows. First, we measure the competition intensity across-banks at a country-level using the market power proxy widely applied in the literature (Berger, et al., 2009; Turk-Ariss, 2010; Beck et al., 2013; Anginer, 2014.; Leroy and Lucotte, 2017, 2019, Fungáčová et al., 2017), i.e. the Lerner index, with a higher value indicating less market competition. This indicator varies over time, and thus may be used to analyze the impact of competition on cyclicality of profitability. Second, regarding profitability procyclicality, we follow Bouvatier et. (2012), Bertay et al. (2015) and Leroy and Lucotte (2018) by defining it as a sensitivity of profitability to real Gross Domestic Product Growth (GDPG).

In this study we apply robust fixed effects estimator to a large panel of bank-level financial data from 109 countries in 2004-2015. We also use macro-level data of business cycle and bank competition as well as market structure. Such a strategy helps us overcome the potential endogeneity bias, stemming from the fact that aggregate profitability in country k influences business cycle in this country and vice versa, as well as from the fact that bank-level profitability might directly affect bank-level market power. Our results suggest that increased competition is related with reduced procyclicality of profitability. There is diversity of this effect between high-income versus low-income countries. As our study shows, increased competition in high-income countries results in more procyclicality of NIM, whereas in low-income countries the opposite result holds. This study also gives support to the view that increased concentration in banking sector is related with increased procyclicality of return on assets and return on equity. In economic terms, our results imply that perfect competition is related with countercyclicality of effect of business cycle on net interest margin ratio. Similar implication is for the role of concentration in cyclicality of ROA and ROE. Our findings have important implications policy decision-makers. They suggest that more competitive banking

sectors or less concentrated banking sector is related with decreased procyclicality of profitability. Thus, the effectiveness of regulatory tools, such as countercyclical macroprudential policy instruments, may be affected by the competition intensity. Additionally, improvement of competitive environment in the banking industry may stimulate the procyclicality without the use of any regulatory tool.

The rest of the paper is structured as follows. Section 2 presents review of the literature and develops hypotheses. We describe our sample and research methodology in Section 3. We discuss results and robustness checks in Section 4. Section 5 concludes our work.

2. Literature review and hypotheses development

2.1. Procyclicality in banking industry and its sources

Procyclicality is an inherent feature of the financial sector and especially of bank credit activity. It can be broadly defined as an enhancing interaction between financial variables and real economic activity during the business cycle. In practical terms, procyclicality denotes the financial system's tendency to generate financial booms and busts and, more specifically, those mechanisms that feed onto themselves to amplify financial fluctuations (Borio, 2018). Procyclicality has its roots in information asymmetries between borrowers and lenders and, therefore, in changes in the access to external finance (financial accelerator theory) and in inappropriate responses by financial market participants to changes in risk over time (Borio et al., 2001; Athanasoglou et al., 2014). Financial accelerator theory is helpful in explaining large swings in the economic activity and looks at credit as amplifying the real economic sector through its impact on the investment. In contrast, the theory focusing on the inappropriate responses to risk over the business cycle sees procyclicality of credit as an endogenous factor which increases the probability of a financial crisis (instability) occurring, and not only the enhancement mechanism (Minsky, 1987; Borio, 2014; Leroy and Lucotte, 2019). In line with this concept, banks underestimate risk during booms – which is the period of excessive risk-taking and overestimate it during downturns – which is the period of excessive risk-avoidance. Both, practitioners and academic research engaged in finding solutions to achieve financial stability, perceive procyclicality of banks as one of two major factors behind excessive increase in systemic risk. Thus, since the last Global Financial Crisis of 2007/8, procyclicality has become the area of a new regulatory and supervisory policy, i.e. of the macroprudential policy. To be effective, macroprudential policy needs to consider significant factors shape the procyclicality of financial sector, and in particular of the banking sector.

Many factors can strengthen or mitigate this inherent procyclicality of bank's risk-taking and in effect, of its lending. These factors include market failures, such as incentive problems (e.g. moral hazard and incomplete contracts), information asymmetry (adverse selection, moral hazard, externalities in networks between financial intermediaries, risk illusion) and coordination problems (information cascades, agency problems, externalities in payment systems) (Bank of England, 2009) and cognitive biases (Borio et al., 2001). These basic reasons affect the risk measurement by banks and by regulators, and thus drive economic decisions. Competition between banks is also affecting the responses of banks to risk over the business cycle (Borio et al., 2001; Leroy and Lucotte, 2019), due to its direct impact on bank profits and on bank risk-taking. Theory gives some explanation how banking competition impacts on procyclicality through profits (Aliaga-Diáz and Olivero, 2010; Mandelman, 2011; Ravn, 2016). Aliaga-Diáz and Olivero (2010) show that bank market power (in particular monopoly in the banking market) generates a countercyclical price-cost margin that acts as a financial accelerator, amplifying the initial macroeconomic shock as the cost of credit increases during recessions. This mechanism results in increased procyclicality of credit in less competitive markets, due to procyclical behaviour of interest margins. The empirical evidence for this effect of competition on procyclicality of credit is presented by Leroy and Lucotte (2019) for European banks.

The research on the links between competition and stability offers further explanations about the role of competition in procyclicality through the risk-taking channel (henceforth the "risk-taking channel of procyclicality"). Basically, this literature by showing how competition in the banking market affects risk-taking, provides hypotheses for the impact of competition on cyclicality of bank profitability. The literature on the role of competition for bank risk-taking is quite extensive and covers three lines of explanations: the competition-fragility, competition-stability and non-linear (U-shaped) impact of competition on bank fragility. Traditional view sees competition as detrimental to financial stability and is supported by many theoretical contributions (Hellmann et al., 2000; Matutes and Vives, 2000). Under the competition – fragility view banks choose the risks of their asset portfolio (Marcus, 1984; Keeley, 1990). However, competition erodes bank profits and thus the banks' franchise values. In effect, bank have enhanced incentives to take on excessive risks due to the decreased costs of bankruptcy for bank shareholders. The competition-stability hypothesis, on the other hand, demonstrates that market power increases bank portfolio risks. In a theoretical paper, Boyd and De Nicolo (2005), following Stiglitz and Weiss (1981), show that as low competition increases loan rates, borrowers tend to shift to riskier projects. Consequently, banks will face lower credit risk on their loan portfolio in more competitive markets, which should lead to increased banking sector stability. Finally, a third line of research shows that the relationship between competition and risk is U-shaped (Martinez-Miera and Repullo, 2010). Thus, the impact of an increase in competition on risk may be either positive or negative, depending on other factors (Beck et al., 2013).

Empirical research on theories about the role of competition in bank risk-taking is extensive (see Beck et al., 2008 for an overview), and provides evidence for two major explanations (i.e. competition-fragility and competition-stability view). The results are heterogenous due to diversity in samples, risk measures, and competition proxies. Considering the subject matter of our paper, here we refer to recent cross-country studies. Several authors found evidence for the existence of the competition - fragility trade-off (Weill, 2013; Beck et al., 2013; Leroy and Lucotte, 2017, Phan et al., 2019; Saif-Alyousfi et al., 2020). This trade – off is, however, diversified, and may be affected by regulatory, supervisory, country-specific and institutional factors (Beck et al., 2013). The same inference is about the competition - stability view, which is also supported in several recent papers (Schaeck and Cihák, 2014; Leroy and Lucotte, 2017, Noman et al., 2018, Saif-Alyousfi et al., 2020). Of this research the most insignthful for the purpose of our study is a study by Leroy and Lucotte (2017). This study produces seemingly contradictive results, because – depending on the definition of bank stability measure, it provides support for both, competition-stability and competitio-fragility view. This study shows that if we look at the link between individual bank-maket power and individual idiosyncratic risk-taking measure, than the competition-fragility view is valid. However, if we consider the systemic risk measure (SRISK), than increased competition reduces systemic risk. Therefore, the competition-stability hypothesis is supported. Atlhough the evidence on the role of cometition for risk-taking are is extensive, it does not consider its effect on procyclicality of bank profitability. As the competition is inherent factor affecting bank risk-taking, its intensity may drive the sensitivity of profitability to business cycle in the „risk-taking channel of procyclicality".

2.2. Evidence on the effect of business cycle and competition / market concentration on profitability

Previous literature related to bank profitability and, specifically, to the impact of business cycle and of competition on profitability can be divided into two major streams. The first one covers cross-country analyses of profitability, and the other individual country studies. Generally the literature on profitability is buoyant, and in this section we cover only those recent studies, which consider business

cycle and/or competition and concentration as factors affecting profitability. There are several papers which deliver extensive literature review on the topic of profitability and bank performance, considering all its determinants (see Dietrich and Wanzenried, 2014; Tan, 2017; Vera-Gilces et at., 2020). Therefore, in this review we will be trying to consider only this previous research which matters directly for our study, i.e. on the impact of business cycle on profitability and of competition on profitability. More detailed analysis of other determinants of bank profitability will be presented in the next section.

Table 1 provides a summary of the empirical studies focusing on the set of cross-country papers (PANEL A) and individual country studies (PANEL B). As we can see from the table, most papers proxy bank profitability with net interest margin ratio (NIM), return on assets (ROA) and return on equity (ROE). The usual proxy for business cycle in this research is the real Gross Domestic Product growth rate (henceforth GDP growth rate or GDPG) (cross-country studies in this respect include: Campas, 2020; Ie and Ngo, 2020; Paltrinieri et al., 2020; Bongini et al., 2019; Martins et al., 2020; Molyneux et al., 2019; Bitar et al., 2018; Claessens et al., 2018; Maudos, 2017; Djalilov and Piesse, 2016; Petria et al., 2015; Dietrich and Wanzenried, 2014; Mirzaei et al., 2013; Bolt et al., 2012; Chen and Liao, 2011; Albertazzi and Gambacorta, 2009; individual country case studies cover: Fang, et al., 2019; Paroush and Schreiber, 2019; Bouzgarrou et al., 2018; Tan, 2017; Alhassan et al., 2016; Aydemir and Ovenc, 2016; Almeida and Divino, 2015; Trujillo-Ponce, 2013; Dietrich and Wanzenried, 2011; García-Herrero et al., 2009).

Looking first at international investigations, we find that there is a huge diversity in impact of business cycle on profitability. This diversity may be attributed to the heterogeneity of sizes of samples applied (numer of countries), type of data applied (aggregated versus individual bank-level) to the time period of analysis, economic development of these countries, types of banks (real estate, commercial, Islamic, savings and investment bank), definitions of profitability measures and the economic environment of the study (crisis period or environment of low interest rates). Most papers analysing the effect of GDP growth on ROA identifiy positive and usually statistically significant assocation (Campas, 2020; Ie and Ngo, 2020; Paltrinieri et al., 2020; Bongini et al., 2019; Martins et al., 2020; Molyneux et al., 2019; Claessens et al., 2018; Petria et al., 2015; Mirzaei et al., 2013; Bolt et al., 2012; Chen and Liao, 2011; Albertazzi and Gambacorta, 2009). Some papers, however, show ambiguous effect of GDP growth rate on profitability (Dietrich and Wanzenried , 2014; and Djalilov and Piesse, 2016), which seems to be determined by the income level of a country (positive effect in middle and high income economies, but negative in the full sample of 118 countries in study by Dietrich and Wanzenried, 2014) or by the estimation method (Djalilov and Piesse, 2016). The link between ROE and business cycle is also usually positive (Campas, 2020; Paltrinieri et al., 2020; Petria et al., 2015; Dietrich and Wanzenried, 2014; Mirzaei et al., 2013; Chen and Liao, 2011), but may turn negative in low and high income countries (Dietrich and Wanzenried, 2014). Most of the recent cross-country studies show that link between the business cycle and NIM is negative (Ie and Ngo, 2020; Molyneux et al., 2019; Claessens et al., 2018; Dietrich and Wanzenried, 2014; Bolt et al., 2012; Chen and Liao, 2011; Albertazzi and Gambacorta, 2009). Some of the cross-country analyses find a positive effect of GDP growth on NIM (Kanga et al., 2020; Martins et a., 2019; and Bitar et al., 2018). Positive, but statistically insignificant link is also found in middle-income countries by Dietrich and Wanzenried (2014).

Individual country analyses usually provide support to the view that GDP exerts posititive effect on ROA and ROE (if applied) (Fang, et al., 2019; Paroush and Schreiber, 2019; Vera-Gilces et al., 2020; Bouzgarrou et al., 2018; Alhassan et al., 2016; Aydemir and Ovenc, 2016; Trujillo-Ponce, 2013; Dietrich and Wanzenried, 2011; García-Herrero et al., 2009; Athanasoglou et al., 2008). The

link between NIM and business cycle is ambiguos. In some countries it is found to be negative, as in China (Fang et al., 2019), France (Bouzgarrou et al., 2018), Turkey (Aydemir and Ovenc, 2016), and positive in China (Tan, 2017), Ghana (Alhassan et al., 2016), Brazil (Almeida and Divino, 2015), Switzerland (Dietrich and Wanzenried, 2011).

The use of competition intensity in the research on bank profitability is rather rare, as most papers apply concentration ratios (Vera-Gilces et al., 2020, p. 150). Of recent international studies, only four apply Lerner index (Azad et al., 2020; Martins et al., 2019; Maudos et al., 2017; Chen and Liao, 2011), and only one uses Panzer Rosse H-Statistics (Chen and Liao, 2011). Individual studies also present the same pattern. Competition intensity proxied with Lerner index is applied in Vera-Gilces et al. (2020). Boone indicator is employed in Fang et al. (2019) and in Tan (2017). Panzar-Rosse H-Statistics is used in Vera-Gilces et al. (2020). The link between market power, efficiency and profitability is grounded in the structure-conduct-performance (SCP) hypothesis of Bain (1951) and Baumol (1982) and efficient structure hypothesis (ESH) of Demsetz (1973). The SCP hypothesis was originally proposed for the manufacturing sector and then tested in other industries. This theory posits that the structure of a market influences firms pricing decisions and ultimately performance, therefore the link between market share and profitability is expected to be positive. Another related market power theory addressed in the bank research on the determinants of profitability is the Market Power (MP) hypothesis and the Relative Market Power (RMP) hypothesis which implies that the most efficient firms are the firms that have already the highest market shares, and this leads them to obtain extraordinary profit levels (see Shepherd, 1983). Contrary to both the MP and RMP hypotheses, Berger (1995) strongly argues that profitability in banks can be influenced by increased efficiency. Such a notion has background in the efficient structure (ES) hypothesis of Demsetz (1973). Under this theory efficient firms enjoy lower production cost which is translated into lower pricing. This results in increased sales and higher market shares, hence high profitability. Many papers presented in Table 1 show that increase in market power of a bank is related with increase in profitability, which means that low competition intensity is related with better efficiency of banks – which is in line with MP and RMP hypotheses. Some of these studies, however, find that this effect may be diverse in the crisis period (Martins et al., 2019; Maudos, 2017) or in China in case of NIM (Fang et al., 2019).

Several cross-country studies use market structure measures, usually proxied with concentration ratio, like three (five) largest banks asset concentration ratio (CR3(CR5) in Ie and Ngo, 2020; Paltrinieri et al., 2020; Dietrich and Wanzenried, 2014; Mirzaei et al., 2013). Typical of individual country case studies is to use the Herfindahl-Hirschmann index as a proxy for market structure. These studies show that the effect of market structure on profitability is heterogenous, thus they do not definitely advocate for SCP framework. Some papers indentify a negative impact, suggesting that increased concentration in the banking market results in decreased profitablity (Kang et al., 2020; Le and Ngo, 2020; Petria et al., 2015; Dietrich and Wanzenried, 2014). Other papers, on the other hand, identify a positve impact of market concentration. Only a couple of them are international studies (Mirzaei at al., 2013; Chen and Liao, 2011), usually using data which exclude the effects of the Global Financial Crisis of 2007/8. In three individual case studies, covering the crisis period, for Ghana, Brazil and Switzerland, this effect is positive as well (Althassan et al., 2016; Almeida and Divino, 2015; and Dietrich and Wanzenried, 2011).

Table 1. Empirical evidence on the impact of business cycle and competition / concentration on bank profitability

Author(s)	Country/Countries	Period	Profitability measures	Effect of business cycle	Effect of competition	Effect of market structure
PANEL A: Cross-country studies						
Azad et al.. (2020)	20 coutries with Muslim majority	2000-2015	NIM, IEM (interest expense margin)	not included	Lerner (+) NIM, (-) IEM	
Campmas (2020)	26 European countries	1999-2015	ROA, ROE, NIM	GDP growth rate (+)		
Kanga, Murinde and Soumaré (2020)	WAEMU countries	2000-2014	ROA, ROE, NIM	output gap (+) ROA, NIM; (-) ROE		CR3(-)
le and Ngo (2020)	23 countries (aggregated data)	2002-2016	NIM, ROA	GDP growth rate (+) ROA/ (-) NIM		CR3(-)
Paltrinieri et al.. (2020)	11 countries	2007-2016	ROA, ROE	GDP growth rate (+)		
Bongini et al. (2019)	14 European countries	2006-2016	ROA	GDP growth rate (+)		
Martins, et al. (2019)	UK, Germany, U.S.	2000-2014	ROA, ROE, NIM	GPD growth on ROA (+ in whole period, negative in the crisis); ROE (-whole period)/ (+ in crisis); NIM(+)	Lerner on ROA (+); ROE (+) whole period/(-) in the crisis	
Molyneux, Reghezza and Xie (2019)	33 OECD countries	2012-2016	ROA, NIM	GDP growth (-) NIM; (+) ROA		
Bitar et al. (2018)	39 OECD countries	1999-2013	NIM	GDP growth rate (+)		
Claessens et al. (2018)	47 countries	2005-2013	NIM, ROA	GDP growth rate (-) NIM in full sample and in period of high rates / (+) in large banks; (+) ROA		
Maudos (2017)	11 European countries	2002-2012	ROA, ROE	not included/ business cycle proxied with cirsis dummy	Lerner (+)/ (-) in crisis period	
Djalilov and Piesse (2016)	16 transition and 9 developed countries	2000-2013	ROA	GDP growth rate (+/- depending on estimation)		HHI (+/-)
Petria et al. (2015)	27 EU countries	2004-2011	ROA, ROE	GDP growth rate (+)		HHI (-)

Dietrich and Wanzenried (2014)	118 countries	1998-2012	ROA, ROE, NIM	GDP growth (-) ROA in full sample/ (+) in middle and high-income countries; (+) ROE full sample/(-) low and high income countries ; (-) NIM in full sample/ (+) middle income		CR3(-) in full sample; (+/- depending on income group); CR5 (+) in full sample and advanced economies/ (-) in emerging economies
Mirzaei et al. (2013)	50 countries	1999-2008	ROA, ROE	GDP growth rate (+)		
Bolt et al. (2012)	17 OECD countries	1979-2007	NIM, ROA, Other income	GDP growth rate (-) NIM; (+) ROA		
Chen and Liao (2011)	70 countries	1992-2006	ROA, ROE, NIM	GDP growth rate (+) ROA and ROE/ (-) NIM	Lerner (+), P-R H-Statistics (-)	HHI (+), CR4 (+)
Albertazzi and Gambacorta (2009)	11 contries: EU and U.S. (aggregated data)	1981-2003	NIM, Noninterest income; ROA	GDP growth rate (+) ROA; (-) NIM; (-) Non-interest income		
PANEL B: Individual country studies						
Fang, et al. (2019)	China	2003-2016	ROA, NIM	GDP growth rate (+) ROA; (-) NIM	Boone in loan market (+); Boone in deposits (-); Boone for non-interest income (+) ROA, (-) NIM	
Paroush and Schreiber (2019)	US commercial and savings banks	1995-2015	ROA	GDP growth rate (+) in commercial banks; (-) savings banks		
Vera-Gilces et al.. (2019)	Ecuador	2002-2017	ROA	cyclical output (+)	Lerner (+); H-statistics and Boone (-)	
Bouzgarrou et al. (2018)	France	2000-2012	ROA, NIM, ROE	GDP (+) ROA; (-) NIM, ROE		
Tan (2017)	China	2003-2013	ROA, NIM	GDP growth (-) ROA; (+) NIM	Boone (+/-)	
Alhassan et al. (2016)	Ghana	2003 – 2011	ROA, ROE, NIM	GDP (+)		HHI (+) in models with GDP/(-) in models without macroeconomic variables

Aydemir and Ovenc (2016)	Turkey	2002-2014	NIM, ROA	GDP growht rate (+) ROA/ (-) NIM	HHI(-)
Almeida and Divino (2015)	Brazil	2001 – 2012	NIM	GDP (+),	HHI(+)
Trujillo-Ponce (2013)	Spain	1999 – 2009	ROA, ROE	GDP growth rate(+)	Industry concentration HHI (+),
Dietrich and Wanzenried (2011)	Switzerland	1999 – 2009	ROA, ROE, NIM	GDP growth rate (+)	HHI (+)
García-Herrero et al. (2009)	China	1997 – 2004	Pre-provision profit, ROA	GDP growth (+) ROA/ (-) Pre-provision PROFIT	HHI (-)
Athanasoglou et al. (2008)	Greek	1985 – 2001	ROA, ROE	cyclical output (+)	

2.3. Empirical evidence on the effects of competition on procyclicality in banking

The empirical evidence on the role of competition / concentration in the procyclical behavior of banks is limited. In fact there are only two papers which directly deal with this issue at a cross-country level (Bouvatier et al., 2012; Leroy and Lucotte, 2019). These papers, however, deal with procyclicality of credit. Bouvatier et al. (2012) investigate the relationship between the structure of the banking sector and credit procyclicality in the sample of 17 OECD countries over the period of 1986-2010. Using aggregated data and a panel of VAR models, they find that credit responds to business cycle shocks. To test the potential role of competition in procyclicality of credit they divide their sample of OECD banking sectors into clusters with similar banking industry structures and conclude that the structure of the banking sector is not a key determinant in assessing the procyclicality of credit. The major issue in this study is that it does not include the changing nature of market structure throughout the business cycle. Moreover, this paper does not use the traditonal measures of banking competition, but rather the measures of concentration in the banking market, i.e. the 3 largest banks assets concentration and the Herfindahl – Hirschman index. Another challenge of this study is that it uses aggregated data, thus it offers guidance for macro-level policy making, but netiher for individual-bank decision-taking nor for microprudential supervision. Leroy and Lucotte (2019), on the other hand, analyse the effect of the degree of banking competition, proxied with the Lerner index, on the procyclicality of credit of large sample of individual banks operating in 16 European countries in 2005-2014. Their results suggest that increase in competition between banks reduces procyclicality of credit. The implications of this analysis corroborate with investigation applying aggregated data, also used in this study.

Albertazzi and Gambacorta (2009) also point out at the effect of competition on the link between profitability and business cycle fluctuations. As the suggest, structural factors – including the lelvel of competition in the local credit markets, are important in studying the sensistivity of profitability to business cycle. Although they find that there is some diversity in dependence of profitability on business cycle in Anglo-Saxon countries, they do not show how this dievrsity is shaped by the competition in the credit-market.

2.4. Hypotheses

To sum up, the literature presented thus far shows that bank profitability is procyclical, and tends to improve in booms and worsen in downturs. The basic factor behind procyclicality includes the inadequade responses of banks to changes in risk over time, covered in the concept of „risk-taking channel of procyclicality". Procyclicality in banking, and in particular sensitivity of profitability to business cycle is heterogenous (see the research presented in Table 1). There are many factors which shape the responses of banking activity to business cycle, of which competition affects this procyclicality through its impact on bank-risk taking. Looking at theoretical evidence presented in Aliag-Diaz (2010), empirically supported in Leroy and Lucotte (2019) for procyclicality of bank credit we put forward hypothesis, that **increased competition reduces procyclicality of bank profitability (Hypothesis H1)**. Considering that competiton is related to mitigated risk-taking in bank credit portfolio (Boyd and de Nicolo, 2005; Leroy and Lucotte, 2017), the notion that increased competition reduces procyclicality of profitability has further support in the competition-stability hypothesis, presented in Section 2.1.

However, the literature on the role of competition for bank stability also shows that increased competition may result in greater fragility of banks (the so called competition-fragility hypothesis, by Marcus, 1984 and Keeley, 1990). As increased risk-taking is perceived as a source of more procyclicality in bank activity, we therefore put forward alternate hypothesis. In this hypothesis we

expect that **decreased competiton in banking markets reduces procyclicality of profitability (Hypothesis H2)**.

Exploring the non-linear link between competition and risk-taking (Martinez-Miera and Repullo, 2010), we may also expect that **the effect of competition on procyclicality of profitability is non-linear (Hypothesis H3).** Empirical evidence does not convincingly support the U-shaped link between risk and competition, as it show that both high and low competition intensity is related with improved stability (see Tabak et al., 2012). Therefore, we do not make expectations about the characteristics of the non-linearity of link between competition and procyclicality, i.e. of whether it is U-shaped (as in Martinez-Kiera and Repullo, 2010) or inversely U-shaped (as shown in Tabak et al., 2012). We rather investigate the data to find out what type of non-linearity (if any) of competition and cyclicality of profitability exists in the cross-country context.

3. Methodology and data

3.1. Model and variables definition

Our main interest is the relationship between competition and the pro-cyclicality of profitability of a bank. We start with the estimation of the following base specification:

$$\pi_{i,k,t} = f\left(BSOC_{i,k,t-1}, BC_{k,t}, \ , COMP_{k,t-1}\ \right)$$

Eq. (1)

Our empirical specification is designed primarily to test whether the intensity of bank competition impacts the association between profitability and business cycle. The model that we estimate the following equation:

$$\pi_{i,k,t} = f\left(BSOC_{i,k,t-1}, BC_{k,t}, \ , COMP_{k,t-1}, BC_{k,t} * COMP_{k,t-1}, \ \right) \qquad \textbf{Eq. (2)}$$

To analyze the non-linearity of impact of competition on procyclicality of profitability we shall apply the following extension of equation Eq. (2):

$$\pi_{i,k,t} = f\left(BSOC_{i,k,t-1}, BC_{k,t}, \ , COMP_{k,t-1}, BC_{k,t} * COMP_{k,t-1}, \ COMP_{k,t-1}{}^2, BC_{k,t} * COMP_{k,t-1}{}^2\ \right)$$

Eq. (3)

where i=1…N, k=1…109, and t=1…. T. N denotes the number of banks, k denotes the country, and T denotes the total number of years. In our model, π denotes the profitability of the i-th bank operating in country k in moment t, f expresses the operator of function; BSC denotes bank-specific and other control variables; *BC* is the business cycle proxied by the real GDP growth rate; $COMP_{k,t-1}$ indicates the competition intensity in the banking sector in country k at moment t-1, computed at the industry (i.e., country) level; $COMP_{k,t-1}{}^2$ expresses the non-linear link between profitability and competition.

Variable expressed in Eq. (2) as $BC_{k,t} * COMP_{k,t-1}$ and in Eq. (3) $BC_{k,t} * COMP_{k,t-1}{}^2$ denote the interaction term informing about the effect of country-specific competition in the banking industry on procyclicality of bank profitability. We do not make definite expectations about this effect, because this coefficient is used to test our hypotheses and depends on the definition of competition measure applied in the study. In the next sections we will present the expected effects

3.1.1. Dependent variables

In our study we use three different variables to measure profitability of banks, frequently applied in the banking literature (see Table 1), i.e. net interest margin (denoted NIM and is a ratio of net interest margin over lagged loans) defined as the net interest income divided by lagged loans of bank), return on assets after tax (denoted as ROA) defined as profit after tax divided by total assets and return of equity (denoted as ROE) defined as net profit after tax divided by lagged equity.

3.1.2. Determinants of bank profitability

Bank specific determinants

In our selection of bank-specific variables, we look at the banking literature on profitability (see Table 1), both individual country studies (Berger, 1995a; Guru et al., 2002; Mamatzakis and Remoundos, 2003; Pasiouras and Kosmidou, 2007; Ben Naceur and Goaied, 2008; Sufian and Habibullah, 2012; Vera-Gilces et al., 2020) and cross-country analyses (Molyneux and Thornton, 1992; Goddard et al., 2004a; Hsieh and Lee, 2010; Albertazzi and Gambacorta,2009; Naceur and Omran, 2011; Djalilov et al., 2016; Molyneux et al., 2019; Azad et al., 2020). This literature identifies several groups of bank-specific variables which include:

- *Bank business model*. We use several measures which determine business model of a bank. We employ separate set of factors for the net interest margin and for the ROA and ROE. As for the net interest margin we apply balance – sheet items which directly shape the amount of interest income and interest rate costs. Here we apply loans as a source of income, and deposits as a natural source of interest costs. Specifically, the ratio of loans to total assets (Loans/TA) and deposits to total assets (Deposits/TA) characterizes bank's business model as more or less oriented to credit intermediation and deposit collection (Athanasoglou et al., 2008; Tan, 2016; Bongini et al., 2019). For the ROA and ROE, we use the variables which describe the income diversification as determinants of bank business model. They include bank net interest margin (denoted as *NIM*) and the net commissions and fee income (denoted as *No-NIM* and is a ratio of net commissions and fees over lagged total assets) (Bongini et al., 2019). As for the effect of Loans/TA on NIM we expect a positive regression coefficient (Pasiouras and Kosmidou, 2007; Ayadi et al., 2016, Mergaerts and Vander Vennet, 2016; Kanga et al., 2020). Previous literature does not give clear guidance on the effect of deposits on NIM. On the one hand, increased deposits may result in more interest costs and in effect in reduced NIM. However, if lending increases with more deposit funding accessed by banks, than the link may be positive as well. Such a diversified effect is found by Azad et al. (2020), as it is positive for conventional banks and negative for Islamic banks. Consistent with Vera-Gilces et al. (2020) we expect these income parts to have a positive effect on profitability proxied by ROA and ROE.
- *Bank risk profile.* We include liquidity risk, solvency risk and idiosyncratic credit risk to identify the profile. While in the NIM models we proxy the liquidity risk with the ratio of liquid assets over total assets (denoted as Liquidassets), in the ROA and ROE equations we use the ratio of total loans minus total deposits over total deposits (denoted as Liquidity GAP). To proxy the solvency risk of a bank, consistent with previous research we apply equity capital over total assets (denoted as CAP). We shall apply this ratio in all profitability equations. Idiosyncratic credit risk measured with the ratio of loan loss provisions over lagged assets (denoted as LLP), is used determine the levels of ROA and ROE, because it is directly linked with their values through the profit and loss account. As for the role of liquidity in bank performance, the literature provides mixed evidence. On the one hand, Bordeleau and Graham (2010) point out that holding more liquid assets reduces a bank's illiquidy risk and hence the probability of default. This, in turn, tends to reduce financing costs and generate higher profits. Such an effect is found by Berger and Bouwman (2009), Bouzgarrou et al. (2018), Martins et al. (2019) and Azad et al. (2020). On the

other hand, Molyneux and Thornton (1992) and Goddard et al. (2010) document a negative effect of liquidity on bank performance across European countries for the periods of 1986–1989 and the mid-1990s, respectively. The same findings are shown by Tran et al. (2016) for US banks in years 1998-2009 and by Molyneux et al. (2019) for 30 OECD countries in 2012-2016. Greater levels of capital ratio are linked with higher potential to make profits as well as with lower funding costs (Molyneux and Thorton, 1992), thus that the regression coefficient on CAP may be positive (Mirzaei et al, 2013; Maudos et al., 2017; Bongini et al., 2019; Martins et al., 2019; Patrinieri et al., 2020; Vera-Gilces et al., 2020). In contrast, Le and Ngo (2020) find a negative effect of capital ratio on profitability. Consistent with previous evidence we expect that banks that are forced to make larger net loan charge-offs exhibit weaker profitability (Athanasoglou et al., 2008; Dietrich and Wanzenried, 2011, 2014; Martins et al., 2019; Campas 2020).

- The *cost-to-income ratio* (henceforth *C/I*) and *funding costs* are directly affecting the net profit of a bank and thus shape the ROA and ROE. We define the cost-to-income ratio as a ratio of overhead costs over the banking income, i.e. the sum of net interest and non-interest income) and the funding costs as a ratio of interest paid on deposits over deposits. Following previous research, we expect these costs to reduce the profitability (ROA and ROE) (Pasiouras and Kosmidou, 2007; Athanasoglou et al., 2008; Dietrich and Wanzenried, 2011, 2014; Molyneux et al., 2019; Campas 2020).
- *Bank size*: The natural logarithm of bank's total assets is used to define the size of the bank (denoted as *Size*). Literature on the relationship between size and bank profitability provides mixed evidence for the role of size (Bonigini et al., 2019; Molyneux et al., 2019). In particular, it suggests that economies of scale disappear as banks become very large (Iannotta et al., 2007; Elsas et al., 2010; Kanga et al., 2020) and banks that have become extremely large might show a negative link between size and profitability. This is caused by increased agency costs, the overhead costs of bureaucratic processes and other costs related to managing large banks. Tan (2016), Fang et al. (2019), Martins et al. (2019), and Molyneux et al. (2019) and Vera-Gilces et al. (2020) provide evidence that size reduces bank profitability. In contrast, some other papers show a positive link between size and profitability (Maudos, 2017; Parousch and Schreiber, 2019; and Paltrinieri et al., 2020).

Macroeconomic determinants

In our selection of other macroeconomic control variables (i.e. not presented with equations Eq. (1)-(3)) we include monetary policy stance (denoted as Policy rate) and unemployment rate (denoted as Unempl) .The effect of the policy rate may be either positive or negative, depending on whether this rate affects more bank lending supply or demand. On the supply side – increased monetary policy rates should result in more profitable lending and thus in enhanced profitability. This may be particularly true in the environment of relatively stable interest rates. On the other hand, increased rates may discourage potential borrowers from lending. Therefore, the interest income may be low. In effect, the impact of policy rate on profitability may be negative. Unemployment rate informs the ability of bank borrowers to repay loans. Higher levels of Unempl denote weakened capability to repay debts. This results in worsened profitability of banks. In effect we expect the Unempl to exert a negative impact on profitability.

Industry measures: competition intensity and market structure measurement

$COMP_{k,t-1}$ indicates the competition intensity in the banking sector in country k at moment t-1, computed at the industry (i.e. country) level. Previous evidence on the impact of competition on bank profitability makes ambiguous predictions about this link (see Table 1). Therefore, we do not make definite expectations as for the regression coefficient on COMP.

The literature on industrial organization offers several indicators of competition, based on different methodological approaches. They can be categorized under two headings. The first applies the traditional Structure-Conduct-Performance model, whereby indicators of market structure are used to measure the degree of competition. The second category of competition measures is based on the empirical industrial organization and develops non-structural indicators of competition that take into consideration bank conduct and financial data. In our study, we apply both a non-structural indicator of the degree of market competition, i.e., the Lerner index (Lerner) and structural indicators. The Lerner index has been used widely in bank research (Claessens and Leaven, 2004; Berger et al., 2009., Fu et al., 2014; Fungáčová et al., 2017; Alam et al., 2018; Leroy and Lucotte, 2019; Martins et al., 2019; Vera-Gilces et al., 2020). It captures the capacity of price power by calculating the difference between price and marginal costs as a percentage of price. Prices ($P_{A_{i,t}}$) are calculated as total bank revenue over assets, whereas marginal costs ($MC_{A_{i,t}}$) are obtained from an estimated translog cost function with respect to output. Higher values of the Lerner index indicate less bank competition. In particular, the degree of competition is given by the range 0<Lerner index< 1. In the case of perfect competition, the Lerner index =0; under a pure monopoly it is 1; values ranging between 0 and 1 indicate monopolistic competition; a Lerner index below 0 implies pricing below the marginal costs and could result from non-optimal bank behavior.

In our study we are interested in the effects of competition on cyclicality of bank profitability. To capture business cycle, we apply a country level annual real Gross Domestic Product Growth rate. Thus, we need a concise annual measure of competition intensity in the banking industry. We proxy this competition with the annual country – level Lerner index. This annual country-level Lerner index has been used in previous research, e.g. in Fungáčová et al. (2017) and Leroy and Lucotte (2019). We draw this variable from the World Bank's Global Financial Development Database. This index is calculated from underlying bank-by-bank data from the Bankscope database, following the methodology described in Demirgüç-Kunt et al. (2010). Additionally, considering the potential feedback effects of GDPG on competition and vice versa within the same time-period, e.g. one year, in this study we include one year lagged value of annual country - level Lerner index, denoted as Lerner(t-1). Such an approach will help us resolve potential endogeneity between business cycle and competition in the banking industry, which may be present at the same time-period.

As for the structural factors used in this paper, we apply proxies most frequently applied in cross-country research on bank profitability (see Table 1), i.e. the three largest banks and the five largest banks assets concentration ratio, proxied with, CR3 and CR5, respectively. As with the competition intensity, to tackle the potential endogeneity between GDPG and concentration, we also apply a one-year lagged CR3 and CR5 ratios.

Measures of effect of competition and market structure on cyclicality of profitability

To find out what is the effect of competition and of market structure on cyclicality of profitability we apply interaction terms denoted in Eq. (2) as $BC_{k,t} * COMP_{k,t-1}$ and in Eq. (3) $BC_{k,t} * COMP_{k,t-1}{}^2$. Due to the fact that in our study we apply GDPG as a business cycle measure and the Lerner index as a measure of competition intensity and CR3 and CR5 ratios as proxies for bank concentration, we will consider following interaction terms: $GDPG*Lerner_{(t-1)}$, $GDPG*CR3_{(t-1)}$, $GDPG*CR5_{(t-1)}$ in the analysis of Eq. (2), and interaction terms with squared competition intensity $GDPG* Lerner_{(t-1)}{}^2$ in tests about non-linear effects of competition on cyclicality, as shown in Eq. (3). As the concentration does not directly inform about competition intensity (Vera-Gilces et al., 2020, p. 150) we will not use the squared CR3(5). The regression coefficients on double interaction term of *GDPG*Lerner and of GDPG*CR3 (or CR5)* inform about the association of competition intensity (concentration) and cyclicality of profitability. To interpret these interactions in economic terms, we need to know first,

whether bank profitability is procyclical or not. Following the literature (as presented in Table 1), our baseline assumption is procyclicality of bank profits, exhibited by a positive regression coefficient on GDPG. Therefore, the interpretation of the regression coefficients on $GDPG*Lerner_{(t-1)}$, $GDPG*CR3_{(t-1)}$ and $GDPG* CR5_{(t-1)}$ will be as follows. If the coefficient is positive, this implies that low intensity of competition (high market concentration) results in more procyclicality of bank profitability, and thus, more competition is related with decreased procyclicality of profitability. Such a regression coefficient will be our test for hypothesis H1. A negative coefficient on the interaction term of $GDPG* Lerner_{(t-1)}$, ($GDPG* CR3_{(t-1)}$ and $GDPG* CR5_{(t-1)}$) will imply that increased competition (decreased concentration) is associated with more procyclicality of profitability, which is in line with our hypothesis H2. To test the non-linear link between competition and procyclicality, we use the interaction term between GDPG and squared $Lerner_{(t-1)}$. Following the concept of Martinez-Miera and Repullo (2010), we expect a positive regression coefficient on $GDPG* (Lerner_{(t-1)})^2$ if the impact of competition on procyclicality is non-linear and U-shaped. However, should the regression coefficient be negative, then link is non-linear, but inversely U-shaped, as suggested by empirical evidence in Tabak et al. (2012).

3.3. Estimation methods and endogeneity issues

One possible limitation of the suggested empirical strategy is that, in principle, the condition of the banking sector may induce changes in the business cycle, in competition and in market structure. As in our study we apply the "macro-micro approach", we believe that the chances of any individual bank affecting the business cycle and competition as well as market structure measured at the country level are very small. Additionally, following Leroy and Lucotte (2019), who analyze the role of competition in the procyclicality of bank credit in European banks, we expect that, in most cases, the weight of any random bank is small compared to that of the overall economy and also has little potential to influence competition. Thus, we are relatively confident that the business cycle and the Lerner index are exogenous with respect to profitability. To limit potential chances of double counting of efficiency in the Lerner index and in profitability ratios, we include one-year lagged value of Lerner index. In effect, we believe that our regression results capture a causal link from the business cycle, the Lerner index, and their interaction terms to bank profitability. Additionally, even if we question a direct casual link, there is still the objective fact that competition in the banking industry affects both profitability levels and responses of profitability to business cycle.

As for the bank-specific variables (CAP, Loans/Assets, Deposits/Assets, NIM, No-NIM, C/I, Funding costs, LLP, and Size) we control for potential endogeneity by including one year lagged values of each of these variables. In the estimation of Eqs. (1)– (2), the bank-level dependent variable, i.e., bank profitability, is regressed on real GDP growth, competition, and bank-(market-) level explanatory variables. Due the characteristics of our sample as well as due to objectives of the paper in our study we apply the fixed effects estimator. Additionally, to deal with potential endogeneity of the competition / concentration measures, we follow the approach applied by Albertazzi and Gambacorta (2009). They use the lagged value of the proxy of the level of competition in the banking industry.

We prefer bank-clustered, instead of country-clustered standard errors due to the characteristics of our sample. When the cluster sizes are unbalanced (which is our case, due to huge diversity of the number of banks across countries and observations in our study) and their number is relatively small, inference using a cluster-robust estimator may be incorrect (Nichols and Shaffer, 2007; Cameron and Miller, 2015). Therefore, considering the diversity of the sample of the countries in our study we employ clustering at the bank level.

3.4. Bank-level and macroeconomic data description

The data used in our analysis are a mix of bank-level and country-level data. We take bank balance-sheet and income statement information from the Bankscope database published by the Bureau Van Dijk, which provides comprehensive detailed information on banks across many countries. In this study, we apply data covering 109 countries over a period from 2004 to 2015. The data on banks are taken from unconsolidated financials (to avoid double counting of commercial and cooperative banks). We apply several filters to remove potential data errors and outliers. We exclude outliers by winsorizing all observations at 1%. Due to the fact that we are interested in the procyclicality of profitability, we focus on those banks for which we have at least 6 consecutive years' of observations on loans and assets because we use these variables in definitions of the ratios of our variables and we aim to take into account the whole business cycle. To assure the quality of the dataset, we drop those banks for which we have missing information on total assets (which is included in several bank-specific variables applied in our model, see Table A1 in the Appendix) in the 6 years' time-period. Our sample is hugely diversified in terms of the number of banks across countries (see Table A2 in the Annex) and some countries (e.g., Germany, Italy, the Russian Federation, and the United States) dominate the sample. We control for the potential estimation bias due to these large banking sectors by including the top 200 banks (in terms of balance-sheet size) and the other 100 are selected randomly from the rest of the country-level subsample. In effect, the number of observations used in our regressions is over 80,000, with the number of banks equal to 8,358 for the NIM equations. In models looking at determinants of ROA (ROE) the number of observations (banks) is more reduced due to huge number of missing data on profit and loss account for the non-interest profit. In effect it equals over 23000 observations and over 4800 banks. Some basic information about the sample is provided in Tables 2 and 3.

Country-level data used in this research are taken from the International Monetary Fund International Financial Statistics Database and from the World Bank Global Financial Development Database Macroeconomic data used in the

Looking at variables of interest to our study we find that the mean NIM equals 4.03 percent, with a standard deviation of 1.86 percentage points. The average ROE (ROA) equals 0.89 (8.35). The GDPG mean value is 2.28, with standardized variability of 2.84. As Table A1 shows (see the Appendix), there is a huge heterogeneity of the average Lerner index across countries, with a mean value of 0.238 and a standard deviation of 0.133 (see Table 2). The correlations in Table 3 indicate a statistically significant association between NIM, ROA, ROE (See PANEL A, B and C) and all the explanatory variables. In particular, the correlation coefficient for GDPG is positive for all profitability measure, suggesting that individual bank profitability is procyclical.

Our sample includes 64 low-income countries and 45 high-income countries. These countries differ slightly in terms of competition intensity and concentration (see PANEL B of Table A2 in the Appendix). Low income countries seem to be slightly more competitive, with Lerner index of 0.22 and less concentrated, with CR3 (5) of 0.655 (0.69) than high income countries, with Lerner and RC3 (5) equal to 0.224 and 0.69 (0.823), respectively. The difference in profitability is significant, with low-income countries more profitable. The mean net interest margin is 5.986% in low-income countries and 2.94% in high-income countries. The average ROA is 1.69% in low-income group and 0.837% in high-income. What is more, the mean return on equity (ROE) is 13.231% and 8.643% in low-income and high-income countries, respectively. Considering these differences, we expect to find heterogenous responses of profitability to business cycle (as shown by Dietrich and Wanzenried, 2014) and responses of cyclicality of profitability to competition depending on country income-level.

4. Research results

This section presents results of our estimations. First, we provide the results for the baseline model (Eq. (1)). Then we carry out our regression analyzes of the impact of competition and concentration on procyclicality of profitability, as described by models Eq. (2) and (3). This is followed by analysis of the income-level group and the robustness checks.

4.1. Baseline results

For the ease of exposition, we start with the general interpretation of key variables. The data shown in Table 4 presents the baseline regressions. In the first regression we include the estimations for NIM, in the second and third regression we show results for the ROA and ROE, respectively.

[insert Table 4 around here]

Bank-specific variables enter with expected signs. $Loans/TA_{(t-1)}$, $Deposits/TA_{(t-1)}$ and $Liquidassets_{(t-1)}$ enter with the expected positive coefficient also significant at 1% (see the NIM regression). The positive impact of Loans/TA on net interest margin implies that size of credit portfolio is a very important source of interest income. Looking at the positive effect of Deposits/TA on NIM we infer that better access to stable funding is related with increased net interest margin. More liquid banks (in terms of reduced Liquidity GAP) tend to be more profitable, as the regression coefficients show in models 2 and 3.

The coefficients of efficiency measures which directly shape the net profit of a bank and proxy income diversification and thus business model, including net interest margin ($NIM_{(t-1)}$) and commissions and fees income ($No\text{-}nim_{(t-1)}$), enter with expected sign. In particular, NIM and No-NIM exert a positive and statistically significant coefficients meaning that increased income is related with increased profitability.

Well-capitalised banks are more profitable, because the regression coefficient on *CAP* is positive and significant at 1% for the *NIM*, which is consistent with previous evidence (Dietrich and Wanzenried, 2014; Martins et al., 2019 and Vera-Gilces et al., 2020). However, for the *ROA* capital is not significant denoting that solvency risk is not the most significant for the overall profitability of banks. The CAP exerts a negative and statistically significant effect on ROE which is consistent with the view that increases in solvency risk are beneficiary for shareholders income and has been shown by Paltrinieri et al (2020), Martins et al. (2019) and Dietrich and Wanzenried (2014).

The ratio of loan loss provisions relative to total loans ($LLP_{(t-1)}$) is a measure of credit portfolio quality. As we can see from our estimation results, this variable has a statistically significant negative and quite strong effect on *ROA* and *ROE*. Therefore, more costly bank lending, in terms of increased credit risk, results in reduced profitability with the regression significant coefficients on *LLP* ranging between -1.829 and -0.200. This result is consistent with Dietrich and Wannzenried (2014), Fang et al. (2019), Martins et al. (2019), Molyneux et al. (2019) and Azad et al. (2020).

The negative and statistically significant coefficient on C/I implies that better cost-efficiency (i.e. decreased C/I) is associated with increased profitability in terms of *ROA* and *ROE*. Such result is consistent with Athanasoglou et al. (2008) and Dietrich and Wanzenried (2011, 2014), and shows that efficient income and cost management is fundamental to enhanced profitability of banks around the world. Funding costs do not have a significant effect on profitability, because the coefficient is hugely insignificant.

Large banks seem to be less profitable, because in our sample we find that the regression coefficient on *Size* is negative and strongly significant in all estimations. The values of this coefficient range between -0.195 (see model 2) and -2.018 (see regression 3). Our results are consistent with

Djalilov and Piesse (2016), Tan (2016), Fang et al. (2019), Molyneux et al. (2019) and Vera-Gilces et al. (2020) and imply that smaller banks tend to exhibit better profitability.

In line with previous research (see Table 1), we find that profitability is procyclical because in all specifications in Table 4 the coefficient on *GDPG* is positive and statistically significant at 1% and ranges between 0.01 (in NIM model) and 0.256 (in ROE estimations). These results imply that a one percent increase in GDPG is related with 0.01 and 0.256 percent increase in profitability. Of other macroeconomic variables, unemployment rate enters with a negative sign, consistent with the expectation that when people get redundant, banks loose on profitability. Monetary policy, proxied with Policy rate, is positively affecting profitability, which is line with the notion that increases in interest rate result in enhanced profitability.

Looking at the link between Lerner and profitability we find that it is positive – ranging between 0.002 (see regression 2 in Table 4) and 0.01 (see regressions 1 and 3 in Table 4), suggesting that higher levels of Lerner index (i.e. lower competition intensity, more market power in the banking sector) are related with increased profitability of banks. Our results are comparable with Azad et al. (2020), Martins et al. (2019), Maudos (2017), Chen and Liao (2011) and Vera-Gilces et al. (2020) and are consistent with the SCP, MP and RMP hypotheses.

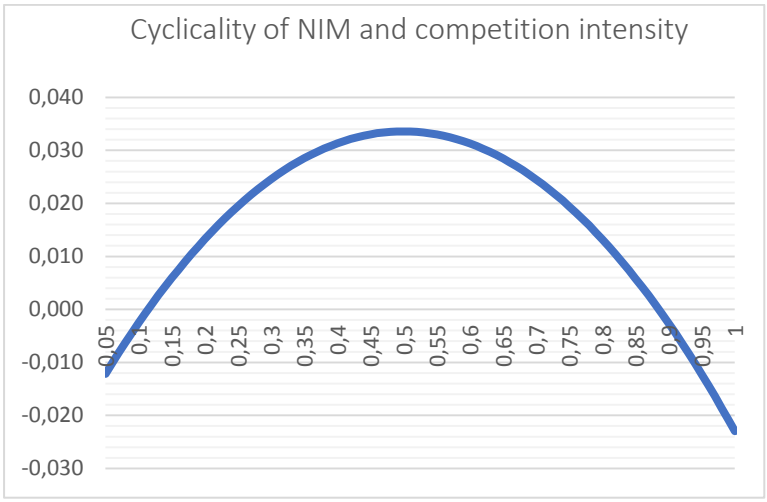
4.2. Effects of competition and of market structure on procyclicality of profitability

Table 5, 6 and 7 document the effects of competition (columns 1 and 2 in each of the Tables) and market structure (columns 3 and 4 in the Tables) on procyclicality of profitability (as shown in Table 4). In Tables 5-7 models included in columns 1, 3 and 4 are estimations of equation Eq. (2) used to test hypotheses H1 and H2. Models estimated in column 2 represent equation (3), applied to investigate whether hypothesis H3 is true. We start our analysis with net interest margin models. As the models include interaction terms between GDPG and competition, then the regression coefficient of GDPG informs about the impact of business cycle on profitability in countries in which the competition measure equals 0 (see columns 1 and 2 in Table 5). In our study this corresponds to perfect competition (Lerner=0). The regression coefficient on GDPG equals to -0.023 (column 1) and -0.03 (column 2) is negative and statistically significant, which implies that under perfect competition net interest rate margin is countercyclical.

The interaction term on GDPG*Lerner (t-1) is positive and significant for the NIM equation (see Table 4 columns 1 and 2) and thus suggests that decline in competition intensity is related with increased procyclicality of net interest margin. In particular, in economic terms if we consider the average value of Lerner index, we find that this effect is 0.011 (=-0.023 + 0.14*0.238). Such an effect is consistent with hypothesis H1, that increased competition reduces procyclicality of bank profitability. The results in column 2 suggest non-linearity of effect of competition on sensitivity of profitability to business cycle. As the regression coefficient on squared Lerner is negative (-0.226), we therefore do not find support for the view that the link between competition and procyclicality of NIM is U-shaped – as is the case if the Martinez and Repullo (2010) view was valid. Our results are, however, consistent with Tabak et al. (2012) findings for risk-taking, that both high and low competition is damaging to stability. In particulat, they suggest that both perfect competition (i.e. Lerner =0) and pure monopoly (Lerner =1) result in countercyclicality of net interest margin. Specifically, if we consider the average values of Lerner, the overall impact of GDPG on NIM negative and equals -0.019 (=-0.03+0.226*0.238-0.226*0.238*0.238). Therefore, our results support the view expressed in hypothesis H3, that the link between competition and procyclicality of profitability is non-linear. They also show that the association between competition and procyclicality of NIM is inversely U-shaped. In Figure 1 we present graphically the link between competition (the

horizontal axis) and sensitivity of net interest margin to business cycle, considering the regression coefficients included in column 2 in Table 5 and typical levels of Lerner ranging between 0 and 1.

Figure 1.
The non-linear inversely U-shaped effect of competition on cyclicality of net interest margin



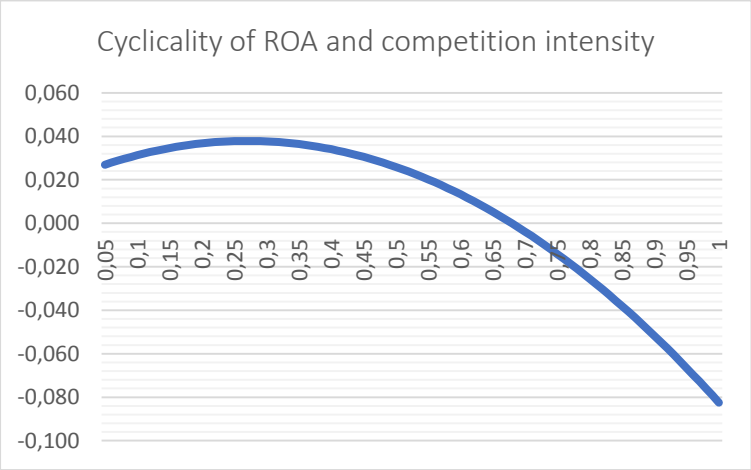
Source: Authors' analysis with input data included in Table 5 in column 2. Vertical axis denotes cyclicality; Horizontal axis denotes Lerner index values.

Looking now at the impact of market concentration on net interest margin we find that increased concentration is related with decreased profitability, which is consistent with previous research (Kanga et al., 2020; Le and Ngo, 2020; Petria et al., 2015; Dietrich and Wanzenried, 2014). The regression coefficient on double interaction term of GDPG*CR3 (CR5) is positive but not statistically significant. Therefore, market structure does not affect significantly the sensitivity of NIM to business cycle. However, the positive sign of the regression coefficients implies that increased concentration increases procyclicality of NIM. Such a result is in line with our hypothesis H1.

[insert Table 5-7 around here]

Results on another performance measure, return on assets (ROA) are presented in Table 6. As regressions included in columns 1 and 2 include interaction terms between business cycle and competition intensity measure, the coefficient on GDPG informs about the effect business cycle under perfect competition (i.e. when the Lerner index is 0). As can be seen from the Table, ROA is procyclical under perfect competition because the regression coefficient on GDPG is positive (around 0.02) and statistically significant at 1%, and implies that a one percent increase in GDPG is related with a 2% increase in ROA if the lending market is fully competitive. The results fail to support the view that the link between competition and procyclicality of ROA is purely linear, as the regression coefficient on double interaction term of GDPG*$Lerner_{(t-1)}$ is not statistically significant. There seem to be a non-linear relationship between competition and procyclicality of ROA which is denoted by significant regression coefficients on GDGP*$Lerner_{(t-1)}$ and GDPG*$Lerner_{(t-1)}^2$ (see column 2 in Table 6). In Figure 2 we present graphically the link between competition (the horizontal axis) and sensitivity of ROA to business cycle, considering the regression coefficients included in column 2 in Table 6 and typical values of Lerner ranging between 0 and 1.

Figure 2.
The non-linear inversely U-shaped effect of competition on cyclicality of return on assets



Source: Authors' analysis with input values included in Table 6 in column 2.
Vertical axis denotes cyclicality; Horizontal axis denotes Lerner index values.

Concentration in the banking market exerts a statistically significant effect on procyclicality on ROA. Increase in concentration results in a strengthened procyclicality of ROA, because the regression coefficients on GDPG*CR3 and GDPG*CR5 is positive and ranges between 0.058 (for CR3) and 0.097 (for CR5). For the ease of exposition, we consider the average level of concentration which is 0.42 for CR3 and 0.53 for CR5. At these mean values of concentration, we thus find that the average impact of GDPG on profitability is 0.026 and 0.02, for the CR3 and CR5, respectively. Therefore, we infer that at a mean concentration level, a one percentage increase in GDPG results in 2% increase of ROA (for the CR5 ratio). To sum up, the results are consistent with the view expressed in hypothesis H1, that an increase in concentration results in more procyclicality of profitability.

Table 7 includes results for our third profitability measure, ROE. Under perfect competition, the ROE is procyclical, because the regression coefficient on GDPG is positive and statistically significant and equals 0.264 (see column 1) and 0.258 (see column 2). The interaction term on GDPG*Lerner is statistically insignificant, we therefore do not find support for the view that competition significantly affects procyclicality on ROE. The interaction terms of GDPG*$Lerner_{(t-1)}$ and GDPG*$Lerner_{(t-1)}^2$ go in the same direction as in the case of NIM and ROA – suggesting potentially non-linear inversely U-shaped effect of competition on cyclicality of ROE, but are statistically insignificant. Therefore, we infer that competition does not significantly influence the sensitivity of ROE to business cycle. The effect of concentration on sensitivity of ROE to business cycle is statistically significant and of the same direction as in the case of ROA. In particular, if for the ease of exposition, we consider the average value of CR3 (CR5), than one percent increase of GDPG results in 20,2% (=0.003+0.471*0.42) increase of ROE. Our results thus imply that less concentrated banking market is associated with reduced procyclicality of ROE, which is consistent with our hypothesis H1.

4.3. The role of income group and robustness checks

The results presented in previous section show that the link between competition and cyclicality of profitability is non-linear. Previous empirical evidence shows that sensitivity of profitability to business cycle may depend on exogenous factors, such as income-level (Ditriech and Wanzenried, 2014). In this section we test if the link between competition and sensitivity of

profitability to business cycle depends on the income-level group. Next, we will conduct robustness checks for our results presented in this paper.

In Table 8 we present the association between competition and profitability in high-income versus low-income countries. As can be seen from the Table profitability is procyclical in high-income countries, because the regression coefficients on *GDPG* (see columns 2, 4 and 6) and on *GDPG*High income* (see columns 1, 3, 5) are positive and statistically significant (but for the regression coefficient in column 5). In contrast, low-income countries exhibit countercyclicality of profitability. The effect of competition on this procyclicality is significant only in the net interest margin models (see columns 1 and 2 in Table 8). From the net interest margin model, we infer that increased competition in high-income countries results in more procyclicality of NIM, because the regression coefficient on *GDPG * Lerner$_{(t-1)}$ * High-income* is negative and significant. Such a result is in line with our hypothesis H2, that decreased competiton reduces procyclicality of profitability**.** The opposite is found for NIM in low-income countries, because the regression coefficient on *GDPG *Lerner$_{(t-1)}$ * Low income* is positive and significant. Therefore, in low-income countries hypothesis H1 that increased competition is associated with a reduced procyclicality of lending is valid.

[insert Table 8 around here]

To build more confidence into our main findings, we employ several robustness checks, to determine whether our results remain unchanged. First, we investigate the robustness of our results by using the lagged value of dependent variable, to test the impact of profitability persistence. The analysis of persistence of profits in banking is important to our study and has been stressed in previous research (Bouzgarou et al., 2018; Campas, 2020; Dietrich and Wanzenried, 2014; Djalilov and Piesse, 2016). Second, we employ an alternative measure for the business cycle. To this end we include the real growth of GDP per capita instead of the real GDP growth (see Table 8). Third, as the regression models for the NIM do not include the effect of the loan portfolio quality, we use the loan-loss provisions ratio in these models. Additionally, we modify the NIM model with the inclusion of liquidity gap as alternative measure of liquidity, which were not applied in the main model of the NIM. We Estimations in Tables 9 - 12 give further support for the implications stemming from analysis covered in previous sections.

To investigate the persistence of profitability we apply one-year lagged value of NIM, ROA and ROE, denoted in the models as $NIM_{(t-1)}$, $ROA_{(t-1)}$ and $ROE_{(t-1)}$. The analysis of persistence of profitability is line with previous research (Bouzgarou et al., 2018; Campas, 2020; Dietrich and Wanzenried, 2014; Djalilov and Piesse, 2016). In particular, our tests of persistence of profitability show that the regression coefficients on lagged values of NIM, ROA and ROE are positive and statistically significant. The association between competition and cyclicality of bank profitability remains the same in the modified models. Looking at Tables 9-11 we find further support for the view that increased competition is linked with a reduced procyclicality of bank net-interest margin and of ROA. Therefore, we provide further support for hypothesis H1, that increased competition reduces procyclicality of bank profitability. Moreover, the association between competition and procyclicality of NIM and procyclicality of ROA is still non-linear and inversely U-shaped, consistent with hypothesis H3.

The inclusion of the lagged profitability gives further support for results included in our tests of the role of income-group level. As can be seen in Table 12 in high-income countries procyclicality of profitability is reduced in reduced competition in the banking industry. In contrast, in low-income countries it is increased competition that is associated with a decline in procyclicality of profitability.

[insert Table 9 -12 around here]

5. Conclusions

This paper investigates the role of the degree of banking competition and market structure in the procyclicality of bank profitability using a cross-country sample of banks from 109 countries over the period of 2004-2015.

Our study provides several important findings. First, we find that increased competition is related with a reduced procyclicality of profitability, in particular of the net interest margin ratio and of the return on assets.

Second, the research shows that the link between competition and procyclicality of profitability is non-linear and inversely U-shaped. Thus, both high and low competition intensities may be associated with a decreased procyclicality of profitability.

Third, there is a huge diversity of this effect between high-income versus low-income countries. As our study shows, increased competition in high-income countries results in more procyclicality of NIM, whereas in low-income countries the opposite result holds.

And finally, this study also gives support to the view that increased concentration in banking sector is related with significantly increased procyclicality profitability, in particular of return on assets and return on equity.

Our findings have important implications policy decision-makers. They suggest that more competitive banking sectors or less concentration in the banking sector is related with decreased procyclicality of profitability. Thus, the stimulation of competition may be an alternative way of achieving financial stability, instead of using regulatory tools (such as micro- and macroprudential policy tools). However, as the association between competition and profitability goes in opposite directions, depending on the income level-group, the conduct of this policy should consider the income level of a country.

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Appendix

Table A1. Variables definitions and data sources

Variable	Notation	Measure	Expected Effect on:		
Dependent Variables (Bank Profitability Proxies)			NIM	ROA / ROE	Data sources
Net interest margin ratio	NIM	(Total interest income minus total interest charges)/Previous year total loans			Bankscope
Return on assets	ROA	Net profit of a bank over previous year total assets			Bankscope
Return of equity	ROE	Net profit of a bank over previous year equity capital			Bankscope
Bank – specific control variables					
Credit intermediation (business model)	$Loans/TA_{(t-1)}$	Bank net loans over total assets	+		Bankscope
Deposit collection (business model)	$Deposits/TA_{(t-1)}$	Bank deposits over total assets	+/-		Bankscope
Net interest margin (sources of net profit)	$NIM_{(t-1)}$	(Total interest income minus total interest charges)/Previous year total loans		+	Bankscope
Non interest income (sources of net profit)	$No\text{-}NIM_{(t-1)}$	Net fees and commissions over previous year total assets		+	Bankscope
Liquidity risk (risk profile)	$Liquidassets_{(t-1)}$	Cash balances and short-term assets over total assets	+		Bankscope
Liquidity risk (risk profile)	Liquidity $GAP_{(t-1)}$	(Total net loans – customer deposits)/coustomer deposits	+	+/-	Bankscope
Solvency risk (risk profile)	$CAP_{(t-1)}$)	Equity capital over total assets	+/-	+/-	Bankscope
Idiosyncratic credit risk (risk profile)	$LLP_{(t-1)}$	Loan loss provisions over lagged total assets		-	Bankscope
Costs of customer deposits	Funding $costs_{(t-1)}$	Interest costs on customer deposits over customer deposits		-	Bankscope
Scale of banking activity	$Size_{(t-1)}$	Natural logarithm of total assets	-	-	Bankscope
Macroeconomic variables					
Monetary policy stance	Policy rate	Long term policy rate	+	+	IMF
Unemployment rate	Unempl	Annual unemployment rate	-	-	IMF
Business cycle	GDPG	Real gross domestic product growth rate	+/-	+	IMF
Industry-specific control variables: Competition and market structure variables					
Competition intensity	Lerner(t-1)	Lerner index lagged by one year	+/-	+/-	GFDD
Market structure	CR3	Concentration of assets of three largest banks	+/-	+/-	GFDD
Market structure	CR5	Concentration of assets of five largest banks	+/-	+/-	GFDD
Other variables					

Income level of a country	High income	Dummy taking the value of one in countries included in the high income cluster and zero otherwise	-	-	GFDD
Income level of a country	Low income	Dummy taking the value of one in countries included in the low income cluster and zero otherwise	+	+	GFDD

Notes: This table defines each main and control variables applied in this study, shows expected effect of control variables on profitability and includes data sources. IMF- International Monetary Fund; GFDD – Global Financial Development Database

Table A2. Baseline descriptive statistics across countries.

PANEL A: Basic descriptive statistics

Country	No. of banks	No. of observations	Competition (average)	Market structure (average)		Mean NIM	Mean ROA	Mean ROE	Income group
			Lerner	CR3	CR5				
Albania	10	91	0.26	0.70	0.83	4.04	0.31	5.26	Low
Algeria	16	160	0.53	0.73	0.91	5.17	1.90	12.36	Low
Angola	11	110	0.41	0.71	0.85	6.32	2.86	23.23	Low
Argentina	51	473	0.27	0.45	0.59	6.40	2.30	16.49	Low
Armenia	13	139	0.32	0.51	0.71	6.65	1.92	9.97	Low
Australia	21	222	0.12	0.68	0.90	2.23	0.76	9.60	High
Austria	138	1301	0.30	0.72	0.81	2.22	0.47	4.75	High
Azerbaijan	14	116	0.30	0.62	0.73	8.18	2.19	11.23	Low
Bahamas	4	38	0.34	0.72	0.88	2.83	1.60	11.35	High
Bahrain	5	47	0.28	0.78	0.93	2.62	1.46	8.26	High
Bangladesh	26	271	0.23	0.48	0.62	3.76	1.33	17.47	Low
Belarus	9	71	0.26	0.71	0.86	8.57	2.95	13.37	Low
Belgium	25	250	0.14	0.73	0.93	2.06	0.62	7.99	High
Belize	2	20	0.29	0.87	0.88	7.86	2.32	16.51	Low
Bhutan	2	22	.	0.99	.	5.25	1.87	18.90	Low
Bolivia	10	106	0.30	0.64	0.83	4.95	1.63	14.21	Low
Bosnia and Herzegovina	21	221	0.26	0.50	0.66	5.20	0.69	4.88	Low
Botswana	8	79	0.21	0.72	0.95	5.53	2.30	21.58	Low
Brazil	78	642	0.22	0.56	0.71	6.57	1.84	11.54	Low
Brunei Darussalam	1	11	.	.	.	5.58	1.33	18.67	High
Bulgaria	16	165	0.34	0.46	0.65	4.53	0.93	8.03	Low
Burundi	4	30	0.32	0.97	1.00	8.01	2.35	20.28	Low
Canada	14	132	-0.02	0.70	0.87	2.17	0.51	6.02	High
Cape Verde	4	43	.	0.88	1.00	4.49	0.82	12.11	Low
Chile	19	92	0.23	0.50	0.73	4.55	1.65	11.87	High
China	114	1032	0.35	0.52	0.65	3.02	0.95	14.89	Low
Colombia	4	33	0.36	0.66	0.69	11.33	2.22	9.37	Low
Costa Rica	14	147	0.25	0.60	0.78	6.13	1.59	11.40	Low
Croatia	29	302	0.28	0.57	0.76	3.94	0.21	3.37	High
Curacao	3	21	0.30	0.82	0.93	2.87	2.04	16.50	High
Cyprus	10	74	0.30	0.76	0.93	3.34	0.62	9.04	High
Czech Republic	16	170	0.36	0.64	0.78	2.72	0.89	11.98	High
Dem. Republic of Congo	9	77	0.14	0.60	0.82	8.20	1.18	10.87	Low
Denmark	38	395	0.30	0.82	0.90	3.41	0.52	5.11	High
Dominican Republic	34	254	0.12	0.70	0.86	10.23	2.15	10.49	Low
Egypt	22	237	0.05	0.58	0.69	2.93	1.16	13.42	Low
Estonia	4	34	0.24	0.95	0.99	2.56	1.56	14.29	High
Ethiopia	9	86	0.54	0.86	0.95	4.32	2.95	25.47	Low
Finland	8	75	0.09	0.95	0.98	1.34	0.49	8.07	High
France	164	1591	0.20	0.62	0.74	2.20	0.66	8.32	High
Gambia	2	19	0.24	0.98	0.99	8.11	3.06	26.20	Low
Georgia	4	26	0.31	0.68	0.83	8.64	0.24	-1.19	Low
Germany	149	1572	-0.11	0.74	0.85	2.48	0.36	4.60	High
Ghana	16	151	0.37	0.56	0.66	9.60	2.70	20.14	Low
Greece	9	87	0.22	0.67	0.88	2.77	-0.02	4.98	High
Haiti	1	7	0.18	0.93	0.97	5.97	0.85	14.65	Low
Honduras	18	178	0.26	0.51	0.68	7.73	1.46	11.93	Low

Hong Kong	12	69	-1.06	0.64	0.77	1.95	1.07	10.45	High
Hungary	12	115	0.22	0.53	0.70	3.21	0.60	6.78	High
Iceland	2	13	0.21	0.99	n.a.	7.96	2.48	21.53	High
India	55	576	0.27	0.31	0.42	3.32	1.04	13.51	Low
Indonesia	55	519	0.36	0.42	0.58	5.63	1.62	12.86	Low
Ireland	4	24	0.25	0.71	0.88	1.08	0.24	9.36	High
Israel	9	88	0.22	0.75	0.92	2.41	0.61	9.46	High
Italy	269	2863	0.14	0.56	0.67	2.70	0.52	4.89	High
Jamaica	5	47	0.34	0.88	0.99	6.49	1.44	11.49	Low
Japan	127	1349	0.36	0.42	0.56	1.50	0.18	3.71	High
Jordan	2	12	0.36	0.80	0.90	2.97	1.27	9.50	Low
Kenya	26	238	0.37	0.44	0.61	7.40	2.34	15.78	Low
Kosovo	4	34	.	.	.	7.73	1.15	9.62	Low
Kuwait	3	20	0.56	0.78	1.00	2.75	1.90	16.58	High
Kyrgyz Republic	3	34	0.44	0.77	0.98	9.62	3.85	22.60	Low
Lao PDR	1	12	.	0.92	1.00	2.69	2.23	13.24	Low
Latvia	17	168	0.31	0.57	0.72	2.69	0.65	10.20	High
Lebanon	19	145	0.04	0.43	0.65	2.75	0.72	7.96	Low
Lesotho	3	29	.	0.99	.	7.05	2.31	24.55	Low
Lithuania	8	83	0.24	0.76	0.91	2.48	0.37	5.38	High
Luxemburg	2	13	0.23	0.35	0.46	1.08	0.23	6.48	High
Malawi	4	39	0.25	0.92	1.00	11.81	4.89	26.88	Low
Malaysia	24	257	0.20	0.77	0.83	2.87	1.13	12.51	Low
Malta	6	63	0.28	0.89	0.99	2.21	0.94	6.92	High
Mauritius	14	141	0.37	0.53	0.74	2.87	1.16	12.34	Low
Mexico	27	133	0.62	0.56	0.76	4.42	0.52	3.49	Low
Mongolia	3	25	0.60	0.91	0.98	4.54	0.89	12.19	Low
Montenegro	7	74	0.02	0.67	0.89	5.59	0.80	5.21	Low
Morocco	6	53	0.26	0.66	0.84	3.99	1.20	13.76	Low
Mozambique	9	89	0.25	0.88	0.92	7.87	1.91	13.59	Low
Nepal	24	245	0.18	0.32	0.46	4.03	1.68	15.56	Low
Netherlands	13	85	0.14	0.84	0.92	1.72	0.70	8.42	Low
New Zealand	10	95	0.18	0.69	0.93	2.15	0.81	12.72	High
Nigeria	15	148	0.21	0.50	0.70	7.60	2.26	15.02	High
Norway	12	111	0.38	0.94	0.97	1.63	0.55	6.76	Low
Pakistan	21	212	0.17	0.64	0.81	4.19	0.88	11.33	High
Panama	34	225	0.35	0.47	0.59	2.87	1.81	14.56	Low
Paraguay	13	132	0.19	0.53	0.72	8.43	2.30	20.02	Low
Peru	13	125	0.30	0.76	0.89	6.77	2.04	16.08	Low
Philippines	21	217	0.21	0.44	0.61	4.04	1.35	11.92	Low
Poland	33	309	0.31	0.39	0.53	3.55	0.99	9.09	High
Portugal	19	168	0.19	0.86	0.92	3.05	0.47	3.88	High
Rep. Of Korea	12	132	0.32	0.67	0.77	2.83	0.71	11.09	High
Rep. Of Moldova	11	113	0.30	0.51	0.71	6.59	2.41	11.28	Low
Romania	19	165	0.25	0.57	0.72	5.36	0.02	1.83	Low
Russian Federation	298	3142	0.21	0.29	0.38	6.37	1.56	9.37	Low
Serbia	27	263	0.20	0.42	0.56	7.63	0.80	1.63	Low
Singapore	8	76	0.77	0.90	0.97	1.89	0.89	9.17	High
Slovak Republic	7	60	0.27	0.68	0.84	3.33	0.52	6.49	High
Slovenia	15	154	0.21	0.55	0.69	2.37	0.17	2.74	High
South Africa	12	124	0.16	0.79	0.99	5.62	1.92	16.16	Low
Spain	90	807	0.33	0.62	0.82	2.28	0.52	5.69	High
Sri Lanka	12	131	0.22	0.64	0.82	5.29	1.06	14.39	Low
Sweden	19	201	0.32	0.95	0.97	3.29	1.33	10.95	High
Switzerland	101	1060	0.16	0.89	0.92	1.51	0.77	5.57	High

Tajikistan	3	25	.	0.96	0.99	8.54	1.77	8.13	Low
Thailand	20	218	0.39	0.46	0.66	3.10	1.08	8.84	Low
Trinidad and Tobago	4	29	0.35	0.86	0.96	5.27	1.31	10.79	High
Uganda	14	123	0.28	0.57	0.74	9.69	2.84	17.14	Low
Ukraine	33	312	0.25	0.47	0.60	6.54	0.68	3.59	Low
United Kingdom	81	635	0.31	0.57	0.75	2.23	0.56	4.78	High
United States	5526	59632	0.27	0.34	0.45	4.06	0.82	8.10	High
Uruguay	17	164	0.19	0.64	0.77	4.37	0.38	3.66	High
Venezuela	21	190	-3.42	0.41	0.61	9.31	3.09	24.59	Low

PANEL B: Comparison of Lerner index, market structure and profitability across income groups

	Income group average:					
Country group	Lerner	CR3	CR5	Mean NIM	Mean ROA	Mean ROE
Low income	0.220	0.655	0.780	5.986	1.688	13.231
High income	0.224	0.690	0.823	2.940	0.836	8.643

Table 2. Descriptive statistics

Variable	NIM	ROA	ROE	Loans/TA	Deposits/TA	CAP	Liquid assets	Liquidity GAP	LLP	No-NIM	Cost / income	Funding costs	Size	Policy rate	Unempl	GDPG	Lerner	CR3	CR5
Obs	88 595	89 077	88 538	89 044	89 050	89 623	90 244	88 753	75 176	41 913	88 035	51 340	88 863	102 229	103 008	103 059	101 271	102 923	102 544
N	8 517	8 571	8 570	8 547	8 556	8 565	8 577	8 539	8 391	5 826	8 519	7 860	8 508	8 590	8 584	8 590	8 573	8 586	8 579
Mean	4.03	0.89	8.35	59.65	81.83	11.84	9.63	-25.27	0.43	0.73	68.87	3.41	12.59	-0.19	7.02	2.28	0.24	0.42	0.54
Std.Dev.	1.86	1.28	9.55	17.18	12.68	7.73	8.91	27.18	0.63	1.20	19.85	9.23	1.78	1.34	3.09	2.84	0.13	0.16	0.16

Notations: NIM - Net interest margin ratio; ROA - Return on assets; ROE - Return of equity; $Loans/TA_{(t-1)}$ - Credit intermediation (business model); $Deposits/TA_{(t-1)}$ - Deposit collection (business model); $CAP_{(t-1)}$ - Solvency risk (risk profile); $Liquidassets_{(t-1)}$ - Liquidity risk (risk profile); Liquidity $GAP_{(t-1)}$ - Liquidity risk (risk profile); $LLP_{(t-1)}$ - Idiosyncratic credit risk (risk profile); $NIM_{(t-1)}$ - Net interest margin (sources of net profit); $No\text{-}NIM_{(t-1)}$ - Non interest income (sources of net profit); $C/I_{(t-1)}$ - Cost efficiency; Funding $costs_{(t-1)}$ - Costs of customer deposits; $Size_{(t-1)}$ - Scale of banking activity; Policy rate - Monetary policy stance; Unempl - Unemployment rate; GDPG - Business cycle; $Lerner_{(t-1)}$ - Competition intensity; CR3 - Market structure; CR5 - Market structure; High income - Income level of a country; Low income - Income level of a country

Table 3. Correlation matrix

PANEL A: Correlations for NIM

	NIM		$Loans/TA_{(t-1)}$		$Deposits/TA_{(t-1)}$		$CAP_{(t-1)}$		$Liquidassets_{(t-1)}$		$Size_{(t-1)}$		Policy rate		Unempl		GDPG	
$Loans/TA_{(t-1)}$	0.094	***	1.000															
$Deposits/TA_{(t-1)}$	-0.152	***	0.098	***	1.000													
$CAP_{(t-1)}$	0.270	***	-0.184	***	-0.607	***	1.000											
$Liquidassets_{(t-1)}$	0.266	***	-0.270	***	-0.048	***	0.127	***	1.000									
$Size_{(t-1)}$	-0.256	***	0.036	***	-0.060	***	-0.240	***	-0.060	***	1.000							
Policy rate	-0.010	***	0.031	***	-0.014	***	-0.015	***	-0.013	***	-0.008	**	1.000					
Unempl	0.042	***	-0.020	***	-0.054	***	0.052	***	0.084	***	0.005		-0.102	***	1.000			
GDPG	0.168	***	-0.147	***	0.004		0.044	***	0.122	***	0.069	***	-0.067	***	-0.186	***	1.000	
$Lerner_{(t-1)}$	0.034	***	0.012	***	0.032	***	-0.004		-0.007	**	-0.041	***	0.016	***	-0.001		0.120	0.00

PANEL B: Correlations for ROA

	ROA		$CAP_{(t-1)}$		Liquidity $GAP_{(t-1)}$		$LLP_{(t-1)}$		$NIM_{(t-1)}$		No-$NIM_{(t-1)}$		$C/I_{(t-1)}$		Funding $cost_{(t-1)}$		$Size_{(t-1)}$		Policy rate		Unempl		GDPG	
$CAP_{(t-1)}$	0.149	***	1.000																					
Liquidity $GAP_{(t-1)}$	0.004		0.149	***	1.000																			
$LLP_{(t-1)}$	-0.128	***	0.092	***	0.157	***	1.000																	
$NIM_{(t-1)}$	0.343	***	0.236	***	0.168	***	0.232	***	1.000															
No-$NIM_{(t-1)}$	0.231	***	0.188	***	-0.033	***	0.189	***	0.276	***	1.000													
$C/I_{(t-1)}$	-0.420	***	0.012	***	-0.016	***	0.042	***	-0.024	***	0.014	***	1.000											
Funding $cost_{(t-1)}$	0.095	***	0.190	***	0.257	***	0.158	***	0.222	***	0.147	***	0.074	***	1.000									
$Size_{(t-1)}$	-0.007	**	-0.240	***	0.065	***	0.082	***	-0.235	***	-0.051	***	-0.251	***	0.040	***	1.000							
Policy rate	0.011	***	-0.015	***	0.040	***	-0.063	***	0.002		-0.004		-0.013	***	0.011	**	-0.008	**	1.000					
Unempl	-0.071	***	0.052	***	0.013	***	0.224	***	0.031	***	0.084	***	0.064	***	-0.050	***	0.005		-0.102	***	1.000			
GDPG	0.226	***	0.044	***	-0.128	***	0.025	***	0.140	***	0.135	***	-0.134	***	0.020	***	0.069	***	-0.067	***	-0.186	***	1.000	
Lerner $_{(t-1)}$	0.038	***	-0.004		-0.012	***	-0.008	**	-0.040	***	-0.044	***	-0.008	**	-0.021	***	-0.041	***	0.016	***	-0.001		0.120	***

PANEL C: Correlations for ROE

	ROE		$CAP_{(t-1)}$		Liquidity $GAP_{(t-1)}$		$LLP_{(t-1)}$		$NIM_{(t-1)}$		No-$NIM_{(t-1)}$		$C/I_{(t-1)}$		Funding $cost_{(t-1)}$		$Size_{(t-1)}$		Policy rate		Unempl		GDPG	
$CAP_{(t-1)}$	-0.140	***	1.000																					
Liquidity $GAP_{(t-1)}$	-0.050	***	0.149	***	1.000																			
$LLP_{(t-1)}$	-0.180	***	0.092	***	0.157	***	1.000																	
$NIM_{(t-1)}$	0.215	***	0.236	***	0.168	***	0.232	***	1.000															
No-$NIM_{(t-1)}$	0.158	***	0.188	***	-0.033	***	0.189	***	0.276	***	1.000													
$C/I_{(t-1)}$	-0.451	***	0.012	***	-0.016	***	0.042	***	-0.024	***	0.014	***	1.000											
Funding $cost_{(t-1)}$	0.036	***	0.190	***	0.257	***	0.158	***	0.222	***	0.147	***	0.074	***	1.000									
$Size_{(t-1)}$	0.086	***	-0.240	***	0.065	***	0.082	***	-0.235	***	-0.051	***	-0.251	***	0.040	***	1.000							

Policy rate	0.035	***	-0.015	***	0.040	***	-0.063	***	0.002		-0.004		-0.013	***	0.011	**	-0.008	**	1.000							
Unempl	-0.120	***	0.052	***	0.013	***	0.224	***	0.031	***	0.084	***	0.064	***	-0.050	***	0.005		-0.102	***	1.000					
GDPG	0.243	***	0.044	***	-0.128	***	0.025	***	0.140	***	0.135	***	-0.134	***	0.020	***	0.069	***	-0.067	***	-0.186	***	1.000			
$Lerner_{(t-1)}$	0.049	***	-0.004		-0.012	***	-0.008	**	-0.040	***	-0.044	***	-0.008	**	-0.021	***	-0.041	***	0.016	***	-0.001		0.120	***		

Notations: NIM - Net interest margin ratio; ROA - Return on assets; ROE - Return of equity; $Loans/TA_{(t-1)}$ - Credit intermediation (business model); $Deposits/TA_{(t-1)}$ - Deposit collection (business model); $CAP_{(t-1)}$ - Solvency risk (risk profile); $Liquidassets_{(t-1)}$ - Liquidity risk (risk profile); Liquidity $GAP_{(t-1)}$ - Liquidity risk (risk profile); $LLP_{(t-1)}$ - Idiosyncratic credit risk (risk profile); $NIM_{(t-1)}$ - Net interest margin (sources of net profit); $No\text{-}NIM_{(t-1)}$ - Non interest income (sources of net profit); $C/I_{(t-1)}$ - Cost efficiency; Funding $costs_{(t-1)}$ - Costs of customer deposits; $Size_{(t-1)}$ - Scale of banking activity; Policy rate - Monetary policy stance; Unempl - Unemployment rate; GDPG - Business cycle; $Lerner_{(t-1)}$ - Competition intensity; *.** and *** denote significance at 10%. 5% and 1% levels. respectively.

Table 4. Baseline results

	NIM			ROA		ROE	
	1			3		4	
$Loans/TA_{(t-1)}$	0.027	***	$NIM_{(t-1)}$	0.141	***	1.041	***
	(0.001)			(0.017)		(0.114)	
$Deposits/TA_{(t-1)}$	0.006	***	$No\text{-}NIM_{(t-1)}$	0.172	***	1.154	***
	(0.002)			(0.039)		(0.297)	
$Liquidassets_{(t-1)}$	0.029	***	$Liquidity\ GAP_{(t-1)}$	-0.002	***	-0.020	***
	(0.001)			(0.001)		(0.005)	
$CAP_{(t-1)}$	0.029	***	$CAP_{(t-1)}$	0.001		-0.403	***
	(0.003)			(0.007)		(0.040)	
			$LLP_{(t-1)}$	-0.200	***	-1.829	***
				(0.018)		(0.138)	
			$C/I_{(t-1)}$	-0.008	***	-0.065	***
				(0.001)		(0.008)	
			$Funding\ costs_{(t-1)}$	-0.001		0.003	
				(0.003)		(0.026)	
$Size_{(t-1)}$	-0.290	***	$Size_{(t-1)}$	-0.195	***	-2.018	***
	(0.024)			(0.029)		(0.239)	
Policy rate	0.021	***	Policy rate	0.008		0.081	*
	(0.006)			(0.007)		(0.044)	
Unempl	-0.019	***	Unempl	-0.060	***	-0.560	***
	(0.003)			(0.006)		(0.045)	
GDPG	0.009	***	GDPG	0.033	***	0.256	***
	(0.003)			(0.005)		(0.035)	
$Lerner_{(t-1)}$	0.969	***	$Lerner_{(t-1)}$	0.191	*	0.954	
	(0.129)			(0.107)		(0.756)	
Intercept	4.819	***	Intercept	3.792	***	43.812	***
	(0.330)			(0.467)		(3.718)	
Number of observations	82548			23184		23003	
Number of banks	8358			4805		4793	
R squared:							
within	0.121			0.135		0.138	
between	0.164			0.255		0.121	
overall	0.152			0.239		0.144	
Prob of F	0.00			0.00		0.00	

Notations: This this the fixed effects estimation of equation Eq. (1). NIM - Net interest margin ratio; ROA - Return on assets; ROE - Return of equity; $Loans/TA_{(t-1)}$ - Credit intermediation (business model); $Deposits/TA_{(t-1)}$ - Deposit collection (business model); $NIM_{(t-1)}$ - Net interest margin (sources of net profit. income diversification. business model); $No\text{-}NIM_{(t-1)}$ - Non interest income (sources of net profit. income diversification. business model); $Liquidassets_{(t-1)}$ - Liquidity risk (risk profile); $Liquidity\ GAP_{(t-1)}$ - Liquidity risk (risk profile); $CAP_{(t-1)}$ - Solvency risk (risk profile); $LLP_{(t-1)}$ - Idiosyncratic credit risk (risk profile); $C/I_{(t-1)}$ - Cost efficiency; $Funding\ costs_{(t-1)}$ - Costs of customer deposits; $Size_{(t-1)}$ - Scale of banking activity; Policy rate - Monetary policy stance; Unempl - Unemployment rate; GDPG - Business cycle; $Lerner_{(t-1)}$ - Competition intensity; *.** and *** denote significance at 10%. 5% and 1% levels. respectively.

Table 5. The effect of competition and market structure on cyclicality of net interest margin

	1		2		3		4	
$Loans/TA_{(t-1)}$	0.027	***	0.027	***	0.027	***	0.027	***
	(0.001)		(0.001)		(0.001)		(0.001)	
$Deposits/TA_{(t-1)}$	0.006	***	0.006	***	0.007	***	0.007	***
	(0.002)		(0.002)		(0.002)		(0.002)	
$Liquidity_{(t-1)}$	0.029	***	0.029	***	0.031	***	0.031	***
	(0.001)		(0.001)		(0.001)		(0.001)	
$CAP_{(t-1)}$	0.029	***	0.029	***	0.030	***	0.030	***
	(0.003)		(0.003)		(0.003)		(0.003)	
$Size_{(t-1)}$	-0.281	***	-0.288	***	-0.293	***	-0.279	***
	(0.024)		(0.024)		(0.024)		(0.024)	
Policy Rate	0.018	***	0.012	*	0.032		0.034	
	(0.006)		(0.006)		(0.006)		(0.006)	
Unempl	-0.018	***	-0.018	***	-0.015	***	-0.011	***
	(0.003)		(0.003)		(0.003)		(0.003)	
GDPG	**-0.023**	***	**-0.030**	***	**0.009**		**0.012**	
	(0.007)		(0.007)		(0.007)		(0.008)	
$Lerner_{(t-1)}$	0.580	***	0.331	**				
	(0.001)		(0.002)					
$GPPG*Lerner_{(t-1)}$	**0.140**	***	**0.226**	***				
	(0.026)		(0.037)					
$Lerner_{(t-1)}^2$			1.035	***				
			(0.204)					
$GDPG*Lerner_{(t-1)}^2$			**-0.226**	***				
			(0.073)					
CR3					-0.661	***		
					(0.128)			
GDPG * CR3					**0.013**			
					(0.014)			
CR5							-0.752	***
							(0.142)	
GDPG * CR5							**0.008**	
							(0.013)	
Intercept	4.786	***	4.872	***	5.260	***	5.176	
	(0.329)		(0.330)		(0.326)		(0.325)	
Number of observations	82548		82548		83218		83011	
Number of banks	8358		8358		8387		8375	
R squared:								
within	0.124		0.126		0.117		0.118	
between	0.166		0.163		0.170		0.171	
overall	0.154		0.152		0.157		0.160	
Prob of F	0.00		0.00		0.00		0.00	

Notations: This this the fixed effects estimation of equation Eq. (2). NIM - Net interest margin ratio; $Loans/TA_{(t-1)}$ - Credit intermediation (business model); $Deposits/TA_{(t-1)}$ - Deposit collection (business model); $Liquidassets_{(t-1)}$ - Liquidity risk (risk profile); $CAP_{(t-1)}$ - Solvency risk (risk profile); $Size_{(t-1)}$ - Scale of banking activity; Policy rate - Monetary policy stance; Unempl - Unemployment rate; GDPG - Business cycle; $Lerner_{(t-1)}$ - Competition intensity; CR3 - Market structure; CR5 - Market structure; *.** and *** denote significance at 10%. 5% and 1% levels. respectively.

Table 6. The effect of competition and market structure on cyclicality of ROA

	1		2		3		4	
	coefficient/std err		coefficient/std err		coefficient/std err		coefficient/std err	
$NIM_{(t-1)}$	0.140	***	0.138	***	0.138	***	0.141	***
	(0.017)		(0.017)		(0.016)		(0.017)	
$No\text{-}NIM_{(t-1)}$	0.169	***	0.170	***	0.177	***	0.178	***
	(0.039)		(0.039)		(0.038)		(0.038)	
$Liquidity\ GAP_{(t-1)}$	-0.002	***	-0.002	***	-0.002	***	-0.002	***
	(0.001)		(0.001)		(0.001)		(0.001)	
$CAP_{(t-1)}$	0.001		0.002		0.000		0.001	
	(0.007)		(0.007)		(0.007)		(0.007)	
$LLP_{(t-1)}$	-0.199	***	-0.200	***	-0.202	***	-0.202	***
	(0.018)		(0.018)		(0.018)		(0.018)	
$C/I_{(t-1)}$	-0.008	***	-0.008	***	-0.008	***	-0.008	***
	(0.001)		(0.001)		(0.001)		(0.001)	
$Funding\ costs_{(t-1)}$	-0.001		-0.001		-0.002		-0.002	
	(0.003)		(0.003)		(0.003)		(0.003)	
$Size_{(t-1)}$	-0.195	***	-0.194	***	-0.205	***	-0.196	***
	(0.029)		(0.029)		(0.029)		(0.029)	
Policy rate	0.007		0.005		0.010		0.011	
	(0.007)		(0.007)		(0.007)		(0.007)	
Unempl	-0.060	***	-0.059	***	-0.054	***	-0.052	***
	(0.006)		(0.006)		(0.006)		(0.006)	
GDPG	**0.024**	***	**0.021**	***	**0.002**		**-0.032**	*
	(0.008)		(0.008)		(0.013)		(0.017)	
$Lerner_{(t-1)}$	0.072		-0.294					
	(0.113)		(0.002)					
$GDPG*Lerner_{(t-1)}$	0.039		0.122	**				
	(0.029)		(0.050)					
$Lerner_{(t-1)}^2$			0.654	**				
			(0.282)					
$GDPG*Lerner_{(t-1)}^2$			-0.226	**				
			(0.099)					
CR3					-0.618	***		
					(0.102)			
GDPG*CR3					0.058	**		
					(0.023)			
CR5							-0.764	***
							(0.128)	
GDPG*CR5							0.097	***
							(0.026)	
Intercept	3.816	***	3.832	***	4.265	***	4.278	***
	(0.466)		(0.466)		(0.459)		(0.464)	
Number of observations	23184		23184		23561		23460	

Number of banks	4805	4805	4826	4816
R squared:				
within	0.135	0.136	0.137	0.139
between	0.255	0.257	0.238	0.243
overall	0.239	0.240	0.226	0.229
Prob of F	0.00	0.00	0.00	0.00

Notations: This this the fixed effects estimation of equation Eq. (2). ROA - Return on assets; $NIM_{(t-1)}$ - Net interest margin (sources of net profit. income diversification. business model); $No\text{-}NIM_{(t-1)}$ - Non interest income (sources of net profit. income diversification. business model); $Liquidassets_{(t-1)}$ - Liquidity risk (risk profile); Liquidity $GAP_{(t-1)}$ - Liquidity risk (risk profile); $CAP_{(t-1)}$ - Solvency risk (risk profile); $LLP_{(t-1)}$ - Idiosyncratic credit risk (risk profile); $C/I_{(t-1)}$ - Cost efficiency; Funding $costs_{(t-1)}$ - Costs of customer deposits; Size $_{(t-1)}$ - Scale of banking activity; Policy rate - Monetary policy stance; Unempl - Unemployment rate; GDPG - Business cycle; $Lerner_{(t-1)}$ - - Competition intensity; CR3 - Market structure; CR5 - Market structure; *.** and *** denote significance at 10%. 5% and 1% levels. respectively.

Table 7. The effect of competition and market structure on cyclicality of ROE

	1		2		3		4	
	coefficient/st d err		coefficient/st d err		coefficient/st d err		coefficient/st d err	
$NIM_{(t-1)}$	1.042	***	1.039	***	1.019	***	1.040	***
	(0.113)		(0.114)		(0.110)		(0.111)	
$No\text{-}NIM_{(t-1)}$	1.156	***	1.160	***	1.183	***	1.195	***
	(0.296)		(0.296)		(0.285)		(0.293)	
Liquidity $GAP_{(t-1)}$	-0.020	***	-0.020	***	-0.022	***	-0.022	***
	(0.005)		(0.005)		(0.005)		(0.005)	
$CAP_{(t-1)}$	-0.403	***	-0.400	***	-0.407	***	-0.399	***
	(0.040)		(0.040)		(0.041)		(0.041)	
$LLP_{(t-1)}$	-1.829	***	-1.831	***	-1.848	***	-1.838	***
	(0.138)		(0.138)		(0.136)		(0.136)	
$C/I_{(t-1)}$	-0.065	***	-0.065	***	-0.068	***	-0.067	***
	(0.008)		(0.008)		(0.007)		(0.007)	
Funding $costs_{(t-1)}$	0.003		0.003		0.001		-0.001	
	(0.026)		(0.026)		(0.026)		(0.026)	
$Size_{(t-1)}$	-2.019	***	-2.018	***	-2.101	***	-2.033	***
	(0.239)		(0.239)		(0.237)		(0.237)	
Policy rate	0.082	*	0.079	*	0.099	**	0.101	**
	(0.043)		(0.044)		(0.043)		(0.043)	
Unempl	-0.560	***	-0.558	***	-0.508	***	-0.503	***
	(0.045)		(0.045)		(0.046)		(0.046)	
GDPG	**0.264**	***	**0.258**	***	**0.003**		**-0.180**	
	(0.053)		(0.053)		(0.115)		(0.139)	
$Lerner_{(t-1)}$	1.051		0.348					
	(0.919)		(1.462)					
$GPPG*Lerner_{(t-1)}$	-0.032		0.138					
	(0.201)		(0.291)					
$Lerner_{(t-1)}^2$			1.360					
			(1.758)					
$GDPG*Lerner_{(t-1)}^2$			-0.455					
			(0.628)					

CR3			-4.119 ***	
			(0.912)	
GDPG*CR3			0.471 **	
			(0.220)	
CR5				-5.026 ***
				(1.001)
GDPG*CR5				0.651 ***
				(0.215)
Intercept	43.793 ***	43.809 ***	47.107 ***	46.978 ***
	(3.711)	(3.72)	(3.66)	(3.683)
Number of observations	23003	23003	23377	23276
Number of banks	4793	4793	4814	4804
R squared:				
within	0.138	0.138	0.140	0.140
between	0.121	0.121	0.113	0.118
overall	0.144	0.144	0.133	0.135
Prob of F	0.00	0.00	0.00	0.00

Notations: This this the fixed effects estimation of equation Eq. (2). Dependent variable: ROE - Return of equity; Independent variables: $NIM_{(t-1)}$ - Net interest margin (sources of net profit. income diversification. business model); $No\text{-}NIM_{(t-1)}$ - Non interest income (sources of net profit. income diversification. business model); $Liquidassets_{(t-1)}$ - Liquidity risk (risk profile); $Liquidity\ GAP_{(t-1)}$ - Liquidity risk (risk profile); $CAP_{(t-1)}$ - Solvency risk (risk profile); $LLP_{(t-1)}$ - Idiosyncratic credit risk (risk profile); $C/I_{(t-1)}$ - Cost efficiency; $Funding\ costs_{(t-1)}$ - Costs of customer deposits; $Size_{(t-1)}$ - Scale of banking activity; Policy rate - Monetary policy stance; Unempl - Unemployment rate; GDPG - Business cycle; $Lerner_{(t-1)}$ - Competition intensity; CR3 - Market structure; CR5 - Market structure; *.** and *** denote significance at 10%. 5% and 1% levels. respectively.

Table 8. The effect of competition on cyclicality of bank profitability in high versus low income countries

	NIM		NIM		ROA		ROA		ROE		ROE	
	1		2		3		4		5		6	
	coefficient/std err	p-val.	coefficient/std err	p-val.	coefficient/std err	p-val.	coefficient/std err	p-val.	coefficient/std err	p-val.	coefficient/std err	p-val.
GDPG	**-0.074**	***	**0.024**	***	**-0.006**		**0.038**	***	**0.140**		**0.298**	***
	(0.014)		(0.003)		(0.017)		(0.007)		(0.105)		(0.056)	
$Lerner_{(t-1)}$	0.620	**	0.001		0.000		-0.001		0.014		-0.011	
	(0.003		(0.001)		(0.003)		(0.001)		(0.021)		(0.009)	
$GDPG*Lerner_{(t-1)}$	0.261	***	0.038	***	0.095	*	0.055	**	0.027		0.528	**
	(0.044)		(0.014)		(0.057)		(0.026)		(0.369)		(0.222)	
GDPG*High income	0.098	***			0.044	**			0.158			
	(0.014)				(0.018)				(0.119)			
$Lerner_{(t-1)}$*High income	-0.509	*			-0.114				-2.431			
	(0.273)				(0.290)				(2.328)			
$GDPG*Lerner_{(t-1)}$*High income	-0.223	***			-0.040				0.502			
	(0.047)				(0.063)				(0.432)			
GDPG*Low income			-0.098	***			-0.044	**			-0.158	
			(0.014)				(0.018)				(0.119)	
$Lerner_{(t-1)}$*Low income			0.509	*			0.114				2.431	
			(0.273)				(0.290)				(2.328)	
$GDPG*Lerner_{(t-1)}$*Low income			0.223	***			0.040				-0.502	
			(0.047)				(0.063)				(0.432)	
Intercept	4.840	***	4.840	***	3.962	***	3.962	***	44.860	***	44.860	***
	(0.330)		(0.330)									
					(0.465)		(0.465)		(3.703)		(3.703)	
Number of observations	82548		82548		23184		23184		23003		23003	

Number of banks	8358	8358	4805	4805	4793	4793
R squared:						
within	0.129	0.129	0.137	0.137	0.140	0.140
between	0.168	0.168	0.246	0.246	0.113	0.113
overall	0.156	0.156	0.231	0.231	0.137	0.137
Prob of F	0.00	0.00	0.00	0.00	0.00	0.00

Notations: This this the fixed effects estimation of equation Eq. (2). NIM - Net interest margin ratio; ROA - Return on assets; ROE - Return of equity; Loans/$TA_{(t-1)}$ - Credit intermediation (business model); Deposits/$TA_{(t-1)}$ - Deposit collection (business model); $CAP_{(t-1)}$ - Solvency risk (risk profile); $Liquidassets_{(t-1)}$ - Liquidity risk (risk profile); Liquidity $GAP_{(t-1)}$ - Liquidity risk (risk profile); $LLP_{(t-1)}$ - Idiosyncratic credit risk (risk profile); $NIM_{(t-1)}$ - Net interest margin (sources of net profit); No-$NIM_{(t-1)}$ - Non interest income (sources of net profit); $C/I_{(t-1)}$ - Cost efficiency; Funding $costs_{(t-1)}$ - Costs of customer deposits; $Size_{(t-1)}$ - Scale of banking activity; Policy rate - Monetary policy stance; Unempl - Unemployment rate; GDPG - Business cycle; $Lerner_{(t-1)}$ - Competition intensity; CR3 - Market structure; CR5 - Market structure; High income - Income level of a country; Low income - Income level of a country; *.** and *** denote significance at 10%. 5% and 1% levels. respectively.

Table 9. Robustness checks of the effect of competition and market structure on cyclicality of net interest margin

			CR3	**CR5**	**GDPG per capita**	
	1	2	3	4	5	6
	coefficient /std err	coefficient/std err	coefficient/std err	coefficient/std err	coefficient/std err	coefficient/std err
$NIM_{(t-1)}$	0.463 ***	0.462 ***	0.467 ***	0.469 ***		
	(0.011)	(0.011)	(0.010)	(0.011)		
Loans/$TA_{(t-1)}$	0.012 ***	0.012 ***	0.012 ***	0.012 ***	0.027 ***	0.024 ***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Deposits/$TA_{(t-1)}$	0.003 **	0.003 **	0.003 ***	0.003 **	0.006 ***	
	(0.001)	(0.001)	(0.001)	(0.001)	(0.002)	
$Liquidity_{(t-1)}$	0.014 ***	0.014 ***	0.015 ***	0.015 ***	0.029	
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	
$LiquidityGAP_{(t-1)}$						0.020 **

											(0.002)	
$CAP_{(t-1)}$	0.022	***	0.022	***	0.022	***	0.023	***	0.029	***	-0.003	***
	(0.002)		(0.002)		(0.002)		(0.002)		(0.003)		(0.001)	
$LLP_{(t-1)}$											-0.205	
											(0.024)	
$Size_{(t-1)}$	-0.202	***	-0.205	***	-0.205	***	-0.197	***	-0.281	***	0.006	***
	(0.016)		(0.016)		(0.016)		(0.016)		(0.023)		(0.007)	
Policy Rate	0.036	***	0.034	***	0.043	***	0.043	***	0.018	***	0.017	**
	(0.006)		(0.006)		(0.005)		(0.005)		(0.006)		(0.007)	
Unempl	0.002		0.002		0.003		0.005	**	-0.019	***	-0.005	
	(0.002)		(0.002)		(0.002)		(0.002)		(0.003)		(0.003)	
GDPG	**-0.004**		**-0.007**		**0.004**		**0.007**		**-0.025**	***	0.001	
	(0.005)		(0.005)		(0.006)		(0.007)		(0.006)		(0.008)	
$Lerner_{(t-1)}$	0.232	**	0.173						0.677	***	1.194	***
	(0.093)		(0.001)						(0.121)		(0.175)	
$GDPG*Lerner_{(t-1)}$	0.065	***	0.094	***					0.150	***	0.050	*
	(0.021)		(0.035)						(0.026)		(0.030)	
$Lerner_{(t-1)}^2$			0.351	*								
			(0.198)									
$GDPG*Lerner_{(t-1)}^2$			-0.066									
			(0.071)									
Market structure					-0.440	***	-0.422	***				
					(0.089)		(0.098)					
GDPG*Market structure					0.020	*	0.013					
					(0.012)		(0.011)					
Intercept	3.246	***	3.278	***	3.468	***	3.389	***	4.784	***	2.970	***
	(0.222)		(0.224)		(0.220)		(0.219)		(0.329)		(0.220)	
Number of observations	82258		82258		82923		82723		82548		70726	
Number of banks	8347		8347		8376		8364		8358		8193	
R squared:												

within	0.330	0.330	0.330	0.332	0.124	0.077
between	0.836	0.833	0.827	0.834	0.164	0.107
overall	0.728	0.725	0.723	0.727	0.152	0.104
Prob of F	0.00	0.00	0.00	0.00	0.00	0.00

Notations: This this the fixed effects estimation of equation Eq. (2). Dependent variable: NIM - Net interest margin ratio; Explanatory variables: Loans/$TA_{(t-1)}$ - Credit intermediation (business model); Deposits/$TA_{(t-1)}$ - Deposit collection (business model); $CAP_{(t-1)}$ - Solvency risk (risk profile); $Liquidassets_{(t-1)}$ - Liquidity risk (risk profile); Liquidity $GAP_{(t-1)}$ - Liquidity risk (risk profile); $LLP_{(t-1)}$ - Idiosyncratic credit risk (risk profile); $NIM_{(t-1)}$ - Net interest margin (sources of net profit); No-$NIM_{(t-1)}$ - Non interest income (sources of net profit); $C/I_{(t-1)}$ - Cost efficiency; Funding $costs_{(t-1)}$ - Costs of customer deposits; $Size_{(t-1)}$ - Scale of banking activity; Policy rate - Monetary policy stance; Unempl - Unemployment rate; GDPG - Business cycle; $Lerner_{(t-1)}$ - Competition intensity; CR3 - Market structure; CR5 - Market structure*.** and *** denote significance at 10%. 5% and 1% levels. respectively.

Table 10. Robustness checks of the effect of competition and market structure on cyclicality of ROA- the role of profit persistance

					CR3		CR5	
	1		2		3		4	
	coefficient/std err	p-val.	coefficient/std err	p-val.	coefficient/std err	p-val.	coefficient/std err	p-val.
$ROA_{(t-1)}$	0.138	***	0.138	***	0.141	***	0.138	***
	(0.028)		(0.028)		(0.027)		(0.027)	
GDPG	**0.024**	***	**0.021**	***	**0.002**		**-0.032**	*
	(0.008)		(0.008)		(0.012)		(0.017)	
$Lerner_{(t-1)}$	0.054		-0.254					
	(0.111)		(0.201)					
GDPG*$Lerner_{(t-1)}$	0.036		0.110	**				
	(0.029)		(0.052)					
$Lerner_{(t-1)}^2$			0.560	*				
			(0.291)					
GDPG*$Lerner_{(t-1)}^2$			-0.193	*				
			(0.101)					
Market Structure					-0.612	***	-0.768	***
					(0.099)		(0.125)	

GDPG*Market Structure					0.055	**	0.096	***
					(0.023)		(0.025)	
Intercept	3.245	***	3.259	***	3.694	***	3.725	***
	(0.468		(0.470)		(0.459)		(0.465)	
Number of observations	23123		23123		23500		23399	
Number of banks	4798		4798		4819		4809	
R squared:								
within	0.141		0.142		0.144		0.146	
between	0.314		0.316		0.295		0.299	
overall	0.276		0.278		0.263		0.265	
Prob of F	0.00		0.00		0.00		0.00	

Notations: This this the fixed effects estimation of equation Eq. (2). Dependent variable: ROA - Return on assets; Independent variables: ; $NIM_{(t-1)}$ - Net interest margin (sources of net profit. income diversification. business model); $No\text{-}NIM_{(t-1)}$ - Non interest income (sources of net profit. income diversification. business model); $Liquidassets_{(t-1)}$ - Liquidity risk (risk profile); Liquidity $GAP_{(t-1)}$ - Liquidity risk (risk profile); $CAP_{(t-1)}$ - Solvency risk (risk profile); $LLP_{(t-1)}$ - Idiosyncratic credit risk (risk profile); $C/I_{(t-1)}$ - Cost efficiency; Funding $costs_{(t-1)}$ - Costs of customer deposits; $Size_{(t-1)}$ - Scale of banking activity; Policy rate - Monetary policy stance; Unempl - Unemployment rate; GDPG - Business cycle; $Lerner_{(t-1)}$ - Competition intensity; CR3 - Market structure; CR5 - Market structure; *.** and *** denote significance at 10%. 5% and 1% levels. respectively.

Table 11. Robustness checks of the effect of competition and market structure on cyclicality of ROE – the role of profit persistance

					CR3		CR5	
	1		2		3		4	
	coefficient/std err		coefficient/std err		coefficient/std err		coefficient/std err	
$ROE_{(t-1)}$	0.146	***	0.146	***	0.146	***	0.143	***
	(0.020)		(0.020)		(0.020)		(0.020)	
GDPG	**0.261**	***	**0.255**	***	**0.045**		**-0.132**	
	(0.052)		0.052		(0.112)		(0.135)	
$Lerner_{(t-1)}$	1.097		(0.681)					
	(0.886)		1.433)					
$GDPG*Lerner_{(t-1)}$	-0.014		(0.111					
	(0.195)		0.297)					
$Lerner_{(t-1)}^2$			1.097					
			(1.77)					
$GDPG*Lerner_{(t-1)}^2$			-0.324					
			(0.628)					
Market Structure					-4.061	***	-4.975	***
					(0.892)		(0.969)	
GDPG*Market Structure					0.395	*	0.582	***
					(0.215)		(0.209)	
Intercept	36.153	***	36.138	***	39.548	***	39.568	***
	(3.675)		(3.682)		(3.644)		(3.666)	
Number of observations	22818		22818		23186		23087	
Number of banks	4776		4776		4797		4788	
R squared:								
within	0.145		0.145		0.147		0.146	
between	0.183		0.183		0.168		0.170	
overall	0.191		0.191		0.178		0.178	
Prob of F	0.00		0.00		0.00		0.00	

Notations: This this the fixed effects estimation of equation Eq. (2). NIM - Net interest margin ratio; ROA - Return on assets; ROE - Return of equity; Loans/TA(t-1) - Credit intermediation (business model); $Deposits/TA_{(t-1)}$ - Deposit collection (business model); $CAP_{(t-1)}$ - Solvency risk (risk profile); $Liquidassets_{(t-1)}$ - Liquidity risk (risk profile);

Liquidity $GAP_{(t-1)}$ - Liquidity risk (risk profile); $LLP_{(t-1)}$ - Idiosyncratic credit risk (risk profile); $NIM_{(t-1)}$ - Net interest margin (sources of net profit); $No\text{-}NIM_{(t-1)}$ - Non interest income (sources of net profit); $C/I_{(t-1)}$ - Cost efficiency; Funding $costs_{(t-1)}$ - Costs of customer deposits; $Size_{(t-1)}$ - Scale of banking activity; Policy rate - Monetary policy stance; Unempl - Unemployment rate; GDPG - Business cycle; $Lerner^{(t-1)}$ - Competition intensity; CR3 - Market structure; CR5 - Market structure*.** and *** denote significance at 10%. 5% and 1% levels. respectively.

Table 12. Robustness checks of the effect of competition on cyclicality of bank profitability in high versus low income countries – the role of persistance of profits

	NIM		NIM		ROA		ROA		ROE		ROE	
	1		2		3		4		5		6	
	coefficient/std err	p-val.	coefficient/std err	p-val.	coefficient/std err	p-val.	coefficient/std err	p-val.	coefficient/std err	p-val.	coefficient/std err	p-val.
$NIM_{(t-1)}$	**0.460**	***	**0.460**	***								
	(0.011)		(0.011)									
$ROA_{(t-1)}$					**0.135**	***	**0.135**	***				
					(0.028)		(0.028)					
$ROE_{(t-1)}$									**0.140**	***	**0.140**	***
									(0.020)		(0.020)	
GDPG	**-0.043**	***	**0.021**	***	**-0.006**		**0.037**	***	**0.140**		**0.297**	***
	(0.012)		(0.003)		(0.017)		(0.007)		(0.104)		(0.056)	
$Lerner_{(t-1)}$	0.080		-0.026		-0.115		-0.115		1.064		-0.539	
	(0.002)		(0.001)		(0.003)		(0.001)		(0.021)		(0.009)	
$GDPG*Lerner_{(t-1)}$	0.157	***	0.023		0.095	*	0.055	**	0.092		0.416	**
	(0.039)		(0.013)		(0.057)		(0.026)		(0.364)		(0.212)	
GDPG*High income	0.064	***			0.043	**			0.157			
	(0.012)				(0.018)				(0.119)			
$Lerner_{(t-1)}$*High income	-0.106				0.000				-1.603			
	(0.223)				(0.285)				(2.244)			
$GDPG*Lerner_{(t-1)}$*High income	-0.134	***			-0.040				0.325			
	(0.041)				(0.063)				(0.421)			
GDPG*Low income			-0.064	***			-0.043	**			-0.157	
			(0.012)				(0.018)				(0.119)	
$Lerner_{(t-1)}$*Low income			0.106				0.000				1.603	
			(0.223)				(0.285)				(2.244)	
$GDPG*Lerner_{(t-1)}$*Low income			0.134	***			0.040				-0.325	
			(0.041)				(0.063)				(0.421)	

Intercept	3.309 ***	3.309 ***	3.399 ***	3.399 ***	37.287 ***	37.287 ***
	(0.224)	(0.224)	(0.468)	(0.468)	(3.669)	(3.669)
Number of observations	82258	82258	23123	23123	22818	22818
Number of banks	8347	8347	4798	4798	4776	4776
R squared:						
within	0.332	0.332	0.144	0.144	0.146	0.146
between	0.826	0.826	0.301	0.301	0.171	0.171
overall	0.719	0.719	0.265	0.265	0.181	0.181
Prob of F	0.00	0.00	0.00	0.00	0.00	0.00

Notations: This this the fixed effects estimation of equation Eq. (2). NIM - Net interest margin ratio; ROA - Return on assets; ROE - Return of equity; $Loans/TA_{(t-1)}$ - Credit intermediation (business model); $Deposits/TA_{(t-1)}$ - Deposit collection (business model); $CAP_{(t-1)}$ - Solvency risk (risk profile); $Liquidassets_{(t-1)}$ - Liquidity risk (risk profile); Liquidity $GAP_{(t-1)}$ - Liquidity risk (risk profile); $LLP_{(t-1)}$ - Idiosyncratic credit risk (risk profile); $NIM_{(t-1)}$ - Net interest margin (sources of net profit); $No\text{-}NIM_{(t-1)}$ - Non interest income (sources of net profit); $C/I_{(t-1)}$ - Cost efficiency; Funding $costs_{(t-1)}$ - Costs of customer deposits; $Size_{(t-1)}$ - Scale of banking activity; Policy rate - Monetary policy stance; Unempl - Unemployment rate; GDPG - Business cycle; $Lerner_{(t-1)}$ - Competition intensity; CR3 - Market structure; CR5 - Market structure; High income - Income level of a country; Low income - Income level of a country; *.** and *** denote significance at 10%. 5% and 1% levels. respectively.