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Suchkov, Ivan

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University of the Witwatersrand, Johannesburg
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Stability of banking systems in BRICS countries: state vs. private bank ownership

Supervisor: Dr. Thanti Mthanti

Student: Ivan Suchkov (1772763)

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Chapter 1. Introduction

In today's global business environment of cutthroat competition and continuous innovation, companies need to constantly reinvent themselves in order to stay ahead. As Arthur Martinez, Chairman and Chief Executive Officer of Sears, said just over a decade ago, "If you look at the best retailers out there, they are constantly reinventing themselves." (Greenwald, 1996, p. 54)

Some 18 years ago, Jim O'Neill introduced the term “BRIC countries” (Brazil, Russia, India, and China) that ever since has been entrenched in the common language of economists around the world. At that time, the joint BRIC’s GDP in PPP terms constituted $9,668 bln. or 23.3% of world GDP (O’Neill, 2001). This club of four emerging economies that were grouped according to their economic growth potential and uprising global influence was joined by South Africa in late 2010.

In the decade following the Global Financial Crisis (GFC) of 2008, the contribution of BRICS countries to world economic growth is known to have exceeded nearly 50%, and these countries will outrun the developed economies in terms of annual economic growth figures by 2030 (Kose & Ozturk, 2014). During the last two decades the trade turnover of BRICS countries has approximately tripled, which is a clear sign of an increased magnitude of their role in global trade flows (Rasoulinezhad & Jabalameli, 2018).

Today, when the focus of trade and investments is shifting from the West to Asia and Africa, the BRICS is widely considered as an alternative formation capable of promoting its independent economic agenda and introducing alternative financial institutions and instruments like the New Development Bank and Contingent Reserves Arrangement (Shahrokhi, 2017). The discussions about the creation of a BRICS payment system, an alternative to SWIFT, and the BRICS Rating agency are underway. These developments are perceived by many developed countries as a challenge. Yet, in the last several years, the BRICS countries have faced a range of issues ranging from political turbulence, problems with governance at key state-owned enterprises, hampered economic growth, low level of financial inclusion, high unemployment, lack of investments in fixed capital, significant dependence on highly volatile commodities, etc.

The stability of the BRICS countries’ banking systems is one of the key elements of their future prosperity and economic growth. The BRICS countries are not homogeneous in terms of control over the banking systems. Russia and India have clearly a government-controlled banking system, Brazil and China are mixed types, South Africa is clearly a privately[1] controlled system. It is essential to evaluate to what extent a government can be as efficient as a private sector in managing capital allocation and exercising prudent assets-liabilities management. At the same time, it is also important to answer the question of whether banking activities of privately-owned banks could be exercised in the interests of socioeconomic development of their countries of origin.

The question of which banking system is more stable has been researched in both developed and developing economies during times of stability and financial shocks. These research works suggest that in the first place, the

[1] For the purposes of this research, unless clearly stated otherwise, a privately-owned bank or banking system means the opposite of government ownership. At the same time, both government-owned and privately-owned banks in BRICS countries can be listed as public entities with a certain portion of shares in free float.

objectives of government and privately-owned banks are different: while private institutions set profit-making as their primary and often the only goal, the governmental[2] institutions play a pivotal role in stabilizing the economy in times of severe economic shocks and the following recovery (Brei et al., 2014). Banks that serve the public interest have an agenda of providing credit even at times when borrowers' credit quality deterioration is evident and solvency issues are elevated. That is only possible when government support mechanisms like recapitalization of banks that face liquidity problems caused by economy stabilizing measures are available in such forms as direct equity injections (Brei et al., 2014). It has also been found that government-controlled banks play social and development roles by providing credit to strategically important sectors of the economy, thus promoting job creation and social welfare (Cull et al., 2017). This doesn't mean, though, that private banks do not play a developmental role when providing credit to the general public and capital-intensive projects (often in the form of limited-recourse project finance). They certainly do. It is empirically found, though, that private lenders do cut down lending during financial crises, as a response to financial shocks and as a measure of avoiding the increase in default rates, increase in non-performing loans, and consequently deterioration of own financial standing and returns (Brei et al., 2014). While government-owned banks are often used to provide counter-cyclical support to the economy (Coleman et al., 2015), private banks are pro-cyclical institutions (Brei et al., 2014), and thus they expand or contract lending according to prevailing market conditions. Private banks have the ability to reduce access to finance on the local market if the risk profile of the borrowers is considered to be non-satisfactory without considering the importance of the industry in which a given risky borrower operates to the economic growth of the country (Detragiache et al., 2008; Coleman et al., 2015).

This essentially means that a financial institution cannot pursue two opposite goals during a crisis as that would entail two opposite lines of action: either sustaining (or increasing) the provision of capital to those borrowers in need or cutting it down. The psychological factor is also an important one, as the general public and entities tend to withdraw their funds from financial institutions either in fear of losing them or in need to support their own liquidity. Fear of losing one's saving tend to be less when they are deposited in financial institutions that have a high chance of receiving timely support from the government during a financial shock (Brei et al., 2014).

This research will try to answer whether the state-controlled banks were better managed than their private-owned competitors during ten years (2007 – 2017) based on key efficiency and stability metrics.

[2] Brei M and Schclarek, A. in their work “theoretical model of bank lending: Does ownership matter in times of crises?” do not use the term government-owned banks. They refer to public banks and oppose them to private banks. They do not give a clear definition of a public bank, though. Thus, the author of this research, based on his understanding, made an assumption that public banks are institutions that are either owned or controlled by the government in the interests of the public.

Chapter 2. Literature review

The acronym BRIC was first introduced in 2001 by Goldman Sachs economist Jim O'Neill (O'Neill, 2001). It represented four countries, i.e. Brazil, Russia, India, and

China, which had a healthier economic growth outlook compared to the G7. Wilson & Purushothaman (2003) and Cheng et al. (2007) then forecasted that BRIC could become the largest global economic group by 2050. In late 2010 South Africa joined this group to form what is now known as BRICS.

A significant amount of research was done on the economic and political aspects of BRICS formation and even more on individual aspects of each member state. Although, in the beginning, BRIC was no more than an exercise in compound growth rates for a cluster of countries experiencing rapid economic growth, it eventually evolved into a political reality with the first annual summit of the BRIC nations taking place in 2009 (Nayyar, 2016). According to Schaefer & Poffenbarger (2014), BRICS, being an intergovernmental organization, was formed and behaved as a balancing coalition that could seek to constrain the United States, working to end its "unipolar moment". Some research works indicate however the increasing gap between the BRICS countries in their economic development. Specifically, India and China can be considered heavyweights in the international transmission of shocks and their impact on the economic growth of other BRICS countries. Empirical evidence was found that credit to the private sector in these countries has a positive spillover effect on growth in some of the BRICS countries through bilateral international trade (Samargandi & Kutan, 2016; Kocourek, 2015).

Extensive research was also done exploring BRICS' integration in the global capital and derivatives markets. Ahmad et al. (2018) analyzed the financial connectedness of BRICS and global sovereign debt markets and found that Russia and South Africa are the net transmitters of shocks within BRICS, while China and India show weak connectedness and thus might be useful for hedging and diversification. Ngwu et al. (2017) examine the challenges and prospects of securitization in BRICS countries. They conclude that although securitization might be a rather risky activity, which was extensively evidenced during the GFC of 2018, it remains an important instrument for addressing funding constraints in BRICS countries. The implications of the GFC on BRIC (no South Africa at that time) stock and bond markets were thoroughly examined by Bianconi et al. (2013). They found empirical evidence of stock and bond markets deviating much more from the US stress than they deviate among themselves. The research also showed that the worst performers among BRIC countries were Russia and Brazil, with the correlations of their stock and bond markets being significantly large and negative.

Despite having promising prospects for the future, each of the BRICS countries has obstacles that could prevent them from achieving the envisaged growth and the potential to lead the future world economy (Cheng et al., 2007). Such existing and potential obstacles include the difficulty of doing business within each country (Cheng et al., 2007), corruption (Toader et al., 2018), socioeconomic inequalities and problems of good governance (Pant, 2013), economic and political turmoil, rising inflation (Shahrokhi et al., 2017), etc. Other such potential obstacles rest with the banking efficiency and banking stability, as per Koivu (2002), who found that the presence of an efficient banking sector accelerated economic growth in transition economies, and as per Jayakumar et al. (2018), who found that banking stability is a significant long-term driver of economic growth in the European countries.

2.1 Definitions of banking efficiency and financial stability

First and foremost, before going any further, it is important to distinguish between banking stability and banking efficiency.

2.1.1 Banking stability

According to the World Bank[3]"banking or financial stability is about the absence of system-wide episodes in which the financial system fails to function (crises). It is also about the resilience of financial systems to stress. A stable financial system is capable of efficiently allocating resources, assessing and managing financial risks, maintaining employment levels close to the economy's natural rate, and eliminating relative price movements of real or financial assets that will affect monetary stability or employment levels…In stability, the system will absorb the shocks primarily via self-corrective mechanisms, preventing adverse events from having a disruptive effect on the real economy or on other financial systems. Financial stability is paramount for economic growth, as most transactions in the real economy are made through the financial system."

Based on the existing literature and research, banking stability is commonly measured as a bank Z-score, which is estimated as $\frac{ROA+\left({}^{equity}/_{assets}\right)}{\sigma_{ROA}}$, where ROA is the return on assets and σ_{ROA} is a standard deviation of ROA. Since Z-score is highly skewed, the natural logarithm of it is often used, which is normally distributed (Fernández, 2016; Ozili, 2018). Toader et al. (2018, p.597 & p.595) suggest that "it represents the number of standard deviations below the mean by which profits would have to fall so as to deplete the bank's equity capital" and that "a higher Z-score implies a lower probability of insolvency, providing a direct measure of soundness". This technique is quite popular and has recently been used by Laeven & Levine (2009), Houston et al. (2010), Beck et al. (2013), Fernández et al. (2016), Goetz (2017), Ozili (2018), Toader et al. (2018) and many others.

There is also literature that quantifies banking stability using a binary variable (i.e., the one taking the value of 1 for the years of the occurrence of a crisis in a given country and 0 for the absence of it). This technique has been used by Ali et al. (2020), yet it is not as common as the Z-score.

2.1.2 Banking efficiency

Efficiency is usually defined as the ability of a firm to produce a result with minimum effort or resources. When speaking of a bank, efficiency is then defined as its ability to generate profit incurring the lowest cost (or loss). It is important to note that banking efficiency is a significant determinant of banking stability, making them interconnected yet different (Ozili, 2018). In fact, previous studies argue that Non-Performing Loans (NPLs) (i.e., a common measure of bank cost efficiency) can be employed to mark the start of a banking crisis (Reinhart & Rogoff, 2011; Park, 2012), which, as was discussed above is what defines banking instability.

There are three performance measures that are commonly used to measure bank efficiency (Figueira et al., 2006). The first measure consists of a set of financial and economic ratios frequently used to assess bank performance. For example, Malik (2015) uses this measure of banking efficiency by employing profitability variables (i.e., Return on Assets or Return on Equity) and cost/loss variables (i.e., Non-Performing Loans [NPLs]). A similar

[3] https://www.worldbank.org/en/publication/gfdr/gfdr-2016/background/financial-stability

approach is used by Figueira et al. (2006), Kiruri (2013), Nora Azureen Abdul Rahman & Anis Farida Md Reja (2015), Nguyen Hong Son et al. (2015), Ekanayake & Premerathne (2016), etc.

The second measure uses mathematical modeling of performance using data envelopment analysis (DEA). This method assumes economic optimization of the efficiency frontier and it is formed as the piecewise linear combination which connects the set of observations in the series being analyzed (Oluitan, 2014). This performance measure is used, for example, by Das et al. (2005), Figueira et al. (2006), Joshi & Bhalerao (2011), Wolters et al. (2013), etc.

The third performance measure involves statistical modeling using a stochastic cost frontier (SCF) model. Altunbas et al. (2001, p. 931) suggest that "the stochastic-frontier approach labels a bank as inefficient if its costs are higher, or profits lower, than those predicted for an efficient bank producing the same input/output combination and the difference cannot be explained by statistical noise". This performance measure is also used by Figueira et al. (2006) and Oluitan (2014), etc.

2.2 Existing literature on banking efficiency and stability

Despite the existing significant amount of research done on BRICS and its individual member states, it is only Wanke et al. (2018) who addressed the matter of banking efficiency of BRICS countries. In their research "Efficiency in BRICS banking under data vagueness using two-stage fuzzy approach" (Wankel et al. 2018, p.58), they capture vagueness in the relative efficiency of BRICS banking over 2010 to 2014 using fuzzy TOPSIS and adopt fuzzy regressions based on different rule-based systems to enhance the power of significant socioeconomic, regulatory and demographic variables to predict banking efficiency. The results show that when the inflation and GINI index levels are high, the banking efficiency is low. At the same time, higher competition in the banking sector and the presence of foreign banks can decrease inequality in the economy. This last finding then raises the question of whether bank ownership has an impact on bank efficiency and stability.

In recent years there has been extensive research done on trends and implications of bank ownership around the world. Figueira et al. (2006) researched whether privately-owned African banks outperform state-owned banks and whether foreign ownership enhances bank performance. Their results showed that, on average, privately-owned banks in Africa did not appear to outperform state-owned banks; yet private ownership involving foreign participation did seem to have a positive effect on bank performance. Similar findings were made in extensive research on trends and implications of bank ownership around the world, which was done by IMF (Cull et al., 2017). This work sheds light on the global transformation of banking ownership structure around the world: since the 1990s, the government-owned banks have given way to foreign banks, which tend to be more efficient, promote competition, and credit stability in times of idiosyncratic shocks.

Some research works show that in specific countries, results may be opposite to other findings. While it is generally empirically proven that foreign banks (usually private banks) are more cost-efficient and provide better quality services (Bonin et al. 2005), it has been found that in Russia, a country with a unique banking system that

has its roots in the Soviet past, government-controlled banks (such as Sberbank) tend to be more efficient than the private banks (Mamonov et al., 2017).

It is also interesting to note that while some research clearly shows that state-owned banks, being counter-cyclical institutions, do indeed stabilize the local economies and limit the financial fallout during crises, as it happened in Brazil after the global financial crisis of 2008 (Coleman et al., 2015), they are generally poor performers in terms of efficiency (Micco et al., 2007) and can fall victims to political capture and misallocation of funds (Coleman et al., 2015), which implies lending at elevated risks to politically connected enterprises and increasing provision of credit during the years of governmental elections to increase the electorate as a consequence of money surplus, higher consumer spending and rising economic growth (Micco et al., 2007).

It is also very important to highlight that mere private ownership doesn't mean better financial performance, efficiency, and balance sheet quality of a given bank (Bonin et al., 2005). For example, there are more than 500 banks in Russia, and most of them are private, but most of them have a "captive nature," as they were created for purposes of servicing large industrial and investment groups. Starting from 2010, the Central Bank of Russia started cleaning the banking sector by withdrawing banking licenses from those private banks which had weak balance sheets and low levels of capital adequacy, and this led to shrinking quantities in the private sector and consolidation of capital in the major state-owned banks. As suggested in the finings of Mamonov et al. (2017), today, those several large state-owned banks could be considered as efficient as some of their large private peers. Thus, the efficiency of the banking sector is very country-specific, with different trends in developed and developing markets and major differences in emerging economies, especially in BRICS countries. It is important to take into consideration the historical past that framed the existing banking sectors in these countries when doing the analysis.

Ownership structure and bank performance have also been thoroughly researched in individual countries. Das et al. (2005) focused on Indian banks, Figueira et al. (2006) on African banks, Kiruri (2013) on Kenyan banks, Nora Azureen Abdul Rahman & Anis Farida Md Reja (2015) on Malaysian banks, Nguyen Hong Son et al. (2015) and Malik et al. (2015) on Vietnamese banks, Ekanayake & Premerathne (2016) on Sri Lankan banks, etc. BRICS banks and those of BRICS member states have not been sufficiently researched.

The stability of a banking system has always been of paramount importance and has been at the top of policymakers' agenda across the developed and developing countries, especially following all the recent financial crises (IMF, 2007). The definition of a banking system’s stability is provided in the next chapter, but it is worth mentioning that a stable system is one that contains banks with high capital adequacy ratios in accordance with Basel Committee regulations, low default, and liquidity risks.

Siddika A. et al. (2019) examined the relationship of change in capital, ownership, and regulations across banks in 52 countries. This study showed that capital adequacy plays a vital role in the stability of banking systems, and there is an inverted relationship between capital and insolvency risk. Moreover, the ownership turned out to have little significance, most probably due to a very large sample of banks (over 500 banks were examined). Many of the banks originate from developed countries and thus could be better managed.

The lending behavior is also an important factor in the discussion on bank stability. It was found that banks listed on the stock exchange in India tend to provide more credit (Bhaumik S.K., 2008). More credit ultimately leads

to a discussion on efficient allocation of capital, credit appraisal, and project selection. In some cases, the abundance of financial resources could lead to misallocation of funds or simple failure to make proper due diligence on the borrowers. Lending behavior could also be examined in close relation to the ownership structure. Ferri et al. (2014) made their own classification dividing the banks into two groups: shareholder banks (those institutions that have profit-making as their primary goal, thus in our case, private banks) and stakeholder banks (those institutions that have a broader mandate and that have many stakeholders, in our case – government-owned banks). Similar to the findings of Coleman et al. (2015) and Brei et al. (2014), Ferri et al. (2014) discovered that stakeholder banks tend to focus on long-term lending relationships with their borrowers/clients and thus play a more counter-cyclical, anti-crisis and stabilizing function.

The question about the connection between bank stability and bank ownership types is fundamental in its nature. It is an important question for researchers and policymakers alike who care about the stability of the overall banking system (Beck et al., 2009). Extensive research has thus been done in recent years exploring the relationship between bank ownership and banking stability. Beck et al. (2009) researched bank ownership and bank stability in Germany, concluding that cooperative banks are the most stable financial institutions in Germany, as measured by the Z-score, followed by government-owned savings banks and privately-owned banks. Garcia Marco & Robles Fernández (2008) analyzed the determinants of risk-taking, which relates directly to stability, in the Spanish commercial and savings banks with special emphasis on the ownership structure and bank size. Their results revealed that both ownership and size are determinants of risk-taking behavior. Claessens & van Horen (2012) wondered whether foreign banks performed better than domestics ones in a large number of countries between 1999 and 2006. They found that foreign banks tend to perform better when coming from a high-income country but worse when coming from a developing country. Additionally, they discovered that foreign banks tend to outperform domestic banks when competitiveness in the host country is limited. In general, the distinction between foreign and domestic banks and their performance has been thoroughly analyzed (see, among others, DeYoung & Nolle, 1996; Mahajan et al., 1996; Sturm & Williams, 2004; Grigorian & Manole, 2006; Berger et al., 2009 and many others).

2.3 Literature gap overview

The review of the existing literature has revealed that the relationship between bank ownership and banking efficiency has been researched but not extensively. Government ownership, as opposed to any other type of ownership, offers a unique perspective that has not been widely analyzed. Additionally, the BRICS region has hardly been the focus of the existing research.

The relationship between bank ownership and banking stability has generally been scarce. Foreign ownership, as opposed to the domestic one, has been analyzed from different angles, yet government ownership has barely been the research focus. In this instance as well, the BRICS region has been generally overlooked.

As a result, the interplay between government bank ownership, banking stability, financial efficiency, and the BRICS region offers a unique research angle and thus represents a clear literature gap.

Chapter 3. Theoretical framework

This chapter firstly presents how banking stability and efficiency (i.e., the two dependent variables) are to be quantified in this study, which will then be followed by an overview of the main determinants of both that will be used as independent and control variables. An overview of the variables is also presented in Appendix 1.

Based on the information gathered thus far and discussed above in the literature review, the following broad statement will be tested in this study.

***Statement**: Government ownership makes banks in the BRICS countries less stable and less efficient when compared with private ownership.*

3.1 Quantifying banking stability

It can be considered that the financial system is stable when individual financial institutions that form part of the system are stable at the bank level. Such stability stems from careful and well-established governance as well as regulation of the banking system. The global financial crisis of 2008 showed flaws in the existing at that time set of Basel regulations. It turned out that some leaders of the international financial system, like Leman Brothers and Bear Sterns, had excessive exposure to a certain class of derivatives and insufficient capital. As a result of a financial shock caused by the credit crunch in the housing market of the US, many highly esteemed banks and insurance companies went bankrupt. Each bankruptcy worsened the situation in financial markets and required a swift and decisive response from the reserve banks, especially the Federal Reserve System. It became evident post-crisis that the stability of each individual bank is of paramount importance, and enhanced regulation should be adopted. This resulted in the introduction of Basel III regulations introducing enhanced minimum capital and liquidity requirements together with other measures.

For the purposes of this research, we are focusing on the stability of individual banks that are strategically important for the financial systems of BRICS countries. As was discussed in the literature review, a Z-score is a convenient metric for measuring the stability of financial institutions. According to Laeven and Levine (2009, p. 262), "the Z-score measure the distance from insolvency", which is defined by the same authors as “a state in which losses surmount equity”. Essentially this means that the higher is the Z-score of an individual bank, the lower is its probability of insolvency. As was presented before in the literature review, the following formula is used to quantify the Z-score:

$$Z\ score_{i,j,t} = \frac{ROA_{i,j,t} + \frac{Equity_{i,j,t}}{Total\ Assets_{i,j,t}}}{\sigma_{ROA_{i,j,t}}}, \quad (1)$$

where ROA is the return on assets of a bank i from country j in the year t and σ_{ROA} is a standard deviation of ROA. Since Z-score is highly skewed, the natural logarithm of it is often used, which is normally distributed (Fernández, 2016; Ozili, 2018). Similar to Schaeck & Cihák (2014), a three-consecutive-year rolling window has been used to calculate σ_{ROA} in this study.

Despite its popularity and relative ease of use, Z-score has a number of limitations that need to be considered when reviewing the results of this study. Firstly, and perhaps most importantly, the Z-score is based purely on accounting data. Accounting data is always a subject of management's assumptions and very often manipulations. To tackle that problem, some of the largest banks of the BRICS countries that undergo rigorous checks and audits have been selected to be analyzed in this research. Additionally, the Z-score looks at each bank separately, potentially overlooking the risk that a default in one financial institution may lead to a multiplier effect in the whole banking system.

In spite of all the limitations, the Z-score still remains the best estimate of a bank's stability and is thus to be used in this study as a dependent variable. Because of the skewness, a logarithm of Z-score is to be used, yet for brevity, the variable will be labeled Z-score.

3.2 Quantifying banking efficiency

The most common ways to quantify the efficiency of banks have been presented in the literature review. For the purposes of this research, banking efficiency is quantified using a set of financial and economic ratios that assess bank performance. For the purposes of this research, banking efficiency will be measured using the metric of Credit losses which is defined as the ratio of non-performing loans (NPLs) divided by gross loans (please see Appendix 1 for definitions and sources). According to Toader et al. (2018, p 597), "the quality of bank loans plays an essential role in the overall bank soundness since one of the core activities of banking institutions is to make loans, even though its importance has been gradually decreasing over the past decades".

3.3 Quantifying bank ownership

As per the literature gap overview, an interaction between banks' stability/efficiency and bank ownership in the BRICS countries has been overlooked by the research community and is the focus of this research paper. As a result, the independent variable to be analyzed is the bank's ownership. This study will primarily focus on government ownership as opposed to any other type of ownership, most importantly the private one. The dependent variable will thus be of a binary nature, taking the value of 1 for BRICS government ownership and 0 for any other type of ownership. It is important to note that ownership is not static and may change over the years. Thus, ownership of the considered banks will be reviewed over the years of interest of this research.

3.4 Overview of control variables

It is obvious that such notions as financial stability and banking efficiency are quite sophisticated and multifaceted, and there are many factors that impact them. Bank ownership is only one such factor. In order to make the used model robust, it is thus important to account for other factors that impact the banking stability / efficiency as well. The following is an overview of the control variables that are to be used in the model of this research in order to control for bank- and country-specific characteristics. As per Schaeck & Cihák (2014), all such explanatory control variables are lagged by one period unless stated otherwise.

The following control variables have been selected[4]:

1) Bank size, which is measured as the logarithm of the bank's total assets.
2) Asset quality – a ratio of loan loss provision to total assets.
3) Investment strategy – a ratio of loans to total assets.
4) Capital structure – a ratio of equity to total assets.
5) Funding structure – a ratio of deposits to total assets.

These variables will allow to control for size, balance sheet structure, and risk appetite of different banks.

Prior studies also suggest that country-level factors need to be controlled for when analyzing banking stability. As in Schaeck & Cihák (2014) and Toader et al. (2018), the following country-level control variables will be used: (1) *Financial intermediation level* calculated as % of GDP to control for the effect of the market structure; (2) *Return on Assets (ROA)* of the whole banking market; (3) *Bank concentration* as a proxy for competition; (4, 5) *GDP growth* and *Inflation* will adjust the regressions for the macroeconomic environment.

3.5 Hypotheses

As seen in the literature review, different aspects of BRICS integration in and influence on the global economy have been researched, together with the internal challenges of each member state. At the same time, significant research was done on different aspects of banking efficiency, stability, profitability, regulation, etc., in countries outside BRICS. Yet little research was done on the efficiency of BRICS banking systems. This research will make an attempt to evaluate the effects of the ownership structure of the key banks in BRICS countries on the stability of the national banking systems and the efficiency of individual banks. Based on the information discussed thus far, the following hypotheses will be considered:

H_1: There is a negative relationship between government ownership and the financial stability of banks in BRICS countries.

H_2: There is a negative relationship between government ownership and banking efficiency in BRICS countries.

[4] For a full list of definitions and sources of definitions, please see "Appendix 1: Overview of variables."

Chapter 4. Research design and Data set

The objective of this study is to contribute to the development of theory on bank ownership, banking efficiency, and banking stability in BRICS countries. In light of this, the chapter presents the set of banks to be analyzed, explains how the variables will be quantified, identifies the nature of the study, and analyzes if the results will be valid, reliable, and generalizable.

4.1 Research domain

The goal of this research is to analyze banking stability and efficiency in the BRICS countries. For the data to be appropriate, only large systemically important commercial banks of the BRICS countries, leaders of the local banking sector, are to be analyzed. Central banks, pure investment banks, development financial institutions, postal banks, mutual banks, subsidiaries of foreign banks, representative offices, etc., have not been looked at since they perform very specific roles according to their mandates. The influence of their actions (even if they are part of a credit provision process in the country), their corporate governance, and the mechanics of their internal decision-making process are considered to be different from the commercial lenders to such an extent that it makes them incomparable. The national development banks are also excluded from the analysis even though they are major long-term capital providers to nationally important projects that have a social-economic impact (Myrdal, 1968). They are excluded since they are usually government-controlled, government-funded, and can be considered a part of national treasuries. Their assets-liabilities management and risk management processes are of other nature as opposed to commercial banks. To a significant extent, they can rely on equity injections from the federal budget, especially during economic shocks. This makes them "stable" no matter how dire their financial situation is.

The final sample of banks to be analyzed was selected based on the bank size relative to the total assets of a relevant banking system, the number of branches, and systemic importance. It is assumed that chosen banks are “too big to fail” and in case of financial problems and shortages of capital, they would most probably be bailed out by the government to avoid detrimental effects on the economy. Thus, it could be assumed that because of their magnitude, in case of financial distress, they all have a fair chance of capital injections. This point is made to emphasize the systemic importance of the considered banks.

The final banking sample consists of 6 banks from 5 BRICS countries (i.e., 30 banks in total) that cover at least 50% of the banking sector of the relevant BRICS country based on total assets. All these banks prepare annual financial statements (AFS) under International Financial Reporting Standards (IFRS), which ensures the quality of the presented accounting data.

The following is the full list of banks being analyzed in this research. Further details on each bank, its ownership, and its main activities are presented in Appendix 2.

Table 1. Selected Commercial Banks

Brazil	Ownership	
Itaú Unibanco	2011 - 2017	Private
Banco do Brasil	2011 2021 - 2017	Private Government
Caixa Econômica Federal	2011 - 2017	Government
Banco Bradesco	2011 - 2017	Private
Banco Votorantim	2011 - 2017	Private
Banco Santander	2011 - 2017	Private

China	Ownership	
China Construction Bank Corp	2011 - 2017	Government
Industrial and Commercial Bank of China (ICBC)	2011 - 2017	Government
Agricultural Bank of China	2021 - 2017	Government
Bank of China	2011 - 2017	Government
Bank of Communications	2011 - 2017	Private
Postal Savings Bank of China Co	2011 - 2017	Government

India	Ownership	
State Bank of India	2011 - 2017	Government
Bank of Baroda	2011 - 2017	Government
ICICI Bank	2011 - 2017	Private
Punjab National Bank	2011 - 2017	Government
Bank of India	2011 - 2017	Government
HDFC Bank	2011 - 2017	Private

South Africa	Ownership	
Standard Bank Group	2011 - 2017	Private
FirstRand Group	2011 - 2017	Private
Absa Bank	2011 - 2017	Private
Nedbank	2011 - 2017	Private
Investec	2011 - 2017	Private
Capitec Bank	2011 - 2017	Private

Russia	Ownership	
Sberbank	2011 - 2017	Government
VTB	2011 - 2017	Government
Gazprombank	2011 - 2013 2014 - 2017	Government Private
Alfa Bank	2011 - 2017	Private
Raiffeisenbank	2011 - 2017	Private
Bank Otkritie FC	2011 - 2016 2017	Private Government

For the purposes of this research, it is important to define government ownership as this is the focus of the study. BRICS government ownership should be assumed if 50% of bank shares are owned either by the government of any of the BRICS countries itself or by BRICS-government-owned entities. As was previously mentioned, this variable is binary in nature, taking the value of 1 for BRICS government ownership and 0 for any other type of ownership. For brevity, any other type of ownership will be labeled 'private' for the purposes of this research. Since ownership is not static and may change, it has been reviewed over the years of interest for each of the considered banks.

As was mentioned before, this research focuses on the period from 2011 to 2017 (i.e., seven years in total). The dates were selected based on the availability of data. When this research was carried out, World Bank data was available only until 2017, which limited the research time range.

4.2 Operationalization of constructs and Data sources

Since there are two dependent variables being analyzed, two separate models are to be prepared and used – one testing a linear relationship between the stability of banks (i.e., a Z-score) and bank ownership (i.e., the independent variable) and another one testing a linear relationship between banking efficiency (i.e., Credit losses) and bank ownership. In order to specify the model better, a set of control variables will be used in both models. An overview of the control variables was presented in Chapter 2.

For the purposes of this analysis, all data were collected from 3 reliable, independent sources, i.e., Bloomberg Terminal, World Bank, and International Monetary Fund (IMF). This study was purposefully limited to just these sources to ensure homogeneity and comparability of data. All bank-related data were thus collected from Bloomberg Terminal and Financial Statements, banking-sector-related data were collected from World Bank's Global Financial Development Database (GFDD), and all macro-related data were collected from IMF's Economic Outlook Database. Sources of data for each of the variables are presented in Appendix 1.

4.3 Nature of the study

In order to test the hypotheses, a quantitative study is to be conducted. As has already been mentioned, this research will analyze the performance of systematically important banks in each BRICS country from 2011 to 2017. Since the required data have been gathered on an annual basis for each entity, a panel data study needs to be conducted (Sekaran, 2003; Brooks, 2014). Due to data availability, the resulting sample panel is unbalanced in nature, with some cross-sectional elements having fewer observations (Brooks, 2014).

Having established that a panel data study needs to be performed, it is then essential to decide whether a fixed effects or a random effects model needs to be used. To confirm that, a Hausman test was performed to test whether the independent coefficient (or random effect) is correlated with the independent variable. Since, as has already been mentioned, two separate models will need to be prepared to test the hypotheses, i.e., a Stability model and an Efficiency model, a Hausman test needs to be done for each of these models. Below are the results of the Hausman test for the Stability model.

Correlated Random Effects - Hausman Test
Equation: Stability model
Test cross-section random effects

Test Summary	Chi-Sq. Statistic	Chi-Sq. d.f.	Prob.
Cross-section random	24.453248	12	0.0176

The p-value of 0.0176 implies that the H_0 of the Hausman test can be rejected at a 5% significance level, indicating that a fixed effects model is appropriate and is to be preferred. Analysis of the existing literature, e.g., Schaeck & Cihák (2014) and Toader et al. (2018), revealed that similar research also used a fixed effects model, which confirms that a fixed effects model is the most appropriate.

The results of the Hausman test for the Efficiency model indicate a p-value of 0.0089, which implies that the H_0 of the Hausman test can be rejected at a 5% significance level, indicating that a fixed effects model is appropriate and is to be preferred for the Efficiency model as well.

Correlated Random Effects - Hausman Test
Equation: Efficiency model
Test cross-section random effects

Test Summary	Chi-Sq. Statistic	Chi-Sq. d.f.	Prob.
Cross-section random	26.582241	12	0.0089

4.4 Validity, Reliability and Generalizability

In order to enhance the quality and to ensure the usefulness of the research, the 'goodness' of the measures needs to be assessed (Sekaran, 2003). To do so, it is necessary to address such concepts as validity, which is "achieved when scores can be considered to capture meaningfully the ideas contained in the corresponding concept" (Dul & Hak, 2008, p. 260), and reliability, "an estimate of the precision of the score obtained by a measurement" (Dul & Hak, 2008, p. 262).

The concept of reliability has been addressed when choosing specific variables for the research and their data sources. All the data was collected from reliable sources (i.e., trustworthy institutions and databases) and thus can be considered highly reliable, stable, and consistent. The quality of the accounting data, which forms the basis of this research, has been ensured by carefully choosing only large, systemically important commercial banks of the BRICS countries that are leaders of their local banking sector.

Sekaran (2003) mentions that validity can be assessed using several types of tests. The most widely used are content validity (which “establishes the representative sampling of a whole set of items that measures a concept, and reflects how well the dimensions and elements thereof are delineated” [Sekaran, 2003, p. 415]), criterion-related validity (“that which is established when the measure differentiates individuals on a criterion that is expected to predict” [Sekaran, 2003, p. 416]), and construct validity (which “testifies to how well the results obtained from the use of the measure fit the theories around which the test was designed” [Sekaran, 2003, p. 415]). Based on the literature review and the theoretical framework, content and criterion-related validities have been accounted for since the measures have previously been used in other studies. Construct validity is also secured as the measurements used have been suggested by renowned researchers within the field.

Considering that the research is exclusively based on the commercial banking sector, the strength of the external validity and generalizability might be questionable. Despite that, the findings can still be generalized within the commercial banking sector of the BRICS countries. In order to be able to draw conclusions from other countries and other types of financial institutions, further research is required.

Chapter 5. Descriptive analysis

The final sample set of banks that was analyzed in this research was presented in table 1 in Chapter 3. Z-score for each bank was calculated using its accounting data, with σ_{ROA} being calculated using a three-consecutive-year rolling window. Finally, the natural logarithm of the Z-score was taken to tackle the skewness issue. Efficiency in the form of *Credit losses* was quantified using accounting data as a ratio of NPLs to Total Loans. Log difference was then taken to tackle the non-stationarity problem.

Bank ownership was assessed based on the data available in Bloomberg Terminal and was coded as a dummy variable taking the value of 1 for BRICS government ownership and 0 for any other type of ownership. Furthermore, as part of the model, ten control variables were used to control for bank-, banking sector- and country-level factors and characteristics. Log difference was then taken from a number of them to tackle the non-stationarity problem.

The following tables show the descriptive statistics of the variables for the stability and the efficiency data sets, where OWN is for ownership, BSIZE for bank size, AQUAL for asset quality, CSTRUC for capital structure, FSTRUC for funding structure, ISTRAT for investment strategy, FINTER for financial intermediation, BCONC for bank concentration, CBROA for country banking ROA, GDPGR for GDP growth, and INFL for inflation.

Table 2. Descriptive Statistics

	Z_SCORE	CREDIT_LOSSES	OWN	BSIZE	AQUAL	CSTRUC	FSTRUC	ISTRAT	FINTER	BCONC	CBROA	GDPGR	INFL
Mean	2.21	4.17	0.45	5.30	2.21	8.56	60.5	57.3	90.3	51.3	0.99	4.27	6.21
Median	2.29	3.50	0.00	5.15	1.59	8.02	62.7	58.8	62.5	47.6	1.00	4.50	5.80
Maximum	6.30	17.57	1.00	6.54	10.02	23.90	93.40	79.95	157.60	79.20	1.60	10.60	15.50
Minimum	-3.43	0.00	0.00	3.09	0.00	2.53	3.82	26.8	41.6	26.9	0.10	-2.00	1.40
Std. Dev.	1.17	3.40	0.50	0.70	1.72	3.45	18.19	11.69	44.42	19.54	0.31	3.38	2.85
Skewness	-0.60	1.62	0.21	-0.24	1.87	2.10	-0.77	-0.42	0.39	0.15	-0.81	-0.00	0.87
Kurtosis	6.26	5.83	1.05	3.07	6.71	8.85	3.28	2.41	1.28	1.38	4.07	2.04	4.59
Jarque-Bera	99.95	152.90	33.18	2.03	230.69	429.65	20.41	8.61	29.53	22.49	31.51	7.62	45.86
Probability	0.00	0.00	0.00	0.36	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.02	0.00
Sum	440.76	829.50	89.00	1,054.69	438.87	1,702.63	12,043.42	11,397.98	17,967.90	10,207.40	197.70	850.40	1,236.70
Sum Sq. Dev.	271.86	2,295.10	49.20	97.26	583.22	2,351.77	65,503.47	27,058.44	390,758.78	75,607.72	19.10	2,256.69	1,605.21
Observations	199	199	199	199	199	199	199	199	199	199	199	199	199

According to the descriptive statistics, the only normally distributed variable is *BSIZE* (its skewness being close to 0, kurtosis being close to 3, and Jarque-Bera statistic's probability being above 0.05). All other variables mirror normal distribution, yet they are positively or negatively skewed.

5.1 Multicollinearity analysis

Multicollinearity occurs when a perfect linear relationship exists between two variables in a given model. In order to check for multicollinearity, pair-wise correlations between all the variables in the two models were calculated and are presented in table 3. The analysis revealed that several correlations are significant, i.e., above 0.4. Despite that, none of the values is above the threshold limit of 0.7, and therefore the observed multicollinearity should not pose a problem in the data analysis.

Table 3. Pair-Wise Correlation Matrix

Correlation Probability	Z_SCORE	CREDIT_ LOSSES	OWN	BSIZE	AQUAL	CSTRUC	FSTRUC	ISTRAT	FINTER	BCONC	CBROA	GDPGR	INFL
Z_SCORE	1.00												

CREDIT_	-0.43	1.00											
LOSSES	0.00	-----											
OWN	-0.07	0.04	1.00										
	0.34	0.58	-----										
BSIZE	0.24	-0.12	0.48	1.00									
	0.00	0.08	0.00	-----									
AQUAL	-0.29	0.42	-0.10	-0.38	1.00								
	0.00	0.00	0.18	0.00	-----								
CSTRUC	-0.03	0.11	-0.43	-0.64	0.64	1.00							
	0.70	0.12	0.00	0.00	0.00	-----							
FSTRUC	0.21	-0.32	0.43	0.23	-0.26	-0.20	1.00						
	0.00	0.00	0.00	0.00	0.00	0.00	-----						
ISTRAT	-0.21	0.16	0.05	-0.38	0.36	0.39	0.36	1.00					
	0.00	0.03	0.50	0.00	0.00	0.00	0.00	-----					
FINTER	0.50	-0.37	-0.13	0.19	-0.21	0.03	0.25	-0.14	1.00				
	0.00	0.00	0.06	0.01	0.00	0.68	0.00	0.05	-----				
BCONC	0.35	-0.05	-0.41	-0.05	-0.00	0.07	-0.35	-0.25	0.60	1.00			
	0.00	0.51	0.00	0.53	0.95	0.30	0.00	0.00	0.00	-----			
CBROA	0.21	-0.16	-0.03	0.22	-0.24	-0.09	-0.14	-0.25	0.19	0.16	1.00		
	0.00	0.02	0.67	0.00	0.00	0.21	0.05	0.00	0.01	0.02	-----		
GDPGR	0.22	-0.33	0.43	0.39	-0.43	-0.32	0.56	-0.09	0.06	-0.47	0.07	1.00	
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.20	0.44	0.00	0.30	-----	
INFL	-0.33	0.24	-0.11	-0.44	0.26	0.11	-0.23	0.21	-0.60	-0.19	-0.32	-0.41	1.00
	0.00	0.00	0.13	0.00	0.00	0.13	0.00	0.00	0.00	0.01	0.00	0.00	-----

Note: *OWN is for ownership, BSIZE for bank size, AQUAL for asset quality, CSTRUC for capital structure, FSTRUC for funding structure, ISTRAT for investment strategy, FINTER for financial intermediation, BCONC for bank concentration, CBROA for country banking ROA, GDPGR for GDP growth, and INFL for inflation.*

5.2 Analysis of outliers

In this section, an analysis of each variable is carried out. An important thing to consider here is the omission of outliers. Some outliers have a considerable influence on the data being analyzed. The omission of certain observations is necessary in order to perform a reliable analysis. It is, therefore, necessary to show the graphs of the variables before and after the deletion of outliers.

Stability (Z-score)

Graph 1 in Appendix 3 presents a stability *Z-score* histogram that reports the dispersion of the year-to-year *Z-score* for the sampled 30 commercial banks. *Z-score* turned out to be highly skewed, as a result of which a natural logarithm of it is being used. The resulting observations range between (-3.43) and 6.30, with a mean for the entire sample being 2.21. The histogram reveals that there are no extreme outliers, the omission of which might lead to substantial improvements.

Efficiency (Credit losses)

Graph 2 in Appendix 3 presents a histogram that reports the dispersion of the year-to-year *Credit losses* for the sampled 30 commercial banks. Since *Credit losses* are measured in percentage terms as a ratio of NPLs to Total Loans, the variable is skewed. The observations range between 0 and 17.6, with a mean for the entire sample being 4.1. The histogram reveals that there are no extreme outliers, the omission of which might lead to substantial improvements.

Bank-level control variables

Graph 3 in Appendix 3 presents histograms for the five bank-level control variables used in the regression models, i.e., *Bank size*, *Investment strategy*, *Asset quality*, *Capital structure*, and *Funding structure*. *Bank size*, being calculated as a logarithm of Total assets, appears normally distributed with no outliers being identified. *Investment strategy*, *Asset quality*, *Capital structure*, and *Funding structure* are calculated as ratios to Total assets, which leads to them being skewed. Since the normal distribution of explanatory variables is not required, these variables were left in their original form. Graphs indicate that there might be extreme outliers, the omission of which might lead to substantial improvements. Further analysis revealed no such improvements. Thus no outlier was omitted.

Banking sector control variables

Graph 4 in Appendix 3 presents histograms for the three banking sector control variables used in the regression models, i.e., *Financial intermediation level*, *Country banking ROA* and *Bank concentration*. Graphs and further analysis reveal no outliers worth omitting.

Macro-level control variables

Graph 5 in Appendix 3 presents histograms for the three macro-level control variables used in the models, i.e., *GDP growth* and *Inflation*. Graphs indicate that there might be extreme outliers, the omission of which might lead to substantial improvements. Further analysis revealed no such improvements. Thus no outlier was omitted.

Chapter 6. Empirical results

As has already been mentioned, in order to test the hypotheses laid out in Chapter 2, two separate regression analyses are to be done – a Stability and an Efficiency one. Based on the Hausman test, it was established that models for both of them will take the form of a fixed effects regression model.

The goal of this chapter is then to present the results of the regression analysis together with the assessment of the hypotheses. This chapter will, however, start with a unit root (stationarity) test.

6.1 Stationarity test

Unit root test was performed in order to ensure that the selected variables were stationary. The stationarity of variables is important as it ensures that a variable is time-invariant and that its mean and variance are constant over time. As non-stationary variables cannot be used in a regression analysis, the unit root test is paramount when ensuring the validity of the regression analysis. According to the results presented in Table 4, the following variables were found stationary and thus can be used in further analysis in their level form: Bank size (BSIZE), Asset quality (AQUAL), Capital structure (CSTRUC), Investment strategy (ISTRAT) and GDP growth (GDPGR). Other variables, i.e., Funding structure (FSTRUC), Financial intermediation (FINTER), Bank concentration (BCONC), Country bank ROA (CBROA), and Inflation (INFL) were found non-stationary in their level form, and thus the ^{first} difference of these variables needs to be taken to ensure stationarity.

Table 4. Unit Root Test Results

Variable	Chi-Sq Statistic	Prob.
BSIZE	113.00	0.00***
AQUAL	95.82	0.00***
CSTRUC	96.94	0.00***
D(FSTRUC)	91.52	0.00***
ISTRAT	94.41	0.00***
D(FINTER)	87.77	0.00***
D(BCONC)	144.42	0.00***
D(CBROA)	74.11	0.04**
GDPGR	94.19	0.00***
D(INFL)	137.91	0.00***

6.2 Stability regression analysis

A linear regression test was conducted using the panel random effects type of model, during which the relationship between the dependent variable Z-score, the independent variable Bank ownership, and ten control variables for each of the years from 2011 to 2017 was analyzed. In total, six models were prepared to test the relationship.

- Model 1 assesses the relationship between the dependent and independent variables in the presence of bank-level controls only, i.e., Bank size, Asset quality, Capital structure, Funding structure, and Investment strategy. This model specification and the same control variables were previously used by Toader et al. (2018) and Schaeck & Cihak (2014).
- Model 2 then widens the set of control variables to include banking sector controls, i.e., Financial intermediation, Bank concentration, and Country banking ROA. This model specification and the same control variables were previously used by Toader et al. (2018) and Schaeck & Cihak (2014).
- Models 3-4 further widen the set of control variables to also include macro-level controls, i.e., GDP growth and Inflation. Model 3 then controls for cross-sectional fixed effects, whereas model 4 for cross-sectional and period fixed effects.
- Models 5-6 add a 1-period lag of the Z-score to the analysis.

As a result, a full regression equation to be tested is the following, which is in line with the approach used by Toader et al. (2018) and Schaeck & Cihak (2014):

$$\boldsymbol{Z\ score_{i,j,t}} = \boldsymbol{\alpha} + \boldsymbol{\beta_1} \times \boldsymbol{Ownership_{i,j,t}} + \boldsymbol{\beta_2} \times \boldsymbol{BC_{i,j,t}} + \boldsymbol{\beta_3} \times \boldsymbol{BS_{i,j,t}} + \boldsymbol{\beta_4} \times \boldsymbol{MC_{i,j,t}} + \boldsymbol{\varepsilon_{i,j,t}} \quad (2)$$

where:

- $Z\ score_{i,j,t}$ is a Z-score for bank i from country j in the year t risk, the dependent variable.
- $Ownership_{i,j,t}$ is a bank ownership variable, where 1 represents government ownership, and 0 represents private. This is the independent variable.
- $BC_{i,j,t}$ represents a vector of yearly bank-level controls, i.e., Bank size, Investment strategy, Asset quality, Capital structure, and Funding structure.
- $BS_{i,j,t}$ represents a vector of yearly banking sector controls, i.e., Financial intermediation, Country banking ROA and Bank concentration.
- $MC_{i,j,t}$ represents a vector of yearly macro-level controls, i.e., GDP growth and Inflation.
- $\varepsilon_{i,j,t}$ – error term.

An overview of the outputs of the stability regression analysis is presented in table 5. Detailed results of each Stability model are presented in Appendix 4.

Table 5. Stability Regression Analysis

Dependent: Z-Score	**Model 1**	**Model 2**	**Model 3**	**Model 4**	**Model 5**	**Model 6**
Method	Panel FE	Panel FE	Panel FE	Panel FE	Panel FE	Panel FE
Cross-Section Fixed Effect	Yes	Yes	Yes	Yes	Yes	Yes
Time Fixed Effect	Yes	Yes	No	Yes	Yes	Yes
Adjusted R-square	0.5500	0.5755	0.5573	0.5771	0.5302	0.5986
Number of Banks	30	30	30	30	30	30
Number of Observations	169	169	169	169	169	169
Ownership (OWN)	**1.3543***	**1.1663**	**1.3212***	**1.4710***	**1.1660**	**1.2683***
	(1.7505)	(1.5467)	(1.6803)	(1.8837)	(1.5485)	(1.6592)
Z-Score (-1)					0.2541***	0.2408***
					(3.0357)	(2.7510)
Bank Size (BSIZE)	-4.6152***	-3.7254***	-3.6403***	-3.1790**		-3.0184**
	(-4.2627)	(-3.3152)	(-3.2891)	(-2.5701)		(-2.5016)
Asset Quality (AQUAL)	-0.0965	-0.1088	-0.1725	-0.0542		0.0423
	(-0.7574)	(-0.8724)	(-1.4088)	(-0.4184)		(0.3228)
Capital Structure (CSTRUC)	0.1011	0.0601	0.0118	0.0620		0.0613
	(1.2339)	(0.6678)	(0.1337)	(0.6839)		(0.6942)
D (Financial Structure [FSTRUC])	-0.0037	-0.0011	0.0001	-0.0019		-0.0011
	(-0.2772)	(-0.0804)	(0.0082)	(-0.1418)		(-0.0846)
Investment Strategy (ISTRAT)	-0.0186	-0.0159	-0.0086	-0.0147		-0.0194
	(-0.9369)	(-0.8169)	(-0.4450)	(-0.7507)		(-1.0083)
D (Financial Intermediation [FINTER])		-0.0257	0.0017	-0.0205		-0.0103
		(-1.1822)	(0.0916)	(-0.9255)		(-0.4709)
D (Bank Concentration [BCONC])		0.0240**	0.0235**	0.0243**		0.0301***
		(2.3247)	(2.4893)	(2.3409)		(2.9184)
D (Country Banking ROA [CBROA])		0.5346**	0.4538*	0.4033		0.2916
		(2.2351)	(1.7914)	(1.5581)		(1.1415)
GDP Growth (GDPGR)			-0.0089	-0.0793		-0.0787
			(-0.2095)	(-1.2507)		(-1.2727)
D (Inflation [INFL])			-0.0526*	-0.0466		-0.0459
			(-1.6831)	(-1.3378)		(-1.3536)

Note: *** is for a 1% significance, ** is for a 5% significance, and * is for a 10% significance.

The regression analysis identified a number of significant relationships in the Stability regression models. First and foremost, the relationship with the independent variable Ownership was found significant in the majority of models at a 10% significance level with a positive coefficient. This implies that BRICS government ownership has a positive impact on a bank's Z-score and thus its stability. Additionally, a relationship with the following control variables was also found significant across the different models (please refer to Appendix 1 for a full list of definitions and their sources):

- *Bank size (BSIZE)* with a negative coefficient, implying that the larger the bank, the less stable it is.
- *Bank concentration* with a positive coefficient, implying that the higher the assets of the three largest commercial banks, the higher the stability.
- *Country Banking ROA* with a positive coefficient, implying that the larger the average commercial bank's net income to yearly averaged total assets, the higher the stability.
- *Inflation* with a negative coefficient implies that the higher the inflation, the lower the stability.

The results of models 5 and 6 indicate that there is also a strong positive relationship between Z-score and its lag, implying that previous period stability positively impacts current period stability.

The goodness of the model fit

To assess whether the regression models are able to accurately predict the variation of the dependent variable as a result of changes in the independent variables, the goodness-of-fit of the regression model needs to be assessed.

According to DeFucso et al. (2022, p. 83), "the F-statistic measures how well the regression equation explains the variation in the dependent variable". The significance of the *F* statistic can be assessed through the p-value, which needs to be below 0.05 for a 5% significance level. As can be seen in the outputs of the regression analysis in Appendix 4, the p-value of the F-statistic of the proposed Stability models equals 0.00. Consequently, all of the models analyzed capture a significant fraction of the variation in the dependent variable.

The explanatory power is another method used to measure the validity and goodness of fit of a regression model. The explanatory power model uses the value of R-square, called the coefficient of determination, adjusted for degrees of freedom. The closer the value is to 1, the better the regression model fits the data. The adjusted R-square of the proposed Stability regression models varies between 0.5302 and 0.5986. Thus, more than 50% of the variation in the dependent variable is explained by the variation in the control variables.

Autocorrelation

Autocorrelation (or serial correlation) refers to the degree of correlation of the same variables between two successive time intervals. Durbin-Watson statistic is a common measure of it, which takes the value between 0 and 4, with the value of 2 indicating an absence of autocorrelation.

According to the outputs presented in Appendix 4, the Durbin Watson statistic for all of the Stability models is close to 2. As a result, it is assumed that there is no autocorrelation in the Stability models.

Heteroskedasticity

Heteroskedasticity implies that the variance of the error terms differs across observations and is thus not constant. It is a common problem in a cross-sectional analysis. Yet, in the panel data, it is not a big issue and is thus often ignored in the empirical analysis.

6.3 Efficiency regression analysis

A linear regression test was conducted using the panel random effects type of model, during which the relationship between the dependent variable Credit losses, the independent variable Bank ownership, and ten control variables for each of the years from 2011 to 2017 were analyzed. In total, six models were prepared to test the relationship.

- Model 1 assesses the relationship between the dependent and independent variables in the presence of bank-level controls only, i.e., Bank size, Asset quality, Capital structure, Funding structure, and Investment strategy. This model specification and the same control variables were previously used by Toader et al. (2018) and Schaeck & Cihak (2014).
- Model 2 then widens the set of control variables to include banking sector controls, i.e., Financial intermediation, Bank concentration, and Country banking ROA. This model specification and the same control variables were previously used by Toader et al. (2018) and Schaeck & Cihak (2014).
- Models 3-4 further widen the set of control variables to also include macro-level controls, i.e., GDP growth and Inflation. Model 3 then controls for cross-sectional fixed effects, whereas model 4 for cross-sectional and period fixed effects.
- Models 5-6 add a 1-period lag of the Credit losses to the analysis.

As a result, a full regression equation to be tested is the following, which is in line with the approach used by Toader et al. (2018) and Schaeck & Cihak (2014):

$$\boldsymbol{Credit\ losses_{i,j,t} = \alpha + \beta_1 \times Ownership_{i,j,t} + \beta_2 \times BC_{i,j,t} + \beta_3 \times BS_{i,j,t} + \beta_4 \times MC_{i,j,t} + \varepsilon_{i,j,t}} \quad (3)$$

where:

- $Credit\ losses_{i,j,t}$ are credit losses (i.e., NPLs / Total loans) for bank i from country j in the year t risk, the dependent variable.
- $Ownership_{i,j,t}$ is a bank ownership variable, where 1 represents government ownership, and 0 represents private. This is the independent variable.
- $BC_{i,j,t}$ represents a vector of yearly bank-level controls, i.e., Bank size, Investment strategy, Asset quality, Capital structure, and Funding structure.
- $BS_{i,j,t}$ represents a vector of yearly banking sector controls, i.e., Financial intermediation, Country banking ROA and Bank concentration.
- $MC_{i,j,t}$ represents a vector of yearly macro-level controls, i.e., GDP growth and Inflation.
- $\varepsilon_{i,j,t}$ – error term.

An overview of the outputs of the stability regression analysis is presented in table 6. Detailed results of each Efficiency model are presented in Appendix 5.

Table 6. Efficiency Regression Analysis

Dependent: Credit Losses	**Model 1**	**Model 2**	**Model 3**	**Model 4**	**Model 5**	**Model 6**
Method	Panel FE	Panel FE	Panel FE	Panel FE	Panel FE	Panel FE
Cross-Section Fixed Effect	Yes	Yes	Yes	Yes	Yes	Yes
Time Fixed Effect	Yes	Yes	No	Yes	Yes	Yes
Adjusted R-square	0.6040	0.6041	0.5975	0.6091	0.5191	0.6079
Number of Banks	30	30	30	30	30	30
Number of Observations	169	169	169	169	169	169
Ownership (OWN)	**1.7542**	**1.6304**	**1.6114**	**0.7802**	**0.1858**	**0.8999**
	(0.8909)	(0.8252)	(0.7934)	(0.3830)	(0.0919)	(0.4399)
Credit Losses (-1)					0.1744*	-0.0881
					(1.6648)	(-0.7919)
Bank Size (BSIZE)	11.8523***	13.4740***	14.9057***	12.2245***		12.5285***
	(4.3016)	(4.5762)	(5.2063)	(3.7888)		(3.8500)
Asset Quality (AQUAL)	0.9346***	0.8848***	1.03396***	0.7285**		0.8433**
	(2.8837)	(2.7090)	(3.2641)	(2.1558)		(2.2904)
Capital Structure (CSTRUC)	-0.5467***	-0.4887**	-0.4141*	-0.4811**		-0.4865**
	(-2.6210)	(-2.0740)	(-1.8206)	(-2.0353)		(-2.0543)
D (Financial Structure [FSTRUC])	-0.0368	-0.0458	-0.0586*	-0.0447		-0.0478
	(-1.0929)	(-1.3235)	(-1.7112)	(-1.2922)		(-1.3712)
Investment Strategy (ISTRAT)	-0.0195	-0.0121	-0.0042	-0.0132		-0.0245
	(-0.3857)	(-0.2374)	(-0.0852)	(-0.2582)		(-0.4600)
D (Financial Intermediation [FINTER])		-0.0781	-0.0856*	-0.0967*		-0.0925
		(-1.3687)	(-1.8098)	(-1.6782)		(-1.5963)
D (Bank Concentration [BCONC])		0.0262	0.0196	0.0240		0.0255
		(0.9681)	(0.8027)	(0.8855)		(0.9400)
D (Country Banking ROA [CBROA])		-0.2055	-0.1694	0.2579		0.2623
		(-0.3279)	(-0.2586)	(0.3820)		(0.3879)
GDP Growth (GDPGR)			-0.1172	0.2011		0.2060
			(-1.0631)	(1.2158)		(1.2425)
D (Inflation [INFL])			0.0895	0.1631*		0.1685*
			(1.1069)	(1.7948)		(1.8466)

Note: *** is for a 1% significance, ** is for a 5% significance, and * is for a 10% significance.

First and foremost, the results indicate that the relationship with the independent variable Ownership was found insignificant in all of the models analyzed. As a result, it can be concluded that no evidence was found that bank ownership has an impact on bank efficiency. Relationship with the following control variables was, however, found significant across the different models:

- *Bank size* with a positive coefficient, implying that the bigger the bank, the higher the size of NPLs and the lower the efficiency.
- *Asset quality* with a positive coefficient, implying that the higher the share of loan loss provision, the more NPLs there are and the more inefficient the bank.
- *Capital structure* with a negative coefficient, implying that the higher the share of equity, the smaller the size of NPLs and the higher the efficiency.
- *Funding structure* with a negative coefficient, implying that the higher the share of deposits, the smaller the size of NPLs and the higher the efficiency.

- *Financial intermediation level* with a negative coefficient, implying that the higher the level of domestic credit to the private sector, the smaller the size of NPLs and the higher the efficiency.
- *Inflation* with a positive coefficient implies that the higher the inflation, the higher the size of NPLs and the lower the efficiency.

The results of models 5 and 6 provide mixed results on a relationship between Credit losses and its lag. As a result, no conclusion can be made about what kind of relationship exists between them.

The goodness of the model fit

To assess whether the regression model is able to accurately predict the variation of the dependent variable as a result of changes in the independent variables, the goodness-of-fit of the regression model needs to be assessed.

According to DeFucso et al. (2022, p. 83), "the F-statistic measures how well the regression equation explains the variation in the dependent variable". The significance of the *F* statistic can be assessed through the p-value, which needs to be below 0.05 for a 5% significance level. As can be seen in the outputs of the regression analysis in Appendix 5, the p-value of the F-statistic of the proposed Efficiency models equals 0.00. Consequently, the model captures a significant fraction of the variation in the dependent variable.

The explanatory power is another method used to measure the validity and goodness of fit of the regression model. The explanatory power model uses the value of R-square, called the coefficient of determination, adjusted for degrees of freedom. The closer the value is to 1, the better the regression model fits the data. The adjusted R-square of the proposed Efficiency regression models varies between 0.5191 and 0.6091. Thus, more than 50% of the variation in the dependent variable is explained by the variation in the control variables.

Autocorrelation

As was mentioned before, the Durbin-Watson statistic is a common measure of autocorrelation, which takes the value between 0 and 4, with the value of 2 indicating an absence of autocorrelation. According to the outputs presented in Appendix 5, the Durbin Watson statistic is close to 2 for all of the models analyzed. It is assumed that there is no autocorrelation in the Efficiency models.

Heteroskedasticity

Heteroskedasticity implies that the variance of the error terms differs across observations and is thus not constant. It is a common problem in a cross-sectional analysis. Yet, in the panel data, it is not a big issue and is thus often ignored in the empirical analysis.

6.4 Assessment of hypotheses

Hypothesis 1 proposes a negative relationship between government ownership and the financial stability of banks (measured by Z-score) in BRICS countries. The empirical results of the regression analysis do not provide

support for this hypothesis, indicating a positive relationship instead. It can thus be concluded that there is enough evidence to conclude that bank ownership has a positive impact on bank stability.

Hypothesis 2 proposes a positive relationship between government ownership and credit losses of banks in BRICS countries. This then translates into a negative relationship with efficiency, as increases in credit losses effectively mean a decrease in inefficiency. The empirical results of the regression analysis do not provide support for this hypothesis. In other words, there is not enough evidence to conclude that bank ownership has an impact on bank efficiency.

Control variables

Many of the proposed control variables proved to have a significant relationship with the dependent variables. For banking stability, bank size, bank concentration, country banking ROA, and inflation proved to be significant, having their share of impact. For banking efficiency, bank size, asset quality, capital structure, funding structure, financial intermediation, and inflation were found to be significant.

Chapter 7. Discussion

It is often said that banks are the “blood vessels” of the economy. If banks are not able or not willing to provide credit to the participants of economic relations in sufficient quantity and in an efficient way, the country is not able to achieve sustainable economic growth. In this context, two notions of bank performance become paramount, i.e., bank stability and bank efficiency. The stability of a banking system is crucial for the appropriate socioeconomic development of any country, and failure to withstand financial shocks by systematically important banks can lead to extreme costs. The efficiency of banks determines if a bank managed to create a robust credit policy, can minimize the number of non-performing loans, and ensure optimal use of its credit funds. Since both these notions are of vital importance, the objective of this study was to test them both in greater detail by zooming into BRICS countries. As was discussed before, BRICS countries are the main emerging markets in the world. Their integration in the global trade and financial flows has become significant and will be increasing in the future. Thus, the inability of the BRICS banks to efficiently source credit locally due to unstable financial performance could be disastrous on the national level, BRICS level and even have spillover effects on the rest of the world.

Another notion that is important for bank governance and performance, and thus efficiency and stability, is bank ownership. With the focus of this research being on BRICS countries, bank state ownership becomes an important facet since, in such countries as China, India, and Russia, state-owned banks are important, if not predominant, representatives of the local banking system. As a result, the goal of this research was to test whether bank state ownership has an impact on bank stability and efficiency in the BRICS countries.

The results of this research provide evidence that state ownership does have a positive impact on bank stability in the BRICS countries. In other words, BRICS state-owned banks tend to be more stable and more resistant to financial shocks when compared to their privately-owned counterparts. One possible reason for this is bank size – state-owned banks tend to be the largest banks in a local BRICS banking system. Moreover, bank size, being a control variable, was indeed found to be a significant factor for bank stability, indicating that larger banks tend to be more stable. Another possible reason for the increased stability of state-owned banks is government intermediation and its full support of state-owned banks. This intermediation and support can take the form of regulations, policymaking, and capital injection for the benefit of a state-owned bank. The results of this research could also indicate that bank governance imposed by state ownership is indeed better equipped to promote stability. This, however, needs to be further researched and has not been a part of this research.

The findings of this research indicate that the approach of such countries as China, India, and Russia, where state-owned banks form a predominant power, is a correct one, as state ownership does increase bank stability. The viability of privately-run banking systems (as in South Africa and Brazil) can then be questioned.

As has already been discussed, another important notion when discussing bank performance is bank efficiency. As opposed to stability, the findings of this study indicate no evidence that bank ownership has an impact on bank efficiency in the BRICS countries. As a result, it is safe to conclude that bank ownership is not a determining factor when measuring bank efficiency.

Chapter 8. Conclusion

Since the main goal of this research was to analyze the relationship between bank ownership and bank stability and efficiency in the BRICS countries, this paper contributes to the important debate among academics and policymakers on what determines bank stability and bank efficiency. On top of that, the interplay between bank ownership and bank stability / efficiency has not been extensively researched, forming a literature gap that this research tries to fill. In order to measure bank stability, a Z-score was used, which is a common and established stability measure within the academic community. Efficiency, in turn, was measured as a share of non-performing loans to the total assets, which is also a common measure often used in similar research. Since this study was zooming into the BRICS countries, state bank ownership was the main focus since such banks form a predominant power in the BRICS banking system.

Using panel data of 30 banks across the five BRICS countries over the period of 7 years, it was established that bank ownership does have a positive relationship with bank stability but no relationship with bank efficiency. These results have important implications for the structure of the BRICS banking system, wherein in such countries as South Africa and Brazil, state-owned banks barely exist. There are indications that state ownership could contribute to the overall stability of a banking system and thus should be an important consideration of any government and policymakers.

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Appendix 1. Overview of variables

Variable	Unit	Definitions[5]	Source
Z-score*		Bank distance to default quantified as a natural logarithm of the sum of the return on assets and capital structure divided by the standard deviation of the return on assets.	Bloomberg Terminal, Financial Statements
Credit losses**	%	Ratio of Non-Performing Loans (NPLs) to Total Loans.	Bloomberg Terminal, Financial Statements
Ownership*	1	Dummy variable taking the value of 1 if bank has more than 50% of government ownership.	Bloomberg Terminal
Bank size*	%	Measured as a logarithm of bank's total assets.	Bloomberg Terminal, Financial Statements
Investment structure*	%	The ratio of Loans to Total Assets.	Bloomberg Terminal, Financial Statements
Capital structure*	%	The ratio of Equity to Total Assets.	Bloomberg Terminal, Financial Statements
Funding structure*	%	The ratio of Deposits to Total Assets.	Bloomberg Terminal, Financial Statements
Asset quality	%	The ratio of Loan Loss Provision to Total Assets.	Bloomberg Terminal, Financial Statements
Financial intermediation Level*	% of GDP	Domestic credit to the private sector by banks.	World Bank, Global Financial Development Database (GFDD)
Country Banking Return on Assets (ROA)*	%	Average commercial bank's net Income to yearly averaged Total Assets.	World Bank, Global Financial Development Database (GFDD)
Bank concentration*	%	Assets of three largest commercial banks as a share of total commercial banking assets.	World Bank, Global Financial Development Database (GFDD)
GDP growth	Real %	The annual percentage growth rate of GDP.	IMF, World Economic Outlook
Inflation	Annual % change	Annual percentage change in the consumer price index.	IMF, World Economic Outlook

[5] * - all definitions are taken directly from Toader, T., Onofrei, M., Popescu, A. & Andries, A. M., (2018), 'Corruption and Banking Stability: Evidence from Emerging Economies'.

** - https://corporatefinanceinstitute.com/resources/knowledge/finance/non-performing-loan-npl/

Appendix 2. Overview of selected banks

#	Bank name	Country of origin	Type of ownership	Year established	Headquarters	Description of operations[6]	Source of information
1	*Itaú Unibanco*	Brazil	Private	2008	São Paulo, Brazil	・The largest financial conglomerate in the Southern Hemisphere. ・10th largest bank in the world by market value. ・Being traded on the São Paulo Stock Exchange and NYSE. ・The bank has over 3,527 bank branches and 27,981 ATMs in Brazil and the world.	https://www.itau.com
2	*Banco do Brasil*	Brazil	Government	1808	Brasilia, Brazil	・One of the largest banks in Brazil and all of Latin America. ・Being controlled by the Brazilian government, its stock is also traded on the São Paulo Stock Exchange. ・In addition to commercial and government services, the bank offers a large variety of services to private consumers.	www.bb.com.br
3	*Caixa Econômica Federal*	Brazil	Government	1861	Brasilia, Brazil	・The largest 100% government-owned financial institution in Latin America. ・Caixa has more than 85 million accounts, with liabilities worth more than R$237 billion in savings or investment.	www.caixa.gov.br
4	*Banco Bradesco*	Brazil	Private	1943	São Paulo, Brazil	・The third largest Brazilian bank by total assets. ・Being traded on BM&F Bovespa, NYSE and Madrid Stock Exchange. ・Bank offers insurance, pension plans, annuities, credit card services, savings bonds, personal and commercial loans and leasing services.	https://banco.bradesco
5	*Banco Votorantim*	Brazil	Private	1988	São Paulo, Brazil	・The seventh largest bank in Brazil. ・Bank operates in the wholesale, retail, treasury, asset management and brokerage fields. ・It is one of the largest industrial conglomerates in Latin America, operating in various sectors such as finance, energy, steel, etc.	https://www.bv.com.br

[6] All descriptions are prepared by respective financial institutions. Source is indicated in the “source of information” column.

6	*Banco Santander*	Brazil	Private	1982	São Paulo, Brazil	・Brazilian subsidiary of the Spanish Banco Santander, being traded on São Paulo Stock Exchange. ・It is the fifth largest commercial bank in Brazil by assets. ・With more than 9 million customers, the bank operates in all segments of financial markets, with a network of 3,696 branches and 18,312 ATMs.	https://www.santander.com.br
7	*China Construction Bank Corporation (CCB)*	China	Government	1954	Beijing, China	・One of the "Big Four" banks in China. ・2nd largest bank in the world by market capitalization and 6th largest company in the world. ・Being owned by the Chinese government holding company, Central Huijin Investment Company, the bank is also traded on the Stock Exchange of Hong Kong and the Shanghai Stock Exchange.	http://www.ccb.com
8	*Industrial and Commercial Bank of China Limited (ICBC)*	China	Government	1984	Beijing, China	・One of the "Big Four" banks in China. ・For many years it has been ranked the world's largest bank. ・Being owned by the Chinese government, the bank is also traded on the Stock Exchange of Hong Kong and the Shanghai Stock Exchange.	http://www.icbc-ltd.com
9	*Agricultural Bank of China (ABC)*	China	Government	1951	Beijing, China	・One of the "Big Four" banks in China. ・ABC has 320 million retail customers, 2.7 million corporate clients, and nearly 24,000 branches. ・Being owned by the Chinese government, the bank is also traded on the Stock Exchange of Hong Kong and the Shanghai Stock Exchange.	www.abchina.com
10	*Bank of China*	China	Government	1912	Beijing, China	・One of the "Big Four" banks in China. ・It is the most globally active of China's banks with operations in 27 countries. ・Being owned by the Chinese government, the bank is also traded on the Stock Exchange of Hong Kong and the Shanghai Stock Exchange.	www.boc.cn

11	*Bank of Communications Limited*	China	Private	1986	Shanghai, China	・Bank is among the top 5 leading commercial banks in mainland China. ・It is one of the major financial service suppliers in China with its business scope covering commercial banking, securities, trust, financial leasing, fund management, insurance, offshore financial services, etc. ・The bank is traded on the Hong Kong Stock Exchange and the Shanghai Stock Exchange.	www.hk.bankcomm.com
12	*Postal Savings Bank of China (PSBC)*	China	Government	2007	Beijing, China	・It is a commercial retail bank, which provides basic financial services, especially to small and medium enterprises, rural and low income customers. ・The bank with its extremely broad reach assists China's credit cooperatives in their microcredit schemes, using it as a tool for national development and poverty reduction. ・Being government owned, the bank is also traded on the Hong Kong Stock Exchange and the Shanghai Stock Exchange.	www.psbc.com
13	*State Bank of India*	India	Government	1955	Mumbai, India	・This multinational banking and financial services company is the largest bank of India and the 43rd largest bank in the world. ・SBI has over 24000 branches in India with roughly 90% of total profits being contributed by domestic operations. ・Being government owned, the bank is also traded on the Bombay Stock Exchange and the National Stock Exchange of India.	www.onlinesbi.com
14	*Bank of Baroda*	India	Government	1908	Vadodara, India	・It is the third largest public sector bank in India with 131 million customers, a total business of US$218 billion, and a global presence of 100 overseas offices. ・Being government owned, the bank is also traded on the Bombay Stock Exchange and the National Stock Exchange of India.	www.bankofbaroda.in

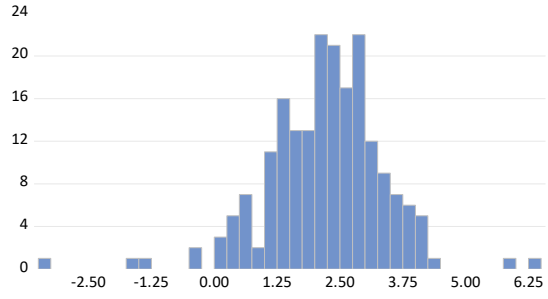
15	*ICICI Bank Limited*	India	Private	1994	Mumbai, India	・This multinational banking and financial services company is the second largest bank of India with a network of 5,275 branches and 15,589 ATMs across India. ・It offers a wide range of banking products and financial services for corporate and retail customers in the areas of investment banking, life, non-life insurance, venture capital and asset management. ・The bank is traded on the Bombay Stock Exchange and the National Stock Exchange of India.	www.icicibank.com
16	*Punjab National Bank*	India	Government	1894	New Delhi, India	・This public-sector bank has over 180 million customers, 10,910 branches and 13,000+ ATMs. ・Being government owned, the bank is also traded on the Bombay Stock Exchange and the National Stock Exchange of India.	www.pnbindia.in
17	*Bank of India*	India	Government	1906	Mumbai, India	・This commercial bank has 5,316 branches, including 56 offices outside India. ・Being mostly owned by the Indian government, it is also traded on Bombay Stock Exchange and the National Stock Exchange of India.	www.bankofindia.co.in
18	*HDFC Bank Limited*	India	Private	1994	Mumbai, India	・This banking and financial services company is the largest private sector bank by assets and the largest bank in India by market capitalization. ・Bank provides wholesale banking, retail banking, treasury, auto loans, two-wheeler loans, personal loans, loans against property, consumer durable loan, lifestyle loan and credit cards.	www.hdfcbank.com
19	*Sberbank*	Russia	Government	1991	Moscow, Russia	・The largest bank in Russia and Eastern Europe, the third largest in Europe, and 33rd in the world. ・The bank had about 16,500 offices, over 137 million retail clients and over 1.1 million corporate clients in its 22 countries of presence.	www.sberbank.com

20	*VTB Bank*	Russia	Government	1990	Moscow, Russia	・It is one of the leading government-owned banks of Russia. ・VTB Bank and its subsidiaries form a leading Russian financial group – VTB Group, which offers a wide range of banking services and products in Russia, CIS, Europe, Asia, Africa, and the U.S.	www.vtb.com
21	*Gazprombank*	Russia	Government / Private	1990	Moscow, Russia	・It is a private-owned Russian bank, the third largest bank in the country by assets. ・The bank's principal business areas are corporate banking, retail banking, investment banking and depository services. Its banking activities also include securities trading, foreign exchange operations, precious metals operations, clearing operations and settlement services. ・The bank has a distribution network of 43 branches and over 260 banking outlets located throughout the Russian Federation.	www.gazprombank.com
22	*Alfa Bank*	Russia	Private	1990	Moscow, Russia	・It is one of the largest private commercial banks in Russia. ・It operates in seven countries, providing financial services to over 381,600 active corporate customers and 14.2 million retail clients.	www.alfabank.com
23	*Raiffeisenbank*	Russia	Private	1996	Moscow, Russia	・Raiffeisenbank is a private commercial bank in Russia, a subsidiary of Raiffeisen Bank International, which in turn is a fully controlled subsidiary of Raiffeisen Zentralbank (Austria). ・Raiffeisenbank is one of Russia's major banks, ranked 9th in Russia in assets, 5th in private deposits, and 7th in consumer lending.	www.raiffeisen.ru/en
24	*Bank Otkritie FC*	Russia	Private / Government	1992	Moscow, Russia	・The bank has more than 440 offices of different formats in Russia. ・Initially the bank was privately owned until 2017, when it was bailed out by the Central Bank of Russia at a cost to the state of over US$ 8 billion.	www.open.com

25	*Standard Bank Group Limited*	South Africa	Private	1862	Johannesburg, South Africa	・This financial services group is Africa's biggest lender by assets. ・The major services that are provided are Personal & Business Banking, Corporate & Investment Banking, and Insurance. ・The bank is being traded at the Johannesburg Stock Exchange (JSE) and the Namibian Stock Exchange.	www.standardbank.co.za
26	*FirstRand Group*	South Africa	Private	1838	Johannesburg, South Africa	・This financial services provider is one of the five largest banking groups in South Africa and sub-Saharan Africa. ・It provides banking, insurance and investment products and services to retail, commercial, corporate and public sector customers. ・The bank is being traded at the Johannesburg Stock Exchange (JSE) and the Namibian Stock Exchange.	www.firstrand.co.za
27	*Absa Bank Limited*	South Africa	Private	1986	Johannesburg, South Africa	・It is a 100% subsidiary of Absa Group Limited, the Pan African financial services conglomerate headquartered in South Africa. ・The bank is being traded at the Johannesburg Stock Exchange (JSE).	www.absa.co.za
28	*Nedbank Limited*	South Africa	Private	1888	Johannesburg, South Africa	・This financial services group offers wholesale and retail banking services as well as insurance, asset management, and wealth management in South Africa and SADC. ・The bank is being traded at the Johannesburg Stock Exchange (JSE) and the Namibian Stock Exchange.	www.nedbank.co.za
29	*Investec*	South Africa	Private	1974	Johannesburg, South Africa	・It is an Anglo-South African international banking and wealth management group, providing a range of financial products and services to a client base in Europe, Southern Africa, and Asia-Pacific. ・The bank is traded on the London Stock Exchange and the Johannesburg Stock Exchange.	www.investec.com
30	*Capitec Bank*	South Africa	Private	2001	Stellenbosch, South Africa	・This retail bank maintains 500 retail branches nationwide, 3,418 own or partnership ATMs and has over 6.2 million customers. ・The bank is being traded at the Johannesburg Stock Exchange (JSE).	www.capitecbank.co.za

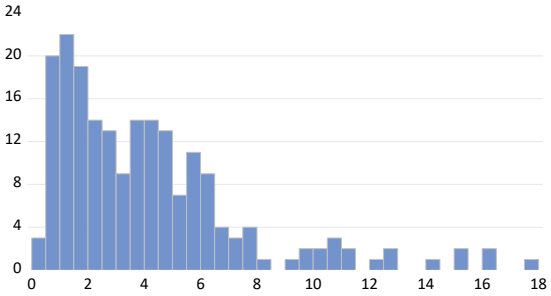
Appendix 3. Histograms

Graph 1. Stability Z-score Histogram



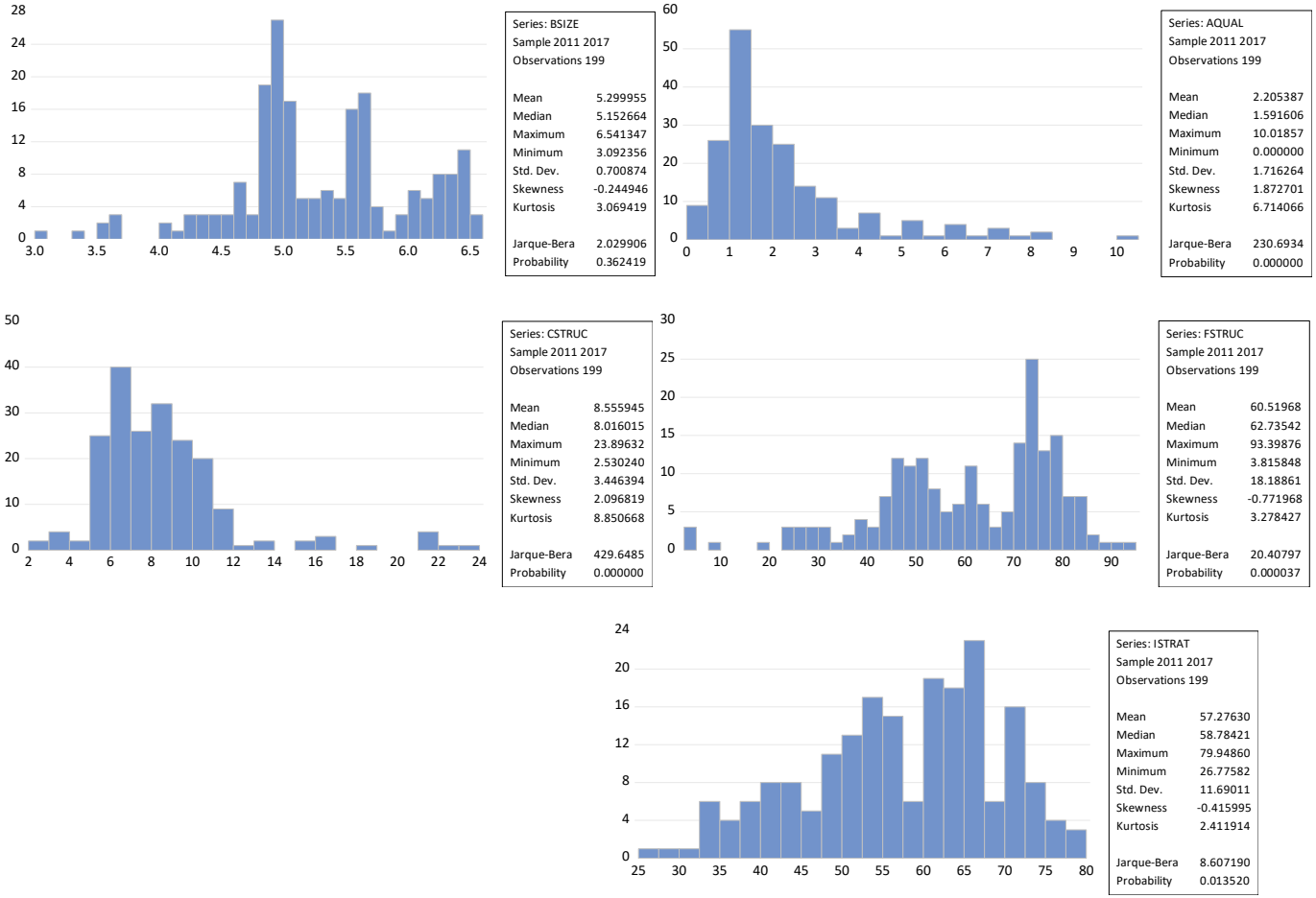
Series: Z_SCORE	
Sample 2011 2017	
Observations 199	
Mean	2.214896
Median	2.293810
Maximum	6.300948
Minimum	-3.433170
Std. Dev.	1.171768
Skewness	-0.596983
Kurtosis	6.260148
Jarque-Bera	99.94876
Probability	0.000000

Graph 2. Credit Losses Histogram

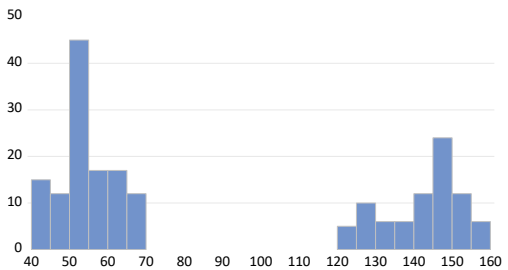


Series: CREDIT_LOSSES	
Sample 2011 2017	
Observations 199	
Mean	4.168335
Median	3.499785
Maximum	17.56546
Minimum	0.000000
Std. Dev.	3.404617
Skewness	1.615165
Kurtosis	5.829313
Jarque-Bera	152.8987
Probability	0.000000

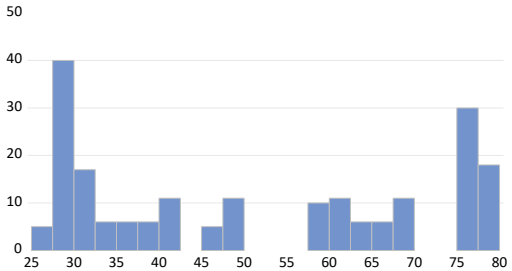
Graph 3. Bank-Level Control Variables' Histograms



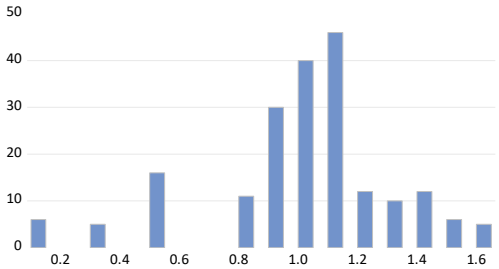
Graph 4. Banking Sector Control Variables' Histograms



Series: FINTER	
Sample 2011 2017	
Observations 199	
Mean	90.29095
Median	62.50000
Maximum	157.6000
Minimum	41.60000
Std. Dev.	44.42442
Skewness	0.390938
Kurtosis	1.282438
Jarque-Bera	29.52954
Probability	0.000000

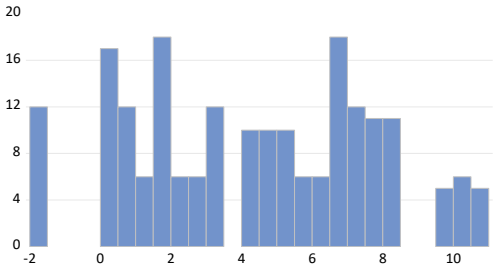


Series: BCONC	
Sample 2011 2017	
Observations 199	
Mean	51.29347
Median	47.60000
Maximum	79.20000
Minimum	26.90000
Std. Dev.	19.54117
Skewness	0.154740
Kurtosis	1.382291
Jarque-Bera	22.49330
Probability	0.000013

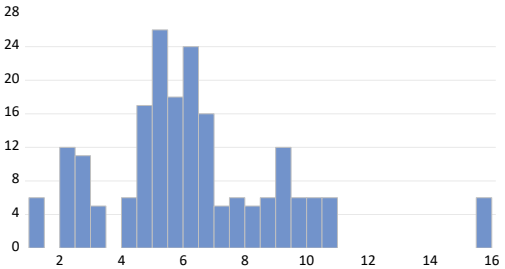


Series: CBROA	
Sample 2011 2017	
Observations 199	
Mean	0.993467
Median	1.000000
Maximum	1.600000
Minimum	0.100000
Std. Dev.	0.310600
Skewness	-0.814903
Kurtosis	4.069686
Jarque-Bera	31.51242
Probability	0.000000

Graph 5. Macro-Level Control Variables' Histograms



Series: GDPGR	
Sample 2011 2017	
Observations 199	
Mean	4.273367
Median	4.500000
Maximum	10.60000
Minimum	-2.000000
Std. Dev.	3.376006
Skewness	-0.000397
Kurtosis	2.041214
Jarque-Bera	7.622292
Probability	0.022123



Series: INFL	
Sample 2011 2017	
Observations 199	
Mean	6.214573
Median	5.800000
Maximum	15.50000
Minimum	1.400000
Std. Dev.	2.847299
Skewness	0.867776
Kurtosis	4.587067
Jarque-Bera	45.86059
Probability	0.000000