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# Bank Competition in a Transition Economy: The Case of North Macedonia

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# Abstract

In this thesis, I study the relationship between bank concentration, market power, and competition in the banking system of North Macedonia. I calculate the concentration measures CR5 and HHI, as well as a market power measure, the Lerner Index, for the period 2012-2022. The Lerner Index is calculated for each bank and for the banking sector as a weighted average, using a trans logarithmic cost function, structured as a panel fixed effect model. In general, results indicate that banking concentration declines until 2019 and increases in the last three years. The Lerner Index increases over the analyzed period, due to declining marginal costs. This indicates a rise in market power and decreased banking competition. The Lerner Index shows monopolistic competition in the Macedonian banking sector. Findings show that the Lerner Index provides a more direct measure of changes in market power and competition, compared to traditional concentration measures.

# Contents

# 1. Introduction

This paper explores bank competition in North Macedonia, analyzing the impact of bank concentration and market power on it. Banking competition has a significant role in economic thinking. The subject is extensively explored in empirical literature, due to the crucial role banks play for growth as financial intermediaries transferring savings into productive investments (King & Levine, 1993). The paper will explore the evolution of the competition of the banking sector in North Macedonia, based on individual data for each bank, for the period 2012-2022. The relationship of concentration and market power with competition will be analyzed by calculating structural and non-structural measurements.

According to traditional industrial organization model (IO), competitive bank sector allocates most credit to the economy at the lowest price. Adversely, lower competition enables banks to limit supply of credit and charge higher rates (Freixas & Rochet, 2008). However, these effects could be offset by efficiency gains based on economies of scale if they exist. Empirical testing using traditional measures Concentration ratio (CR) and Herfindahl–Hirschman Index (HHI), shows that competitive behavior may be associated with both less concentrated markets (Berger & Hannan, 1989) and more concentrated markets (Allen & Gale, 2001). Overall, there is a broad agreement that concentration alone does not directly measure competitive behavior of banks (Claessens et al., 2010), and is rather considered as its determinant (Bikker & Haaf, 2002). The new empirical industrial organization (NEIO) paradigm argues that competitive outcomes can develop in concentrated markets, and collusion can happen in less concentrated markets (Baumol et al., 1983). The Lerner Index (A. P. Lerner, 1934) is the most widely used measurement of market power and predictor of competition over time. Empirical results of Valverde & Fernández (2007) show that declining Lerner Index is compatible with increased market power. The Lerner Index provides a better measure for market power and competition, compared to traditional concentration ratios. Still, the extent to which the index can predict competition depends on the measures used to assess competitive behavior: regulatory entry/exit of new banks, presence of foreign banks, degree of restrictions on bank activities, use of new technology etc.

These relationships are even more complicated in transition economies. In North Macedonia, easy entry at the 1990s resulted in substantial number of banks. However, the sector remained concentrated compared to CEEC average (Giustiniani & Ross, 2008). After 2005, the situation started to change with the entry of new foreign banks, mergers, acquisitions and exits, and tightening of the regulatory standards. Ivanovska (2020) finds moderately high concentration, with declining tendency after 2009. The Panzar-Rosse test points to high scale inefficiencies and monopolistic market structure (Giustiniani & Ross, 2008). The single paper exploring Lerner Index (NBRM, 2014) indicates an increase in competition until 2012 and a slight decline after that.

With this background, the paper will include calculation of CR5 and HHI, with focus on the Lerner Index. The research builds on previous studies (NBRM, 2014; Ivanovska, 2020) by expanding the timeframe over recent period. The outcome provides insight on the evolution of bank competition and its relationship with concentration and market power. The results are useful for central bankers and the academic community exploring bank competition in transition economies. As such, this paper is a timely effort to answer the research question: What Lerner Index tells us about the relationship between concentration, market power and competition in North Macedonia and what is the current level of bank competition?

To answer the research question, I will calculate the Lerner Index as explained in Angelini & Cetorelli (2003), to determine the cost function and estimate the supply equation to obtain the mark-ups. I will use a data series for all banks, adjusted for size, annually for 2012 - 2022. The period chosen includes a variety of economic cycles and bold structural changes. The data used for the calculations is derived from the NBRM Annual Reports (Reports on the risks in the banking system, Financial Stability Reports) and firm-level audited balance-sheet data from banks web sites.

I expect CR5 and HHI to show increasing concentration ratios, reflecting bank consolidation and regulatory tightening in the analyzed period. In line with previous research, I expect to find an inconsistent relationship between concentration and competition. I expect Lerner Index to provide better prediction of the outcome, i.e., the degree of bank competition. However, the assessment of the degree of bank competition based solely on the Lerner Index, is a challenging task, as it depends on the selection and weight given to specific factors for assessing banks' competitive

behavior. Based on the empirical results for Croatia (Kraft & Huljak, 2018), my expectation is to find negative relationship between market power and competition. Looking at the composition of the Index, I expect a decline in bank prices, accompanied by an even bigger decrease in marginal costs.

The remainder of this paper is structured as follows. Section 2 discusses relevant theoretical literature and previous research. Section 3 focuses on describing the data, while Section 4 discusses the research methodology. Section 5 outlines the results of the research. Section 6 contains a discussion of the research outcomes and finally, Section 7 discusses concluding remarks.

# 2. Theoretical Background

## 2.1 Banking Competition

The concept of competition is central to economic thinking. Its origin lies in the classic work, The Wealth of Nations 1776 (Smith, 2008), which emphasizes that free competition is an ordering force towards equilibrium, leading to prices being equal to the costs of production in the long run. Smith considers competition not as a static state, but more as a race towards bigger market share. Subsequently, two major concepts developed (McNulty, 1967): i) Competition as a static state (Cournot & Bacon, 1929) which relates competition to the outcome of the race. Harrod & Chamberlin (1933) attempt to adapt perfect competition to reality, by proposing so called "workable competition", or monopolistic competition. It is a situation where most of the firms have differentiated products that are not perfect substitutes, take other prices as given and ignore the impact of their own prices on other firms 'products. The oligopoly theory makes a distinction between three states of competition: perfect competition, imperfect competition, and monopoly. Its neoclassical concept laid the foundation for developing both structural and non-structural measures of competition; and ii) Austrian school of thought - von Mises, Schumpeter and Hayek define competition as a "complex process of rivalry between firms". They criticize neoclassicists for treating competition as a state, rather than as a process. As such, firms are continuously improving their products to cope with competition. The selection mechanism brought by the

competition removes less efficient firms and enables the entry of new firms. Firms that undertake risk and innovate get temporary profit based on static monopoly power.

Banking systems are fundamental to growth, due to the crucial role banks play as financial intermediators, by channeling savings into productive investments. King and Levine (1993) analysis of data for 80 countries for the period 1960-1989, confirms that various financial indicators (credit to GDP, size of banking sector to GDP) are strongly correlated with growth, physical capital accumulation and efficient capital allocation. Their findings are consistent with Giovannini & De Melo (1991) and Chamley & Honohan (1993) who provide evidence that financial system promotes growth by increasing the rate of capital accumulation and improving the efficiency of its use. In this context, banking sector competition matters both from microeconomic and macroeconomic perspective: it affects quality and pricing of bank products, stability of the banking sector and other sectors in the economy, and productive and allocative efficiency of the services. Theoretical and empirical work on the link between bank competition and stability brings two contrasting views. The traditional "competition-fragility" view maintains that lower competition is needed to ensure stability in the banking sector. It is driven by the seminal work of Keeley (1990) who studied the role of deposit-insurance scheme on the pooled data of 85 large U.S. banks in the period 1970-1986. He confirmed the hypothesis that increased competition in the U.S. in the 1980s erodes banks charter value, with deposit insurance scheme encouraging more risky behavior. This is consistent with Hellmann et al. (2000), who argue that in a less competitive environment, banks have higher profit margins and have no need to engage in risky activities. However, there is a "competition-stability" view (Boyd & De Nicoló, 2005) which rejects the tradeoff between competition and stability. Moreover, it claims that instability is higher when there is less competition: banks tend to engage in more risky activities to benefit from increased lending rates, while borrowers tend to invest in more risky investments to cover increased borrowing costs, both increasing the risk of defaults.

Empirical literature does not offer consensus on the link between bank competition and stability. Research on Spanish banks by Jiménez et al. (2013), confirmed the paradigm that franchise value is key to limit bank risk, or alternatively that reduced competition as underlying source of the franchise value, results in more stability. Similarly, Beck et al. (2006), analyzing a sample of 69 countries for the period 1980-1997, shows that banking crises occurrence is lower in less

competitive environment. This contrasts with Schaeck et al. (2009) findings in 45 countries that more competitive systems are less prone to bank crises. Along the same lines, Liu et al. (2012), conclude that competition does not increase risk-taking in the case of South Asian banks, using data for banking sectors of four countries for 1998 -2008.

Bank competition is also related to allocative and productive efficiency. According to the traditional IO model, competitive bank sector allocates most credit to the economy at the lowest possible price. If there is lower competition, banks can limit credit supply and charge higher rates (Freixas & Rochet, 2008). Bank competition also relates to productive (cost) efficiency, which implies outputs are produced at the lowest cost. In traditional IO framework, there is a negative relationship between competition and cost efficiency. However, it could be offset by efficiency gains based on economies of scale if they exist. Overall, a more competitive environment is conducive to efficiency gains. It is unclear, though, whether the existing inefficiencies are the result of the lack of competition or unrealized scale efficiency.

## 2.2 Banking Concentration and Competition

Market concentration, in the context of economics, is defined as "the amalgamation of firms, factories, producers, etc., in a particular market or industry; the extent to which a market or industry is dominated by a limited number of firms" (*OED* Online, 2022). Similarly, scientific literature defines industry concentration, as "the extent to which the market shares of the largest firms within a market (industry) account for a large proportion of economic activity such as sales, assets, or employment" (Kvålseth, 2018).

Bank concentration is often analyzed in context of its relationship with banking sector stability. There are conflicting theoretical arguments and country studies on the impact of bank concentration on banking system fragility. The "concentration-stability" view (Allen & Gale, 2003) asserts that large banks have better diversification potential, and systems with few large banks are more stable, compared to systems with many small banks. Furthermore, concentrated systems enable economies of scale and higher profits for large banks. These profits increase the franchise value and serve as a buffer against fragility, as banks have less incentive to engage in risky activities (Hellmann et al., 2000). Opposing "concentration-fragility" view claims that

systems with few large banks result in moral hazard, due to “too big to fail” situation. The existence of deposit insurance schemes and other state subsidies encourages more risky behavior by large banks, increasing the fragility of the system (Mishkin, 1999). Another channel of fragility is the greater complexity of large banks and challenges to monitor it. Finally, more concentration provides an opportunity for some banks to charge higher interest rates, which translates into more risky investments taken by the borrowers. Ultimately, this results in a positive relationship between bank concentration and fragility.

Despite the challenging theoretical background, empirical evidence on the link between concentration and bank system fragility/stability is not abundant. Most of the cross-country studies on bank fragility, reflect the relationship with other factors, such as macroeconomic, financial liberalization, deposit insurance scheme etc. Beck et al. (2006), is studying the impact of bank concentration on potential for crises in a sample of 70 countries in the period 1980-1997, while controlling for differences in regulatory regimes for entry of new banks, property rights and deposit insurance schemes protection, bank ownership structure and macroeconomic and financial conditions. Their findings are that crises are less likely in countries with more concentrated banking systems. This is in line with (Allen & Gale, 2003) “concentration-stability” view, and in particular its aspect that more concentrated systems enable better monitoring and greater diversification of activities, which in turn reduces fragility.

The relationship between concentration and competition is a complex one. According to Angelini and Cetorelli (2000), the literature on bank competition is broadly divided into two major streams: structural and non-structural. The former includes early studies that followed the “structure-conduct-performance paradigm” (SCP), and “efficient structure hypothesis” (ESH), both of which use concentration measures to explain market behavior. The non-structural stream includes the “New Empirical Industrial Organization” approach (NEIO), whose basic premise is that firms behave differently in relation to the market structure in which they operate.

The traditional SCP-based relationship associates more firms (less concentration) with price-competitive behavior, and vice versa. It was formally introduced in the 1930s by Mason but got popularized with seminal work "Industrial Organization: A Treatise” (Bain, 1959), which serves as a reference point for future research on the relationship between market concentration, company

behavior, and market performance. It claims that market structure (concentration, entry and exit policies) determines firm conduct (pricing policies, collusion), which affects performance (profitability). The theory predicts that a higher number of firms (less concentration) enforces more competition in pricing, resulting in lower prices and reduced profits (less market power). More specifically, a higher concentration leads to collusive behavior of banks that reduces market competition and improves market performance. As concentration ratios provide information on the market structure, they are used to assess potential competition. The two most often used measures are Concentration Ratio (CR) and Herfindahl-Hirschman Index (HHI).

The competitive approach embodied around the Structural efficiency hypothesis (ESH), also predicts a positive relationship between concentration and prices (Demsetz, 1973). However, in contrast to SCP, ESH provides efficiency explanation for the positive relationship between concentration and profits. The X-efficiency version of ESH maintains that banks with higher managerial efficiency and better technology have higher profits, resulting in market gains and higher concentration. Scale-efficiency version of ESH adds to management and technology one more factor: economies of scale that result in lower costs and higher profits per unit. Positive structure-profit relationship in both ESH variants is not a direct result, but rather a spurious outcome (Lambson, 1987). In this case the market structure is endogenous, with higher concentration resulting in efficiency gains.

Early empirical studies reinforced the SCP view that market and bank performance depend on exogenously given market structure. Berger & Hannan (1989) study includes data on 470 banks in 195 local markets in the USA. Their findings are that banks in the most concentrated markets pay deposit rates that are lower by 25-100 basis points than those in markets with the least bank concentration. This is consistent with SCP approach that banks in markets with high concentration levels, exhibit higher profit margins, charge higher rates on loans, and pay lower rates to deposits. However, later studies find inconclusive results. Berger (1995) tests SCP and ESH hypotheses by regressing profits against concentration indicators, X-efficiency, and scale efficiency. He uses extensive sample of thirty data sets with 1.300 - 2.000 observations each, for ten years and three different competitive environments in the U.S.A. Contrary to both SCP and ESH, the study finds higher concentration linked to lower profits. The study also finds efficiency to be related to profit, but the relationship between concentration and efficiency is weak. They claim that banking

concentration measured in traditional SPC framework is not an appropriate measure of market power. Authors argue that HHI presents only potential market power and needs to be augmented by behavioral factors to provide information on how competitive/collusive the environment is. Overall, there is prevailing view that both from theoretical and empirical perspective SCP concentration measures (CR and HHI) cannot be used as indicators of market competition.

## 2.3 Bank Market Power and Competition

Market power defined as the "ability to affect the price or quality of goods or services by dominating the market in either supply or demand", plays a crucial role in determining industry competition (OED Online, 2022). In this context, bank market power represents the degree of market control in the banking industry and the potential impact on market outcomes, such as prices, interest rates, etc. Lerner (1934) defines market power as the monopoly manufacturers 'ability to raise prices beyond the marginal cost. Although market concentration and market power are related concepts reflecting competition, they have distinct meaning in the context of this paper.

In criticism to SCP, NEIO paradigm (Bresnahan, 1989 ; Panzar & Rosse, 1987), argues that competitive outcomes can develop in concentrated markets, and collusion can happen in less concentrated markets. The major advantage of the NEIO approach compared to the SCP is that it focuses on the behavior of firms in response to changes of market conditions. As such, it rejects to accept a priori that a concentrated market is not competitive, because market contestability depends not only on market structure, but on other factors as well (e.g., credible possibility of entry and exit of banks). In this direction, Claessens & Leaven (2004) advocate that other factors in addition to market structure and concentration, affect bank competition: e.g., regulation barriers for entry/exit, presence of foreign banks, new technology etc. Hence, new non-structural indicators to measure competition are developed, such as the Panzar Rosse (PR) H-Statistic and Lerner Index (representing static model of competition and oligopoly theory), and Boone Indicator (representing more dynamic model of competition).

There is an abundant empirical literature using non-structural indicators in assessing banking system competition. The Panzar  Rosse (PR) test uses industry data for analysis of three market structures: perfect competition, monopolistic competition, and monopoly. Claessens & Leaven

(2004) calculate the PR H-statistics for 50 countries during the period of 1994 to 2001, showing that most bank industries display monopolistic competition. However, contrary to conventional view, they find no negative correlation between concentration and competition. The evidence of monopolistic competition is also found by Bikker & Haaf (2002), who analyze 23 industrialized countries over the period of 10 years; Mamatzakis et al. (2005) for Central and Eastern Europe for both interest income and total operating income, for a period 1998-2002; and De Bandt & Davis (2000) for large German and French banks, while small banks operate under monopoly power. However, contrary to Claessens & Leaven (2004), the latter research finds support for the conventional view that concentration hampers competition.

The Lerner Index is the most used measure of market power capturing the mark-ups that banks charge to their customers. The advantage over the PR H-statistics is that it can be measured at the bank level and over time. Moreover, it does not require clear definition of the geographical market of the bank, in contrast to market concentration measures (Berger et al., 2004). However, there are also two potential issues with the Lerner Index: i/ it assumes bank efficiency and does not consider that efficient banks may decide not to use pricing opportunities arising from their market power; and ii/ calculating marginal costs implies some form of market power on the deposit side, when raising funds, which may bias the findings (Maudos & De Guevara, 2007).

Various empirical studies explore market power and competition at country level, using Lerner index. Angelini and Cetorelli (2003) analyze Italian banking competition over 1984-1997. They find unchanged competition before 1992, and improved competition after the implementation of the EU Second Banking Directive in 1993. They also find that bank consolidation did not lead to worsening competition, but rather to improved efficiency. Maudos and De Guevara (2007) study bank competition in 15 EU-countries in the period 1993-2000. Using the Lerner index, they find increased competition by 10% on average in ten out of fifteen countries. Weill (2013) investigates whether EU integration has improved bank competition in the period 2002-2010, using H-statistics and Lerner index. The results do not provide evidence of significant improvement in the competition. To the contrary, a slight increase in the Lerner Index is evidenced in the period before the 2008 crisis, which came to a halt during the crisis years. In addition, the study finds reduced disparity in competition levels among EU countries, as biggest improvements in competition were found in the economies with lowest competition. Karadima and Louri (2020) examine the

evolution of bank competition in Euro area countries divided into three groups: core, periphery and total 19 countries, for the period 2005-2017, on a sample of 1.442 banks. They find that market power decreased until 2008, and started increasing after the financial crisis, reaching its peak in 2015, when competition was at lowest level.

Many empirical studies exploring correlation between competition measures, find weak or no correlation. Bolt and Humphrey (2015), find no correlation between HHI, H-statistics and Lerner Index on a sample of 2.655 large U.S. commercial banks over 2008-2010. This is in line with Bikker & Haaf (2002) who explore market power and competition in 23 developed countries in Europe and find negative, but weak correlation between market power and competitiveness. Similarly, Claessens & Leaven (2004) observe a weak relationship between structural and non-structural indicators of bank competition. Using panel-data for 50 countries, they find imperfect competition present in all countries. Furthermore, they find market contestability to be positively related to concentration and negatively to the number of banks. Valverde and Fernández (2007) provide a comprehensive overview on the use of five competition indicators (net interest margin, Lerner index, returns on assets, H-statistic, and HHI), in a cross-section study of 14 European countries with panel of 1.912 banks, over 1995-2001. The indicators show weak positive association, suggesting it is difficult to assess with confidence the degree of competition in the banking sector in Europe. Contrary to previous studies, Delis (2012) finds a high correlation between the Lerner Index and the Boone indicator for the banking industries of 84 countries worldwide. A possible explanation for the dichotomy in these studies is: i/ markups may decrease for traditional bank products, but overall return on assets may still increase due to higher off-balance revenues (fees); ii/ expansion of new technology. This may reduce operational costs faster than net interest margin, meaning higher Lerner Index cannot be interpreted as worsening of competition. Therefore, the use of different competitive measures impacts the interpretation of results and the assessment of competitive behavior of banks.

Theoretical premises and empirical findings indicate that compared to SCP measures, Lerner index is more direct measure of bank competition. It captures real rather than potential competition measured by HHI (Bolt & Humphrey, 2015). This is because in addition to market structure, it includes behavioral changes in conduct and performance as a response to market structure changes. Still, the extent to which the Lerner index can predict competition depends on the measures used

to assess competitive behavior. Therefore, factors such as regulatory entry/exit of new banks, presence of foreign banks, degree of restrictions on bank activities, use of new technology etc. are important for better assessment of contestability and competitive behavior of banks.

## 2.4 Competition, Concentration, and Power: The Case of Macedonia

The complex relationships between bank concentration, competition, and power are even more complicated in transition economies. Similarly, to other transition countries, banking sector in North Macedonia went through substantial structural changes in the past three decades. The financial deregulation in the 1990s with low capital requirement resulted in the entry of many banks (24 in 1998). However, due to the market's small size and political instability in the region, entry of reputable foreign banks was limited to two regionally important banks. In addition, some small domestic banks were undercapitalized and mainly served their owners and shareholders. So, despite many banks, concentration remained high, and the degree of competition remained low.

Empirical work of Giustiniani & Ross (2008) shows that CR5 Index for the period 2001-2005, calculated for total bank assets, ranges between 72,1-76,3. This level is higher than the average of 67,2-70,4 for Central and Eastern Europe, and much higher than the EU average of 37,8-40,2. Similarly, HHI varies between 1,667-1,756, compared to CEEC 1,491-1,673, and EU 505-569. The Panzar-Rosse test points to high scale inefficiencies and monopolistic market structure. In addition, other indicators of competition, such as level of interest spreads, range of new products and services, and adoption of new technology, also indicate to low competition. Weak institutional and legislative framework and inconsistent reform implementation contributed to the weaknesses of the banking sector. Thus, EBRD (2005) scorecard for financial sector reforms, indicates that North Macedonia was below average among transition economies, ranking particularly low in the areas of insolvency and secured transactions law. These deficiencies caused high levels of non-performing loans (17% at the end of 2004), high interest spreads and low profitability in the banking sector. Overall, high bank concentration was associated with low competition and relatively poor performance.

After the financial and Euro debt crisis, bold legislative reforms were introduced, including increased capital requirements and more stringent macro prudential measures. By the end of 2014,

the number of banks was reduced to 15, with further consolidation to 12 by the end of 2022. The analysis of Ivanovska (2020) measuring CR5 and HHI for the period 2004-2017, shows diverging trends: an increase of concentration until 2010, and a declining trend after that, with "concentration at moderate and acceptable level at the end of 2017". However, there is no clear indication how and to what extent these changes in concentration levels affect competition in the market. It is unclear whether the concern about possible negative impact of decreased number of banks on competition, is offset by improved productivity and efficiency gains from transfer of know-how and technology, new products and adoption of best international practices brought by foreign banks.

The NBRM FSR (2014) measuring Lerner Index, suggests that competition increased between 2007 and 2012, with rising marginal costs and relatively stable prices of bank products (declining mark-ups). However, the trends during the GFC should be taken with caution, as cyclical factors had major impact on bank activities and behavior. Namely, large banks were conservative and kept their prices broadly unchanged/reduced, while some smaller banks tried to gain market share by offering new products. The situation remained unchanged during the Euro debt crisis in 2011, with banks reducing their mark-ups to retain the market share. However, after 2012 the fear of transforming real sector crises into banking crisis, led to reduced marginal costs with slightly increased prices of bank products, suggesting slight negative trend in competition. After 2014, there are no available studies on the Lerner Index in North Macedonia.

Based on dynamic structural changes in the Macedonian banking sector in the last decade, I expect traditional measures CR5 and HHI to show increasing concentration. However, in line with theoretical and empirical literature, I expect these measures not to be sufficient to establish a clear, conclusive assessment of the degree of competition, as they are purely relying on market structure. In environment with bold regulatory and structural changes, such as in North Macedonia, the inability of HHI and CR5 to capture behavior changes is even reinforced. Lerner Index will provide much better prediction of the outcome, i.e., the real market power and degree of bank competition, as it incorporates changes in bank behavior. In line with Claessens & Leaven (2004) and similarly to many European countries, I expect the value of the index to reflect a state of monopolistic competition, with negative relationship between market power and competition, However, assessing banking sector competition in transition economy remains a challenge, as it requires

better understanding of the specific role of factors beyond market structure, such as regulatory environment, new technology, product differentiation, etc.

# 3. Data

## 3.1 Sample Description

I collected annual panel data on all banks[1], 12 as of 2023, in the Republic of North Macedonia over the period 2012 to 2022. I will analyze aggregate data for the banking sector and for each bank to avoid sample non-representativeness. The eleven-year sample period allows for a sufficiently long-time frame to observe the dynamics of the banking industry by including different periods of the economic cycle - economic upturn (2014-2019) and economic downturns (2012-2013, 2020-2022). It maximizes robustness and reliability by offering a sizable amount of data points to capture the different patterns and variations over time, while at the same time ensuring feasibility of the dataset. Additionally, the data has annual frequency because of data availability and aggregation.

It is essential to highlight the structural changes that occurred within the banking sector during the period of research considered. Initially, there were 15 banks in operation as of 2012. However, in 2016, Silk Road Capital Bank acquired Alpha Bank AD Skopje. Additionally, in November 2019, Ohridska Banka AD Skopje, subsidiary of the French-based Societe Generale Group, merged with Sparkasse Bank AD Skopje, a subsidiary of Austrian Steiermärkische Sparkasse, one of the largest financial institutions in South Europe. Finally, in August 2020, Eurostandard Bank declared bankruptcy due to non-fulfillment of minimum legal requirements for operations. This resulted in a consolidation of the total number of commercial banks to 12. It is important to note that data for Eurostandard Bank for the year 2019 is not available as their annual report was not audited and released. These structural changes resulted in an unbalanced panel data set.

[1] The Development Bank of the Republic of North Macedonia was excluded because it is a state-owned bank created to support companies for their export activities.

The data used for calculating the CR5 Index was derived from the "Data and Indicators for the Banking System of the Republic of North Macedonia" dataset[2], retrieved from the website of the National Bank of the Republic of North Macedonia (NBRM). Also, the values of the HHI per annum were derived from the Audited Annual Reports from the official website of each bank and the NBRM "Report on the Risks in the Banking System of the Republic of North Macedonia". Lastly, the data needed to calculate the Lerner Index was directly obtained from the Audited Annual Reports from the official website of each bank individually.

## 3.2 Variables

### 3.2.1 Variables measuring market concentration:

The CR5 and HHI are calculated based on 5 categories: total assets, loans to households, loans to non-financial companies, deposits from households, and deposits from non-financial companies.

**The CR5 Index** is calculated as the sum of the market shares of the largest 5 banks in the market for a t=11 years (2012-2022) for various categories. There are in total 55 (11 data points per 5 categories) observations of the CR5 Index. All data used for calculating the CR5 is expressed in millions of Macedonian Denars. The market share of each bank for a certain category is calculated by dividing the total amount of the bank for the specific category with the total amount for the same analyzed category for the whole banking sector, expressed in percentages. Subsequently, we can calculate the CR5 Index using the following equation:

$$CR5 = \sum_{i=1}^{k=5} (S_i)$$

(1)

[2] NBRM calculations are based on the data provided from the audited annual reports for each bank.

where *S* is the market share of each bank *i* for the specific category analyzed, and *k* is the range of 5 leading banks in the market. Higher values of the index indicate a higher level of concentration of market share among the largest 5 banks, enabling a significant presence and influence on the market. Conversely, a lower value signals a less concentrated, fragmented market.

**The Herfindahl-Hirschman Index (HHI)** is widely considered as a standard measure of concentration in the academic literature, often used as a reference for evaluating other concentration indices. It is a comprehensive index as it captures the distribution of market shares of each bank size in the industry. The Index is calculated as the sum of the squared market shares of all banks in the industry (Bikker & Haaf, 2002) for a t=11 years (2012-2022) for different categories. There are in total 55 (11 data points per 5 categories) observations. All data used for calculating the HHI is expressed in millions of Macedonian Denars. The equation used for the calculation:

$$HHI = \sum_{i=1}^{n} (S_i)^2$$

(2)

where *S* is the market share of each bank *i* for the category analyzed and *n* is the total number of banks in the system. The value of the HHI I ranges from 100 to 2,500 index points. A higher value of the HHI stipulates a higher level of concentration in the market, meaning that a larger share of the market is held by a small number of banks; conversely, the lowest value is reached when the market consists of *n* banks with equal size (Bikker & Haaf, 2002). According to NBRM, the level of concentration in a market is considered acceptable when the value of the index lies between 1000 and 1800 points.

### 3.2.2 Variable measuring market power

**The Lerner Index** is a widely accepted measure of market power of banks, often used to analyze competition in the industry. My approach for calculating the Lerner Index in this study follows the

methodology originally developed by Iwata (1974) related to the econometric approach for determination of price in oligopoly market. Iwata finds that price level of a product is determined as a function of elasticity of demand, marginal cost, and a conjectural variation of the firm. Genesove & Mullin (1998) confirm the validity of this approach for estimating market power, by comparing the Lerner Index measured directly in a controlled environment with the estimated one. Later this model was extensively used in banking research, including Angelini and Cetorelli (2003) who note that a firm/bank sets the equilibrium price and quantities to achieve maximum profit, and the decision depends on costs and market competition.

The index displays the pricing power of individual banks in the market by assessing the degree to which they can set the prices of banking products and services above marginal costs. Therefore, the index captures the margin above marginal costs. A higher value of the Lerner Index indicates a higher level of market power (lower competition), and a lower value indicates a lower level of market power (higher competition) in the banking industry. The values of the Lerner Index range from 0 (perfectly competitive market) to 1 (monopoly). Depending on the purpose of the research, it can be calculated using multiple bank output components, such as total assets, total loan, and total debt. To calculate the Lerner Index, I will use the following equation:

$$L_{it} = \frac{1}{|e|} = \frac{P_{it} - MC_{it}}{P_{it}} \quad (3)$$

where $P_{it}$ represents the price of banking products/services for bank *i* at time *t* and $MC_{it}$ measures the marginal cost for bank *i* at time *t*. According to (Coccorese, 2008), the greater distance between $P_{it}$ and $MC_{it}$ is, the farther we are from perfect competition, and the degree of market power which the bank can exercise in the industry is greater. The Index will be calculated for each bank individually and for the whole banking sector for each year, leading to 158 observations of the Index. All data used for calculating the Lerner Index has an annual frequency for t=11 years and is expressed in millions of Macedonian Denars. The detailed methodology for calculating the Lerner Index and its main input variables will be explained below.

### 3.2.3 Input Variables Market Concentration (Five categories)

Empirical literature explores various variables when assessing bank market concentration. Bikker & Haaf (2002) and Talpur (2023) focus on banks' market share in total assets, capturing the market share held by banks based on overall financial capacity. On the other hand, Berger and Hannan (1989) focus on deposits from households since they consider interest rates on those deposits as the most informative indicator for banks pricing behavior. Kraft & Huljak (2018) and Gajurel & Pradhan (2012) use total assets, total loans, and total deposits for calculating HHI for Croatian and Nepalese banking sector, respectively; Beck et al. (2006) limits CR5 calculation to deposits as a variable. Angelini & Cetorelli (2000) use other variables, such as branch concentration in four different geographical regions in Italy. However, this variable is not suitable for Macedonia, due to the small market size and limited observations. In line with Angelini and Cetorelli (2000) measuring HHI in the Italian Banking Industry, and the Report on Risks in the Banking System of the Republic of North Macedonia, published by NBRM, I calculate the concentration indices HHI and CR5 across five categories: total assets, loans to households and nonfinancial companies, and deposits from households and nonfinancial companies.

**Total Assets (TA)** indicates the size and financial strength of the bank. It refers to the sum of all assets presented on a bank's balance sheet, such as cash, loans, investments, securities, etc.

**Loans to households (LH)** are funds lent by banks to individual clients for personal purposes, including housing, education, and other related expenditures.

**Loans to non-financial companies (LNFC)** refers to the provision of financial resources by banks to non-finance related businesses, like services, manufacturing, construction, or retail to finance their day-to-day expenses and capital expenditures or support business growth.

**Deposits from households (DH)** are the funds of households held by banks for safekeeping and generating interest.

**Deposits from non-financial companies (DNFC)** are the funds of non-financial businesses held by banks for safekeeping and generating interest.

### 3.2.4 Input Variables Market Power

I follow Angelini and Cetorelli (2003) and Kraft and Huljak (2018) to calculate the Lerner Index using price output and marginal cost variables as per Eq. (3). Considering that the Lerner Index is also known as the Price-Cost margin, there is a consensus in the academic community on the use of output price and marginal costs to calculate the Index.

**Output Price (P)** refers to the financial amount paid by clients in exchange for the banking products/services.

**Marginal Cost (MC)** refers to the additional costs incurred to produce/deliver an extra unit of a financial product/service.

Depending on the research purpose, there are differences in the definition of the output price and marginal costs. Although banks have multiple products, the Aggregate Lerner Index, based on total assets a single aggregate output factor, is the most popular measure in academic literature (Valverde & Rodríguez Fernández, 2007; IJtsma et al., 2017). However, other studies use product specific Lerner Indices based on loans, deposits, securities, derivatives, and other products as output variables. For instance, Wang et al., (2020) calculate the Lerner Index for 19 EU countries based on deposits and loans, while Huang et al., (2017) includes loans, investments, and other specific products in the calculation of the Lerner Index for 28 EU countries. In line with Angelini and Cetorelli (2000), when defining marginal costs, an extended list of balance sheet components is used.

**Total Loans (TL)** are referred to as the sum of loans to households and non-financial companies.

**Total Deposits (TD)** are referred to as the sum of deposits from households and non-financial companies.

**Interest Income (II)** are the funds earned from interest-bearing assets held in the portfolio, such as loans, bonds, mortgages etc.

**Net Fees and Commissions (NFC)** refers to the income balance earned from providing financial services and the incurred expenses for external transactions and services used.

**Interest Expense (IE)** refers to the financial expenditures in the form of interest paid on deposits.

**Total Operating Costs (TOC)** represent all the expenses required to run daily operations, which include costs related to facilities, technology, personnel, marketing, and other operational functions.

**Total Costs (TC)** are referred to as the sum of total operating costs and interest expenses.

**Labor Costs (LC)** refer to the total expenditures incurred in relation to its workforce such as wages, salaries, benefits, and other expenses.

**Number of employees (E)** presents the end of year employed in each bank.

## 3.3 Descriptive Statistics

Table 1 and 2 display the descriptive statistics of the CR5 and HHI for 5 categories in the banking market. The mean shows the average concentration level, the standard deviation captures the variability from the mean, and the minimum and the maximum show the range of the values in the data set for each index per category.

| | Mean | Std. Dev. | Minimum | Maximum |
|---|---|---|---|---|
| Total Assets | 75.88 | 2.73 | 74.15 | 81.5 |
| Loans to households | 79.64 | 2.03 | 77.1 | 83.5 |
| Loans to non-financial companies | 76.56 | 2.75 | 72.3 | 80.4 |
| Deposits from households | 81.51 | 2.30 | 79.9 | 86.1 |
| Deposits from non-financial companies | 79.40 | 2.93 | 75.5 | 84 |

**Table 1.** Descriptive Statistics of CR5 Index for 5 categories, including the mean, standard deviation, minimum and maximum values. The mean presents the average value of CR5 Index per category, the std. deviation shows how dispersed the data is in relation to the mean, the minimum value presents the lowest value of the CR5 Index per category, while the maximum presents the highest. The values are given in percentages for 2012-2022. The data used to derive the CR5 descriptive statistics values presented in the table, is from the audited annual report of each bank and the NBRM Report on risks in the Banking System.

From Table 1, it is notable that the standard deviation for all categories is relatively low. This means that the range of the data is narrowly clustered around the mean, which stipulates a certain stability of the level of market concentration. As evidenced, the categories total assets and loans to non-financial companies show moderate mean values of market concentration, while for the other three they are relatively high. The highest mean is for deposits from households (81,5%), indicating a high level of market concentration compared to the other categories. The lowest level of market concentration is for the category loans to non-financial companies (72.3%).

| | Mean | Std. Dev. | Minimum | Maximum |
|---|---|---|---|---|
| Total Assets | 1405 | 50.03 | 1343 | 1477 |
| Loans to households | 1725 | 141.11 | 1552 | 1980 |
| Loans to non-financial companies | 1482 | 172.30 | 1286 | 1800 |
| Deposits from households | 1842 | 64.89 | 1762 | 1960 |
| Deposits from non-financial companies | 1437 | 99.62 | 1326 | 1585 |

**Table 2.** Descriptive Statistics of HHI for 5 categories including the mean, standard deviation, minimum and maximum values. The mean presents the average value of the HHI per category, the std. deviation shows how dispersed the data is in relation to the mean, the minimum value presents the lowest value of the HHI, while the maximum presents the highest. The values are measured in index points for 2012-2022. The data is derived from the NBRM "Data and Indicators for the Banking System" dataset.

As presented in Table 2, the mean value for the category TA is 1405 index points, with the smallest standard deviation out of all categories. The former signals a moderate level of concentration and the latter shows that the data is closely clustered around the mean, which makes the data more consistent and representative. Deposits and loans from/to non-financial companies have a similar mean value compared to total assets with an approximately twofold/threefold higher standard deviation. Interestingly, loans to households present with a higher mean value and almost threefold higher standard deviation when compared to TA, suggesting greater variability in concentration levels. Conversely, deposits and loans to/from households show a significantly higher mean value, indicating less acceptable levels of concentration in the market. It is notable that the maximum values of loans and deposits to/from households are above the upper range of acceptable values of bank concentration by the NBRM. Overall, we can note that the higher variation in the HHI across most categories shown by the standard deviation values, predicts the expected variations of the competitiveness in the market.

Descriptive statistics for variables used for the calculations of the Lerner Index are provided in Table 3.

| | Mean | Std. Dev. | Min | Max |
|---|---|---|---|---|
| Total Assets | 35,393.69 | 37,336.42 | 1,408 | 150,975 |
| Total Loans | 21,173.49 | 21,212.24 | 838 | 85,340 |
| Total Deposits | 27,619.79 | 31,007.14 | 1,073 | 133,248 |
| Interest Income | 1,432.97 | 1,402.22 | 78 | 4,672 |
| Net Fees and Commissions | 503.45 | 578.5 | 21 | 3,416 |
| Interest Expense | 356.67 | 378.45 | 39 | 2,066 |
| Total Operating Costs | 826.5 | 654.34 | 101 | 2,470 |
| Total Costs | 1,183.16 | 964.38 | 142 | 4,039 |
| Labor Costs | 355.27 | 290.51 | 43 | 1,080 |
| N of Employees | 437.64 | 318.38 | 72 | 1,055 |

**Table 3:** Descriptive Statistics Input Variables Lerner Index including the mean, standard deviation, minimum and maximum values. The mean presents the average value per item, the std. deviation shows how dispersed the data is in relation to the mean, the minimum value presents the lowest value per item, while the maximum presents the highest. The values are expressed in millions of Macedonian denars for the period of 2012-2022, except for the number of employees. The data is derived from the audited annual reports of each bank.

The mean of total assets is 35,393.69 million denars, displaying a variation with a standard deviation of 37,336.42. Similarly, the average number of loans and deposits are 21,173.49 and 27,619.79 million denars, respectively. The average amount of interest income and expense amount to 1,432.97 and 356.67 million denars, while the former shows a standard deviation of 1,402.22 and the latter 378.45. Total costs have a mean value of 1,183.16 million deviation of 964.38.

# 4. Methodology

For the quantitative part of this research, I will use the statistical software Stata.

First, I will calculate traditional measures of market concentration by following the SCP paradigm. This framework uses measures of concentration, such as the CR5 and HHI to infer the level of concentration in the market. These indices are calculated based on 5 categories using Eq. (1) and Eq. (2). Once the value of the indices is calculated per each category, I will construct a line chart to analyze the data and research expectation.

The Lerner Index is measured as the difference between the price of bank products/services and marginal costs relative to the price of bank product/services as per Eq. (3). To obtain the components of Eq. (3), I will use a ratio and a trans-logarithmic cost function.

The first component, *Pit* measures the price of bank products/services, and it is derived by dividing total bank revenue (interest and non-interest bearing) with total assets for bank *i* at time *t*. The net revenue is calculated as the sum of interest revenue collected from provision of loans and noninterest revenue from bank fees and commissions.

The second component of Eq. (3), $MC_{it}$, is derived from a trans logarithmic function of costs that estimates the elasticity of total costs in relation to the price of the main input components of banks. Following Angelini & Cetorelli (2003) the results for the Marginal Costs are derived using the partial derivative of a trans logarithmic function. The trans logarithmic regression is specified in

the form of a fixed effect panel data model estimated with instrumental variables using Two-Stage Least Squares (2SLS). Similar to Angelini & Cetorelli (2000) to avoid the endogeneity of the quantity variable, I used the first order lagged values of the variable as instruments. A Transcendental Logarithmic Cost Function is frequently used in econometrics and microeconomics to quantify complex relationship between variables. It is a comprehensive and flexible method used to capture both linear and non-linear relationships, as well as the relationship between few variables. The structure of the translog cost function includes three main components: total costs, the banks output levels (total assets, total loans, total deposits, depending on the research purpose), and the prices of three key bank input variables (cost of labor, financial capital, and physical capital). The squared terms are used to capture non-linear effects, while the cross-product term represents the interaction between the output and input variables. The coefficients represent the elasticities and interactions between the variables.

The function is presented as:

$$lnTC_{it} = \beta_0 + \beta_1 lnQ_{it} + \beta_2 (lnQ_{it})^2 + \sum_{k=1}^{3} \beta_k lnW_{k,it} + \sum_{k=1}^{3} \sum_{j=1}^{3} \beta_k lnW_{k,it} lnW_{j,it} + \sum_{k=1}^{3} \gamma_k lnQ_{it} lnW_{k,it} + \varepsilon_{it}$$

(4)

Where:

$TC_{it}$ = total costs (operating and interest expense), for bank *i* and year *t*

$Q_{it}$ = total assets (single aggregate output product), for bank *i* and year *t*

$W_{k,it}$ = the prices of three key input components (deposits, physical capital, and labor), for bank *i,* year *t,* and *k*=1,2,3

Following Angelini and Cetorelli (2000) and Shaffer & Spierdijk (2020), I will use a broad definition of banking output Q, measured as total assets. Similarly to Angelini and Cetorelli (2003), the prices of the three input variables are determined as following: $W_1$ is the price of deposits

measured by the ratio of interest expense to total deposits; $W_2$ is the price of physical capital measured by the ratio of the difference between total operating and labor costs, divided by total assets; and $W_3$ represents the price of labor, measured by the ratio of labor costs to the number of employees. There is one established constraint of linear homogeneity in relation to the input prices, where the sum of the three coefficients of the input components equals 1, meaning that an equal percentage increase in all input prices will result in a proportional increase of total costs, while holding the output constant. Total costs are calculated as the sum of operating costs and interest expenses. Once the trans logarithmic function is estimated, the marginal costs are calculated by deriving the partial derivative with respect to total assets, expressed as:

$$MCit = \frac{TC_{it}}{Q_{it}} \left[ \beta_1 + \beta_2 lnQ_{it} + \sum_{k=1}^{3} \gamma_k lnW_{k,it} \right] \quad (5)$$

When substituting for the values of the coefficients and variables in Eqs. (4) and (5), the marginal costs are obtained for each bank in the sample and for the whole bank industry for each year. Using *Pit- assets* and substituting for the values derived using the Eqs. (4) and (5), we calculate Eq. (3) and derive the values of the Lerner Index. Similarly to Kraft & Huljak (2018), once the Lerner Index is calculated for each bank and year, I calculate the weighted average of the index for the whole banking sector per year, which is consistently aggregated.

# 5. Results

To address the research questions, I first present and discuss the results for the CR5 and HHI as concentration measures. The second part focuses on the Lerner Index for the Macedonian banking sector.

## 5.1 CR5 Index and HHI

Once the indices are derived using Eq. (1) and Eq. (2), a line chart is generated to depict their trend over a time span of 11 years. The CR5 Index is measured in percentages, while the HHI is measured in so-called index points.

The results for the CR5 Index are presented in Figure 1.

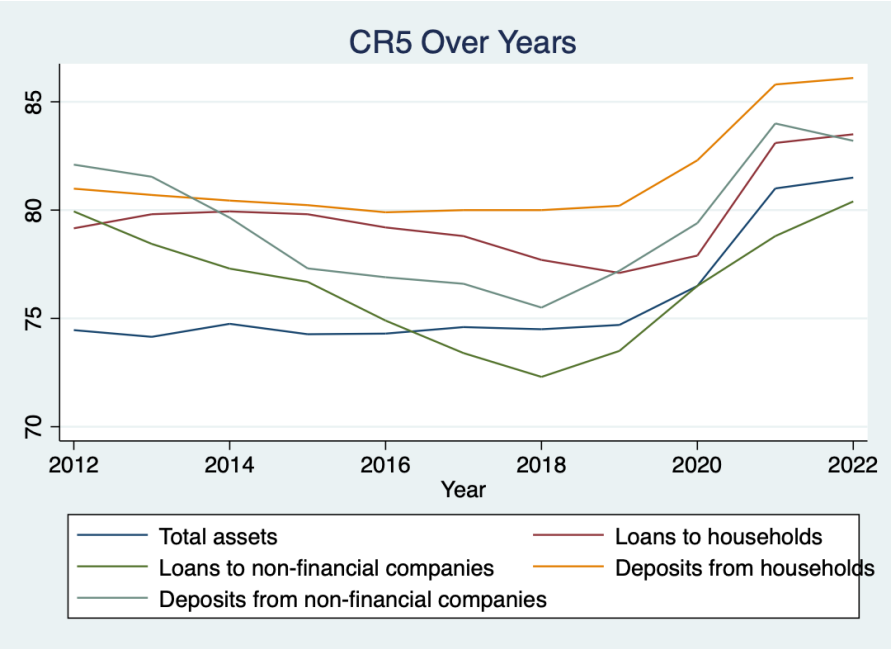


**Figure 1.** CR5 Index for the Macedonian Banking Sector presented in a line chart for the period 2012-2022. The CR5 is expressed in percentages. The y-axis represents the CR5 Index, while the x-axis shows the years. Each line represents one of the five categories for which the index is calculated, as shown in the legend below the figure.

Figure 1 presents the concentration of the five largest banks in the whole sector based on assets, as well as on the credit and deposit market for both households and non-financial companies. Noticeably, between 2012 and 2019, CR5 for total assets and households in deposit and loan markets remains constant overall with small fluctuations during the years. On the other hand, CR5 for loans and deposits to non-financial companies shows a significant decline of around 6-7 pp., while, for loans to households shows a slight decline until 2019. In 2020-2021 the trend reverses, and steep increase of the CR5 Index is noted for almost all categories, while in 2022 it tapers off.

The results for the HHI are presented in Figure 2.

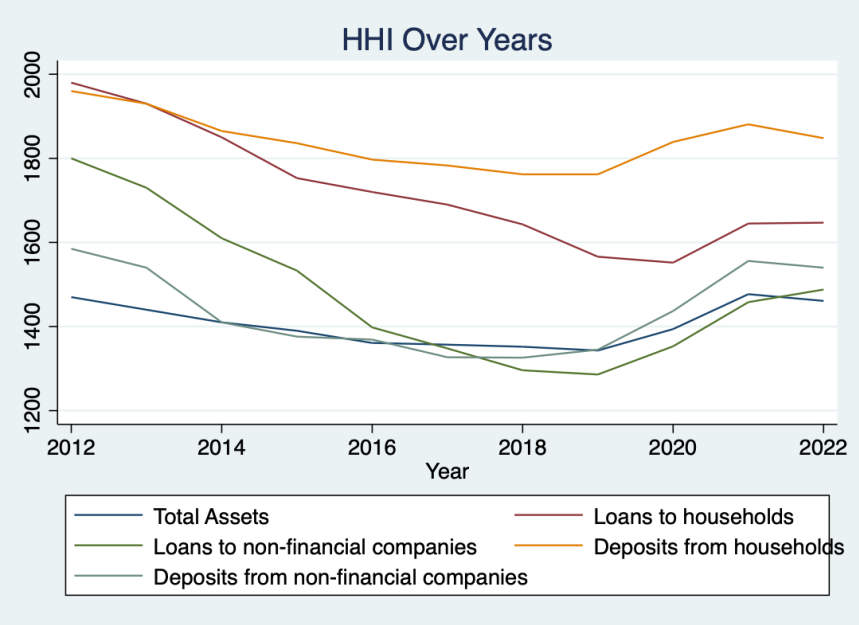


**Figure 2.** HHI for the Macedonian Banking Sector presented in a line chart for the period 2012-2022. The HHI is expressed in index points. The y-axis represents the HHI, while the x-axis shows the years. Each line represents one of the five categories for which the index is calculated, as shown in the legend below the figure.

As shown in Figure 2, the HHI for all categories decreases until 2019. HHI for total assets and loans to households shows modest decrease, while HHI for other categories decreases more rapidly. For instance, the HHI for loans to non-financial companies drops significantly from approximately 1800 to 1250 index points. This is contrary to my expectations for increased concentration, based on bank consolidation and regulatory tightening. However, from 2020 onwards, the trend of HHI is upward for all categories, showing increasing market concentration in the banking sector and for the loan and deposit market. Similarly, to the CR5 Index, the trend is halted after 2021, when the HHI for the banking sector and the credit market declined. For the period analyzed, the highest concentration is noted for loans to households, 1980 index points in 2012; while the lowest value is noted for the loans to nonfinancial companies in 2019, 1286 index points.

## 5.2 Lerner Index

This segment outlines the results of the Lerner Index shown in Table 4 and Table 5. Table 6 of Appendix A presents the coefficients of the translog cost function estimation.

As mentioned, the Lerner Index is calculated using Eq. (3) annually for each bank, and then the weighted average is calculated for the whole banking sector per year. Table 4 presents the relevant values used in the partial derivative calculation of marginal costs for the largest bank by total assets, Komercjalna Banka AD Skopje for 2012-2022. I will apply the methodology for calculating the Lerner Index for this bank for the year 2022.

| Year | TC | Q | ln_Q | ln_$W_1$ | ln_$W_2$ | ln_$W_3$ | P | MC | LI |
|---|---|---|---|---|---|---|---|---|---|
| 2012 | 3,585 | 82,775 | 11.324 | -3.695 | -4.379 | -0.240 | 0.066 | 0.039 | 0.398 |
| 2013 | 3,481 | 86,834 | 11.372 | -3.869 | -4.418 | -0.149 | 0.061 | 0.037 | 0.402 |
| 2014 | 2,896 | 92,770 | 11.438 | -4.287 | -4.560 | -0.245 | 0.054 | 0.028 | 0.476 |
| 2015 | 2,432 | 97,142 | 11.484 | -4.761 | -4.694 | -0.245 | 0.051 | 0.023 | 0.561 |
| 2016 | 2,270 | 100,737 | 11.520 | -5.051 | -4.754 | -0.223 | 0.047 | 0.020 | 0.571 |
| 2017 | 2,263 | 104,860 | 11.560 | -5.221 | -4.754 | -0.184 | 0.045 | 0.019 | 0.570 |
| 2018 | 2,310 | 114,390 | 11.647 | -5.246 | -4.950 | -0.042 | 0.037 | 0.019 | 0.495 |
| 2019 | 2,303 | 123,018 | 11.720 | -5.342 | -5.022 | -0.033 | 0.035 | 0.017 | 0.503 |
| 2020 | 2,340 | 132,584 | 11.795 | -5.682 | -4.973 | 0.034 | 0.042 | 0.016 | 0.623 |
| 2021 | 2,423 | 148,535 | 11.909 | -5.926 | -4.963 | 0.061 | 0.038 | 0.015 | 0.614 |
| 2022 | 2,479 | 150,975 | 11.925 | -6.029 | -4.942 | 0.123 | 0.045 | 0.015 | 0.678 |

**Table 4.** Lerner Index Calculation Variables for Komercijalna Banka AD Skopje for the period 2012-2022. TC and Q are expressed in millions of Macedonian denars. Columns 4-7 include natural logarithms of variables Q, W1, W2, and W3 expressed millions of Macedonian denars. The price column shows the amount of revenue generated with each unit of assets for every year. The marginal cost is calculated using the partial derivative of the trans logarithmic cost function and represents additional cost incurred to produce an extra unit of bank product/service. The last column represents the Lerner Index expressed as a value between 0 and 1. The data is derived from the audited annual reports for each bank.

The coefficients relevant for the calculation of the elasticity of costs with respect to assets, $\beta_1$ (0.843), $\beta_2$ (-0.017), $\gamma_1$ (0.048), $\gamma_2$ (-0.148), and $\gamma_3$ (0.072), are derived using the translog cost Eq. (4). The values of all the coefficients are presented in Table 6 in Appendix A. As a second step, I

derive the values for TC, Q, ln_Q, ln_$W_{k,it}$, where k=1,2,3, as explained in the methodology for each of these components. The calculated values are presented in Table 4. The third step is substituting for the values of the coefficients and variables in the marginal cost Eq. (5), to derive the marginal cost value for Komercijalna Banka in 2022, amounting to 0.015. Finally, the marginal costs are then substituted in Eq. (3) together with the value of P (0.045) to calculate the Lerner Index for 2022 - 0.678.

Table 4 shows a declining trend in both price and marginal costs for the period analyzed. However, the Lerner Index for Komercijalna Banka increases over time, due to a larger decrease in marginal costs compared to the price of banking products.

Once the individual Lerner Indices are calculated, the weighted average Lerner Index for the banking sector is presented in Table 5.

| Year | Price of banking products | Marginal Cost | Lerner Index |
|---|---|---|---|
| 2012 | 0.072 | 0.050 | 0.303 |
| 2013 | 0.069 | 0.046 | 0.330 |
| 2014 | 0.065 | 0.040 | 0.387 |
| 2015 | 0.062 | 0.034 | 0.443 |
| 2016 | 0.059 | 0.031 | 0.481 |
| 2017 | 0.057 | 0.029 | 0.486 |
| 2018 | 0.052 | 0.027 | 0.489 |
| 2019 | 0.049 | 0.025 | 0.491 |
| 2020 | 0.047 | 0.022 | 0.527 |
| 2021 | 0.044 | 0.021 | 0.523 |
| 2022 | 0.046 | 0.021 | 0.547 |

**Table 5.** Weighted Lerner Index, Price, and Marginal Cost for the period 2012-2022 for the banking sector based on the market share of each bank determined by total assets. The price column shows the amount of revenue generated with each unit of assets for every year. The marginal cost is calculated using the partial derivative of the trans logarithmic cost function and represents additional cost incurred to produce an extra unit of bank product/service. The last column represents the Lerner Index expressed as a value between 0 and 1. The data for calculating the weighted Lerner Index is derived from the audited annual reports for each bank.

As evidenced in Table 5, there is a clear upward trend in the Lerner Index during the period analyzed. From 2012-2016 the Lerner Index increases rapidly, while the pace slowed down during

2016-2018 and then accelerates again until 2021. Overall, the steady increase of the Lerner Index indicates a rise in market power throughout the years. This trend reverses in 2021, when we exhibit a slight decrease of the Lerner Index, which is more than offset in 2022. The results are in line with my expectations and available results for 2012-2014 from the NBRM FSR in 2014. The decomposition of the Lerner Index shows that the price of banking products and the marginal costs decline constantly until 2021, with marginal costs falling at a much faster rate. The values of the Lerner index in North Macedonia in the period 2012-2022 are significantly below 1, with average value of 0.45.

To check for robustness, I included two dummy variables for the Euro debt and Covid/Energy Crises years, 2012-2013 and 2020-2022. The results of the regression including the dummy variables are presented in Table 6 in Appendix A. Results show that the Euro debt Crisis has a statistically significant effect on the model with a small magnitude, while the Covid crises has an insignificant effect. Therefore, controlling for the crises did not significantly alter overall results of the Lerner Index. The results from our statistical model remain robust when subjected to these alternative specifications.

# 6. Discussion

## 6.1 Bank Concentration: CR5 and HHI

The HHI declines in the period 2012-2019, and gradually increases after. My expectations for an increase in bank concentration were partially met, for the period after 2019, while in 2012-2019 the concentration declined contrary to my expectations. A possible explanation is the following: the bank consolidation process started after 2016, but its major effect on the concentration was the merger of two medium-sized banks in 2019. The effects on HHI are notable with some time lag, starting from 2020 when concentration increased. With exception of the initial period 2012-2015 for loans and deposits to/from households, HHI shows bank concentration for all categories to be at moderate and acceptable level as per the guidelines of the Central bank[3]. This is consistent with

[3] Concentration is considered at acceptable level if HHI ranges between 1000 and 1800; NBRM Financial Risks Annual reports 2012-2022

findings of Ivanovska (2020). However, there are some variances in sub-periods and per categories. In the aftermath of the GFC and Euro debt crisis, the entry of foreign capital was temporarily halted. Simultaneously, loan losses accumulated resulting in steep increase of NPLs, contributing to decline of profitability. As a result, the concentration for deposits and loans to households over 2012-2015 remained high (1800-2000), albeit with a declining trend. At the same time, the concentration for assets, loans, and deposits to/from non-financial companies, though relatively high (1500-1800), remained at acceptable levels. After 2015 we evidence more significant decline in the bank concentration for all categories, with the lowest levels reached in 2019 (1286-1343) for bank assets, loans, and deposits to/from non-financial companies, and 1566-1762 for loans and deposits to/from households. The trend reversed with gradual increase until 2021-2022. The increase in concentration reflects accelerated bank consolidation, with a merger of two medium banks that jointly represent 12% of total bank assets, and bankruptcy of one small bank.

The movement of CR5 in the analyzed period 2012-2022 shows relatively steady concentration levels at 75% - 80% between 2012 and 2019, and significant increase afterwards. The levels of concentration are slightly higher than previous research of Giustiniani & Ross (2008). An exception of the trend are concentrations of loans and deposits to/from non-financial companies, which show declining levels until 2019, with minimum reached at around 74%-77% (except for deposits at 80%). The strong upward trend after 2019 for all five categories reflects the fact that the three largest banks have broadly maintained their organic growth and market share, while the next two banks have increased it through the merger. However, it is not clear how the change in concentration levels in the period 2012-2022 and the two sub-periods with declining (HHI) and steady (CR5) concentration between 2012 and 2018, and increase in the period 2019-2022, reflects on market competition. Both CR5 and HHI carry no sufficient information on how banks' efficiency gains and other behavioral changes affect market power. Therefore, HHI and CR5 cannot be used as a measure of bank competition in Macedonia, which is in line with my expectations and Claessens and Leaven (2004) who find no correlation between competition and concentration.

## 6.2 Bank Market Power: Lerner Index

The analysis of the results of the Lerner index for 2012-2022 is presented in Figure 3.

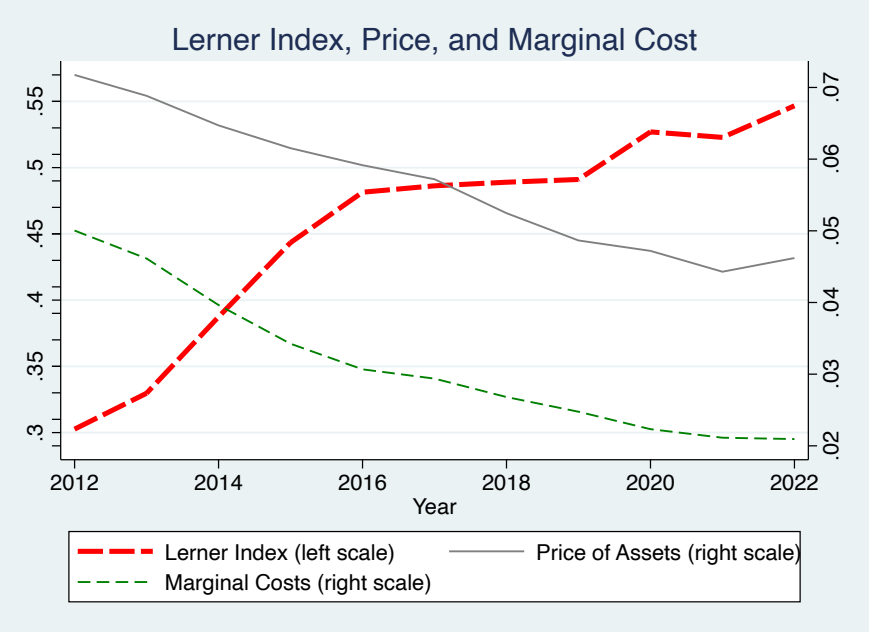


**Figure 3.** Weighted Lerner Index, Price, and Marginal Cost in the banking sector visualized in a line chart for the period 2012-2022. The Lerner Index is presented on the left y axis, while P and MC are presented on the right. The x-axis presents the years.

Figure 3 shows an increasing trend for the Index, indicating a steady decrease in competition in the banking system. This is similar with the results of NBRM, Financial Stability Report for the Republic of Macedonia in 2014, evidencing worsening competition in the banking sector between 2012 and 2014. The decomposition of the Lerner index shows that the steady decline of marginal costs explains the upward movements of the index. In the initial years of my observation, in the aftermath of the financial crisis and Euro debt crisis, cyclical factors negatively affected both prices and costs of funding. There are three channels of transmission of the crisis on the Lerner index components: 1/ financial deleveraging led to delay of entry of new foreign banks, providing opportunity for incumbents to maintain or increase their mark-ups and market share; 2/ fear of possibility of real sector crisis to translate into new financial crisis, led to change of banks behavior to extremely conservative attitude to lending and borrowing funds, both at reduced price; and 3/ the crisis accompanied by Government interventions for struggling firms, affected customers

behavior, including their pricing strategies and product cost structure. As a result of these factors, banks were able to gain market power by getting access to funds at significantly reduced cost, while having no competitive pressure to accordingly reduce their product prices. The decline in marginal costs was at a much higher pace compared to the decrease in product prices. This translated into higher mark-ups, leading to an increase in the Lerner index and reduced competition.

After 2014, the business cycle improved, with credit growth gradually recovering to pre-crisis levels. However, the increasing trend of the Lerner Index continued, with prices decreasing further, but at slower pace than marginal costs. Since cyclical factors abated, the efficiency of banks became the driving force behind cost movements. The reduction of marginal costs in the period 2016-2020 mainly reflects improved bank efficiency, including both foreign banks using better know-how and technology, and domestic banks acquiring the new technology (ATMs, digital banking etc.) The increase of market power was reinforced with accelerated bank consolidation. After acquisition of one bank by a new foreign bank in 2016, there was a merger of two medium size banks with combined share of 12% of the total assets in 2019, and an exit of one smaller bank in 2020. The increased market power of a group of large banks reflects organic growth of incumbent banks, and the merger of the two medium banks that created the fourth largest bank in the market. As a result, those banks' profitability improved, while NPLs were reduced after more stringent regulatory requirements were imposed by the Central Bank. Improved banking sector profitability accompanied by increased market power, confirms the “concentration-stability” view (Allen & Gale, 2003) that systems with few large banks provide economies of scale and higher profits, which serve as a buffer contributing to stability. At the same time, prices of bank products also decreased, specifically for large banks, who have access to cheaper funds (from their “mother” banks abroad) and may respectively keep prices at lower level. Smaller banks’ prices, albeit with declining trend, are kept at somewhat higher level compared to large banks, due to higher credit risk of the specific market of small enterprises they are serving. The decline of bank prices evidenced in the analyzed period implies that banks did not use increased market power only for-profit maximization, but instead passed through some of the efficiency gains to their customers.

The only exception to the increasing trend of the Lerner index is 2021, when the index slightly declined compared to 2020 and competition improved. This is due to a significant decrease in market prices, while costs declined slightly. The temporary increase in competition in 2021 coincides with monetary policy measures for reducing interest rates to historically lowest levels, to prevent recessionary risks due to Covid 19, energy crisis and war conflict in Ukraine. This affected the pricing of bank products. However, the trend reversed in 2022 when monetary policy was tightened and subsequent increases in loan rates more than offsets bank products prices' reduction from 2021. As a result, market power increased, and competition declined again.

The results of the Lerner Index confirm that the Macedonian banking system is equally far from perfect competition and monopoly. It is in a state of monopolistic competition, in line with my expectations and findings of two previous studies for North Macedonia (NBRM, 2014; Giustiniani & Ross, 2008). The results are also consistent with several other studies for European banking systems, which also found monopolistic competition (Claessens & Leaven, 2004); Bikker & Haaf, 2002; Mamatzakis et al., 2005; and De Bandt & Davis, 2000). In addition, the results confirm the negative relationship between increasing market power and declining competition, which is consistent with my expectations and Claessens & Leaven (2004).

# 7. Conclusion

In this study I examine the evolution of competition in the banking system in North Macedonia for the period 2012-2022, and the relationship between concentration, market power and bank competition. Previous research shows that concentration is not a direct measure of competition in the banking system (Claessens et al., 2010), but rather its determinant (Bikker & Haaf, 2002). Lerner index as a widely used measure for market power provides better information about competition, as it includes behavioral changes by banks. These relationships become even more complex in transition economies, where the banking system undergoes bold regulatory and structural changes. Previous research on Macedonia shows high levels of concentration and weak competition, that started to improve after 2005 until 2012, when it deteriorated again. However, there is no research covering the period after 2014. Therefore, the question that is studied in this

thesis is the relationship of concentration and market power with competition, and what is the level and evolution of the competition in the Macedonian banking sector.

To answer this question, I calculate CR5 and HHI, as well as non-structural Lerner index, as per Iwata (1974) and Angelini and Cetorelli (2003) methodology. HHI shows decreasing bank concentration between 2012 and 2019 and increase after. The results are similar with Ivanovska, (2020). The CR5 Index in the period 2012-2019 remains largely stable and increased after, because of a merger of two medium-size banks. Despite explaining the evolution of concentration, HHI and CR5 do not contain information on the behavioral changes affecting market shares. Therefore, the two measures cannot be used as a proxy for the competition in the banking sector of North Macedonia, as outlined in empirical literature (Claessens & Leaven, 2004). The Lerner Index increases over 2012-2022 (with exception of 2021), indicating a steady decline of bank competition. The decomposition shows a significant decrease in marginal costs with moderate reduction of bank product prices, leading to increase of mark-ups. The average level of Lerner index shows that Macedonian banking system is in a state of monopolistic competition. The results are in line with my expectations and previous research (Giustiniani & Ross, 2008); NBRM, FSR for the Republic of Macedonia in 2014). They also confirm a negative relationship between market power and competition (Claessens & Leaven, 2004). Overall, compared to CR5 and HHI, the Lerner Index provides more robust information for the research question about the relationship between concentration, market power and competition and assessment of the level of banking sector competition in North Macedonia.

The research limitations reflect short time-series available for the banking sector in North Macedonia at homogenous level, necessary for data consistency. Future research could potentially include more data for product-specific bank outputs. In addition, future work could explore bank competition in North Macedonia in the broader context of institutional and regulatory framework, including regulatory policy, role of non-bank financial institutions etc.

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# Appendix A

Table 6 shows the results of the regression analysis and the robustness checks by controlling for the Euro Debt and Covid Crises. The panel data fixed effects model is estimated using a 2SLS estimation technique and accounts for endogeneity of the quantity variable by including the lagged values of the variable as instruments. Additionally, robust standard errors are included in the model to account for heteroskedasticity.[4] Considering that the variables in the trans logarithmic equation are expressed in natural logarithms, the estimated coefficients of the output and input variables are interpreted as elasticities. Moreover, a 1% change in an independent variable (X), corresponds to a change in the dependent variable equal to the coefficient of the X variable.

[4] Adding the constraint of linear homogeneity as additional structure to the model has an insignificant effect on the results.

| | ln_TC (1) | ln_TC (2) |
|---|---|---|
| **ln_Q** | 0.843 | 0.699 |
| | (0.501) | (0.466) |
| **ln_Q_sq** | -0.017 | 0.006 |
| | (0.053) | (0.052) |
| **ln_W1** | 0.286 | 0.259 |
| | (0.237) | (0.242) |
| **ln_W2** | 1.204** | 1.277** |
| | (0.416) | (0.390) |
| **ln_W3** | 1.174 | 0.915 |
| | (0.728) | (0.744) |
| **ln_W1_sq** | 0.072** | 0.081*** |
| | (0.022) | (0.020) |
| **ln_W2_sq** | 0.089 | -0.006 |
| | (0.232) | (0.233) |
| **ln _W3_sq** | -0.014 | -0.063 |
| | (0.184) | (0.186) |
| **ln_Q_W1** | 0.048** | 0.060*** |
| | (0.016) | (0.016) |
| **ln_Q_W2** | -0.148 | -0.085 |
| | (0.171) | (0.171) |
| **ln_Q_W3** | 0.072 | 0.080 |
| | (0.058) | (0.055) |
| **ln_W1_W2** | -0.031 | -0,027 |
| | (0.048) | (0.043) |
| **ln_W1_W3** | 0.043 | 0.015 |
| | (0.081) | (0.081) |
| **ln_W2_W3** | 0.382** | 0.372** |
| | 0.135 | (0.124) |
| **Covid** | | -0.015 |
| | | (0.013) |
| **Euro_crisis** | | -0.027* |
| | | (0.014) |
| **Constant** | 2.967 | 3.728* |
| | (2.201) | (2.076) |
| $R^2$ | 0.961 | 0.969 |
| **Number of observations** | 132 | 132 |

**Table 6.** Translog cost function regression analysis. It displays the estimated regression coefficients, standard errors, p-value, R-squared (within) and number of observations. The coefficients are estimated using a 2SLS estimation technique. Variables with potential endogeneity problems total assets(log) and total assets squared (log) were instrumented using their lagged values. Heteroskedastic standard errors are reported in parenthesis. The meaning of the stars is related to the statistical significance of the coefficient (* p<0.10 ** p<0.05 *** p<0.01). The second column presents the results of the cost function with the addition of two dummy variables for the crises years.