

Early warning systems: an effective tool for predicting and preventing banking crises

KERFIS Fatima Zahra ^{*1},BAHIRI Kada ²

¹ Enterprise Management Laboratory,Djillali Liabes University ,kerfisfatimazouhra297@gmail.com,

² Enterprise Management Laboratory, Djillali Liabes University, k.bahiri@yahoo.fr,

Received: 16/08/2024

Accepted: 31/10/2024

Abstract:

The banking sector is a crucial component of any economy, and its stability is paramount for overall financial health. Early Warning Systems (EWS) play a pivotal role in predicting and preventing crises within the banking sector. This paper explores the significance of EWS as an effective tool for forecasting and mitigating banking crises. It delves into the key components and methodologies employed in these systems, emphasizing their role in risk management and financial stability. The study also assesses the practical implementation of EWS in various banking institutions and its impact on averting potential crises

Key Words : Early warning systems, banking crises.

JEL Classification: E37 , E44

*-Corresponding author: KERFIS Fatima Zahra, e-mail: kerfisfatimazouhra297@mail.com.

1. Introduction

The banking industry, as a critical component of any economy, requires mechanisms that can predict and prevent potential crises for overall financial stability. The pivotal role of the early warning system is to provide advance notice of potential threats, allowing timely intervention to mitigate risks and prevent crises from escalating.

The effectiveness of early warning systems lies in their ability to analyze key indicators and risk factors that may indicate the beginning of a banking sector crisis. By using cutting-edge methodologies and taking advantage of technological advances, these systems contribute significantly to risk management practices. It provides financial institutions with the insights needed to proactively address vulnerabilities and implement preventative measures.

The proactive nature of early warning systems is crucial in identifying emerging challenges and implementing corrective actions in a timely manner. This not only ensures the stability of individual financial institutions, but also contributes to enhancing the overall resilience of the entire banking sector. Through continuous monitoring and analysis, early warning services enable regulators, policy makers and financial institutions to make informed decisions that mitigate potential crises and maintain a healthy Financial environment.

Main Question:

How do Early Warning Systems serve as an effective tool for predicting and preventing crises within the banking sector?

Subsidiary Questions:

- What key indicators and risk factors do Early Warning Systems analyze to signal potential crises in the banking sector?
- What proactive measures can be taken based on the insights provided by Early Warning Systems to address vulnerabilities and prevent crises?
- What is the significance of constant monitoring and analysis by Early Warning Systems in the evolving global financial landscape?

Hypotheses :

- Early warning systems enhance the accuracy of forecasting banking crises through continuous analysis of economic and financial indicators.
- Early warning systems analyze economic factors factors and Monitoring loan performance , Market behavior analysis .
- Strategic Portfolio Diversification: An assumption may be that financial institutions, guided by Early Warning System insights, strategically diversify their portfolios to minimize concentration risk and enhance overall resilience.
- Timely Identification of Emerging Risks: An assumption may be that the continuous monitoring and analysis conducted by Early Warning Systems allow for the timely identification of emerging risks, enabling proactive measures to be taken before they escalate.

Study Objective :

The primary aim of this study is to assess the Algerian experience related to Early Warning Systems for banking crises and shed light on key indicators and risk factors analyzed by these systems. The study seeks to achieve the following objectives:

- understand the measures that can be taken based on the insights provided by Early Warning Systems.
- emphasize the importance of continuous monitoring and analysis in preventing crises., and highlight the significance of evaluating the Algerian experience in the context of Early Warning Systems.

Study Objectives:

The significance of our study lies in understanding the role of Early Warning Systems in predicting and preventing banking crises. Additionally, we aim to explore the methodologies employed by Algerian banks in implementing these systems.

2. Definition of EWS for Banking Crises:

Early Warning Systems can be defined as tools capable of anticipating crises through the assessment of the economic, political, and social risk ... landscape of a specific country. These systems encompass theoretical foundations and a set of coherent and sequenced scientific procedures. Through these procedures, the overall risks for a particular domain within a country are identified. The aim is to provide pertinent information for decision-makers and policymakers, aiding in the anticipation of potential crises in the concerned country. This process involves the systematic evaluation of economic, political, social, and other relevant factors to generate insights that can inform preemptive decision-making and policies . (Ghareeb, p. 68)

As indicated by the central bank, Early Warning Systems (EWS) are increasingly recognized as pivotal models in applied economics, utilizing banking data patterns for anticipating workplace crises, including financial emergencies. These models excel in capturing external fluctuations, leveraging regular analysis from historical data to detect deviations that could potentially lead to crises. The framework of the experimental scientific approach relies on a combination of leading indicators, prominently the rate of change, while the accuracy of results hinges on data quality, emphasizing the frequency of information updates for risk assessment. This approach aligns with the systematic and empirical scientific framework, incorporating a range of variables as leading indicators, with a particular emphasis on data frequency to enhance precision in identifying potential risks. (Barr R.S, 1994, p. 129)

Based on the above definitions, EWS for predicting banking crises can be defined as a set of integrated economic and financial variables to be applied within a unified econometric model.

The system can interpret four possibilities from the analysis of information and signals, which are:

- **Confirmation:** This means the establishment and truthfulness of the information and signals in recognizing the signs of an imminent crisis.
- **Failure:** This indicates the failure of the leaders or managers of this institution to correctly analyze the information and data, which may lead to a real crisis and disaster.

- **False Alarm:** This refers to an attempt to mislead the decision-maker or manager about the occurrence of an imminent crisis, where the information ultimately turns out to be erroneous or false, either intentionally or unintentionally.

- **Explicit Rejection:** In this situation, the leader or manager is determined about the inaccuracy of the information regarding the occurrence of a crisis or at least its signs, which later confirms the manager's sagacity and experience in such situations and the good choice of correct decisions at the appropriate time and place. (Abdelaziz Boukhers, p. 04)

3. The importance of early warning systems :

- Early warning systems generally assist in the following:
- Continuous assessment of banking institutions' systems in the form of a formal framework or structure for evaluation, whether during inspection or between inspection periods.
- Identifying institutions or locations within institutions where problems exist or are likely to occur.
- Assisting in determining inspection priorities and the optimal allocation of supervisory resources, and advance planning for inspections.
- Directing proper attention and timing by bank supervisors.
- There are numerous risks in banking activities, and the task of early warning systems and leading financial indicators is to direct attention to these risks, which include credit, liquidity, and market risks, operational or business risks. Early detection of these risks will help policymakers take preventive measures to prevent their occurrence or mitigate the effects by minimizing losses to the lowest possible extent if it is not possible to avoid these risks, and besides that, to avoid the recurrence of these risks. (Dr. Belkacem Ibrahim, pp. 34-35)
- Assisting in determining the priorities for inspection, and the optimal allocation of supervisory resources and advance planning for control operations, along with directing attention at the appropriate time to the weak points in the financial centers by the supervisors of the financial system. (D. Latrash Zahabiya, 2018, p. 07)

The importance of the early warning system is highlighted in knowing the timing of a crisis occurrence; however, the exact time when the crisis will occur often remains unknown. It provides us with complete details on the data periodically, which aids in full supervision. It also serves as a concise system for decision-makers. The early warning system's connection to the phenomenon of crisis contagion and the mechanisms of crisis transmission is through understanding the economic characteristics of the countries that have been affected by the contagion. The importance of continually updating the list of indicators for the early warning system is due to the flexibility that characterizes the economic system as a result of the interconnection of economic variables. For example, capital flows affect the currency exchange rate . (Guasmiya, 2012, p. 22)

4. The importance of EWS for banking crises :

Early Warning Systems play a crucial role in predicting banking crises. They offer the following benefits:

- Their existence allows policymakers to immediately monitor economic vulnerabilities at specific locations.

- They provide hints to supervisors about both negative and positive events related to the financial system at an early stage, significantly contributing to continuous supervision of financial institutions.
- Supervisors need these systems to understand the banking environment thoroughly, enabling a comprehensive assessment of banking risks.
- The presence of significant financial stress can hinder the effectiveness of standard macroeconomic tools, making these systems essential.
- Enhancing safeguards against financial crises helps strengthen current vigilance.
- These systems aim to predict the likelihood of crises occurring within a specific time frame (three to six months or a year).
- They complement on-site monitoring and supervision rather than serving as alternatives.

5. Methodology of EWS:

Designing an early warning system requires identifying the areas it will cover, which take priority in the composition of the risk profile and may potentially be a source of crises. There are three main steps: (Oronia, 2023, pp. 26-27)

- **First Step:** Determine which events should trigger an alert, such as economic or financial events, etc. The system design needs to define the areas it will cover, i.e., selecting indicators that reflect and appropriately represent the situation, based on economic theory. Economic theory determines whether the areas will be a direct economic crisis or an indirect economic crisis; a direct economic crisis means the monetary value of the total or partial destruction of physical properties in the affected area, almost equivalent to the material damages.

An indirect economic crisis means a decrease in added value as a result of the direct economic crisis.

- **Second Step:** Develop a set of appropriate analytical tools that combine quantitative and qualitative analysis.
- **Third Step:** Involves the evaluation and forecasting process to come up with numerical estimates that are discussed by experts to determine the realism and interrelation of those results.

6. The financial indicators used in EWS to predict banking financial crises :

The importance of indicators has increased with the development of quantitative techniques for estimating stability, as they are used in early warning systems. These individual indicators may provide sufficient information about the financial health of the system but do not offer adequate information about its ability to withstand shocks.

Typically, the following indicators are used in early warning systems:

the rate of real credit growth.

GDP development

the relationship between private lending and GDP

liquidity and banking reserves / total bank assets

the relationship between M2 / foreign currency reserves

real interest rates

currency devaluation,.... etc. (Qaladi, 2017, p. 325)

The economists "Davis and Karim" divided the indicators used in early warning models into three groups:

Table 01: the indicators used in early warning models

Macroeconomic variables	1.Real GDP growth (%) 2. Change in terms of trade (%) 3.N ominal depreciation (%) 4. Real interest rate (%) 5. Inflation (%) 6. Fiscal surplus / GDP (%)
Financial variables	7. M2/foreign exchange reserves (%) 8. Credit to private sector/GDP (%) 9. Bank liquid reserves/total bank assets (%) 10. Real domestic credit growth (%)
Institutional variables	11. Real GDP per capita 12. Deposit insurance (binary dummy)

Source : (Karim, 2008, p. 98)

While Sabreen's study summarized the most important financial indicators used for early warning of banking crises in Mali: (Sabreen, 2017)

6.1 . Financial indicators related to capital adequacy (financial solvency):

- Regulatory capital* (100) / Risk-weighted assets and off-balance sheet liabilities > minimum requirement of 8%.
- Core capital*(100) / Risk-weighted assets and off-balance sheet liabilities > minimum requirement of 4%.

When these ratios increase, the bank's ability to meet risks also increases and vice versa. However, a larger increase in these ratios comes at the expense of the bank's profitability."

6.2. Financial Indicators Related to Liquidity:

6.2.1. Short-Term Assets to Liquid Liabilities Ratio (Term Short to Assets Liquid Liabilities):

This ratio indicates the proportion of liquid assets to short-term liabilities. An increase in this ratio suggests a decrease in liquidity risks. It serves as a measure of liquid assets, aiming to monitor the variation in asset and liability liquidity, providing evidence of banks' ability to meet short-term withdrawal demands without encountering liquidity issues.

6.2.2. Total Assets to Liquid Assets Ratio (Assets Total to Assets Liquid):

This ratio represents the liquid assets that serve as evidence of the available liquidity to meet both expected and unexpected cash demands. The liquidity level reflects a bank's capacity to withstand shocks that may occur. Based on the above, the researchers contend that there are several regulatory indicators used to predict financial, monetary, and banking crises. Assessing performance can contribute to early warnings of potential crises. These indicators can be reflective of the bank's position individually, at the sector level, within the national financial system, or globally. Examples include economic growth rates, inflation rates, balance of payments, among other indicators. (Dr. & Dr. Salah, 2020)

7. Building an Early Warning System:

The early warning system relies on two methodologies:

7.1.The Signal Approach: The signal model is one of the most important indicators used to predict banking crises. This methodology involves monitoring a set of leading indicators, which fluctuate significantly before the occurrence of a banking crisis. It examines whether these indicators, individually or collectively, have reached a threshold value historically associated with the onset of a banking financial crisis. Therefore, exposure to the crisis occurs when the value of the variable exceeds its normal average level by a value that surpasses a certain threshold, which signals the risk of a banking crisis occurring within the next 24 months, referred to as the signal horizon. The following table illustrates the matrix of leading indicators for crises." (Al-Hamwi, 2016, p. 66)

8. Early Warning Indicators of Financial Crisis in Indonesia and Thailand :

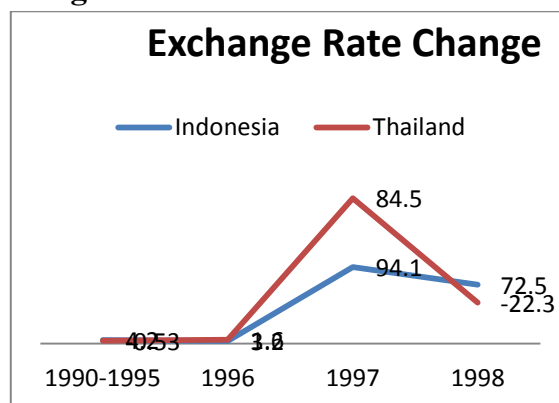
- Both countries experienced significant depreciation of their national currencies. The exchange rate fell by 95% in Indonesia and 74.5% in Thailand. However, the real exchange rates remained overvalued before the crisis, negatively impacting the competitiveness of their national exports, trade balances, and foreign reserves.
- Inflation rates were moderate prior to the crisis and did not show a noticeable impact as an early warning sign.
- A massive influx of short-term capital occurred in both countries through investment funds aiming for quick profits and rapid exit strategies. The currency crisis coincided with this rapid outflow of short-term capital.
- Economic growth rates began declining in both countries about a year before the crisis, intensifying further during the crisis. Additionally, there was a pre-crisis decline in domestic demand growth, which served as an indicator of the impending crisis.
- Current account deficits relative to GDP were warning signs of the financial crisis. Both countries experienced deficits in their current account balances during the period from 1990 to 1996, and these deficits increased significantly before the crisis.
- Prior to the banking crisis, there was rapid credit growth in both countries from 1990 to 1996. Key indicators included credit to the private sector as a percentage of GDP, the debt-to-equity ratio, and the vulnerability of debt repayment due to the short-term nature of the loans.

Table 01 : Early Warning Indicators of Financial Crisis in Indonesia and Thailand

Indicator	Country	1990-1995	1996	1997	1998
Exchange Rate Change	Indonesia	4.2	3.2	95.1	72.5
	Thailand	-0.53	1.6	84.5	-22.3
Current Account Deficit /Gross Domestic Product	Indonesia	-2.5	-4.3	-3.6	3.2
	Thailand	-6.7	-8.7	-3	11.3
Foreign Debt / Gross Domestic Product	Indonesia	53.3	48.5	64.5	162.7
	Thailand	49.1	49.9	59.6	72.5
Real National Demand Growth Rate	Indonesia	9.3	8.6	6.8	-20.4
	Thailand	10.1	6.2	-7.6	-21.9
Short-Term Debt- to-total debt Ratio	Indonesia	18.9	25	26.6	-
	Thailand	39.1	41.5	37	-
Interest Rates	Indonesia	12.06	13.96	27.82	62.79
	Thailand	13.75	12.4	13.2	15

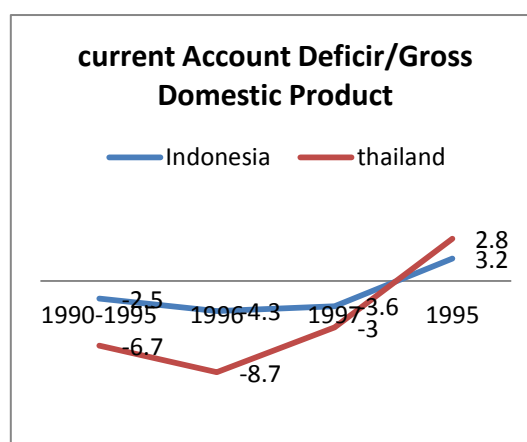
Source : (Hill, 2003, pp. 291-292)

Fig.1. Exchange Rate Change



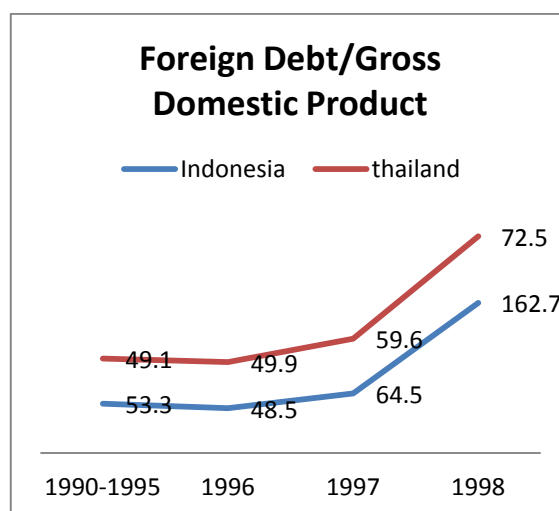
Source: prepared by researchers based on Excel outputs

Fig.2. current Account Deficir / Gross Domestic product



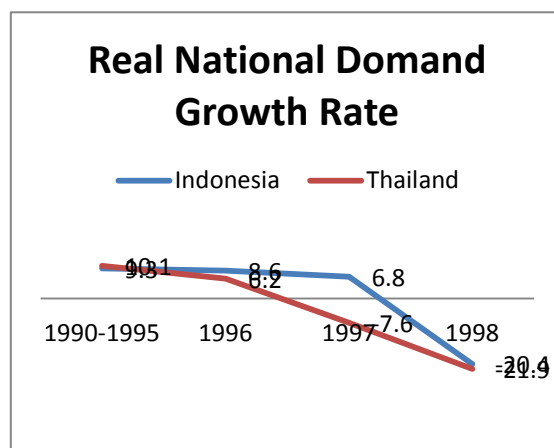
Source: prepared by researchers based on Excel outputs

Fig.3. Foreing Debt / Gross Domestic product



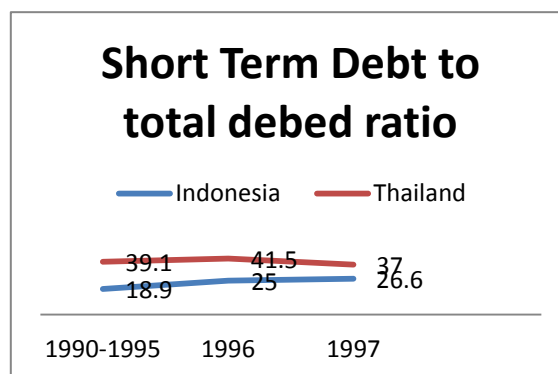
Source: prepared by researchers based on Excel outputs

Fig.4. Real National Demand Growth Rate



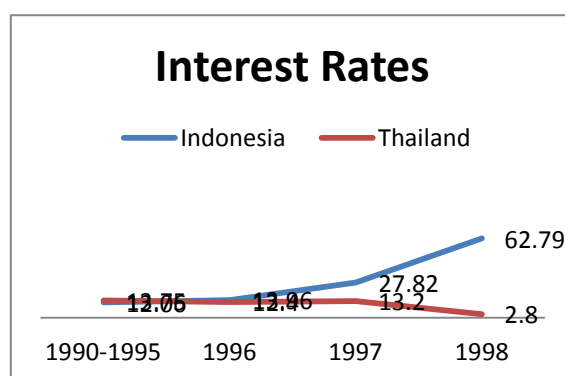
Source: prepared by researchers based on Excel outputs

Fig.5. Short Term Debt to total debted ratio



Source: prepared by researchers based on Excel outputs

Fig.6. Interest Rates



Source: prepared by researchers based on Excel outputs

Despite the difficulty in predicting the timing of crises, some models have been more successful than others in predicting the relative severity of crises in different countries. This has led to the consideration that models may be more useful in identifying countries most susceptible to crises during periods of international financial disturbances, rather than predicting the timing of monetary crises. Such models contribute significantly to early warning systems, as they can draw attention to countries that need policy adjustments before a crisis erupts and evolves. They also highlight the variables that are most crucial in crisis determination.

Researchers, including Pikeman and others, have found that early warning systems have strong predictive power, and changes in fundamentals signal future problems. These systems assist policymakers in preventing crises. For example, when Standard & Poor's downgraded the credit rating of the United States on August 5, 2011, it effectively signaled that the U.S. was no longer the safest place for investment globally. The mounting debt in the U.S., exceeding \$4 trillion, shifted its economy's reliance more toward services than production, making it less productive. This downgrade was a clear indication of the declining strength of the U.S. economy and its trajectory toward recession. The repercussions were severe, affecting the credit ratings of several European countries within 23 weeks, as well as global and Asian stock markets. Arab securities markets also experienced significant turmoil. Egypt's main index, EGX30, lost approximately 7.86% of its value, eventually reaching a decline of 35.04% by the end of August 2011. Similarly, the Saudi stock market index dropped by 6.46%, Dubai's market by 1.66%, and Jordan's decline reached 3.23%." (Mudni, 2013-2014, p. 149)

"In contrast, many academics acknowledge that a significant number of financial crises were unexpected. Despite developing numerous models for various variables associated with these crises, credit rating agencies, for instance, faced criticism for their failure to predict the Asian crisis. They were also held accountable for the 2008 mortgage crisis. Eugene Fama pointed out that credit rating agencies failed to differentiate between different securities risks. Additionally, they struggled to classify the creditworthiness of mortgage-backed securities, along with their inability to forecast crises in several companies such as Enron, WorldCom, and Parmalat. 18 (Djebbara, 2009, p. 12)

Moreover, it is evident that most crises are interpreted after they occur. However, waiting for a crisis to happen in order to interpret it is not a good strategy. Researchers have found that the early warning models are incomplete tools. They often produce false signals, predicting crises that do not happen while missing actual crises. Nevertheless, these models provide useful information and their advantage lies in systematically and objectively describing the historical relationship between variables related to the conditions leading to crises and the crises themselves. On the downside, they attempt to lump all countries and crises into a single basket, overlooking vast amounts of information that cannot be easily quantified. Therefore, modern literature focuses on the detailed financial situation of various sectors rather than the overall financial situation of the entire country, which may conceal some imbalances at the sectoral level. 19 (nasima, 2007-2008, p. 350)

9. CONCLUSION

The significance of early warning indicators lies in their ability to signal the safety and stability of the financial system. They assist in assessing the financial sector's susceptibility to financial and economic crises and serve as an early warning tool when the financial system is at risk. The process of early warning involves various analytical tools and indicators, along with qualitative analysis to identify risks and systemic vulnerabilities affecting sectors and financial institutions. It aims to uncover trends that make countries and markets vulnerable to shocks. Early warning analysis also examines channels of contagion transmission and the impact of infection, recommending necessary policies to address different risks.

Predicting financial crises is inherently challenging. While crises resulting from declines and weaknesses in fundamental economic indicators may be somewhat predictable, the likelihood of early warning models anticipating crises caused by inadequate supervision, lack of transparency in banks and financial markets, or those arising from hard-to-quantify factors, moral hazard, or investor behavior is lower. Most studies have shown that financial crises occur suddenly, making accurate prediction difficult. Even specialized institutions like credit rating agencies have struggled to forecast previous crises, whether in terms of timing or severity. Additionally, the nature of future crises differs from past ones, involving complex interactions among economic, political, and psychological factors. Therefore, successful prevention requires a deeper understanding of their causes.

10. Bibliography List :

Thèses:

1. Al-Hamwi, N. M. (2016). "A Proposed Model for Predicting Financial Failure in Private Syrian Banks," . *master's thesis submitted to fulfill the requirements for a degree in Financial Markets, University of Damascus, Syria* .
2. Djebbara, M. (2009). , "Predicting Financial Crises: Myth and Reality", . *Recueil de Communications du Colloque International sur: " la crise Financière et Economique et Gouvernance Mondiale", Algérie, Sétif, Université Farhat Abbas),* .
3. Dr. Belkacem Ibrahim, D. H. (s.d.). r"Effectiveness of Early Warning Systems in Financial Crisis Prevention,,. *University of Hassiba Ben Bouali, Chlef*
4. Mudni, A. (2013-2014). "Methods of Protecting Arab Stock Markets from Financial Crises." . *Doctoral thesis in Economics, specializing in Money and Finance, University of Chlef.*
5. nasima, o. (2007-2008). financial crises and the possibility of preventing them and mitigating their effects (with a case study in southeast asia . *doctoral thesis , faculty of economics and management sciences , university of algiers.*

Journal article

1. Abdelaziz Boukhers, L. A. (s.d.). "Developing an Early Crisis System Using Dashboard Metrics and Indicators: An Analytical Study. *the Journal of North African Economics, Issue 14 (02)* .
2. Barr R.S, e. s. (1994). predicting bank failure using D.E.A to Quantily Management Quality . *financial industry studies Working paper , fedarel reservebank of dallas.*
3. D. Latrash Zahabiya, D. K. (2018). The Role of Early Warning Programs and Stress Tests in Predicting Financial Crises,, *in the Algerian Journal of Economic and Financial Research, Issue 01.*
4. D. M.-M.-A., & Dr. Salah, M. A. (2020). "The Role of Hedge Accounting in Enhancing the Effectiveness of Early Warning Systems for Predicting Banking Financial Crises: A Case Study of the Islamic Solidarity Bank in Sudan,". *the journal "Business Research and Studies," Issue 01, Volume 04.*
5. Ghareeb, D. A. (s.d.). Indicators of the Early Warning System for Banking Crises,. *"Management and Development for Research and Studies," Issue 10.*
6. Guasmiya, S. (2012). "The Role of Early Warning Systems in Crisis Prediction,". *the Journal of Economic and Financial Investigation Strategies, Issue 02, Volume 03.*
7. Hill, A. J. (2003). "Financial Crises: Concept, Indicators, and Predictability in Selected Countries. *Journal of Damascus University, Volume 19, Issue 1.*
8. Karim, E. P. (2008, march 2). Comparing early warning systems for banking crises. *Journal of Financial Stability 4.*

9. Oronia, H. M. (2023). "Effectiveness of Early Warning for Economic Crises: Analysis of Early Warning Indicators in the Real Sector in Libya (2010-2020)," *the Journal "Al-Hadath" for Financial and Economic Studies, Issue 10* .
10. Qaladi, N. (2017). "The Effectiveness of Early Warning Systems (EWS) in Measuring Financial Stability,," *the Journal of Humanities, Issue 08, Part 02*.
11. Sabreen, M. (2017). "Early Warning Indicators for Predicting Banking Risks," *the Journal of Research University, Volume 39, Issue 23*, .