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Procyclicality of Bank Growth and Competitive Environment: Cross-country Evidence

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Abstract

This paper attempts to find out what is the role of competitive environment in shaping the sensitivity of growth in banking to the business cycle. To answer this question, we apply a large set of individual bank level data including over 8000 banks operating in more than 100 countries. This study uses the growth of assets, loans, deposits and leverage as proxies of bank growth and Lerner index as a proxy for the competitive environment. The analysis shows that decreased competition is associated with increased procyclicality of bank growth. However, in a perfectly competitive environment the growth turns out to be countercyclical. This effect differs between high- and low-income countries. A perfectly competitive environment is associated with countercyclical growth in high-income countries. The opposite result is found for low-income countries. Our results for Central Eastern European countries show that increased competition is associated with enhanced procyclicality of growth.

Keywords: assets, loans, deposits, leverage, procyclicality, competition

JEL Classification: E32, G21, G28, G32

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1 Introduction

The concept of procyclicality is used to describe an economic or financial variable's co-movement with aggregate economic activity. Thus, procyclicality of financial activity refers to the tendency of financial variables to fluctuate around a trend during the economic cycle (Landau, 2009; Borio, 2014). Increased procyclicality in the banking industry is associated with enhanced fluctuations, and therefore with stronger sensitivity of financial variables to changes in the business cycle. The literature shows that there are many factors that contribute to the procyclicality in the banking industry (Borio et al., 2001; Athanasoglou et al., 2014). Many empirical studies deal with procyclicality of bank balance-sheets and profit and loss account items (Bertay et al. 2015; Bouvatier and Lepetit, 2013; Wheeler, 2019; Özlem Dursun-de Neef and Schandlbauer, 2020; Zins and Weill, 2018; Olszak et al, 2018). These studies show that procyclicality depends on regulation, supervision, shareholders structure, governance effectiveness and bank specific features (specialization, size, solvency). However, only a few papers focus on the role of competition in credit procyclicality of individual banks (Leroy and Lucotte, 2019; Kouretas et al., 2020).

Previous research focuses mostly on the role of competition in credit procyclicality, both macroeconomic (see Bouvatier et al., 2012; Leroy and Lucotte, 2019; Kouretas et al., 2020) and bank-level procyclicality (Leroy and Lucotte, 2019; Kouretas et al., 2020). These analyses are limited to certain regions, like OECD countries (see Bouvatier et al., 2012), banks in 13 European countries (Leroy and Lucotte, 2019) and banks in EU countries (Kouretas et al., 2020). Thus, we do not know what is the role of competition in a wider cross-country context at individual banks level. Banking research suggests that procyclicality is a broad concept (Athanosoglou et at., 2014; Borio et al., 2001). Thus, many activities of banks are cyclical, including assets (Claessens et al., 2014), deposits (Bertay et al., 2015) and leverage (Adrian and Shin, 2010; Claessens et al, 2014; Niţoi et al., 2019; Özlem Dursun-de Neef and Schandlbauer, 2020; Barattieri et al., 2021). However, the research omits the role of competition in cyclicality of these activities in a wider cross-country context. Therefore, in our study we aim to look at these activities to find out how competition shapes their sensitivity to business cycle.

Following the literature on procyclicality in banking and research on the role of competition in financial stability, we propose two research questions. Firstly, does a competitive environment diminish procyclicality of bank growth, which is in line with the competition-stability approach? Secondly, following the competition-fragility concept, is a more competitive environment associated with an increased procyclicality of bank growth?

We are the first to analyze the links between the competitive environment in the banking industry and the cyclicality of bank growth in a wide cross-country context. There are only two papers which are like ours in terms of the research interest in the role of competition in procyclicality of growth. The first is the study by Leroy

and Lucotte (2019), who analyze the effect of competition on bank credit growth of a sample of 16 European countries. The other one concentrates on three types of bank lending in the European Union and tests the role of the market structure and the competition in procyclicality (Kouretas et al., 2020).

Our contribution is threefold. Firstly, in contrast to earlier papers, our study focuses on four dimensions of bank activity, analyzed in the literature, i.e., asset growth (Claessens et al., 2014), loans growth, deposits growth (Bertay et al., 2015; Leroy and Lucotte, 2019; Kouretas et al., 2020) and leverage growth (Lim et al., 2011). Secondly, we also apply a definitely wider sample, as we consider over 8000 banks operating in over 100 countries. Thirdly, we also look at the role of income level for the effects of a competitive environment and procyclicality. Thus, our study shows a global perspective of the links between competition and procyclicality of growth of individual banks.

In this study we apply a robust fixed effects estimator to a set of data of individual commercial and cooperative banks in over 100 countries. Our analysis shows that banking sectors with decreased competition are associated with increased procyclicality of assets growth, loans growth and deposits growth. This effect differs between high-income and low-income countries. The impact of competition on procyclicality is also different for Central and Eastern European (CEE) countries.

The rest of the paper is structured as follows. Section 2 presents a review of relevant literature and develops our 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

This study is related to two significant streams in economic and finance literature. The first focuses on the factors explaining procyclicality and the other looks at links between competition and bank risk.

Previous mainstream literature focuses on procyclicality of the banking activity and provides some evidence about its underlying factors (Albertazzi and Gambacorta, 2009; Lim et al., 2011; Bouvatier et al., 2012; Bertay et al., 2015; Olszak et al., 2018; Leroy and Lucotte, 2019). Albertazzi and Gambacorta (2009) find that country region matters and show that profits of banks in Anglo-Saxon countries are more procyclical than are those of euro-area banks. However, this study does not show why there is a difference in procyclicality across country groups. Lim at al. (2011) show that growth and procyclicality of aggregated credit in 49 countries depends on the use of macroprudential policy instruments. Bouvatier et al. (2012) show that credit in 17 OECD countries is procyclical, but it does not seem to be affected by the structure of the banking market. Olszak et al. (2017, 2018) show that procyclicality of loan – loss provisions depends on regulations, supervision, investor protection and the use of macroprudential policy instruments. Bertay et al. (2015) suggest that procyclicality

of credit and deposits depends on the characteristics of shareholders (state owned versus privately owned banks).

Only two studies by Leroy and Lucotte (2019) and Kouretas et al. (2020) concentrate directly on the effect of competition on procyclicality of lending of individual banks. Leroy and Lucotte (2019) consider the role of competition in procyclicality of credit in 16 European countries. This paper suggests that an increased market power for banks (i.e., decreased competition) enhances the financial accelerator mechanism by showing that less competition in the banking sector makes credit more procyclical. This study also shows that procyclicality of credit of individual banks is enhanced under an uncompetitive environment. However, due to a limited country coverage, this study does not look at the diversity of effects of competition on procyclicality of credit, and, thus, does not provide evidence of the factors that explain why, in some countries, more competition is associated with less procyclicality. Kouretas et al. (2020) focus on three categories of credit, i.e., consumer loans, mortgage loans and corporate loans and look at the role of market concentration and competition measures in procyclicality of lending. They find that there is a non-linearity in the relationship between the market concentration and procyclicality. Their study also reveals that there are some differences between the advanced and transitioning European Union banking sectors. However, an in-depth analysis of results of the role of competition proxied with Lerner index shows that only procyclicality of mortgage loans is (i.e., statistically significantly) reduced under a perfect competition in EU countries and any decline in competition intensity is associated with an enhanced procyclicality of mortgages. This effect seems to be opposite (but not statistically significant) for CEE (less developed) countries. Thus, it seems that to some extent, economic development matters. This paper also examines the nonlinearity of effects of competition measures on procyclicality. The results in the full sample of EU countries, however, do not show any statistically significant links between the business cycle and squared competition measure for either category of loans.

The literature makes contrasting predictions about the relationship between bank competition and bank risk and in general, may be summarized under two headings. The first is the competition-fragility perspective that predicts a positive relationship between competition and bank risk. The other is competition-stability perspective and assumes a negative relationship between a competitive environment and bank risk. In the "competition-fragility" nexus the argument goes that competition in deposit market erodes banks' profit margins and hence charter values, thus enhancing risk-taking incentives because banks have less to lose in an insolvency (Marcus 1984; Keeley, 1990). A lot of empirical papers support this perspective (Cipolini and Fiordelisi, 2012; Mirzaei et al., 2013; Craig and Dinger, 2013; Beck et al., 2013; Kabir and Worthington, 2017; Davis and Karim, 2019; Phan et al., 2019; Saif-Alyousfi et al., 2020).

The competition-stability hypothesis contends that financial instability increases as the degree of competitiveness is lessened. Banks with more market power will earn

more rents by charging higher interest rates on business loans. Boyd and de Nicoló (2005) argue that banks which compete for deposits also provide loans and set the prices for loans by considering the total amount of loans provided in the market. They assume that the risk of these loans is increasing along with the interest rates charged by banks. Empirical research on the competition – stability hypothesis is not so extensive. Several studies looking at the pre–Global Financial Crisis period provide evidence in line with the competition-stability perspective (Boyd et al., 2008; Schaeck et al., 2009; Berger et al., 2009; Schaeck and Cihák, 2010). However, Fu et al. (2014), Beck et al. (2013) and Saif-Alyousfi et al. (2020) find that competition-stability hypothesis may be supported along with competition-fragility view, depending on regulations, supervision, region, bank type or risk and competition measure.

In summary, the existing literature shows that bank growth is expected to be procyclical. The basic factor behind procyclicality includes the inadequate responses of banks to changes in risk over time. There are many factors shaping the responses of banking activity to business cycle, including competitive environment. Looking at theoretical evidence presented in Aliaga-Diaz (2010) and empirically supported in Leroy and Lucotte (2019) we state that increased competition reduces procyclicality of bank growth (Hypothesis H1). Considering that competition 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 bank growth has further support in the competition-stability hypothesis. Such a perspective has also been supported by recent evidence in European banks.

However, the literature on the effect of competition on bank risk-taking also shows that a more competitive environment may result in greater bank fragility (the competition-fragility hypothesis). As increased risk-taking is perceived as a source of enhanced procyclicality in bank activity, we propose the second hypothesis that decreased competition in the banking industry reduces procyclicality of bank growth (Hypothesis H2).

Previous research on credit procyclicality of EU banks shows some diversity between less developed countries and high-income countries (CEE versus EU 12 in Kouretas et al., 2020). Thus, we propose the hypothesis that the effect of competition on procyclicality of growth depends on income-level of a country (Hypotheses H3).

3 Methodology and data description

3.1 Methodology

We focus on four dimension of banking growth that are of investigated in the literature focusing on procyclicality, that is the assets growth rate (Claessens et al., 2014), loans growth rate (Leroy and Lucotte, 2019; Bertay et al., 2015; Kouretas et al., 2020), deposit growth rate (Bertay et al., 2015) and leverage growth rate (Adrian and Shin, 2010; Claessens et al, 2014, Burietz et al., 2023). The baseline model looks at the role

of the business cycle and of a competitive environment on the growth rates:

$$\mathrm{BG}_{i,j,t} = \beta\,(\mathrm{BSOV}_{i,j,t;t-1}) + \alpha_1 \mathrm{Business\ Cycle}_{j,t} + \mathrm{Intercept} + \vartheta_{i,t} + \varepsilon_t \qquad (1)$$

In this equation *BG* is our proxy for growth of a bank i in country j at moment t. We consider four aspects of this growth: *assets growth* rate (Claessens et al., 2014), *loans growth* rate (Leroy and Lucotte, 2019; Bertay et al., 2015), *deposit growth* rate (Bertay et al., 2015) and *leverage growth* (annual change in the leverage) (Adrian and Shin, 2010; Claessens et al, 2014; Niţoi et al., 2019; Özlem Dursun-de Neef and Schandlbauer, 2020; Barattieri et al., 2021). *BSOV* covers bank specific and other macroeconomic variables. The set of bank specific variables depends on the model. In our choice of the variables, we refer to Claessens et al. (2014), Leroy and Lucotte (2019), Bertay et al. (2015) and Kouretas et al. (2020).

In the *asset growth* model, we use *Leverage* (defined as assets to equity capital), *LtD* (defined as loans to deposits ratio), *Size* (defined natural logarithm of assets). Previous research for bank-level data shows negative impact of leverage ratio and positive (but not statistically significant) effect of LtD (see Claessens et al., 2014). As for the *Size* variable we expect a negative effect on the asset growth, consistent with the view that large corporations tend to grow slowly (Bertay et al., 2015).

The *loans growth* model applies *CAP* (equity to assets ratio), *NIM* (net interest margin to average loans), *DEP/A* (deposits to assets), *LLP/L* (loan loss provisions to average loans), *Liquidity GAP* (Total net loans – customer deposits)/customer deposits) and *Size* defined as a natural logarithm of assets. The effect of CAP may be positive if lending is constrained by the capital ratio (Carlson et al., 2013; Bertay et al., 2015; Olszak et al., 2019; Kouretas et al., 2020). Some papers show the negative impact of CAP on loans growth (Leroy and Lucotte, 2019; Kouretas et al., 2020). This diversity in effect of capital ratio may be attributed to the sample choice, as Leroy and Lucotte (2019) and Kouretas et al. (2020) focus only on European banks. Kouretas et al. (2020) show that *CAP* exerts a positive effect on mortgage loans growth rate. *NIM* is expected to exert a positive effect on loans growth consistent with the view that bank managers are motivated to increase lending if they expect to be rewarded for this with more profits. Kouretas et al. (2020) and Olszak and Kowalska (2019) show increased loans growth if the profitability is improved. DEP has been shown to be associated with decreased loans growth (Olszak et al., 2019). LLP/L proxy the quality of credit portfolio. We expect a negative impact of this proxy, consistent with the view that increased loan-losses discourage banks from extending their credit portfolios (Olszak et al., 2019). Liquidity GAP proxies the access to a stable funding. In fact, it is a measure of the degree of reliance on wholesale funding, much of which tends to be short-term in nature (ECB, 2009, p. 14). Increased levels of this ratio (i.e., over 0) inform about the use of instable funding applied by banks. Previous research applying alternate proxies for liquidity (e.g., liquid assets to total assets) shows increased growth rate of loans with increased liquidity ratios (Kouretas et al., 2020; Bertay et al. 2015). Liquidity GAP increases are associated

with reduced liquidity, therefore we expect a negative effect of Liquidity GAP on loans growth rate. Size is associated with a reduced growth of lending in Leroy and Lucotte (2019), Bertay et al. (2015), Kouretas et al. (2020) and Olszak and Kowalska (2022). This effect may also be positive in specific categories of loans, country regions (CEE) or bank size groups (Kouretas et al., 2020; Olszak et al., 2019).

The *deposits growth* model employs *CAP* (equity to assets ratio), *Loans/A* (loans to assets ratio), *LtD* (defined as loans to deposits ratio), *Size* (defined as natural logarithm of assets). Increases in the CAP are associated with a more stable solvency of banks, and thus a reduction of risk to debtholders. Therefore, we expect a positive effect of *CAP* on deposits growth rate (see Bertay et al., 2015). We expect that banks with greater credit portfolios can get more external funding through deposit taking. Therefore, the effect of *Loans/A* should be positive, consistent with Bertay et al. (2015). *LtD* is a proxy for liquidity risk. Bertay et al. (2015) show that liquidity proxied with liquid assets to total assets is associated with increased levels of deposits growth. We thus expect that *LtD* exerts a negative effect on deposits growth, consistent with the view that decreased liquidity limits accessibility to external funding. Consistent with previous research we expect a negative effect of *Size* on deposits growth (Bertay et al., 2015).

The *leverage growth* model includes *Loans/A* (loans to assets ratio), *LtD* (defined as loans to deposits ratio) and *Size* (defined as natural logarithm of assets). We expect that banks with large credit portfolios need more equity capital to cover unexpected losses generated due to the lending activity. As increased leverage is associated with reduction of capital adequacy, we expect that *Loans/A* exert a negative effect on leverage growth. We expect that banks with increased *LtD* can increase *Leverage growth*. Thus, *LtD* shall be positively linked with leverage growth. We expect that large banks will tend to decline their leverage, as they need to keep stable levels of leverage, due to the market discipline concerns and external stakeholders monitoring. Therefore, *Size* is expected to exert a negative impact on *Leverage growth*.

Other macroeconomic variables include monetary policy stance (denoted as *Policy rate*), unemployment rate (denoted as *Unempl*) and competition (denoted as *Competition*). Papers focusing on bank growth, and specifically on credit growth (Agoraki and Kouretas, 2021; Mirzaei and Samet, 2022) show heterogenous effect of interest rates. Agoraki and Kouretas found the rate to be both positive and negative (depending on the model) and statistically insignificant for the general loan growth in European banks. However, this effect was negative and significant for commercial and industrial loans in EU-15, and positive in countries that newly accessed the EU. For the consumer loans growth this impact was negative and significant only in the EU-15. Mirzaei and Samet (2022) focus on loans growth in a sample of 91 countries and find huge diversity of the impact of interest rate, with significant effects positive. Surprisingly, this study also uses inflation that proxies pricing conditions in the real economy, and in some of statistically significant results inflation exerts negative impact on credit growth. A negative effect of inflation on credit growth and

on deposit growth is also found in a cross-country study by Bertay et al. (2015). Considering this diversity of results in our study we do not predefine the expected links between bank growth and interest rates.

Higher levels of *Unempl* denote worsened capability to repay debts by non-financial borrowers. This results in a dampened quality of banks' assets and reduced incentives by banks to extend loans. Therefore. *Unempl* is associated with reduced asset growth and loans growth. The effect on deposit growth, however, maybe positive because depositors look for safe and liquid investments in periods of increased unemployment and go for risky assets when the job market is flourishing. *Leverage growth* may increase in the periods of rising unemployment, because of decreased levels of equity capital associated with more loan losses. The opposite may be specific of decreased unemployment. Therefore, we expect a positive effect of *Unempl* on leverage growth. $Competition_{(j,t-1)}$ indicates the competition intensity in the banking sector in country j at moment t-1, and is computed at the industry (i.e., country) level. Following earlier research on bank lending growth (Leroy and Lucotte, 2019; Kouretas et al., 2020) in our study, we apply a non-structural indicator of the degree of market competition i.e., the Lerner index (Lerner). The Lerner index has been widely adopted in empirical research (Claessens and Leaven, 2004; Berger et al., 2009., Fu et al., 2014; Fungáčová et al., 2017; Alam et al., 2018; Leroy and Lucotte, 2017, 2019; Alam et al., 2018; Danisman and Demirel, 2019; Davis and Karim, 2019; Kouretas et al, 2020). It expresses banks' ability to keep their prices over their marginal costs and is an inverse measure of competition intensity. With the Lerner the degree of competition is given by the range 0 to 1. In the case of perfect competition, the Lerner index equals 0; under a pure monopoly it is 1; values ranging between 0 and 1 indicate monopolistic competition. In our study we proxy competition with the annual country-level Lerner index (see also Fungáčová et al. 2017; Leroy and Lucotte; 2019). Earlier evidence on the impact of competition on bank growth, in particular credit growth, only makes ambiguous predictions about this link. Leroy and Lucotte (2019) show a positive link between competition and bank-level credit growth. Kuoretas et al. (2020) show both positive and negative effects, that depend on the sample selection. Therefore, we do not make definite expectations as for the regression coefficient on Competition. Previous research, however, does not show any evidence on the links between competition and deposit growth and asset growth. Leverage growth informs us about changes in the levels of the risk of insolvency of the bank. Thus, the direction of association between competition and leverage growth may be derived from previous studies on competition and stability. Beck et al. (2013) in a cross-country study and Fu et al. (2014) in Asia Pacific show positive overall links between the Lerner index and Z-score, implying that decreased competition is associated with increased financial stability. In our analysis increased leverage growth denotes decreased financial stability. Thus, we expect that the general effect of our competition measure on leverage growth is negative. The business cycle measure is captured with a country level annual real Gross Domestic Product Growth

rate. Following previous literature (Bertay et al., 2015; Leroy and Lucotte, 2019; Kouretas et al., 2020; Agoraki and Kouretas, 2021; Mirzaei and Samet, 2022), our baseline assumption is procyclicality of bank growth, exhibited by a positive regression coefficient of bank asset growth, loan growth and deposit growth on the *Business Cycle*. Niţoi et al. (2019) show that leverage ratio is lower during busts. However, literature does not give a clear guidance on the links between leverage growth and the *Business Cycle*. We may expect increased *leverage growth* during economic downturns because the capital buffers are depleted in such periods. This implies that the *leverage growth* is negatively affected by the business cycle.

To evaluate the association between competition and procyclicality of banking growth we introduce interaction term between the *Business Cycle* and *Competition* (see Leroy and Lucotte, 2019; Kouretas et al., 2020). We model this with the following equation:

$$\begin{aligned} \mathrm{BG}_{i,j,t} = \beta\left(\mathrm{BSOV}_{i,j,t}\right) + \alpha_1 \mathrm{Business\ Cycle}_{j,t} \\ + \alpha_2 \mathrm{BusinessCycle}_{j,t} \times \mathrm{Competition}_{j,t-1} + \mathrm{Intercept} + \vartheta_{i,t} + \varepsilon_t \end{aligned} \quad (2)$$

Business Cycle × *Competition* is our measure of the association between degree of competition and procyclicality of bank growth.

The effect of a change in business cycle on bank growth can be expressed by the derivative of $(\delta \mathrm{BankGrowth}_{i,j,t})/(\delta \mathrm{Business\ Cycle}_{j,t}) = \alpha_1 + \alpha_2 \mathrm{Competition}_{j,t-1}$. The economic meaning of regression coefficients of interest is as follows (see Leroy and Lucotte, 2019). The α_1 denotes the effect of business cycle in countries with perfect competition (Lerner=0). A positive (negative) sign on this coefficient implies procyclicality (countercyclicality) of bank growth in perfectly competitive environment. Under pure monopoly (Lerner=1) the overall sensitivity of bank growth to the business cycle is a sum of α_1 and α_2. The α_2 coefficient denotes the effect of business cycle on bank growth conditioned upon a competitive environment. The interpretations of the α_2 coefficients multiplied by *Competition*$_{(t-1)}$, are basically twofold. If the coefficient is positive, this implies that low intensity of competition results in greater procyclical bank growth, and vice versa (i.e., more competition is related with decreased procyclicality of bank growth). Such a regression coefficient will be our test for hypothesis H1 (competition - stability view). A negative coefficient on the interaction term of *Business Cycle* × *Competition*$_{(t-1)}$ will imply that increased competition (decreased level of the Lerner index) is associated with the increased procyclicality of bank growth, which is in line with our hypothesis H2 (competition - fragility view).

As for the bank-specific variables we control for potential endogeneity by including one-year lagged values of each of these variables. Additionally, to deal with potential endogeneity of the competition measures, we use the lagged value of Lerner index (Albertazzi and Gambacorta, 2009; Leroy and Lucotte, 2018). Our sample is hugely diversified in terms of the number of banks and observations per country, therefore in our study we apply bank-clustered standard errors (Nichols and Shaffer, 2007; Cameron and Miller, 2015). In the main results we will apply a fixed-effects model.

3.2 Data and preliminary results

The data in our analysis merge bank and country-level items. All bank balance-sheets and income statements data is taken from the Bankscope database published by Bureau Van Dijk (BVD). The sample period of our study spans 2004–2015 in 110 countries both high income and developing (listed in the Appendix in Table A1). Our dataset is taken from the earlier version of the BVD database which included bank level data collected by the Fitch Ratings agency. Its huge advantage is that it covers the pre-crisis data before 2008. However, it ends in 2015. We cannot replace or merge this data with more recent Orbis database, due to the following reasons: (1) change in the financial data supplier (Moody's instead of Fitch); (2) changes in the codes of the banks; (3) limited time horizon of the data (only the last 9 years of data is available). Our data for the Lerner index available from the Global Financial Development Database (GFDD) ends in 2015, which additionally prompts us to use the 2015-year limit in our data. We apply several filters to remove potential data errors and outliers. Data for all variables are winsorized to the 1% and 99% tails of their distributions to mitigate the impact of outliers. We focus on those banks for which we have at least 6 consecutive years of observations on loans and assets. With this time span we aim to consider the average length of the business cycle. This step is necessary to measure the procyclicality of bank growth – the main research area of this study. Such an approach also gives us the opportunity to preserve the benefits of the panel dimension of our sample. In effect, the number of observations used in our regressions is over 69,000 or 80,000 (depending on the bank growth variable), with the number of banks over 8000. Country-level data used in this research are taken from the International Financial Statistics Database (published by the International Monetary Fund) and the Global Financial Development Database (published by the World Bank). Our sample includes 64 low-income countries and 46 high-income countries (see Table A1 in Appendix). The definitions of our variables and their data sources are included in Table 1.

The variables of interest in our study show that the mean Assets Growth equals 7.08 percent, with a standard deviation of 14.04 percentage points. The average Loans Growth and Deposits Growth equal 7.06 and 7.03, respectively. The mean Leverage Growth is negative -0.41, suggesting that banks increased their equity capital and thus financial stability has been improved. The mean Business Cycle value is 2.04, with a standardized variability of 2.68. As Table A1 shows (see Appendix), there is a huge diversity of the average Lerner index across countries, with a mean value of 0.266 and a standard deviation of 0.09 (see Table 2, Panel A). The correlations (in Table 2, Panel B) indicate a statistically significant association between bank growth and most explanatory variables. In particular, the correlation coefficient for *Business Cycle* is positive for all growth measures, but for the Leverage Growth, for which it is negative and insignificant. Positive links between asset growth, loans growth and deposit growth and *Business Cycle* imply procyclicality of bank activity. The same

Table 1: Variable names, definitions, expected effect on banking growth and data sources

Variable name	Variable definition	Expected effect of variable on: Assets Growth	Loans Growth	Deposits Growth	Leverage Growth	Source of data
Assets Growth	Real growth rate of assets computed as Ln(Assetst)-Ln(Assets t-1)					Bankscope database; the variable has been computed using the BvD database and CPI available in the GFDD of World Bank
Loans Growth	Real growth rate of loans computed as Ln(Loans t)-Ln(Loanst-1)					Bankscope database; the variable has been computed using the BvD database and CPI available in the GFDD of World Bank
Deposits Growth	Real growth rate of deposits computed as Ln(Deposits t)-Ln(Depositst-1)					Bankscope database; the variable has been computed using the BvD database and CPI available in the GFDD of World Bank
Leverage Growth	Annual change in the leverage; Leverage is proxied with Assets/Equity					Bankscope database;
Leverage	Assets divided by equity capital	(+/-)				Bankscope database;
LtD	Loans to deposits ratio	(+)		(+)	(+)	Bankscope database;
CAP	Equity to assets ratio		(+)	(+)		Bankscope database;
NIM	Net interest margin to average loans		(+)			Bankscope database;

Table 1: Variable names, definitions, expected effect on banking growth and data sources cont.

Variable name	Variable definition	Expected effect of variable on: Assets Growth	Loans Growth	Deposits Growth	Leverage Growth	Source of data
DEP/A	Deposits to assets		(+/-)	(+)		Bankscope database;
LLP/L	Loan-loss provisions to average loans		(-)			Bankscope database;
Liquidity GAP	(Total net loans - customer deposits)/customer deposits		(-)			Bankscope database;
Loans/A	Loans to assets ratio			(-)	(-)	Bankscope database;
Size	Natural logarithm of assets	(-)	(-)	(-)	(-)	Bankscope database;
Policy rate	Monetary policy stance	(-)	(-)	(-)	(-/+)	International Monetary Fund, IFS database
Unempl	Unemployment rate	(-)	(-)	(-)	(-)	International Monetary Fund, IFS database
Business cycle	Annual real Gross Domestic Product Growth rate	(+)	(+)	(+)	(+/-)	International Monetary Fund, IFS database
Competition	Lerner index	(+/-)	(+/-)	(+/-)	(+/-)	Global Financial Development Database

Table 2: Descriptive statistics and correlation matrix. Panel A: Descriptive statistics

	Mean	Std. Dev.	Min	Max	#Observ.
Assets Growth	7.08	14.04	-48.49	85.72	83,182
Loans Growth	7.06	15.92	-53.90	103.88	69,946
Deposits Growth	7.03	13.81	-36.46	71.76	81,387
Leverage Growth	-0.41	139.83	-739.64	691.47	82,617
Leverage	10.40	4.40	1.13	48.49	83,182
LtD	74.87	26.42	7.36	268.22	83,182
CAP	11.21	5.70	2.06	85.65	83,182
NIM	4.04	1.63	-0.23	16.47	69,946
DEP/A	83.60	9.59	9.13	94.58	69,946
LLP/L	0.69	1.05	-1.75	9.53	69,946
Liquidity GAP	-24.27	23.88	-92.64	168.22	69,946
Loans/A	60.19	16.64	3.22	92.28	82,617
Size	12.50	1.74	8.98	18.48	83,182
Policy rate	-0.17	1.15	-16.59	22.26	83,182
Unempl	7.08	2.85	0.50	31.10	83,182
Business cycle	2.04	2.68	-14.81	34.50	83,182
Competition	0.27	0.09	-2.56	0.94	83,182

Note: Variable names and definitions in Table 1. *Source:* Authors analysis with the Bankscope dataset. Computed in STATA.

can be inferred for leverage growth because excessive leverage growth may be specific to economic downturns.

4 Main empirical results

4.1 Discussion

Table 3 presents the baseline results obtained by the estimation of Equation 1. Before going on with the analysis of the role of competition on procyclicality, we shortly refer to the effects of bank-specific variables on the banks growth variables. We find that *Leverage* exerts a negative effect on asset growth. The opposite is found for *LtD*. These results are consistent with earlier evidence. Large banks tend to grow slowly, because the statistically significant coefficient of *Size* is negative. Expectedly, while *CAP* and *NIM* have a positive effect on loans growth, the impact of *DEP/A, LLP/L, Liquidity GAP* and Size is negative. *LtD* and *CAP* are associated with increased deposits growth, consistent with previous evidence (Bertay et al., 2015). In contrast to Bertay et al. (2015), *Loans/A* have a negative effect on deposits growth. In line with expectations, large banks experience decreased deposits growth rates, because the coefficient on *Size* is negative. The leverage growth increases with the level of *LtD* ratio, which is consistent with the view that the use of interbank lending

Table 2: Descriptive statistics and correlation matrix. Panel B: Correlation matrix (pair-wise correlations of the variables used in the analysis)

	Assets Growth	Loans Growth	Deposits Growth	Leverage Growth	Leverage	LtD	CAP	NIM	DEP/A	LLP/L	Liquidity GAP	Loans/A	Size	Policy rate	Unempl	Business cycle	Competition
	Correlations																
Assets Growth	1.00																
Loans Growth	0.72	1.00															
Deposits Growth	0.91	0.64	1.00														
Leverage Growth	0.32	0.17	0.34	1.00													
Leverage	0.01	-0.02	0.03	0.09	1.00												
LtD	0.03	0.10	0.01	-0.01	-0.11	1.00											
CAP	0.01	0.04	0.01	-0.06	-0.64	0.16	1.00										
NIM	0.11	0.11	0.10	0.00	-0.32	0.17	0.25	1.00									
DEP/A	-0.05	-0.05	-0.03	0.01	0.33	-0.49	-0.60	-0.15	1.00								
LLP/L	0.01	-0.05	0.01	0.08	-0.04	0.03	0.16	0.22	-0.20	1.00							
Liquidity GAP	0.03	0.10	0.01	-0.01	-0.11	1.00	0.16	0.17	-0.49	0.03	1.00						
Loans/A	0.00	0.08	-0.01	-0.01	0.05	0.74	-0.18	0.11	0.10	-0.08	0.74	1.00					
Size	0.08	0.07	0.09	-0.05	0.37	0.06	-0.24	-0.24	-0.06	0.07	0.06	0.03	1.00				
Policy rate	-0.05	-0.04	-0.04	-0.01	0.01	0.04	-0.01	-0.01	0.00	-0.08	0.04	0.04	-0.01	1.00			
Unempl	-0.04	-0.09	-0.02	0.00	-0.06	-0.03	0.04	0.04	-0.02	0.19	-0.03	-0.05	0.00	-0.10	1.00		
Business cycle	0.21	0.25	0.17	-0.004	0.00	-0.07	0.06	0.17	-0.04	-0.01	-0.07	-0.11	0.08	-0.07	-0.19	1.00	
Competition	-0,03	-0,03	-0,02	-0,01	-0,01	-0,01	0,00	-0,04	0,03	-0,01	-0,01	0,01	-0,04	0,00	0,02	0,05	1.00

Table 2: Descriptive statistics and correlation matrix. Panel B: Correlation matrix (pair-wise correlations of the variables used in the analysis) cont.

	Assets Growth	Loans Growth	Deposits Growth	Leverage Growth	Leverage	LtD	CAP	NIM	DEP/A	LLP/L	Liquidity GAP	Loans/A	Size	Policy rate	Unempl	Business cycle	Competition
	Probabilities denoting significance of the correlations																
Assets Growth																	
Loans Growth	0.00																
Deposits Growth	0.00	0.00															
Leverage Growth	0.00	0.00	0.00														
Leverage	0.00	0.00	0.00	0.00													
LtD	0.00	0.00	0.06	0.00	0.00												
CAP	0.00	0.00	0.07	0.00	0.00	0.00											
NIM	0.00	0.00	0.00	0.50	0.00	0.00	0.00										
DEP/A	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00									
LLP/L	0.06	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00								
Liquidity GAP	0.00	0.00	0.06	0.00	0.00	0.00	0.00	0.00	0.00	0.00							
Loans/A	0.81	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00						
Size	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00					
Policy rate	0.00	0.00	0.00	0.13	0.07	0.00	0.01	0.00	0.26	0.00	0.00	0.00	0.00				
Unempl	0.00	0.00	0.00	0.29	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00			
Business cycle	0.00	0.00	0.00	0.21	0.76	0.00	0.00	0.00	0.00	0.10	0.00	0.00	0.00	0.00	0.00		
Competition	0.00	0.00	0.00	0.00	0.00	0.00	0.72	0.00	0.00	0.00	0.00	0.00	0.00	0.63	0.00	0.00	

improves the capital adequacy requirements. As expected, *Loans/A* are associated with a decreased (but not statistically significant) leverage growth. The same is found for *Size*, implying that large banks are characterized by a declined leverage growth. Focusing now on macroeconomic variables, we find that *Policy rate* enters with negative coefficient in all three out of four bank growth models, suggesting that increased interest rates reduce the assets, loans and deposits growth. Increased unemployment rate is associated with decreased loans growth which is in line with earlier evidence (Beatty and Liao, 2011). Our results seem to support the view that safe and liquid investments (such as deposits) are more desired during increased unemployment, and thus deposits growth is positively affected by *Unempl.* Consistent with the view that increases in unemployment are associated with damaged quality of loans and worsened capital adequacy, leverage growth is positively affected by Unempl.

For all specifications in Table 2, we can see a positive and significant relationship between the Business Cycle and individual bank – level growth, which indicates that bank growth is procyclical. Such a general effect is in line with Bertay et al. (2015). This effect ranges between 0.184 and 0.343 and is the strongest for the loans growth equations and the most moderate for the deposits growth model. In most estimations the effect of Lerner is negative, suggesting that decreased competition is associated with a reduced growth of banks.

Table 4 reports the regression results for Equation (2). Since in this model we include interaction terms the interpretation of the regression coefficient of *Business Cycle*, and of *Business Cycle* × *Competition* depends on the degree of competition intensity. First, we consider the Lerner=0 (perfect competition). Under this assumption the α_1 coefficient is negative and statistically significant for the assets growth, loans growth and deposits growth models. These effects imply that under perfect competition the bank growth is countercyclical. In the opposite case, i.e., under pure monopoly (Lerner=1), we find that the α_2 coefficient is positive, suggesting increased procyclicality of bank growth. The procyclicality is as follows 1.625 (=1.732-0.107) for the asset growth, 2.085 (=2.214-0.129) for the loans growth, and 1.528 (=1.721-0.193) for the deposits growth model. The overall effect of the business cycle on the bank growth, therefore, depends on the level of competition intensity. The more competitive the banking industry is, the less procyclical the growth will be. Looking at the statistically significant coefficient, we note that under average Lerner index (=0.266) the link between business cycle and the bank growth will equal 0.354, 0.46, 0.265, for the assets, loans and deposits growth, respectively. This result implies that any decrease in the degree of competition is associated with an increased procyclicality of the bank growth. Therefore, our results support hypothesis H1, that increased competition reduces procyclicality of the bank growth. Our results for the loans growth are in line with earlier research focusing only on credit of European banks by Leroy and Lucotte (2019) and Kouretas et al. (2020).

Table 3: Baseline results

	Asset growth (1)	Loans growth (2)	Deposits growth (3)	Leverage growth (4)
$Leverage_{(t-1)}$	-0.006***			
	(0.000)			
$LtD_{(t-1)}$	0.058***		0.160***	1.169***
	(0.006)		(0.012)	(0.077)
$CAP_{(t-1)}$		0.708***	0.523***	
		(0.054)	(0.044)	
$NIM_{(t-1)}$		0.020		
		(0.142)		
$DEP/A_{(t-1)}$		-0.350***		
		(0.028)		
$LLP/L_{(t-1)}$		-2.348***		
		(0.099)		
Liquidity $GAP_{(t-1)}$		-0.262***		
		(0.011)		
$Loans/A_{(t-1)}$			-0.032*	-0.515***
			(0.018)	(0.125)
$Size_{(t-1)}$	-12.721***	-11.949***	-10.500***	-48.340***
	(0.283)	(0.376)	(0.275)	(2.169)
Policy rate	-0.218***	-0.069	-0.167**	1.177*
	(0.060)	(0.080)	(0.065)	(0.652)
Unempl	-0.056*	-0.986***	0.116***	1.805***
	(0.032)	(0.040)	(0.032)	(0.310)
Business Cycle	0.277***	0.343***	0.184***	-0.502
	(0.031)	(0.044)	(0.033)	(0.325)
$Competition_{(t-1)}$	-7.294***	-8.961***	-5.291***	-68.834***
	(1.087)	(1.612)	(1.101)	(10.501)
R-squared	0.173	0.234	0.140	0.029
F(p-value)	0.000	0.000	0.000	0.000
#Observ.	83,182	69,946	81,387	82,617
#Banks	8,416	8,178	8,395	8,413

Notes: This table shows the regression results with the bank growth as dependent variables estimated with FE using Equation 1. Robust standard errors clustered at bank level are reported below their coefficient estimates. Intercept is also included but not displayed. Definitions of variables used in the analysis are presented in Table 1. *, ** and *** indicate statistical significance at 10%, 5% and 1% levels, respectively.

Table 4: Procyclicality of banking growth and competition

	Asset growth (1)	Loans growth (2)	Deposits growth (3)	Leverage growth (4)
$Leverage_{(t-1)}$	-0.006***			
	(0.000)			
$LtD_{(t-1)}$	0.057***		0.160***	1.170***
	(0.006)		(0.012)	(0.077)
$CAP_{(t-1)}$		0.716***	0.526***	
		(0.054)	(0.044)	
$NIM_{(t-1)}$		-0.008		
		(0.142)		
$DEP/A_{(t-1)}$		-0.350***		
		(0.028)		
$LLP/L_{(t-1)}$		-2.336***		
		(0.098)		
Liquidity $GAP_{(t-1)}$		-0.264***		
		(0.011)		
$Loans/A_{(t-1)}$			-0.036**	-0.521***
			(0.018)	(0.125)
$Size_{(t-1)}$	-12.583***	-11.751***	-10.346***	-48.173***
	(0.283)	(0.376)	(0.275)	(2.190)
Policy rate	-0.250***	-0.090	-0.196***	1.140*
	(0.061)	(0.080)	(0.066)	(0.652)
Unempl	-0.042	-0.968***	0.132***	1.821***
	(0.032)	(0.040)	(0.032)	(0.311)
$Competition_{(t-1)}$	-12.327***	-15.147***	-10.449***	-74.788***
	(1.283)	(1.856)	(1.323)	(12.683)
Business Cycle	-0.107**	-0.129*	-0.193***	-0.964
	(0.053)	(0.073)	(0.061)	(0.613)
Business Cycle× × $Competition_{(t-1)}$	1.732***	2.214***	1.721***	2.070
	(0.234)	(0.337)	(0.261)	(2.407)
R-squared	0.174	0.235	0.142	0.029
F(p-value)	0.000	0.000	0.000	0.000
# Observ.	83,182	69,946	81,387	82,617
# Banks	8,416	8,178	8,395	8,413

4.2 Robustness checks

We also conduct additional tests to ensure that our results presented in Table 4 are not biased due to the choice of the business cycle measure, country's characteristics, or competition intensity measure. Thus, in sensitivity analysis we focus on the role of the income-level of the country, the market structure, the alternate proxy of bank competition, the change in the proxy for Business Cycle, and the change of the estimation technique. We also assess what is the role of competitive pressures on procyclicality of growth in CEE countries. Tables 5–10 report the results.

Prior research gives some support to the view that income level is associated with implementation of regulations that reduce procyclicality (Cerutti et al., 2017). Claessens et al. (2014) show difference in the response of bank growth to the use of borrower targeted macroprudential instruments between emerging (low-income) and developed (high-income) countries. Considering this heterogeneity, we run Equation (2) applying a proxy for the income level to evaluate its role in: (1) the cyclicality of growth, (2) the links between competition and cyclicality. We divide our sample of countries into two sets, low- and high-income countries, following the classification of countries included in the Global Financial Development Database (see Table A1 in the Appendix).

To test the effect of income level on the procyclicality bank growth we introduce an interaction term between income-level dummy and the *Business Cycle*. In our analysis we include only low - income dummy variable because the results for the high-income countries are identified for the regression coefficients without interaction terms that cover this income dummy. The results of this test are included in Table 5. The coefficient of *Business Cycle* informs about the effect of the business cycle on the bank growth under a perfectly competitive environment (Lerner=0) in high-income countries. This coefficient is negative and significant for the a*ssets growth, loans growth and deposits growth*, and ranges between -0.512 and -0.366, implying that the bank growth is countercyclical in high-income countries under perfect competition. However, the *leverage growth* tends to be negatively associated with the business cycle in high-income countries. This implies an increased procyclicality of leverage growth in perfectly competitive banking sectors. For developing countries, we find the opposite result. In particular, the regression coefficients of *Low income* × *Business Cycle* is positive under perfect competition for all bank growth variables. The results for the assets growth, loans growth and deposits growth range between 1.192 and 1.486 and imply that the bank growth is procyclical in developing countries. A positive regression coefficient of *Low income* × *Business Cycle (*equal to 3.201) in the leverage growth model implies that leverage growth is countercyclical under perfect competition in low-income economies.

The regression coefficient on the double interaction of *Business Cycle* × $Competition_{(t-1)}$ informs about the effect of business cycle in high income countries depending on the degree of competition intensity. Under monopoly (Lerner =1) the

Table 5: Sensitivity analysis - role of competition low-income versus high-income countries

	Asset growth (1)	Loans growth (2)	Deposits growth (3)	Leverage growth (4)
$Leverage_{(t-1)}$	-0.006***			
	(0.000)			
$LtD_{(t-1)}$	0.056***		0.163***	1.175***
	(0.006)		(0.012)	(0.078)
$CAP_{(t-1)}$		0.723***	0.521***	
		(0.053)	(0.044)	
$NIM_{(t-1)}$		0.053		
		(0.142)		
$DEP/A_{(t-1)}$		-0.347***		
		(0.028)		
$LLP/L_{(t-1)}$		-2.252***		
		(0.098)		
Liquidity $GAP_{(t-1)}$		-0.268***		
		(0.011)		
$Loans/A_{(t-1)}$			-0.042**	-0.536***
			(0.018)	(0.126)
$Size_{(t-1)}$	-12.475***	-11.470***	-10.263***	-47.596***
	(0.286)	(0.372)	(0.279)	(2.217)
Policy rate	-0.083	0.058	-0.049	1.379**
	(0.061)	(0.079)	(0.067)	(0.678)
Unempl	-0.193***	-1.135***	0.008	1.718***
	(0.031)	(0.039)	(0.031)	(0.327)
$Competition_{(t-1)}$	-3.348**	-9.038***	-3.122**	-80.705***
	(1.325)	(1.902)	(1.377)	(16.277)
Low-income× × $Comptetition_{(t-1)}$	-4.977	20.526***	-4.277	44.964
	(3.182)	(5.031)	(3.499)	(32.639)
Business Cycle	-0.434***	-0.366***	-0.512***	-1.884**
	(0.054)	(0.062)	(0.061)	(0.751)
Business Cycle× × $Competition_{(t-1)}$	1.192***	1.384***	1.486***	4.661
	(0.243)	(0.275)	(0.262)	(3.433)
Low-income× × Business $Cycle_{(t-1)}$	1.175***	2.025***	1.080***	3.201**
	(0.150)	(0.256)	(0.163)	(1.553)

Table 5: Sensitivity analysis - role of competition low-income versus high-income countries cont.

Low-income× × Business Cycle $_{(t-1)}$× × Competition$_{(t-1)}$	-0.790	-2.965***	-1.003*	-8.592
	(0.527)	(0.851)	(0.575)	(5.427)
R-squared	0.180	0.242	0.146	0.029
F(p-value)	0.000	0.000	0.000	0.000
#Observ.	83,182	69,946	81,387	82,617
#Banks	8,416	8,178	8,395	8,413

bank growth is procyclical in high-income countries because all regression coefficients are positive and statistically significant at 1% (but for the *Leverage growth*). The positive coefficient on this interaction term informs that in high-income countries any decrease in competition is associated with greater procyclicality of *assets, loans and deposits growth*. The overall procyclicality for high-income countries equals 0.758 (=1.192-0.434) for the *assets growth*, 1.018 (=1.384-0.366) for *loans growth* and 0.974 (=1.486-0.512) for the *deposits growth*. Therefore, in high-income countries our competition -stability hypothesis (H1) is supported, that more competitive banking industry is associated with decreased procyclicality of the bank growth. In contrast to this, for *low - income* countries we find that decreased competition is associated with statistically significant reduction in procyclicality of the *loans growth* and the *deposits growth*. Thus, our findings for *low - income* countries are therefore in line with the competition-fragility hypothesis (H2), that more competition in the banking industry is associated with increased procyclicality. In summary, our results provide evidence for hypothesis H3, that the links between procyclicality of the growth and competitive environment depend on income level of a country.

Prior studies also use market structure as a proxy for competition intensity (see Bouvatier et al., 2012; Kouretas et al., 2020). Therefore, we run additional models of Equation (2), applying assets concentration of three largest banks in a country. We denote this variable as Market Structure CR3. We would like to highlight that the concentration ratio is in fact not a direct measure of competition. Thus, the empirical results for this measure may be different from the effects of the Lerner index. In Table 6 we find that reduced market concentration (CR 3 ratio closer to 0) is associated with the increased procyclicality of the asset and the deposit growth, and with a reduced procyclicality of the loans growth. More concentrated banking sectors show greater procyclicality of the loans growth and declined procyclicality of the deposit growth. As for the *leverage growth* we find that less concentrated banking sectors are associated with negative links between the *leverage* and *Business Cycle* – implying more procyclicality.

Table 6: Procyclicality of growth and market structure proxied with CR3 (concentration ratio of assets 3 largest banks)

	Asset growth	Loans growth	Deposits growth	Leverage growth
	(1)	(2)	(3)	(4)
$Leverage_{(t-1)}$	-0.006***			
	(0.000)			
$LtD_{(t-1)}$	0.060***		0.161***	1.193***
	(0.006)		(0.012)	(0.077)
$CAP_{(t-1)}$		0.684***	0.510***	
		(0.053)	(0.044)	
$NIM_{(t-1)}$		-0.013		
		(0.139)		
$DEP/A_{(t-1)}$		-0.356***		
		(0.028)		
$LLP/L_{(t-1)}$		-2.354***		
		(0.099)		
Liquidity $GAP_{(t-1)}$		-0.263***		
		(0.011)		
$Loans/A_{(t-1)}$			-0.034*	-0.521***
			(0.018)	(0.124)
$Size_{(t-1)}$	-12.891***	-12.151***	-10.748***	-48.939***
	(0.285)	(0.373)	(0.274)	(2.139)
Policy rate	-0.252***	-0.117	-0.163***	0.514
	(0.060)	(0.072)	(0.062)	(0.608)
Unempl	-0.089***	-1.040***	0.071**	1.591***
	(0.032)	(0.040)	(0.032)	(0.309)
Market Structure CR3	0.064***	0.035**	0.112***	-0.219
	(0.014)	(0.016)	(0.015)	(0.139)
Business Cycle	0.302***	-0.068	0.318***	-1.511*
	(0.079)	(0.102)	(0.084)	(0.815)
Business Cycle× × Market Structure CR3	-0.002	0.007***	-0.004**	0.007
	(0.002)	(0.002)	(0.002)	(0.018)
R-squared	0.173	0.233	0.142	0.028
F(p-value)	0.000	0.000	0.000	0.000
#Observ.	83,847	70,506	82,016	83,276
#Banks	8,447	8,212	8,426	8,440

Table 7: Sensitivity analysis - role of change in the competition measure - Boone indicator

	Asset growth (1)	Loans growth (2)	Deposits growth (3)	Leverage growth (4)
$Leverage_{(t-1)}$	-0.006***			
	(0.000)			
$LtD_{(t-1)}$	0.059***		0.156***	1.215***
	(0.006)		(0.012)	(0.078)
$CAP_{(t-1)}$		0.706***	0.507***	
		(0.053)	(0.044)	
$NIM_{(t-1)}$		-0.053		
		(0.138)		
$DEP/A_{(t-1)}$		-0.353***		
		(0.029)		
$LLP/L_{(t-1)}$		-2.423***		
		(0.099)		
Liquidity $GAP_{(t-1)}$		-0.260***		
		(0.011)		
$Loans/A_{(t-1)}$			-0.031*	-0.553***
			(0.018)	(0.125)
$Size_{(t-1)}$	-12.987***	-12.267***	-10.817***	-48.391***
	(0.283)	(0.371)	(0.273)	(2.149)
Policy rate	-0.271***	-0.167**	-0.184***	0.295
	(0.060)	(0.072)	(0.062)	(0.608)
Unempl	-0.039	-0.955***	0.118***	1.637***
	(0.032)	(0.040)	(0.033)	(0.316)
Competition $Boone_{(t-1)}$	-4.670***	-5.433***	-1.871*	-33.745**
	(0.960)	(1.469)	(1.109)	(14.957)
Business Cycle	0.265***	0.316***	0.144***	-0.722**
	(0.032)	(0.042)	(0.034)	(0.338)
Business Cycle× × Competition $Boone_{(t-1)}$	0.349***	0.403**	0.052	3.607**
	(0.128)	(0.174)	(0.157)	(1.697)
R-squared	0.176	0.237	0.142	0.029
F(p-value)	0.000	0.000	0.000	0.000
#Observ.	82,738	69,652	80,946	82,207
#Banks	8,448	8,211	8,427	8,442

Table 8: Sensitivity analysis - the role of GDP per Capita

	Asset growth (1)	Loans growth (2)	Deposits growth (3)	Leverage growth (4)
$Leverage_{(t-1)}$	-0.006***			
	(0.000)			
$LtD_{(t-1)}$	0.058***		0.161***	1.170***
	(0.006)		(0.012)	(0.077)
$CAP_{(t-1)}$		0.713***	0.524***	
		(0.054)	(0.044)	
$NIM_{(t-1)}$		-0.009		
		(0.142)		
$DEP/A_{(t-1)}$		-0.350***		
		(0.028)		
$LLP/L_{(t-1)}$		-2.334***		
		(0.098)		
Liquidity $GAP_{(t-1)}$		-0.263***		
		(0.011)		
$Loans/A_{(t-1)}$			-0.036**	-0.518***
			(0.018)	(0.125)
$Size_{(t-1)}$	-12.580***	-11.786***	-10.353***	-48.215***
	(0.282)	(0.375)	(0.275)	(2.186)
Policy rate	-0.243***	-0.090	-0.194***	1.166*
	(0.061)	(0.080)	(0.066)	(0.651)
Unempl	-0.051	-0.983***	0.123***	1.839***
	(0.032)	(0.040)	(0.032)	(0.306)
$Competition_{(t-1)}$	-10.810***	-13.303***	-8.946***	-71.012***
	(1.232)	(1.792)	(1.242)	(11.640)
GDPG per capita	-0.040	-0.115	-0.164***	-0.706
	(0.053)	(0.074)	(0.061)	(0.603)
GDPG per capita× × $Competition_{(t-1)}$	1.537***	2.174***	1.634***	1.038
	(0.237)	(0.346)	(0.261)	(2.368)
R-squared	0.174	0.235	0.142	0.029
F(p-value)	0.000	0.000	0.000	0.000
#Observ.	83,182	69,946	81,387	82,617
#Banks	8,416	8,178	8,395	8,413

Table 9: Sensitivity analysis - procyclicality in CEE countries

VARIABLES	Asset growth (1)	Loans growth (2)	Deposits growth (3)	Leverage growth (4)
$Leverage_{(t-1)}$	0.001			
	(0.001)			
$LtD_{(t-1)}$	0.008		0.175***	0.786**
	(0.028)		(0.052)	(0.380)
$CAP_{(t-1)}$		-0.589***	-0.320**	
		(0.164)	(0.149)	
$NIM_{(t-1)}$		0.966*		
		(0.523)		
$DEP/A_{(t-1)}$		-0.269**		
		(0.107)		
$LLP/L_{(t-1)}$		-1.530***		
		(0.371)		
Liquidity $GAP_{(t-1)}$		-0.264***		
		(0.042)		
$Loans/A_{(t-1)}$			-0.038	0.844
			(0.084)	(0.833)
$Size_{(t-1)}$	-18.206***	-20.808***	-18.436***	-57.907***
	(1.176)	(1.402)	(1.197)	(10.986)
Policy rate	0.523**	0.611**	0.359	-0.573
	(0.213)	(0.270)	(0.236)	(2.848)
Unempl	-0.880***	-1.293***	-0.664***	3.530*
	(0.163)	(0.201)	(0.173)	(1.894)
$Competition_{(t-1)}$	-15.092	-1.350	-25.769***	2.757
	(9.304)	(11.389)	(8.995)	(86.235)
Business Cycle	0.773***	1.150***	0.677***	-2.058
	(0.099)	(0.116)	(0.106)	(1.318)
R-squared	0.332	0.441	0.290	0.031
F(p-value)	0.000	0.000	0.000	0.000
#Observ.	2,398	1,954	2,302	2,399
#Banks	282	271	282	282

Table 10: Sensitivity analysis - the effect of competition on procyclicality in CEE countries

	Asset growth	Loans growth	Deposits growth	Leverage growth
	(1)	(2)	(3)	(4)
$Leverage_{(t-1)}$	0.001			
	(0.001)			
$LtD_{(t-1)}$	0.011		0.176***	0.787**
	(0.027)		(0.052)	(0.380)
$CAP_{(t-1)}$		-0.593***	-0.318**	
		(0.163)	(0.149)	
$NIM_{(t-1)}$		0.990*		
		(0.526)		
$DEP/A_{(t-1)}$		-0.263**		
		(0.107)		
$LLP/L_{(t-1)}$		-1.557***		
		(0.378)		
Liquidity $GAP_{(t-1)}$		-0.261***		
		(0.042)		
$Loans/A_{(t-1)}$			-0.034	0.846
			(0.084)	(0.838)
$Size_{(t-1)}$	-18.247***	-20.768***	-18.477***	-57.928***
	(1.198)	(1.425)	(1.214)	(11.007)
Policy rate	0.616***	0.673**	0.404*	-0.542
	(0.222)	(0.273)	(0.242)	(2.836)
Unempl	-0.882***	-1.300***	-0.667***	3.528*
	(0.164)	(0.202)	(0.173)	(1.895)
$Competition_{(t-1)}$	-4.414	4.836	-19.439**	5.851
	(9.267)	(11.197)	(9.238)	(99.563)
Business Cycle	1.908***	1.946***	1.358***	-1.717
	(0.356)	(0.466)	(0.351)	(4.290)
Business Cycle× $\times$ $Competition_{(t-1)}$	-4.445***	-3.177*	-2.657**	-1.345
	(1.419)	(1.857)	(1.332)	(16.325)
R-squared	0.336	0.442	0.292	0.031
F(p-value)	0.000	0.000	0.000	0.000
#Observ.	2,398	1,954	2,302	2,399
#Banks	282	271	282	282

Third, our results might also be affected by choice of the competition measure. Therefore, we run alternate models in which we apply the Boone indicator (Leroy and Lucotte, 2017; Kouretas et al., 2020), instead of the Lerner index. The Boone indicator measures the effect of changes in marginal costs on profits and can be interpreted as the measure of the banking sector's sensitivity to marginal costs (Aysan and Ozturk, 2018). This indicator is generally negative and informs about the percentage decrease in profits resulting from a 1 percent increase in the marginal cost (Aysan and Ozturk, 2018). It is based under idea that the negative relationship between marginal costs and profit is steeper in more competitive banking markets, meaning that more efficient companies tend to increase their market share of profits (Cañón et al., 2022). Thus, the Boone indicator should take on higher values in absolute terms (i.e., more negative values) when competition increases (Kick and Prieto, 2015). The basic drawback of the Boone indicator, in comparison to the Lerner index, is that there are no reference values for this indicator that definitely state what level of the Boone reflects perfect competition or monopoly. Generally, values close to 0 reflect proximity of monopoly. However, we cannot tell what values below 0 indicate proximity of perfect competition. Thus, in the analysis of the models that include the Boone indicator, we look at the signs of the regression coefficients on the *Business Cycle* × *Competition Boone* – to check whether they are in line with results presented in Table 4. In Table 7 we give further support to the findings presented in Table 4. We find that the coefficient of Business *Cycle* × *Competition Boone* is positive and significant in the assets and loans growth models, implying that increased competition is associated with the reduced procyclicality of growth. Under the assumption that Boone indicator = 0 denotes monopoly, the positive and significant coefficients on Business Cycle in the assets, loans and deposits growth models imply that the uncompetitive banking sectors are more procyclical. Thus, we infer that the competition-stability hypothesis (H1) is further supported in the full sample.

A fourth way to check the robustness of our results consists in replacing the *Business Cycle* measure of the real GDP growth rate with a real GDP per capita growth rate (denoted as GDPG per capital). This robustness check also allows us to report estimation results consistent with Table 4.

In particular, we still find under Lerner equal to 0 (perfect competition) the bank growth is countercyclical, because the coefficients on *GDPG per capita* are negative. Positive coefficients on the double interaction term of *GDPG per capita* × $Lerner_{(t-1)}$ give further support to hypothesis H1, that more competition is associated with reduced procyclicality. Therefore, we still find support for the main results presented in Table 4.

Our next sensitivity check consists of analysis of the role of competition in Central European Countries (CEE). In Tables 9 and 10 we generate regressions for the CEE sample that replicate the results presented in Tables 3 and 4, respectively. The results presented in Table 3 show that bank growth in procyclical, with procyclicality

enhanced for the asset growth, deposit growth and loans growth. In Table 10 we provide evidence that weakened competition is associated with the decreased procyclicality of bank growth, which is statistically significant. This result contradicts our results presented in Table 4 for the full sample. Thus, for the CEE countries, the competition – fragility seems to be supported as expressed in Hypothesis H2, that decreased competition in banking industry reduces the procyclicality of bank growth. In our sensitivity analyses we have also conducted more checks, including the change in the estimation technique and the analysis of non-linearity of effects of competition (see e.g., Kouretas et al., 2020). The use of alternate estimators, like 2 -step robust GMM technique and Random Effects estimator provides that same baseline conclusion, that more competitive banking sectors are less procyclical. Analysis of the non-linearity of effects does not show any statistically significant effects of squared competition measure on procyclicality of bank growth.

5 Conclusions

This paper's aim was to find out what is the role of competitive environment in shaping the procyclicality bank growth. Using a cross-country sample covering over 8000 commercial and cooperative banks operating in over 100 countries in 2004-2016, we tried to find out how competition intensity affects the links between bank growth and the business cycle. Our analysis aimed to test three hypotheses. Firstly, following the competition – stability perspective, we said that increased competition in the banking industry was associated with decreased procyclicality of bank growth. Secondly, following the competition-fragility perspective t, we assumed that a more competitive environment was associated with increased procyclicality of the bank growth. Thirdly, does income level matter for the links between competition and the procyclicality of bank growth?

Our results in the full sample support the competition-stability hypothesis. We find that under perfect competition bank growth is countercyclical and any decrease in competition intensity is associated with greater procyclicality of the asset, the loans and the deposits growth. The effects on the procyclicality of leverage growth are opposite because we find that increased competition is associated with greater procyclicality of leverage.

Our sensitivity analysis shows that the links between competition and cyclicality of the assets, deposits and credit growth depend on the income-level of a country. We show that the competition-stability hypothesis is supported in high-income countries. For developing countries, we find the opposite effects. Our results are robust to alternate measure of competition intensity and to change in the measurement of the business cycle.

Overall, the results emphasize the importance of a competitive environment for procyclicality of bank growth. They may be considered by regulators and supervisors responsible for macroprudential policy. As we show that competition may reduce

procyclicality, decision-makers should consider it in design and choices about macroprudential policy tools. Moreover, they should consider the income-level group, because it matters for the links between competition and procyclicality of bank growth.

Our study considers only competition as a potential explanation for the diversity in procyclicality of bank growth. Obviously, there are other factors shaping the links between bank growth and the business cycle, such as regulations and supervision. The association between competition and procyclicality of bank growth may be also diversified, depending on regulations and supervision. Therefore, future research can be further extended by assessing the potential diversity of the links between the procyclicality of bank growth and competition.

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A Appendix

Table A1: Sample description per country

Country	#Banks	#Observ	Competition average	Income group	Country	#Banks	#Observ	Competition average	Income group
Albania	10	86	0.26	Low-income	Jamaica	5	44	0.34	Low-income
Algeria	16	145	0.41	Low-income	Japan	127	1331	0.36	High income
Angola	11	104	0.27	Low-income	Jordan	2	12	0.36	Low-income
Argentina	53	475	0.32	Low-income	Kenya	27	264	0.37	Low-income
Armenia	13	125	0.30	Low-income	Korea. Rep.	12	132	0.32	High income
Australia	21	204	0.12	High income	Kuwait	3	20	0.56	High income
Austria	138	1257	0.53	High income	Kyrgyz Republic	3	32	0.44	Low-income
Azerbaijan	14	104	0.30	Low-income	Latvia	17	143	0.31	High income
Bahamas	4	38	0.34	High income	Lebanon	17	75	0.04	Low-income
Bahrain	5	43	0.28	High income	Lithuania	8	80	0.24	High income
Bangladesh	26	271	0.21	Low-income	Luxemburg	2	12	0.23	High income
Belarus	9	64	0.26	Low-income	Malawi	4	42	0.25	Low-income
Belgium	25	238	0.14	High income	Malaysia	24	246	0.20	Low-income
Belize	2	18	0.29	Low-income	Malta	6	59	0.28	High income
Bolivia	10	100	0.30	Low-income	Mauritius	14	134	0.37	Low-income
Bosnia and Herzegovina	21	180	0.26	Low-income	Mexico	26	108	0.62	Low-income
Botswana	8	75	0.21	Low-income	Moldova	11	109	0.30	Low-income
Brazil	81	690	0.22	Low-income	Mongolia	3	21	0.60	Low-income
Bulgaria	16	158	0.34	Low-income	Montenegro	7	56	0.01	Low-income
Burundi	4	28	0.32	Low-income	Morocco	6	50	0.26	Low-income
Canada	14	125	-0.02	High income	Mozambique	10	97	0.25	Low-income
Bulgaria	16	158	0.34	Low-income	Nepal	24	232	0.18	Low-income
Chile	18	84	0.23	High income	Netherlands	19	158	0.14	High income
China	114	964	0.35	Low-income	New Zealand	10	85	0.18	High income
Colombia	4	30	0.36	Low-income	Nigeria	15	142	0.21	Low-income
Congo Dem. Rep.	9	66	0.14	Low-income	Norway	12	95	0.38	High income

Table A1: Sample description per country cont.

Country	#Banks	#Observ	Competition average	Income group	Country	#Banks	#Observ	Competition average	Income group
Costa Rica	14	146	0.25	Low-income	Pakistan	21	211	0.17	Low-income
Croatia	29	290	0.28	High income	Panama	35	212	0.35	Low-income
Cyprus	10	68	0.30	High income	Paraguay	13	134	0.19	Low-income
Czech Republic	16	162	0.36	High income	Peru	14	138	0.30	Low-income
Denmark	38	386	0.30	High income	Philippines	22	216	0.21	Low-income
Dominican Republic	36	304	0.12	Low-income	Poland	33	288	0.31	High income
Egypt	22	234	0.05	Low-income	Portugal	19	152	0.19	High income
Estonia	4	31	0.24	High income	Romania	19	151	0.25	Low-income
Ethiopia	9	89	0.54	Low-income	Russian Federation	756	6533	0.21	Low-income
Finland	8	72	0.09	High income	Serbia	27	257	0.20	Low-income
France	164	1577	0.20	High income	Singapore	9	84	0.77	High income
Gambia	2	20	0.24	Low-income	Slovak Republic	7	57	0.27	High income
Georgia	4	23	0.31	Low-income	Slovenia	15	144	0.21	High income
Germany	1064	10746	-0.11	High income	South Africa	12	128	0.16	Low-income
Ghana	16	144	0.37	Low-income	Spain	89	743	0.33	High income
Greece	9	85	0.22	High income	Sri Lanka	12	129	0.22	Low-income
Haiti	1	6	0.18	Low-income	Sweden	19	194	0.32	High income
Honduras	18	180	0.26	Low-income	Switzerland	101	1015	0.16	High income
Hong Kong	26	228	-1.06	High income	Thailand	20	205	0.39	Low-income
Hungary	13	115	0.22	High income	Trinidad and Tobago	4	26	0.35	High income
Iceland	2	11	0.21	High income	Uganda	14	125	0.28	Low-income
India	55	570	0.27	Low-income	Ukraine	34	280	0.25	Low-income
Indonesia	55	487	0.36	Low-income	United Kingdom	93	801	0.31	High income
Ireland	7	67	0.25	High income	United States	5528	58693	0.27	High income
Israel	9	88	0.22	High income	Uruguay	17	150	0.19	High income
Italy	454	4720	0.14	High income	Venezuela	21	180	0.32	Low-income