



جامعة الإسكندرية  
ALEXANDRIA  
UNIVERSITY  
كلية الدراسات الاقتصادية والعلوم السياسية  
Faculty of Economic Studies & Political Science  
معرفة واتسام

المجلة العلمية  
لكلية الدراسات الاقتصادية والعلوم السياسية

<https://esalexu.journals.ekb.eg>

دورية علمية محكمة

المجلد العاشر (العدد التاسع عشر، يناير 2025)

# Measuring Financial Stability in Egypt Since the Implementation of Banking Reform Program (2004-2023)<sup>(1)</sup>

ياسمين محيي الدين غريب<sup>1</sup>، عبد الحميد مصطفى عبد الحميد<sup>2</sup>، داليا رضا حسن أبو العلا<sup>3</sup>

<sup>1</sup> مدرس الاقتصاد، كلية الاقتصاد والعلوم السياسية، جامعة القاهرة، مصر

[Yasminemohie@feps.edu.eg](mailto:Yasminemohie@feps.edu.eg)

<sup>2</sup> مدرس بقسم التأمين والعلوم الاكتوارية، كلية التجارة، جامعة القاهرة، مصر

[AbdelHamid\\_Mostafa@foc.cu.edu.eg](mailto:AbdelHamid_Mostafa@foc.cu.edu.eg)

<sup>3</sup> مدرس بقسم الاقتصاد التمويلي، كلية إدارة الأعمال، جامعة الأهرام الكندية، مصر

[Dalia.reda@acu.edu.eg](mailto:Dalia.reda@acu.edu.eg)

(1) تم تقديم البحث في 2024/9/16، وتم قبوله للنشر في 2024/10/23.

## Abstract

This paper is significant as it addresses the absence of a financial stability index for Egypt, for the period starting from 2004, when banking sector reforms began. Its purpose is to develop an aggregate financial stability index (AFSI) for Egypt covering the years 2004 to 2023. The methodology involves two approaches: one based on equal sub-indices' weight and another on equal individual indicators' weight. Both approaches begin with data normalization, followed by the construction of the AFSI, which is then tested econometrically. The findings reveal increased financial sector stability in Egypt since 2020, although periods of instability were noted during the 2008 financial crisis, the 2011 revolution, and the COVID-19 pandemic. The econometric model confirmed the validity of the AFSI.

**Keywords:** Financial stability, public goods, AFSI, financial instability, Egyptian banking sector reform.

### قياس الاستقرار المالي في مصر منذ تطبيق برنامج الإصلاح المصرفي

(2023-2004)

#### الملخص

تتبع أهمية هذه الورقة من عدم وجود مؤشر للاستقرار المالي في مصر للفترة التي تبدأ من عام 2004 ، حيث بدأ تطبيق برنامج إصلاح القطاع المصرفي. وتهدف هذه الورقة إلى تطوير مؤشر كلي للاستقرار المالي (AFSI) في مصر للفترة (2004-2023). وتتضمن المنهجية تطبيق أسلوبين أو منهجين: أحدهما يعتمد على الوزن المتساوي للمؤشرات الفرعية الأربعة التي يتكون منها المؤشر الكلي، والآخر يعتمد على الوزن المتساوي للمؤشرات الفردية التي تتكون منها المؤشرات الفرعية الأربعة. يبدأ كلا المنهجين بتطبيع البيانات Normalization، يليه بناء المؤشر الكلي للاستقرار المالي AFSI، والذي يتم اختباره بعد ذلك قياسياً، وكشفت النتائج عن تحسن استقرار القطاع المالي في مصر منذ عام 2020 ، على الرغم من ملاحظة فترات من عدم الاستقرار خلال الأزمة المالية لعام 2008 ، وثورة 2011 ، وجائحة كوفيد-19. كما أكد النموذج القياسي صلاحية المؤشر المحسوب AFSI.

الكلمات المفتاحية: الاستقرار المالي، السلع العامة، مؤشر الاستقرار المالي الكلي، عدم الاستقرار المالي، برنامج الإصلاح المصرفي المصري.

## 1. Introduction:

All countries worldwide are facing the economic and political consequences that resulted from the events that occurred over the past few years, including the Covid-19 pandemic, Russian-Ukrainian war, and the Israel-Gaza war that began on 7 October 2023.

In this context, the IMF Global Financial Stability Report (GFSR) showed that financial stability risks are still threatening the world economy, these threats could be attributed to several factors; for instance, upside surprises to inflation, and concerns about debt sustainability. However, the report confirmed that policymakers in different countries should take measures to maintain financial stability, and to support economic growth. In this respect, the report explained that despite global core inflation slowing during the year 2023, bringing inflation rates back to normal levels should remain one of the top priorities of policymakers in different countries, taking the specific circumstances of each economy into consideration (IMF, 2023).

As a result, many central banks around the world are increasingly focusing on financial stability alongside their monetary policy objectives. It is evident that many governments aim to regulate financial institutions, especially commercial banks, to ensure their safety, soundness, and ability to meet obligations (Akosah, 2018)."

However, despite defining or measuring financial stability is considered a complicated issue, most nations or central banks have developed their own measures of financial stability depending on the size and nature of their economies. More specifically, many central banks have constructed financial stability indices to analyze banking system instability. In addition, publishing financial stability reports became one of the authorities' major concerns (Freedman and Goodlet, 2007; Nasreen et al., 2015).

If one goes a step further, Central Bank of Egypt (CBE) - alongside with the Financial Regulatory Authority (FRA), which supervises the non-banking financial sector - plays a major role in maintaining financial stability in the Egyptian financial system, which is centered around the banking sector (CBE, 2020). In addition, Central Bank of Egypt (CBE) has started publishing annual stability report since the year 2014, (CBE) has developed an aggregate

financial stability index (AFSI) for Egypt. Yet, the index is constructed using quarterly data, and the most recent financial stability index (AFSI) for Egypt covers only the period (July 2011 – June 2023) (CBE, 2023).

**Importance of the study:** To the best of the author's knowledge, the survey of the literature shows that except for the aggregate financial stability index (AFSI) which is developed by the (CBE) and covers - in its last issuance - the period (July 2011 – June 2023) as mentioned above, there is no aggregated financial stability index for Egypt has been developed to start from the year 2004 —when the banking sector reform program was implemented in two phases (2004-2008) and (2009-2012) (CBE, 2014).

**Objectives of the study:** The aim of the study is to develop an aggregate financial stability index (AFSI) for Egypt cover the period (2004-2023).

Based on the study's objective, it addressed two research questions: (a) How to construct the financial stability index over the period (2004- 2023) since the implantation of the banking sector reform program? (b) Is the constructed financial stability index valid over the period (2004-2023)?

**Study Hypothesis:** The main two hypotheses of the study are:

Hypothesis 1: The construction of an aggregate financial stability index (AFSI) for Egypt over the period (2004-2023) reveal significant trends in financial stability aligned with the banking sector reform program that has Implemented since 2004.

Hypothesis 2: The constructed financial stability index (AFSI) for Egypt will demonstrate statistical validity and reliability in measuring financial stability over the period from 2004 to 2023.

**Methodology:** The study adopts a methodology similar to the methodology employed by Morris (2010) and Albulescu (2011), with some changes made to be suitable for Egypt. The AFSI involves the aggregation of four sub-indices which are: Financial Development Index (FDI), Financial Soundness Index (FSI), Financial Vulnerability Index (FVI), and the World Economic Climate Index (WECD).

Finally, the paper concluded that financial stability indices help decision makers to and to predict expected disturbances in financial system and to take suitable measures to avoid financial instability in the future.

The remainder of the paper is structured as follows: the theoretical framework and literature review, the research methodology, the analysis and findings, and finally, the conclusion and policy recommendations.

## 2. Theoretical Framework and Literature Review:

**2.1 The impact of financial crises on the global economy:** In fact, many financial crises have affected the global economy over the last few decades; for instance, the Latin America debt crisis in the 1980s, the Mexican Peso Crisis in the mid-1990s, the financial crisis in Asia, Russia, and Latin America, and the Global Financial Crisis and Europe's sovereign debt crisis between 2008 - 2013. Needless to say, that the global economy has also been affected with COVID-19 crises and the repercussions of Russian-Ukrainian war, and the effect of current disruptions in Middle East due to Israel-Gaza war (Hites et al., 2023).

However, World Bank (2020) indicates that the main reason for financial crises is the excessive risk-taking behavior of financial institutions.<sup>2</sup> In this respect, achieving financial stability has become one of the financial authorities' major concerns in different countries. In addition, financial crises usually urge regulatory authorities to take many difficult measures. For instance, the G – 20 has authorized Financial Stability Board (FSB) to monitor the implementation of different regulatory and supervisory financial policies. Furthermore, the Basel Committee on Banking Supervision (BCBS) has introduced the third Basel framework (Basel III)<sup>3</sup> regarding new capital and liquidity requirements for banks.

**2.2 Key Definitions and Implications of Financial Stability:** According to the World Bank (2016) there are many definitions for financial stability, but most definitions agree that financial stability involves the absence of widespread disruptions that prevent the financial system from functioning effectively or the absences of "crises". In addition, all definitions refer to the ability of the financial system to face pressures; in other words, the resilience of financial system. Besides, the world bank explains that the stability of financial system refers to the financial system's efficiency in resource allocation, its ability to deal with financial risks, and to monitor employment levels to keep them as close as possible from the economy's natural rate, and it also refers to control price movements of real or financial assets in order to maintain financial stability, and required employment level. On the contrary, financial instability has many negative repercussions on the financial system,

---

<sup>2</sup> For instance, when financial intermediaries increase their leverage.

<sup>3</sup> The third Basel framework (Basel III) were introduced by Basel Committee on Banking Supervision (BCBS) in response to the financial crisis of 2007-09.

for instance, banks' reluctance to finance profitable projects, hyperinflation, stock market crashes, and many other consequences that undermine confidence in the whole economic system.

However, Gadancz and Jayaram (2019) adopted European Central Bank (ECB) definition for financial stability as a condition where the financial system becomes able to "withstanding shocks and the unravelling of financial imbalances" as they mentioned. Whilst, Freedman & Goodlet (2007) and Nasreen et al. (2015) mentioned that most of the literature confirmed that defining or measuring financial stability is not an easy task. They defined financial stability as a situation where financial system can efficiently face difficult situations, and continue to provide different financial services without being affected by such stressful circumstances. They added that financial instability can lead to decreasing output, and misallocation of society's resources, as well as having a negative effect on economic growth. And, they discussed the role of central banks in promoting macro-financial stability. In addition, they explained the importance of publishing financial stability reports by central banks; they clarify that issuing these reports helps the private sector to take precautionary actions aim at lowering risks that private sector face.

**2.3 Financial stability as a public good:** Interestingly, financial stability could be considered as a public good; on the one hand, it is a non-rival because its use by one person does not change the amount available for others to use, on the other hand, it is non-excludable, because no one could be excluded from using it once its available. Creel, et al. (2015) explained that new regulations are proposed after financial crises in order to maintain the main characteristic of the financial system as a public good. In other words, financial stability should be preserved, for instance, in case of banking crises, in order to prevent generating an intrinsic impact that might result from spreading shocks via informational or contractual links, or even via psychological links.

Further, Freedman and Goodlet (2007) clarified that macro-financial stability also has many features of a public good; they explained that private sector participants hardly consider the impact of actions on other participants in the economy, or on the whole financial sector, which justifies the interventions of public sector to guarantee a reasonable degree of macro-financial stability, and central banks and other authorities concerned with financial stability

should aim at mitigating the impact of shocks either on the financial system or on the whole economy. In this context, IMF (2023) confirmed that banking supervision is essential in maintaining financial stability, and supervisors should ensure that banks have corporate governance and risk management processes which are compatible with their risk profiles. In addition, authorities should evaluate that Basel III liquidity standards are well performed. In addition, risk assessments of nonbank financial intermediation (NBFIs) are considered one of the top priorities in maintain financial stability. Moreover, carbon pricing is considered a very important tool in determining climate financing priorities in both emerging and developing economies.

#### **2.4 Techniques for assessing the systemic stability in the financial system:**

The literature review shows that most empirical studies clarify that there are several techniques for assessing the systemic stability of the financial system. A study by Albulescu (2010) explained that, one of the most important techniques is the early warning systems (EWS) which help in forecasting, based on the probability of financial crisis appearances, but these systems have many disadvantages. For instance, they do not include all kinds of risks faced by the system.

Additionally, the stress tests techniques are also considered as important techniques. In general, the stress tests are used to identify the potential shocks and to estimate the resistance of the financial system. In this regard, Akosah (2018) explains that stress tests are used to identify the sources of risks and vulnerabilities of the investigated banking sector or the overall financial sector. In addition, Hites et al. (2023) developed financial stress index (FSI) for 110 countries using quarterly data over the period 1967-2018. They used a computer algorithm to make the index easy to update. The study aims to assess the impact of financial stress on the economy using country- and firm-level data. The main finding of the study confirms that there is a significant relationship economically between financial stress and output. More specifically, 1 standard deviation increase in financial stress index results in a reduction in the level of output by 0.35 percent one year after the increase in financial stress and by 0.2 percent after 5 years of the increase.

Further, Albulescu (2010) indicated that aggregate financial stability index (AFSI) is considered as another independent and complementary quantitative technique in measuring the stability of a financial system, although some studies considered it a supporting technique. He explained that (AFSI) has

many advantages, such as enable making comparisons between different financial systems and periods of time. In general, many central banks in different countries have developed financial stability indices in order to assess the financial stability of the financial sector and to help monetary authorities to identify financial sector weakness and to perform the suitable measures which could be used in dealing with the expected risks in an early stage. However, each of the above-mentioned techniques has its advantages and disadvantages.

It is worth mentioning that Gadanez and Jayaram (2019) explained that despite single aggregate measures being a good tool to know about financial system conditions, but these measures are still in their early stages, that financial authorities could not yet rely on in predicting financial crises or even financial stress. More specifically, there is a need for using more advanced quantitative or qualitative methods and not to rely only on the single aggregate measures of financial stability developed by central banks. Moreover, the private sector will find the analysis in central bank financial stability reports a useful starting point for its own examination of the risks and exposures that it faces, particularly in the macroeconomic area. In this regard, one of the central bank objectives in preparing and publishing such reports is to provide information to the private sector that the private sector can incorporate in its decision-making process and possibly use to act in order to mitigate the risks discussed.

In light of the extensive use of aggregate financial stability index (AFSI) measure in empirical studies, the next section of the research will explore the key techniques for its construction.

**2.5 Key Techniques for constructing the Aggregate Financial Stability Index (AFSI):** Karanovic<sup>a</sup> and Karanovic<sup>b</sup> (2015) confirmed the importance of the statement that was performed by Albulescu (2008), which says "The design of an (AFSI) does not represent an arbitrary exercise. In this context, they mentioned that a certain step should be followed to develop a dependable index that can be used in developing policies. More specifically, they explained that the "Handbook on Constructing Composite Indicators" that was prepared by the OECD and Joint Research Centre of the European Commission recommended an "ideal (ten-step) sequence" that help in constructing a composite index. These steps include the theoretical framework.



**2.5.1 Key indicators for measuring financial stability:** Gadanez and Jayaram (2019) explained that the vast majority of the literature focuses on some indicators and monitoring variables which are commonly used in measuring financial stability. More specifically, they clarify that there are six main sectors included in order to construct an index to measure financial stability, which are: (1) the real economy that could be measured by many variables, for instance, GDP growth and inflation, (2) The corporate sector (could be measured by total debt to equity, earnings to interest and principal expenses, net foreign exchange exposure to equity, etc...), (3) the household sector (could be measured by net assets and net disposable income etc...), (4) the external sector (could be measured by real exchange rates, the current account, foreign exchange reserves etc...), (5) the financial sector (could be measured by monetary aggregates, real interest rates, banks' capital and liquidity ratios etc...) (6) the financial markets (can be measured by equity indices, volatility etc...). In general, the choice of variables should take into consideration the structure of the financial system in each country.<sup>4</sup> Most importantly, financial stability is considered a multidimensional economic phenomenon, which can only be analyzed by using the means of a synthetic index which aggregates different indicators that reflect the dimensions of financial stability (Albulescu, 2010).

Moreover, many empirical studies that tried to develop an aggregate financial stability index (AFSI) for different countries by computing the following four sub-indices, or in other words sub-groups of indicators, which are: Financial Development Index (FDI), Financial Soundness Index (FSI), Financial Vulnerability Index (FVI), and the World Economic Climate Index (WECI), and These indices will then be consolidated into an aggregate financial stability index (AFSI)<sup>5</sup> (Yusifzadeh et al., 2017; Akosah et al., 2018; Morris, 2010 and Albulescu, 2010).

Nevertheless, there are other sub-indices that are used in developing an aggregate financial stability index, for instance, (AL-Rjoub, 2021) constructed an aggregate financial stability index for Jordan based on

---

<sup>4</sup> The number of indicators which are used in the analysis differs among studies, for instance, Morris (2011) used 19 variables, Nana et al (2018) used 22 variables, Albulescu (2010) used 20 variables etc...

<sup>5</sup> These indicators will be explained in detail in the forthcoming part of this paper as they will be used in developing an aggregate financial stability index (AFSI) for Egypt.

aggregation of fifteen indicators, into four main categories: Capital Adequacy, Asset Quality, Earnings and Profitability, and liquidity. The study explains that Popovska (2014) constructed a simple index of financial stability for the banking sector in Macedonia using six sub-indices of capital adequacy, asset quality, management quality, profitability, liquidity, interest rates, and market sensitivity into her aggregate index. Also, Nasreen et al. (2015) constructed an aggregate financial stability index (AFSI) for five South Asian countries<sup>6</sup> (AFSI) by the aggregation of sub-indices which cover financial sector development, vulnerability and soundness.

### **2.5.2 Normalization methods for constructing aggregate financial indices:**

Moreover, Morris (2010) indicated that to aggregate the variables into a single index each indicator has to be normalized to allow for enabling comparison between variables. In this regard, Albulescu (2010) showed that there are many normalization methods, but the most commonly used methods are: Statistical normalization, empirical normalization, Axiological normalization, and mathematical normalization. However, each method has its advantages and disadvantages. It is worth mentioning that the empirical normalization method has two advantages: first one is that it could help in calculating a stress index – in case that the analysis is based on the volatility of the variables, or it can help in constructing the stability index – especially if the normalization procedure considers the worst and the best values - which are measured by the indicators within the analysis time frame. In this respect, the empirical normalization method supposes different techniques; one of these techniques is conducted through giving the 0 value (Min) to the worst observed value and 1 or 10 (Max) to the best observed value. However, confirmed that among various methods which are used for normalization, statistical normalization and empirical normalization are considered the most frequently adopted methods in the construction of aggregate index.

### **2.5.3 Weighting methods in financial stability index construction:**

Akosah (2018) indicated that the normalization process is followed by defining the weights of the selected variables. In this context, Babar et al. (2019) mentioned that the study of Illing and Liu (2006) confirmed that whether

---

<sup>6</sup> The study addressed five South Asian countries which are: Pakistan, India, Bangladesh, Nepal and Sri Lanka over the period 1980-2012.

assigning equal or different weights<sup>7</sup> it makes no significant difference in results. Further, Arrigoni et al. (2022) agreed with this conclusion about using equal weights; they used data from 18 countries including both advanced and emerging economies to assess whether using equal weights in assessing financial stability indexes leads to less accurate results compared to those which are based on using different weights techniques. They concluded that using equal weights in assessing financial stability is not less accurate than using other measures, and in some cases might be considered a better technique.

However, Yusifzadeh et al. (2017) explained that after the normalization process and defining the weights of the selected variables, individual indicators should be grouped into four sub-indices. They showed that aggregate financial stability index should be calculated using equal weights for all four sub-indices (each equal to 0.25). Then, the aggregate financial stability index should be calculated<sup>8</sup>.

**2.5.4 Different approaches in constructing the aggregate financial stability index (AFSI):** Despite many techniques being used to build an aggregate financial stability index, one of the most common methods is the standard approach. In fact, many studies that developed an aggregate financial stability index for developing countries preferred to apply the standard approach as will be explained later. In this context, Morris (2010) justifies applying the standard approach due to a lack of data, which results in reducing the number of observations, which in turn associated with degrees of freedom. He added that due to all these facts, employing the econometric estimations of the weights is considered a difficult task, making the use of standard procedure of equal weightings a better and easier method.

As mentioned above, in many countries - especially in developing countries where a lack of data usually represent a major problem- the most commonly used approach in developing an aggregate financial stability index (AFSI) is the standard approach. In this respect, many studies used this approach to develop (AFSI) for various countries. For instance, Akosah (2018) developed an aggregate financial stability index (AFSI) for Ghana, using the standard

---

7 There are many other weighting techniques which were identified in the literature, for instance, factor analysis (Albulescu, 2010).

8 The formulas that are used to calculate the four sub-indices and the aggregate financial stability index will be explained in the fourth section of the paper.

approach, with weights based on those commonly used in the literature and on expert judgments. Morris (2010) adopted the same approach in developing an aggregate financial stability index (AFSI) for Jamaica, and weights are based on expert judgments due to data limitations. Also, Albuлесcu (2008) used the standard approach to develop financial stability index (AFSI) for Romania, the study also used the stochastic simulation model to forecast the Romanian banking system stability. In addition, Nasreen et al. (2015) used the same approach to develop (AFSI) for five South Asian countries (AFSI) as mentioned above.

It is worth mentioning that KaranovicA and Karanovicb (2015) constructed an aggregate financial stability index (AFSI) for nine Balkan countries<sup>9</sup> over the period 1995-2011. They explained that there are significant social, economic, and political similarities among these countries that urged them to develop a single index for the nine countries despite lack of data in some periods of time due to political disturbances, which make the procedures of increasing the accuracy of data result in losing additional observations and affects the results. It also concluded that the financial index of Balkan region was at low levels during the period of the study. In their conclusions they highly recommended publishing a financial stability report regularly for the entire region.

As stated earlier, besides the standard approach, there are many other techniques that are used to build an aggregate financial stability index. For instance, Yusifzadeh et al. (2017) developed an aggregate financial stability index (AFSI) for Azerbaijan, using the so-called "fuzzy approach" which provides the advantage of assigning the different weights of sub-indices.

Also, Babar et al. (2019) The study developed three different financial stability indices for Pakistan by using Variance-Equal Weighted Method, Linear Probability Model (LPM), and the Logit Model. They used many indicators to develop an aggregate financial stability index; these indicators include profitability, liquid liability to the liquid asset, non-performing loan portfolio, uncovered liabilities, and interbank funds/liquid assets from the financial sector. The sample constitutes of all the banks that were listed on the Karachi Stock Exchange (KSE) for the years 2001–2011. In this respect,

---

9 The nine countries which are included in the study are: Albania, Bosnia and Herzegovina, Bulgaria, Croatia, The former Yugoslav, Republic of Macedonia, Romania, Serbia, and Slovenia.

the study agreed with the above-mentioned approach of assigning equal weights in constructing stress index and confirmed that this way is considered an easy and good one, but using a different weight to the variables is considered more useful. In this context, the study also explained that there is no significant difference in results if we use equal or different weights, as mentioned above. Additionally, the study concluded that each one of the above-mentioned methods that were used to construct indices has its advantages and disadvantages, but they should be used in order to strengthen the financial stability.

### **2.6 Constructing an aggregate financial stability index (AFSI) for Egypt:**

In fact, few studies were conducted on the financial stability in Egypt. A study by Hafez (2022) examined whether the efficiency of Egyptian banks negatively impacts financial stability. A sample of 30 banks operating in Egypt was chosen to address this issue, using the data envelopment analysis (DEA) approach and financial ratios. The study also aimed at assisting the Central Bank of Egypt in determining which banking system—Islamic or traditional—is more efficient and plays a significant role in promoting economic growth. It concluded that the Islamic banking system in Egypt is more efficient than traditional banks and has a greater influence on financial stability.

Abdelaziz (2021) analyzed the impact of cooperation between banking supervisory authorities on maintaining financial stability. The study aimed at analyzing the banking supervisory cooperation between supervisory authorities in Egypt and other international and regional authorities. It used the Single Supervisory Mechanism in 2013 that was established in Eurozone to help facing the challenges that the resulted from financial instability after the global financial crisis in 2007. The study confirmed the importance of cooperation between different supervisory authorities in maintaining financial stability in the long run.

Elshef (2018) examined the relationship between financial inclusion, the size of the shadow economy (SE), and financial system stability using panel data from 20 emerging economies - Egypt was included - over the period 2004-2014. It constructed two indices, one index for financial inclusion and the other index for financial instability respectively the study concluded that varying degrees of financial inclusion result in differing levels of financial

stability, with the size of the shadow economy significantly affecting this relationship.

In addition to the above mentioned, a study by Prasad et al. (2016) investigates the experience of 19 Arab countries – Egypt included - in implementing macroprudential policies and offers recommendations to enhance their macroprudential frameworks. Regarding Egypt, the study confirmed the role of the Central Bank of Egypt (CBE) in maintaining financial stability. In this regard, the CBE established an independent Financial Stability Unit in 2006, known as the Macroprudential Unit.

El-shal (2012) constructed the emerging markets-financial stability index (EM-FSI) for Egypt and used it in a Vector Autoregression (VAR) analysis to empirically examine the spillover effects of the global financial crisis on economic activity in emerging economies, with Egypt taken as a case study. Moreover, since the year 2014 Central Bank of Egypt (CBE) has started publishing annual stability report in order to assess the degree of financial stability in Egypt. The report is considered the key communication channel between stakeholders and the public. It also sheds light on the role of the Central Bank of Egypt and the Financial Regulatory Authority (FRA) in identifying and addressing the risks facing the financial system. Most importantly, Central Bank of Egypt has developed an aggregate financial stability index (AFSI) for Egypt, the index represents a composite quantitative measure, which reflects the stability of the current macro-financial crises. More specifically, the index was built using an extensive set of variables (21 variables) which are classified under four sub-indices, which reflects, the banking sector performance, domestic macroeconomic conditions, financial markets developments, and the climate of the global economy. Additionally, the most recent financial stability index (AFSI) for Egypt is constructed using quarterly data covering the period (July 2011 – June 2023 (Central Bank of Egypt, 2018; 2019; 2023).<sup>10</sup>

In the light of the previous analysis, this study – to the best of the author's knowledge – is the first study that aims at constructing an aggregate financial stability index (AFST) for Egypt covering the period (2004 – 2023), as the first phase of banking reform was launched in 2004.

---

10 The index was reconstructed in 2019 to be computed using the two methods; equal weights and factor analysis (Central Bank of Egypt, 2019).

To sum up, the literature revealed that financial stability can be considered a public good, which justifies the role of central banks and other regulatory authorities in maintaining it. The primary aim of developing financial stability indices is to assist authorities in preserving stability and preventing disruptions in financial systems. Additionally, constructing an aggregate financial stability index (AFSI) is particularly important for economies in developing countries to help avoid financial disturbances. Each method used in developing these indices has its strengths and weaknesses. Overall, more research is needed to develop advanced quantitative and qualitative methods to address financial stability issues.

### 3. The Egyptian Banking Reform

The Central Bank of Egypt plays a crucial role in bolstering Egypt's economy and maintaining financial stability. Its key responsibilities include safeguarding the banking sector, setting and overseeing monetary policy, managing the country's foreign currency reserves, and printing and circulating cash.

Since 2004, the Central Bank of Egypt has been implementing a two-phase banking reform program to strengthen and modernize the country's financial system. The goal is to create a robust and competitive banking sector that contributes to economic growth.

The first phase (2004-2008) focused on establishing a stable foreign exchange market, reforming monetary policy, and implementing structural changes to the banking industry. These reforms aimed to create strong and efficient banks operating under effective supervision, all while promoting a transparent and flexible exchange rate system that allows free capital flows. The ultimate objective is to foster economic growth through a stable and competitive banking sector. The second phase of the banking reform program (2009-2012) built upon the success of the first phase. It aimed to strengthen confidence in the exchange market and monetary policy, improve the efficiency and safety of the Egyptian banking sector, and increase its competitiveness and risk management capabilities. The independence of the Central Bank of Egypt contributed to the successful implementation and outcomes of both phases of the reform program (CBE, 2014).

The first phase of the banking reform program (2004/2008) involved four main areas: privatization and merger in the banking sector, addressing bad

debt issues, restructuring public sector banks, and enhancing supervision at the Central Bank of Egypt. These achievements set the foundation for the next phase, as the second phase of the banking reform program (2009/2012) was based on three main pillars: Implementing the Basel II framework in the Egyptian banking sector, adopting an initiative to promote and develop banking activities for various sectors, particularly small and medium-sized enterprises, and applying the principles of corporate governance in the Egyptian banking sector (CBE, 2014).

#### **4. Methodology and Analysis**

To measure the aggregated financial stability index for Egypt, the paper adopted two different approaches applied in empirical literatures (Albulescu, 2010 ; Morris, 2011). These approaches are: Equal sub-indices' weight approach and equal individual indicators' weight approach. The two approaches start with normalization of data, then constructing the aggregate financial stability index with different methods. the paper also tests the validity of AFSI econometrically. the paper constructed the stability index for Egypt financial sector based on annual data during the period (2004-2023). We started from 2004 to include the period where the Central Bank of Egypt has initiated a banking reform program, as mentioned before.

##### **4.1 The Construction of Stability Index for Egypt's Financial System:**

The aggregate indicator of financial stability consists of four sub-indices: The Financial Market Index (FMI), Financial Vulnerability Index (FVI), Financial Soundness Index (FSI), and World Economic Climate Index (WEI). Indicators within Each sub-index are explained in table (1).



Measuring Financial Stability in Egypt Since the Implementation of the Banking Reform Program (2004-2023)

ياسمين محيي الدين غريب<sup>1</sup>، عبد الحميد مصطفى عبد الحميد<sup>2</sup>، داليا رضا حسن أبو العلاء<sup>3</sup>

**Table (1)**  
**Financial Stability Indicators**

Individual Indicators	Definition	Source of Data	Expected Impact on Financial Stability*
<b>1. The indicators of Financial Market Index - FMI</b>			
Total credit to GDP ratio (DC)	Measures how credit institution perform their intermediation functions.		Positive
Interest Spread (IS)	The difference between credit rates and deposits rates- reflects the banking system's development.		Negative
Market capitalization	Reflects the development of capital market.		Positive
<b>2. The indicators of Financial Vulnerability Index - FVI</b>			
Fiscal deficit to GDP ratio (FD)	An indicator of financial system stress.		Negative
Current account balance (Deficit) to GDP (CAD)	Allow tracking up the coming external shocks.		Positive
Inflation rate (IN)	Represents a macroeconomic vulnerability indicator		Negative
Real Effective Exchange Rate (REER)	Reflects the exports competitiveness.		Negative
Public Debt to GDP ratio (PD)	Measures the ability of the country to pay back its debt.		Negative
International Reserves to Import ratio (IR)	Measures the ability of the country to pay its imports.		Positive
Non-Government Credit to Total Credit Ratio (NGC)	A crucial indicator of the financial health of an economy? This ratio measures the proportion of credit provided by non-government entities compared to the total credit available in the economy		Positive
Ratio of M2 to International Reserves (MIR)	Used to gauge a country's financial stability and its ability to weather economic fluctuation		Negative
Money multiplier (MM)	Describes how the supply of private money (deposits) responds to the money base.		Negative
<b>3. Indicators of Financial Soundness Index - FSI</b>			
Return on Assets (ROA)	Measures banks' profitability in relation to their total assets		Positive
Non-Performing Loans / Total Assets (NPL)	A financial metric used by banks and financial institutions to assess the quality of their loan portfolio		Negative

Liquidity Ratio in Local Currency (LR)	Measures percentage of liquid deposits in local of total deposits		Positive
Bank regulatory capital to risk weighted assets (RCRWA)	Known as the capital adequacy ratio, is a key measure used to assess a bank's financial health and stability		Positive
<b>4. Indicators of World Economic Climate Index (WEI)</b>			
World Economic Growth (WEG)-% change	The global economy is a delicate web, where a decline in key indicators like economic growth, and inflation can have a ripple effect, ultimately threatening the economic and financial stability of individual nations		Positive
Global Inflation Rate (GIN)- % change			Negative

Source: prepared by Authors

\*In case of increasing the indicator

#### 4.2 The Equal Sub-Indices' Weights Approach of Measuring AFSI

The first step in this approach is to normalize the individual indicators. The paper will use Z-Score normalization, also known as standardization, is a technique where the data are standardized to have a mean of 0 and a standard deviation of 1. The advantages of this method are to reduces the effect of outliers, and improve the interpretability of the results. For this purpose, the following formula has been used:

$$X_{tn} = \frac{(X_t - \bar{X})}{\sigma}$$

Where :

$X_{tn}$ : is the normalized value of indicator X in Year t

$X_t$  : is the value of the indicator X in year t

$\bar{X}$  : is the mean or average value of the indicator X during the period

$\sigma$  : is the standard deviation of the indicator X during the period.

After the normalization, the individual indicators are grouped into four sub-indices respectively using by formulas below:

$$FMI = \frac{\sum_{j=1}^3 X_{mj}}{3}$$

$$FVI = \frac{\sum_{j=1}^9 X_{vj}}{9}$$

$$FSI = \frac{\sum_{j=1}^4 X_{sj}}{4}$$

$$FWI = \frac{\sum_{j=1}^2 X_{wj}}{2}$$

Aggregate index of financial stability is calculated as follows:

$$AFSI = W_1 * FMI + W_2 * FVI + W_3 * FSI + W_4 * FWI$$

## Measuring Financial Stability in Egypt Since the Implementation of the Banking Reform Program (2004-2023)

باسم من محيي الدين غريب<sup>1</sup>، عبد الحميد مصطفى عبد الحميد<sup>2</sup>، داليا رضا حسن أبو العلاء<sup>3</sup>

Where  $W_i$  ( $i = 1, \dots, 4$ ) are weights of corresponding sub-indices. The paper assumed that the four sub-indices have received equal weights of 0.25

Table 2 shows the normalized value of all individual indicators during the period (2004-2023).

	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
DC	1.146	1.111	0.651	-0.574	-1.406	-1.081	-1.551	-1.257	-1.374	-0.479	-0.029	0.481	1.563	0.938	-0.264	-0.936	0.243	0.526	1.055	1.041
IS	-0.597	3.079	1.241	1.241	1.241	0.322	0.322	0.322	-0.597	-0.597	-0.597	-0.597	-0.597	-0.597	-0.597	-0.597	-0.597	-0.597	-0.597	-0.597
MC	-1.593	-0.897	-0.727	0.226	1.123	-0.36	-0.587	-0.631	-0.885	-0.562	-0.301	-0.269	-0.704	0.589	1.536	0.88	0.168	0.498	0.304	2.594
FD	-0.193	-0.242	0.435	0.773	1.111	1.063	0.483	-0.338	-0.483	-1.884	-1.498	-1.159	-1.643	-0.87	-0.338	0.435	0.58	0.821	1.449	1.479
CA	2.208	1.83	1.261	1.299	0.845	-0.178	-0.064	-0.292	-0.633	-0.14	0.314	-0.67	-1.466	-1.542	-0.216	-0.633	-0.443	-1.011	-0.67	0.201
IN	-0.144	-1.025	-0.643	-0.413	0.825	-0.077	-0.145	-0.31	-0.716	-0.392	-0.309	-0.268	0.205	2.364	0.286	-0.436	-1.001	-0.977	0.217	2.966
REER	-1.69	-1.205	-1.07	-1.081	-0.115	0.347	0.429	0.665	0.411	0.655	1.449	2.022	-1.51	-1.06	-0.356	0.564	0.847	1.196	-0.291	-0.006
PD	1.604	0.87	0.975	-0.073	-1.564	-1.68	-1.634	-1.343	-0.865	-0.073	0.323	-0.318	0.532	1.778	0.497	-0.434	0.031	0.497	-0.662	0.94
IR	1.294	1.584	1.351	1.216	0.36	0.513	0.779	-1.115	-1.501	-1.303	-1.495	-1.431	-0.699	0.27	0.492	0.532	0.318	0.039	-0.657	-0.345
NGC	1.681	1.348	1.188	1.488	1.533	0.922	0.781	0.288	-0.082	-0.437	-0.736	-0.844	-1.025	-0.738	-0.803	-0.829	-0.999	-0.896	-0.905	-0.926
M2	-0.707	-0.94	-0.973	-0.957	-0.926	-0.808	-0.797	0.587	1.386	1.226	2.064	2.154	-0.421	-0.734	-0.768	-0.517	0.102	0.457	0.385	0.203
MM	-0.224	0.288	0.178	0.38	-0.407	0.032	-0.389	-1.304	-1.066	-1.194	-1.048	-2.018	-0.645	0.581	0.16	1.679	1.039	1.258	1.478	1.222
ROA	-1.3	-1.093	-0.268	-0.681	-0.681	-0.681	-0.268	-0.268	-2.331	-0.268	0.351	0.763	1.795	1.795	0.763	0.557	1.382	0.144	0.144	0.144
BCA	-1.079	-1.031	-1.055	-1.079	-0.886	-0.91	1.694	1.549	-2.237	0.344	0.512	0.681	-0.066	-0.115	0.078	0.585	0.802	0.874	0.44	0.898
LAA	-0.708	-1.148	-0.89	-2.06	-0.923	-0.247	-0.182	0.965	1.287	1.652	1.749	1.427	0.622	-0.161	-0.225	-0.064	0.375	-0.107	-0.333	-1.03
RCRA	0.914	1	1.471	1.278	1.343	1.3	0.978	0.4	0.357	0.057	-0.115	-0.415	-0.693	-0.886	-1.001	-1.036	-1.165	-1.186	-1.208	-1.293
WEG	-0.265	-0.131	-0.131	0.071	1.482	-1.072	-0.333	0.541	-0.064	-0.4	-0.669	-1.005	-1.005	-0.601	-0.4	-0.467	-0.669	0.339	3.028	1.751
GDP	0.918	0.615	0.918	0.969	-0.245	-1.864	0.918	0.311	-0.043	-0.094	0.008	-0.043	-0.144	0.109	0.008	-0.397	-3.179	1.475	-0.043	-0.195

Source: Authors' calculations



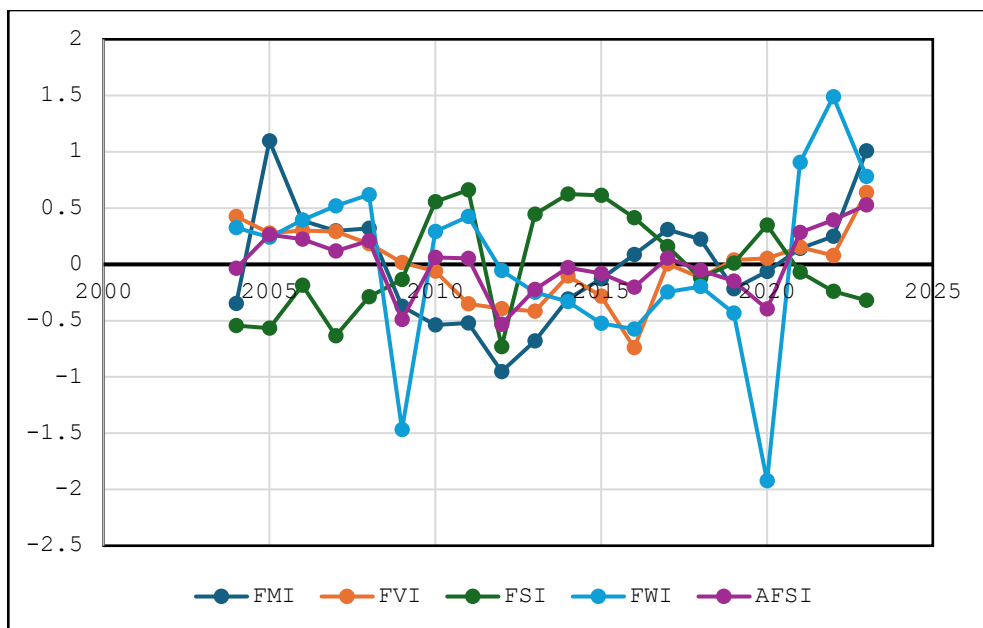
In table (3) and figure (1), The results of calculation for sub-indices and aggregate index of Egypt during (2004-2023). With weights equal to 0.25 for all sub-indices.

Table (3):  
The Four Sub-indices and Aggregate Index of Financial Stability of Egypt Using Standard Approach (2004-2023)

	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
FMI	-0.348	1.097667	0.388833	0.297667	0.319933	-0.373	-0.59867	-0.522	-0.952	-0.679933	-0.309	-0.12833	0.087333	0.31	0.25	-0.21767	-0.062	0.142333	0.25	1.01
FVI	0.425444	0.278667	0.380222	0.297444	0.184667	0.01889	-0.06189	-0.33133	-0.94833	-0.41578	-0.104	-0.28133	-0.7433	0.005444	-0.11622	0.040111	0.052667	0.153778	0.08	0.64
FSI	-0.54325	-0.568	-0.1885	-0.6555	-0.28675	-0.1345	0.5555	0.6615	-0.731	0.44625	0.62025	0.614	0.4145	0.15825	-0.12225	0.0105	0.3485	-0.06875	-0.24	-0.32
FMI	0.3265	0.242	0.3995	0.52	0.6185	-1.468	0.2925	0.426	-0.0535	-0.247	-0.3305	-0.524	-0.5745	-0.246	-0.196	-0.432	-1.924	0.907	1.49	0.78
AFSI	-0.09483	0.262583	0.224139	0.118653	0.208938	-0.449015	0.061861	0.053542	-0.53271	-0.22397	-0.02381	-0.07992	-0.2035	0.058924	-0.05212	-0.14976	-0.39621	0.28359	0.395	0.5275

Source: Authors' calculations

Figure (1)  
**Sub -indices and aggregated index of financial stability in Egypt Using Standard Approach (2004-2023)**



Source: Prepared by Authors

According to the initial approach, it was found that the AFSI in Egypt did not reach a value of "1" between 2004 and 2023. This shows that the financial system in Egypt was not consistently stable during this period. The highest value of the AFSI was recorded in 2023 at around 0.53, indicating a progression in the index over time. On the other hand, the lowest value was observed in 2012 at around (-0.5), attributed to the events of the January 25th revolution which impacted various aspects of Egyptian life and economy. Following this, all four sub-indices declined but began to show signs of improvement starting from the latter half of 2013.

The 2008 Global financial crisis was one of the most severe in history. Egypt responded to this crisis by implementing a series of fiscal and monetary policies to minimize its impact on the Egyptian economy. The crisis led to a significant increase in food, energy, and commodity prices, which disproportionately affected middle and low-income Egyptians who spent a large portion of their income on basic necessities. In response, the Egyptian government swiftly adopted strategic measures to mitigate the crisis's negative effects and maintain social and economic stability. This included the launch of EGP 15.5 billion fiscal stimulus package in 2008/09, equivalent to 1.5% of GDP (Mansour, 2021) primarily aimed at funding investments in

public utilities. The Central Bank of Egypt is utilizing a tightening monetary policy and encouraging commercial banks to fund small and medium-sized enterprises because these businesses require a significant amount of labor.

However, the AFSI decreased due to the global economic downturn, which affected the FI (Financial Instability) as people lost trust in the banking system, fearing defaults and non-performing loans. Fortunately, the banking system was not severely impacted by the crisis since it had limited connections to the global financial system.

Following the events of January 2011, Egypt experienced a period of political instability, security turmoil, and severe economic deterioration. This had a negative impact on various economic indicators: Escalation of the unemployment rate, high inflation rates, noticeable decline in foreign investments, significant decrease in foreign reserves, from \$36 billion at the beginning of January 2011 to a record low of \$13.6 billion by the end of January 2013, low GDP growth rates, with figures of 1.76%, 2.22%, and 2.18% for the years 2011, 2012, and 2013, respectively, which were lower than historical rates (Mansour, 2021).

The 2011 Egyptian Revolution severely impacted the country's economy and financial system. The banking system was disrupted, leading to declines in financial market indicators and investor confidence. Political and economic instability also contributed to a worsening economic outlook, marked by rising deficits, inflation, and public debt, while GDP and foreign reserves fell. This turbulent period also coincided with global instability, further impacting international investment in Egypt.

However, This Egyptian banking reform (2004-2012) played a significant role in shielding Egyptian banks from the direct ramifications of the global financial crisis and the effects of the political and economic upheaval following the revolution of 25<sup>th</sup> January, 2011.

In a bold move on November 3, 2016, the Central Bank of Egypt under Governor Tarek Amer floated the Egyptian pound. This decision aimed to boost dollar reserves, eliminate the black market, strengthen Egypt's international financial standing, and bring about economic stability. The move helped Egyptian exports become more competitive and supported struggling private businesses hampered by limited access to foreign currency.

The economic reform program led to a substantial boost in real GDP growth. This growth was primarily driven by the construction and energy sectors, as well as private consumption, public investment, a rebound in tourism, and increased exports. Additionally, the ICT, gas, and mining industries experienced notable growth.

The World Bank and the International Monetary Fund commended the Egyptian economy for its performance during the Covid-19 pandemic.

Egypt was the only country in Africa and the Middle East to achieve positive growth rates exceeding 3% in 2020. This growth was attributed to the successful implementation of an economic reform program in 2016, along with strong progress in all key economic indicators. The economy also benefited from close alignment between monetary and fiscal policies, as well as effective coordination among various economic authorities. Consequently, Fitch Ratings maintained Egypt's credit rating in July 2020 at B+ for both local and foreign currencies, with a stable outlook.

The AFSI registered a value of 0.4, indicating a decline in the index. This decline was primarily driven by a sharp drop in the FWI, which is closely tied to the global economy. The global economy was adversely affected by the COVID-19 pandemic.

In 2022, the global economy bounced back to its pre-pandemic growth rate, driven by the adaptability of many economies and a decrease in inflation towards the end of the year. However, the tight monetary policies in developed countries led to a decrease in foreign investments in emerging markets, prompting them to raise interest rates to combat inflation, attract foreign capital, and stabilize their currencies, but at the cost of higher borrowing costs domestically.

Global developments in 2022 played a significant role in reducing Egypt's current account deficit. The surplus in the oil balance doubled, while the deficit in the non-oil balance decreased. Additionally, tourism and Suez Canal revenues increased. However, remittances from workers abroad decreased and the investment income deficit increased. On the positive side, net direct investments increased and other investment flows continued, helping to limit the outflow of portfolio investments from Egypt. In the fourth quarter, the rate of exit decreased as foreign investors returned to the local market. The balance of payments showed a deficit in 2022, mainly concentrated in the first half due to the repercussions of the war. However, the second half recorded a surplus, highlighting the resilience of the Egyptian economy in absorbing these repercussions (CBE, 2023).

The banking sector played a crucial role in mitigating the effects of fluctuating foreign capital. It saw an increase in its share of local treasury bills balances after the war outbreak. This increase, along with the growth in shares of other economic sectors and the non-banking financial sector, indicates a rising number of local investors. This helps limit the impact of sudden foreign investment withdrawals on the government's ability to manage its financing needs. Furthermore, the banking sector's use of its net foreign assets decreased in the second and third quarters of 2022, but increased in the fourth quarter with net inflows (CBE, 2023).

Economic growth in the first half of fiscal year 2022/2023 mirrored the average growth seen before the pandemic. However, the war in Ukraine



has reshaped the economic landscape. The agricultural sector saw a boost, while tourism, the Suez Canal, and communications sectors experienced significant growth, nearly doubling their contributions. Despite global economic turbulence, several industries maintained their usual level of contribution (CBE, 2023).

Public finance continues to perform well, with stable net government liabilities and a slight increase in government securities. This reduces the risk of disturbances in public finance performance. The government aims to decrease debt and servicing costs by diversifying financing sources and issuing new financing instruments.

The combination of these factors led to a rising trend in AFSI from 2022 onwards, despite some volatility in the four sub-indices due to inflation and interest rate changes, which had a negative impact specially on FWI and FSI.

#### 4.3 The Equal Individual Indicators' Weights Approach of Measuring AFSI

In this approach, the paper has assigned the same weight for all individual indicators, after normalizing the value of indicators using z-score normalization method. There are different methods to construct the aggregate index using this approach:

##### 4.3.1 The Standard Procedure:

In this method, the paper first calculates the four sub-indices using the following formulas:

$$FMI = \frac{\sum_{j=1}^3 X_{mj}}{3}$$

$$FVI = \frac{\sum_{j=1}^9 X_{vj}}{9}$$

$$FSI = \frac{\sum_{j=1}^4 X_{sj}}{4}$$

$$FWI = \frac{\sum_{j=1}^2 X_{wj}}{2}$$

Then, the paper gives the same importance to all individual financial stability indicators<sup>11</sup> which describe the financial system vulnerability, development and soundness, as well as the world economic climate. The aggregate index calculation formula is:

$$AFSI = 0.17 * FMI + 0.5 * FVI + 0.22 * FSI + 0.11 * FWI$$

<sup>11</sup> The weight of each individual indicator is 0.056 approximately.

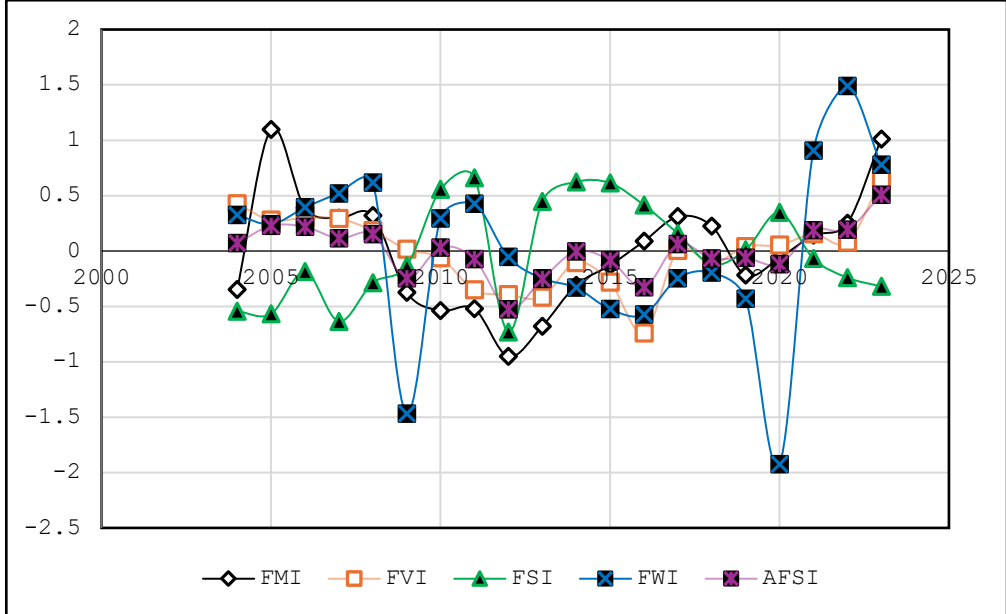
The evolution of the four sub-indices and the AFSI in Egypt during the period (2004-2023) using the weighted average approach is shown in Tale (4) and Figure (2).

	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
FSI	-0.54925	-0.568	-0.1855	-0.6355	-0.28675	-0.1345	0.5555	0.6615	-0.731	0.44625	0.62425	0.614	0.4145	0.15825	-0.2225	0.0105	0.3485	-0.06875	-0.24	-0.32
FIU	0.3265	0.242	0.3395	0.52	0.6185	-1.468	0.2925	0.426	-0.0555	-0.247	-0.3305	-0.524	-0.5745	-0.246	-0.196	-0.432	-1.924	0.907	1.49	0.78
AFSI	0.06996	0.2276	0.2186	0.11422	0.15157	-0.24704	0.03187	-0.07202	-0.52571	-0.23237	-0.00355	-0.08504	-0.32782	0.06318	-0.0881	-0.06216	-0.11938	0.18573	0.1396	0.5071

Number of variables: 3,9,4,2  
 $W = 0.17, 0.5, 0.22, 0.11$

Source: Authors' calculations

**Figure (2)**  
**The Four Sub-indices and Aggregate Index of Financial Stability of Egypt Using Weighted Average Approach (2004-2023)**



Source: Prepared by Authors

According to Figure 2, the second approach also reveals that the highest AFSI value was 0.5 in 2023, while the lowest value was (-0.5) in 2012. Moreover, it's evident that ASFI using weighted average approach follows a similar trend as AFSI measured using the first approach, and both are influenced by the political, economic, and financial crises that Egypt has faced.

#### 4.3.2 The Arithmetic Mean and Geometric Mean Methods:

The paper can also calculate the Aggregate index using the chain index based on the arithmetic and geometric mean of the variables. In this method, the variables are transformed in percentiles, Using the cumulative sampling distribution function - CDFs (Illing and Liu, 2006; Rouabah, 2007). In this case, the last percentile corresponds to a period of high instability, while the value of the first percentile characterizes a low level of stress. Other values around the median reflect an average level of risk. Before creating the overall index, the normalized variables are grouped into a chain index and the correlation between them can be established using the arithmetic mean and the geometric mean, according to the two formulas:

$$AFSI = \frac{\sum_i(X_{it}W_{it}) + \sum_i(X_{it}W_{it-1})}{2}$$

$$AFSI = \sqrt{\sum_i(X_{it}W_{it}) * \sum_i(X_{it}W_{it-1})}$$

where:

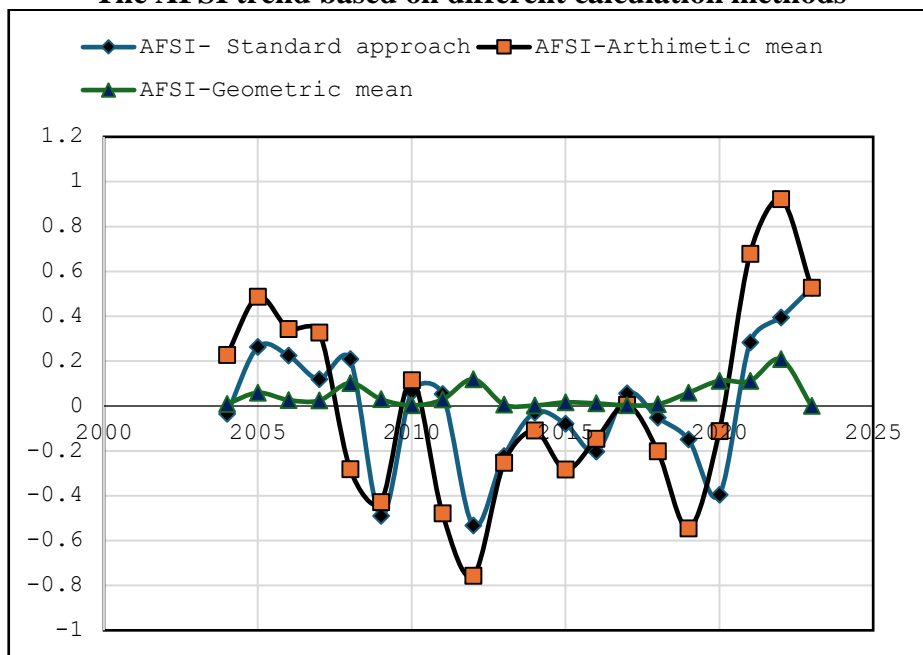
$X_{it}$ : is the transformed individual variable

$W_{it}$ : is the weight within the index in the (t) period.

The weight is calculated based on the ratio between the normalized variable and the sum of all the variables at the (t) moment.

The next figure compares between different methods in calculating the AFSI using equal weights for all individual indicators. The results of AFSI standard approach and AFSI Arithmetic mean Approach are similar while the result of AFSI Geometric mean approach is different. the standard and arithmetic mean methods capture all the financial and economic instabilities experienced by the system and highlights on how the different crises Egypt faced affected the financial stability. However, the paper prefers the standard method for further researches related to the econometric validation of the aggregate index and to the forecast exercise.

**Figure 2**  
**The AFSI trend based on different calculation methods**



Source: Prepared by Authors

#### 4.4 The AFSI econometric analysis

The analysis conducted on AFSI dynamics indicates that it effectively detects the crisis periods experienced by the Egyptian financial system between 2004 and 2023. To validate AFSI econometrically, the paper has selected various macroeconomic variables that exhibited distinct behavior during times of crisis in comparison to stable periods. These variables are: the economic growth rate, the ratio foreign currency lending to GDP, the overnight lending interest rate, and the EGX 100 index.

The model equation, depending on the paper of Albulescu (2010) is:

$$AFSI_t = c + \alpha * AFSI_{t-1} + \beta * GR_t + \gamma * FCL_t + \delta * OLI_t + \theta * EGX100_t + \varepsilon_t$$

where: AFSI is the financial stability aggregate index, GR is the economic growth rate, FCL is foreign currency lending to GDP ratio, OLI represents the overnight lending interest rate, and EGX100 is the Egyptian stock exchange index. The econometric analysis depends on calculated AFSI using weighted average approach as it is more accurate and takes into considerations the number of individuals indicators inside each sub index.

The first variable is economic growth rate (GR) that serves as a measure of both the fluctuation in the business cycle and the volatility of the economic environment in which financial institutions operate. When economic activity declines, it impacts the banks' operations and subsequently affects the stability of the financial system. Financial crises further contribute to the slowdown of economic activity.

The second variable is the foreign currency lending to GDP ratio (FCL), which is an indicator of vulnerability in an economy. This ratio represents the total amount of foreign currency-denominated lending, both by the government and the private sector, relative to the country's overall economic output (GDP). An increase of foreign currency lending means that the country has a sufficient liquidity in foreign currency which leads to higher financial stability.<sup>12</sup>

The third variable is the overnight lending interest rate (OLI), which impacts bank profitability by increasing it when OLI rises. Essentially, a higher OLI

---

<sup>12</sup> The effect of this variable is different from country to another based on the structure of financial stability index in the country.

results to higher financial stability for banks due to the increase in interest on loans.<sup>13</sup>

The last explanatory variable retained in the analysis is the EGX 100 index (EGX100), a gauge of the top 100 companies' financial health and overall economic conditions. A decline in this index suggests a potential drop in profitability and a waning confidence among investors in the financial and economic system.

The expected effect of independent variables on the dependent variable, according to the economic theory and literature of structuring AFSI in Egypt, is shown in the following table:

**Table (5)**  
**The Impact of Independent Variables on AFSI**

The independent variable	AFSI <sub>t-1</sub>	GR	FCL	OLI	EGX100
The expected sign	Positive	Positive	Positive	Positive	Positive

Source: Prepared by authors

The first test done is the stationarity of the variables. To obtain more precise information, the paper has used three different tests: Augmented Dickey-Fuller (ADF), Phillips-Perron (PP), and Kwiatkowski, Phillips, Schmidt, and Shin test (KPSS). The results are described in Table 6.

**Table (6)**  
**Unit root test and stationary analysis**

	ADF level	ADF difference	PP level	PP difference	KPSS level	KPSS difference
	Unit root		Unit root		Unit root	
<b>GR</b>	-4.716709***	--	-2.416251	-4.858973***	0.137822	0.082461
<b>AFSI</b>	-2.131722	-2.871605*	-1.642678	-2.513154	0.139047	0.140409
<b>FCL</b>	-2.696146	-3.376498**	-2.060277	-3.376006**	0.317790	0.143036
<b>OLI</b>	-0.623349	-4.503395***	-1.923347	-2.566064	0.382412	0.084748
<b>EGX100</b>	0.310819	-5.220283***	0.007003	-5.295101***	0.564244	0.348399

Source: Software Output

\*significant at 90%

\*\*significant at 95%

\*\*\*significant at 99%

<sup>13</sup> The effect of this variable is different from country to another based on the structure of financial stability index in the country

Based on the results of the ADF tests in Table 6, the paper can conclude that all variables become stationary after taking the first difference, except for the economic growth rate, which is stationary at the level. The PP test results indicate that some variables (GR, FCL, and EGX100) become stationary after taking the first difference, while others (OLI and AFSI) do not. However, the KPSS test results suggest that none of the variables are stationary, either at the level or after taking the first difference. Therefore, the paper will rely on the ADF test results for the analysis.

The paper dropped the first difference of AFSI from the model as an independent variable because it used it as dependent variable based on ADF results.

The final equation can be expressed as follows:

$$AFSI_t = c + \alpha * GR_t + \beta * FCL_t + \gamma * OLI_t + \delta * EGX100_t + \epsilon_t$$

The results of the econometric estimation are presented in the following table (7)

**Table (7)**  
**Econometric results**

Variable	Coefficient	Standard deviation
C	0.043619**	0.147804
GR(-1)	0.37704***	0.176958
FCL(-1)	0.002276*	0.190248
OLI(-1)	0.134566**	0.193561
EGX100(-1)	0.153561**	0.253117
R <sup>2</sup>	0.444343	
DW	1.297786	
Observations	19	

Source: Output software

\*significant at 90%

\*\*significant at 95%

\*\*\*significant at 99%

As shown from table (7), all estimated coefficients are statistically significant at different level of significance, as economic growth rate is statistically significant at 1%, While the foreign currency lending to GDP ratio is statistically significant at 10%, while overnight lending rate and EGX100 index are statistically significant at 5%. The reduced coefficients values show a small impact of the explanatory variables upon the aggregate index. Nevertheless, the explanatory power of the model is high as compared

to the small number of observations ( $R^2 = 0.44$ ), and the coefficient signs are those expected. The Durbin Watson (DW) is around 1.3 which means that less autocorrelation in the residuals from a regression analysis.

## 5 Conclusion and Policy Recommendations

### 5.1 Conclusion

The importance of constructing an aggregate financial stability index (AFSI) lies in its ability to provide a comprehensive and timely assessment of the overall health of a country's financial system. An aggregate financial stability index serves as an early warning system, enabling policymakers and regulators to identify potential risks and vulnerabilities in the financial system. This allows them to take proactive measures to mitigate these risks and prevent the occurrence of financial crises. Also, the index provides a holistic view of the financial system, capturing the interactions and interdependencies between different segments, such as banking, securities, and insurance. This helps to identify potential contagion effects and systemic risks that may not be apparent from analyzing individual components in isolation.

AFSI enables the assessment of the overall risk profile of the financial system, including macro-prudential risks, micro-prudential risks, and market risks. This facilitates a more informed decision-making process for policymakers and regulators. Moreover, the index allows for comparability across different countries and regions, enabling the identification of best practices and areas for improvement. This facilitates international cooperation and the development of more effective financial stability policies. Also, it is highly recommended publishing a financial stability report regularly for the entire region.

The paper's main contribution is the development of a comprehensive stability index to detect turmoil in the Egyptian financial system, which is then verified using econometric methods. Additionally, the study innovatively incorporates indicators such as global economic growth rates and international business climate perceptions into the aggregate index.

From the previous analysis, the paper concluded that:

1. The paper utilized various approaches to calculate AFSI, including the equal sub-indices' weight approach and the equal individual indicators' weights approach. While these approaches may seem straightforward at first, they are not random. Several steps must be taken, such as selecting individual indicators, choosing a normalization method, and determining



a weighting method based on specific criteria and weights. The selection of individual indicators is influenced by system characteristics and data accessibility.

2. The aggregate indicator of financial stability in Egypt consists of four sub-indices: The Financial Market Index (FMI), Financial Vulnerability Index (FVI), Financial Soundness Index (FSI), and World Economic Climate Index (WEI). Indicators within Each sub-index.
3. Each sub-index consists of a number of indicators with different effect, and the effect of each of the four sub-indices on the AFSI varies from one period to another.
4. The AFSI experienced a decline due to the global financial crisis of 2008, which had a negative impact on the Financial Instability. This was because the economic downturn led to a loss of trust in the banking system, with people fearing potential defaults and non-performing loans. However, the banking system itself was not severely affected by the crisis, as it had limited connections to the broader global financial system.
5. The Egyptian economy and financial system were significantly affected by the 2011 revolution. The disruption in the banking system resulted in a decrease in financial market indicators and investor trust. The combination of political and economic uncertainty led to a deteriorating economy, marked by rising deficits, inflation, and public debt, while GDP and foreign reserves fell. This turbulent period also coincided with global instability, further impacting international investment in Egypt, and negatively affecting the AFSI.
6. Egypt's banking reform from 2004 to 2012 helped protect its banks from the negative impacts of the global financial crisis and the country's subsequent political and economic instability after the 2011 revolution.
7. As a result of the COVID-19 pandemic, The AFSI has recorded a decrease to 0.4, showing a decline in the index. This decrease was mainly caused by a significant reduction in the FWI, which is strongly linked to the worldwide economic conditions. The global economy suffered negative impacts due to the pandemic.
8. The results indicate that the Egyptian financial sector has become more stable, with an improvement in the AFSI since 2020. However, the sector experienced significant instability during major crises, including the 2008 financial crisis, the 2011 revolution, and the COVID-19 pandemic in 2020. The econometric model confirmed the validity of the AFSI calculations.
9. The results suggest that the Egyptian banking sector experienced progress and strengthened resilience after the reforms introduced in 2004, which played a crucial role in stabilizing the sector during periods of

economic crises. The IMF attributed the sector's stability amid financial turmoil to the effectiveness of the reform efforts launched in 2004. Additionally, the World Bank views Egypt's financial reform program as highly successful within the MENA region, commending its holistic and forward-looking approach.

10. The econometric model verified the AFSI, as all estimated coefficients of the independent variables (GR, FCL, OLI, & EGX100) are statistically significant at different level of significance. And the explanatory power of the model is high as compared to the small number of observations ( $R^2 = 0.44$ ), and the coefficient signs are those expected. The Durbin Watson (DW) is around 1.3 which means that less autocorrelation in the residuals from a regression analysis.

## 5.2 Policy Recommendations

To improve the Aggregate Financial Stability Index (AFSI) in Egypt:

1. The macro financial stability could be considered as a public good, as it is crucial to maintain, especially during banking crises, as it helps prevent the ripple effect of shocks that can spread through various channels, including information networks, contractual agreements, and even psychological factors, ultimately minimizing the intrinsic impact on the system.
2. There's a need to increase financial stability by focusing on enhancing all indicators composed Aggregate financial stability index.
3. Monetary and fiscal policy tightening, including through containing off-budget capital expenditure, are needed to reduce inflation and maintain debt stability (IMF, 2024)
4. Reforms to unleash private sector activity should include efforts to create more flexible labor markets by reducing rigid employment protection and lowering labor taxation to encourage more and better-quality job creation (OECD, 2024).
5. High social security contribution rates should be reduced as they are a major driver of informality, leaving workers without social protection. Female employment is very low at 12.7% as women often leave the labor market due to household responsibilities. Better reconciling work and family lives by expanding childcare facilities would help raise women's labor force participation (OECD, 2024).
6. Enhance political and economic stability, promote energy sustainability, water and food security, bolster SMEs and support youth/vulnerable groups. (European Bank for Reconstruction and Development, 2022)

7. Expanding trade relationships, strengthen supply chain durability, encourage non-dollar trade transactions, and draw in foreign direct investment from a variety of sources.
8. Improving banks' capital by Implementing robust risk management practices to minimize losses and optimize capital allocation (risk management), adopting capital conservation strategies, such as reducing dividend payouts or issuing debt, to preserve capital (capital conservation), exploring opportunities to raise capital through equity or debt issuance, or consider mergers and acquisitions (capital raising), and ensuring compliance with regulatory capital requirements, such as Basel III, to avoid penalties and maintain a strong capital position (regulatory compliance).
9. Improving banks' profitability by diversify revenue streams through non-interest income sources, such as fees, commissions, and investment income (revenue diversification), implementing cost-saving initiatives, such as process automation, outsourcing, and branch rationalization (cost optimization), focusing on lending to high-quality borrowers and implementing effective credit risk management practices to reduce provisioning (asset quality improvement), and leveraging digital channels to improve customer experience, reduce costs, and increase revenue (digital transformation)
10. Improving banks' liquidity by maintaining a diversified funding mix, including stable deposits, wholesale funding, and securitization also, implementing robust liquidity risk management frameworks, including stress testing and contingency planning, optimizing the maturity structure of assets and liabilities to manage liquidity gaps, holding an appropriate level of high-quality liquid assets to meet regulatory liquidity requirements, and developing liquidity forecasting and monitoring capabilities to anticipate and respond to liquidity needs.

### **Limitations and future research:**

The limitation of this study is the data availability of some individual indicators which led to excluding them from analysis, such as Herfindahl–Hirschman Index (HHI) in assets.

For future research, there is a need to develop more advanced quantitative or qualitative methods to help central banks and other financial regulatory authorities in maintaining financial stability.

## References

- 1- Ahir, H., Dell’Ariccia, G., Furceri, D., Papageorgiou, C., & Qi, H. (2023). Financial Stress and Economic Activity Evidence from a New Worldwide Index. IMF Working Papers. International Monetary Fund (IMF). Retrieved from: <https://www.imf.org/en/Publications/WP/Issues/2023/10/18/Financial-Stress-and-Economic-Activity-Evidence-from-a-New-Worldwide-Index-540713>
- 2- Akosah, N., Lolohb, K., Lawsonb, N & Kumahb, C. (2018). Measuring Financial Stability in Ghana: A New Index-Based Approach. Munich Personal RePEc Archive (MPRA). 86634, 1-19.
- 3- AL-Rjoub. S. (2021). A financial Stability Index for Jordan. *Journal of Central Banking Theory and Practice*, 2, 157-178. DOI: 10.2478/jcbtp-2021-0018
- 4- Arrigoni, S., Bobasu, A & Venditti, F. (2022). Measuring Financial Conditions using Equal Weights Combination. International Monetary Fund (IMF). 669- 697. Retrieved from: <https://link.springer.com/article/10.1057/s41308-022-00170-y>
- 5- Abdelaziz, S and Francis, M. (2022). Financial stability and supervisory cooperation (SSM in Eurozone – Banking supervisory cooperation in Egypt. *Review of Economics and Political Science*. 7(1), 22-33.
- 6- Albulescu, C.T. (2010). Forecasting the Romanian Financial System Stability Using a Stochastic Simulation Model. *Romanian Journal of Economic Forecasting*, (1), 81-98.
- 7- Babar, S., Latief, R., Ashraf, S., & Nawaz, S. (2019). Financial Stability Index for the Financial Sector of Pakistan. *Economies*. 7(81), 1-24. doi:10.3390/economies7030081. Retrieved from: [www.mdpi.com/journal/economies](http://www.mdpi.com/journal/economies)
- 8- Central Bank of Egypt. Financial Stability Report (2014). 6. The Arabic version.
- 9- Central Bank of Egypt. Financial Stability Report (2018). 19. The Arabic version.
- 10- Central Bank of Egypt. Financial Stability Report (2019). 22-24. The Arabic version.
- 11- Central Bank of Egypt. Financial Stability Report (2020). 20-70.
- 12- Central Bank of Egypt. Financial Stability Report (2022). 5-11.
- 13- Central Bank of Egypt. Financial Stability Report, First Half. (2023). The Arabic Version. P: 25-54.
- 14- Creel, J., Hubert, P., & Labondance, F. (2015). Financial stability and economic performance. *Economic Modelling*, 48, 25-40. Retrieved from: <https://doi.org/10.1016/j.econmod.2014.10.025>
- 15- Elsherif, N. (2019). Financial Inclusion, SE and Financial Stability: Evidence from Emerging Economies. Master of Science Thesis, School of Business, The American University. Cairo. 2-64
- 16- European Bank for Reconstruction and Development. (2022). Egypt Country Strategy 2022-2027. Retrieved from: <https://www.ebrd.com/what-we-do/strategies-and-policies/egypt-strategy.pdf>
- 17- Freedman, C & Goodlet, C. (2007). Financial Stability: *What It Is and Why It Matters*. C.D. Howe Institute. Commentary. No. 265. 1- 28. Retrieved from: [https://www.researchgate.net/publication/23799588\\_Financial\\_Stability\\_What\\_It\\_Is\\_and\\_Why\\_It\\_Matters](https://www.researchgate.net/publication/23799588_Financial_Stability_What_It_Is_and_Why_It_Matters)
- 18- Gadanez, B & Jayaram, K. (2009). Measures of financial stability: a review. IFC Bulletins chapters, Bank for International Settlements, Proceedings of the IFC

- Conference on measuring financial innovation and its impact". Basel, 26-27 August 2008, 31, 365-380.
- 19-Hafez, H. (2022). Does the Efficiency of Banks Adversely Affect Financial Stability? A comparative Study between Traditional and Islamic Banks; Evidence from Egypt. *Banks and Bank Systems*. 17(2), P: 13-26. doi:10.21511/bbs.17(2).2022.02
- 20-International Monetary Fund (IMF). (2024) Frequently Asked Questions on Egypt and the IMF. Retrieved from: <https://www.imf.org/en/Countries/EGY/Egypt-qandas>.
- 21- International Monetary Fund (IMF). (2023). Global Financial Stability Report: Financial and Climate Policies for a High-Interest-Rate Era. Washington, DC, October. 1-122.
- 22-Javis, C. (2015). How Can Egypt Achieve Economic Stability and Better Living Standards Together? IMF BLOG: Insights and Analysis on Economics and Finance. Retrieved from: <https://www.imf.org/en/Blogs/Articles/2015/02/11/how-can-egypt-achieve-economic-stability-and-better-living-standards-together>
- 23-Karanovic A, G & Karanovic, b. (2015). Developing an aggregate Index for Measuring Financial Stability in The Balkans. 7<sup>th</sup> International Conference: The Economies of Balkan and Eastern Europe Countries in the Changed World, EBEEC, 2015. *Procedia Economics and Finance*, 33, 3-17.
- 24-Mansour, A. (2021). The Egyptian economy since the early 1990s until after 2021. FEB (in Arabic). Retrieved from: <https://febanks.com/36683/>
- 25-Morris, V.C. (2011). Measuring and Forecasting Financial Stability: The Composition of an Aggregate Financial Stability Index for Jamaica. *Journal of Business, Finance and Economics in Emerging Economies*, 6(2), 34-51.
- 26-Nasreen, S., Anwar, S & Shahzadi, H. (2015). Financial Stability and Macroeconomic Environment: Evidence from Panel Data Analysis of South Asian Countries. *Pakistan Journal of Social Sciences (PJSS)*. 35 (1), 145-160.
- 27-OECD. (2024). Reforms to boost productivity and private investment would help secure stronger growth, more high-quality jobs and increased living standards in Egypt. Retrieved from: <https://www.oecd.org/en/about/news/press-releases/2024/02/reforms-to-boost-productivity-and-private-investment-to-secure-stronger-growth-high-quality-jobs-and-increased-living-standards-egypt.html>
- 28-Prasad, A., Abdel Monem, H., & Martinez, P. (IMF). Macroprudential Policy and Financial Stability in the Arab Region. *IMF Working Paper*, 16/98, 2-56.
- 29-El-Shal. A. (2012). The Spillover Effects of the Global Financial Crises on Economic Activity in Emerging Economies – Investigating the Egyptian Case Using the Financial Stability Index. *Economic Research Forum. Egypt*. (373), 1-17.
- 30- World Bank. (2016). *Financial stability*. World Bank, Washington, DC. Retrieved from: <https://www.worldbank.org/en/publication/gfdr/gfdr-2016/background/financial-stability>
- 31- World Bank. (2020). Bank Regulation and Supervision a Decade after the Global Financial Crisis. International Bank for Reconstruction and Development, *The World Bank*, 1-155. DOI: 10.1596/978-1-4648-1447-1
- 32-Yusifzadeh, R., Aliyeva, H. & Gorkhmaz, E. (2017). Financial stability in Azerbaijan: The application of Fuzzy approach. *Bulletin of Monetary Economics and Banking*, 19(3), 319-333. DOI:10.21098/bemp. v19i3.668