Concentration, competition and financial stability in the South-East Europe banking context

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Abstract

The banking industries of South-East European (SEE hereafter) countries are the main channel through which financial resources are distributed across the region and over the last decades they have witnessed deep structural changes such as privatisations, consolidation and cross-border acquisitions. The purpose of this study is to shed further light on how concentration, competition and the financial stability of these banking industries has changed over time. In addition, this study investigates how concentration and competition in the SEE banking industries affects the financial stability of SEE banks. By using alternative measures of market concentration and competition, I find a reduction in the degree of concentration as well as market structures characterised by monopolistic competition. Furthermore, using several measures of financial stability I find a reduction of non-performing loans as well as a reduction in the probability of insolvency of SEE banks. When analysing the effects of either concentration or competition measures on the financial stability of SEE banks, this study reveals that an increase in market concentration results in a reduction of the non-performing loans ratios, therefore indicating greater financial stability of SEE banks. On the other hand, by using the Lerner index as a measure of competition, the findings presented in this study reveal that an increase in banks' market power has the effect of increasing non-performing loans ratios of SEE banks. Finally, by breaking down SEE banks in accordance with their ownership (i.e. domestic versus foreign ownership) and size (large versus small banks), this study reveals mixed results in relation to the effect of both concentration and competition measures on the financial stability of SEE banks.

Keywords: Market concentration, non-performing loans, financial stability, banking

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1. Introduction

The South-East Europe (SEE hereafter) banking industries have gone through massive structural changes since the second half of the 1990s (Mamatzakis et al., 2005). In this period, SEE governments implemented reforms with the goal of facilitating the transition from planned- to market-oriented economies. These transition processes were mainly conducted through the sale of state-owned companies to private investors. At the same time, relevant reforms were implemented in order to set up institutional frameworks capable of facilitating the functioning of market economies. Since the completion of the transition to market economies, many SEE governments implemented additional reforms with the aim of meeting the requirements necessitated by the accession to the European Union (EU) and the adoption of the euro currency. One of the consequences of this additional wave of reforms in the late 1990s was a radical change in terms of the ownership of SEE banks. In fact, foreign banks, mainly located in Western Europe, were allowed to purchase existing savings and commercial banks situated in the SEE region (Bonin et al., 2005). As these foreign banks sought to expand their business through cross border acquisitions in the SEE region, reforms implemented by SEE governments became congenial to that strategy

The large scale entry of foreign banks is SEE countries, via their own branches or through the acquisition of local banks, makes the SEE banking industry a very peculiar case as in no other region is the banking system so massively in the hands of private, foreign financial institutions (Bonin, 2014). In addition to this, SEE countries have relatively new judicial systems, although their institutional environments still lag behind their neighbours in Western Europe in terms of legal protection, rule of law, government effectiveness and political instability. Given the context in which they operate, SEE banking industries constitute a very particular case in comparison with other banking industries in other regions. The relevance of this study is to shed further light on the SEE banking industries by focusing on three important aspects: that is, the degree of concentration in SEE banking markets, the degree of competition within each SEE banking industry, their financial stability and the effect of the first two aspects on the latter. These aspects have been widely investigated in the context of other countries (see Soedarmono et al., 2011; Beck et al., 2013; Fiordelisi and Mare, 2014; Fu et al., 2014; Akins et al., 2016; Leroy and Lucotte, 2017; Clark et al., 2018), while only a few studies have focused on the SEE region and aspects of concentration and competition (see, for instance, Mamatzakis et al., 2005).

The present study contributes to the existing empirical banking literature in several ways. Firstly, by focusing on a relatively unexplored region, I shed further light onto the debate on market concentration, market power, financial stability and the way the two former aspects affect the latter. Secondly, my analysis captures a period from the early 2000s, when a large number of SEE banks were the target of acquisitions from Western, foreign banks, to the 2007-2009 global financial crisis and the following European sovereign debt crisis that was broken up in 2009. Thirdly, the empirical analysis I present in this study is based on a four-tiered analytical approach. In particular, I start by conducting an analysis of concentration in a wide range of SEE banking markets (i.e. deposit, loans and assets markets) and I then move on to the analysis of competition in the SEE banking industries. I will then proceed to investigate the financial stability of SEE banking firms by looking at both the quality of their loans portfolio as well as the banks' overall degree of solvency. Finally, I use the results of concentration, competition and financial stability in order to investigate the effects of both former aspects on the latter.

The rest of this paper is organised as follows Section 2 provides a detailed background of the banking industries in the SEE that might not be well known by the general public. Section 3 provides a review of the literature on the relationship between banking concentration, competition and financial stability. Section 4 introduces the methodologies and Section 5 describes the data sources used in this study. Section 6 presents the empirical results and Section 7 draws the conclusions.

2. Developments in the South-Eastern Europe banking industries

In order to provide a more detailed background of the banking industries in the SEE, this section illustrates the institutional set-up and broader events that have significantly impacted the recent developments of SEE banking industries.

The banking sector is the most developed segment of the Albanian financial system. The large presence of foreign banks as a consequence of privatisation implemented in the late 1990s has contributed to improve the competitiveness and efficiency of the banking sector (Vika and Suljoti, 2015). All banks in the Albanian banking sector are universal/commercial (Vika and Suljoti, 2015). Lending to the private sector is one of the main activities of Albanian banks. The domestic credit to the private sector from banks increased by almost 30 percentage points from 6.5% in 2002 to 34.5% in 2016 (World Bank, 2016). Borrowers from commercial banks (per 1,000 adults) were reported at 157 in 2016 in comparison to 14 in 2004 (World Bank, 2016). The high credit growth rate and wider access to banking services have contributed to the expansion of economic activity in Albania despite the slowdown of the domestic economy following the financial crisis in 2008.

The financial system in Bosnia-Herzegovina is bank-oriented since the banks are the main providers of credit in the economy, especially for small and medium-sized enterprises as well as households (Kovacevic, 2015). Foreign banks play a key role in the domestic banking system as the main providers of credit to the private sector. The presence of foreign banks in Bosnia-Herzegovina is very wide; this is not a surprise since the country underwent processes of privatisation and consolidation (Matić and Papac, 2014; Memić, 2015) in the late 1990s. As a results of this, by the end of 2013 17 banks were foreign-owned and 8 were domestically owned. In accordance with the World Bank (2016), the domestic credit to the private sector by banks increased from 35.9% in 2004 to 53.2% in 2015 (World Bank, 2016).

The collapse of the domestic banking system in 1997 led the Bulgarian government to accelerate the privatisation of state-owned banks. As in other SEE countries, privatisation processes paved the way for interested foreign banks to enter into the Bulgarian banking sector. By 2013, the share of banking assets held by foreign banks accounted for up to 75.3% of total banking assets (Bulgarian National Bank, 2014). Lending to the private sector increased rapidly from 25.9% in 2003 to 66.4% in 2013 (World Bank, 2016). The collapse of the Corporate Commercial Bank, the country's fourth largest bank, in 2014 and mass cash withdrawals from branches of First Investment Bank, the country's third-biggest lender, raised doubts about the corporate governance of Bulgarian banks.

The 1998 banking crisis in Croatia significantly reduced the number of commercial and savings banks in the country. New legislation introduced in 2001 required an increase in bank capitalisation which was followed by a new wave of privatisation and the entry of foreign banks (Kraft and Huljak, 2018). New banking laws were then introduced in 2003 and 2008 in order to further raise the minimum initial capital for banks as well as to increase their capital ratios (Kraft and Huljak, 2018). The domestic credit provided by banks to the private sector increased substantially from 47.9% in 2004 to 64.4% in 2015 (World Bank, 2016). In 2017, the share of assets held by foreign-owned banks in Croatia increased to 89.2%, while domestic-owned banks accounted for the remaining share (Croatian National Bank, 2018).

At the end of 2014 the Romanian banking system counted 30 banks, of which 25 had majority foreign capital, 3 had majority domestic capital and 2 which had fully or majority state owned capital. (National Bank of Romania, 2014). A large part of the foreign ownership of Romanian banks resulted from the privatisation process undertaken in Romania in the late 1990s. The link between the Romanian and European banking system remains strong high (National Bank of Romania, 2014), with capital invested in Romanian banks coming mainly from Austria (27.2%), Greece (17.5%) and the Netherlands (10.2%).

As in other SEE countries, the presence of foreign banks in Serbia is very large. At the end of 2014, 21 banks were majority foreign-owned; domestic private capital dominated in 2 banks while 6 banks were comprised of majority state-owned capital (National Bank of Serbia, 2014). Out of the total assets of the Romanian banking sector, banks from Italy, Austria and Greece accounted for the dominant share of Romanian foreign owned banks with values of 24.9%, 14.8% and 14.1%, respectively (National Bank of Serbia, 2014).

The development of the SEE banking industries in the last two decades can be attributed to three reasons. First, SEE governments have managed to adopt policies aiming to qualify SEE countries for EU membership. Reforming domestic banking industries was therefore an important step that SEE governments had to take in order to meet EU accession requirements. Secondly, privatisation and consolidation policies of the domestic banking industries attracted the interest of foreign banks that was initially curtailed by SEE governments fearing that foreign-owned banks would have facilitated capital flight phenomenons with the effect of destabilising domestic economies. However, once SEE governments realised that allowing foreign investors to purchase domestic banks would be a source of consistent revenue and a way of improving banks' performances, the restrictions on foreign banks were lifted (Bonin et al, 2014). Thirdly, the large presence of foreign banks in the SEE banking industries has been generally beneficial in terms of knowledge transfer, the introduction of new financial products as well as the disappearance of less efficient banks which could not compete with these new entrants.

3. Literature review

As pointed out previously, SEE banking industries have experienced deep structural change since the 1990s. An additional result of these changes has been the large presence of Western European banks in the SEE banking industries.[2] These developments have raised questions about the state of the SEE banking industries and a number of empirical studies have tried to address this by focusing on the state of concentration and competition in the aforementioned banking industries. The theoretical background on which studies of concentration and competition are grounded encompasses two alternative views, that is the *Structure-Conduct-Performance* (*SCP* hereafter) paradigm and the *Efficient Structure Hypothesis* (*ESH* hereafter). In accordance with the *SCP* paradigm, a positive relationship exists between profits and concentration (Bain, 1959). This is motivated by the fact that a higher degree of market concentration might result in collusion practices among market participants with the goal of reducing the competition. A lower degree of competition then has the effect of reducing the market efficiency through monopoly profits. For a long period of time the acceptance of this paradigm has been at the basis of anti-trust and competition policies. The *SCP* paradigm, however, was challenged by Demesetz (1973), who argued instead that the aforementioned positive relationship is the result of production efficiency by firms that are then able to gain additional market shares, resulting in increased market concentration. Therefore, in accordance with the *ESH* hypothesis, anti-trust policies impeding market concentration would be counterproductive and lead to losses in economic welfare as they would force firms to operate at lower levels of efficiency (Demesetz, 1973). On the basis of these two alternative paradigms, a vast empirical banking literature has focused on the degree of concentration and competition in the banking industries of developed economies (see Molyneux et al., 1994; De Bandt and Davis, 2000; Bikker and Haaf, 2002; Coccorese, 2005; De Guevara et al., 2005; Carbo et al., 2009; Weill,

[2] In the 1990s and early 2000s, SEE governments launched bank privatisation programmes with the goal of encouraging competition and enhancing performance of the banking sector. An active role in this process of privatisation has been played by foreign banks which have gained a dominant position in the space of a few years in most of the SEE banking industries. It has been argued that foreign banks play a stabilising role in the host country. On the other hand, there are still a number of concerns related to 1) the type of customer served, with foreign banks focusing on large and more profitable firms, leaving small and medium sized enterprises for domestic banks; 2) the fact that information available to the host country supervisor tends to reduce with the increasing presence of foreign banks; 3) the possibility that the host country is more exposed to external events affecting foreign banks in their home country.

2013). Only recently has more attention been given to emerging economies such as SEE countries. Mamatzakis et al. (2005) investigated the degree of concentration and competition for seven SEE banking industries for the period 1998-2002. Using the *CR-3* ratio as a measure of concentration[3], they found that, despite the declining number of banks as a result of mergers and acquisitions, there is no evidence of increasing concentration over the period of analysis. Furthermore, by using the *H-statistic*[4] proposed by Panzar and Rosse (1987), they found an increasing degree of competition among banks in the SEE region. In a recent study, Staikouras and Koutsomanoli-Filippaki (2006) compared the degree of competition in the banking industries of the European Union (EU-15) countries with those in Eastern Europe plus Cyprus and Malta (EU-10) that joined the EU in May 2004. Using the *H-statistic* as a measure of competition, they found evidence that, over the period 1998–2002, the degree of competition in the banking industries of the EU-15 countries was higher than that in the EU-10 countries. Along similar lines, Delis (2010) investigated the evolution of competition in the banking industries of 22 Eastern European countries over the period 1999–2006. Their results show that in those countries where privatisation processes were implemented earlier, the degree of competition among banks was usually higher in comparison to countries that were still completing privatisation processes. Recent studies have also focused on the Russian banking industry where privatisation processes were implemented on a large scale since the beginning of the 2000s. Anzoategui et al. (2012), investigated the degree of market power in the Russian banking industry across different groups of Russian banks in accordance with their size, ownership, customer-oriented characteristics and geographical presence. Using the *Lerner index* as a measure of market power, Anzoategui et al. (2012) found that large banks and state-owned banks had more market power in comparison to small and privately-owned banks. In addition, they found that the degree of competition amongst banks was higher in those regions where the economic and financial development was greater compared with other, less-developed Russian regions.

More recently, a new strand of empirical banking literature has emerged, focusing on the relationship between competition in the banking markets and banks' financial stability. The theoretical background behind these studies is based on two alternative views of this relationship, that is the *competition-fragility* and *competition-stability* views.

From a theoretical standpoint, the *competition-fragility* view assumes that more competition among banks has the effect of reducing their financial stability. It is argued that this negative relationship between competition and financial stability is due to the fact that more competition results in a reduction of profit margins, which prevents banks from building up a buffer to hedge against either internal or external shocks (Marcus, 1984; Keeley, 1990). This reduction of profit margins has a combined effect of higher interest rates paid out by banks on customer deposits and lower interest rates charged on loans. Furthermore, as greater competition among banks has the effect of decreasing their profit margins, there is an incentive for banks to take on riskier investment projects in order to boost their profit which could, in turn, lead them to greater financial stability (Berger et al., 2009) in accordance with the *competition-fragility* hypothesis.

On the other hand, the *competition-stability* view assumes that there is a positive relationship between bank competition and financial stability. Boyd and De Nicoló (2005) in particular argued that a reduction in the degree of competition among banks leads them to charge higher interest rates on customer loans. This results in riskier projects and higher loan default rates that lead banks to a greater degree of financial instability. The second relevant point of the *competition-stability* view is that a reduction in the degree of competition is quite often accompanied by the presence of a few large banks that incentivise policy-makers to introduce 'too-big-to-fail policies' in order to avoid major disruptions

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[3] The CR-3 ratio is the percentage of market share taken up by the three largest firm operating in a market.

[4] The H-statistics is a measure of the degree of competition in the banking market. The H-statistics was presented for the first time in the seminal paper of Panzar and Rosse (1987) who demonstrated that a negative value of the mentioned statistics must be interreted as an evidence of a monopolistic market structure.

as a consequence of the failure of large banks. Such policies have the effect of increasing banks' risk-taking behaviour and, consequently, decrease the stability of the entire banking system (Beck, 2008).

Many empirical banking studies have investigated whether either *competition-fragility* or *competition-stability* hypotheses tend to prevail. Kasman and Carvallo (2014), investigated the aforementioned hypotheses by focusing on Latin American and Caribbean banking industries over the period 2001–2008. Their results show that the greater the competition in the banking industries, the greater their financial stability, therefore finding evidence of the *competition-stability* hypothesis in the case of the banking industries under study. Along the same lines, Liu et al. (2012) investigated the relationship between competition and bank-risk in the South-East Asian banking industries for the period 1998–2004. Measuring competition through the *H-statistic*, and financial stability by various indicators (such as loan loss reserves, loan loss provisions, return on assets, and the *Z-score*), their results show that a positive relationship exists between competition and financial stability. In other words, an increase in the degree of competition among banks has the effect of increasing their financial stability. These results show that the *competition-stability* hypothesis holds in the case of the South-East Asian banking industries. More recently, Fu et al. (2014) investigated the effects of concentration and competition on the financial stability of banking industries in 14 Asian countries. Using the *Lerner index* as a measure of competition, as well as two measures of financial stability such as the probability of insolvency as proposed by Merton (1974) and modified by McDonald (2002) and the *Z-score* ratio, their results show a positive relationship between competition and financial stability. In particular, higher values of the *Lerner index* (i.e. an increase in the level of competition) were found to have a positive effect on banking firms' financial stability, therefore supporting the *competition-stability* hypothesis. More recent studies have examined the relationship between competition and financial stability by focusing on small credit institutions. For example, Fiordelisi and Mare (2014) investigated the aforementioned relationship by considering a sample of cooperative banks in five European countries over the period 1998–2009. As a measure of market power, they used the *Lerner index,* while banks' financial stability was measured using the *Z-score*. Their findings support the *competition-stability* view, meaning that more competition among cooperative banks led to a reduction in the level of banks' risk-taking behaviour and therefore increased their financial stability.

Other studies have looked at the relationship between competition and financial stability by focusing on specific periods of time characterised by financial turmoil. Akins et al. (2016) investigated the effect of competition on the financial stability of the U.S. banking industry using the recent 2007–2009 global financial crisis period as a setting. By using a sample of 7,351 banks and the *H-statistic* as a measure of competition, Akins et al. (2016) found evidence in line with the *competition-stability* view.

Finally, a handful of empirical studies refer to the relationship between market power and financial stability using the *concentration-stability* and *concentration-fragility* hypotheses where the former predicts that greater banking concentration leads to greater financial stability and the latter predicts that greater banking concentration leads to higher financial fragility. In accordance with this distinction, Beck et al. (2006) examined the relationship between bank concentration and banking stability for the period 1980–1987 using bank-level data on 69 countries. Using a number of alternative measures of concentration and banking stability measures, Beck et al. (2006) found evidence supporting the *concentration-stability hypothesis*.

4. Methodology

In this study I used the concentration ratio of the three largest firms *(CR-3)*, the Herfindhl-Hirschman Index *(HHI)* and the *Lerner Index* as measures of market concentration and competition. On the other hand, I also measured the financial stability of SEE banking industries via the *Z-score* as well as the non-performing loans over total loans (*NPLs*) ratio. I then investigated the effect of either market concentration or competition on financial stability via dynamic panel data models. A description of all these methodologies is provided in the following sub-sections.

4.1 Market concentration and competition measures

One of the most widely used measures of market concentration is the concentration ratio (*CRk* hereafter) which calculates the market share of the *k* largest firms in the market, that is $CRk = \sum_{i=1}^{k} s_i$, where s_i is the market share of banking firm *i* and *k* represents the leading firms operating in the market under analysis. One of the main drawbacks of the *CRk* ratio is its focus on leading firms only. In other words, the *CRk* ratio does not take into consideration all the firms in the industry and does not consider the size distribution of firms. This is why the *HHI* is often used as an alternative[5] or in addition to the *CRk*. The *HHI* is calculated by adding up the market share of all the firms in an industry which is then squared, so that $HHI = \sum_{i=1}^{n} s_i^2$. The fact that the market shares are squared gives more weight to the larger firms, accounting for situations where there is a very uneven distribution of market power (for example, where the biggest firm has twice the market power of the second biggest). An alternative way of measuring the degree of competition within an industry is based on models of profit-maximising behaviour. One of the most popular models, developed within the New Empirical Industrial Organization, is the Panzar-Rosse model (Panzar and Rosse, 1987) which has been widely used to analyse the degree of competition in banking industries (Bikker and Haaf, 2002; Mamatzakis et al., 2005; Al-Muharrami et al., 2006; Casu and Girardone, 2006; Matthews et al., 2007; Goddard and Wilson, 2009; Daley and Matthews, 2012). The Panzar-Rosse model can be represented via a log-linear revenue equation which is specified as follows:

$$ln(R_{i,t}) = c + \sum_{i=1}^{n} \alpha_i \, ln(W_{k,t}) + \sum_{i=1}^{n} \beta_i ln(\Upsilon_{i,t}) + \sum_{i=1}^{n} \gamma_i ln(\Omega_{i,t}) + \epsilon_{i,t} \quad (1)$$

where $R_{i,t}$ represents the total revenue of a specified bank *i* at a specified time *t*; the terms in $W_{k,t}$ represent the price of specified inputs *k* at a specified time *t*; the terms in $\Upsilon_{i,t}$ represent bank-specific variables while the terms in $\Omega_{j,t}$ represent macroeconomic variables of country *j* at a specified time *t*. The degree of competition is then assessed via the *H-statistic* which is calculated by adding up the coefficient estimates of the input prices, that is $H = \sum_{i=1}^{n} \alpha_i$. The *H-statistic* is then interpreted as follows: $H \leq 0$ implies a monopoly or a perfect colluding oligopoly market structure, $0 < H \leq 1$ implies monopolistic competition and $H = 1$ is associated with perfect competition. The conclusion drawn from the *H-statistic* holds if the industry is in long-term equilibrium. According to Matthews et al. (2007), a banking industry is considered to be in equilibrium if $E = \alpha_1' + \alpha_2' + \alpha_3'$ is equal to zero. This condition is verified by replacing the dependent variable in Eq.(1) with a profit rate and then performing a Wald test. Following similar studies (Casu and Girardone, 2006; Al-Muharrami et al., 2006), in this study I estimate the Panzar-Rosse model by using a revenue equation specified as follows:

$$ln(TREV_{i,t}) = \alpha_0 + \alpha_1 \text{ln\_}ACL_{i,t} + \alpha_2 \text{ln\_}ACC_{i,t} + \alpha_3 \text{ln\_}ACF_{i,t} + \sum_{i=1}^{n} \Upsilon_{i,t} + \epsilon_{i,t} \quad (2)$$

where *TREV* represents the ratio of bank revenues (which I proxy as the sum of the variables *interest income on loans*, *other interest income* and *non-interest income*) to *total assets* for bank *i* at a specified time *t*; *ACL* is the average cost of labour calculated as the ratio of *personnel expenses* to *total assets* (i.e. the unit price of labour); *ACC* is the average cost of capital which is calculated as *total capital expenses* to *fixed assets* (i.e. the unit price of capital) and *ACF* is the average cost of deposits, calculated as the ratio of *interest expenses on customer deposits* to *total customer deposits* (i.e. the unit

[5] The *HHI* is a more accurate measure of concentration, as it considers all the firms in the industry and not only the largest as in the case of the *CRk* ratio. Also, by squaring the market shares, the *HHI* gives more weight to the largest firms, and thus accounts for situations where, say, a firm has a disproportionate amount of market share (and hence power) compared with the next biggest. Finally, because it accounts for all firms in an industry, the *HHI* accounts for transfers of market shares (for example following mergers and acquisitions) among smaller firms, which would not be reflected by the *CRk*.

price of funds). Studies using the Panzar-Rosse model to investigate the degree of concentration in banking industry (see, for example, Al-Muharrami et al., 2006; Casu and Girardone, 2006) found that the signs of the estimated coefficients of ACL, ACF and ACC were generally positive, so this is what I expect from the application of the Panzar-Rosse model in this study. Eq.(2) also includes a vector Υ_i containing bank-specific control variables. The first control variable is *total assets* (*AST*) which I use to investigate to what extent bank size affects bank revenues. The second bank-specific control variable is the ratio of *total equity* to *total assets* (*EQAST*) which I use to check whether the level of leverage has any effect on revenues. According to the relevant empirical banking literature, the coefficient estimates of *EQAST* can be either negative (Molyneux et al., 1994) or positive (Bikker and Groeneveld, 1998; Coccorese, 2009). The third bank-specific control variable is *total loans* to *total assets* (*LOANAST*) which I use to measure the effect of credit risk on bank revenues. High values of the coefficient estimate of credit risk indicate an aggressive loan growth policy while lower values would mean a more prudent approach (Casu and Girardone, 2006). The fourth control variable I use is the ratio of *cash and due from banks* to *total deposits* (*CASHDEP*) in order to investigate whether liquidity risk affects bank revenues. Banks with a high ratio of liquidity could miss investment opportunities, although it might also be true that banks with higher ratios could be in a better position to handle immediate cash needs. In relation to the expected sign of the coefficient of the *CASHDEP* variable, the evidence from the literature is mixed (Casu and Girardone, 2006); it could be either positive or negative.

As mentioned previously, the contestability parameter *H*, calculated through the estimation of Eq.(2), is given by the sum of the three estimated coefficients of the input prices ACL, ACF and ACD, that is $\mathrm{H} = \alpha_1 + \alpha_2 + \alpha_3$. The value of the contestability parameter indicates the degree of competition within the banking industry under study. Furthermore, the results of Eq.(2) are consistent if the banking industry is in long-term equilibrium. Such a hypothesis is verified by substituting the dependent variable of Eq.(2) with a measure of bank profitability such as *return on assets* (ROA). In accordance with the relevant empirical literature, I tested the long-term equilibrium hypothesis by replacing the dependent variable in Eq.(2) with a profitability variable so that the new equation is:

$$ln(1 + ROA_{it}) = \alpha_0 + \alpha_1 lnPL_{i,t} + \alpha_2 lnPK_{i,t} + \alpha_3 lnPF_{i,t} + \sum_{i=1}^{n} \Upsilon_{i,t} + \epsilon_{i,t} \tag{3}$$

Eq.(3), which is also identified by the term 'long-term equilibrium equation', has the same independent variables used in Eq.(2) while the dependent variable is ROA.[6] The long-term equilibrium is then tested through a simple Wald Test applied to the following linear combination $\alpha_1 + \alpha_2 + \alpha_3 = 0$ derived from the estimated long-term equilibrium equation. The null hypothesis of long-term equilibrium is rejected if the linear combination $H = \alpha_1 + \alpha_2 + \alpha_3$ is statistically different from zero.

A final measure of market competition I use in this study is the *Lerner index*, which represents the mark-up over marginal costs and which has been widely used in recent empirical literature (De Guevara et al., 2005; Berger et al., 2009; Beck et al., 2013; Buch et al., 2013; Kick and Prieto, 2015; Fernández et al., 2016; Leroy and Lucotte, 2017). The *Lerner index* is a time-varying indicator of the degree of market power at firm level and is calculated as follows:

$$L_{it} = \frac{p_{it} - mc_{it}}{p_{it}} \tag{4}$$

where p_{it} is the price of total assets proxied by the ratio of total revenue (interest and non-interest income) to total assets of a bank *i* at a specified time *t*, while mc_{it} is the marginal cost of total assets of bank *i* at a specified time *t* (Berger et al., 2009). The values of the *Lerner index* range from 1 to 0. The closer the value of the index to 1, the higher a bank's market power is. In contrast, the closer the value is to 0, the lower a bank's market power. In order to calculate the *Lerner index*, the first step is to estimate a translog cost function, modelled as follows:

[6] Following Claessens and Laeven (2004) and Casu and Girardone (2006), I added a value of 1 to the ROA in order to adjust it for small negative values.

$$lnTC_{it} = \alpha_0 + \alpha_1 lnQ_{it} + \frac{1}{2}\alpha_2(lnQ_{it})^2 + \sum_{k=1}^{3}\gamma_{kt} lnW_{k,it} + \sum_{k=1}^{3}\theta_k lnQ_{it} lnW_{k,it} + \frac{1}{2}\sum_{k=1}^{3}\phi_k\left(lnW_{k,it}\right)^2 + \beta_1 ln\omega_{1,it} ln\omega_{2it} + \beta_2 ln\omega_{1,it} ln\omega_{3,it} + ln\omega_{2,it} ln\omega_{3,it} + \varepsilon_{it} \quad (5)$$

where TC_{it} represents total costs of bank *i* at a specified time *t*; Q_{it} represents bank output which is proxied by total assets for bank *i* at a specified time *t* and $W_{k,it}$ are the three input prices, that is $W_{1,it}$, $W_{2,it}$, $W_{3,it}$, which indicate the prices of labour, funds, and fixed capital and are calculated as the ratios of personnel expenses to total assets, the interest expenses to total deposits and other operating and administrative expenses to total assets respectively. In this study, we rearrange the translog cost function as defined in Eq.(5) as follows:

$$lnTC_{it} = \alpha_0 + \alpha_1(lnTA_{it}) + \alpha_2\frac{1}{2}(lnTA_{it})^2 + \beta_1(lnACL_{it}) + \beta_2(lnACC_{it}) + \beta_3(lnACD_{it}) + \gamma_1(lnTA_{it} \times LnACL_{it}) + \gamma_2(lnTA_{it} \times LnACC_{it}) + \gamma_3(lnTA_{it} \times LnACD_{it}) + \phi_1\frac{1}{2}(lnACL_{it})^2 + \phi_2\frac{1}{2}(lnACC_{it})^2 + \phi_3\frac{1}{2}(lnACD_{it})^2 + \omega_1(lnACL_{it} \times LnACC_{it}) + \omega_2(lnACL_{it} \times LnACD_{it}) + \omega_3(lnACC_{it} \times LnACD_{it}) + \varepsilon_t \quad (6)$$

The estimated coefficients calculated thorough Eq.(6) are then used to calculate the marginal costs, as defined in Eq.(7), with respect to the three input prices which are labour, funds, and fixed capital, that is:

$$mc_{it} = \frac{\partial lnTC_{it}}{\partial lnQ_{it}} = \frac{TC_{it}}{Q_{it}}\left[\alpha_1 + \frac{1}{2}\alpha_2 lnQ_{it} + \sum_{k=1}^{3}\theta_k lnW_{k,it}\right] \quad (7)$$

The *Lerner index* is then calculated at bank level in accordance with Eq.(4) by using the marginal costs of bank *i*, as calculated in Eq.(6), and the price of total assets for bank *i* at time *t* as indicated previously.

4.2 Measures of financial stability

I measure the financial stability of SEE banks by using alternative accounting-based measures such as the *NPLs ratio* and the *Z-score*.

The *NPLs ratio* is used to evaluate whether or not a better quality portfolio of loans has the effect of increasing banks' financial stability. It must be pointed out that loans that are classified as non-performing do not necessarily lead to losses. In other words, losses might not occur if there is adequate collateral for loans taken out by households or firms. However, proper recognition of non-performing loans is essential in order to monitor the credit quality of a portfolio. The reason is that large non-performing loans imply the bankruptcy of a bank, an event that could lead to a loss of confidence in the banking system, especially if the failure is linked to a prominent bank. A loss of confidence in the banking system can lead to a run on other banks, with individuals and companies, being unable to distinguish between troubled and sound banks, withdrawing their deposits,. *NPLs* ratio as a measure of financial stability at bank level has been widely used in the empirical banking literature (Berger et al., 2009; Jiménez et al., 2013, Kasman and Kasman, 2016) and is calculated as follows:

$$NPL\ ratio_{it} = \frac{Non\ Performing\ Loans_{it}}{Total\ Loans_{it}} \quad (8)$$

where $Non\ Performing\ Loans_{it}$ are loans that are in default or close to being in default for bank *i* at a specific time *t* and $Total\ Loans_{it}$ are loans made by bank *i* at a specific time *t*. Since SEE banks are mostly oriented towards traditional interest-based activities (i.e. loans and deposits) rather than non-traditional intermediary activities (i.e. securities brokerage, asset securitisation and investment banking), I am confident that the stability of SEE banks is related to the quality of their loans portfolio. I therefore used the *NPL ratio* as an indicator of their financial stability.

As an alternative measure of financial stability I used the *Z-score*, which assesses the probability of insolvency at bank level. In particular, the lower (the higher) the value of the *Z-score*, the higher (the lower) the probability of insolvency. The *Z-score* has been widely used in the empirical banking literature (Boyd et al., 2006; Uhde and Heimeshoff, 2009; Houston et al., 2010; Beck et al., 2012; Liu et al., 2012; Schaeck and Cihák, 2014; Fu et al., 2014; Fernández et al., 2016). A variety of options to compute the *Z-score* have recently been surveyed in Lepetit and Stobel (2013). In this study I calculated the *Z-score* as follows:

$$Z_{it} = \frac{ROA_{it}+CAR_{it}}{St.Dev\ ROA_{it}} \tag{9}$$

where ROA_{it} indicates return on assets for bank *i* at a specified time *t*, CAR_{it} is the ratio of total equity over total assets of bank *i* at a specified time *t* and $St.Dev\ ROA_{it}$ is the standard deviation of return on assets of bank *i* at a specified time *t*. In the case of Eq.(9), I calculated the standard deviation of ROA_{it} by using a three-year rolling window approach. As pointed out by other authors (Beck et al., 2013; Schaeck and Cihák, 2010), allowing for the time variation of the *Z-score* prevents the variation in *Z-scores* of banks over time being exclusively driven by changes in the levels of profitability (ROA_{it}) and capital (CAR_{it}). From a mathematical point of view, the *Z-score* indicator tends to rise with higher values of profitability (i.e. *ROA*) as well as increases in capitalisation levels (i.e. *CAR*). Conversely, a reduction of the *Z-score* is associated with unstable profitability reflected by an increase of the *ROA* standard deviation.

4.3 Panel data model

To examine the effect of either concentration or competition on SEE banks' financial stability I used a dynamic panel data model that includes *p* lags of the dependent variable. The rationale of using a dynamic panel regression in this study, rather than a fixed-effects panel regression, is that using fixed-effect estimators with lagged dependent variables would lead to biased and inconsistent estimators (Nickell, 1981; Kiviet, 1995; Efthyvoulou and Yildirim, 2014) as it is likely that unobservable bank characteristics are correlated with the lagged dependent variable (either *NPLs ratio* or *Z-score*). Therefore, to address this problem I used the Generalized Method of Moments (GMM hereafter) system as proposed by Blundell and Bond (1998). The GMM system is also recommended in the presence of independent variables that are not strictly exogenous, meaning that they are correlated with past and possibly current realisations of error. It also addresses the problem of endogeneity between financial stability and either concentration or competition. In other words, the effect of market concentration or competition on financial stability is based on the assumption that financial stability is affected by either concentration or competition. However, as pointed out by Berger et al. (2009), market concentration or competition could also depend on financial stability. If this is the case, concentration or competition and financial stability are interdependent; that is, there is a problem of endogeneity. Endogeneity can be addressed by using instrumental variables techniques. The idea is that while market structure (or market power) may affect financial stability and vice versa, it is less likely that market structure (or market power) can affect past values of financial stability. Therefore market structure (or market power) may be used as an instrument for financial stability.

A distinctive element of the system GMM estimator is the transformation of data. In particular, two alternative transformations are commonly used. One is the 'first-difference transformation' which leads to the *difference GMM estimator*, while the other is the 'forward orthogonal deviations' transformation which leads to the *deviations GMM estimator* (Rodman, 2009). The main difference between these two alternative GMM estimators is that the 'forward orthogonal deviations' minimises the data loss in comparison with the 'first-difference transformation' GMM estimator. In other words, the advantage of the *deviations GMM* over the *difference GMM estimator* is that the former does not subtract the observation at time $t-1$ from the contemporaneous observation at time t as in the *difference GMM*, instead it subtracts from the contemporaneous observation the average of all future available observations of the variable

(Rodman, 2009). Therefore, the *deviations GMM estimator* has the advantage that it does not amplify gaps in unbalanced data sets. Given that the panel data set used in the present study is unbalanced, I therefore used the *deviations GMM estimator* to avoid losing too many observations, which is what happens when using the alternative *difference GMM estimator* on data sets where there are missing observations. Furthermore, I implemented the system GMM with Windmeijer corrected standard errors in a two-step estimation. Using Windmeijer corrected standard errors is recommended as, without this correction, standard errors tend to be downwardly biased (Windmeijer, 2005). The consistency of the GMM estimator is guaranteed only if there is no serial correlation in the idiosyncratic errors and if the instrumental variables are valid. I checked the former condition by using the Arellano-Bond test and the latter through both the Sargan and Hansen tests. The Arellano-Bond test for first- and second-order correlation is applied to the residuals in differences of the estimated system GMM. The presence of autocorrelation in the mentioned residuals would render some lags invalid as instruments. On the other hand, the Sargan and Hansen tests test the joint null hypothesis that the instruments are valid and they are therefore uncorrelated to the error term. The general form of the GMM model I used in this study is as follows:

$$FinStability_{i,t} = \alpha_0 + \alpha_1 FinStability_{i,t-1} + \alpha_2 MS + \Gamma X_{i,t} + \Theta \mathrm{Y}_{\mathrm{j,t}} + u_{i,t} \quad (10)$$

where subscripts *i* and *j* refer to bank and country respectively. As financial stability is inclined to persist over time (Kasman and Carvallo, 2014; Schaeck and Cihák, 2014; Berger et al., 2009; Köhler, 2015; Kasman and Kasman, 2016), Eq.(10) includes a lagged dependent variable, that is $FinStability_{i,t-1}$, to capture this phenomenon. As mentioned in the previous section, as a proxy of financial stability I used either the *NPLs ratio* or the *Z-score*. In particular, the *NPLs ratio* is used to account for loan portfolio risk; therefore, the higher the *NPLs ratio*, the more risky the banks' loan portfolios are. Conversely, the *Z-score* is an inverse measure of overall bank risk and the higher the *Z-score*, the lower the probability of a bank *i*'s insolvency. Eq.(10) includes either a market structure or market competition measure (i.e. *MS*) that I approximated using three alternative measures: the Concentration Ratio (*CR-3*), the Herfindahl-Hirschman Index (*HHI*) and the *Lerner index*. The first two measures (i.e. *CR-3* and *HHI*) are used as indicators of market structure whereas the remaining measure (i.e. the *Lerner index*) is used as an indicator of market power. Eq.(10) also includes a vector $X_{i,t}$, which contains bank-level variables, as well as a vector $Y_{j,t}$ that contains country-level macroeconomics variables. In the case of bank-level control variables I used the ratio of total equity divided by total assets. The rationale of using this was to check whether better-capitalised banks have a positive effect on financial stability as well as the ratio of net loans over total assets. To account for macroeconomic conditions, I used a country-level variable such as Gross Domestic Product (GDP) in order to investigate to what extent economic growth might either increase or decrease the financial stability of the SEE banks. In accordance with studies where the effect of GDP on banks' financial stability is also measured (De Ramon et al., 2018), I expect a positive relationship between GDP growth and banks' financial stability.

5. Data

The geographical coverage of this study is as follows: Albania, Bosnia-Herzegovina, Bulgaria, Croatia, FYROM, Romania and Serbia. The time period considered is from 2003 to 2012. The reason behind the decision to consider this period is that data about SEE banking firms have been collected and made available on a significant scale only recently. The banking firm database *BankScope* has gathered a significant amount of data from an increasing number of SEE banking firms since 2003. Therefore, as I used *BankScope* in this study, the start date of the analysis presented in this study is 2003. As pointed out by Al-Muharrami et al. (2006), any attempt to carry out a quantitative analysis on banks has to be based on relatively homogeneous banks. Therefore, in this study I focused on commercial banks sourced from the *BankScope* database. Hence, I excluded investment banks, cooperative banks and other non-banking credit institutions. As pointed out by Fiordelisi et al. (2011), the behaviour and incentives of commercial banks are very different from those of banking firms such as savings banks and investment banks. Therefore, aggregating different types of banking firms together might lead to results that are difficult to interpret. Furthermore, in putting the data set together I considered only commercial banks with at least three years of continuous data. In accordance with this criterion, I ended up with a data set of 169 commercial banks[7] and 17,514 observations at bank level. I complemented bank data with information about domestic and foreign ownership taken from the Claessens and Van Horen database[8] and additional sources.[9] It is worth pointing out that, as in previous studies based on data sourced from the *BankScope* database, the data set used in this study might suffer from a selection bias. This might be due to the selection made by *BankScope* which includes mainly the larger and more financially sound banks (Fries and Taci, 2005). The main downside of this is that the estimation results may reflect the best-known banks only, rather than all banks.[10] The data gathered from *BankScope* were, in most cases, in the domestic currency. This was then converted into U.S. dollars by using a spot exchange rate between each domestic currency and the U.S. dollar.[11] After converting the data into this common currency, the effects of inflation were then removed by using the U.S. GDP deflator from the U.S. National Bureau of Economic Analysis[12] with all values expressed in 2009 prices. I complemented bank-level data with macroeconomic data at country level sourced from the World Bank –World Development Indicator (WDI) database. Table 1 shows the number of observations at bank level for each variable across the SEE banking industries under study. Croatia was the banking industry with the largest number of observations (3,707), closely followed by Serbia (3,411), Romania (3,185), Bosnia-Herzegovina (2,535), Bulgaria (2,278), FYROM (1,396) and then Albania (1,002). Table 2 shows the average values of variables at bank level used in this study. In terms of total assets, the larger banks are located in Romania while the smaller banks are located in Bosnia-Herzegovina, with average total assets per bank of $3,043 million and $405 million respectively. At SEE aggregate level, banks have on average $1,499 million of assets. Average deposits per bank are the largest in the Romanian banking industry and the smallest in the banking industry in Bosnia-Herzegovina, with values of $1,682 million and $291 million respectively. Banks in Romania and Croatia on average lend out more when compared with banks in other SEE countries, with average total loan values of $1,843 million and $1,402 million respectively. On the other hand, banks in Albania and FYROM lend out less, with average values per bank of $233 million and $222 million respectively. Romanian banks earn on average $209 million on interest loans which is well above the average value of $96 million earned by a typical SEE bank. In contrast, banks in Albania and FYROM earn less on average in terms of interest income on loans when compared with banks located in other SEE countries, with values of $22 and $24 million respectively. The dataset used in the present study shows that banks in Romania and Croatia are on average the largest in terms of capitalisation (i.e. equity) with values of $320 million and $299 million respectively. Conversely, the average capitalisation of banks in Albania and FYROM, with values of $48 million and $50 million respectively, is the smallest

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[7] In particular I ended up with 12 Banks from Albania, 24 from Bosnia-Herzegovina, 22 from Bulgaria, 33 from Croatia, 13 from FYROM, 30 from Romania and 35 from Serbia.

[8] The Claessens and Van Horen database provides full ownership information over the period 1995–2013 for 5,498 banks active in 137 countries. Among other things, this database includes for each bank the type of ownership (foreign or domestic) on a yearly basis. More information about this database is available at https://neeltjevanhoren.com/my-research/datasets/

[9] A major problem I encountered with the Claessens and Van Horen database was that it provided ownership data only up to the end of 2009, thus it did not provide ownership information for the remaining three years of the period under analysis in this study. I overcame that problem by using the ORBIS database to retrieve information about the ownership for the banks analysed in this study, and where that was not possible, I looked at the websites of those banks where ownership information was missing. Finally, for the year 2012, the balance sheet and income statement documents downloaded from *BankScope* provided information about the ownership of each bank. Looking at that information I was able to find out whether the ownership would have been domestic or foreign in the year 2012.

[10] This is a common problem in a large number of empirical studies based on the *BankScope* database (Fries and Taci, 2005; Mamatzakis et al., 2005; Al-Muharrami et al., 2006; Casu and Girardone, 2010; Delis and Kouretas, 2011; Dietrich and Wanzenried, 2011; Fang et al., 2011; Lepetit et al., 2008; Lei and Song, 2013; Weill, 2013).

[11] The spot exchange rate between each currency of the SEE countries was retrieved from Thomson Reuters DataStream database.

[12] The US GDP deflator is calculated by the National Bureau of Economic Analysis dividing US Nominal GDP by US Real GDP at 2009 prices. I then used those values by dividing all the nominal variables of the data set used in this study with the US GDP deflator. A similar procedure was used in Goddard et al. (2001) as the authors collected variables in domestic currency, converted them in the European Currency Unit (ECU) and removed the effect of inflation by using an ECU GDP deflator.

and well below the average capitalisation of SEE banking firms, which is approximately $189 million. Finally, total revenues for SEE banks are largest in the case of Romanian banks and smallest in the case of FYROM banks, with values of $308 million and $33 million respectively.

Table 1 – Number of observations by variable and geographical area, 2003–2012

	Albania	Bosnia	Bulgaria	Croatia	FYROM	Romania	Serbia	SEE
Total operating income	74	196	169	272	105	233	256	1304
Total assets	74	196	169	272	116	234	256	1305
Total personnel expenses	74	148	154	260	100	230	241	1207
Total interest expenses on customer. deposits	61	118	127	236	65	203	169	979
Total interest income on loans	66	118	139	238	65	202	181	1009
Other interest income	74	196	169	260	105	232	252	1298
Total non-interest operating income	74	196	169	271	105	232	256	1301
Total customer deposits	74	189	168	269	105	233	256	1294
Total equity	61	196	168	272	105	225	258	1285
Total fixed assets	74	196	169	272	105	233	256	1305
Total loans	74	196	169	272	105	231	258	1305
Cash and due from banks	74	196	169	272	105	232	256	1304
ROA	74	196	168	268	105	232	256	1299
Total revenue	74	198	171	273	105	233	260	1314

Note: This table shows the number of observations at bank level for each country as well as for their aggregation at SEE level.

Table 2 – Average values (US$ million) by country, 2003–2012

	Albania	Bosnia	Bulgaria	Croatia	FYROM	Romania	Serbia	SEE
Total operating income	21.462	24.793	80.316	102.687	22.530	192.458	95.775	91.630
Total assets	513.024	467.21	1670.367	2246.079	405.378	3043.909	714.076	1499.894
Total personnel expenses	4.375	8.308	15.843	25.836	5.267	50.703	12.942	21.556
Total interest expenses on customer deposits	16.843	8.15	37.830	44.631	10.981	85.894	19.498	39.605
Total interest income on loans	22.579	26.642	102.51	109.934	24.55	209.769	47.230	96.695
Other interest income	13.67	10.47	16.451	26.072	10.266	52.567	20.769	24.184
Total non-interest operating income	3.429	9.450	22.355	38.495	7.808	74.480	65.340	39.210
Total customer deposits	417.505	291.37	1015.005	1341.072	300.73	1682.539	339.405	871.506
Total equity	48.239	55.345	192.902	299.985	50.804	320.744	147.628	189.404
Total fixed assets	8.421	14.182	28.906	47.149	11.852	75.979	23.789	35.354
Total loans	233.7332	289.932	1019.719	1402.649	222.273	1843.725	415.119	907.522
Cash and due from banks	61.056	81.306	182.087	259.937	74.731	607.634	141.680	235.443
ROA	0.492	0.747	1.143	0.474	0.186	-0.126	0.346	0.447
Total revenue	37.241	35.597	121.679	159.84	33.272	308.362	116.842	136.96

Note: This table provides average values of bank-level variables over the sample period 2003–2012. Reported values are author's computation on *BankScope* data. Values are in millions of U.S. dollars.

6. Empirical results

The first part of this section illustrates the changes over time of the different measures of market structure and the financial stability for the SEE banking industries. The second part of this section discusses the effects of either concentration or competiton on financial stability for SEE banks.

6.1 Concentration and market power results

Table 3 details *CR-3* as well as the *HHI* results for each of the SEE banking industries for the year 2003 (the start date of this study) and 2012 (the end date of this study), as well as the percentage change between the two years. These measures of concentration were calculated by considering *total assets, total customer deposits* and *total loans* of SEE banks. Table 3 shows that in 2003 the Albanian and FYROM banking industries had the highest *CR-3* in terms of total assets (Panel A), total customer deposits (Panel B) and total loans (Panel C) in comparison to other SEE banking industries. Conversely, the banking industry in Serbia had the lowest *CR-3* in both total assets and total loans markets, while the banking industry in Bulgaria was the one with the lowest *CR-3* in the total customer deposits markets. In 2012, at the end date of this analysis, the banking industry in FYROM was the one with the highest *CR-3* in the total assets, total customer deposits, and total loans markets, while Serbia had the lowest *CR-3* ratio in total assets and total customer deposits markets and Bulgaria had the lowest *CR-3* in the total loans market. Moving to the *HHI* results, Table 3 shows that in 2003 the total assets and total customer deposits markets were moderately concentrated only in the case of the Bosnia-Herzegovina banking industry; for all the remaining countries the same markets were regarded as very concentrated. If we compare these results with the findings related to *HHI* in the year 2012, we can see that in the case of the FYROM banking industry these three markets were the most highly concentrated when compared with the other SEE banking industries, whereas in the case of the Serbian banking industry the same markets were the least concentrated, with *HHI* scores ranging from 963 in the case of the total loans market to 836 in the total assets market. The last two columns of Table 3 show the percentage change in terms of *CR-3* and *HHI* between 2003 and 2012. Interestingly, the percentage changes in both *CR-3* and *HHI* indicate a relevant reduction in the degree of concentration in all the markets under study. In particular, in Albania the percentage reductions in both the *CR-3* and *HHI* were the largest in most of the markets under study, while in Croatia, in terms of reducing the degree of concentration, the progress was generally lower than in most of the markets under study.

It has been pointed out that one of the consequences of highly concentrated markets is that banks usually charge higher interest rates on business loans and lower interest rates are paid on retail deposits (Berger and Hannan, 1997; Hannan, 1991). Furthermore, Andrés et al. (2013) point out that in highly concentrated markets the spread between the lending and deposit rates tends to be larger. According to the World Bank – WDI database, in 2003 the difference between the lending and deposit rate was 5.89% in Albania, 6.84% in Bosnia-Herzegovina, 5.61% in Bulgaria, 10.05% in Croatia, 14.41% in Romania and 12.73% in Serbia. If we look at the same countries in 2012, the difference between the lending and deposit rates was 5.45% in Albania, 4.15% in Bosnia-Herzegovina, 6.63% in Bulgaria, 7.59% in Croatia, 5.82% in Romania and 7.63% in Serbia. Therefore, looking at this data related to SEE countries, we can observe that the spread between lending and deposit rates was very large in 2003 but slightly smaller in 2012. One of the factors behind this decline in the aforementioned spread might have been the reduction in the degree of concentration in the markets under study.

De Nicoló et al. (2004) found that less concentrated banking industries exhibit levels of financial risk that are potentially lower than in highly concentrated banking industries. Therefore, this raises the question as to whether the observed reduction in the degree of concentration might have led to greater financial stability in the SEE banking industries.I am going to address this question in the next paragraph.

Table 3 – Concentration in the SEE banking industry in a time invariant approach: 2003–2012

	2003		2012		% Change	
Panel A: Total Assets market	CR-3	HHI	CR-3	HHI	CR-3	HHI
Albania	92.7	3269.9	60.01	1732.51	-35.26	-47.02
Bosnia-Herzegovina	61.64	1416.47	40.90	977.55	-33.65	-30.99
Bulgaria	67.53	2043.25	43.01	1061.5	-36.30	-48.04
Croatia	73.49	2277.23	66.59	1831.12	-9.39	-19.59
FYROM	83.65	2673.1	71.76	1897.79	-14.21	-29.00
Romania	65.28	2052.34	49.47	1154.97	-24.22	-43.72
Serbia	56.47	1525.13	23.92	836.25	-57.64	-45.17
SEE region	68.08	1993.61	47.66	1291.98	-29.99	-35.19
Panel B: Total Customer Deposits market	CR-3	HHI	CR-3	HHI	CR-3	HHI
Albania	95.21	3401.29	60.1	1728.31	-36.88	-49.18
Bosnia-Herzegovina	60.45	1582.56	46.08	1155.59	-23.77	-26.98
Bulgaria	60.04	1735.94	43.71	1051.78	-27.19	-39.41

Croatia	76.40	2491.818	66.57	1843.94	-12.86	-26.00
FYROM	89.58	3290.35	76.88	2165.23	-14.18	-34.19
Romania	67.07	2215.97	54.57	1260.66	-18.64	-43.11
Serbia	64.89	2069.47	34.48	893.13	-46.86	-56.84
SEE region	69.68	2186.33	51.89	1366.45	-25.53	-37.5
Panel C: Total Loans market	CR-3	HHI	CR-3	HHI	CR-3	HHI
Albania	83.06	2660.29	55.71	1474.32	-32.93	-44.58
Bosnia-Herzegovina	61.65	1793.55	42.38	1023.01	-31.26	-42.96
Bulgaria	65.39	1720.54	42.69	1080.48	-34.71	-38.14
Croatia	74.23	2225.25	67.82	1863.32	-8.63	-16.26
FYROM	80.4	2335.34	76.29	2108.71	-5.11	-9.7
Romania	66.02	1848.66	49.11	1175.81	-25.61	-36.4
Serbia	55.35	1394.53	44.07	963.23	-20.38	-30.93
SEE region	67.13	1903.53	52.03	1311.73	-22.49	-31.08

Note: This table shows the 3-bank concentration ratio (*CR-3)* and Herfindahl-Hirschman Index (*HHI*) values calculated with respect to total assets, total customer deposits and total loans markets in 2003 and 2012, as well as the percentage change between the two years.

Figure A1 (see Appendix A) illustrates the evolution of the *CR-3* on a yearly basis over the period 2003–2012. What we can observe is a general trend towards a reduction in the degree of concentration in the markets under study in most of the SEE banking industries. Interestingly, the total customer deposits market in most of the SEE countries, apart from Bosnia-Herzegovina and Bulgaria, seems to be characterised by the highest levels of concentration. Furthermore, Figure B1 (see Appendix B) illustrates the evolution of the *HHI* and what can be observed is a shift from very concentrated to moderately concentrated markets in most of the SEE banking industries under study. Interestingly, Figure B1 (see Appendix B) shows that since 2008 this downward trend in terms of reduced concentration seems to have come to an end in all SEE banking industries except for Albania and Bulgaria. Although I do not investigate the reasons behind this reduction of concentration values, it is likely that liberalisation policies implemented by SEE countries since the beginning of the 2000s, that aimed to modernise and open up the domestic financial sectors to foreign capitals, might have had the effect of reducing the degree of concentration in the markets under study. That said, , it is difficult to predict how long the reduction in the concentration of the SEE banking industries is going to last. Casu and Girardone (2006) have pointed out that one of the effects of the deregulation of the EU financial sector, as well as the adoption of a common currency, was a wave of mergers and acquisitions in the EU banking landscape that led, among other things, to an increase in the degree of concentration of the EU banking industry. Therefore, we might expect similar effects on the banking industries of the SEE once these countries gain full membership of the EU, improve their integration within the EU financial system and adopt the euro currency.

The results related to the examination of the competitive structure of the banking industries in the SEE region are presented in Table 4 where the estimate of the Panzar-Rosse *H-statistics* are presented for each banking industry under study. The findings show that the value of the contestability parameter (i.e. *H*), which is the sum of the coefficient-input (that is ln_ACL, ln_ACC, ln_ACF) elasticities, is 0.007 at the SEE level (Table 4 – column 8), thus indicating that monopolistic competition characterises the overall SEE banking industry. Using the Panzar-Rosse model at country level, we observe relevant differences in the market structure of each of the SEE banking industries. For example, the sum of the three coefficient-input elasticities that make up the values of the *H-statistic* range between 0.174 in the case of Albania (Table 4 – column 1), which indicates a domestic banking industry characterised by monopolistic competition, and -0.184 in the case of Bulgaria (Table 4 – column 3), corresponding to a monopoly market which also characterises the banking industry of Romania with a *H-statistic* of -0.089 (Table 4 – column 6). All the remaining banking industries of Bosnia-Herzegovina, Croatia, FYROM and Serbia show positive values of the *H-statistic*, indicating that monopolistic competition is the prevailing market structure. An analysis of the signs and significance of the regression results presented in Table 4 shows that the coefficient estimate of the average cost of labour (ACL) is negative and statistically significant in the case of Serbia and the overall SEE banking industry. In contrast, it is positive and statistically significant in the case of the FYROM banking industry. The positive sign of the ACL coefficient is consistent with studies focusing on the Eastern European banking industries (Mamatzakis et al., 2005) as well as studies focusing on banking industries of other geographical areas (Molyneux et al., 1994; Al-Muharrami et al., 2006; Casu and Girardone, 2006; Rezitis, 2010; Fosu, 2013). The estimated coefficients for the average cost of capital (ACC) were found to be positive and statistically significant in the case of Croatia (Table 4 – column 4) and Serbia (Table 4 – column 6) as well as for the overall SEE banking industry (Table 4 – column 8). Only in the case of the Bulgarian banking industry was the ACC coefficient estimate found to be negative and statistically significant (Table 4 – column 3). Overall, the size of the ACC coefficient estimates is generally small and this is consistent with similar studies (Casu and Girardone, 2006). Furthermore, Table 4 shows that the average cost of funds (ACF) is negative and statistically significant in the case of Croatia (Table 4 – column 4), FYROM (Table 4 – column 5), Romania (Table 4 – column 6) and the overall SEE banking industry (Table 4 – column 8). These results are not consistent with similar studies (Yeyati and Micco, 2007; Mamatzakis et al., 2005) in which positive and statistically significant coefficients for ACF coefficient estimates are reported. Looking at the other bank-specific variables, the findings show that the estimated total equity to total assets ($EQAST$) ratio coefficients are statistically significant and positive for the banking industries in Croatia (Table 4 – column 4) and Serbia (Table 4 – column 7) as well as for the overall SEE banking industry (Table 4 – column 8). In contrast, the $EQAST$ coefficient is negative and statistically significant in the case of the Bosnia-Herzegovina industry (Table 4 – column 2). The estimated coefficients on total assets (AST) are negative and statistically significant in the case of Bosnia-Herzegovina (Table 4 – column 2), Croatia (Table 4 – column 4), FYROM (Table 4 – column 5), Romania (Table 4 – column 6) and the overall SEE banking industry (Table 4 – column 8). In accordance with the empirical literature using the Panzar-Rosse model in banking studies, negative coefficient estimates of AST indicate a banking industry characterised by diseconomies of scale. Therefore, as the size of banks (in terms of total assets) increases, their revenues tend to decline. Table 4 shows that the estimated coefficients of the ratio of total loans to total assets ($LOANAST$) are generally positive and statistically significant in most of the banking industries under study as well as at SEE level, confirming the hypothesis that banks' total revenues increase as the proportion of loans rises. As mentioned in the methodology section, the results of the Panzar-Rosse model are supposed to be valid only under the hypothesis that banking industries are in a long-run equilibrium. I test this hypothesis by using a two-step procedure. The first step is to re-estimate the Panzar-Rosse model by using return on assets (ROA) as a dependent variable (see Eq.3). I present the results of this first step in Table 5. The second step is to run a Wald Test in order to test the hypothesis that the sum of the input prices' elasticity (that is, the estimated coefficients of the variables ACL, ACC, and ACF) of Eq.(3) is zero (i.e. $E = 0$), which is equivalent to testing the equilibrium condition. The findings of the second step procedure are presented in Table 6 and show that most of the banking industries, apart from those in Bosnia-Herzegovina and Bulgaria, are in a state of long-run equilibrium.

Table 4 – Panzar-Rosse model results: Total revenue equation model

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Variable	Albania	Bosnia-Herzegovina	Bulgaria	Croatia	FYROM	Romania	Serbia	SEE
ln_ACL	0.012	0.076	0.104	-0.013	**0.24*** **	-0.023	**-0.331*** **	**-0.123*** **
	(0.116)	(0.099)	(0.061)	(0.096)	**(0.07)**	(0.072)	**(0.081)**	**(0.032)**
ln_ACC	-0.058	0.055	**-0.223*** **	**0.219*** **	0.034	0.072	**0.421*** **	**0.237*** **
	(0.088)	(0.059)	**(0.07)**	**(0.07)**	(0.03)	(0.054)	**(0.04)**	**(0.018)**
ln_ACF	**0.22***	-0.109	-0.065	**-0.167***	**-0.123** **	**-0.138** **	-0.035	**-0.107*** **
	(0.124)	(0.076)	(0.049)	**(0.087)**	**(0.061)**	**(0.054)**	(0.064)	**(0.025)**
ln_AST	-0.093	**-0.274*** **	-0.007	**-0.139** **	**-0.288*** **	**-0.168*** **	**0.001** **	**-0.08*** **
	(0.107)	**(0.078)**	(0.052)	**(0.064)**	**(0.096)**	**(0.051)**	**(0.09)**	**(0.028)**
ln_EQAST	-0.076	**-0.139** **	0.057	**0.122*** **	0.026	0.026	**0.257*** **	**0.107*** **
	(0.078)	**(0.067)**	(0.068)	**(0.035)**	(0.085)	(0.046)	**(0.096)**	**(0.026)**
ln_LOANAST	0.094	**0.530*** **	**0.836*** **	**0.252** **	**0.442*** **	0.079	**-0.219***	**0.299*** **
	(0.093)	**(0.098)**	**(0.07)**	**(0.10)**	**(0.078)**	(0.083)	**(0.168)**	**(0.043)**
ln CASHDEP	**-0.22*** **	0.002	0.017	0.01	0.001	**-0.063** **	0.045	-0.014

	(0.055)	(0.031)	(0.024)	(0.019)	(0.03)	(0.025)	(0.054)	(0.013)
Time trend	-0.17***	0.004	0.005	0.001	-0.054*	-0.022	0.022	-0.024***
	(0.047)	(0.014)	(0.015)	(0.017)	(0.028)	(0.016)	(0.047)	(0.007)
Lending rate	-0.12***	-0.052	0.014	0.130**	-0.009	0.029***	0.01	0.002
	(0.031)	(0.035)	(0.042)	(0.049)	(0.028)	(0.006)	(0.014)	(0.003)
DCPPSB	0.042***	-0.004	-0.006	0.01	0.012	0.028***	-0.019*	0.003
	(0.01)	(0.007)	(0.004)	(0.007)	(0.008)	(0.006)	(0.011)	(0.002)
GDP growth	-0.02	0.00	-0.004	0.018	-0.006	-0.002	-0.003	-0.007***
	(0.017)	(0.007)	(0.004)	(0.013)	(0.01)	(0.004)	(0.011)	(0.002)
Intercept	-2.07	0.013	-1.367***	-2.798***	-0.142	-1.939***	-1.438	1.237***
	(0.669)	(0.744)	(0.369)	(0.936)	(0.665)	(0.355)	(0.551)	(0.156)
R-squared	0.722	0.329	0.781	0.292	0.601	0.342	0.410	0.252
Hausman Test	[0.00]	[0.563]	[0.00]	[0.00]	[0.00]	[0.00]	[0.135]	[0.00]
No. of obs.	61	105	152	250	100	185	169	1159

Note: This table shows the results for the Panzar-Rosse model as defined in Eq.(2). Estimations of the Panzar-Rosse model use *total revenue* in log form as a dependent variable and rely on panel data methodologies. I report in brackets the *p-value* of the *Hausman test* we performed between the Fixed Effect (FE) and the Random Effect (RE) models in order to find the most efficient estimator. Before estimating both the FE and RE models, I used OLS in order to check for the presence of multicollinearity among the covariates of Eq.(2). By using a Variance Inflation Factor (VIF) approach, and following the rule of thumb that the VIF value being greater than 10 may merit further investigation, I did not find any values exceeding the value of 10. Therefore we concluded that there is no evidence of multicollinearity among the covariates of the model as per Eq.(2). Standard errors are in parentheses. *, **, *** and denote statistical significance at the 10%, 5%, and 1% levels respectively.

Table 5 – Panzar-Rosse model results: Long-run equilibrium model

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Variable	Albania	Bosnia-Herzegovina	Bulgaria	Croatia	FYROM	Romania	Serbia	SEE
ln_ACL	0.211	0.151	0.272	-0.927***	-1.012**	0.699*	0.045	0.086
	(0.610)	(0.271)	(0.22)	(0.178)	(1.541)	(0.377)	(0.166)	(0.084)
ln_ACC	-1.188	0.192	-0.785***	0.109	-0.157	-0.515	0.006	-0.081*
	(0.778)	(0.148)	(0.235)	(0.120)	(0.289)	(0.358)	(0.074)	(0.048)
ln_ACF	0.744	0.084	0.158	0.756***	1.258**	0.097	-0.032	-0.006
	(0.840)	(0.198)	(0.148)	(0.165)	(0.498)	(0.328)	(0.143)	(0.068)
ln_EQAST	0.518	0.368**	0.411**	0.309***	0.698**	0.358	0.572**	0.367***
	(0.43)	(0.191)	(0.202)	(0.065)	(0.524)	(0.28)	(0.232)	(0.072)
ln_AST	0.073	0.467**	0.482***	-0.602***	-0.064	0.076	-0.104	0.089
	(0.589)	(0.205)	(0.147)	(0.113)	(0.53)	(0.256)	(0.189)	(0.072)
ln_LOANAST	1.015	0.545**	0.215	0.167	0.49	0.367	0.145	0.187*
	(0.569)	(0.261)	(0.225)	(0.191)	(0.418)	(0.425)	(0.33)	(0.107)
ln CASHDEP	-0.306	-0.017	0.069	0.076**	-0.11	-0.022	0.108	0.004
	(0.357)	(0.081)	(0.07)	(0.03)	(0.138)	(0.103)	(0.104)	(0.03)
Time trend	-0.016	0.012	-0.179***	-0.067**	0.052	-0.099	-0.003	-0.068***
	(0.238)	(0.036)	(0.041)	(0.03)	(0.133)	(0.074)	(0.091)	(0.007)
Lending rate	0.073	0.01	0.015	0.231**	-0.023*	0.035	0.013	0.019**
	(0.171)	(0.089)	(0.117)	(0.086)	(0.115)	(0.029)	(0.026)	(0.008)
DCPPSB	-0.033	-0.058***	0.00	0.043***	-0.053*	0.012	-0.016	-0.002
	(0.061)	(0.019)	(0.012)	(0.013)	(0.034)	(0.03)	(0.022)	(0.004)
GDP pc growth	0.001	0.035*	0.016	0.058**	0.048	0.031*	0.033	0.025***
	(0.08)	(0.019)	(0.011)	(0.022)	(0.05)	(0.018)	(0.021)	(0.006)
Constant	-1.242	1.432	-1.01***	-2.321	-0.377	0.211	3.125***	1.204***
	(3.51)	(1.875)	(1.034)	(1.755)	(3.072)	(1.737)	(1.099)	(0.386)
R-squared	0.42	0.414	0.562	0.463	0.451	0.198	0.41	0.224
Hausman Test	[0.196]	[0.006]	[0.00]	[0.009]	[0.829]	[0.557]	[0.176]	[0.078]
No. of obs	51	131	140	218	76	165	238	952

Note: This table shows the results for Eq.(3). I report in brackets the *p-value* of the *Hausman test* I performed between the *FE* and the *RE* models in order to find the most efficient estimator. Standard errors are in parentheses. *, **, *** and denote statistical significance at the 10%, 5%, and 1% levels respectively.

Table 6 – Wald test for long-run equilibrium condition

	$H_o: E = 0$	$H_o: E = 1$	Equilibrium in the banking industry
Albania	$F(1{,}30) = 0.14$	$F(1{,}30) = 0.14$	Yes
	[0.71]	[0.06]	
Bosnia-Herzegovina	$F(1{,}99) = 9.24$	$F(1{,}99) = 16.31$	No
	[0.00]	[0.00]	
Bulgaria	$F(1{,}108) = 11$	$F(1{,}108) = 160.89$	No
	[0.00]	[0.00]	
Croatia	$F(1{,}177) = 1.75$	$F(1{,}177) = 527.19$	Yes
	[0.187]	[0.00]	
FYROM	$F(1{,}53) = 0.07$	$F(1{,}53) = 7.58$	Yes
	[0.791]	[0.008]	
Romania	$F(1{,}125) = 1.44$	$F(1{,}125) = 9.32$	Yes
	[0.232]	[0.002]	
Serbia	$F(1{,}125) = 0.03$	$F(1{,}126) = 80.34$	Yes
	[0.857]	[0.00]	

SEE	$F(1{,}783) = 0.00$ [0.998]	$F(1{,}783) = 388{,}6$ [0.00]	Yes

Note: This table shows the results of the Wald Test performed on the results of Eq.(3) as reported in Table 5. In accordance with the Wald Test, I tested a null hypothesis that the sum of the estimated coefficients of ACL, ACC, ACF are equal to zero (H_0: $\alpha_1 + \alpha_2 + \alpha_3 = 0$), in other words, whether the banking industries under study are in a condition of long-run equilibrium.

An additional measure of market power I used in this study is the *Lerner index*. The first step in calculating this measure was to estimate the translog cost function as presented in Eq.(6), the results of which are then reported in Table 7. The findings show that in many cases the coefficient estimates of the quadratic terms of the variable *total assets*do not have the same positive value as the corresponding non-quadratic terms coefficient estimates. This means that increases in total assets have the effect of increasing total costs until a turning point is reached. Once that point is reached, further increases in total assets have the effect of reducing total costs. From an economic viewpoint, this means that SEE banks can benefit in terms of economies of scale only if they increase their size (in terms of assets) beyond a certain threshold.

One of the disadvantages of the translog function is that the many interaction terms make the respective individually estimated coefficients difficult to interpret directly. Therefore, further inference on the results presented in Table 7 is problematic. However, what I can add to the discussion is that the *R-squared* values are very high in all the specifications at country- and SEE banking-industry levels. This means that the variation in the dependent variable of the translog function, or total costs, is well captured by the variation in the chosen dependent variables. Finally, in accordance with the Hausman Test results, the null hypothesis of zero random effects cannot be rejected at usual significant levels in all the specifications, thus confirming the validity of the fixed effects estimator model used in estimating Eq.(6).

Estimating the translog function is a necessary condition to calculate the marginal costs as defined in Eq.(7), the results of which were then used to calculate the *Lerner index*. Table 8 presents *Lerner index* values calculated at banking- and year-levels. The findings show that over the period 2003–2012 banks in Bosnia-Herzegovina were those that, on average, had the highest *Lerner index* value (Panel A of Table 8 – column 2) while banks located in Romania scored, on average, the lowest (Panel A of Table 9 – column 6), with values of 0.358 and 0.129 respectively. This leads to the conclusion that, among the SEE banks, those located in Bosnia-Herzegovina had the highest market power while those located in Romania had the lowest in comparison to other banks operating in other SEE countries.

If we look at the average *Lerner index* of the SEE banks overall (Panel A of Table 8 – column 8), there is evidence of a reduction of market power over the period 2003-2012. When distinguishing SEE banks based on ownership (i.e. domestic versus foreign-ownership), Panel B of Table 8 – column 8 shows that SEE domestic-owned banks had on average a *Lerner index* of 0.178 over the period 2003–2012. In contrast, the *Lerner index* of foreign-owned banks (Panel C of Table 9 – column 8) scored a value of 0.219 over the same period. Therefore, we can infer that SEE foreign-owned banks had, on average, a market power larger than SEE domestic-owned banks. If we look at country level, however, the results are mixed. In the case of Albania, Bosnia-Herzegovina, Croatia, FYROM, and Serbia, we observe that domestic-owned banks on average had more market power than foreign-owned banks. I did not investigate the reason behind these differences in market power relating to the ownership of banks. However, it might be the case that in some SEE countries, domestic-owned banking firms might have a better and closer knowledge of the markets they operate in as well as the customers they serve. This superior information might result in greater contractual influence of these domestic banks over their customers, meaning that they have a superior market power in comparison with foreign-owned banks.

To extend even further the analysis about the market power of SEE banks, I divided banks of the data set into small and large banks in accordance with their asset size. On the basis of this distinction, Panel D – column 8 of Table 8 shows that, on average, over the period 2003–2012 small SEE banks had a *Lerner index* smaller than large SEE banks (Panel E – column 8), with values of 0.197 and 0.306 respectively. Therefore, large SEE banks could have enjoyed more market power in pricing in comparison with small SEE banks. The distinction between small and large banks at country level confirms the previous results at SEE level except for the FYROM, as we observe in this case small banks with an average value of the *Lerner index* marginally higher than large banks (0.198 versus 0.144). In addition, among SEE banking industries, small banks in Romania (Panel D of Table 8 – column 6) are the ones with the smallest market power (0.119), while large Bulgarian banks (Panel E of Table 8 – column 3) are the ones with, on average, the largest *Lerner index* value in comparison to other large banks operating in other SEE banking industries.

Table 7 – Empirical results of the translog cost function at country and SEE level.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Dependent variable: lnTC	Albania	Bosnia-Herzegovina	Bulgaria	Croatia	FYROM	Romania	Serbia	SEE
$lnTA$	**1.517*****	**0.685*****	**0.794*****	**0.527*****	**0.654****	**1.104*****	**0.594*****	**0.974*****
	(0.294)	**(0.255)**	**(0.264)**	**(0.093)**	**(0.268)**	**(0.112)**	**(0.148)**	**(0.047)**
$lnTA^2$	0.077	**0.110***	**-0.223*****	**0.025***	0.149	**-0.096*****	0.001	**-0.056*****
	(0.09)	**(0.057)**	**(0.029)**	**(0.015)**	(0.105)	**(0.023)**	(0.029)	**(0.009)**
$lnACL$	1.334	**-1.494****	0.195	**-1.298***	-0.112	0.269	0.169	-0.008
	(1.816)	**(0.708)**	(0.571)	**(0.448)**	(0.295)	(0.377)	(0.170)	(0.078)
$lnACC$	**-1.589***	-0.455	0.258	**0.791****	0.148	0.242	**0.471*****	**0.311*****
	(0.887)	(0.412)	(0.678)	**(0.313)**	(0.219)	(0.386)	**(0.099)**	**(0.055)**
$lnACD$	0.386	**1.920*****	-0.565	0.468*	**0.581***	**-0.662****	**-0.205****	**-0.176*****
	(1.045)	**(0.484)**	(0.564)	(0.281)	**(0.310)**	**(0.257)**	**(0.101)**	**(0.057)**
$lnTA \times lnACL$	0.105	0.046	-0.173	**-0.077****	0.041	-0.057	**-0.157*****	**-0.092*****
	(0.162)	(0.105)	(0.106)	**(0.035)**	(0.127)	(0.049)	**(0.032)**	**(0.014)**
$lnTA \times lnACC$	0.180	0.033	**-0.299*****	0.006	**-0.025***	-0.042	-0.017	0.006
	(0.129)	(0.078)	**(0.100)**	(0.025)	**(0.082)**	(0.041)	(0.02)	(0.009)
$lnTA \times LnACD$	-0.274	**-0.167****	**0.427*****	**0.089*****	-0.126	**0.16*****	**0.106*****	**0.092*****
	(0.164)	**(0.082)**	**(0.079)**	**(0.031)**	(0.105)	**(0.041)**	**(0.022)**	**(0.01)**
$lnACL^2$	1.260	-0.363	**-0.611****	**-0.514****	0.153	0.009	**-0.179****	-0.059
	(0.925)	(0.362)	**(0.303)**	**(0.167)**	(0.294)	(0.267)	**(0.07)**	(0.043)
$lnACC^2$	**0.186***	-0.069	**-1.04****	**0.143***	**0.092*****	**0.119*****	**0.177*****	**0.111*****
	(0.101)	(0.154)	**(0.405)**	**(0.174)**	**(0.022)**	**(0.022)**	**(0.02)**	**(0.007)**
$lnACD^2$	0.158	-0.293	**-0.634*****	**-0.365****	-0.157	**-0.267*****	**-0.21*****	**-0.205*****
	(0.343)	(0.179)	**(0.235)**	**(0.10)**	(0.139)	**(0.098)**	**(0.041)**	**(0.02)**
$lnACL \times lnACC$	-0.605	-0.163	0.328	-0.028	**-0.246***	-0.168	**-0.174*****	**-0.105*****
	(0.384)	(0.207)	(0.259)	(0.132)	**(0.137)**	(0.134)	**(0.031)**	**(0.018)**
$lnACL \times lnACD$	-0.298	0.325	0.262	**0.487*****	0.108	0.009	**0.245*****	**0.166*****
	(0.512)	(0.220)	(0.240)	**(0.125)**	(0.160)	(0.112)	**(0.044)**	**(0.024)**
$lnACC \times lnACD$	0.162	0.126	**0.521****	-0.137	0.109	0.178	-0.026	0.004
	(0.306)	(0.119)	**(0.217)**	(0.085)	(0.102)	(0.113)	(0.026)	(0.014)
constant	-3.474	-4.342	-0.466	**-1.708*****	-1.7	**-0.944****	-0.419	**-1.57*****
	(2.174)	(0.764)	(0.966)	**(0.494)**	(0.711)	**(0.472)**	(0.409)	**(0.162)**
No of obs	74	140	153	260	100	230	239	1196
R-squared	0.968	0.89	0.93	0.937	0.942	0.938	0.959	0.92
Hausman Test	[0.000]	[0.072]	[0.275]	[0.00]	[0.00]	[0.004]	[0.001]	[0.004]

Note: This table shows the results for the translog cost function as defined in Eq.(6) and estimated using a fixed effect panel data approach. Estimations of the translog cost function use *total costs* in log form as a dependent variable and rely on panel data methodologies. Dependent variables in log form are: total assets (TA); average cost of labour (ACL); average cost of capital (ACC); average cost of funds (ACD). I report in brackets the *p-value* of the Hausman Test we performed between the fixed effect and the random effect models in order to find the most efficient estimator. Standard errors are in parentheses. *, **, *** and denote statistical significance at the 10%, 5%, and 1% levels, respectively.

Table 8 – Lerner index: average values, 2003–2012

Panel A:	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
All banks	Albania	Bosnia-Herzegovina	Bulgaria	Croatia	FYROM	Romania	Serbia	SEE
2003	0.350	-	0.148	0.242	0.244	0.132	0.446	0.212
2004	0.276	0.256	0.263	0.229	0.356	0.13	0.327	0.206
2005	0.429	0.379	0.321	0.228	0.353	0.154	0.211	0.226
2006	0.378	0.357	0.241	0.233	0.337	0.175	0.349	0.249
2007	0.173	0.389	0.365	0.173	0.27	0.141	0.267	0.215
2008	0.288	0.338	0.430	0.156	0.118	0.125	0.007	0.193
2009	0.290	0.357	0.434	0.159	0.082	0.131	0.127	0.196
2010	0.26	0.362	0.368	0.140	0.038	0.110	0.072	0.181
2011	0.272	0.396	0.227	0.151	0.044	0.119	0.181	0.193
2012	0.248	0.387	0.211	0.099	0.052	0.068	0.152	0.149
Average	0.296	0.358	0.301	0.181	0.189	0.129	0.214	0.202

Panel B: Domestic-owned banks	Albania	Bosnia-Herzegovina	Bulgaria	Croatia	FYROM	Romania	Serbia	SEE
2003	-	-	0.101	0.250	0.249	-0.07	0.422	0.190
2004	-	0.321	0.199	0.215	0.284	-0.015	0.299	0.193
2005	-	0.442	0.202	0.176	0.313	0.126	0.393	0.224
2006	-	0.413	0.118	0.184	0.236	0.15	0.433	0.222
2007	0.407	0.440	0.263	0.184	0.243	0.161	0.348	0.251
2008	0.436	0.432	0.271	0.307	0.148	-0.173	0.032	0.174
2009	0.394	0.419	0.272	0.132	0.101	0.038	0.067	0.144
2010	0.314	0.432	0.141	0.059	0.033	0.151	0.074	0.120
2011	0.365	0.474	0.051	0.111	0.099	0.071	0.115	0.149
2012	0.115	0.465	0.069	-0.066	0.241	0.174	0.19	0.122
Average	0.314	0.437	0.168	0.155	0.194	0.062	0.212	0.178
Panel C: Foreign-owned banks	**Albania**	**Bosnia-Herzegovina**	**Bulgaria**	**Croatia**	**FYROM**	**Romania**	**Serbia**	**SEE**
2003	0.350	-	0.528	0.215	0.232	0.159	0.476	0.240
2004	0.276	0.237	0.457	0.175	0.452	0.136	0.41	0.221
2005	0.429	0.350	0.456.	0.185	0.421	0.150	0.043	0.228
2006	0.378	0.328	0.337	0.089	0.489	0.175	0.295	0.268
2007	0.139	0.373	0.442	-0.247	0.293	0.247	0.23	0.197
2008	0.266	0.282	0.554	0.105	0.099	0.304	-0.01	0.206
2009	0.275	0.312	0.548	0.104	0.069	0.241	0.173	0.231
2010	0.246	0.318	0.551	0.130	0.042	0.304	0.07	0.224
2011	0.251	0.333	0.383	0.078	0.007	0.296	0.225	0.221
2012	0.277	0.319	0.338	0.048	-0.028	0.226	0.139	0.161
Average	0.275	0.32	0.459	0.088	0.16	0.227	0.164	0.219
Panel D: Small banks	**Albania**	**Bosnia-Herzegovina**	**Bulgaria**	**Croatia**	**FYROM**	**Romania**	**Serbia**	**SEE**
2003	0.328	-	0.058	0.263	0.27	0.095	0.436	0.413
2004	0.233	0.236	0.175	0.227	0.403	0.07	0.32	0.277
2005	0.436	0.384	0.231	0.173	0.413	0.038	0.167	0.149
2006	0.325	0.357	0.124	0.117	0.376	0.025	0.436	0.401
2007	-0.047	0.423	0.140	0.097	0.283	0.025	0.292	0.278
2008	0.211	0.397	0.346	0.243	0.095	0.487	0.120	0.180
2009	0.271	0.39	0.281	0.055	0.079	0.296	0.015	0.062
2010	0.146	0.392	0.018	0.012	0.013	0.078	0.061	0.012
2011	0.157	0.434	0.576	0.003	0.002	0.022	0.145	0.098
2012	0.091	0.472	0.381	0.094	0.049	0.058	0.167	0.102
Average	0.215	0.387	0.233	0.128	0.198	0.119	0.215	0.197
Panel E: Large banks	**Albania**	**Bosnia-Herzegovina**	**Bulgaria**	**Croatia**	**FYROM**	**Romania**	**Serbia**	**SEE**
2003	0.438	-	0.466	0.192	0.111	0.264	0.527	0.584
2004	0.449	0.295	0.441	0.156	0.074	0.309	0.354	0.392
2005	0.422	0.359	0.451	0.19	0.175	0.284	0.417	0.477
2006	0.432	0.356	0.359	0.181	0.180	0.253	0.235	0.295
2007	0.394	0.359	0.427	0.173	0.228	0.29	0.251	0.318
2008	0.333	0.256	0.442	0.174	0.192	0.361	0.111	0.177
2009	0.302	0.312	0.467	0.165	0.093	0.342	0.192	0.249
2010	0.336	0.325	0.446	0.167	0.081	0.358	0.079	0.148
2011	0.368	0.358	0.334	0.168	0.107	0.331	0.204	0.247
2012	0.379	0.312	0.298	0.133	0.207	0.263	0.143	0.177
Average	0.385	0.325	0.413	0.169	0.144	0.305	0.251	0.306

Note: This table shows results for the *Lerner index* calculated in accordance with Eq.(4). The *Lerner index* values have been calculated at a bank level on a yearly basis and this table reports aggregate values at country level on a yearly basis. Panel A reports the *Lerner index* irrespective of the size and ownership of banks. Panel B and Panel C report *Lerner index* values for domestic- and foreign-owned banking firms respectively. Panel D and Panel E report *Lerner index* values for small- and large banks respectively.

Breaking down the *Lerner index* into its components as defined in Eq.(4) and presenting the results in Figure C1 (see Appendix C), I illustrate the evolution of (i) prices, (ii) marginal costs, (iii) prices minus marginal costs as well as the *Lerner index* itself for all SEE bankson the basis of banks' ownership, and size. In particular, if we compare domestic-owned banks with foreign-owned banks, we observe that over the period 2003–2012 the marginal costs of domestic-owned banks were slightly higher when compared to the marginal costs of foreign-owned banks. The same comparison shows that prices charged by domestic-owned banks were usually higher than those charged by foreign-owned banks. In addition, Figure C1 shows that, over time, foreign-owned banks enjoyed a relatively stable market power while in the case of domestic-owned banks I found evidence of wider fluctuations of the *Lerner index* values. Last but not least, from the second half of the 2000s domestic-owned banks started to lose market power at a faster pace in comparison with the loss of market power suffered by foreign-owned banks. Furthermore, as shown in Figure 1, the gap between prices and marginal costs became narrower in the case of domestic-owned banks compared with foreign-owned banks from the beginning of 2008. A reason for this could rely on the fact that foreign-owned SEE banks might have received additional financial support from their parent banks[13], which might have contributed to keep marginal costs down.

On the other hand, domestic-owned SEE banks experienced an increase in marginal costs during the period 2007-2008 and this resulted in a reduction of the gap with prices as shown in Figure C1. By comparing small banks to large banks, Figure C1 shows a consistent reduction of the *Lerner index* for SEE small banks since the year 2008; in addition, we observe that the gap between prices and marginal costs in the case of small banks has been narrowing since 2008. Overall, the comparison between small and large banks illustrates a progressive loss of market power in the case of small banks while large banks were able to keep their market power quite stable over the period 2003–2012.

6.2 Financial stability of SEE banking industries

As anticipated earlier, I used two different indicators to measure the financial stability of SEE banking industries: the *NPLs ratio* and the *Z-Score.* I calculated the *NPLs ratio* as non-performing loans over gross loans at bank level and on a yearly basis and presented the results in Table 9. In particular, Panel A of Table 9 shows that, on average, Serbian and FYROM banks had the highest *NPLs ratios* with percentage values of 34.6% and 13% respectively. In the case of the FYROM banks, the *NPLs ratio* rose sharply during the second half of the 2000s, while in the case of Serbian banks the values of the *NPLs ratio* were particularly high in the first half of the 2000s. On the other hand, Bulgarian and Albanian banks were characterised by the lowest *NPLs ratios*, with values of 4.9% and 5.7% respectively. By considering bank ownership, the findings show that domestic-owned banks (Panel B of Table 9) had, on average, *NPLs ratios* substantially higher in comparison with foreign-owned banks (Panel C). Claessens and Van Horen (2013) argue that foreign-owned banks in the host country handpick only the best customers, leaving the domestic-owned banks with a worsening credit pool with higher-risk profiles. This might result in higher default rates on loans given out by domestic-owned banks and therefore higher *NPLs ratios*. Panel B of Table 9 shows that, on average, over the period 2003-2012 domestic-owned banks in Serbia scored the highest *NPLs* ratio (63.4%) in comparison with domestic-owned banks operating in other SEE banking industries. In contrast, domestic-owned banks in Bulgaria scored, on average, the lowest *NPLs ratio* (0.036) over the same period. Panel C of Table 9 shows that foreign-owned banks in Serbia scored, on average, the highest *NPLs ratio* (0.119), whereas foreign-owned banks in Albania scored, on average, the lowest *NPL ratio* (0.046) over the period 2003-2012. Considering banks on the basis of their size, Panel D of Table 9 shows that in Serbia and FYROM, small bank firms suffered the highest ratios of *NPLs*, with values of 0.538 and 0.133 respectively. On the other hand, looking at Table 9 – Panel E, we observe that large banks in both Serbia and FYROM scored the highest *NPLs ratios* with values of 0.155 and 0.115 respectively. This is in contrast to the lowest values in Albania (0.039) and Bulgaria (0.042).

Figure 1 illustrates the evolution of *NPLs ratio* values at SEE banking industry level. Results show that in the first half of the 2000s, domestic-owned SEE banks managed to considerably lower their *NPL ratios* and align their values with the *NPLs ratio* values of foreign-owned banks. Despite this, *NPLs ratios* of domestic banks were higher in comparison to SEE foreign-owned banks over the entire period of analysis.

[13] As pointed out by De Haas and Van Lelyveld (2014), foreign banks subsidiarie in Eastern Europe usually enjoy additional support from parent banks in the form of liquidity and capital.

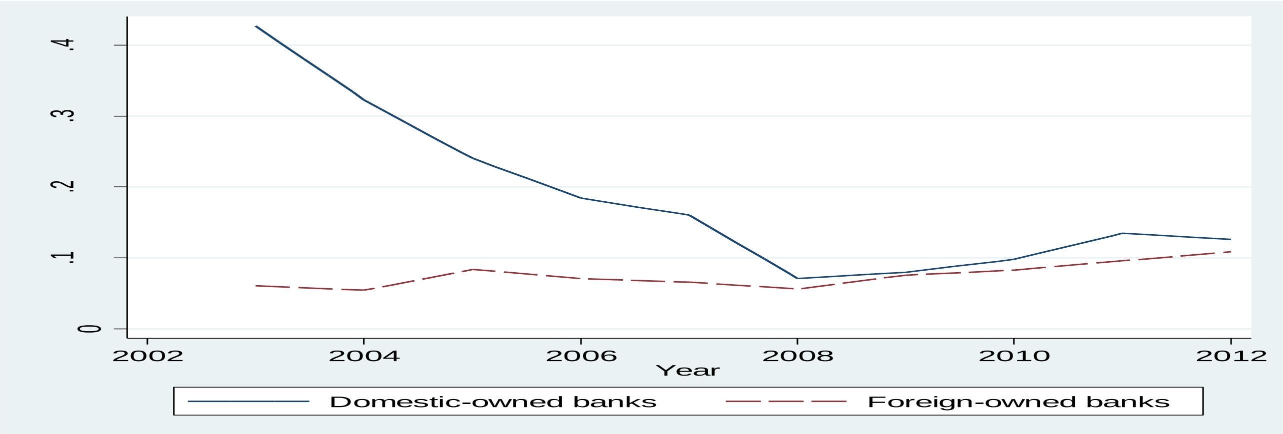

Figure 1 – Evolution of financial stability at bank-ownership level: the *NPL* indicator. This figure plots *NPL ratios* at bank-ownership level and on a yearly basis. *NPL ratios* were calculated in accordance with Eq. (8).

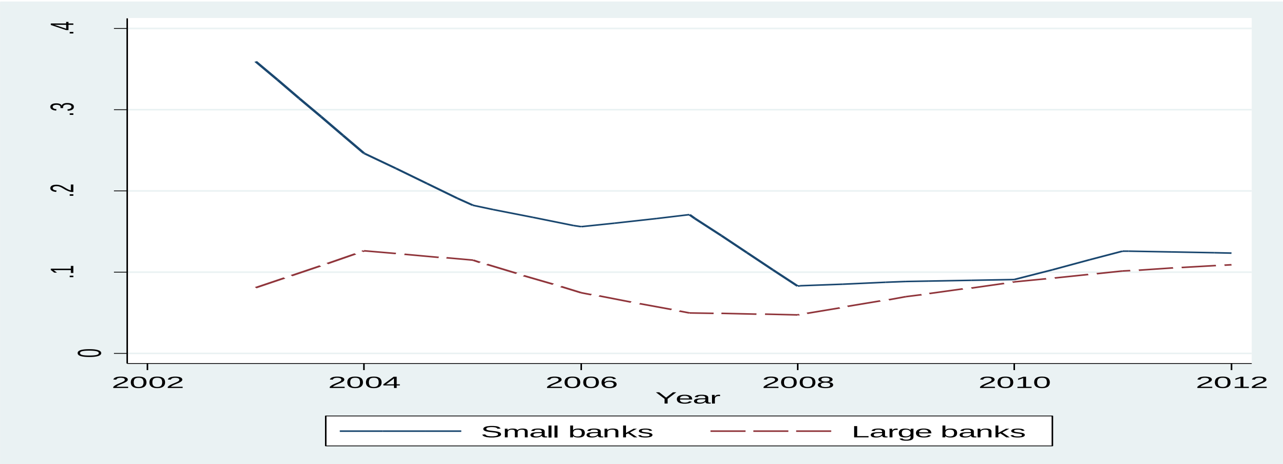

Figure 2 – Evolution of financial stability at bank ownership level: the *NPL* indicator. This figure plots average yearly *NPL ratios* at bank-level size. *NPL ratios* were calculated in accordance with Eq.(8).

Table 9 – NPLs ratio results by year and country

Panel A: All banks	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	Average
Albania	0.083	0.071	0.046	0.013	0.016	0.026	0.039	0.062	0.087	0.097	0.057
Bosnia	0.084	0.075	0.067	0.055	0.045	0.044	0.053	0.07	0.088	0.074	0.065
Bulgaria	0.044	0.033	0.031	0.029	0.026	0.027	0.041	0.072	0.101	0.089	0.049
Croatia	0.092	0.094	0.106	0.059	0.049	0.049	0.06	0.074	0.117	0.105	0.08
FYROM	0.115	0.081	0.058	0.113	0.209	0.131	0.140	0.103	0.133	0.168	0.13
Romania	0.055	0.022	0.020	0.022	0.022	0.028	0.085	0.125	0.142	0.138	0.064
Serbia	1.547	0.92	0.563	0.394	0.280	0.112	0.112	0.101	0.103	0.143	0.346
Panel B: Domestic-owned banks	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	Average
Albania	-	-	-	-	0.013	0.022	0.04	0.13	0.234	0.221	0.139
Bosnia	0.085	0.084	0.08	0.065	0.058	0.051	0.049	0.054	0.087	0.063	0.069
Bulgaria	0.041	0.036	0.028	0.032	0.028	0.019	0.023	0.034	0.065	0.057	0.036
Croatia	0.097	0.103	0.09	0.066	0.063	0.062	0.07	0.085	0.156	0.140	0.093
FYROM	0.115	0.105	0.064	0.062	0.061	0.068	0.083	0.094	0.197	0.482	0.102
Romania	0.104	0.025	0.024	0.031	0.028	0.041	0.113	0.234	0.224	0.124	0.089
Serbia	2.02	1.223	0.926	0.746	0.625	0.145	0.134	0.111	0.105	0.177	0.634
Panel C: Foreign-owned banks	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	Average
Albania	0.083	0.071	0.046	0.013	0.016	0.026	0.038	0.044	0.054	0.069	0.045
Bosnia	0.083	0.065	0.059	0.048	0.042	0.04	0.055	0.081	0.089	0.083	0.063
Bulgaria	0.049	0.024	0.036	0.026	0.025	0.033	0.054	0.106	0.137	0.117	0.061
Croatia	0.076	0.058	0.131	0.049	0.037	0.037	0.051	0.063	0.08	0.086	0.066
FYROM	-	0.032	0.046	0.177	0.294	0.170	0.188	0.110	0.091	0.089	0.155
Romania	0.019	0.02	0.018	0.019	0.019	0.025	0.075	0.089	0.115	0.143	0.053
Serbia	0.131	0.132	0.2	0.168	0.095	0.087	0.096	0.094	0.102	0.136	0.119
Panel D: Small banks	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	Average
Albania	0.083	0.093	0.073	0.013	0.017	0.029	0.041	0.089	0.13	0.126	0.077
Bosnia	0.08	0.071	0.062	0.052	0.040	0.042	0.045	0.054	0.087	0.062	0.061
Bulgaria	0.047	0.037	0.034	0.025	0.020	0.05	0.066	0.186	0.274	0.072	0.081
Croatia	0.092	0.1	0.084	0.06	0.048	0.054	0.063	0.082	0.111	0.129	0.082
FYROM	0.115	0.059	0.058	0.092	0.225	0.141	0.152	0.106	0.153	0.256	0.133
Romania	0.077	0.019	0.015	0.028	0.031	0.032	0.16	0.172	0.238	0.112	0.069
Serbia	1.792	0.979	0.562	0.510	0.557	0.14	0.108	0.083	0.078	0.148	0.538
Panel E: Large banks	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	Average
Albania	-	0.005	0.019	0.013	0.015	0.024	0.037	0.043	0.051	0.073	0.039
Bosnia	0.111	0.092	0.084	0.06	0.048	0.046	0.063	0.091	0.088	0.087	0.073
Bulgaria	0.037	0.025	0.026	0.032	0.028	0.023	0.035	0.055	0.077	0.091	0.042
Croatia	0.091	0.074	0.141	0.057	0.049	0.045	0.057	0.068	0.121	0.076	0.077
FYROM	-	0.188	-	0.278	0.14	0.097	0.108	0.099	0.105	0.109	0.119
Romania	0.025	0.027	0.023	0.019	0.019	0.027	0.064	0.116	0.110	0.142	0.061
Serbia	0.325	0.626	0.572	0.214	0.102	0.091	0.114	0.112	0.118	0.142	0.155

Note: This table reports the *NPL ratio* values grouped at country level and on a yearly basis over the period 2003–2012. *NPL ratio* values were calculated as *Reserve on Impaired Loans and non-performing loans over gross loans* at bank level in accordance with Eq.(8) and then grouped by country and period.

An alternative measure of financial stability considered in this study is the *Z-score* which was calculated in accordance with Eq.(9). Figure 3 illustrates the evolution of the *Z-score* on a yearly basis at country and SEE level. Over the period 2005–2012, the Croatian banking industry was characterised by the highest levels of financial stability. In contrast, both the Romanian and Serbian banking industries scored the lowest *Z-score* average values, suggesting that, among the SEE banking industries, both the Romanian and Serbian banks were the most exposed to the risk of insolvency. An additional element worth noting from Figure 3 is that during the 2007–2009 global financial crisis there was a drop in the values of the *Z-score* across all the SEE banking industries and therefore a general increase in the probability of insolvency. Altough a temporary recovery is evident in 2010 for almost all of the banking industries under study, we observe a general downward trend of the *Z-score* values from 2011 onwards with a consequent deterioration of financial stability across almost all of the SEE banking industries.

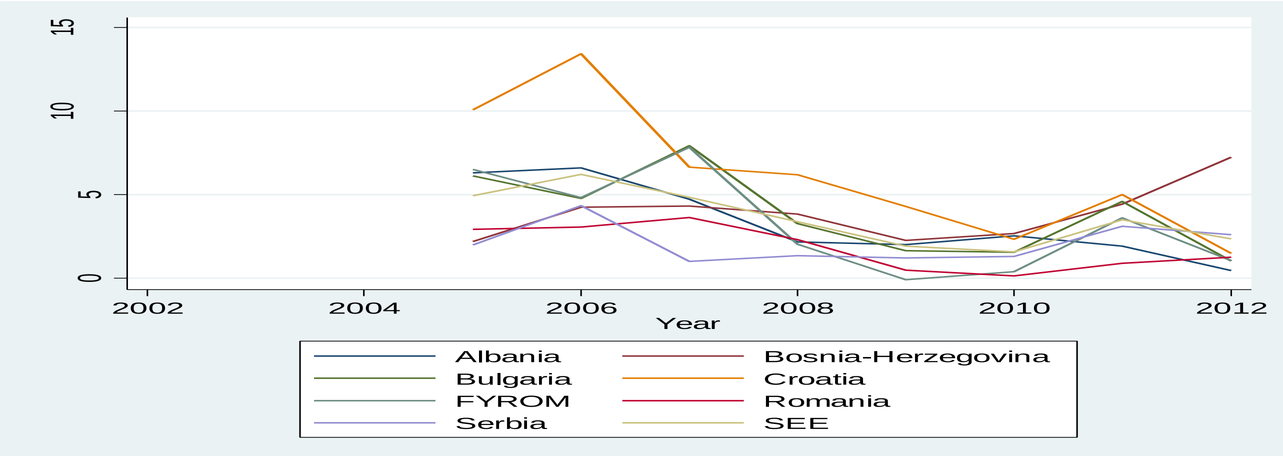

Figure 3 – Evolution of financial stability: the *Z-score* indicator. This figure plots *Z-score* values at both country level and SEE level and on a yearly basis. *Z-scores* were calculated in accordance with Eq.(9) therefore before the year 2005this graph does not show any value as the denominator of the *Z-score*; that is, the standard deviation of ROA was calculated using a three-year rolling window approach.

Figure 4 illustrates the evolution of the *Z-score* for both domestic-owned and foreign-owned banks for the entire SEE banking industry. The results show that the probability of insolvency was generally higher for domestic-owned SEE banks in comparison with foreign-owned SEE banks up to the end of 2007. Conversely, from 2010 foreign-owned SEE banks seemed to be more at risk of insolvency compared with domestic-owned SEE banks. Recent studies (Anginer et al., 2016) found a positive and statistically significant correlation during the global financial crisis between parent banks' default risk and the default risk of their foreign affiliates. Given that a large number of SEE banking firms are foreign-owned banks with their parent banks being mainly Austrian, French, German, Greek, and Italian, the banking crisis that was experienced by many of these Western countries over the period following the 2007–2009 global financial crisis[14] might explain the reason behind the switch.[15]

[14] In order to identify whether a country experienced a systematic banking crisis, Laeven and Valencia (2010) listed five criteria: 1) extensive liquidity support; 2) significant restructuring costs; 3) significant asset purchases; 4) significant guarantees and liabilities; 5) significant nationalisations. According to these criteria a systematic banking crisis occurs if at least three of the listed interventions took place. Over the period 2007–2009, based on these criteria, Laeven and Valencia (2010) argue that Austria and Germany went through a systematic banking crisis, while France and Greece were borderline cases as they met two of the three criteria.

[15] Interestingly, Claessens and Van Horen (2013) point out that foreign-owned banks might introduce financial instability in the host country as shocks in their home markets can propagate and result in a reduction of credit in the host countries. This hypothesis is also confirmed in De Haas and Van Lelyveld (2014) who found that during the 2007–2009 global financial crisis, foreign-owned banks witnessed a reduction of lending growth that was three times as fast as domestic-owned banks.

By taking into account the size of SEE banks in terms of assets, Figure 5 clearly shows that large banks were characterised by *Z-score* values higher that the *Z-score* values of small banks. Therefore, the risk of insolvency was higher for small banks in comparison to large banks. Furthermore, on average, the *Z-score* values of small and large banks over the period 2005-2012 were 1.555 and 3.376 respectively. This suggests that small banks were almost twice more at risk of insolvency than large banks. Recent empirical banking literature has pointed out that banks with higher loan growth rates are significantly less stable in comparison to banks with lower loan growth rates. For instance, Foos et al.'s (2010) analysis of banks' financial stability in 16 advanced economies over the period 1997-2007 found that a very high rate of loan growth is negatively associated with banks' solvency. In a more recent study, Köhler (2015) investigated the impact of loan growth on bank risk in 15 EU countries, finding that banks with high rates of loan growth are more at risk of insolvency. A reason behind these results is that banks might reduce lending standards in order to increase their lending and to weaken their competitors (Ruckes, 2004; Köhler, 2015). In accordance with these findings, I calculated the average annual loan growth rate over the period 2003–2012 for small and large SEE banks. In the case of small SEE banks, the rate of growth over 2002-2012 was 34.8% on an annual basis, while in the case of large SEE banks the rate of growth was 25.6%. This difference of almost 10% clearly indicates that annual loan growth rates of small banks in SEE were on average higher in comparison with large banks. Thus I might assume that the findings in both Foos et al. (2010) and Köhler (2015) also apply in the present study.

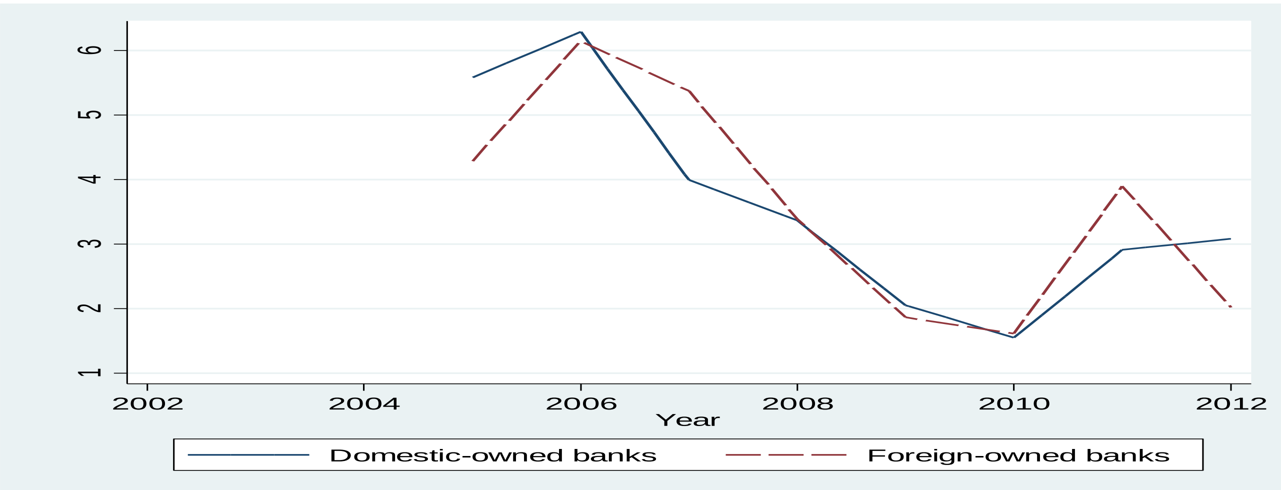

Figure 4 – Evolution of financial stability at bank-ownership level: the *Z-score* indicator. This figure plots *Z-score* values at bank-ownership level and on a yearly basis. *Z-scores* were calculated in accordance with Eq.(9). Therefore, before 2005 this graph does not show any value as the denominator of the *Z-score*; that is, the standard deviation of ROA was calculated using a three-year rolling window approach.

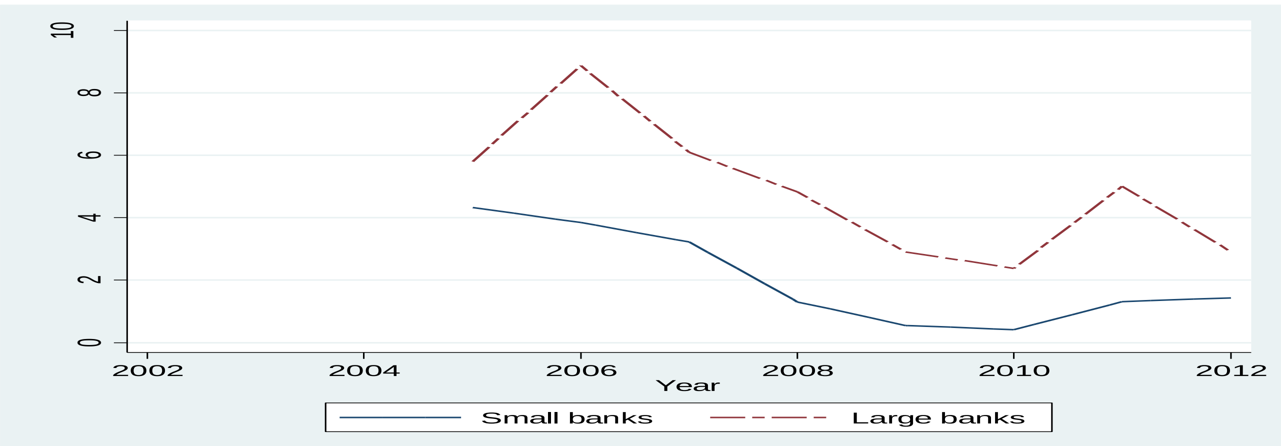

Figure 5 – Evolution of financial stability at bank-size level: the *Z-score* indicator. This figure plots *Z-score* values at bank-ownership level and on a yearly basis. *Z-scores* were calculated in accordance with Eq.(9). Before 2005 this graph does not show any value as the denominator of the *Z-score*; that is, the standard deviation of ROA was calculated using a three-year rolling window approach.

A further question is whether or not the constituents of the *Z-score* indicator as per Eq.(9) (that is CAR, ROA and SDROA) can reveal additional information about how the risk of insolvency might depend on the size of these components. Table 10 shows the breakdown of the *Z-score* in its constituents. Consistent with similar studies (Köhler, 2015), my results show that the differences in *Z-score* values across banks are mainly due to higher volatility of returns (SDROA) rather than differences in either the level of capitalisation (CAR) or profitability (ROA). According to the findings presented in Table 10 – Panel A, banks in Croatia and Bosnia-Herzegovina showed the highest *Z-score* values (5.947 and 3.891 respectively) and the lowest values of standard deviation of ROA (0.666 and 0.619) in comparison with banks operating in other SEE countries. In contrast, banks operating in Romania and Serbia presented the lowest *Z-score* values (1.815 and 2.093 respectively) associated with the highest standard deviations for ROA (1.436 and 2.641). These results clearly show that a large variability of ROA can be identified as one of the main elements that increases the risk of insolvency for SEE banks. Repeating this analysis by taking bank ownership into account, Table 10 – Panel B shows that domestic-owned banks in Bosnia-Herzegovina and Croatia were characterised by the highest *Z-score* values (5.37 and 4.48 respectively) and the lowest standard deviations for ROA (0.466 and 0.761) in comparison with domestic banks operating in other SEE countries. In the case of foreign-owned banks (Table 10 – Panel C), Croatia was the country where the *Z-score* of banks was the highest (7.488) and the related standard deviation of ROA was the lowest (0.252). In contrast, foreign-owned banks located in Serbia had the lowest *Z-score* (1.815) and the highest standard deviation of ROA (2.361). The same analysis conducted in the case of small and large banks (Panels D and E – Table 10) confirms the previous relationship. In particular, small banks in Bosnia-Herzegovina and Croatia, as well as large-banks in Croatia and FYROM, scored on average the highest *Z-score* values and the lowest standard deviation of ROA in comparison with other banks of similar size located in other SEE countries.

Interestingly, looking at the capitalisation (CAR) and profitability ratios (ROA), Table 10 shows that on average domestic-owned SEE banks (Panel B) are better capitalised (0.183) and more profitable (0.656) in comparison with foreign-owned SEE banks (Panel C) that score lower in terms of capitalisation (0.166) and profitability (0.283). In addition, the *Z-score* for domestic-owned banks is slightly higher (3.503) in comparison with foreign-owned SEE banks (3.395). Further, it can be observed that, on average, small SEE banks are better capitalised in comparison with large SEE banks with values of 0.217 and 0.13 respectively. Conversely, the profitability of large SEE banks (Panel E) is higher than what we observe in the case of small SEE banks (Panel D), with values of 0.795 and 0.098 respectively. Even though small SEE banks are better capitalised than large SEE banks, they have significantly lower *Z-score* values (2.049) owing to a significantly higher standard deviation of returns (0.899). Therefore, SEE domestic-banks are more at risk of insolvency in comparison to SEE foreign-owned banks.

Table 10 – Average and median of *Z-score* and its components at country level, 2003–2012

Panel A: All banks	Z-score		CAR		ROA		SDROA	
	Mean	Median	Mean	Median	Mean	Median	Mean	Median
Albania	2.356	0.88	0.142	0.125	0.492	0.73	0.736	0.534
Bosnia	3.891	2.618	0.199	0.137	0.747	0.704	0.619	0.355
Bulgaria	3.702	2.108	0.123	0.114	1.143	1.016	0.776	0.532
Croatia	5.947	3.481	0.142	0.125	0.474	0.85	0.666	0.285
FYROM	2.942	1.432	0.231	0.165	0.186	0.83	1.093	0.769
Romania	1.815	0.799	0.131	0.113	-0.126	0.77	1.436	0.843
Serbia	2.093	0.582	0.241	0.206	0.346	0.744	2.641	1.348
SEE	3.438	1.835	0.173	0.135	0.447	0.8	1.23	0.596
Panel B: Domestic-owned banks	Z-score		CAR		ROA		SDROA	
	Mean	Median	Mean	Median	Mean	Median	Mean	Median
Albania	2.034	2.531	0.123	0.09	0.043	1.06	0.976	0.576
Bosnia	5.37	3.947	0.224	0.207	0.892	0.76	0.466	0.267
Bulgaria	3.278	2.608	0.105	0.091	0.94	0.996	0.602	0.435
Croatia	4.480	3.299	0.144	0.123	0.615	0.854	0.761	0.300
FYROM	2.719	1.432	0.174	0.156	1.22	1.47	1.159	0.788
Romania	1.072	0.564	0.144	0.115	-0.73	0.816	1.865	1.160
Serbia	2.57	1.245	0.293	0.251	0.993	1.135	3.143	1.775
SEE	3.503	2.422	0.183	0.141	0.656	0.89	1.290	0.552
Panel C: Foreign-owned banks	Z-score		CAR		ROA		SDROA	
	Mean	Median	Mean	Median	Mean	Median	Mean	Median
Albania	2.4	0.729	0.145	0.127	0.554	0.616	0.709	0.499
Bosnia	2.794	2.156	0.178	0.11	0.626	0.624	0.73	0.414
Bulgaria	4.08	1.415	0.139	0.131	1.323	1.249	0.937	0.631
Croatia	7.488	3.788	0.141	0.126	0.299	0.804	0.565	0.252
FYROM	3.12	1.49	0.278	0.183	-0.659	0.401	1.041	0.697
Romania	2.08	0.993	0.126	0.113	0.128	0.74	1.261	0.701
Serbia	1.815	0.362	0.203	0.197	-0.133	0.55	2.361	1.169
SEE	3.395	1.407	0.166	0.132	0.283	0.74	1.199	0.620
Panel D: Small banks	Z-score		CAR		ROA		SDROA	
	Mean	Median	Mean	Median	Mean	Median	Mean	Median
Albania	1.166	0.556	0.172	0.165	-0.127	.364	1.145	1.106
Bosnia-	4.249	2.881	0.254	0.213	0.884	0.665	0.586	0.345
Bulgaria	2.214	2.328	0.142	0.120	1.070	1.156	1.111	0.702
Croatia	2.631	1.574	0.155	0.136	0.178	0.682	0.968	0.520
FYROM	1.262	0.377	0.282	0.208	-0.252	.462	1.436	1.163
Romania	-0.233	-0.543	0.181	0.169	-1.573	-0.265	3.135	2.365
Serbia	0.654	0.166	0.272	0.215	0.048	0.24	3.151	1.877
SEE	2.049	0.883	0.217	0.175	0.098	0.571	1.616	0.899
Panel E: Large banks	Z-score		CAR		ROA		SDROA	
	Mean	Median	Mean	Median	Mean	Median	Mean	Median
Albania	3.488	2.531	0.107	0.106	1.079	1.361	0.440	0.396
Bosnia	3.380	2.372	0.099	0.093	0.5	0.78	0.665	0.384
Bulgaria	4.203	2.07	0.113	0.103	1.181	1.015	0.666	0.45
Croatia	9.573	5.270	0.127	0.113	0.83	0.94	0.346	0.20
FYROM	6.367	4.918	0.104	0.111	1.283	1.235	0.393	0.347
Romania	2.418	1.622	0.109	0.107	0.564	0.88	0.856	0.644
Serbia	3.188	0.903	0.207	0.198	0.668	1.11	2.254	1.104
SEE	4.523	2.376	0.130	0.115	0.795	0.969	0.941	0.459

Note: This table displays detailed statistics for *Z-scores* and the components used to calculate them. CAR represents the capital assets ratio calculated as total equity over total assets, ROA is return on assets and SDROA is the standard deviation calculated over a rolling period of three years.

6.3 The impact of either market concentration or competition on the financial stability of SEE banks

To examine whether either market concentration or competition have any effect on the financial stability of SEE banks, I estimated Eq.(10) by using a dynamic panel data regression approach. Models 1, 2, and 3 of Table 11 illustrate the effect of market concentration measures (either *CR-3* or *HHI)* and competition measures (the *Lerner index)* on *NPLs ratio* of SEE banks. Focusing the discussion on the coefficients that are statistically significant, I found that, in the case of Model 2, the *HHI* has a negative and statistically significant effect on *NPL ratios*. Therefore, an increase in market concentration results in lower *NPLs ratios,* and therefore in greater financial stability of SEE banks. This result lends support to the *concentration-stability* hypothesis. Model 3 of Table 14 shows that the effect of the *Lerner index* on *NPLs ratios* is positive and statistically significant indicating that an increase in banks' market power determines an increase of *NPL ratios* values. This latter result lends support to the *competition-fragility* hypothesis and is consistent with the findings in Jiménez et al. (2007). An explanation for this outcome is that an increase in the banks' market power results in higher interest rates charged to borrowers that mayin turn lead to moral hazard and adverse selection problems, resulting in higher *NPL ratios* and greater fragility of banking systems (Boyd and De Nicoló, 2005). In this case, the role played by regulation and competition authorities, whichprevent dominant banks exploiting their market power by charging excessive prices, is essential.[16] Hellmann et al. (2000) point out that an increase in the degree of competition in the deposit market can lead banks to offer high deposit rates in an effort to steal market shares from their rivals. Therefore, the lack of ceilings to deposit rates might lead banks to invest in assets with a high level of risk in order to cover the expenditure coming from high rates paid on customer deposits.

Banks' characteristics such as ownership and size are important determinants of their customer portfolios (De Haas and Naaborg, 2006) and this might ultimately lead to the consideration that the effect of either concentration or competition on the *NPLs ratios* may vary with bank ownership and size. To address this point, Table 12 and 13 show the effects of either market concentration or competition on the financial stability of either domesic-owned or foreign-owned banks. Focusing only on the results that are statistically significant, I found that the effect of the *HHI* on the *NPLs ratio* values of domestic-owned banks is negative and statistically significant (Model 2 – Table 12). Therefore, an increase in the degree of concentration as measured via the *HHI* results in a lower *NPLs ratios,* lending support to the *concentration-stability* hypothesis in the case of domestic-owned SEE banks. Table 13 presents the effect of market concentration and competition measures on the financial stability of foreign-owned SEE banks. Model 3 of Table 13 shows a positive and statistically significant effect of the *Lerner index* on the *NPLs ratio* of SEE foreign-owned banks. This result clearly shows that an increase in the market power of foreign-owned SEE banks has the effect of increasing their *NPLs ratio,* hence leading to increasing financial instability. Furthermore, Model 6 of Table 13 shows that an increase in the *Lerner index* results in a higher *Z-score* for foreign-owned SEE banks, suggesting that higher market power reduces the probability of insolvency for these banks.[17] The different effect of market power on the two alternative financial stability measures is related to what these two variables are in fact measuring. While the *NPL ratio* only looks at the fraction of

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[16] In South-Eastern Europe the organisation and functioning of competition authorities is still an ongoing problem. Despite the completion of the transition process from planned to market economy, SEE countries still lag behind in terms of having adequate competition authorities and fully operative competition policies. The lack of resources allocated to these SEE competition authorities, especially in terms of human capital, constitute a serious problem to their functioning (Begović and Popović, 2018). This leads to the conclusion that the enforcement of competition laws is still quite problematic in many SEE countries. As pointed out by Begović and Popović (2018), competition laws prohibit and sanction various typologies of firms' behaviour such as anti-competitive agreements and abusive practices of dominant firms. Even if some SEE banks are able to charge excessive prices, the weakness of competitive SEE authorities might impede the application of fines to banks adopting these abusive practices.

[17] Similar results have been found in Kick and Prieto (2015) who point out that a higher pricing power of banks, as measured via the *Lerner index*, has the effect of reducing the probability of a distress event. The results of this study are also consistent with Beck et al. (2013) who found a positive relationship between market power as measured through the *Lerner index* and financial stability of banks as measured via the *Z-score*. It is worth pointing out that, as mentioned in Fu et al. (2014), an increase in the *Lerner index*, that is, a greater discretion for banks in terms of price setting, enables them to build greater capital buffers that can be used to protect against external and internal shocks thus reducing their probability of insolvency.

loans that are not repaid, the *Z-score* looks at the overall financial situation of a bank. A bank could be unable to recoup its loans and yet be solvent overall if it has access to resources to cover the losses. This is more likely to be the case for foreign-owned SEE banks that are backed by their parent banks and which might be willing to cover losses due to non-performing loans.

The effect of either market concentration or market power on banks' financial stability might differ according to bank size. Depending on their size, banks might tend to serve different customers. For instance, large banks tend to allocate a large majority of their portfolios to large-denomination industrial and commercial loans to business firms. Conversely, small banks might tend to focus on retail credit in the form of smaller-denomination personal cash loans and home mortgage loans to individuals as well as small business loans to small firms. Furthermore, small banks operate in a local context whereas larger banks are able to operate in a wider context making them able to serve a wider number and typology of customers (Schaeck and Cihák 2010). In addition, large banks tend to be less capitalised, more organisationally complex and more engaged in market-based activities rather than in traditional banking activities (Laeven et al., 2016). Taking into account these differences, I investigated the effect of market concentration or competition on the financial stability of either small or large banks. The findings are reported in Table 14 and Table 15 for large and small banks respectively. In particular, Model 1 of Table 14 shows that the *CR-3* had a negative and statistically significant effect on the *NPL ratio* of large SEE banks, therefore demonstrating an increase in the concentration ratio results in a reduction of *NPL ratio* for large SEE banks. In addition, Table 14 – Model 3 shows that the effect of the *Lerner index* on the *NPLs ratios* of large SEE banks is positive and statistically significant, pointing to the fact that an increase in market power leads to higher *NPLs ratio* of large SEE banks. Finally, Table 15 shows the impact of either industry concentration or competition measures on the financial stability of small SEE banks. The findings show that only the *CR-3* has a negative and statistically significant effect on financial stability as measured by the *Z-score* (Model 4). This means that an increase of the *CR-3* results in a lower *Z-score* and, hence, a higher probability of insolvency, suggesting that the financial stability of small SEE banking firms tends to deteriorate as market concentration increases.

6.4 The effect of GDP growth, equity and net loans on financial stability

Concerning country-level control variables, Models 1, 2 and 3 of Table 11 show that the effect of GDP growth on *NPL ratios* is negative and statistically significant irrespective of the market-power and competition variable used. From an economic standpoint, this means that a booming economy reduces banks' risk (Yeyati and Micco, 2007). This clearly provides evidence of the pro-cyclicality of financial stability, implying that the probability of insolvency of SEE banks tends to reduce when the economy goes through a cycle of expansion. Looking at the estimated coefficients of the bank-level control variables, Table 11 – Models 1, 2 and 3 show that the variable *Equity to total assets* has a negative and statistically significant effect on *NPL ratios*, which suggests that an increase in bank capitalisation results in lower *NPL ratios*. Therefore the better a bank is capitalised, the better its financial stability is.

Considering domestic-owned SEE banks, Table 12 shows the negative and statistically significant relationship between GDP growth and *NPLs ratios* of domestic-owned banks, confirming the effect of economic expansion in terms of reducing the *NPLs ratio* values of SEE banks. In addition, the effect of the variable *Equity to total assets* on *NPLs ratios* is negative and statistically significant, confirming that better capitalised banks enjoy lower *NPLs ratios*.

Table 13 shows that GDP growth has the effect of reducing *NPLs ratio* as well as increasing the *Z-score* for foreign-owned SEE banks. This confirms the fact that a booming economy has a positive effect on the financial stability of banks. It is worth noting that the size of the reduction of the *NPLs ratio* as a consequence of GDP growth is usually larger for foreign-owned SEE banks in comparison with domestic-owned SEE banks.

Models 1, 2 and 3 of Table 14 show that the effects of both *GDP growth* and *Equity to total assets* on *NPL ratios* are negative and statistically significant, suggesting that large SEE banks enjoy a reduction of *NPL ratios* when the economy is expanding as well as when these large SEE banks increase their capitalisation ratio. When I consider the *Z-score* as an indicator of financial stability, we observe that the variables *GDP growth* in Models 4 to 6 and *Equity to total assets* in Models 4 and 5 have the effect of increasing the *Z-score*, which means a reduction in the probability of insolvency for large SEE banks. Furthermore, Models 4 and 5 of Table 14 show a negative and statistically significant effect of *Net loans to total assets* on the *Z-score* of large SEE banks. In other words, an increase in the level of loans results in a reduction of the *Z-score* which means an increase in the probability of insolvency of large SEE banks. This last result might be explained by the presence of government safety nets that encourage large banks to take greater risks in lending, on the basis of the belief that if they incur financial difficulties then the government will bail them out.

Finally, the results for Models 1, 2, and 3 of Table 15 show that an increase of *GDP growth* has the effect of reducing the *NPL ratio* of small SEE banking firms. We also notice that the size of the reduction of the *NPL ratio* as a consequence of economic growth is smaller for small SEE banking firms in comparison with large SEE banks where the effect is larger.

In summary, the findings suggest that economic growth has the effect of reducing *NPL ratios* of SEE banks irrespective of their ownership and size; in particular, the effect in terms of reducing the *NPL ratios* is larger in the case of foreign-owned as well as large SEE banks. Furthermore, GDP growth has the effect of increasing the *Z-score* (and hence reducing the probability of insolvency) only in the case of foreign-owned and large SEE banks.

Table 11 – Financial stability and degree of market power: the case of SEE banking firms

Dependent Variable: *lnNPLs Ratio* or *lnZ-score*

	lnNPL ratio			*lnZ-score*		
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Dep. Variable (-1)	**0.595*****	**0.815*****	**0.763*****	**0.393*****	**0.595*****	**0.639*****
	(0.097)	**(0.038)**	**(0.04)**	**(0.137)**	**(0.097)**	**(0.117)**
Dep. Variable (-2)	-	-	-	-0.079	**-0.191*****	**-0.242****
				(0.101)	**(0.064)**	**(0.115)**
Dep. Variable (-3)	-	-	-		**0.134****	**0.243****
					(0.055)	**(0.094)**
CR-3	-0.085	-	-	0.441	-	-
	(0.167)			(0.753)		
HHI	-	**-0.236***	-	-	0.267	-
		(0.125)			(0.573)	
Lerner index	-	-	**0.088***	-	-	0.32
			(0.049)			(0.313)
GDP growth	**-0.042****	**-0.037*****	**-0.044*****	**0.027****	**0.032****	**0.034****
	(0.007)	**(0.007)**	**(0.008)**	**(0.013)**	**(0.016)**	**(0.016)**
Equity to Total Assets	**-0.119***	**-0.165****	**-0.186****	-0.133	0.241	0.184
	(0.062)	**(0.071)**	**(0.069)**	(0.260)	(0.203)	(0.277)
Net Loans to Total Assets	-0.01	-0.039	0.002	-0.484	-0.186	-0.287
	(0.107)	(0.113)	(0.177)	(0.424)	(0.464)	(0.521)
Constant	-0.374	0.967	**-0.75*****	-1.619	-1.138	0.939
	(0.672)	(0.)	**(0.208)**	(3.05)	(4.076)	(0.798)
Number of instruments	122	88	122	61	90	50
Sargan-test	$\chi_2(82) = 124.43$	$\chi_2(82) = 99.72$	$\chi_2(116) = 127.04$	$\chi_2(54) = 82.54$	$\chi_2(31) = 33.46$	$\chi_2(42) = 48.08$
	[0.28]	[0.089]	[0.228]	[0.007]	[0.349]	[0.002]
Hansen Test	$\chi_2(116) = 130.41$	$\chi_2(82) = 96.20$	$\chi_2(116) = 130.33$	$\chi_2(54) = 61.19$	$\chi_2(31) = 35.88$	$\chi_2(42) = 45.34$
	[0.170]	[0.135]	[0.172]	[0.234]	[0.25]	[0.335]
Arellano-Bond Test for AR1	-1.29	-1.28	-1.27	-2.19	-3.51	-3.15
	[0.198]	[0.202]	[0.205]	[0.028]	[0.00]	[0.002]
Arellano-Bond Test for AR2	0.7	0.7	1.08	-2.32	-1.60	-0.79
	[0.482]	[0.485]	[0.281]	[0.02]	[0.110]	[0.43]
Observations	895	895	780	388	273	252`

Note: This table reports coefficient estimates from the system-GMM models where in Models (1), (2), and (3) the dependent variable is the *NPL ratio*, while it is the *Z-score* in the case of Models (4), (5), and (6). The *System GMM* models were estimated by using three alternative measures of market power: the CR-3 calculated as the share of the banking industry total assets of the three largest banks within a country on a yearly basis; the *HHI* defined as the sum of the squared shares of bank assets to total banking industry assets within a given country in a year and the *Lerner index*. GDP growth rate is the rate of growth of Gross Domestic Product; Equity to total assets is the ratio of total equity as a share of total assets; Net Loans to Total Assets is the ratio of net loans to total assets. Since all variables, apart from GDP growth, are monetary values, or measure the size of something, I decided to use logarithmic transformation by converting them into natural logarithms. This approach allows interpretation of the effect of changes in the value of repressors by 1% to changes of the dependent variable in percentage terms. Robust standard errors are in parentheses. *, **, *** and indicate statistical significance at the 10%, 5%, and 1% levels respectively. For the orthogonal deviations equation I have used the following instruments: financial stability, market power and bank characteristics variables, while the instruments for the levels equation are year dummies. The Sargan Test has a null hypothesis of "the instruments as a group are exogenous". Therefore, the higher the *p-value* of the Sargan Statistic the better it is. In robust estimation Stata reports the Hansen statistic with the same null hypothesis. The Arellano-Bond test for autocorrelation has a null hypothesis of no correlation and is applied to the differenced residuals. The test for AR(1) process in first differences usually rejects the null hypothesis. The test for AR(2) in first differences is more important because it will detect autocorrelation in levels. Year dummies are included in all specifications but not shown in this table due to space limitations.

Table 12 – Financial stability and degree of market power: the case of domestic-owned banking firms

Dependent Variable: *lnNPL ratio* or *lnZ-score*

	lnNPL ratio			*lnZ-score*		
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Dep. Variable (-1)	**0.897***** **(0.05)**	**0.919***** **(0.052)**	**0.891***** **(0.054)**	**0.635***** **(0.133)**	**0.617***** **(0.143)**	**0.599***** **(0.192)**
Dep. Variable (-2)	-	-	-	**-0.452**** **(0.189)**	**-0.485*** **(0.228)**	-0.362 (0.368)
Dep. Variable (-3)	-	-	-	**0.456**** **(0.198)**	0.308 (0.183)	0.318 (0.263)
CR-3	-0.175 (0.143)	-	-	-1.27 (1.149)	-	-
HHI	-	**-0.186*** **(0.105)**	-	-	-0.248 (0.703)	-
Lerner index	-	-	-0.01 (0.055)	-	-	0.019 (0.426)
GDP growth	**-0.027***** **(0.005)**	**-0.025***** **(0.006)**	**-0.081***** **(0.006)**	0.028 (0.036)	0.023 (0.028)	0.024 (0.052)
Equity to Total Assets	**-0.224***** **(0.07)**	**-0.214**** **(0.06)**	**-0.234***** **(0.071)**	0.172 (0.309)	0.185 (0.293)	-0.093 (0.266)
Net Loans to Total Assets	0.003 (0.178)	0.009 (0.157)	0.072 (0.133)	-0.496 (0.321)	-0.46 (0.549)	**-0.672***** **(0.22)**
Constant	0.082 (0.571)	0.809 (0.771)	**-0.605**** **(0.231)**	5.153 (4.518)	2.263 (4.491)	-0.347 (0.720)
Number of instruments	88	88	88	51	51	51
Sargan-test	$\chi_2(82) = 119.93$ [0.004]	$\chi_2(82) = 120.15$ [0.004]	$\chi_2(82) = 134.52$ [0.00]	$\chi_2(43) = 55.03$ [0.103]	$\chi_2(43) = 52.11$ [0.161]	$\chi_2(43) = 57.55$ [0.068]
Hansen Test	$\chi_2(82) = 68.70$ [0.853]	$\chi_2(82) = 67.22$ [0.881]	$\chi_2(82) = 63.10$ [0.94]	$\chi_2(43) = 31.26$ [0.908]	$\chi_2(43) = 27.96$ [0.963]	$\chi_2(43) = 33.13$ [0.861]
Arellano-Bond Test for AR1	-1.16 [0.246]	-1.16 [0.247]	-1.17 [0.242]	-2.20 [0.028]	-2.19 [0.029]	-1.52 [0.128]
Arellano-Bond Test for AR2	0.95 [0.344]	0.94 [0.348]	1.11 [0.267]	-0.69 [0.49]	-0.85 [0.395]	-0.82 [0.414]
Observations	357	357	313	115	115	106

Note: This table reports coefficient estimates from the system-GMM models where in Models (1), (2), and (3) the dependent variable is the *NPL ratio*, while it is the *Z-score* in the case of Models (4), (5), and (6). The System GMM models were estimated by using three alternative measures of market power: the CR-3 calculated as the share of the banking industry total assets of the three largest banks within a country on a yearly basis; the *HHI* defined as the sum of the squared shares of bank assets to total banking industry assets within a given country in a year and the *Lerner index*. GDP growth rate is the rate of growth of Gross Domestic Product; Equity to total assets is the ratio of total equity as a share of total assets; Net Loans to Total Assets is the ratio of net loans to total assets. Since all variables, apart from GDP growth, are monetary values, or measure the size of something, I decided to use logarithmic transformation by converting them into natural logarithms. This approach allows interpretation of the effect of changes in the value of repressors by 1% to changes of the dependent variable in percentage terms. Robust standard errors are in parentheses. *, **, *** and indicate statistical significance at the 10%, 5%, and 1% levels respectively. For the orthogonal deviations equation I have used the following instruments: financial stability, market power, and bank characteristics variables, while the instruments for the levels equation are year dummies. The Sargan Test has a null hypothesis of "the instruments as a group are exogenous". Therefore the higher the *p-value* of the Sargan Statistic the better it is. In robust estimation Stata reports the Hansen statistic with the same null hypothesis. The Arellano-Bond test for autocorrelation has a null hypothesis of no correlation and is applied to the differenced residuals. The test for AR(1) process in first differences usually rejects the null hypothesis. The test for AR(2) in first differences is more important because it will detect autocorrelation in levels. Year dummies are included in all specifications but not shown in this table due to space limitations.

Table 13 – Financial stability and degree of market power: the case of foreign-owned SEE banking firms

Dependent Variable: *lnNPL ratio* or *lnZ-score*	*lnNPL ratio*			ln*Z-score*		
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Dep. Variable (-1)	**0.702***** **(0.042)**	**0.696***** **(0.039)**	**0.723***** **(0.047)**	**0.425***** **(0.131)**	**0.433***** **(0.123)**	**0.458***** **(0.128)**
Dep. Variable (-2)	-	-	-	-0.082 (0.081)	-0.083 (0.08)	**-0.127*** **(0.073)**
CR-3	-0.228 (0.197)	-	-	0.510 (0.596)	-	-
HHI	-	-0.172 (0.187)	-	-	0.099 (0.525)	-
Lerner index	-	-	**0.08**** **(0.037)**	-	-	**0.297*** **(0.155)**
GDP growth	**-0.052***** **(0.01)**	**-0.051***** **(0.01)**	**-0.055***** **(0.011)**	**0.042***** **(0.015)**	**0.043***** **(0.015)**	**0.049***** **(0.014)**
Equity to Total Assets	-0.003 (0.081)	-0.008 (0.83)	-0.021 (0.096)	0.001 (0.341)	-0.005 (0.296)	0.187 (0.224)
Net Loans to Total Assets	-0.081 (0.137)	-0.087 (0.129)	-0.106 (0.123)	0.516 (0.67)	0.78 (0.636)	0.631 (0.566)
Constant	0.141 (0.799)	**0.442***** **(1.341)**	**-0.618**** **(0.244)**	-1.059 (2.42)	**0.336***** **(3.7)**	**1.726**** **(0.69)**
Number of instruments	88	88	88	61	61	61
Sargan-test	$\chi_2(82) = 71.11$ [0.799]	$\chi_2(82) = 71.01$ [0.802]	$\chi_2(82) = 69.00$ [0.847]	$\chi_2(54) = 62.18$ [0.208]	$\chi_2(54) = 54.60$ [0.451]	$\chi_2(54) = 67.89$ [0.097]
Hansen Test	$\chi_2(82) = 88.22$ [0.3]	$\chi_2(82) = 86.07$ [0.358]	$\chi_2(82) = 83.98$ [0.419]	$\chi_2(54) = 57.30$ [0.354]	$\chi_2(54) = 55.74$ [0.409]	$\chi_2(54) = 52.67$ [0.526]
Arellano-Bond Test for AR1	-1.16 [0.248]	-1.15 [0.25]	-1.15 [0.252	-2.17 [0.03]	-2.31 [0.021]	-2.27 [0.023]
Arellano-Bond Test for AR2	0.74 [0.461]	0.73 [0.466]	1.02 [0.31]	-1.18 [0.236]	-1.14 [0.253]	-0.66 [0.512]
Observations	538	538	467	226	226	210

Note: This table reports coefficient estimates from the system-GMM models where in Models (1), (2), and (3) the dependent variable is the *NPL ratio*, while it is the *Z-score* in the case of Models (4), (5), and (6). The System GMM models were estimated by using three alternative measures of market power: the CR-3 calculated as the share of the banking industry total assets of the three largest banks within a country on a yearly basis; the *HHI* defined as the sum of the squared shares of bank assets to total banking industry assets within a given country in a year and the *Lerner index*. GDP growth rate is the rate of growth of Gross Domestic Product; Equity to total assets is the ratio of total equity as a share of total assets; Net Loans to Total Assets is the ratio of net loans to total assets. Since all variables, apart from GDP growth, are monetary values, or measure the size of something, I decided to use logarithmic transformation by converting them into natural logarithms. This approach allows interpretation of the effect of changes in the value of repressors by 1% to changes of the dependent variable in percentage terms. Robust standard errors are in parentheses. *, **, *** and indicate statistical significance at the 10%, 5%, and 1% levels, respectively. For the orthogonal deviations equation I have used the following instruments: financial stability, market power, and bank characteristics variables, while the instruments for the levels equation are year dummies. The Sargan Test has a null hypothesis of "the instruments as a group are exogenous". Therefore the higher the *p-value* of the Sargan Statistic the better it is. In robust estimation Stata reports the Hansen statistic with the same null hypothesis. The Arellano-Bond test for autocorrelation has a null hypothesis of no correlation and is applied to the differenced residuals. The test for AR(1) process in first differences usually rejects the null hypothesis. The test for AR(2) in first differences is more important because it will detect autocorrelation in levels. Year dummies are included in all specifications but not shown in this table due to space limitations.

Table 14 – Financial stability and degree of market power: the case of large SEE banking firms

Dependent Variable: *lnNPL ratio* or *lnZ-score*

	lnNPL ratio			*lnZ-score*		
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Dep. Variable (-1)	**0.792***** **(0.048)**	**0.795***** **(0.042)**	**0.772***** **(0.043)**	**0.512***** **(0.134)**	**0.505***** **(0.112)**	**0.485***** **(0.103)**
Dep. Variable (-2)	-	-	-	-0.115 (0.089)	**-0.135**** **(0.06)**	**-0.197*** **(0.107)**
Dep. Variable (-3)	-	-	-	0.121 (0.075)	**0.112*** **(0.066)**	**0.235**** **(0.094)**
CR-3	**-0.130***** **(0.211)**	-	-	0.254 (0.484)	-	-
HHI	-	-0.233 (0.224)	-	-	0.752 (0.466)	-
Lerner index	-	-	**0.130***** **(0.045)**	-	-	0.125 (0.285)
GDP growth	**-0.051***** **(0.011)**	**-0.05***** **(0.012)**	**-0.056***** **(0.012)**	**0.059***** **(0.015)**	**0.052***** **(0.016)**	**0.058***** **(0.015)**
Equity to Total Assets	**-0.163**** **(0.081)**	**-0.239***** **(0.082)**	**-0.316**** **(0.134)**	**0.833**** **(0.36)**	**0.838**** **(0.34)**	0.623 (0.397)
Net Loans to Total Assets	-0.062 (0.152)	-0.044 (0.106)	-0.01 (0.012)	**-0.794***** **(0.245)**	**-0.527*** **(0.289)**	-0.299 (0.511)
Constant	-0.268 (0.875)	0.741 (1.557)	**-0.935**** **(0.401)**	0.855 (2.155)	-3.381 (3.399)	**1.765*** **(0.982)**
Number of instruments	88	88	122	51	90	50
Sargan-test	$\chi_2(82) = 61.64$ [0.955]	$\chi_2(82) = 61.79$ [0.953]	$\chi_2(116) = 80.02$ [0.996]	$\chi_2(43) = 50.80$ [0.193]	$\chi_2(82) = 99.83$ [0.088]	$\chi_2(42) = 49.45$ [0.2]
Hansen Test	$\chi_2(82) = 88.29$ [0.298]	$\chi_2(82) = 84.98$ [0.389]	$\chi_2(116) = 91.13$ [0.957]	$\chi_2(43) = 45.55$ [0.366]	$\chi_2(82) = 49.73$ [0.998]	$\chi_2(42) = 44.45$ [0.369]
Arellano-Bond Test for AR1	-1.24 [0.217]	-1.23 [0.218]	-1.27 [0.203]	-2.79 [0.00]	-3.08 [0.002]	-3.22 [0.001]
Arellano-Bond Test for AR2	0.94 [0.349]	0.93 [0.353]	1.09 [0.274]	-0.84 [0.401]	-0.77 [0.441]	0.23 [0.815]
Observations	504	504	490	200	200	189

Note: This table reports coefficient estimates from the system-GMM models where in Models (1), (2), and (3) the dependent variable is the *NPL ratio*, while it is the *Z-score* in the case of Models (4), (5), and (6). The System GMM models were estimated by using three alternative measures of market power: the CR-3 calculated as the share of the banking industry total assets of the three largest banks within a country on a yearly basis; the *HHI* defined as the sum of the squared shares of bank assets to total banking industry assets within a given country in a year and the *Lerner index*. GDP growth rate is the rate of growth of Gross Domestic Product; Equity to total assets is the ratio of total equity as a share of total assets; Net Loans to Total Assets is the ratio of net loans to total assets. Since all variables, apart from GDP growth, are monetary values, or measure the size of something, I decided to use logarithmic transformation by converting them into natural logarithms. This approach allows interpretation of the effect of changes in the value of repressors by 1% to changes of the dependent variable in percentage terms. Robust standard errors are in parentheses. *, **, *** and indicate statistical significance at the 10%, 5%, and 1% levels, respectively. For the orthogonal deviations equation I have used the following instruments: financial stability, market power, and bank characteristics variables, while the instruments for the levels equation are year dummies. The Sargan Test has a null hypothesis of "the instruments as a group are exogenous". Therefore the higher the *p-value* of the Sargan Statistic the better it is. In robust estimation Stata reports the Hansen statistic with the same null hypothesis. The Arellano-Bond test for autocorrelation has a null hypothesis of no correlation and is applied to the differenced residuals. The test for AR(1) process in first differences usually rejects the null hypothesis. The test for AR(2) in first differences is more important because it will detect autocorrelation in levels. Year dummies are included in all specifications but not shown in this table due to space limitations.

Table 15 – Financial stability and degree of market power: the case of small SEE banking firms

Dependent Variable: *lnNPL ratio* or *lnZ-score*	*lnNPL ratio*			*lnZ-score*		
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Dep. Variable (-1)	**0.75*** **	**0.771*** **	**0.737*** **	**0.597** **	**0.426*** **	**0.373** **
	(0.05)	**(0.05)**	**(0.056)**	**(0.16)**	**(0.116)**	**(0.155)**
Dep. Variable (-2)	-	-	-	-0.265	-0.017	-0.063
				(0.178)	(0.138)	(0.123)
Dep. Variable (-3)	-	-	-	0.231	-	-
				(0.237)		
CR-3	-0.135	-	-	**-1.937** **	-	-
	(0.175)			**(0.863)**		
HHI	-	-0.091	-	-	-0.869	-
		(0.127)			(0.667)	
Lerner index	-	-	-0.020	-	-	0.145
			(0.028)			(0.213)
GDP growth	**-0.033*** **	**-0.032*** **	**-0.028*** **	-0.013	-0.009	-0.02
	(0.007)	**(0.007)**	**(0.009)**	(0.042)	(0.028)	(0.036)
Equity to Total Assets	-0.106	-0.111	-0.034	0.053	-0.008	0.158
	(0.07)	(0.078)	(0.068)	(0.601)	(0.388)	(0.347)
Net Loans to Total Assets	-0.113	-0.116	0.025	0.322	0.158	0.023
	(0.128)	(0.112)	(0.153)	(1.096)	(0.755)	(0.715)
Constant	-0.335	-0.166	**-0.725*** **	8.223	**6.631** **	**0.888** **
	(0.703)	(0.917)	**(0.253)**	(3.621)	**(4.320)**	**(0.814)**
Number of instruments	88	88	122	51	61	102
Sargan-test	$\chi_2(82) = 99.72$	$\chi_2(82) = 98.97$	$\chi_2(116) = 141.59$	$\chi_2(43) = 52.79$	$\chi_2(54) = 75.12$	$\chi_2(54) = 80.81$
	[0.089]	[0.098]	[0.053]	[0.146]	[0.03]	[0.011]
Hansen Test	$\chi_2(82) = 75.5$	$\chi_2(82) = 81.04$	$\chi_2(116) = 89.68$	$\chi_2(43) = 23.35$	$\chi_2(54) = 34.53$	$\chi_2(54) = 34.29$
	[0.68]	[0.509]	[0.967]	[0.994]	[0.982]	[0.983]
Arellano-Bond Test for AR1	-3.01	-3.02	-2.62	-2.29	-2.34	-1.88
	[0.003]	[0.003]	[0.009]	[0.022]	[0.019]	[0.06]
Arellano-Bond Test for AR2	-1.19	-1.25	1.28	-1.71	-1.89	-2.03
	[0..234]	[0.211]	[0.201]	[0.087]	[0.059]	[0.042]
Observations	391	391	290	73	115	102

Note: This table reports coefficient estimates from the system-GMM models where in Models (1), (2), and (3) the dependent variable is the *NPL ratio*, while it is the *Z-score* in the case of Models (4), (5), and (6). The System GMM models were estimated by using three alternative measures of market power: the CR-3 calculated as the share of the banking industry total assets of the three largest banks within a country on a yearly basis; the *HHI* defined as the sum of the squared shares of bank assets to total banking industry assets within a given country in a year and the *Lerner index*. GDP growth rate is the rate of growth of Gross Domestic Product; Equity to total assets is the ratio of total equity as a share of total assets; Net Loans to Total Assets is the ratio of net loans to total assets. Since all variables, apart from GDP growth, are monetary values, or measure the size of something, I decided to use logarithmic transformation by converting them into natural logarithms. This approach allows interpretation of the effect of changes in the value of repressors by 1% to changes of the dependent variable in percentage terms. Robust standard errors are in parentheses. *, **, *** and indicate statistical significance at the 10%, 5%, and 1% levels, respectively. For the orthogonal deviations equation I have used the following instruments: financial stability, market power, and bank characteristics variables, while the instruments for the levels equation are year dummies. The Sargan Test has a null hypothesis of "the instruments as a group are exogenous". Therefore the higher the *p-value* of the Sargan Statistic the better it is. In robust estimation Stata reports the Hansen statistic with the same null hypothesis. The Arellano-Bond test for autocorrelation has a null hypothesis of no correlation and is applied to the differenced residuals. The test for AR(1) process in first differences usually rejects the null hypothesis. The test for AR(2) in first differences is more important because it will detect autocorrelation in levels. Year dummies are included in all specifications but not shown in this table due to space limitations.

7. Conclusions

In this study I contributed to the empirical banking literature on market concentration, competition and financial stability by looking at the case of SEE banks. While the empirical literature has investigated the above three features predominantly in the context of advanced economies, the SEE banking industries have receieved far less attention. In exploring the aforementioned aspects, I used a variety of market concentration and competition measures (such as the *CR-3, HHI* and the *Lerner index),* as well as financial stability measures (such as *NPLs ratio* and the *Z-score*). In addition, I explored the effects of either market concentration or competition on the financial stability of SEE banking industries.

The findings of the present study show that SEE countries have been moving from highly concentrated to less concentrated banking markets. Particularly over the period 2003-2012, the evolution of a measure of concentration like the *CR-3* ratio shows a reduction in the degree of concentration in most of the SEE banking industries. Furthermore, another measure of concentration like the *HHI* illustrates a shift from very concentrated to moderately concentrated markets in most of the SEE banking industries. The entry of foreign-banks into the SEE banking markets, as well as political and economic reforms aiming at meeting conditions for EU membership, might have been the main drivers that contributed to lower the degree of concentration on the aforementioned markets over the period under study. By investigating the degree of competition through the Panzar-Rosse model I found that the banking industries of SEE countries operate mostly in a monopolistic competition. There is no consensus in the theoretical and empirical banking literature about the optimal competitive structure of banking industries. By implementing policies that restricted competition, these results indicate that policy makers in SEE might have preferred to facilitate some degree of market power in order to maintain the stability of their domestic banking industries.

By focusing on the financial stability of SEE banking industries, the results of this study show that domestic-owned SEE banks have on average higher *NPLs ratio* compared to foreign-owned SEE banks. Furthermore, I found that the average rate of the *NPLs* of small banks tend to be higher than in large SEE banks. However, I also found that these differences narrowed over time, with domestic-owned and small banks experiencing a reduction of the *NPLs ratio* up to 2008. In the following period, however, the SEE banks experienced an increase in *NPLs ratio* regardless of ownership or size. Similar results are found when using the *Z-score* as a measure of banks' insolvency. Interestingly, from 2010 *Z-score* values show a higher risk of insolvency for foreign-owned and large banks compared with domestic-owned and small banks.

When I looked at the impact of concentration and competition on financial stability, I found mixed results. When the *HHI* was used on all SEE banks, irrespective to their ownership or size, I found a negative and statistically significant effect on *NPLs ratios*. Therefore, an increase in market concentration results in lower *NPL ratios* which leads to greater financial stability of SEE banks. This result lends support to the *concentration-stability* hypothesis, suggesting that industry concentration leads to higher financial stability. Using the *Lerner index* as a measure of market power, I found that the effect of this indicator on *NPL ratios* was positive and statistically significant; that is, an increase in banks' market power increases their *NPLs ratios*. While these results may seem contradictory, they may be reconciled by the fact that while the *HHI* is an industry-level measure of the size distribution of firms, the *Lerner index* is a firm-level measure of a bank's ability to determine the price it charges. Hence, these two indicators in fact measure two different things.

Policy implications of the present study can be summarised as follows: firstly, reforms implemented by SEE governments had the result of reducing the degree of concentration in SEE banking markets as well as bringing down non-performing loans and insolvency risks for SEE banks. In addition, monopolistic competition seems to be widely accepted and aimed at by SEE policy-makers. Furthermore, external shocks such as the 2007-2009 global financial crisis clearly shows that SEE banks are not immune to these events and that larger and foreign-owned banks seem to be particularly vulnerable. This leads to the conclusion that SEE policy-makers should strengthen the resilience of SEE banks, or specific typologies of banks in relation to their size or ownership, to these unexpected shocks by further increasing their capitalisation. Secondly, the effect of either concentration or competition on the financial stability of SEE banks should consider either banks' size or ownership. Neglecting the latter aspects might lead not only to conclusions that do not reflect the complexity of SEE banking industries but ultimately to decisions that might damage the financial stability of the entire banking system. Therefore, breaking down the analysis by considering particular aspects of banking firms under analysis, such as large versus small banks and foreign versus domestic ownership, could reveal substantial differences about the effects of banking concentration or competition on banks' financial stability. Finally, the results of this study could inform policy makers about the effects of liberalisation, competition and deregulation policies on concentration, the degree of competition and the financial stability of banking firms.

Appendix A

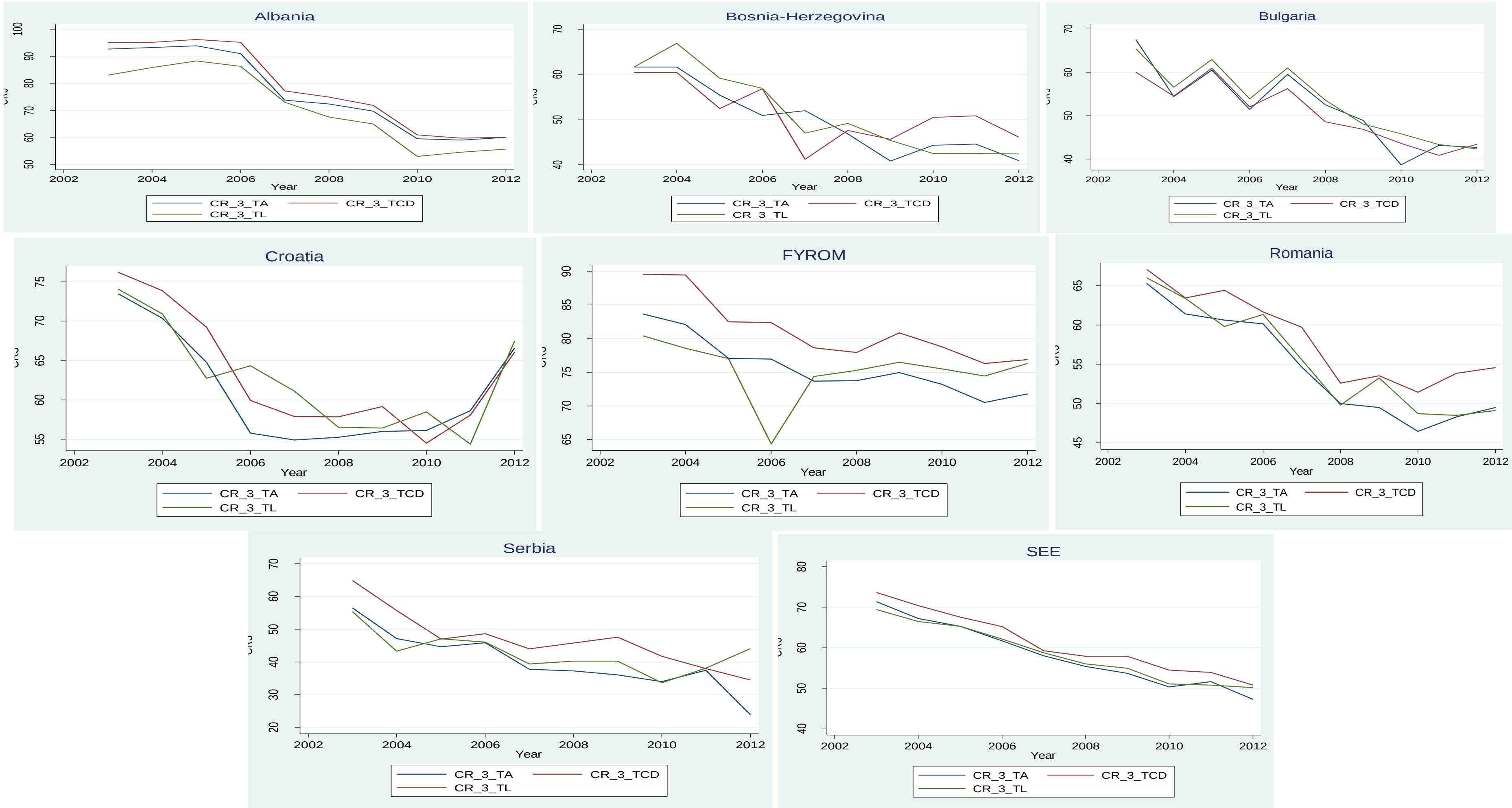

Figure A1 – 3-bank concentration ratio (*CR-3*). This figure illustrates the evolution of the *CR-3* for each of the SEE banking industries as well as the overall SEE region. The evolution is reported by considering the total assets market, the total customer deposits market, and the total loans market. CR_3_TA stands for *CR-3* in the total assets market, CR3_3_TCD stands for *CR-3* in the total customer deposits market, and CR_3_TL stands for *CR-3* in the total loans market.

Appendix B

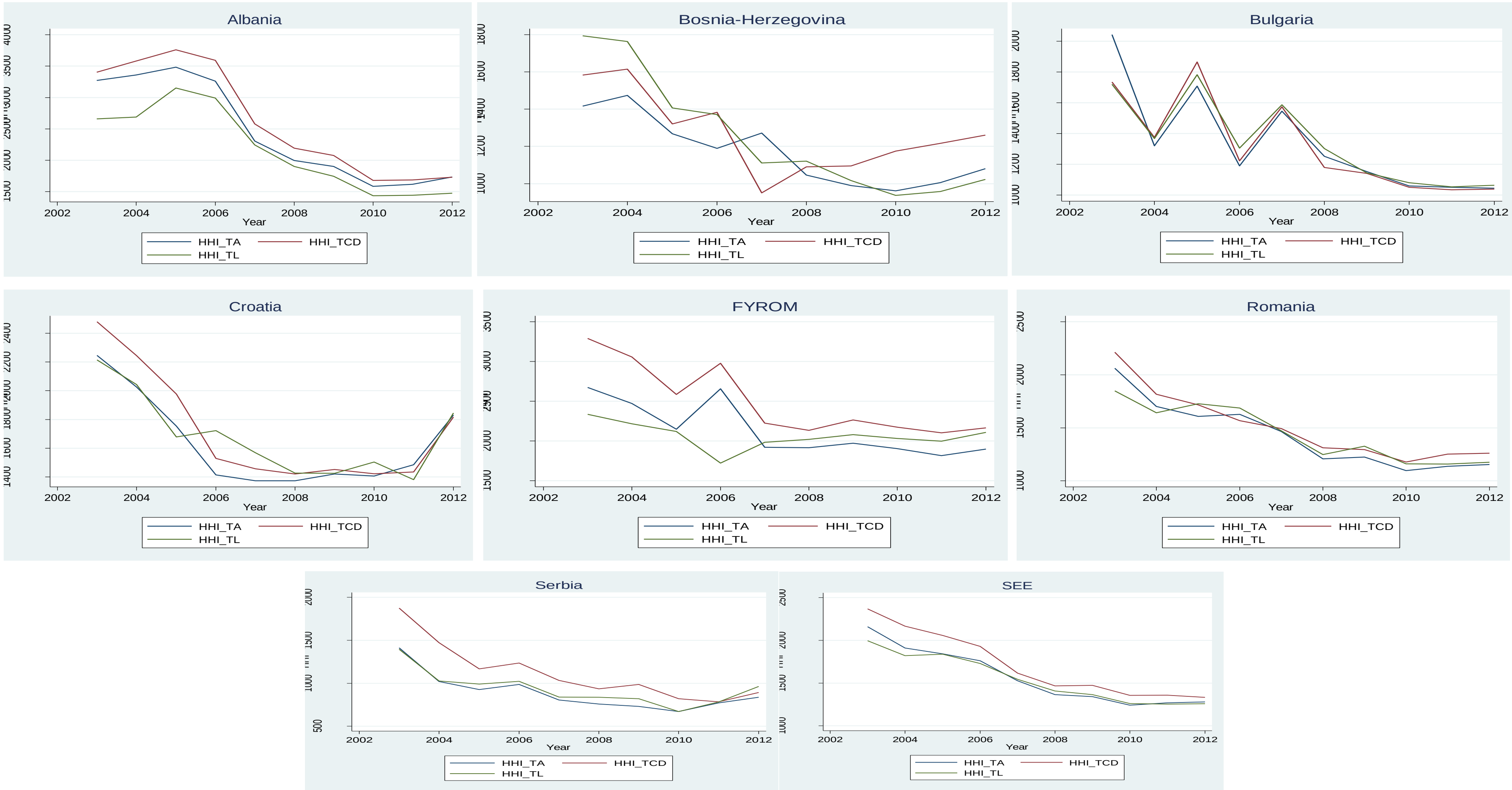

Figure B1 – Herfindahl-Hirschman Index (*HHI*). This figure illustrates the evolution of the *HHI* for each of the SEE banking industries as well as the overall SEE region. The evolution is reported by considering the total assets market, the total customer deposits market, and the total loans market. HHI_TA stands for *HHI* in the total assets market, HHI_TCD stands for *HHI* in the total customer deposits market, and HHI_TL stands for *HHI* in the total loans market.

Appendix C

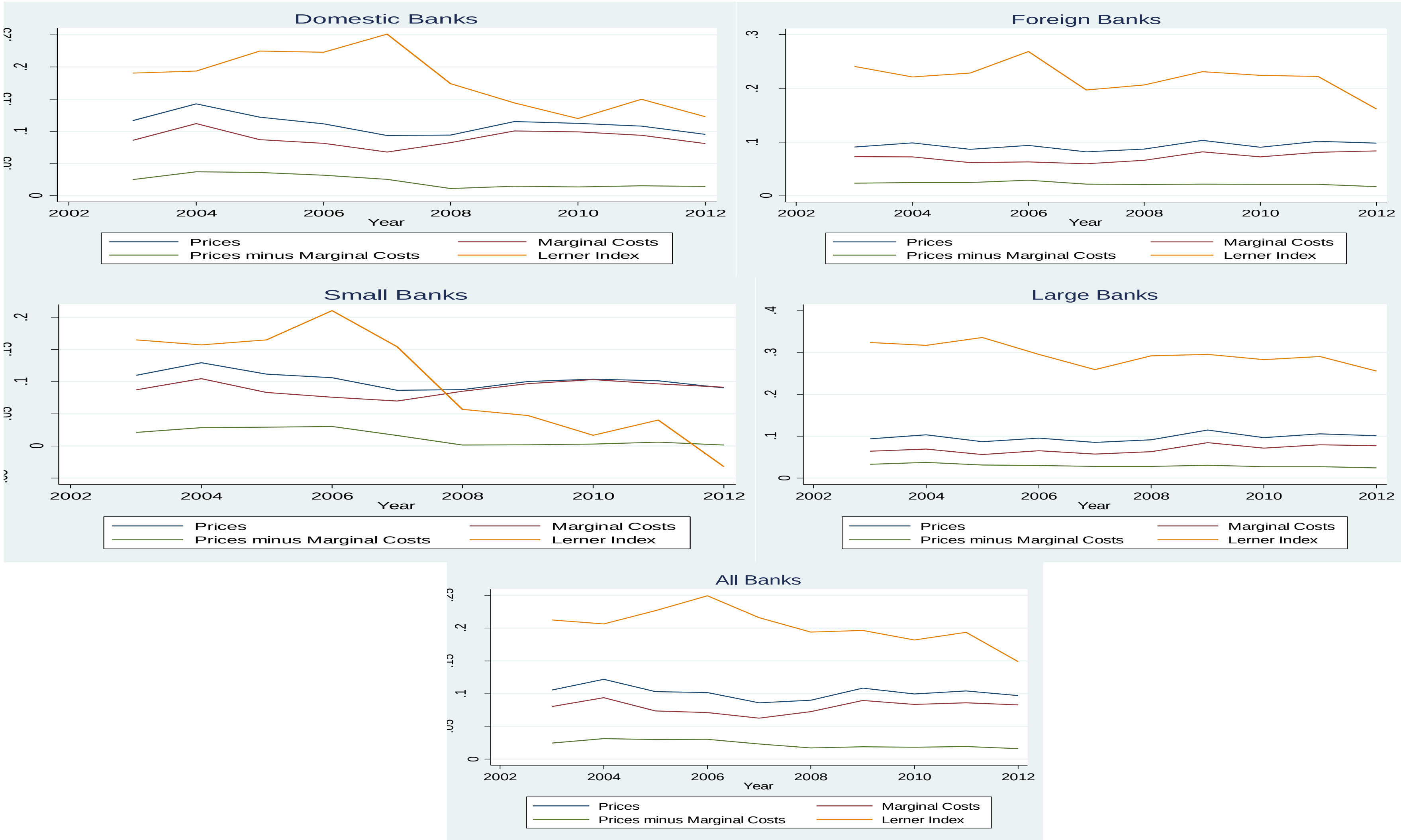

Figure C1 – This figure reports the evolution of price, marginal costs and *Lerner index* values by considering the overall SEE industry. The term 'All banks' indicates SEE banks owned by either domestic or foreign entities, while the terms 'Domestic banks' and 'Foreign banks' indicate SEE banks owned by either domestic or foreign entities, respectively. The term 'Small banks' indicates SEE banks with total assets less than or equal to the average asset size, while the the term 'Large banks' indicates SEE banks with an amount of total assets higher than the average asset size.

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