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Social Sciences Institute





**ANALYSIS OF FINANCIAL INSTITUTIONS' SOUNDNESS: IN
THE CASE OF FRAGILE FIVE COUNTRIES**

Master Thesis

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Eskişehir 2022

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Master Thesis

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FINAL APPROVAL FOR THESIS

This thesis entitled “ANALYSIS OF FINANCIAL SOUNDNESS OF INSTITUTIONS: IN THE CASE OF FRAGILE FIVE COUNTRIES” has been prepared and submitted by Shafiq Noorie in partial fulfillment of the requirements in “Anadolu University Directive on Graduate Education and Examination” for the Degree of Master of Sciences in Finance Department. It has been examined and approved on 07/22/2022.

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ABSTRACT

ANALYSIS OF FINANCIAL INSTITUTIONS' SOUNDNESS: IN THE CASE OF FRAGILE FIVE COUNTRIES

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In recent years, economic globalization and technology advancement have contributed to a major growth in financial market integration. A financial shock in one market can quickly be transmitted internationally to other markets, according to research findings in this area. Recent events have demonstrated that some developing countries' financial markets are more vulnerable to financial shocks than other emerging markets. Current account deficits, currency volatility, and weakening financial institutions are all contributing to the standoff. This could be due to a lack of knowledge and bias among international investors about some emerging markets.

This research evaluates and analyzes the financial soundness of 12 countries (The "Fragile Five" plus other countries with similar characteristics). For this purpose, the most recent (2018-2020) annual data available on the IMF website for 8 financial soundness indicators of selected countries were used. The importance level of these data was first obtained by the Entropy method, and then the soundness of the financial systems was ranked in the selected periods by using the TOPSIS method (one of the Multi-Criteria Decision-Making methods). The financial system soundness of the selected countries was evaluated according to their financial institutions' soundness. When compared with the countries in the whole sample, it was found that the countries with the worst performance in the periods covered by the research were not only the "Fragile Five". Argentina and Greece are below the optimal ideal solution for certain years. Moreover, Brazil and South Africa from Fragile Five constantly showed top performance. The results for other countries were fluctuating during recent years.

Keywords: Financial soundness indicators, Financial institutions, Fragile Five countries, Entropy weight method, TOPSIS

ÖZET

FİNANS KURUMLARININ SAĞLAMLIĞININ ANALİZİ: KIRILGAN BEŞ ÜLKE ÖRNEĞİNDE

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Ekonomik küreselleşme ve teknolojik ilerleme, son yıllarda finansal piyasaların entegrasyonunda önemli bir artışa katkıda bulunmuştur. Bu alandaki araştırma bulguları, bir pazardaki finansal şokun uluslararası olarak diğer pazarlara hızla iletilebileceğini göstermiştir. Son olaylar, bazı gelişmekte olan ülkelerin finansal piyasalarının finansal şoklara diğer gelişmekte olan piyasalardan daha duyarlı olduğunu göstermiştir. Bu açmazın, cari hesap açıkları, kur oynaklığı ve zayıflamış finansal kurumlar dahil olmak üzere çeşitli nedenleri vardır. Bunun nedeni, yabancı yatırımcıların bazı yükselen piyasalar hakkında bilgi eksikliği ve önyargıları olarak söylemek mümkündür.

Bu araştırma, 12 ülkenin ("Kırılgan Beşli" artı benzer özelliklere sahip diğer ülkeler) finansal sağlamlığını değerlendirmekte ve analiz etmektedir. Bu amaçla seçilen ülkelerin 8 finansal sağlamlık göstergesi için IMF internet sitesinde yer alan en güncel (2018-2020) verileri kullanılmıştır. Bu verilerin önem düzeyi önce Entropi ağırlık ölçüm yöntemi ile elde edilmiş, ardından TOPSIS "Çok Kriterli Karar Verme yöntemlerinden" biri kullanılarak seçilen dönemlerde finansal sistemlerin sağlamlığı derecelendirilmiştir. Seçilen bu ülkelerin finansal sistemlerinin sağlamlığı, finansal kurumlarının sağlamlığına göre değerlendirilmiştir. Tüm örneklemedeki ülkelerle karşılaştırıldığında, araştırmanın kapsadığı dönemlerde en kötü performansa sahip ülkelerin sadece "Kırılgan Beşli" olmadığı tespit edilmiştir. Arjantin ve Yunanistan, belirli yıllar için optimal ideal çözümün altındadır. Ayrıca, Kırılgan Beş gurubundan olan Brezilya ve Güney Afrika sürekli olarak en iyi performans sergilediği gözlemlenmiştir. Diğer ülkeler için sonuçlar son yıllarda dalgalı olarak elde edilmiştir.

Anahtar Sözcükler: Finansal sağlamlık göstergeleri, Finansal kurumlar, Kırılgan Beş ülkeleri, Entropi ağırlık yöntemi, TOPSİS

PREFACE

As a graduate student in the Finance subdepartment of the Business Administration Department, I am writing my thesis entitled "ANALYSIS OF FINANCIAL INSTITUTIONS' SOUNDNESS: IN THE CASE OF FRAGILE FIVE COUNTRIES" with the approval of my supervisor Professor Dr. Aslı Afşar. As a result, I would like to express my endless thanks for my well-known supervisor, Professor Dr. Aslı Afşar's assistance and unwavering moral support, stating that my thesis would never have progressed to this point without the assistance of my esteemed professor. I would also like to express my sincere thanks to Professor Robert Laurini, member of CPU-Lyon (an association devoted for helping students) and founder of "Universitaires Sans Frontières/Academics Without Borders" for taking the time to assist me for increasing the quality of my manuscript.

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27/ June/ 2022

STATEMENT OF COMPLIANCE WITH ETHICAL PRINCIPLES AND RULES

I hereby truthfully declare that this thesis is an original work prepared by me; that I have behaved in accordance with the scientific ethical principles and rules throughout the stages of preparation, data collection, analysis and presentation of my work; that I have cited the sources of all the data and information that could be obtained within the scope of this study, and included these sources in the reference section; and that this study has been scanned for plagiarism with “scientific plagiarism detection program” used by Anadolu University, and that “ it does not have any plagiarism” whatsoever. I also declare that, if a case contrary to my declaration is detected in my work at any time, I hereby express my consent to all the ethical and legal consequences that are involved.

Signature

Shafiq Noorie

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ABBREVIATIONS

BCBS	: Basel Committee on Banking Supervision
CAMELS	: Capital Adequacy, Asset Quality, Management Soundness, Earnings, Liquidity, and Sensitivity to Market Risk
CAR	: Capital Adequacy Ratio
CCPs	: Central Clearing Counterparties
DTs	: Deposit-takers
EWM	: Entropy Weight Method
EMEs	: Emerging Market Economies'
FCs	: Financial Corporations
FI	: Financial Institutions
FSI	: Financial Soundness Indicators
IMF	: International Monetary Fund
MCDM	: Multiple Criteria Decision-Making
MMFs	: Money Market Funds
NFCs	: Nonfinancial Corporations
NPL	: Non-performing Loans
OFCs	: Other Financial Corporations
ROA	: Return on Assets
ROE	: Return on Equity
RWA	: Risk-Weighted Assets
TOPSIS	: Technique for Order Preference by Similarity to Ideal Solution
2019 Guide	: 2019 Financial Soundness Indicators Compilation Guide

INTRODUCTION

While financial crises in the past and present have occasionally impacted only one country's economy, they have sometimes had a significant impact on the economies of many countries. With the growth of international commerce, financial market liberalization, and technological advancements, a crisis that started at one end of the world can now affect markets in other parts of the world in a short period of time. Market volatility and investor risk aversion rise dramatically during financial crises. In current tumultuous times, financial contagion decreases the benefits of diversity for investors. There are several researches done on the international transmission or contagion of economic shocks and financial crises in the literature (Lowell et al, 1998; Mendoza & Quadrini, 2010; Aloui et al., 2011; Choi & Douady, 2013; Heliodoro et al., 2020)

Looking at the crises in the world from past to present, it is seen that the incidence of crises is higher in developing countries. The reason for this is that a stable financial structure cannot be achieved and some economic indicators are not at the desired level. However, when a comparison is made between the money and banking crises, it is seen that the banking crises occur more than the money crises and the losses on the country's economy are bigger due to the crises in the financial system affecting the real economy at the same time.

Moreover, the economic contraction that started with the mortgage crisis in the USA in 2008 has shown itself as a result of the monetary expansion in Greece, which resulted in the foreign debt crisis. The cost of the foreign debt crisis experienced by an EU member country has been quite high for EU countries. In a sense, Greece, which stated that it could not fulfill its obligations, faced with rescue packages and economic sanctions, but could not achieve the economic power to repay its debts to EU countries. At this point, Greece reputation has been damaged and the country's credit rating has been reduced by successive credit rating agencies. Therefore, the external debt crisis in a country has reached the point where it can affect other countries that have purchased their bonds due to the fact that they cannot pay their debt (Kaykac, 2013, p. 9-10).

As a result of the crises summarized above as an example and other financial crises, since the breakouts of the Asian Financial Crisis in the late 1990s and the global financial instability in 2007, analyzing the strengths and weaknesses of a financial sector based on a set of financial indicators has become more important (Davies, 2011, p. 47). The

assessment is necessary in order to identify any potential crises. As a consequence of this, it is expected that a set of strategic rules and regulations, as well as activities, would be implemented (Asian Development Bank, 2015).

The Brazilian real, Indian rupee, Indonesian rupiah, South African rand, and Turkish lira were called the "Fragile Five" by Morgan Stanley (2013), based on the most volatile emerging market currencies under pressure vs the US dollar.

Bearing all that in mind, it is critical to investigate the financial soundness of financial institutions in emerging nations, especially the “Fragile Five” countries. So, the main research question of this thesis is formulated as follows: “In terms of financial soundness, how do the Fragile Five countries compare to the other developing countries in the sample?”

Secondary research question could be: “By examining the so-called Fragile Five countries, what are the methodology, the indicators and the criteria for studying the soundness of their financial sector and ranking them accordingly?”

After acknowledging the necessity of financial soundness, particularly in light of the global financial crises, the remainder of this study is divided into four chapters: The financial sector factors and financial soundness indicators are detailed in the following two parts. The data, methods, and model construction with the research data are explained in the third chapter. The research's findings, discussions, and conclusion are presented in the last chapter.

CHAPTER 1

1. FINANCIAL SECTOR

Intermediation between sources and users of money in the financial sector is enabled through institutional units, financial instruments and markets, and government regulation. Financial markets make it easier to shift productive resources from companies or sectors with excess resources to those in need, hence boosting the economy's productive potential and development. Markets provide a context in which financial claims may be traded under established guidelines, making credit, market, and other risks more manageable. They are also crucial in determining market pricing ("price discovery").

Classifying institutional units into institutional sectors is a key in all macroeconomic statistical frameworks. They consist in financial corporations FCs which include central bank, deposit-takers (DTs), and other financial corporations (OFCs) such as nonfinancial corporations and general government together with local authorities. The International Monetary Fund (IMF) has provided not only definitions, but also explanations for particular cases (Financial Soundness Completion Guide, 2019).

1.1. Central Bank

This is a government-run financial regulator that oversees important aspects of the financial sector. Its primary responsibilities include issuing currency, managing international reserves, providing credit to deposit-taking corporations, and acting as a banker to the government, which includes holding central government deposits and providing credit in the form of overdrafts, advances, and securities purchases. Keep in mind that FSIs are not calculated for the central bank in most cases.

1.2. Deposit-Takers

Financial intermediation is the major activity of deposit-takers (DTs). They do so by taking cash, short-term certificates of deposit, bills, bonds, and other debt securities, as well as other financial instruments. DTs may be subject to licensing and regulatory constraints.

Deposit-takers are an important part of any financial system. They provide as a source of liquid assets and capital for the rest of the economy by allowing people to deposit and borrow money. They play an important role in the transmission of monetary

policy. They also offer payment services that are used by all other companies. Failures of deposit-takers can have a significant influence on the activities of all other financial and non-financial enterprises, as well as public trust in and functioning of the financial system. As a result, any evaluation of financial system stability must involve a look at the health and soundness of deposit-takers.

1.2.1. Commercial banks

A commercial bank is the most popular categorization for a deposit-taking organization, yet just because an entity's name contains the word "bank" does not guarantee it is a commercial bank; it should be classified as a bank based on its actions, not just its name. The variety of operations that a commercial bank can participate in varies widely between nations, depending on national banking legislation and practices, as well as the sophistication of a country's financial system.

The most common services provided by commercial banks are the collection of deposits and the provision of loans or other types of financial assistance to businesses and people. Many nations require them to maintain reserves with the central bank, which are often estimated as a percentage of their deposit liabilities.

1.2.2. Other deposit-taking corporations

Other deposit-taking corporations include corporations and quasi-corporations such as merchant banks, mortgage banks, savings and loan associations and building societies are all types of financial institutions, cooperative credit and credit unions, credit institutions run by municipalities, agricultural and Rural banks, and electronic money institutions, such as Internet banks, are only a few examples.

1.3. Other financial corporations

Outside of the banking system, the OFCs business has increased in prominence in recent years as part of the financial intermediary, or auxiliary, operations. "shadow banking"¹ which is defined as credit intermediation involving businesses and activities

¹ McCulley (2007) coined the phrase "shadow banking," which policymakers adopted. The shadow banking system is a web of specialized financial institutions that use a variety of securitization and secured funding strategies to move funds from savers to investors (Adrian and Ashcraft, 2012, p. 2). This system serves the same purpose as traditional banking, but the players' names are different, and the regulatory structure is either light or non-existent. In its broadest sense, shadow banking encompasses organizations like investment banks, money market mutual funds (MMMFs), and mortgage brokers, as well as more esoteric instruments like asset backed securities (ABSs), collateralized debt obligations (CDOs), and asset backed

that are not part of the regulated banking system, is one of these activities. The FSIs are calculated using all OFCs' total assets as well as selected financial statement and memorandum series for money market funds, insurance companies, and pension funds.

1.4. Financial Sector Soundness

Financial soundness is described as a condition in which the financial system, which includes financial institutions, markets, and infrastructures, can withstand financial shocks and imbalances, lowering the risk of disruptions in the intermediation process. A financial crisis is described as a situation in which a financial system's financial soundness is disrupted and the smooth operation of the intermediation process is hampered, impacting all economic units, including people, businesses, and governments (Noman & Isa, 2021).

Due to the complexity of the financial system, maintaining financial stability needs a comprehensive inquiry. The soundness of financial institutions, the state of financial markets, and the efficiency of the financial infrastructure all have an influence on financial stability because it is decided by the financial system's components. As a result, in financial stability analysis, a comprehensive framework should be used to monitor and govern the financial system's institutions and financial markets, as well as the technical infrastructure (Semih & Bektaş, 2022).

The contagion mechanism is susceptible to any weakness in the financial institution. As a result, the entire financial system will face unforeseen financial risks and potential crises, such as the failure of a systemically important institution.

The financial crises of the late 1990s, as well as the global financial crisis of 2008, were caused by weak financial institutions, insufficient regulation and oversight, and a lack of transparency. The significance of comprehensive systemic risk monitoring and management was further underscored by the crisis. As a result, the IMF has increased its efforts to assist nations in implementing policies that promote stable financial systems..

Banks, nonbank lenders, securities markets, pension, mutual, and other investment funds, insurers, and market infrastructures including central clearing counterparties

commercial paper (ABCP)(Gorton et al., 2010, p. 261-262). For more information see (Poschmann, 2012) and part I from (Pozsar et al, 2010).

CCPs, payment providers, and central banks, as well as regulatory and supervisory bodies, make up a country's financial system (Financial soundness completion guide, 2019). These organizations and markets offer a framework for conducting economic transactions and implementing monetary policy, as well as assisting in the channeling of savings into investment, so promoting economic growth.

Financial system flaws not only disrupt financial intermediation, but they may also weaken monetary policy efficacy, intensify economic downturns, cause capital flight and exchange rate pressures, and result in high government expenditures associated with bailing out insolvent financial firms. Furthermore, as financial institutions become more connected, fintech businesses arise, and financial and trade linkages between nations get closer, financial shocks in one jurisdiction can swiftly spread across financial sectors and national borders. As a result, both local and international economic and financial stability require strong financial institutions that are adequately regulated and controlled.



CHAPTER 2

1. HISTORY AND DEVELOPMENT OF THE FSI METHODOLOGY

Financial Soundness Indicators are indicators of a country's financial institutions' current financial health and soundness, as well as its corporate and household counterparts. They comprise both aggregated data from individual financial institutions and indications that are reflective of the marketplaces in which they operate (Financial Soundness Indicators Compilation Guide, 2019).

The development and study of a collection of financial indicators should aid policymakers in identifying financial system's strengths and vulnerabilities so that they can take preventative measures to avoid a crisis. In this area, the International Monetary Fund (IMF) has launched a variety of projects. The joint IMF-World Bank Financial Sector Assessment Program began collecting and assessing financial stability indicators in 1999, primarily to monitor financial system instability. Following extensive consultations, the IMF published a compilation guide on financial soundness indicators (FSIs) in 2006 which is updated in 2019, in collaboration with the International Accounting Standards Board (IASB), the Bank for International Settlements (BIS), the Basel Committee on Banking Supervision (BCBS), and other international and regional organizations.

The FSIs were based on aggregate bank balance sheet and income statement information, as well as nonfinancial firms and nonbank financial markets aggregate indicators of financial statements.

2.1. Core and Additional FSI

The FSIs are divided into two categories: core and additional indicators. The core indicators are a set of 17 indicators that assess deposit-taking institutions' potential vulnerabilities (Financial Soundness Indicators Compilation Guide, 2019), including capital adequacy, asset quality, earnings and profitability, liquidity, and market risk sensitivity. Other financial sectors such as other players (other financial corporations), borrowers (households and nonfinancial firms), and linked markets are assessed using the additional indicators on a country-by-country basis (securities and real estate). According to 2019 Guide the total of all financial soundness indicators is 53 with additional

indicators. Approximately 96 nations have submitted their FSIs on a regular basis to the IMF, which maintains the database (Asian Development Bank, 2015).

According to the 2019 Guide, DTs should collect a minimum set of 17 core FSIs that encompass the most essential FSIs. They should, however, be complemented with other FSIs, including for other sectors of the economy, for a more holistic assessment of the financial sector's health. This study only includes six core and two additional FSIs due to a lack of common data for all options. The following are explanations of these indices:

2.1.1. Tier 1 capital to risk-weighted assets (RWA)

The FSI Tier 1 capital to Risk Weighted Assets focuses on the key capital concept of the Basel Committee on Banking Supervision BCBS. Because it is permanent and absorbs losses by ranking last in the hierarchy of claims in the event of insolvency, Tier 1 capital is the most dependable and accessible tier of regulatory capital. In contrast to the statutory capital to RWA ratio, this FSI examines the most readily and promptly accessible resources to absorb losses. Tier 1 capital is the numerator of this FSI, while RWA is the denominator.

2.1.2. Non-performing loans to total gross loans

The FSI nonperforming loans to total gross loans ratio is used to identify loan portfolio asset quality difficulties, with a growing ratio indicating a reduction in credit portfolio quality. For a good interpretation, it should be used in conjunction with the FSIs NPLs net of provisions to capital ratio mentioned before and Provisions to NPLs explained later.

This FSI is a lagging indicator since NPLs are only detected after problems develop. Nonetheless, it demonstrates a long-term trend in the quality of DT portfolios. NPLs must be appropriately identified for this ratio to be relevant and cross-country comparable. The indicator should be compared to those for the nonfinancial corporate sector, because a worsening financial situation for nonfinancial enterprises might signal a future deterioration of this ratio. Furthermore, this metric can provide light on the creation of systemic credit risk by allowing financial systems to be benchmarked in non-stressful times, changes to be tracked through time, and cross-jurisdictional comparisons.

2.1.3. Return on assets (ROA)

The FSI return on assets (ROA) measures DT profitability as a proportion of total assets and may be used to assess how well DTs manage their assets to generate profits. In addition to the ratio, the FSI on return on equity can be employed (ROE). This FSI is the net income to total assets ratio (including financial and nonfinancial). Because it is unaffected by cross-country tax discrepancies and so allows for better cross-country comparison, the suggested definition of net income is before taxes.

2.1.4. Return on equity (ROE)

This FSI is used to determine how well DTs manage their money. It also contains information on DTs' ability to generate capital internally through retained earnings, as well as the sector's appeal to new equity investment. Differences in capital structure and business mix between countries have an influence on bank performance, emphasizing the significance of looking at many operational ratios at once. Banks with more leverage (lower equity-to-assets ratio) have a better rate of return on investment (ROI). As a result, a profit forecast based solely on ROE is likely to ignore the greater risks associated with high debt levels. In connection to net income, the ROA indicator examines data sources and compilation difficulties.

2.1.5. Interest margin to gross income

The percentage of gross revenue made up of net interest income is calculated using this FSI (interest earned minus interest expenses). The importance of income produced by DTs' intermediation activity is shown by this percentage (mobilizing savings for investment).

2.1.6. Net open position in foreign exchange to capital

The goal of this FSI is to evaluate how much capital DTs are exposed to exchange rate risk. By quantifying the mismatch (open position) of foreign currency asset and liability holdings, it analyzes the DT sector's potential susceptibility to exchange rate fluctuations. The most often used measure of foreign currency risk is the net open position. Even if the sector as a whole does not, individual DTs or groups of DTs may not have an open foreign exchange position.

While a matching currency position will safeguard a DT's capital adequacy ratio CAR, it will not protect it from exchange rate changes. Even if a DT's foreign assets and liabilities are properly balanced, its capital/asset ratio will decline if the local currency falls.

A matching currency position will safeguard a DT's capital adequacy ratio, but it will not protect it from exchange rate changes. Even if a DT has a perfectly balanced portfolio of foreign assets and liabilities, if the local currency depreciates, its capital/asset ratio will decrease.

2.1.7. Customer deposits to total (non-interbank) loans

This FSI calculates the percentage of DT's gross loans (excluding interbank activity) that are backed by customer deposits, which are considered more stable than wholesale interbank funding. There is increased financing risk when steady deposits are low in contrast to loans: DTs' portfolios are more reliant on more "volatile" funding.

This FSI, which is the opposite of the commonly used loan-to-deposit ratio by regulators and analysts, gives a rapid picture of a bank's reliance on erratic funding. A low score indicates that non-deposit funding is more commonly employed. More complex research requiring more knowledge about the customer deposit base is required to examine the relative stability of the various kinds of deposits within the wider category of client deposits.

2.1.8. Foreign-currency-denominated liabilities to total liabilities

This FSI reflects the relative significance of foreign currency funding within overall liabilities. It's important to assess the magnitude of this ratio, as well as the value of FSI foreign currency denominated loans as a percentage of overall loans. Exchange rate changes will result in gains or losses on the national-currency equivalent value of these holdings.

Although access to international markets is critical for domestically incorporated DTs, a high dependence on foreign currency borrowing may signal that DTs are taking on greater risks by increasing their exposure to exchange rate fluctuations and foreign currency financing reversals. It might also imply that citizens are wary of their own currency and prefer to save in a foreign currency. Extensive foreign currency lending

supported by foreign currency borrowing in the same currency can minimize DTs' foreign exchange risk. DTs, on the other hand, may be exposed if loans are given to local borrowers with no foreign currency income, as the debtors may struggle to repay the loans if the currency depreciates significantly (Financial Soundness Indicators Compilation Guide, 2019).

2.2. Regional Grouping of Countries

Based on the IMF's World Economic Outlook, the 2019 Guide offers the following grouping of nations for the indicator or geographic distribution of loans.

- Advance economies consist of 39 countries,
 - Euro area consists of 19 countries,
 - Major advanced economies (G7) consist of seven countries,
- There are 155 nations in the emerging market and developing economies category,
 - 30 nations in emerging and developing Asia.
 - 16 nations in emerging and developing Europe.
 - 33 nations in Latin America and the Caribbean. Middle East and Central Asia consists of 31 countries,
 - 45 nations in Sub-Saharan Africa.

As of September 2018, the IMF reports that 138 jurisdictions, including all Group of Twenty (G-20) nations, provide FSIs (data and metadata) on a regular basis to the fund which is shown in Figure 2.1.



Figure 2.1. *Reporting Countries and Economies on FSIs (IMF's FSI website)*

Figure 2.1 shows that countries reporting financial soundness indicators have increased steadily from 2009 to October 2019.

The goal of this study is to rate emerging nations based on their financial institutions' soundness. To begin with, the initial Fragile Five nations (Brazil, India, Indonesia, South Africa, and Turkey) were obtained from Morgan Stanley's 2013 study, which has been widely debated and many studies conducted on it to this day in the literature. Individuals and organizations interested in making foreign investments can benefit from understanding about the Fragile Five's financial health and the list's current position. Mexico, Columbia, Turkey, Indonesia, and South Africa were renamed the Fragile Five by Morgan Stanley in 2016. Egypt, Pakistan, Turkey, Qatar, and Argentina were added to the list in 2017. The original Fragile Five countries are shown in Figure 2.2.



Figure 2.2. Fragile Five countries (www.youtube.com/watch?v=QBv9z0KWI0I)

For sure, other emerging countries can be included into this study, for instance countries appearing in the fragile eight list such as Argentina, Chile and Russian Federation. According to the study made by Okur et al (2021) it could be interesting to include Greece, Italy, Mexico, Pakistan and Poland. Of course, other countries should have been interesting to be included, but due to the lack of data, it was decided not to be involved in this research (such as Egypt, Qatar, Columbia, Cyprus, Portugal, Romania, Spain, China, Nigeria).

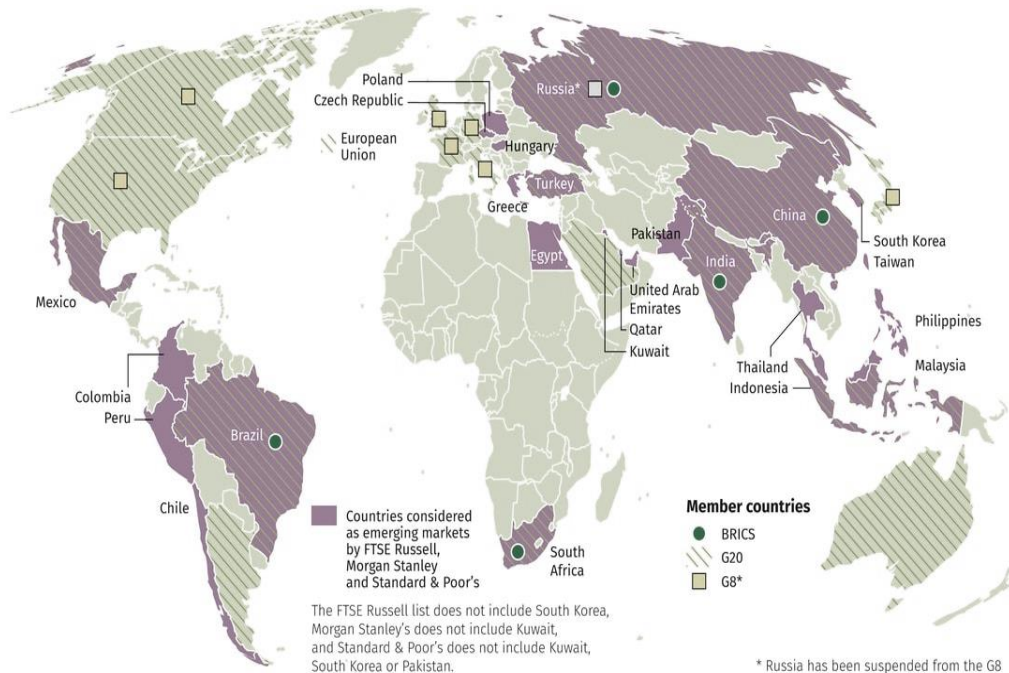


Figure 2.3. Emerging markets (G20, www.g20.org; Standard & Poor's; Morgan Stanley; FTSE Russell)

Since the all FSIs data are not available for all countries, the number of countries included in the sample has been limited, and the number of criteria has been reduced to find a common point. Argentina, Greece, Italy, Mexico, Pakistan, Poland, and Russia, in addition to the major Fragile Five countries, are chosen as a result of the data availability eliminations, and this analysis is carried out. Table 2.2 lists these sample nations and their region.

Table 2.1. *Countries included in this research*

No.	Country	Region
1	Argentina	South/Latin America
2	Brazil	South/Latin America
3	Greece	Europe
4	India	Asia
5	Indonesia	Asia
6	Italy	Europe
7	Mexico	South/Latin America
8	Pakistan	Asia
9	Poland. Rep. Of.	Europe
10	Russian Federation	Europe
11	South Africa	Africa
12	Turkey	Europe

2.3.Literature Review

In this section, the review will be split into two categories. The first one will deal with emerging countries as a group whereas the second one will study a few counties individually.

Studies on the emerging countries as a group:

According to Bizuneh and Geremew (2021), the present globalized economic atmosphere has made Emerging Market Economies (EMEs) very sensitive to global

economic shocks. EMEs experienced increased health-care costs and a larger need for fiscal stimulus during the Covid-19 epidemic. Furthermore, most EMEs have seen currency depreciation, capital flow reversal, a decline in global demand, and a significant drop in domestic revenue, boosting the sovereign bonds risk premiums (SRP). Using dynamic panel estimations and focusing on 12 countries, they conclude that the Covid-19 pandemic influences SRP mostly through GDP growth and political stability indicators. They also find that the real exchange rate and the net export to GDP ratio have statistically significant effects on the risk premium on government bonds (Bizuneh & Geremew, 2021).

One of the first studies to look at the link between the Fragile Five countries' CDS premiums and their stock market indices was undertaken by Avsarligil and Turut (2021). The augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) unit root tests were utilized to achieve this goal. The Granger Causality test, Johansen Cointegration, and Pearson Correlation analysis were performed to determine the link between two variables. India and Turkey, out of the Fragile Five, had a causal link between stock market indices and CDS premiums, however it was just a short-term relationship, according to the study's findings. Furthermore, there was a long-term cointegration link between CDS premiums and Turkish stock market indexes (Avsarligil & Turgut, 2021).

Okur, Kose, and Akpınar (2021) assessed and compared the financial soundness of 18 nations based on the Fragile Five. Financial institutions were used to assess the soundness of these countries' financial infrastructure. When compared to the rest of the sample, the data reveal that the countries with the worst performance over the specified time period are not included in the "Fragile Five" list (Okur et al., 2021).

Chadwick (2019) studies on the relationship between financial markets in key emerging market countries and US monetary policy, as well as monetary policy uncertainty. She accomplishes it by employing Patton's time-varying copula models (2006). She was particularly concerned in the disparities in developing nations' monetary policy reliance on the United States, specifically whether countries' financial markets move together more or less in reaction to quantitative easing or quantitative tightening. The findings of her study are significant because financial risks from contagion have been

an important concern, particularly after the subprime crisis of 2008, when emerging countries were hit worse than industrialized ones.

The findings of the research by Chadwick (2019) reveal that there are considerable differences amongst developing markets in terms of their monetary policy reliance on the United States. The correlation persistence parameters, which determine the growth of time-varying dependency, demonstrates that rising nations in the Latin American area, in particular, are more dependent on both US monetary policy and the subsequent uncertainty. In this context, it is noteworthy to mention that the data reflect rising dependency during the subprime crisis, which then declined after 2009, which could be regarded a risk factor for policymakers that closely monitor emerging market financial markets (Chadwick, 2019).

The financial institution's good economic performance during the financial crisis is due to the financial system's sustainability. The country's economy must be healthy, effective, and profitable in order for the financial system to be sustainable. With considering this Stankeviien & Nikanorova (2019) investigate the financial system's long-term sustainability. The article includes an examination of the financial system's long-term sustainability strategy, as well as an examination of the financial system's structure, design, and soundness. Furthermore, the benefits and drawbacks of sustainability on financial systems are examined. The model for measuring sustainability is based on the MULTIMOORA technique and sustainability indicators. The findings suggest that financial system sustainability aids financial institutions in maintaining strong economic performance even during times of crisis. The financial system's sustainability is assessed using the sustainability approach, which takes into account the interaction of economic, social, and environmental factors. For this study, ten "A10" countries were chosen, all of which joined the European Union in 2004 (Stankevičienė & Nikanorova, 2019).

Simdi and Seker (2017) examine the structural fractures and periods of the "Fragile Five" currencies in relation to the US dollar. As a result, the study uses a structural break unit root test over currencies to try to determine the consistency of the "Fragile Five." Using weekly closing currency numbers, the paper examines the structural breakdowns from January 2010 to June 2013 and July 2013 to December 2016. The study examines the currency instability of such nations using the Kapetanios unit root test, which allows

for five series breakdowns. All nations except Turkey have one structural breach, according to test results, but Turkey has four between 2010:01 and 2013:07. Furthermore, all nations have just one structural break date between 2013:08 and 2016:12. The study's findings show that the "Fragile Five" categorization can be revised based on the consistency of other macroeconomic indicators.

Simdi and Seker add the following to their research findings; Turkey, which is considered to be more fragile, was more affected by the European debt crisis than other nations in the early stages of its vulnerability. Geographical closeness is one of the reasons why Turkey is more negatively affected than the other nations in the group by the crises that have occurred or are expected to occur in Europe. However, any favorable economic progress in Europe would elicit a stronger reaction from Turkey (Simdi & Seker, 2017).

Mete and Destek (2016) investigate the many sources of financial fragility in ten countries by looking at the current account balance, budget balance, and unemployment rate stability aspects. As a result, the current account balance stability of 10 countries is examined from 2005 to 2014; unemployment in ten countries is examined from 2004 to 2013, and the budget balance of eight countries is examined from 2004 to 2012. The panel unit root test is used to study the stability properties of Chile's and Indonesia's current accounts, and it is concluded that both countries' current accounts are stable. South Africa, India, Poland, and Indonesia have all verified a halt in the jobless rate. Finally, Brazil is the only country that advocates for fiscal balance stability (Mete & Destek, 2016).

Albulescu (2015) uses IMF monthly aggregate data to examine the impact of financial soundness measures on bank profitability at the macro level in six Central and South American nations, namely Chile, Colombia, El Salvador, Honduras, Mexico, and Paraguay, during the period December 2006 to June 2013. The random effects model is used to examine the outcome's robustness in this study. And the banking sector's profitability is estimated using two separate measures (ROA and ROE). Nonperforming loans have a negative impact on bank profitability, according to the study, whereas liquidity has a mixed impact. Non-interest expenditures have a negative impact on bank profitability, whereas capitalization and interest rate margins have a favorable impact (Albulescu, 2015).

Önder, Taş, and Hepsen (2015) examine the Fragile Five countries' economic performance model from 2001 to 2013. Analytical Network Process (ANP) and TOPSIS methodologies were used to rank countries based on macroeconomic indicators such as gross domestic product, current account balance, general government gross debt, general government revenue, general government total expenditure, gross national savings, inflation (average consumer prices), population, total investment, unemployment rate, and volume of trade. The subjective and objective opinions of economy experts are quantified in this study using ANP. The findings of the study demonstrate that, despite having the most unstable economy during the Great Recession (2008-2009), Turkey's economy has performed pretty well since then. India has a steady economy and is ranked between 1 and 2 in the world. In 2013, Indonesia had the best performance. According to OECD and IMF predictions issued in 2015, Indonesia is predicted to be the fastest growing economy among the Fragile Five countries, with an average annual growth rate of 6%, followed by India with 5.9% growth in 2014-18. The remaining three countries' average annual GDP is expected to be less than 3%. The most severe effects would be on GDP growth, external and fiscal sustainability, which might be hurt by weaker external demand, reduced commodity prices, political instability, and heightened global risk aversion (Önder, Taş & Hepsen, 2015).

Kasselaki and Tagkalakis (2014) examine the relationships between financial soundness measures and financial crisis events in 20 OECD countries while controlling for important macroeconomic and fiscal parameters in their paper titled " Financial soundness indicators and financial crisis episodes." They focus on the IMF's measures of aggregate capital adequacy, asset quality, and bank profitability. The study's main findings are that regulatory capital to risk weighted assets is increased by about 0.5-0.6 percentage points in times of severe financial crisis; nonperforming loans (NPLs) to total loans increase dramatically (by about 0.5-0.6 percentage points), but loan loss provisions lag behind NPLs (they fall by about 12.3-18.8 percentage points) and profitability plummets (returns on assets (equity) fall by about 0.5-0.6 percentage points) to comply with regulatory and supervisory (Kasselaki & Tagkalakis, 2014).

By performing an empirical analysis of the high financial interdependences of some chosen developing economies with the US, the research by Aloui et al. (2011) investigates the scope of the global crisis and the contagion effects it causes. To simulate the degree

of cross market connections, many copula functions that give the essential flexibility to capture the dynamic patterns of the fat tail as well as linear and nonlinear interdependences are utilized. Using daily return data from Brazil, Russia, India, China (BRIC), and the United States, their empirical findings show strong evidence of time varying dependence between each of the BRIC markets and the US markets, with the dependency being stronger for commodity price dependent markets than for finished-product export-oriented markets. They detect significant levels of dependent persistence for all market pairs throughout both bullish and bearish markets (Aloui et al., 2011).

In their paper, Zapodeanu and Cociuba (2010) examine the most important indicators of financial stability and the evolution of the primary indices of financial health for the Romanian banking sector as a whole and especially for two banks, BRD and Transylvania Bank, respectively. They discovered that banks with foreign stockholders are riskier than local banks, and that the existence of an institutional investor plays a crucial role in bank stability (Zapodeanu & Cociuba, 2010). Even it was demonstrated for Romania, we can suppose that this result can be applicable to other countries.



Studies on some of the emerging countries individually:

The research in the literature about the financial systems of some countries are given as follows:

Brazil

De Moraes & de Mendonça (2019) analyzed data from Brazilian banks to try to understand how monetary policy effects bank risk indicators that can be used as macroprudential financial institutions-based regulations. The findings suggest that a change in the banks' safety and soundness strategy is required when the monetary policy interest rate rises. Banks, on the other hand, lose their risk covers (risk measures) when the central bank reduces the interest rate, making them less safe. As a result, macroprudential supervisors should be aware of this possibility. In summary, the findings show that macroprudential and monetary policy must be coordinated (de Moraes & de Mendonça, 2019).

Greece

According to the study made by Pasiouras & Tsagkarakis (2021), the Greek sovereign debt crisis wreaked devastation on the economic and financial system of the country. Greek banks have seen a large decline in demand in the local market, as well as a significant increase in non-performing loans, following a period of economic boom and high profitability. This had a significant impact on the financing of Greek businesses and people, especially after the Greek banks were recapitalized. After a lengthy period of depression, the Greek banking sector has been reformed into four main systemic banking groupings, and efforts are now being concentrated toward restarting the economy through the financing of enterprises and individuals. However, the recent and ongoing experience with large amounts of non-performing loans and strategic defaults presents a number of difficulties. Stricter regulation enacted in the wake of the financial crisis, business model transformation, fintech and IT innovations, and, most recently, the COVID-19 pandemic, all pose challenges to bank executives. For more details, refer to (Pasiouras & Tsagkarakis, 2021).

In his paper, Kolliopoulos (2021) tries to describe the political economy of Greece's financial reforms. After a decade of profound crisis, Greek banks still have the highest ratio of non-performing loans (NPLs) in the Eurozone, owing to macroeconomic and bank-specific variables. However, because policymakers focused on the macroeconomic determinants of NPLs and the conflicting incentives of the main stakeholders (bankers, politicians, regulators, and investors), the need to improve internal NPL management skills and bank corporate governance, which were both lacking, was overlooked. As a result of the missed opportunity to rebuild Greece's financial sector, macroeconomic conditions have worsened due to a lack of counter-cyclical lending policy (Kolliopoulos, 2021).

India

Gupta and Tyagi (2022) examine the deep and unusual economic recession in India in 2019-20, when the country's economy grew at its slowest rate in a decade, at 4%. They claim that the slowdown lasted only one year, from 2019 to 2020. Prior years' growth rates averaged 7% per year, and none of the other years' growth rates were much lower than this average. In contrary to some popular perceptions, the slowdown did not affect

all sectors or activities equally. It was mostly centered on the manufacturing industry. Agriculture increased at a greater rate than before, while the services sector only had a minor slowdown in the last two quarters of the year. The downturn was principally reflected in a substantial drop in exports on the demand side. In comparison, consumption slowed slightly less, investment remained relatively stable, and government spending increased at a quicker rate than in the preceding decade. Three things can be blamed for the delay. First, the COVID-induced lockdown in the last week of March 2020 contributed around 50 basis points to the slowdown. Second, a drop in exports contributed more than 100 basis points to the slowdown, which may be linked to both a big global slowdown in trade and the fact that India lost ground to other nations in maintaining its market share in a slowing market. Finally, the credit crisis involving banks, non-banking financial companies, and housing finance companies affected production, investment, export, and consumption decisions, making credit a hindrance (Gupta & Tyagi, 2022, p. 35).

Regarding the research by Sharma & Pal (2020) The global economy is slowing generally, with a growth rate of 2.6 percent predicted in 2019, down from prior years. China recently surpassed India as the world's fastest expanding economy, with a growth rate of 6.4 percent compared to India's 5.8 percent in the first quarter of 2019. Though officials originally refused, the slowdown was formally agreed upon when Chief Economic Advisor Krishnamurthy Subramanian submitted the 2018-19 Economic Survey to the Parliament (Sharma & Pal, 2020).

Indonesia

The analysis of Oppusunggu & Simbolon's research (2021) is done through descriptive research with the use of theories and findings from earlier studies. The Return on Assets (ROA) has fluctuated over time, as has the Loan to Deposit Ratio (LDR). From 2.82 percent in January 2015 to 2.47 percent in December 2019, profitability with ROA declined by 0.35 percent. Banking performance, as measured by ROA, deteriorates, making banks vulnerable to a crisis. Liquidity risk may exist for banks with a high LDR. Since there is a sharp trend for the increasing value of LDR, this study presents descriptive data that describe the possibility for high LDR in the future. From 88.48 percent in January 2015 to 94.43 percent in December 2019, LDR increased by 5.95 percent. Liquidity risk is continuing to rise, putting banks at risk of a crisis. In order to manage those risks, this paper presents various insights from past research on normal corporate

governance and risk governance during the financial crisis. Optimal financial soundness can be achieved by evaluating formal company management and risk governance. (Oppusunggu & Simbolon, 2021).

Because of the Asean Economic Community (AEC) period currently, which is developing a system of free-trading among ASEAN countries, Landjang & Tumiwa (2018) made research utilizing the new Bankometer model produced by the IMF in 2000. Capital to asset, equity to asset, CAR, NPL, cost to income, and loans to assets are the six financial ratios that are used. Because of the bank's availability and published financial statements, this study looked at 19 private owned banks that met the criterion of private owned bank with total assets of Rp 50 trillion. For the last three years, the outcome shows that all 19 banks have been classified as super sound. The following are the top three banks: The top three banks were Bank of Tokyo Mitsubishi, Citibank, and BTPN (Landjang & Tumiwa, 2018).

Turkey

Gül and Bektaş (2022) use financia to assess the financial stability of the top 10 commercial banks operating in the Turkish banking sector, ranked by asset size, from 2010 to 2020. The performance criteria in the study were 8 sub-variables from the FSIs defined by the Central Bank of the Republic of Turkey. Entropy and ARAS approaches from Multi-Criteria Decision-Making Methods were utilized together in the analysis. The top three banks in terms of financial stability performance were judged to be Halk Bank, Ziraat Bank, and Garanti Bank, according to the results of the analysis done with the Financial Soundness indicators (Gül & Bektaş, 2022).

The core set of the International Monetary Fund (IMF) financial stability index is used as the basis in the study by Yildirim (2021), and the proposed index is calculated using quarterly data for the period 2007: Q2-2020: Q3. On the standardized data, the principal component analysis method is used. Variables are divided into two primary components based on the results of the principal component analysis. In the first primary component, profitability and liquidity ratios have a high link. Market risk and specific capital adequacy ratios are linked in the second primary component. In 2007: Q2, the index achieved its highest point. Its lowest points have been observed in 2015: Q3 and 2020: Q1. It can be seen that the calculated banking soundness index agrees with the

assessments of the banking sector included in the Central Bank of the Republic of Turkey's financial stability reports (CBRT) (Yildirim, 2021).

In the study of Karadağ (2021), the financial soundness of the deposit banks traded in the Istanbul Stock Exchange BIST was evaluated by TOPSIS and Entropy methods. In the study, IMF financial soundness indicators and 2018 data of deposit banks traded in the BIST were used. Using the methods mentioned in the study, banks were ranked in terms of their financial soundness. As a result of the study, QNP Finansbank A.Ş. was ranked first in terms of IMF financial soundness indicators according to 2018 data; at the second place, Yapı ve Kredi Bankası A.Ş. was taken (Karada et al., 2021).

By using the Panel Regression Model, Koç & Karahan (2017) investigated the notion of financial soundness in the Turkish Banking Sector and its influencing factors. Financial soundness and the causes impacting it are disclosed in the study, which uses bank data from 2005 to 2015, and an assessment of the banking sector's financial structure is made. When the findings of the study for the years 2005 to 2015 were analyzed, all factors were found to be significant. The independent factors of asset quality, non-interest income, net asset profitability, and liquidity have been determined to be the determinants of the dependent variable of financial soundness. Each of these factors plays a vital role in the construction of a bank's balance sheet. The banking system's financial soundness is critical since it is a component that removes instability. According to this finding, when banks place a high value on these characteristics, they will avoid financial fragility and feel secure in times of crises (Koç & Karahan, 2017).

Although several studies have examined financial soundness indicators for individual countries' banking systems, this study will assess the soundness of the financial systems of 12 countries across four world regions the Fragile Five countries, as well as other emerging countries, assuming that the soundness of a country's financial system is related to the financial soundness of its financial institutions. However, to the best of our knowledge, this is one of the rare research projects that focuses on the financial soundness of financial institutions in emerging market economies, notably the Fragile Five.

CHAPTER 3

3. DATA AND METHODOLOGY

To assess the financial soundness of financial institutions in Fragile Five and seven other emerging countries, an integrated approach of Entropy Weight determination and TOPSIS methods was applied on the most recent available annual data for 6 core and 2 additional FSIs of Deposit-takers. The FSIs data obtained from the International Monetary Fund website for the period 2018-2020 (see Appendix A).

3.1. Entropy Weight Method

The weighing procedure, which indicates the importance level of each criterion in Multi-Criteria Decision-Making methods, is commonly done in two ways. There are two types of weighting: objective weighting and subjective weighting (Shemshadi et al., 2011, p. 12161; Chen, 2019, p. 33). While subjective weighting considers the decision maker's judgments, objective weighting considers the quantitative characteristics of the options. When decision matrix scores are known, the entropy approach, which is one of the objectives weighing methods, can be utilized. Entropy method is an important process that has been used recently in social sciences as well as in natural sciences (Çatı et al., 2017, p. 204).

The concept of entropy was first proposed by Rudolf Clausius in 1865 and is known as a criterion of disorder and dispersion in thermodynamics. The term entropy, which is the second law of thermodynamics, briefly states that all systems left to their own devices and natural conditions in the universe will lead to disorganization, disorder and deterioration over time. The concept of entropy has gained a different usage by Shannon (1948) and has become information entropy. Entropy is a measure of the uncertainty associated with random variables, according to information theory (Zhang et al., 2011, p. 444).

In the entropy method, the initial matrix is sufficient to obtain the criterion weights and it is very useful because there is no need to assess the criteria (Özdağoğlu et al., 2017, p. 346). The strength of entropy is that it provides more objective results on the scores of alternatives without the need for evaluation by decision makers (Analizi, 2019). In this method, the uncertainty is higher in the data group with high weight value (Alp et al., 2015, p. 69).

The entropy method consists of the following steps (Shemshadi et al., 2011; Alp et al., 2015; Bakir & Atalik, 2018; Ayçin & Orçun, 2019; Marjanovic & Markovic, 2020)

Step 1: Formation of Decision matrix, in which a row corresponds to a country or an alternative and a column to an indicator.

$$A_{ij} = \begin{bmatrix} x_{11} & x_{12} & \cdots & x_{1n} \\ x_{21} & x_{22} & \cdots & x_{2n} \\ \vdots & \vdots & \ddots & \vdots \\ x_{m1} & x_{m2} & \cdots & x_{mn} \end{bmatrix} \quad (3.1)$$

Step 2: Formation of the Standard (Normalized) Decision Matrix (R): It should be ensured that the values related to the criteria with different units in the decision problems take values in the range of [0,1] by the normalization process by using Equation (3.2).

$$r_{ij} = \frac{x_{ij}}{\sqrt{\sum_{i=1}^n x_{ij}^2}} \quad i = 1, 2, \dots, m \quad j = 1, 2, \dots, n \quad (3.2)$$

i = alternatives

j = criteria

r_{ij} = normalized values

x_{ij} = the value for the i^{th} alternative's j^{th} criterion.

Step 3: Calculation of Entropy Value for each index by following equation²:

$$e_j = -h \sum_{i=1}^n r_{ij} \ln r_{ij}, \quad i = 1, 2, \dots, m \quad j = 1, 2, \dots, n \quad (3.3)$$

Where $\sum_{i=1}^n r_{ij} = 1, r_{ij} \geq 0$ and $0 \ln 0 = 0$ (Zhou et al., 2013, p. 4911).

$h = \frac{1}{\ln n}$ = stands for a constant (entropy coefficient).

r_{ij} = normalized values

e_j = entropy value

The entropy value e_j has a range of [0, 1] (Zhu et al., 2020, p. 2).

Step 4: Determining the Degree of Differentiation (divergence d_j) through:

$$d_j = 1 - e_j, \quad j = 1, 2, \dots, m \quad (3.4)$$

² However, some values can be negative; this is the case for the 2018 FSERA and FSERE data for Greece, the 2018 FSSNO for Pakistan, the 2019 FSSNO for Turkey, the 2020 FSERA and FSERE data for Argentina and Poland and finally the 2020 FSSNO again for Pakistan. In order to overcome the negative situation, the smallest negative value is added to all the values in the relevant variable.

The e_j value in the formula above shows the Entropy values of the criteria.

Step 5: Computing the normalized Weight Vector of each index as follow:

$$w_j = \frac{d_j}{\sum_{j=1}^m d_j} \quad (3.5)$$

The w_j value represents the weight values, which indicate the criteria's importance levels. The sum of the entropy probability values ($\sum_{j=1}^n W_j$) is always equal to 1 (Alp et al., 2015, p. 70; Çatı et al., 2017, p. 204).

$$w_1 + w_2 + w_3 + w_j + \dots w_n = 1 \quad (3.6)$$

3.2.TOPSIS

TOPSIS stands for Technique for Order Preference by Similarity to Ideal Solution. This is one of the Multi Criteria Decision Making approaches which is introduced by Hwang and Yoon (1981) for the first time (Hwang, 1981; Hwang, 1995 as cited in Lukić et al., 2020, p. 58) The TOPSIS methodology has 6 stages (Üçüncü et al., 2018, pp. 94-95; Lukic et al., 2020, pp. 58-60). The stages are described as follows:

Stage 1: Formation of TOPSIS Decision matrix:

The decision points whose superiority is sought to be recorded in the rows of the decision matrix, and the assessment criteria to be employed in decision making in the columns. The decision maker's first matrix is called Matrix A. Indeed, it is the same Decision matrix used in EWM (3.1). The decision matrix is shown as follow.

$$A_{ij} = \begin{bmatrix} x_{11} & x_{12} & \dots & x_{1n} \\ x_{21} & x_{22} & \dots & x_{2n} \\ \vdots & \vdots & \ddots & \vdots \\ x_{m1} & x_{m2} & \dots & x_{mn} \end{bmatrix} \quad (3.7)$$

In the starting matrix A_{ij} , the number of Alternatives (number of decision points) is denoted by m and the number of criteria (number of evaluation factors) is denoted by n .

Stage 2: Formation of the Standard (Normalized) Decision Matrix (R):

The standard decision matrix ($R_{ij}; i = 1, 2, \dots, m, j = 1, 2, \dots, n$) is calculated by using the elements of the A_{ij} matrix through following equation.

$$r_{ij} = \frac{x_{ij}}{\sqrt{\sum_{i=1}^m x_{ij}^2}}, i = 1, 2, \dots, m, j = 1, 2, \dots, n \quad (3.8)$$

$$R_{ij} = \begin{bmatrix} r_{11} & r_{12} & \dots & r_{1n} \\ r_{21} & r_{22} & \dots & r_{2n} \\ \vdots & \vdots & \ddots & \vdots \\ r_{m1} & r_{m2} & \dots & r_{mn} \end{bmatrix}$$

Stage 3: Formation of the Weighted Standard Decision Matrix (R):

First of all, the weight values (W_i) of the evaluation factors are determined by Entropy method for weight determination.

$$\sum_{i=1}^n W_i = 1 \quad (3.9)$$

Then, the elements in each column of the (R) matrix are multiplied by the corresponding W_{ij} value to form the Weighted Standard Decision Matrix (V) matrix.

$$V_{ij} = W_{ij} * r_{ij} \quad (3.10)$$

$$i = 1, 2, 3, \dots, m \quad j = 1, 2, 3, \dots, n$$

The V matrix is shown below:

$$V_{ij} = \begin{bmatrix} w_1 r_{11} & w_2 r_{12} & \dots & w_n r_{1n} \\ w_1 r_{21} & w_2 r_{22} & \dots & w_n r_{2n} \\ \vdots & \vdots & \ddots & \vdots \\ w_1 r_{m1} & w_2 r_{m2} & \dots & w_n r_{mn} \end{bmatrix}$$

Weights related to evaluation criteria determined as $w_1, w_2, \dots, w_n$. For the weighted normalized decision matrix to be created, the values in the columns of the R matrix are multiplied by the weight values of the relevant evaluation criteria, and the columns of the V matrix are calculated.

Stage 4: Constructing Positive Ideal (A^+) and Negative Ideal (A^-) Solutions.

The TOPSIS method assumes that each evaluation criterion has a monotonously increasing or decreasing trend.

In order to create the ideal solution set, the largest of the weighted evaluation factors in the V matrix: that is, the column values (the smallest if the relevant evaluation factor is minimization-oriented) is selected. Finding the ideal solution set is shown in the formula below. In both formulas, J represents the benefit (maximization) and J' represents the loss (minimization).

$$A^+ = \{(\max v_{ij} \mid j \in J), (\min v_{ij} \mid j \in J')\} \quad (3.11)$$

The set to be calculated from the above formula can be represented as follow

$$A^+ = \{v_1^+, v_2^+, \dots, v_n^+\}$$

The negative ideal solution set, on the other hand, is created by choosing the smallest of the weighted evaluation factors in the (V) matrix, namely the column values (the largest if the relevant evaluation factor is in the direction of maximization).

Finding the negative ideal solution set is shown in the formula below.

$$A^- = \{(\min v_{ij} \mid j \in J), (\max v_{ij} \mid j \in J')\} \quad (3.12)$$

The set to be calculated from the above formula can be represented as follow:

$$A^- = \{v_1^-, v_2^-, \dots, v_n^-\}.$$

Both the ideal and negative ideal solution set consists of the number of evaluation factors, i.e., m elements.

In step 4, ideal A^+ and negative ideal A^- solution sets were created. For the set A^+ the largest value in each column of the V matrix was chosen, for the A^- set the smallest value in each column of the V matrix was chosen, and the sets were arranged according to the purpose of the criteria.

Stage 5: Calculation of Separation Measures

In the TOPSIS method, the Euclidian Distance Approach is used to find the deviations of the evaluation criterion value for each decision point from the ideal and negative ideal solution set. The deviation values of the alternatives obtained from here are called Ideal Discrimination S_i^+ and Negative-Ideal Discrimination S_i^- Measure. Ideal separation S_i^+ and negative ideal separation S_i^- measures were calculated according to the formulas below.

$$S_i^+ = \sqrt{\sum_{j=1}^n (V_{ij} - V_j^*)^2} \quad (3.13)$$

Similarly, the distance of each alternative from the negative ideal solution;

$$S_i^- = \sqrt{\sum_{j=1}^n (V_{ij} - V_j^-)^2} \quad (3.14)$$

$$i = 1, 2, 3, \dots, m \quad j = 1, 2, 3, \dots, n$$

The number of (S_i^+) and (S_i^-) to be calculated here will naturally be as much as the number of alternatives.

Stage 6: Calculating Relative Closeness to Positive (ideal) Solution, Relative Ranking of Alternatives and Finding Their Scores

The relative closeness C_i^* of each decision option to the ideal answer is calculated using ideal and negative ideal distance metrics. The share of the negative ideal discrimination measure in the overall discrimination measure is the criterion employed here. The formula below shows how to calculate the relative closeness value to the ideal solution.

$$C_i^* = \frac{s_i^-}{s_i^- + s_i^+} \quad (3.15)$$

$$i = 1, 2, 3, \dots, m$$

Here C_i^* value takes a value in the range of $0 \leq C_i^* \leq 1$, " $C_i^* = 1$ " indicates the absolute closeness of the relevant decision point to the ideal solution, and " $C_i^* = 0$ " indicates the absolute closeness of the relevant decision point to the negative ideal solution (Kurnaz et al, 2014, p. 419).

Finally, the values obtained in the last step are ranked in order of magnitude and the order of importance of the decision points (alternatives) is determined.

3.3. Model Development with Empirical Data

The core FSIs are related to five basic factors that are important in the banking industry and are consistent with the CAMELS methodology for evaluating the soundness of individual financial institutions (Capital adequacy, Asset quality, Management soundness, Earnings, Liquidity, Sensitivity to market risk). The capital adequacy indicators measure the banking sector's ability to absorb unexpected losses and are thus closest to the "resilience to shocks" notion, whereas asset quality indicators are directly linked to potential solvency problems. The profitability indicators assess a bank's ability to absorb losses without affecting its capital, whereas the liquidity indicators assess its ability to withstand cash flow shocks. Foreign currency exposure is a metric that measures

a bank's risk in terms of asset price changes on financial markets. Because of the difficulty in quantifying qualitative indicators, the management quality indicators were eventually left out of the FSIs.

Considering the importance of the factors in CAMELS methodology for evaluating the financial soundness of institutions; financial soundness indicators showing capital adequacy, asset quality, earnings and profitability, sensitivity to market risk and two more FSIs from additional group are taken as criteria in this thesis. Table 3.1 presents these FSIs and the targets according to their nature of being inputs and outputs.

Table 3.1. *Financial soundness indicators used in this research and targets related to the indicators*

The Core and Additional FSIs Sets for Deposit-takers	Code	Target
Capital adequacy		Input/Output
Tier 1 Capital to Risk-Weighted Assets	FSKRTC	Input
Asset Quality		
Non-performing Loans to Total Gross Loans	FSANL	Input
Earnings and Profitability		
Return on Assets (ROA)	FSERA	Output
Return on Equity (ROE)	FSERE	Output
Interest Margin to Gross Income	FSEIM	Output
Sensitivity to Market Risk		
Net open position in foreign exchange to capital	FSSNO	Input
Additional Set		
Customer Deposits to Total (Non-interbank) Loans	FSCD	Input
Foreign-Currency-Denominated Liabilities to Total Liabilities	FSFCD	Input

As previously said, the Brazilian real, Indian rupee, Indonesian rupiah, South African rand, and Turkish lira were named the "Fragile Five" by Morgan Stanley in 2013, referring to the unstable emerging market currencies under the most pressure versus the US dollar. High inflation, weakening GDP, significant external debt, and a high reliance on fixed income inflows, according to the study paper, make these countries' currencies

vulnerable. The hazards connected with these five currencies are further evidenced by the fact that their central banks have been among the most aggressive in their efforts to support their currencies (<https://manualzz.com/doc/21896111/fx-pulse-preparing-for-volatility--trade-recommendations>).

The major goal of this research is to compare the financial soundness of these Fragile Five countries to that of seven other countries with similar financial institutions in recent years.

The indicators are sub-criteria that are further divided into five categories that correspond to model hierarchy criteria (Figure 3.1.): capital adequacy, asset quality, earnings and profitability, sensitivity to market risk and additional or encouraged set.

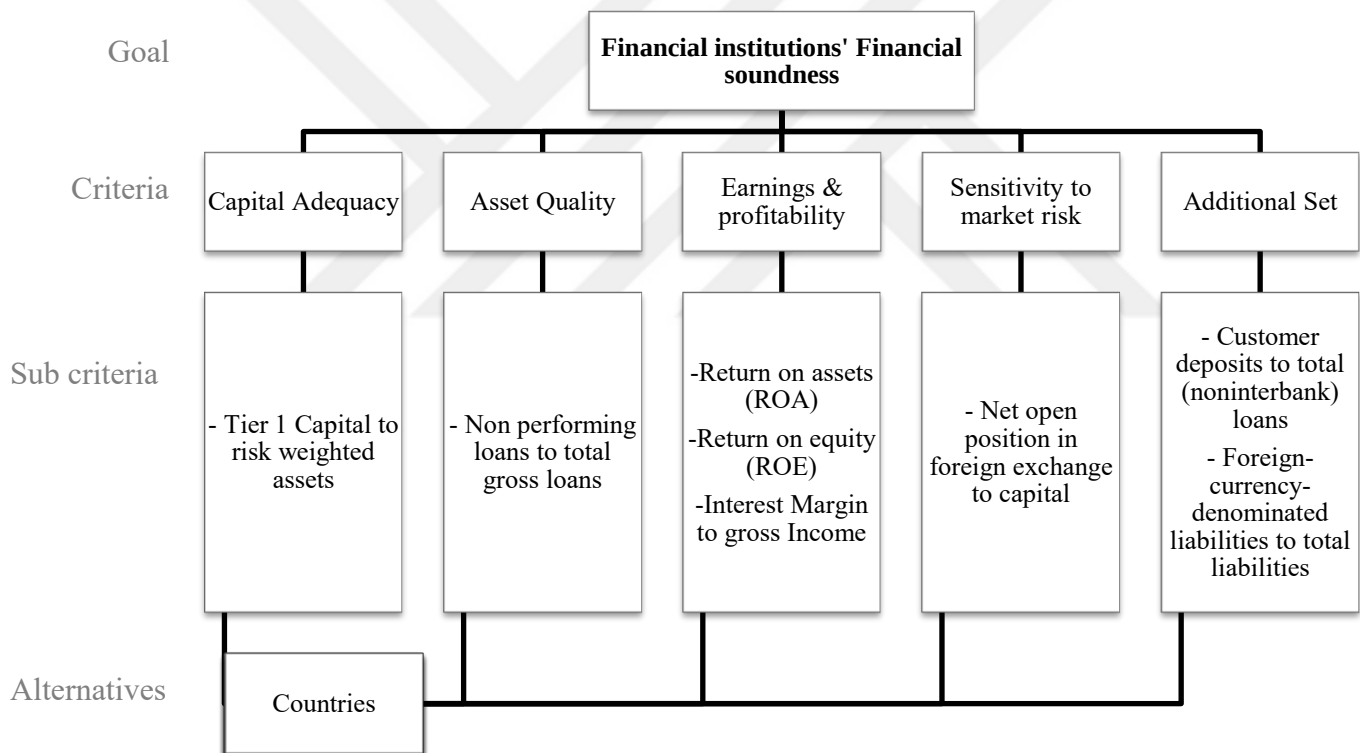


Figure 3.1. The model's hierarchic structure, Source: Author's Preview.

3.4.ENTROPY WEIGHT METHOD IMPLEMENTATION STAGES

The implementation stages of the Entropy method as of the year are shown in the tables below:

Table 3.2. Entropy weight method implementation stages for 2018								
Step 1: Decision Matrix								
COUNTRY	Input FSKRT C	Input FSCD	Input FSAN L	Output FSER A	Output FSER E	Output FSEI M	Input FSSN O	Input FSFC D
Argentina	14.23	175.09	3.11	5.55	48.22	57.55	9.36	30.80
Brazil	14.56	124.17	3.05	1.75	14.88	64.64	0.64	16.92
Greece	15.32	81.31	41.99	0.00	0.00	71.94	0.76	4.40
India	11.91	120.36	9.46	0.20	0.52	66.36	0.30	7.93
Indonesia	19.23	98.09	2.21	2.66	13.69	69.75	6.44	19.99
Italy	13.86	72.81	8.39	0.63	6.42	49.61	0.72	7.50
Mexico	14.22	89.29	2.05	2.36	21.22	74.48	1.09	16.33
Pakistan	13.24	157.39	7.97	0.97	11.10	75.37	0.00	12.91
Poland. Rep. Of.	16.31	91.12	3.85	0.86	7.89	62.84	0.15	17.88
Russian Federation	8.87	75.13	10.12	1.76	13.37	20.92	2.99	23.79
South Africa	14.88	55.72	3.73	1.85	20.18	50.01	0.76	8.01
Turkey	13.99	78.26	3.69	1.95	17.31	67.42	1.55	57.21
Denominator	170.63	$\frac{1218.7}{3}$	99.62	20.54	174.80	730.90	24.76	223.67

Table 3.2. (Continue) *Entropy weight method implementation stages for 2018***Step 2: Standard Decision Matrix**

COUNTRY	Input	Input	Input	Output	Output	Output	Input	Input
	FSKRT C	FSCD	FSAN L	FSER A	FSER E	FSEIM	FSSN O	FSFCD
Argentina	0.0834	0.1437	0.0312	0.2704	0.2758	0.0787	0.3782	0.1377
Brazil	0.0853	0.1019	0.0306	0.0851	0.0852	0.0884	0.0259	0.0756
Greece	0.0898	0.0667	0.4215	0.0000	0.0000	0.0984	0.0308	0.0197
India	0.0698	0.0988	0.0950	0.0095	0.0030	0.0908	0.0122	0.0355
Indonesia	0.1127	0.0805	0.0221	0.1297	0.0783	0.0954	0.2601	0.0894
Italy	0.0812	0.0597	0.0842	0.0307	0.0367	0.0679	0.0290	0.0335
Mexico	0.0833	0.0733	0.0206	0.1151	0.1214	0.1019	0.0442	0.0730
Pakistan	0.0776	0.1291	0.0800	0.0475	0.0635	0.1031	0.0000	0.0577
Poland. Rep. Of.	0.0956	0.0748	0.0387	0.0416	0.0451	0.0860	0.0059	0.0799
Russian Federation	0.0520	0.0616	0.1016	0.0858	0.0765	0.0286	0.1206	0.1064
South Africa	0.0872	0.0457	0.0374	0.0898	0.1155	0.0684	0.0308	0.0358
Turkey	0.0820	0.0642	0.0370	0.0949	0.0990	0.0922	0.0625	0.2558

Step 3: Entropy Value

$h = 1/\ln(12) = 0.4024$	Input	Input	Input	Output	Output	Output	Input	Input
	FSKRT C	FSCD	FSAN L	FSER A	FSER E	FSEIM	FSSN O	FSFC D
Argentina	-0.2072	0.2787	0.1082	0.3536	0.3553	0.2001	0.3677	0.2730
Brazil	-0.2100	0.2327	0.1068	0.2096	0.2098	0.2145	0.0945	0.1953
Greece	-0.2164	0.1806	0.3642	0.0000	0.0000	0.2282	0.1071	0.0773
India	-0.1858	0.2286	0.2236	0.0443	0.0173	0.2178	0.0536	0.1184
Indonesia	-0.2460	0.2028	0.0844	0.2649	0.1995	0.2242	0.3503	0.2158
Italy	-0.2039	0.1683	0.2083	0.1069	0.1213	0.1826	0.1026	0.1138

Table 3.2. (Continue) Entropy weight method implementation stages for 2018								
Step 3: (Continue) Entropy Value								
Mexico	-0.2071	-0.1915	-0.0799	-0.2488	-0.2560	-0.2327	-0.1378	-0.1911
Pakistan	-0.1984	-0.2643	-0.2021	-0.1447	-0.1750	-0.2343	0.0000	-0.1646
Poland. Rep. Of.	-0.2244	-0.1939	-0.1258	-0.1323	-0.1398	-0.2110	-0.0302	-0.2020
Russian Federation	-0.1538	-0.1718	-0.2324	-0.2106	-0.1966	-0.1017	-0.2551	-0.2384
South Africa	-0.2128	-0.1411	-0.1230	-0.2165	-0.2493	-0.1835	-0.1073	-0.1192
Turkey	-0.2051	-0.1763	-0.1220	-0.2235	-0.2290	-0.2199	-0.1732	-0.3487
Total	-2.4708	-2.4307	-1.9806	-2.1558	-2.1488	-2.4505	-1.7794	-2.2577
e_j	0.9943	0.9782	0.7971	0.8676	0.8648	0.9861	0.7161	0.9085
Step 4: Determining the Degree of Differentiation								
d_j=1-e_j	0.0057	0.0218	0.2029	0.1324	0.1352	0.0139	0.2839	0.0915
Total d_j	0.8873							
Step 5: Establishing Weights of Entropy Criteria								
	Input	Input	Input	Output	Output	Output	Input	Input
	FSKRTC	FSCD	FSANL	FSERA	FSERE	FSEIM	FSSNO	FSFCD
W_j	0.0064	0.0246	0.2287	0.1493	0.1524	0.0156	0.3200	0.1031

Table 3.3. Entropy weight method implementation stages for 2019**Step 1: Decision Matrix**

COUNTRY	Input	Input	Input	Output	Output	Output	Input	Input
	FSKRT C	FSCD	FSAN L	FSER A	FSER E	FSEI M	FSSN O	FSFC D
Argentina	15.53	169.20	5.75	6.12	53.03	50.78	9.56	28.46
Brazil	14.24	122.60	3.11	1.98	17.99	70.59	1.32	17.55
Greece	15.93	91.59	36.45	0.16	0.71	67.46	1.64	4.30
India	14.66	122.74	9.23	0.54	2.81	63.84	1.27	6.67
Indonesia	20.06	97.12	2.34	2.45	12.35	65.31	2.13	18.93
Italy	14.86	92.53	6.75	0.39	5.08	48.20	1.41	7.29
Mexico	14.44	90.53	2.09	2.22	20.61	74.92	3.57	13.43
Pakistan	14.01	167.91	8.58	0.83	11.19	79.25	1.02	12.98
Poland. Rep. Of.	16.37	95.39	3.80	0.69	7.85	62.78	1.19	16.81
Russian Federation	9.24	71.15	9.29	2.35	19.54	52.99	4.42	21.00
South Africa	15.58	57.39	3.89	1.47	17.63	52.76	1.90	7.44
Turkey	15.34	87.01	5.02	1.45	12.84	67.69	0.00	56.76
Denominator	180.26	1265.1 5	96.31	20.67	181.63	756.57	29.41	211.63

Table 3.3. (Continue) *Entropy weight method implementation stages for 2019***Step 2: Standard Decision Matrix**

COUNTRY	Input	Input	Input	Output	Output	Output	Input	Input
	FSKRT C	FSCD	FSAN L	FSER A	FSER E	FSEIM	FSSN O	FSFCD
Argentina	0.0862	0.1337	0.0597	0.2961	0.2920	0.0671	0.3250	0.1345
Brazil	0.0790	0.0969	0.0323	0.0960	0.0990	0.0933	0.0449	0.0829
Greece	0.0884	0.0724	0.3785	0.0077	0.0039	0.0892	0.0557	0.0203
India	0.0813	0.0970	0.0959	0.0261	0.0155	0.0844	0.0430	0.0315
Indonesia	0.1113	0.0768	0.0243	0.1186	0.0680	0.0863	0.0723	0.0894
Italy	0.0824	0.0731	0.0701	0.0191	0.0280	0.0637	0.0478	0.0345
Mexico	0.0801	0.0716	0.0217	0.1076	0.1135	0.0990	0.1214	0.0635
Pakistan	0.0777	0.1327	0.0891	0.0403	0.0616	0.1048	0.0345	0.0613
Poland. Rep. Of.	0.0908	0.0754	0.0395	0.0335	0.0432	0.0830	0.0405	0.0794
Russian Federation	0.0512	0.0562	0.0965	0.1139	0.1076	0.0700	0.1501	0.0992
South Africa	0.0864	0.0454	0.0404	0.0711	0.0971	0.0697	0.0647	0.0352
Turkey	0.0851	0.0688	0.0522	0.0700	0.0707	0.0895	0.0000	0.2682

Step 3: Entropy Value

$h = 1/\ln(12) = 0.4024$	Input	Input	Input	Output	Output	Output	Input	Input
	FSKRT C	FSCD	FSAN L	FSER A	FSER E	FSEIM	FSSN O	FSFC D
Argentina	-0.2112	- 0.2691	- 0.1682	- 0.3604	- 0.3594	- 0.1813	- 0.3653	- 0.2698
Brazil	-0.2005	- 0.2262	- 0.1109	- 0.2249	- 0.2290	- 0.2213	- 0.1392	- 0.2065
Greece	-0.2144	- 0.1901	- 0.3677	- 0.0376	- 0.0217	- 0.2155	- 0.1609	- 0.0791
India	-0.2041	- 0.2263	- 0.2248	- 0.0952	- 0.0645	- 0.2086	- 0.1354	- 0.1089
Indonesia	-0.2444	- 0.1971	- 0.0903	- 0.2529	- 0.1828	- 0.2115	- 0.1899	- 0.2159
Italy	-0.2057	- 0.1913	- 0.1863	- 0.0755	- 0.1000	- 0.1754	- 0.1453	- 0.1161

Table 3.3. (Continue) <i>Entropy weight method implementation stages for 2019</i>								
Step 3: (Continue) Entropy Value								
Mexico	-0.2023	-0.1887	-0.0831	-0.2399	-0.2470	-0.2290	-0.2560	-0.1750
Pakistan	-0.1985	-0.2680	-0.2155	-0.1294	-0.1717	-0.2363	-0.1162	-0.1712
Poland. Rep. Of.	-0.2179	-0.1949	-0.1276	-0.1137	-0.1357	-0.2065	-0.1299	-0.2012
Russian Federation	-0.1522	-0.1619	-0.2256	-0.2475	-0.2399	-0.1862	-0.2847	-0.2292
South Africa	-0.2116	-0.1403	-0.1297	-0.1880	-0.2264	-0.1857	-0.1772	-0.1177
Turkey	-0.2097	-0.1841	-0.1540	-0.1861	-0.1873	-0.2160	0.0000	-0.3530
Total	-0.2112	-0.2691	-0.1682	-0.3604	-0.3594	-0.1813	-0.3653	-0.2698
e_j	-0.2005	-0.2262	-0.1109	-0.2249	-0.2290	-0.2213	-0.1392	-0.2065
Step 4: Determining the Degree of Differentiation								
d_j=1-e_j	0.0050	0.0189	0.1615	0.1344	0.1286	0.0046	0.1549	0.0971
Total d_j	0.7049							
Step 5: Establishing Weights of Entropy Criteria								
	Input	Input	Input	Output	Output	Output	Input	Input
	FSKRTC	FSCD	FSANL	FSERA	FSERE	FSEIM	FSSNO	FSFCD
W_j	0.0071	0.0268	0.2291	0.1907	0.1824	0.0066	0.2197	0.1377

Table 3.4. Entropy weight method implementation stages for 2020**Step 1:** Decision Matrix

COUNTRY	Input	Input	Input	Output	Output	Output	Input	Input
	FSKRT C	FSCD	FSAN L	FSER A	FSER E	FSEI M	FSSN O	FSFC D
Argentina	22.34	215.02	3.86	3.89	29.33	49.93	13.47	21.02
Brazil	14.63	133.22	2.24	1.65	18.13	60.84	1.22	19.32
Greece	15.01	91.66	26.98	0.00	0.00	57.39	1.07	3.87
India	14.48	128.56	7.94	1.21	13.16	65.68	0.64	5.49
Indonesia	20.47	103.20	2.64	1.89	12.95	60.96	5.90	18.18
Italy	16.94	68.53	4.36	0.48	6.77	49.48	1.21	5.96
Mexico	16.12	100.18	2.43	1.61	17.62	76.03	2.04	15.02
Pakistan	14.85	191.39	9.19	1.46	19.66	79.72	0.00	10.98
Poland. Rep. Of.	17.44	109.47	3.70	0.40	5.62	62.08	7.52	15.24
Russian Federation	9.68	62.90	8.76	2.45	23.39	52.35	4.95	23.22
South Africa	15.67	60.96	5.18	1.01	13.57	52.01	1.07	6.43
Turkey	15.68	88.93	3.89	1.82	18.71	70.72	3.05	56.65
Denominator	193.31	1354.04	81.17	17.86	178.92	737.19	42.15	201.38

Table 3.4. (Continue) *Entropy weight method implementation stages for 2020***Step 2: Standard Decision Matrix**

COUNTRY	Input	Input	Input	Output	Output	Output	Input	Input
	FSKRT C	FSCD	FSAN L	FSER A	FSER E	FSEIM	FSSN O	FSFCD
Argentina	0.1156	0.1588	0.0476	0.2176	0.1639	0.0677	0.3195	0.1044
Brazil	0.0757	0.0984	0.0276	0.0922	0.1013	0.0825	0.0289	0.0959
Greece	0.0776	0.0677	0.3324	0.0000	0.0000	0.0779	0.0254	0.0192
India	0.0749	0.0949	0.0978	0.0677	0.0736	0.0891	0.0153	0.0273
Indonesia	0.1059	0.0762	0.0326	0.1058	0.0724	0.0827	0.1400	0.0903
Italy	0.0876	0.0506	0.0537	0.0268	0.0378	0.0671	0.0287	0.0296
Mexico	0.0834	0.0740	0.0299	0.0901	0.0985	0.1031	0.0484	0.0746
Pakistan	0.0768	0.1413	0.1132	0.0818	0.1099	0.1081	0.0000	0.0545
Poland. Rep. Of.	0.0902	0.0808	0.0456	0.0224	0.0314	0.0842	0.1785	0.0757
Russian Federation	0.0501	0.0465	0.1079	0.1371	0.1308	0.0710	0.1174	0.1153
South Africa	0.0811	0.0450	0.0638	0.0568	0.0758	0.0705	0.0254	0.0320
Turkey	0.0811	0.0657	0.0479	0.1016	0.1046	0.0959	0.0724	0.2813

Step 3: Entropy Value

$h = 1/\ln(12) = 0.4024$	Input	Input	Input	Output	Output	Output	Input	Input
	FSKRT C	FSCD	FSAN L	FSER A	FSER E	FSEIM	FSSN O	FSFC D
Argentina	-0.2494	- 0.2922	- 0.1449	- 0.3319	- 0.2964	- 0.1824	- 0.3646	- 0.2358
Brazil	-0.1954	- 0.2281	- 0.0992	- 0.2198	- 0.2320	- 0.2059	- 0.1024	- 0.2249
Greece	-0.1984	- 0.1823	- 0.3661	0.0000	0.0000	- 0.1988	- 0.0934	- 0.0760
India	-0.1941	- 0.2235	- 0.2274	- 0.1823	- 0.1920	- 0.2154	- 0.0639	- 0.0982
Indonesia	-0.2377	- 0.1962	- 0.1115	- 0.2376	- 0.1901	- 0.2061	- 0.2753	- 0.2171
Italy	-0.2133	- 0.1510	- 0.1571	- 0.0971	- 0.1239	- 0.1813	- 0.1019	- 0.1042

Table 3.4. (Continue) Entropy weight method implementation stages for 2020								
Step 3: (Continue) Entropy Value								
Mexico	-0.2072	-0.1926	-0.1050	-0.2168	-0.2283	-0.2343	-0.1465	-0.1936
Pakistan	-0.1971	-0.2766	-0.2466	-0.2047	-0.2426	-0.2405	0.0000	-0.1586
Poland. Rep. Of.	-0.2170	-0.2033	-0.1408	-0.0852	-0.1087	-0.2084	-0.3076	-0.1953
Russian Federation	-0.1499	-0.1426	-0.2403	-0.2724	-0.2660	-0.1878	-0.2515	-0.2491
South Africa	-0.2037	-0.1396	-0.1756	-0.1629	-0.1956	-0.1871	-0.0932	-0.1100
Turkey	-0.2037	-0.1788	-0.1456	-0.2324	-0.2361	-0.2249	-0.1902	-0.3568
Total	-2.4671	-2.4070	-2.1599	-2.2432	-2.3117	-2.4728	-1.9905	-2.2196
e_j	0.9928	0.9686	0.8692	0.9027	0.9303	0.9951	0.8010	0.8933
Step 4: Determining the Degree of Differentiation								
d_j=1-e_j	0.0072	0.0314	0.1308	0.0973	0.0697	0.0049	0.1990	0.1067
Total d_j	0.6469							
Step 5: Establishing Weights of Entropy Criteria								
	Input	Input	Input	Output	Output	Output	Input	Input
	FSKRTC	FSCD	FSANL	FSERA	FSERE	FSEIM	FSSNO	FSFCD
W_j	0.0111	0.0485	0.2022	0.1504	0.1077	0.0075	0.3076	0.1650

3.1.TOPSIS IMPLEMENTATION STAGES

The implementation stages of the TOPSIS method as of the year are shown in the tables below:

Table 3.5. TOPSIS implementation stages for 2018								
Stage 1: Decision Matrix								
COUNTRY	Input	Input	Input	Output	Output	Output	Input	Input
	FSKRTC	FSCD	FSANL	FSERA	FSERE	FSEIM	FSSNO	FSFCD
Argentina	14.23	175.09	3.11	5.55	48.22	57.55	9.36	30.80
Brazil	14.56	124.17	3.05	1.75	14.88	64.64	0.64	16.92
Greece	15.32	81.31	41.99	0.00	0.00	71.94	0.76	4.40
India	11.91	120.36	9.46	0.20	0.52	66.36	0.30	7.93
Indonesia	19.23	98.09	2.21	2.66	13.69	69.75	6.44	19.99
Italy	13.86	72.81	8.39	0.63	6.42	49.61	0.72	7.50
Mexico	14.22	89.29	2.05	2.36	21.22	74.48	1.09	16.33
Pakistan	13.24	157.39	7.97	0.97	11.10	75.37	0.00	12.91
Poland. Rep. Of.	16.31	91.12	3.85	0.86	7.89	62.84	0.15	17.88
Russian Federation	8.87	75.13	10.12	1.76	13.37	20.92	2.99	23.79
South Africa	14.88	55.72	3.73	1.85	20.18	50.01	0.76	8.01
Turkey	13.99	78.26	3.69	1.95	17.31	67.42	1.55	57.21
Denominator	49.93	371.50	46.47	7.68	65.55	216.93	12.00	80.18

Table 3.5. (Continue) TOPSIS implementation stages for 2018**Stage 2: Standard Decision Matrix**

COUNTRY	Input	Input	Input	Output	Output	Output	Input	Input
	FSKRTC	FSCD	FSANL	FSERA	FSERE	FSEIM	FSSNO	FSFCD
Argentina	0.2850	0.4713	0.0669	0.7230	0.7356	0.2653	0.7807	0.3841
Brazil	0.2916	0.3342	0.0657	0.2275	0.2271	0.2980	0.0534	0.2110
Greece	0.3069	0.2189	0.9036	0.0000	0.0000	0.3316	0.0635	0.0549
India	0.2385	0.3240	0.2036	0.0254	0.0079	0.3059	0.0251	0.0989
Indonesia	0.3852	0.2640	0.0475	0.3468	0.2089	0.3216	0.5370	0.2493
Italy	0.2776	0.1960	0.1805	0.0821	0.0979	0.2287	0.0598	0.0935
Mexico	0.2848	0.2403	0.0441	0.3078	0.3237	0.3433	0.0912	0.2037
Pakistan	0.2652	0.4236	0.1716	0.1269	0.1693	0.3474	0.0000	0.1610
Poland. Rep. Of.	0.3267	0.2453	0.0829	0.1113	0.1203	0.2897	0.0121	0.2230
Russian Federation	0.1778	0.2022	0.2179	0.2293	0.2040	0.0964	0.2489	0.2967
South Africa	0.2981	0.1500	0.0802	0.2402	0.3079	0.2305	0.0637	0.0999
Turkey	0.2803	0.2107	0.0793	0.2538	0.2641	0.3108	0.1289	0.7135
Total	3.4177	3.2805	2.1438	2.6741	2.6667	3.3693	2.0643	2.7895

Stage 3: Weighted Normalized Decision Matrix

	Input	Input	Input	Output	Output	Output	Input	Input
	FSKRTC	FSCD	FSANL	FSERA	FSERE	FSEIM	FSSNO	FSFCD
Weight →	0.0064	0.0246	0.2287	0.1493	0.1524	0.0156	0.3200	0.1031
Argentina	0.0018	0.0116	0.0153	0.1079	0.1121	0.0041	0.2498	0.0396
Brazil	0.0019	0.0082	0.0150	0.0339	0.0346	0.0047	0.0171	0.0217
Greece	0.0020	0.0054	0.2067	0.0000	0.0000	0.0052	0.0203	0.0057
India	0.0015	0.0080	0.0466	0.0038	0.0012	0.0048	0.0080	0.0102
Indonesia	0.0025	0.0065	0.0109	0.0518	0.0318	0.0050	0.1718	0.0257
Italy	0.0018	0.0048	0.0413	0.0123	0.0149	0.0036	0.0191	0.0096
Mexico	0.0018	0.0059	0.0101	0.0459	0.0493	0.0054	0.0292	0.0210
Pakistan	0.0017	0.0104	0.0392	0.0189	0.0258	0.0054	0.0000	0.0166
Poland. Rep. Of.	0.0021	0.0060	0.0190	0.0166	0.0183	0.0045	0.0039	0.0230

Table 3.5. (Continue) TOPSIS implementation stages for 2018								
Stage 3: (Continue) Weighted Normalized Decision Matrix								
Russian Federation	0.0011	0.0050	0.0498	0.0342	0.0311	0.0015	0.0797	0.0306
South Africa	0.0019	0.0037	0.0183	0.0359	0.0469	0.0036	0.0204	0.0103
Turkey	0.0018	0.0052	0.0181	0.0379	0.0402	0.0049	0.0413	0.0735
Stage 4: Positive Ideal Solution PIS and Negative Ideal Solution NIS								
(+) Ideal Solution	0.0011	0.0037	0.0101	0.1079	0.1121	0.0054	0.0000	0.0057
(-) Ideal Solution	0.0025	0.0116	0.2067	0.0000	0.0000	0.0015	0.2498	0.0735
Stage 5: The distance of each alternative from PIS and NIS alternative								
Country	Si+		Si-					
Argentina	0.2523		0.2490					
Brazil	0.1099		0.3097					
Greece	0.2515		0.2394					
India	0.1568		0.2969					
Indonesia	0.1988		0.2246					
Italy	0.1413		0.2916					
Mexico	0.0942		0.3077					
Pakistan	0.1280		0.3077					
Poland. Rep. Of.	0.1324		0.3145					
Russian Federation	0.1434		0.2399					
South Africa	0.0997		0.3093					
Turkey	0.1282		0.2866					

Table 3.5. (Continue) TOPSIS implementation stages for 2018**Stage 6:** The closeness coefficient of each alternative

Country	Ci	NORMALIZE Ci	RANKING OF ALTERNATIVES
Argentina	0.4967	0.0634	11
Brazil	0.7381	0.0943	3
Greece	0.4876	0.0623	12
India	0.6544	0.0836	8
Indonesia	0.5304	0.0677	10
Italy	0.6737	0.0860	7
Mexico	0.7656	0.0978	1
Pakistan	0.7063	0.0902	4
Poland. Rep. Of.	0.7037	0.0899	5
Russian Federation	0.6260	0.0799	9
South Africa	0.7561	0.0966	2
Turkey	0.6909	0.0882	6

Table 3.6. TOPSIS implementation stages for 2019**Stage 1: Decision Matrix**

COUNTRY	Input	Input	Input	Output	Output	Output	Input	Input
	FSKRTC	FSCD	FSANL	FSERA	FSERE	FSEIM	FSSNO	FSFCD
Argentina	15.53	169.20	5.75	6.12	53.03	50.78	9.56	28.46
Brazil	14.24	122.60	3.11	1.98	17.99	70.59	1.32	17.55
Greece	15.93	91.59	36.45	0.16	0.71	67.46	1.64	4.30
India	14.66	122.74	9.23	0.54	2.81	63.84	1.27	6.67
Indonesia	20.06	97.12	2.34	2.45	12.35	65.31	2.13	18.93
Italy	14.86	92.53	6.75	0.39	5.08	48.20	1.41	7.29
Mexico	14.44	90.53	2.09	2.22	20.61	74.92	3.57	13.43
Pakistan	14.01	167.91	8.58	0.83	11.19	79.25	1.02	12.98
Poland. Rep. Of.	16.37	95.39	3.80	0.69	7.85	62.78	1.19	16.81
Russian Federation	9.24	71.15	9.29	2.35	19.54	52.99	4.42	21.00
South Africa	15.58	57.39	3.89	1.47	17.63	52.76	1.90	7.44
Turkey	15.34	87.01	5.02	1.45	12.84	67.69	0.00	56.76
Denominator	52.65	382.78	41.55	7.99	69.22	220.87	11.93	77.09

Table 3.6. (Continue) TOPSIS implementation stages for 2019**Stage 2: Standard Decision Matrix**

COUNTRY	Input	Input	Input	Output	Output	Output	Input	Input
	FSKRTC	FSCD	FSANL	FSERA	FSERE	FSEIM	FSSNO	FSFCD
Argentina	0.2950	0.4420	0.1383	0.7663	0.7661	0.2299	0.8016	0.3692
Brazil	0.2705	0.3203	0.0749	0.2483	0.2599	0.3196	0.1106	0.2277
Greece	0.3025	0.2393	0.8772	0.0200	0.0103	0.3054	0.1374	0.0558
India	0.2785	0.3207	0.2222	0.0675	0.0406	0.2890	0.1062	0.0865
Indonesia	0.3810	0.2537	0.0563	0.3070	0.1784	0.2957	0.1783	0.2456
Italy	0.2822	0.2417	0.1624	0.0493	0.0734	0.2182	0.1179	0.0946
Mexico	0.2743	0.2365	0.0503	0.2785	0.2978	0.3392	0.2994	0.1743
Pakistan	0.2661	0.4387	0.2065	0.1042	0.1617	0.3588	0.0852	0.1684
Poland. Rep. Of.	0.3109	0.2492	0.0915	0.0866	0.1133	0.2842	0.0999	0.2180
Russian Federation	0.1754	0.1859	0.2235	0.2948	0.2823	0.2399	0.3702	0.2724
South Africa	0.2959	0.1499	0.0937	0.1841	0.2547	0.2389	0.1596	0.0966
Turkey	0.2914	0.2273	0.1209	0.1810	0.1855	0.3065	0.0000	0.7364
Total	3.4237	3.3052	2.3177	2.5877	2.6239	3.4254	2.4662	2.7453

Stage 3: Weighted Normalized Decision Matrix

	Input	Input	Input	Output	Output	Output	Input	Input
	FSKRTC	FSCD	FSANL	FSERA	FSERE	FSEIM	FSSNO	FSFCD
Weight →	0.0071	0.0268	0.2291	0.1907	0.1824	0.0066	0.2197	0.1377
Argentina	0.0021	0.0119	0.0317	0.1461	0.1397	0.0015	0.1761	0.0508
Brazil	0.0019	0.0086	0.0171	0.0473	0.0474	0.0021	0.0243	0.0313
Greece	0.0021	0.0064	0.2009	0.0038	0.0019	0.0020	0.0302	0.0077
India	0.0020	0.0086	0.0509	0.0129	0.0074	0.0019	0.0233	0.0119
Indonesia	0.0027	0.0068	0.0129	0.0585	0.0325	0.0019	0.0392	0.0338
Italy	0.0020	0.0065	0.0372	0.0094	0.0134	0.0014	0.0259	0.0130
Mexico	0.0019	0.0063	0.0115	0.0531	0.0543	0.0022	0.0658	0.0240
Pakistan	0.0019	0.0118	0.0473	0.0199	0.0295	0.0024	0.0187	0.0232
Poland. Rep. Of.	0.0022	0.0067	0.0209	0.0165	0.0207	0.0019	0.0220	0.0300

Table 3.6. (Continue) TOPSIS implementation stages for 2019								
Stage 3: (Continue) Weighted Normalized Decision Matrix								
Russian Federation	0.0012	0.0050	0.0512	0.0562	0.0515	0.0016	0.0814	0.0375
South Africa	0.0021	0.0040	0.0215	0.0351	0.0465	0.0016	0.0351	0.0133
Turkey	0.0021	0.0061	0.0277	0.0345	0.0338	0.0020	0.0000	0.1014
Stage 4: Positive Ideal Solution PIS and Negative Ideal Solution NIS								
(+) Ideal Solution	0.0012	0.0040	0.0115	0.1461	0.1397	0.0024	0.0000	0.0077
(-) Ideal Solution	0.0027	0.0119	0.2009	0.0038	0.0019	0.0014	0.1761	0.1014
Stage 5: The distance of each alternative from PIS and NIS alternative								
Country	Si+		Si-					
Argentina	0.1826		0.2654					
Brazil	0.1396		0.2563					
Greece	0.2757		0.1735					
India	0.1934		0.2323					
Indonesia	0.1463		0.2503					
Italy	0.1898		0.2395					
Mexico	0.1433		0.2434					
Pakistan	0.1733		0.2356					
Poland. Rep. Of.	0.1790		0.2486					
Russian Federation	0.1580		0.2018					
South Africa	0.1496		0.2508					
Turkey	0.1809		0.2511					

Table 3.6. (Continue) TOPSIS implementation stages for 2019**Stage 6:** The closeness coefficient of each alternative

Country	Ci	NORMALIZE Ci	RANKING OF ALTERNATIVES
Argentina	0.5924	0.0856	5
Brazil	0.6475	0.0936	1
Greece	0.3862	0.0558	12
India	0.5458	0.0789	11
Indonesia	0.6312	0.0913	2
Italy	0.5580	0.0807	10
Mexico	0.6294	0.0910	3
Pakistan	0.5763	0.0833	8
Poland. Rep. Of.	0.5813	0.0841	6
Russian Federation	0.5610	0.0811	9
South Africa	0.6264	0.0906	4
Turkey	0.5812	0.0840	7

Table 3.7. TOPSIS implementation stages for 2020**Stage 1: Decision Matrix**

COUNTRY	Input	Input	Input	Output	Output	Output	Input	Input
	FSKRTC	FSCD	FSANL	FSERA	FSERE	FSEIM	FSSNO	FSFCD
Argentina	22.34	215.02	3.86	3.89	29.33	49.93	13.47	21.02
Brazil	14.63	133.22	2.24	1.65	18.13	60.84	1.22	19.32
Greece	15.01	91.66	26.98	0.00	0.00	57.39	1.07	3.87
India	14.48	128.56	7.94	1.21	13.16	65.68	0.64	5.49
Indonesia	20.47	103.20	2.64	1.89	12.95	60.96	5.90	18.18
Italy	16.94	68.53	4.36	0.48	6.77	49.48	1.21	5.96
Mexico	16.12	100.18	2.43	1.61	17.62	76.03	2.04	15.02
Pakistan	14.85	191.39	9.19	1.46	19.66	79.72	0.00	10.98
Poland. Rep. Of.	17.44	109.47	3.70	0.40	5.62	62.08	7.52	15.24
Russian Federation	9.68	62.90	8.76	2.45	23.39	52.35	4.95	23.22
South Africa	15.67	60.96	5.18	1.01	13.57	52.01	1.07	6.43
Turkey	15.68	88.93	3.89	1.82	18.71	70.72	3.05	56.65
Denominator	56.78	422.48	32.55	6.19	58.19	215.41	17.79	74.80

Table 3.7. (Continue) TOPSIS implementation stages for 2020**Stage 2: Standard Decision Matrix**

COUNTRY	Input	Input	Input	Output	Output	Output	Input	Input
	FSKRTC	FSCD	FSANL	FSERA	FSERE	FSEIM	FSSNO	FSFCD
Argentina	0.3935	0.5090	0.1186	0.6282	0.5041	0.2318	0.7571	0.2810
Brazil	0.2577	0.3153	0.0689	0.2662	0.3115	0.2824	0.0685	0.2583
Greece	0.2644	0.2170	0.8288	0.0000	0.0000	0.2664	0.0603	0.0518
India	0.2551	0.3043	0.2439	0.1954	0.2262	0.3049	0.0362	0.0734
Indonesia	0.3605	0.2443	0.0812	0.3054	0.2226	0.2830	0.3317	0.2431
Italy	0.2983	0.1622	0.1339	0.0774	0.1163	0.2297	0.0680	0.0797
Mexico	0.2839	0.2371	0.0746	0.2600	0.3029	0.3530	0.1146	0.2008
Pakistan	0.2615	0.4530	0.2822	0.2360	0.3378	0.3701	0.0000	0.1468
Poland. Rep. Of.	0.3072	0.2591	0.1136	0.0647	0.0966	0.2882	0.4230	0.2037
Russian Federation	0.1705	0.1489	0.2691	0.3957	0.4020	0.2430	0.2783	0.3104
South Africa	0.2760	0.1443	0.1592	0.1640	0.2331	0.2414	0.0601	0.0860
Turkey	0.2761	0.2105	0.1195	0.2934	0.3216	0.3283	0.1716	0.7574
Total	3.4047	3.2049	2.4937	2.8865	3.0749	3.4222	2.3694	2.6924

Stage 3: Weighted Normalized Decision Matrix

	Input	Input	Input	Output	Output	Output	Input	Input
	FSKRTC	FSCD	FSANL	FSERA	FSERE	FSEIM	FSSNO	FSFCD
Weight →	0.0111	0.0485	0.2022	0.1504	0.1077	0.0075	0.3076	0.1650
Argentina	0.0044	0.0247	0.0240	0.0945	0.0543	0.0017	0.2329	0.0464
Brazil	0.0029	0.0153	0.0139	0.0400	0.0336	0.0021	0.0211	0.0426
Greece	0.0029	0.0105	0.1676	0.0000	0.0000	0.0020	0.0185	0.0085
India	0.0028	0.0148	0.0493	0.0294	0.0244	0.0023	0.0111	0.0121
Indonesia	0.0040	0.0118	0.0164	0.0459	0.0240	0.0021	0.1020	0.0401
Italy	0.0033	0.0079	0.0271	0.0116	0.0125	0.0017	0.0209	0.0131
Mexico	0.0031	0.0115	0.0151	0.0391	0.0326	0.0027	0.0353	0.0331
Pakistan	0.0029	0.0220	0.0571	0.0355	0.0364	0.0028	0.0000	0.0242
Poland. Rep. Of.	0.0034	0.0126	0.0230	0.0097	0.0104	0.0022	0.1301	0.0336
Russian Federation	0.0019	0.0072	0.0544	0.0595	0.0433	0.0018	0.0856	0.0512

Table 3.7. (Continue) TOPSIS implementation stages for 2020								
Stage 3: (Continue) Weighted Normalized Decision Matrix								
South Africa	0.0031	0.0070	0.0322	0.0247	0.0251	0.0018	0.0185	0.0142
Turkey	0.0031	0.0102	0.0242	0.0441	0.0346	0.0025	0.0528	0.1250
Stage 4: Positive Ideal Solution PIS and Negative Ideal Solution NIS								
(+) Ideal Solution	0.0019	0.0070	0.0139	0.0945	0.0543	0.0028	0.0000	0.0085
(-) Ideal Solution	0.0044	0.0247	0.1676	0.0000	0.0000	0.0017	0.2329	0.1250
Stage 5: The distance of each alternative from PIS and NIS alternative								
Country	Si+				Si-			
Argentina	0.2368				0.1967			
Brazil	0.0712				0.2794			
Greece	0.1893				0.2443			
India	0.0811				0.2783			
Indonesia	0.1213				0.2236			
Italy	0.0961				0.2788			
Mexico	0.0735				0.2711			
Pakistan	0.0783				0.2814			
Poland. Rep. Of.	0.1636				0.2004			
Russian Federation	0.1101				0.2137			
South Africa	0.0802				0.2795			
Turkey	0.1392				0.2374			

Table 3.7. (Continue) TOPSIS implementation stages for 2020**Stage 6:** The closeness coefficient of each alternative

Country	Ci	NORMALIZE Ci	RANKING OF ALTERNATIVES
Argentina	0.4537	0.0556	12
Brazil	0.7969	0.0976	1
Greece	0.5635	0.0690	10
India	0.7743	0.0948	5
Indonesia	0.6483	0.0794	8
Italy	0.7436	0.0911	6
Mexico	0.7867	0.0963	2
Pakistan	0.7823	0.0958	3
Poland. Rep. Of.	0.5505	0.0674	11
Russian Federation	0.6599	0.0808	7
South Africa	0.7770	0.0951	4
Turkey	0.6303	0.0772	9

CHAPTER 4

4. FINDINGS AND DISCUSSIONS

The financial soundness of a total of Fragile Five countries, as well as seven more emerging countries, are investigated in this dissertation. The most recent annual data for 2018-2020 period available on the IMF's official website are attempted to be used for this purpose. Eight Financial soundness indicators (six core and two additional FSIs) of the 12 countries included in the research were analyzed with the TOPSIS method. It is worth noting that fundamental financial soundness indices are commonly employed in the literature to assess the soundness of a country's banking sector.

As a result of the analysis, one of the very important results is that in the time period covered in the research, the countries with the weakest financial soundness structure are not only the Fragile Five countries. In contrast, Brazil, South Africa and Indonesia from the Fragile Five countries have the highest sound financial systems among the sample countries.

To begin, the method Entropy weight measurement, which has been employed extensively in recent years and is considered highly essential, was used to measure the importance and weight of the indices utilized in the analysis; Table 4.1 summarizes the findings of this application.

Table 4.1. *Application of the entropy weight method and results.*

Weighing of Criteria (FSIs)

Criteria (FSIs)	W _j (2018)	W _j (2019)	W _j (2020)
FSKRTC	0.0064	0.0071	0.0111
FSCD	0.0246	0.0268	0.0485
FSANL	0.2287	0.2291	0.2022
FSERA	0.1493	0.1907	0.1504
FSERE	0.1524	0.1824	0.1077
FSEIM	0.0156	0.0066	0.0075
FSSNO	0.3200	0.2197	0.3076
FSFCD	0.1031	0.1377	0.1650

Table 4.1 indicates the relative importance of each financial soundness index in the analysis for each year. The entropy approach does not involve researcher skills and must be considered as an objective method, as mentioned in Chapter 3. It could be stated that this is an extremely significant method.

Net open position in the foreign exchange to capital (FSSNO) index has the largest weight, as indicated in the bottom of Table 4.1. This outcome is consistent throughout 2018 and 2020, whereas for 2019 the highest weight is belonged to Non-performing Loans to Total Gross Loans (FSANL). This shows that the share of these indices in the results obtained in the relevant year is high.

Following the entropy analysis, the TOPSIS approach was used to identify the financial soundness of the countries in the value of these indices and to order them by years based on their financial soundness. Here Table 4.2 in the following shows just the outcome of this method.

Table 4.2. *Application of the TOPSIS method and results.*

Ranking of Alternatives by Comparing C_i Scores						
Order	2018	C_i score	2019	C_i score	2020	C_i score
1	Mexico	0.7656	Brazil	0.6475	Brazil	0.7969
2	South Africa	0.7561	Indonesia	0.6312	Mexico	0.7867
3	Brazil	0.7381	Mexico	0.6294	Pakistan	0.7823
4	Pakistan	0.7063	South Africa	0.6264	South Africa	0.7770
5	Poland. Rep. Of.	0.7037	Argentina	0.5924	India	0.7743
6	Turkey	0.6909	Poland. Rep. Of.	0.5813	Italy	0.7436
7	Italy	0.6737	Turkey	0.5812	Russian Federation	0.6599
8	India	0.6544	Pakistan	0.5763	Indonesia	0.6483
9	Russian Federation	0.6260	Russian Federation	0.5610	Turkey	0.6303
10	Indonesia	0.5304	Italy	0.5580	Greece	0.5635
11	Argentina	0.4967	India	0.5458	Poland. Rep. Of.	0.5505
12	Greece	0.4876	Greece	0.3862	Argentina	0.4537

According to ranking of alternatives (countries) by their C_i values in Table 4.2, the five countries with the best financial performance in terms of C_i value in 2018; Mexico is in the first place with 0.7656 C_i value, South Africa is in second place with 0.7561, Brazil is in third place with 0.7381, Pakistan is in fourth place with 0.7063, Poland is in fifth place with 0.7037, and so on.

Following that, the five countries with the best financial performance in terms of C_i value in 2019 are as follows: Brazil is first with 0.6475, Indonesia is second with 0.6312, Mexico is third with 0.6294, South Africa is fourth with 0.6264, and Argentina is fifth with 0.5924.

Finally, for 2020, the following are the five countries with the best financial performance in terms of C_i value: Brazil is in first place with 0.7969, Mexico is in second place with 0.7867, Pakistan is in third place with 0.7823, South Africa is in fourth place with 0.7770, and India is in fifth place with 0.7743.

Since $C_i = 1$ indicates the absolute closeness of the relevant decision point to the ideal solution, whereas $C_i = 0$ indicates the absolute closeness of the relevant decision point to the negative ideal solution; it has been demonstrated that practically every country's position is close to the optimum value in this regard. Exceptions notwithstanding Argentina, with a C_i value of 0.4967, and Greece, with a C_i value of 0.4876, are both close to the negative optimal solution value in 2018, and this circumstance should be considered. Greece drew attention once more in 2019 with a C_i value of 0.3862, which is close to the negative optimum solution. Finally, after ranking fifth among nations with good performance in 2019, it is possible to conclude that Argentina did not have a good performance in 2020, as it was at the bottom of the list with a C_i value of 0.4537.

For simpler visual display and understanding, the values in Table 4.2 are illustrated with Radar graphic (Figure 4.1). The years 2018-2020 are denoted by three different colors.

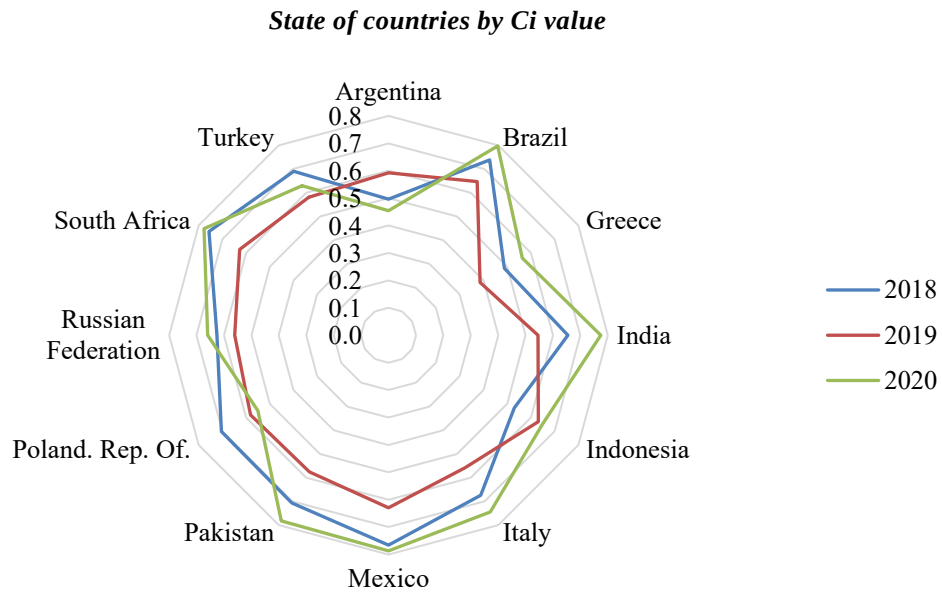


Figure 4.1. State of countries by Ci value

In Figure 4.1 each circle is represented by the integers 0.1, 0.2, 0.3, ..., 0.8 starting with the value 0 in the middle and working outwards. The lines pointing to the middle indicate a value near to the negative ideal solution, while the lines pointing outward suggest a value close to the positive ideal solution; and the Ci values of the countries each year are represented by a line in various colors. Looking closely at this chart, the radar for the two countries of Argentina 2018 and 2020, and Greece 2018 and 2019 appears to be orientated towards the middle. Make a note of the difference in value between the two circles (0.4 and 0.6).

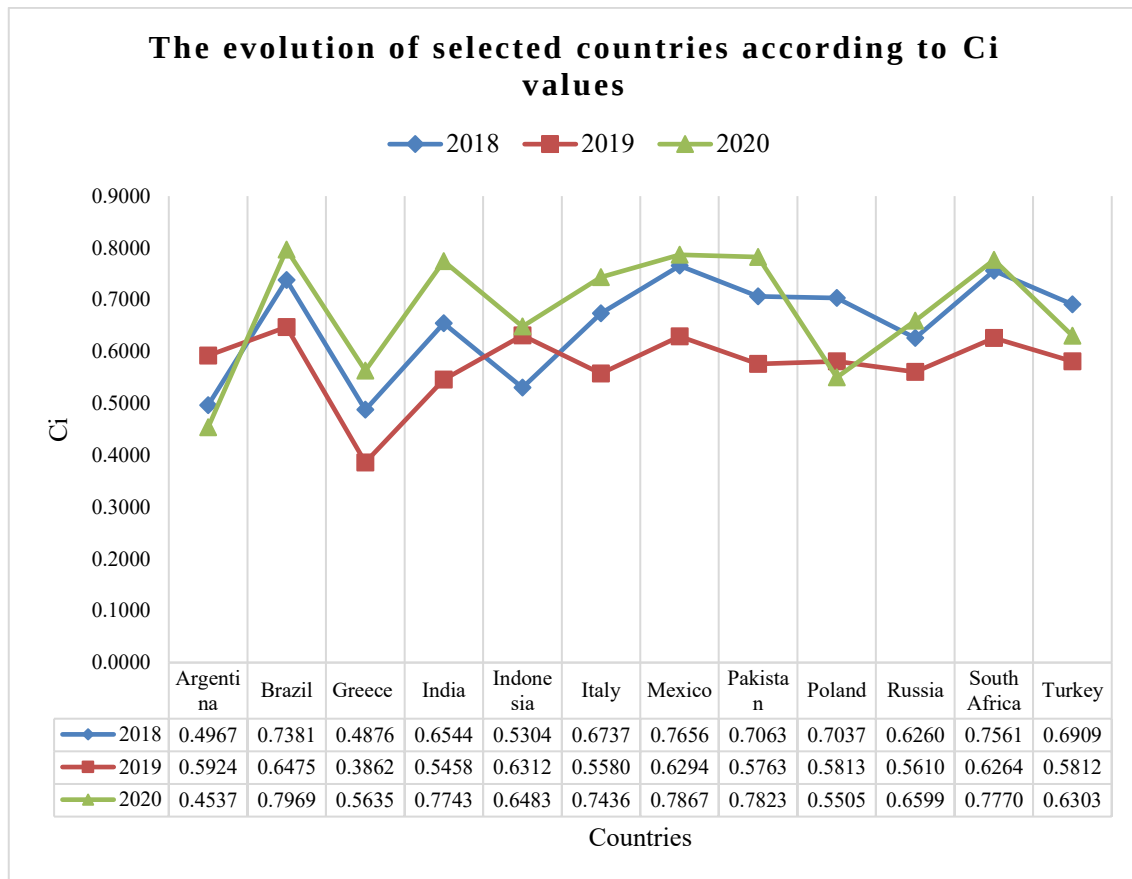


Figure 4.2. Evolution of the selected countries according to C_i values.

As shown in Figure 4.2, the financial soundness of the Fragile Five countries, which is the main subject of this thesis, appears to fluctuate in the list of other countries for each year. This Line Graphic is based on the data in Table 4.2, with the nations on the vertical axis (x) and the C_i values of the countries on the horizontal axis (y).

Moreover, in Figure 4.2, regarding rankings of financial institution soundness, some countries have seen the same evolution, namely a decrease from 2018 to 2019, and then an increase from 2019 to 2020 (Brazil, Greece, India, Italy, Mexico, Pakistan, Russia and South Africa). Four other countries have followed various evolutions, Indonesia with a regular increase; Argentina, an increase followed by a decrease; Poland, a regular decrease; and Turkey a decrease followed by an increase. However, based on the findings of the analysis, the conclusion is that Brazil and South Africa, both from the Fragile Five list, have consistently ranked at the top of the list for the past three years, demonstrating a strong performance.

The result of this research is in line with the result of the Simdi and Seker (2017) and Okur et al. (2021) research in that the Fragile Five countries do not have the lowest

financial system soundness, the list has changed over the years. It is possible to say that the results change when the analysis criteria change.

In 2019, a slowdown was observed for all countries except Argentina and Indonesia: As a result of the Entropy method in 2019, non-performing loans to total gross loans (FSANL) has the highest weight. As such, the overall low status of all countries supports the findings of the Albulescu (2015) and Kasselaki and Tagkalakis (2014) studies regarding non-performing loans to total gross loans; financial soundness indicators and financial crisis. The fact that almost all countries within the scope of the research show similar results (except for two countries) supports the findings of the Aloui et al. (2011) research in terms of the contagious nature of positive and negative shocks.

According to Landjang and Tumiwa (2018), all 19 banks included in the study for Indonesia have been classified as exceptionally sound throughout the last three years. This situation is maintained, and the findings of this thesis research also show that unlike other countries, the robustness of Indonesian financial institutions consistently improves from 2018 to 2019 and from 2019 to 2020. Thus, it is possible to say that the results of these two studies are similar.

The financial soundness of Brazil, Mexico and south African countries is remarkable. This result about Brazil supports the result of the Mete and Destek (2016) research findings for Brazil.

The result of slowing down for India in 2019 is similar to the findings of the Gupta and Tyagi Sharma & Pal (2022) study.

Argentina and Greece are notable, with the lowest rankings. This outcome of this research about Greece supports the Pasiouras & Tsagkarakis (2021) and Kolliopoulos (2021) research's findings; the recent and current experience with high quantities of non-performing loans and strategic defaults, on the other hand, provides a number of challenges. Stricter regulation established in the aftermath of the financial crisis, business model transformation, fintech and IT advancements, and, most recently, the COVID-19 pandemic all pose difficulties for bank leaders.

The Covid 19 pandemic has affected the economy and financial situation of all countries, and it is possible to see this effect more clearly in some countries such as

Argentina, Indonesia, Poland and Turkey. This finding is similar to the finding of the Simdi & Seker (2017) study and shows that Turkey is highly affected by negative shocks.



CONCLUSION

The resilience of a country's financial system to financial shocks is determined by the financial structure of financial institutions with the authority to collect deposits (DTs), which form the foundation of the country's national financial system. Performance metrics and assessments of whether funds are utilized successfully can be used to understand the stability of a financial institution's financial structure.

Furthermore, in order to accurately examine the current situation, performance measurements and evaluations at regular intervals are required due to continually changing situations both inside and outside a country. Moreover, it is critical for investors who want to invest their money in other countries and marketplaces to have access to precise and unbiased information. As a result, by accurately executing their risk return analysis, investors may successfully price assets.

The objective of this study was to analyze financial soundness of 12 emerging countries so called Fragile Five and plus 7 other countries with the similar base of Fragile Five. For this purpose, 8 financial soundness indices which indicates financial soundness of countries are chosen. Next, countries are ranked accordingly by application of Entropy based TOPSIS method for most recent years 2018-2020. Regarding the mathematical methodologies, entropy and TOPSIS approaches were identified as the best and simple way to study financial soundness ranking of sample nations.

As a result of analysis in this study, it is feasible to conclude that the list of nations with the best and soundest financial systems varies annually. Simdi and Seker (2017) and Okur et al. (2021) both lend support to this study's conclusion.

It was discovered that the nations performing the worst were not just the "Fragile Five" but also other nations in the sample during the study periods. Greece is consistently at the bottom of the list from the European Union member states in 2018, 2019 and 2020. Argentina is one of the Latin American countries with the lowest performance in 2018 and 2020, and it should be noted among the sample countries. Additionally, from the Fragile Five, Brazil and South Africa consistently displayed excellent performance. In recent years, the results for different nations have varied.

It is important to carefully assess these results, especially in light of foreign investment. Effective risk and return management depend on this. Due to the Covid 19

pandemic, the last two years have seen one of the largest economic shocks in recent history for the global economy. Emerging economies and poor nations may experience tough challenges as a result of the epidemic. Studying the nation's overall financial structure and taking into account all other necessary circumstances are both required for this goal.

Several short-term perspectives can be addressed: in this study, to include more countries, more indicators and more years, to examine other solutions to avoid negative numbers in the entropy and TOPSIS methods, to use other multicriteria decision making methodologies such as ARAS or MAIRCA and compare the results and etc.

For long-term perspectives, it could be an interest to study separately the banking sector soundness for each country. More, it is important to unveil the economic and political reasons, the mechanisms and the dynamics of the weaknesses regarding financial institutions, and also to list the potential solutions for a complete recovery.

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APPENDICES

Appendix A: Financial soundness indicators (the core and additional sets) data

Argentina		2018	2019	2020
1	Tier 1 capital to risk-weighted assets	14.2302	15.5330	22.3424
2	Customer Deposits to Total (Non-interbank) Loans	175.0860	169.2010	215.0232
3	Non-performing Loans to Total Gross Loans	3.1086	5.7485	3.8613
4	Return on Assets	5.3864	6.1196	3.4726
5	Return on Equity	47.8580	53.0293	23.4559
6	Interest Margin to Gross Income	57.5538	50.7816	49.9347
7	Net open position in foreign exchange to capital	9.3398	8.5621	13.0782
8	Foreign-Currency-Denominated Liabilities to Total Liabilities	30.7954	28.4638	21.0155
Brazil				
1	Tier 1 capital to risk-weighted assets	14.5578	14.2400	14.6300
2	Customer Deposits to Total (Non-interbank) Loans	124.1687	122.5954	133.2200
3	Non-performing Loans to Total Gross Loans	3.0531	3.1106	2.2427
4	Return on Assets	1.5804	1.9832	1.2322
5	Return on Equity	14.5256	17.9885	12.2537
6	Interest Margin to Gross Income	64.6419	70.5893	60.8381
7	Net open position in foreign exchange to capital	0.6151	0.3221	0.8295
8	Foreign-Currency-Denominated Liabilities to Total Liabilities	16.9195	17.5507	19.3160
Greece				
1	Tier 1 capital to risk-weighted assets	15.3203	15.9268	15.0100
2	Customer Deposits to Total (Non-interbank) Loans	81.3119	91.5886	91.6636
3	Non-performing Loans to Total Gross Loans	41.9879	36.4485	26.9780
4	Return on Assets	-0.1667	0.1598	-0.4151
5	Return on Equity	-0.3593	0.7114	-5.8746
6	Interest Margin to Gross Income	71.9405	67.4602	57.3917
7	Net open position in foreign exchange to capital	0.7370	0.6410	0.6832
8	Foreign-Currency-Denominated Liabilities to Total Liabilities	4.3998	4.2988	3.8725

Financial Soundness Indicators: The core and Additional Sets				
India		2018	2019	2020
1	Tier 1 capital to risk-weighted assets	11.9094	14.6619	14.4819
2	Customer Deposits to Total (Non-interbank) Loans	120.3596	122.7441	128.5647
3	Non-performing Loans to Total Gross Loans	9.4610	9.2344	7.9388
4	Return on Assets	0.0285	0.5394	0.7943
5	Return on Equity	-0.1601	2.8111	7.2884
6	Interest Margin to Gross Income	66.3620	63.8410	65.6764
7	Net open position in foreign exchange to capital	0.2762	0.2688	0.2552
8	Foreign-Currency-Denominated Liabilities to Total Liabilities	7.9300	6.6660	5.4925
Indonesia				
1	Tier 1 capital to risk-weighted assets	19.2327	20.0610	20.4674
2	Customer Deposits to Total (Non-interbank) Loans	98.0928	97.1221	103.2024
3	Non-performing Loans to Total Gross Loans	2.2058	2.3394	2.6427
4	Return on Assets	2.4969	2.4515	1.4748
5	Return on Equity	13.3355	12.3458	7.0800
6	Interest Margin to Gross Income	69.7538	65.3074	60.9597
7	Net open position in foreign exchange to capital	6.4165	1.1289	5.5122
8	Foreign-Currency-Denominated Liabilities to Total Liabilities	19.9921	18.9298	18.1850
Italy				
1	Tier 1 capital to risk-weighted assets	13.8610	14.8589	16.9377
2	Customer Deposits to Total (Non-interbank) Loans	72.8054	92.5271	68.5301
3	Non-performing Loans to Total Gross Loans	8.3863	6.7492	4.3597
4	Return on Assets	0.4639	0.3938	0.0642
5	Return on Equity	6.0577	5.0803	0.8940
6	Interest Margin to Gross Income	49.6077	48.2009	49.4813
7	Net open position in foreign exchange to capital	0.6923	0.4082	0.8209
8	Foreign-Currency-Denominated Liabilities to Total Liabilities	7.4996	7.2930	5.9580

Financial Soundness Indicators: The core and Addition Sets				
Mexico		2018	2019	2020
1	Tier 1 capital to risk-weighted assets	14.2177	14.4441	16.1195
2	Customer Deposits to Total (Non-interbank) Loans	89.2859	90.5308	100.1767
3	Non-performing Loans to Total Gross Loans	2.0509	2.0905	2.4292
4	Return on Assets	2.1973	2.2242	1.1941
5	Return on Equity	20.8621	20.6134	11.7482
6	Interest Margin to Gross Income	74.4778	74.9168	76.0307
7	Net open position in foreign exchange to capital	1.0687	2.5730	1.6499
8	Foreign-Currency-Denominated Liabilities to Total Liabilities	16.3309	13.4345	15.0208
Pakistan				
1	Tier 1 capital to risk-weighted assets	13.2423	14.0089	14.8459
2	Customer Deposits to Total (Non-interbank) Loans	157.3859	167.9088	191.3905
3	Non-performing Loans to Total Gross Loans	7.9737	8.5820	9.1858
4	Return on Assets	0.8083	0.8324	1.0452
5	Return on Equity	10.7369	11.1896	13.7830
6	Interest Margin to Gross Income	75.3702	79.2541	79.7158
7	Net open position in foreign exchange to capital	-0.0250	0.0184	-0.3889
8	Foreign-Currency-Denominated Liabilities to Total Liabilities	12.9130	12.9817	10.9832
Poland. Rep. of.				
1	Tier 1 capital to risk-weighted assets	16.3105	16.3696	17.4419
2	Customer Deposits to Total (Non-interbank) Loans	91.1165	95.3881	109.4725
3	Non-performing Loans to Total Gross Loans	3.8535	3.8005	3.6991
4	Return on Assets	0.6883	0.6913	-0.0144
5	Return on Equity	7.5290	7.8458	-0.2511
6	Interest Margin to Gross Income	62.8367	62.7759	62.0768
7	Net open position in foreign exchange to capital	0.1204	0.1946	7.1350
8	Foreign-Currency-Denominated Liabilities to Total Liabilities	17.8811	16.8088	15.2355

Financial Soundness Indicators: The core and Addition Sets				
Russian Federation		2018	2019	2020
1	Tier 1 capital to risk-weighted assets	8.8744	9.2353	9.6808
2	Customer Deposits to Total (Non-interbank) Loans	75.1296	71.1485	62.9032
3	Non-performing Loans to Total Gross Loans	10.1236	9.2891	8.7605
4	Return on Assets	1.5946	2.3544	2.0336
5	Return on Equity	13.0125	19.5398	17.5199
6	Interest Margin to Gross Income	20.9191	52.9942	52.3536
7	Net open position in foreign exchange to capital	2.9613	3.4181	4.5614
8	Foreign-Currency-Denominated Liabilities to Total Liabilities	23.7916	20.9953	23.2154
South Africa				
1	Tier 1 capital to risk-weighted assets	14.8828	15.5778	15.6723
2	Customer Deposits to Total (Non-interbank) Loans	55.7208	57.3878	60.9604
3	Non-performing Loans to Total Gross Loans	3.7280	3.8924	5.1803
4	Return on Assets	1.6783	1.4701	0.5999
5	Return on Equity	19.8228	17.6329	7.6916
6	Interest Margin to Gross Income	50.0076	52.7605	52.0073
7	Net open position in foreign exchange to capital	0.7387	0.9063	0.6807
8	Foreign-Currency-Denominated Liabilities to Total Liabilities	8.0072	7.4430	6.4350
Turkey				
1	Tier 1 capital to risk-weighted assets	13.9930	15.3411	15.6761
2	Customer Deposits to Total (Non-interbank) Loans	78.2630	87.0126	88.9278
3	Non-performing Loans to Total Gross Loans	3.6869	5.0229	3.8901
4	Return on Assets	1.7831	1.4456	1.4005
5	Return on Equity	16.9506	12.8390	12.8382
6	Interest Margin to Gross Income	67.4240	67.6911	70.7248
7	Net open position in foreign exchange to capital	1.5217	-0.9972	2.6645
8	Foreign-Currency-Denominated Liabilities to Total Liabilities	57.2106	56.7637	56.6526

Curriculum Vitae

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2021, Polytechnic University of Cartagena, Spain, Faculty of Business Sciences, MBA

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<https://doi.org/10.15295/bmij.v8i4.1526>