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Effectiveness of banking financial stability in light of the indicators of Central Bank of Iraq (MACHINE LEARNING) - an analytical study of a sample of banks listed on the Iraq Stock Exchange

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Abstract

Financial stability is the basic foundation upon which all sectors operating in a country are based. Without it, it is not possible to work according to fixed future visions that help decision makers to develop plans and determine financing in a better way that enables the individuals of the state of financial stability and the resulting stability of all sectors. Many of the world's economies in particular and the world in general witnessed a number of crises that caused real disasters that affected all workers in various sectors, not just the financial sector, and since the banking sector constitutes the mainstay of work and the main axis of all economic sectors, whether at the local or global level, it occupies The topic of financial stability is the interest of concerned parties in the banking sectors, whether by central bank locally or in international agreements known as the Basel Accords. With this current research, we attempt to re-test the financial stability indicators used by Central Bank of Iraq and published in the financial stability report and verify the effectiveness of these indicators in ensuring the financial stability of the Iraqi banking sector using hierarchical clustering (machine learning), A group of banks listed on the Iraq Stock Exchange was chosen as a sample for the research for the period from

2018 to 2023, namely Baghdad, Iraqi Middle East, National Bank Iraq International Development Bank, and Ashour International Bank. The research concluded that these indicators have the ability to guarantee financial stability. Provided that the relationship between these banks is re-examined using the hierarchical clustering tool, while ensuring the accuracy of the data emerging according to the indicators of the banking sector in question.

Keywords: banking financial stability, hierarchical clustering

Section one /research methodology

1. **Problem**: The issue of maintaining the stability of economic systems in general and banking systems in particular is a subject of research that was confirmed after the global financial crises, which prompted many of those interested in banking financial affairs to give the subject great attention after it was seen as a secondary issue, and thus research was sought to verify the effectiveness of the banking financial stability indicators applied by Central Bank of Iraq by employing the hierarchical clustering tool.

2. **Objectives**: In light of the problem, a set of objectives have been set that help frame scientific research in a systematic manner towards solving the problem. Accordingly, the objectives are:

A. Measuring the banking financial stability of the research sample described as banks in Baghdad, Iraqi Middle East, National Bank Iraq, International Development Bank, and Ashour International Bank.

B. Employing the hierarchical clustering tool for the purpose of indicating the extent of the research sample's commitment to financial stability indicators within the acceptable limits specified by Central Bank of Iraq.

3. **Importance**: It represents a scientific addition to the cognitive contributions of previous researchers within the topic of banking financial stability. It is unique in using the hierarchical clustering tool that helps analyze the nature of the relationship between banks within the financial stability indicators presented by Central Bank of Iraq. Through that tool, it is possible to detect the state of harmony within the banking sector within the two coordinate dimensions (X, Y) (profitability, liquidity) (solvency, asset quality) .

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4. **Hypothesis**: In order to achieve the research goal, a hypothesis was developed, which is (the research sample meets the basic requirements for financial stability and contributes to achieving it through its four indicators and knowledge of capital adequacy, profitability, liquidity, and asset quality).

5. **Procedural chart**: The procedural chart for the research presents the logical steps to complete the current research, as shown in Figure (1):
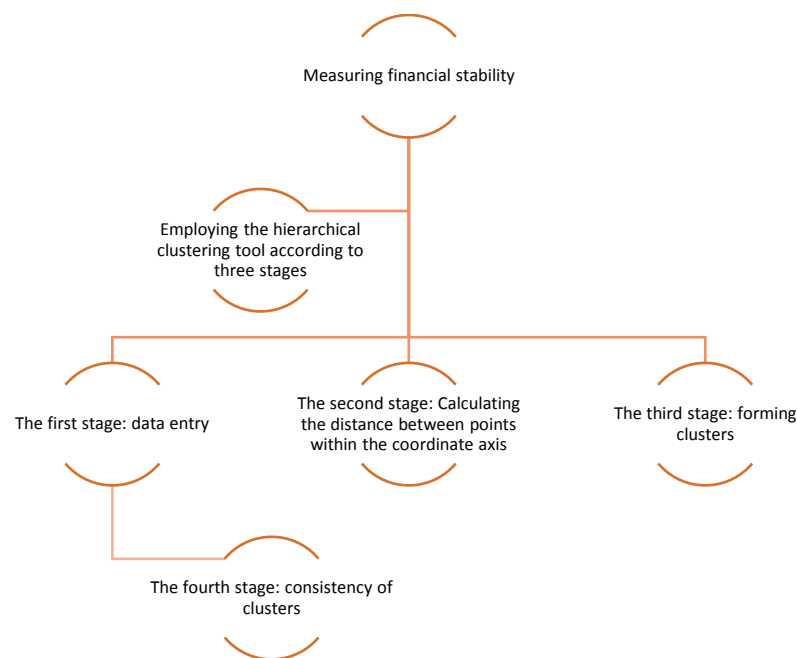
Figure (1) procedural diagram of the study

6. **Research population**, **sample, and sampling method**: The study population consisted of the Iraqi banking sector, while the sample consisted of the banks of Baghdad, Iraqi Middle East, National Bank of Iraq, International Development Bank, and Ashour International Bank, on the condition that they were listed in the Iraq Stock Exchange and that Its lists are certified by the Iraqi Securitas Commitment, while non-probability sampling has been adopted .

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7. Quantitative and statistical tools

A. Financial methods:

1) Capital adequacy: This requirement was measured according to the instructions of Central Bank of Iraq, which stipulates that it should be calculated in accordance with the requirements of the Basel III Committee.

2) Profitability = Return / Assets

3) Liquidity = current assets / total assets

4) Asset quality = non-performing loans / total debt

B. Hierarchical clustering: It is the process of tree representation of data according to the closeness between those pairs arranged within the coordinate axis and works according to the following steps (Patel et al., 2015:538):

1) Enter the data in the form of a group consisting of n ordered pairs, as shown in equation (1):

$$X = \{x_1, x_2, x_3, \ldots \ldots, x_n) \ldots \ldots \ldots (1)$$

2) Measure the distance between ordered pairs using equation (2):

$$d(p, q) = \sqrt{\sum_{i=1}^{n} (q_i - p_i)^2} \ldots \ldots \ldots (2)$$

3) Join the elements according to the minimum distance to represent the state of harmony between the ordered pairs (x, y).

8. MATLAB was used to formulate the program used to extract the results

Section tow /conceptual framework

1. Banking financial stability

Financial stability provides a cross-sectional view of the health of the financial and economic system in general, as the importance of financial stability is highlighted in cases of instability, Whenever the financial system is unable to confront economic crises and the risks resulting from them, then the financial system can be described as a state of instability, and this is reflected in particular on the banking sector, Who refrains from exercising its financing functions, which generally affects the overall lives of individuals (Fabris & Luburic, 2023:11), Despite all the knowledge contributions on the subject of financial stability, until now there is no single definition that can be relied upon to describe the dimensions of financial stability.

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This is due to, among other considerations, the novelty of the topic and the multiplicity of connections that indicate the state of stability or not (Schinasi, 2004: 3), The global financial crisis raised an alarm bell for all global financial systems and all international agreements that aspired to avoid situations of instability to the necessity of reviewing their principles, and that the world today is witnessing an unprecedented change that carries a set of characteristics that have changed the form of the financial system and new concepts synonymous with financial stability Financial inclusion (Morgan & Pontines, 2014:3), The state of financial instability extends to reasons other than economic, which are known as geopolitical. Many cases of inflation can occur through political unrest, which is reflected in the creation of a state of financial crises that indirectly causes financial instability. Any process of manipulation of interest rates is the result of pressure from organizations. International efforts to achieve political goals will indirectly lead to creating a state of insufficient repayment by individuals (ECB, 2024:5). As previously noted, the issue of defining clear, agreed-upon parameters for financial stability is a complex issue as a result of the multiple interconnections and interactions of the financial system and global systems that arise as a result of the widespread The concept of globalization, and accordingly, central banks continuously seek to provide periodic reports through which they indicate the state of financial stability, relying on a set of indicators. Through them, the state of financial stability of the system in general can be monitored and what are the factors that cause a state of stability or lack thereof (Gadanecz & Jayaram, 2009: 365). Central banks around the world work to publish reports on financial stability in general and banking in particular to assess the soundness of the financial and banking system through a set of quantitative and objective indicators that aim to determine the strength of the financial system and what risks that system may face, as the banking sector index consists of Of four basic variables represented by capital adequacy, asset quality, liquidity, and profitability, with a set of weights given to each variable commensurate with its degree of importance, with capital adequacy topping the largest weight leading to the profitability index or variable, and the total weight given to the banking sector index is 51% (FSR, 2022: 78-80), and one of the clear effects of the state of financial instability is the state of interaction between the shocks to which the financial system is exposed and that information that is not available to the decision maker, so that it is not possible to direct funds towards productive investment opportunities. Thus,

individuals and without the presence of any financing operations they will refrain from spending, which constitutes a state of contraction in economic activity. Therefore, it is necessary to understand the reasons that lead to the occurrence of a state of instability. In general, researchers divide the issue of financial stability into that it arises from four factors. The first is the rules of the increase in interest rates, the second is situations of uncertainty, and the third is the impact of the market. Assets on balance sheets and finally the disruptions in the banking sector (Mishkin, 1998:62-63).

2. Knowledge contributions

Keynes famously said, "The ideas of economists and political philosophers, both when they are right and when they are wrong, are stronger than is usually understood" (Stefaniak, 2018: 9-10), and so the review of epistemological contributions begins with the question: Is there a connection? Between the activities of central banks and the reports they publish according to which they monitor the form of economic stability in general and banking in particular, and between the mechanism for overcoming financial crises in all their forms? In this regard, Demekas (2012) presented a survey on the reality of eight countries that regularly publish financial stability reports, represented by Brazil, Korea, Spain, New Zealand, South Africa, Latvia, Iceland, and Canada. He found that these countries were more capable of predicting the short-term probability of... risk and that it is less affected than those countries that did not publish financial stability reports on a regular basis, and (Demekas, 2012) reinforced his study with the studies of (Nier, 2005; Born and others, 2011; Čihák, 2006) (Demekas, 2012:4). -25), during the periods of moderation from 1984 - 2007, the Federal Reserve did not pay much attention to the issue of financial stability, as Ben Bernanke acknowledged during the year 2013, during the centenary of the founding of the Federal Reserve, when he acknowledged that financial stability was given secondary attention, but during the year 2008 and As a result of the financial crisis, financial stability is considered to be of great importance to the relevant parties (Toniolo & White, 2015:3), and although the Federal Reserve Act does not significantly refer to financial stability, there is a significant trend towards financial stability as a result of two reasons: the first is recession. Economic stability was caused by financial instability, and the second is that financial stability will be adopted as a standard tool, which provides the link

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between monetary policy and financial stability (Kashyap & Siegert, 2020: 231), and accordingly, financial stability today has become described as a weasel (weasel), because it has With ambiguity, as it has become a term used to justify the failure of financial systems, as it is still shrouded in ambiguity to this day without a clear definition, as it has become part of the discourses that decision-makers boast about without delving deeply into the true meaning of this term (Stefaniak, 2018: 12-13), while he tried (Bordo (2017) linking financial stability and monetary policy through examining monetary systems starting from the year 1880 until the date of completion of his research. The confirmed fact from the research is that financial instability is due to reasons that are not as they appear to the eye, as simple as monetary policy may cause financial instability and But only for a part of it, and accordingly, financial stability is due to its occurrence for several reasons (Bordo, 2017:6), and from here the beginning of the current research will be by re-testing the indicators of the Central Bank of Iraq according to the established indicator by employing machine learning through its tool described as the hierarchical cluster.

3. Banking financial stability indicators

Within the topic of financial stability indicators, (Dyrberg, 2000) indicates that they are a measure of instability, as the researcher imposes a negative state, without which it is considered a positive state. Thus, the analysis of the indicators focused on quantitative measures centered on the balance sheet and income statement, in addition to capital adequacy, with the need to note Central banks can restrict capital adequacy beyond the Basel Accord (Dyrberg, 2000:61-62), and as a response to the financial crises of the eighties and nineties, many financial institutions began to monitor their systems by using a wide range of tools to ensure the stability of the financial system, which focused on: On financial safety as quantitative indicators, as these indicators deal with the phenomenon of financial stability as a systemic phenomenon, as they are not only related to financial institutions, but also to the real and governmental sectors because they are financed through the financial sector as debtors (Geršl & 2007:61), and among the cognitive contributions made (Imanov et al (2017) Four indicators of banking financial stability represented by (Imanov et al., 2017:324):

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A. Return on assets (the higher the value of this indicator indicates the effectiveness of the banking system).

B. Bank capital on assets (the positive value of the index determines the performance of the banking system).

C. Current assets over total assets (an increase in value indicates an increase in liquidity).

D. Capital on risk-weighted assets (an increase in the value of the index negatively affects the banking system).

In addition, Jakubík & Teplý (2014:77-78) presented four divisions of financial stability indicators, which are:

A. Liquidity indicators: determine the organization's ability to pay its short- and long-term obligations.

B. Solvency indicators: determine the organization's ability to fulfill its long-term obligations.

C. Profitability indicators: determine the way the organization works to create profits.

D. Activity indicators: determine the organization's ability to use inputs effectively to create outputs.

Section three/ the practical aspect

The current research presents the application of the described research idea by finding the common distances between the selected banks, which are Baghdad, Iraqi Middle East, National Bank, Iraq International Development Bank, and Ashour International Bank, using the Hierarchical Clustering tool, by dividing these banks into clusters according to the common characteristics between them. Relying on the Pythagorean distance equation to calculate the distance within the coordinate axis of the ordered pair (x, y), hierarchical clustering was performed in two stages. The first stage dealt with data clustering according to the variables of profitability and liquidity, and the second stage dealt with capital adequacy and asset quality. By moving away from these methods by analysing the relationship between the variables of the study, this aspect presented the distribution of banks according to indicators of banking financial stability within the x- and y-coordinate dimensions. Below, the mechanism of the practical aspect within the approved tool will be explained:

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The first stage: hierarchical clustering within the ordered pair of profitability and liquidity

Based on the (x,y), the banks will be distributed within the aforementioned axis as points drawn according to the profitability and liquidity coordinates, with the distance measured according to the Pythagorean theorem to find the distance between those points to form the basis for forming hierarchical clusters according to that distance. Below, the applied aspect will be explained according to the steps. The following:

1. Enter the ordered pair (x, y) for the profitability and liquidity variables: Table (1) presents the result of calculating the profitability and liquidity variables, thus forming the coordinates of the axis (x, y), as the sequence represents the bank's rank within the total data entered.

Table (1) pair for the coordinate axis

Liquidity	profitability	MANK	NO.	year	liquidity	profitability	BANK	NO.	year
0.8889	0.0143	National	16	2021	0.9355	0.0037	BAGHDADD	1	2018
0.9786	0.0114		17	2022	0.8112	0.0072		2	2019
0.9861	0.0477		18	2023	0.9472	0.0142		3	2020
0.9367	0.0101	Ashour	19	2018	0.9605	0.0195		4	2021
0.9987	0.0142		20	2019	0.9573	0.0308		5	2022
0.9459	0.0312		21	2020	0.9723	0.0567		6	2023

0.956	0.0124		22	2021	0.7151	-0.0029	Middle East	7	2018
0.9773	0.0098		23	2022	0.0645	0.0001		8	2019
0.9722	0.0181		24	2023	0.68	-0.0032		9	2020
0.8464	0.0116	Development	25	2018	0.7207	0.0005		10	2021
0.862	0.0067		26	2019	0.8699	0.00002		11	2022
0.8824	0.0127		27	2020	0.8474	-0.0161		12	2023
0.8866	0.0115		28	2021	0.8989	-0.0151	National	13	2018
0.9418	0.0075		29	2022	0.9312	0.0145		14	2019
0.9602	0.0207		30	2023	0.9426	0.0222		15	2020

The sequence of banks was adopted, starting from the number 1 to the number 30, to represent the years of obtaining the data because it is one of the necessities of using the hierarchical clustering tool, as the years of obtaining the data are ignored when representing the data on the coordinate axis.

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2. Calculate the distance between the pair

By determining the relationships between the pairs ranked from 1 to 30, which are shown in Table (1), 435 relationships will be generated linking the pairs ranked from 1 to 30. For example, a relationship was created between the pair ranked 1 with 2, then between 1 with 3, and so on. Up to ordered pair number 30, Table (2) presents the distance between the generated pairs across 30 ordered pairs. Each ordered pair represents the profitability and liquidity coordinates for each point represented.

Table (2): The distance between pairs ranked from 1 to 30

1,19	1,18	1,17	1,16	1,15	1,14	1,13	1,12	1,11	1,10	1,9	1,8	1,7	1,6	1,5	1,4	1,3
0.01	0.07	0.04	0.05	0.02	0.01	0.04	0.09	0.07	0.22	0.26	0.87	0.22	0.07	0.04	0.03	0.02
2,9	2,8	2,7	2,6	2,5	2,4	2,3	1,30	1,29	1,28	1,27	1,26	1,25	1,24	1,23	1,22	1,21
0.13	0.75	0.1	0.17	0.15	0.15	0.14	0.03	0.01	0.05	0.05	0.07	0.09	0.04	0.04	0.02	0.03
2,27	2,26	2,25	2,24	2,23	2,22	2,21	2,20	2,19	2,18	2,17	2,16	2,15	2,14	2,13	2,12	2,11
0.07	0.05	0.04	0.16	0.17	0.15	0.14	0.19	0.13	0.18	0.17	0.08	0.13	0.12	0.09	0.04	0.06
3,18	3,17	3,16	3,15	3,14	3,13	3,12	3,11	3,10	3,9	3,8	3,7	3,6	3,5	3,4	2,30	2,29
0.05	0.03	0.06	0.01	0.02	0.06	0.1	0.08	0.23	0.27	0.88	0.23	0.05	0.02	0.01	0.15	0.13
4,10	4,9	4,8	4,7	4,6	4,5	3,30	3,29	3,28	3,27	3,26	3,25	3,24	3,23	3,22	3,21	3,20
0.24	0.28	0.9	0.25	0.04	0.01	0.02	0.01	0.06	0.07	0.09	0.1	0.03	0.03	0.01	0.02	0.05
4,28	4,27	4,26	4,25	4,24	4,23	4,22	4,21	4,20	4,19	4,18	4,17	4,16	4,15	4,14	4,13	4,12
0.07	0.08	0.1	0.11	0.01	0.02	0.01	0.02	0.04	0.03	0.04	0.02	0.07	0.02	0.03	0.07	0.12

5,21	5,20	5,19	5,18	5,17	5,16	5,15	5,14	5,13	5,12	5,11	5,10	5,9	5,8	5,7	5,6	4,30
0.01	0.05	0.03	0.03	0.03	0.07	0.02	0.03	0.07	0.12	0.09	0.24	0.28	0.89	0.25	0.03	0
6,15	6,14	6,13	6,12	6,11	6,10	6,9	6,8	6,7	5,30	5,29	5,28	5,27	5,26	5,25	5,24	5,23
0.05	0.06	0.1	0.15	0.12	0.26	0.3	0.91	0.26	0.01	0.03	0.07	0.08	0.1	0.11	0.02	0.03
7,10	7,9	7,8	6,30	6,29	6,28	6,27	6,26	6,25	6,24	6,23	6,22	6,21	6,20	6,19	6,18	6,17
0.01	0.04	0.65	0.04	0.06	0.1	0.1	0.12	0.13	0.04	0.05	0.05	0.04	0.05	0.06	0.02	0.05
7,28	7,27	7,26	7,25	7,24	7,23	7,22	7,21	7,20	7,19	7,18	7,17	7,16	7,15	7,14	7,13	7,12
0.17	0.17	0.15	0.13	0.26	0.26	0.24	0.23	0.28	0.22	0.28	0.26	0.18	0.23	0.22	0.18	0.13
8,24	8,23	8,22	8,21	8,20	8,19	8,18	8,17	8,16	8,15	8,14	8,13	8,12	8,11	8,10	8,9	7,30
0.91	0.91	0.89	0.88	0.93	0.87	0.92	0.91	0.83	0.88	0.87	0.84	0.78	0.81	0.66	0.62	0.25
9,21	9,20	9,19	9,18	9,17	9,16	9,15	9,14	9,13	9,12	9,11	9,10	8,30	8,29	8,28	8,27	8,26
0.27	0.32	0.26	0.31	0.3	0.21	0.26	0.25	0.22	0.17	0.19	0.04	0.9	0.88	0.82	0.82	0.8
10,19	10,18	10,17	10,16	10,15	10,14	10,13	10,12	10,11	9,30	9,29	9,28	9,27	9,26	9,25	9,24	9,23
0.22	0.27	0.26	0.17	0.22	0.21	0.18	0.13	0.15	0.28	0.26	0.21	0.2	0.18	0.17	0.29	0.3
11,18	11,17	11,16	11,15	11,14	11,13	11,12	10,30	10,29	10,28	10,27	10,26	10,25	10,24	10,23	10,22	10,21
0.13	0.11	0.02	0.08	0.06	0.03	0.03	0.24	0.22	0.17	0.16	0.14	0.13	0.25	0.26	0.24	0.23
12,18	12,17	12,16	12,15	12,14	12,13	11,30	11,29	11,28	11,27	11,26	11,25	11,24	11,23	11,22	11,21	11,20
0.15	0.13	0.05	0.1	0.09	0.05	0.09	0.07	0.02	0.02	0.01	0.03	0.1	0.11	0.09	0.08	0.13
13,19	13,18	13,17	13,16	13,15	13,14	12,30	12,29	12,28	12,27	12,26	12,25	12,24	12,23	12,22	12,21	12,20

0.05	0.11	0.08	0.03	0.06	0.04	0.12	0.1	0.05	0.05	0.03	0.03	0.13	0.13	0.11	0.11	0.15
14,21	14,20	14,19	14,18	14,17	14,16	14,15	13,30	13,29	13,28	13,27	13,26	13,25	13,24	13,23	13,22	13,21
0.02	0.07	0.01	0.06	0.05	0.04	0.01	0.07	0.05	0.03	0.03	0.04	0.06	0.08	0.08	0.06	0.07
15,24	15,23	15,22	15,21	15,20	15,19	15,18	15,17	15,16	14,30	14,29	14,28	14,27	14,26	14,25	14,24	14,23
0.03	0.04	0.02	0.01	0.06	0.01	0.05	0.04	0.05	0.03	0.01	0.05	0.05	0.07	0.09	0.04	0.05
16,28	16,27	16,26	16,25	16,24	16,23	16,22	16,21	16,20	16,19	16,18	16,17	15,30	15,29	15,28	15,27	15,26
0	0.01	0.03	0.04	0.08	0.09	0.07	0.06	0.11	0.05	0.1	0.09	0.02	0.02	0.06	0.06	0.08
18,21	18,20	18,19	17,30	17,29	17,28	17,27	17,26	17,25	17,24	17,23	17,22	17,21	17,20	17,19	17,18	16,30
0.04	0.04	0.06	0.02	0.04	0.09	0.1	0.12	0.13	0.01	0	0.02	0.04	0.02	0.04	0.04	0.07
19,28	19,27	19,26	19,25	19,24	19,23	19,22	19,21	19,20	18,30	18,29	18,28	18,27	18,26	18,25	18,24	18,23
0.05	0.05	0.08	0.09	0.04	0.04	0.02	0.02	0.06	0.04	0.06	0.11	0.11	0.13	0.14	0.03	0.04
21,27	21,26	21,25	21,24	21,23	21,22	20,30	20,29	20,28	20,27	20,26	20,25	20,24	20,23	20,22	20,21	19,30
0.07	0.09	0.1	0.03	0.04	0.02	0.04	0.06	0.11	0.12	0.14	0.15	0.03	0.02	0.04	0.06	0.03
23,30	23,29	23,28	23,27	23,26	23,25	23,24	22,30	22,29	22,28	22,27	22,26	22,25	22,24	22,23	21,30	21,29
0.02	0.04	0.09	0.1	0.12	0.13	0.01	0.01	0.02	0.07	0.07	0.09	0.11	0.02	0.02	0.02	0.02
27,30	27,29	27,28	26,30	26,29	26,28	26,27	25,30	25,29	25,28	25,27	25,26	24,30	24,29	24,28	24,27	24,26
0.08	0.06	0	0.1	0.08	0.03	0.02	0.11	0.1	0.04	0.04	0.02	0.01	0.03	0.09	0.09	0.11
29,30	28,30	28,29														
0.02	0.07	0.06														

Observing the first column in Table (2), (X,Y) represent the coordinates of profitability, liquidity, and DIS. It represents the distance between each point and another on the coordinate axis

3. **Generating hierarchical clusters** according to the least distance between the pairs arranged for one bank according to the variables of profitability and liquidity with other banks, regardless of the year. The banks will be arranged according to the hierarchical cluster according to the least distance up to the greatest distance, that is, in descending order, as shown in Table(3) :

Table 3: Hierarchical clusters

Cluster	Points within the cluster		DIS.	year	bank	profitability	liquidity	year	bank	profitability	liquidity
	1st point	2nd point									
1	17	23	0.002	2022	National	0.0114	0.9786	2022	Ashour	0.0098	0.9773
2	39	40	0.009								
2	15	41	0.009	2020	National	0.0222	0.9426				
2	24	32	0.009	2023	Ashour	0.0181	0.9722				
2	5	44	0.011	2022	BAGHDADD	0.0308	0.9573				
2	9	37	0.035	2020	Middle East	-0.0032	0.68				
2	2	53	0.035	2019	BAGHDADD	0.0072	0.8112				
2	54	56	0.041								

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2	55	57	0.091								
3	4	30	0.001	2021	BAGHDADD	0.0195	0.9605	2023	Development	0.0207	0.9602
3	16	28	0.004	2021	National	0.0143	0.8889	2021	Development	0.0115	0.8866
3	27	33	0.004	2020	Development	0.0127	0.8824				
3	19	29	0.006	2018	Ashour	0.0101	0.9367	2022	Development	0.0075	0.9418
3	1	35	0.007	2018	BAGHDADD	0.0037	0.9355				
3	21	42	0.010	2020	Ashour	0.0312	0.9459				
3	11	26	0.010	2022	Middle East	0.00002	0.8699	2019	Development	0.0067	0.862
3	43	46	0.012								
3	25	45	0.016	2018	Development	0.0116	0.8464				
3	6	18	0.016	2023	BAGHDADD	0.0567	0.9723	2023	National	0.0477	0.9861
3	34	48	0.018								
3	20	47	0.020	2019	Ashour	0.0142	0.9987				
3	12	50	0.027	2023	Middle East	-0.0161	0.8474				

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3	13	52	0.029	2018	National	-0.0151	0.8989				
3	49	51	0.030								
3	8	58	0.616	2019	Middle East	0.0001	0.0645				
4	7	10	0.007	2018	Middle East	-0.0029	0.7151	2021	Middle East	0.0005	0.7207
4	22	31	0.008	2021	Ashour	0.0124	0.956				
4	3	38	0.009	2020	BAGHDADD	0.0142	0.9472				
5	14	36	0.007	2019	National	0.0145	0.9312				

It is noted from Table (3) that there are five clusters representing the banks sampled in the research, which were distributed among these five clusters according to the consistency of the distance between the points within the coordinate plane, regardless of the sequence of years. For example, the first cluster was formed by Al-Ahli Bank for the year 2022 and Ashour Bank for the year 2022, while the third cluster consists of the Bank of Baghdad, the National Bank, the Development Bank, and the Bank of Assyria and the Middle East for the years 2018, 2019, 2020, 2021, 2022, and 2023. It is also noted from the table that there are empty fields colored in blue, representing those clusters emerging from the basic points within the coordinate plane, to express the hidden and not clearly visible   interconnection.   Interbank sample research

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Graph (2) shows the hierarchical clusters formed according to the distance element between the ordered pairs of the profitability and liquidity variables
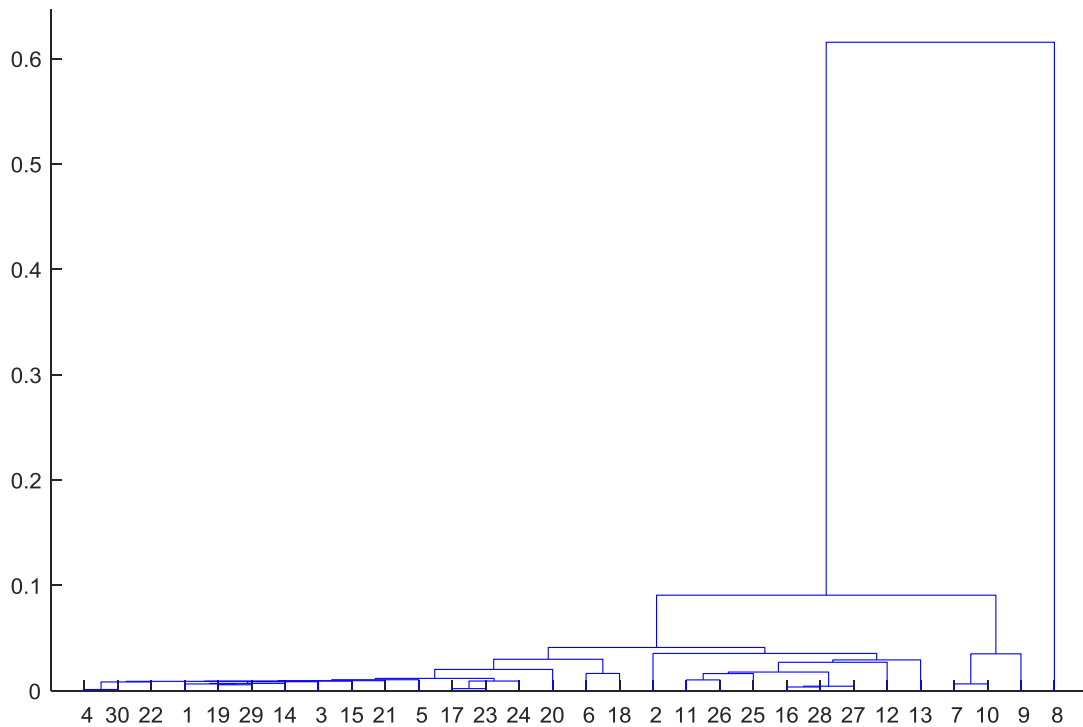

Figure (2) Graphical representation of ordered pair clusters

The horizontal axis represents the coding of banks according to the sequence values from 1 to 30, and the vertical axis represents the distance between points within the coordinate axis.

4. **Cophenetic correlation coefficient test** according to the distance element between the ordered pairs, as its value reached 0.979, which is a high value indicating the accuracy of estimating the distance between the ordered pairs.

5. **Arithmetic mean and standard deviation**:

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Table 4: Arithmetic mean, standard deviation, number of correlations, and inconsistency

Inconsistency coefficient	Number of links	SD.	Mean	NO.	Inconsistency coefficient	Number of links	SD.	Mean	NO.
0.70710678	2	0.0007	0.01	16	0	1	0	0.0012	1
1.0043146	3	0.0013	0.0105	17	0	1	0	0.0021	2
0.70710678	2	0.0042	0.0133	18	0	1	0	0.0036	3
0	1	0	0.0165	19	0.70710678	2	0.0005	0.004	4
0.67312086	3	0.0074	0.0128	20	0	1	0	0.0057	5
0.70710678	2	0.006	0.016	21	0.70710678	2	0.0006	0.0061	6
0.70710678	2	0.0066	0.0224	22	0	1	0	0.0066	7
0.70710678	2	0.0016	0.0282	23	0.70710678	2	0.0004	0.0068	8
1.110059	3	0.0069	0.0222	24	0.70710678	2	0.0051	0.0048	9
0.70710678	2	0.0202	0.0208	25	0.70710678	2	0.0011	0.0078	10
0.70710678	2	0.0044	0.0324	26	1.08571454	3	0.0003	0.0087	11
1.00379106	3	0.0056	0.0355	27	0.70710678	2	0.0002	0.0091	12
1.14902917	3	0.0305	0.0557	28	0.70710678	2	0.0051	0.0057	13
0.70710678	2	0.3711	0.3531	29	0.70710678	2	0.0003	0.0094	14
					0	1	0	0.0103	15

Table (4) presents the arithmetic mean and standard deviation of the correlation formed as a
result of the hierarchical clustering operations. The lowest standard deviation value was based
on the number of correlations between the components of the ordered pairs. When the

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correlation number is 1, the standard deviation value is 0 with an inconsistency coefficient of 0. As the number of correlations increases, it increases with it. The value of standard deviation and inconsistency.

Therefore, the consistency test helps determine whether the bank, during a certain period, has effectively contributed to achieving banking financial stability or not, as it is noted from Table (4) that the consistency value reached 0 during certain periods, thus reflecting the bank's commitment to achieving banking financial stability. On the contrary, the higher the value and the closer it is to one, the more it reflects that the bank does not contribute to achieving banking financial stability, and this is not clearly visible through the banking financial stability report published by the Central Bank of Iraq, which provides an overall picture of the reality of the Iraqi banking sector and not of individual banks. By itself

The second stage: hierarchical clustering within the ordered pair of solvency of capital and assets

1. **Enter the pair (x, y)** for the variables of capital adequacy and asset quality: For the purpose of determining the extent of banks' compliance with the indicators of financial stability, solvency and asset quality, the matlab program will be fed with the results of the solvency calculation in accordance with the requirements of the Basel III standard and asset quality, as shown in Table (5):

Table (5): Results of calculating the solvency and asset quality variables

solvency	Asset quality	bank	No.	year	Solvency	Asset quality	bank	No.	year
26	0.0212	National	16	2021	127	0.0044	Baghdad	1	2018
21	0.0154		17	2022	64	0.2847		2	2019
21	0.0001		18	2023	28.6	0.2473		3	2020
276	0.042	Ashour	19	2018	34	0.0912		4	2021

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271	0.0472		20	2019	52	0.4013		5	2022
273	0.2881		21	2020	67	0.3927		6	2023
172	0.1317		22	2021	110.2	0.3605		7	2018
90	0.0324		23	2022	111.2	0.1728		8	2019
109	0.0406		24	2023	106.2	0.823	Middle East	9	2020
75.83	0.0166		25	2018	126.9	0.8157		10	2021
46	0.0035		26	2019	102	0.8103		11	2022
66	0.0414	Development	27	2020	99	0.8219		12	2023
49.92	0.0298		28	2021	58.19	0.0017		13	2018
37.41	0.0265		29	2022	27.8	0.1469	National	14	2019
31.4	0.0412		30	2023	30.9	0.0232		15	2020

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2. The distance between the pair

By defining the relationships between the pairs from 1 to 30, which are shown in Table (5), 435 relationships will be generated linking the pairs from 1 to 30. For example, a relationship was created between pair 1 with 2, then between 1 with 3, and so on, all the way to the pair. No. 30, Table (6) presents the distance between the pairs generated for 30 pairs

Table (6): The distance between pairs from 1 to 30

(X,Y)	1,19	1,18	1,17	1,16	1,15	1,14	1,13	1,12	1,11	1,10	1,9	1,8	1,7	1,6	1,5	1,4
DIS.	149	106	106	101	96.1	99.2	68.8	28	25	0.82	20.8	15.8	16.8	60	75	93
(X,Y)	2,9	2,8	2,7	2,6	2,5	2,4	2,3	1,30	1,29	1,28	1,27	1,26	1,25	1,24	1,23	1,22
DIS.	42.2	47.2	46.2	3	12	30	35.4	95.6	89.6	77.1	61	81	51.2	18	37	45
(X,Y)	2,27	2,26	2,25	2,24	2,23	2,22	2,21	2,20	2,19	2,18	2,17	2,16	2,15	2,14	2,13	2,12
DIS.	2.01	18	11.8	45	26	108	209	207	212	43	43	38	33.1	36.2	5.82	35
(X,Y)	3,18	3,17	3,16	3,15	3,14	3,13	3,12	3,11	3,10	3,9	3,8	3,7	3,6	3,5	3,4	2,30
DIS.	7.6	7.6	2.61	2.31	0.81	29.6	70.4	73.4	98.3	77.6	82.6	81.6	38.4	23.4	5.4	32.6
(X,Y)	4,10	4,9	4,8	4,7	4,6	4,5	3,30	3,29	3,28	3,27	3,26	3,25	3,24	3,23	3,22	3,21
DIS.	92.9	72.2	77.2	76.2	33	18	2.81	8.81	21.3	37.4	17.4	47.2	80.4	61.4	143	244

(X,Y)	4,28	4,27	4,26	4,25	4,24	4,23	4,22	4,21	4,20	4,19	4,18	4,17	4,16	4,15	4,14	4,13
(X,Y)	15.9	32	12	41.8	75	56	138	239	237	242	13	13	8	3.1	6.2	24.2
DIS.	5,21	5,20	5,19	5,18	5,17	5,16	5,15	5,14	5,13	5,12	5,11	5,10	5,9	5,8	5,7	5,6
(X,Y)	221	219	224	31	31	26	21.1	24.2	6.2	47	50	74.9	54.2	59.2	58.2	15
DIS.	6,15	6,14	6,13	6,12	6,11	6,10	6,9	6,8	6,7	5,30	5,29	5,28	5,27	5,26	5,25	5,24
(X,Y)	36.1	39.2	8.82	32	35	59.9	39.2	44.2	43.2	20.6	14.6	2.11	14	6.01	23.8	57
DIS.	7,10	7,9	7,8	6,30	6,29	6,28	6,27	6,26	6,25	6,24	6,23	6,22	6,21	6,20	6,19	6,18
(X,Y)	16.7	4.03	1.02	35.6	29.6	17.1	1.06	21	8.84	42	23	105	206	204	209	46
DIS.	7,28	7,27	7,26	7,25	7,24	7,23	7,22	7,21	7,20	7,19	7,18	7,17	7,16	7,15	7,14	7,13
(X,Y)	60.3	44.2	64.2	34.4	1.24	20.2	61.8	163	161	166	89.2	89.2	84.2	79.3	82.4	52
DIS.	8,24	8,23	8,22	8,21	8,20	8,19	8,18	8,17	8,16	8,15	8,14	8,13	8,12	8,11	8,10	8,9
(X,Y)	2.2	21.2	60.8	162	160	165	90.2	90.2	85.2	80.3	83.4	53	12.2	9.22	15.7	5.04
(X,Y)	9,21	9,20	9,19	9,18	9,17	9,16	9,15	9,14	9,13	9,12	9,11	9,10	8,30	8,29	8,28	8,27
DIS.	167	165	170	85.2	85.2	80.2	75.3	78.4	48	7.2	4.2	20.7	79.8	73.8	61.3	45.2

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(X,Y)	10,19	10,18	10,17	10,16	10,15	10,14	10,13	10,12	10,11	9,30	9,29	9,28	9,27	9,26	9,25	9,24
DIS.	149	106	106	101	96	99.1	68.7	27.9	24.9	74.8	68.8	56.3	40.2	60.2	30.4	2.91
(X,Y)	11,18	11,17	11,16	11,15	11,14	11,13	11,12	10,30	10,29	10,28	10,27	10,26	10,25	10,24	10,23	10,22
DIS.	81	81	76	71.1	74.2	43.8	3	95.5	89.5	77	60.9	80.9	51.1	17.9	36.9	45.1
(X,Y)	12,18	12,17	12,16	12,15	12,14	12,13	11,30	11,29	11,28	11,27	11,26	11,25	11,24	11,23	11,22	11,21
DIS.	78	78	73	68.1	71.2	40.8	70.6	64.6	52.1	36	56	26.2	7.04	12	70	171
(X,Y)	13,19	13,18	13,17	13,16	13,15	13,14	12,30	12,29	12,28	12,27	12,26	12,25	12,24	12,23	12,22	12,21
DIS.	218	37.2	37.2	32.2	27.3	30.4	67.6	61.6	49.1	33	53	23.2	10	9.03	73	174
(X,Y)	14,21	14,20	14,19	14,18	14,17	14,16	14,15	13,30	13,29	13,28	13,27	13,26	13,25	13,24	13,23	13,22
(X,Y)	245	243	248	6.8	6.8	1.8	3.1	26.8	20.8	8.27	7.81	12.2	17.6	50.8	31.8	114
DIS.	15,24	15,23	15,22	15,21	15,20	15,19	15,18	15,17	15,16	14,30	14,29	14,28	14,27	14,26	14,25	14,24
(X,Y)	78.1	59.1	141	242	240	245	9.9	9.9	4.9	3.6	9.61	22.1	38.2	18.2	48	81.2
DIS.	16,28	16,27	16,26	16,25	16,24	16,23	16,22	16,21	16,20	16,19	16,18	16,17	15,30	15,29	15,28	15,27
(X,Y)	23.9	40	20	49.8	83	64	146	247	245	250	5	5	0.5	6.51	19	35.1

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DIS.	18,21	18,20	18,19	17,30	17,29	17,28	17,27	17,26	17,25	17,24	17,23	17,22	17,21	17,20	17,19	17,18
(X,Y)	252	250	255	10.4	16.4	28.9	45	25	54.8	88	69	151	252	250	255	0.02
DIS.	19,28	19,27	19,26	19,25	19,24	19,23	19,22	19,21	19,20	18,30	18,29	18,28	18,27	18,26	18,25	18,24
(X,Y)	226	210	230	200	167	186	104	3.01	5	10.4	16.4	28.9	45	25	54.8	88
DIS.	21,27	21,26	21,25	21,24	21,23	21,22	20,30	20,29	20,28	20,27	20,26	20,25	20,24	20,23	20,22	20,21
(X,Y)	207	227	197	164	183	101	240	234	221	205	225	195	162	181	99	2.01
(X,Y)	23,30	23,29	23,28	23,27	23,26	23,25	23,24	22,30	22,29	22,28	22,27	22,26	22,25	22,24	22,23	21,30
DIS.	58.6	52.6	40.1	24	44	14.2	19	141	135	122	106	126	96.2	63	82	242
(X,Y)	27,30	27,29	27,28	26,30	26,29	26,28	26,27	25,30	25,29	25,28	25,27	25,26	24,30	24,29	24,28	24,27
DIS.	34.6	28.6	16.1	14.6	8.59	3.92	20	44.4	38.4	25.9	9.83	29.8	77.6	71.6	59.1	43
(X,Y)	29,30	28,30	28,29													
DIS.	6.01	18.5	12.5													

3. **Generating hierarchical clusters** according to the least distance between pairs for one of the banks according to the variables of solvency and asset quality with other banks, regardless of the year. The banks will be arranged according to the hierarchical cluster according to the least distance up to the greatest distance, that is, in descending order, as shown in Table:(7)

Table (7): Hierarchical clusters for the research sample

Cluster	Points within the cluster		DIS.	year	bank	Asset quality	solvency	year	bank	Asset quality	solvency
	1st point	2nd point									
1	15	30	0.500	2020	National	0.0232	30.9	2023	Development	0.0412	31.4
1	3	14	0.806	2020	Baghdad	0.2473	28.6	2019	National	0.1469	27.8
1	1	10	0.817	2018	Baghdad	0.0044	127	2021	Middle East	0.8157	126.9
1	7	8	1.017	2018	Middle East	0.3605	110.2	2019	Middle East	0.1728	111.2
1	6	27	1.060	2023	Baghdad	0.3927	67	2020	Development	0.0414	66
1	4	42	2.600	2021	Baghdad	0.0912	34				
1	9	37	2.907	2020	Middle East	0.823	106.2				
1	11	12	3.000	2022	Middle East	0.8103	102	2023	Middle East	0.8219	99
1	19	39	3.010	2018	Ashour	0.042	276				
1	29	43	3.411	2022	Development	0.0265	37.41				

1	26	41	3.920	2019	Development	0.0035	46				
1	23	49	9.035	2022	Ashour	0.0324	90				
1	54	55	14.170								
1	34	56	15.713								
1	22	57	45.000	2021	Ashour	0.1317	172				
1	46	58	99.000								
2	24	35	1.242	2023	Ashour	0.0406	109				
2	16	33	1.804	2021	National	0.0212	26				
2	20	21	2.014	2019	Ashour	0.0472	271	2020	Ashour	0.2881	273
2	5	28	2.113	2022	Baghdad	0.4013	52	2021	Development	0.0298	49.92
2	32	38	2.311								
2	50	52	8.590								
2	25	53	8.838	2018	Development	0.0166	75.83				
3	17	18	0.015	2022	National	0.0154	21	2023	National	0.0001	21

3	2	36	2.015	2019	Baghdad	0.2847	64				
4	48	51	6.203								
5	44	45	4.200								
5	31	47	5.000								
5	13	40	5.817	2018	National	0.0017	58.19				

It is noted from Table (7) that the banks sampled in the study were divided into five clusters. For example, the second cluster included the Bank of Ashour for the years 2019, 2020, and 2023, the National Bank for the year 2021, the Bank of Baghdad for the year 2022, and the Development Bank for the year 2021.Graph (3) shows the hierarchical clusters formed according to the distance element between pairs of profitability and liquidity variables
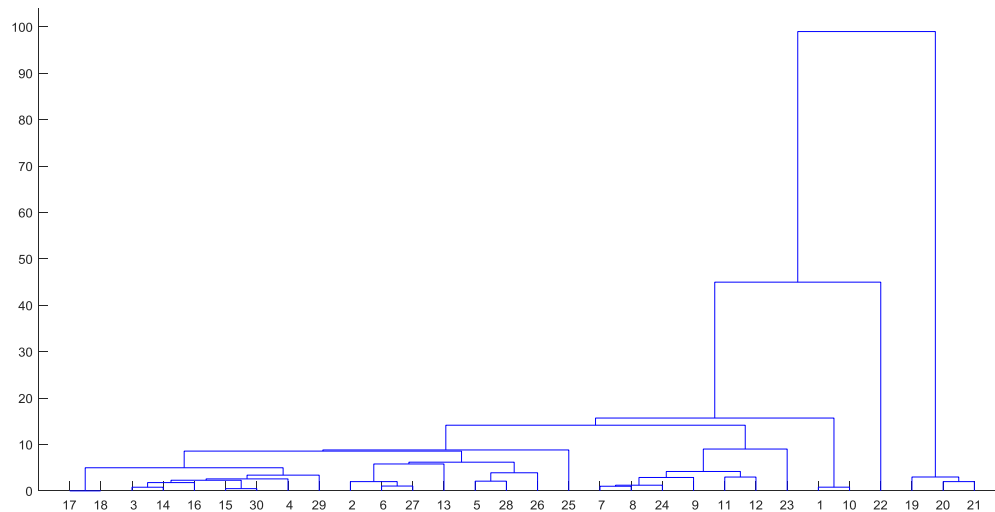
Figure (3): Graphical representation of the clusters within the pair

4. Cophenetic correlation coefficient test according to the distance element between pairs, as its value reached 0.936, which is a high value indicating the accuracy of estimating the distance between pairs, That is, the closer it is to 1, the more consistency there is between your original data and the clusters that were generated.

5. **Arithmetic mean and standard deviation**:

Table (8): Arithmetic mean, standard deviation, number of correlations, and inconsistency

Inconsistency coefficient	Number of links	s.d.	Mean
0.000	1	0.000	0.015

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0.000	1	0.000	0.500
0.000	1	0.000	0.806
0.000	1	0.000	0.817
0.000	1	0.000	1.017
0.000	1	0.000	1.060
0.707	2	0.159	1.130
0.707	2	0.706	1.305
0.000	1	0.000	2.014
0.707	2	0.675	1.537
0.000	1	0.000	2.113
0.827	3	0.934	1.539
0.707	2	0.205	2.456
0.707	2	1.178	2.075
0.000	1	0.000	3.000
0.707	2	0.704	2.512
0.707	2	0.573	3.006
0.707	2	1.278	3.017
1.152	3	0.721	3.369
0.861	3	2.546	2.809
0.707	2	2.689	3.916

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0.728	3	1.222	5.313
1.090	3	1.827	6.598
0.707	2	0.175	8.714
0.707	2	3.419	6.617
1.154	3	3.023	10.681
0.669	3	8.191	10.234
0.707	2	20.709	30.357
1.039	3	48.120	49.003

Table (8) presents the arithmetic mean and standard deviation of the correlation formed as a result of the hierarchical clustering operations. The lowest standard deviation value was based on the number of correlations between the components of the pairs. When the correlation number is 1, the standard deviation value is 0 with an inconsistency factor of 0. As the number of correlations increases, the value increases with it. Standard deviation and inconsistency

Section fourth: conclusions and recommendations

First: conclusions

1. Financial stability is a basic condition for any economic system that seeks to maintain the safety of all its parts from unexpected shocks, and the issue is emphasized in importance with the banking system, which is the basis for the work of all other sectors.

2. There is a number of interactions within the banking sector that do not become apparent with classical financial analysis except by using other tools represented by machine learning and its hierarchical clustering tool. This is what became clear with the clusters formed outside the basic sequence of the number of years, as it became clear that there are hidden relationships

between banks. It indirectly helps, if it expands, to increase the state of banking financial instability.

3. The hierarchical clusters presented the sequence of banks' compliance with the principles of financial stability through its four indicators, which were grouped by two coordinates, the first (profitability, liquidity) and the second (solvency, asset quality). Thus, the current research was able to reflect the state of the Iraqi banking sector in terms of commitment to the principles and Foundations of financial stability.

4. The table of hierarchical clusters presents the preference of some banks for commitment over others, regardless of the logical sequence of years, as it was noted that there are banks that were similar to others during certain years, and this provides decision-makers with a longitudinal cross-sectional overview of the nature of banks' movements towards contributing to achieving financial stability.

5. The deep idea of the research presents unprecedented viewpoints in the field of deep analysis of the Iraqi banking reality and the analytical advantages it provides that help decision makers ensure that the stability of the Iraqi financial reality is maintained.

Second: Recommendations

1. Paying more attention to the issue of financial stability by employing machine learning or deep learning tools through its advanced tools that ensure decision-makers obtain high-accuracy information, which according to the current study exceeded 96%.

2. The current tools for measuring financial stability are very useful for classifying banks based on the extent of their commitment to maintaining financial stability or not, as they graduated, as was evident from the study, from the most committed to the least committed, but all of them are committed to achieving financial stability, and this is an indication of the reports it issues. Central Bank of Iraq.

3. Through the degree of consistency or its absence, decision makers and those responsible for preparing financial stability reports can search for those banks that help in the occurrence of instability, and thus it gives an indicator that overlaps with financial soundness and results in the banks being exposed to bankruptcy.

4. The necessity of reconsidering the method of calculating financial stability indicators and moving away from traditional methods that do not give complete accuracy, as was obtained in the current research, which exceeded 96%.

Sources:

1. Bordo, Michael D. (2017), An Historical Perspective on the Quest for Financial Stability and the Monetary Policy Regime, Economics Working Paper 17108.

2. Fabris ,Nikola & Luburic, Radoica (2023), FINANCIAL STABILITY AND QUALITY OF LIFE, https://www.researchgate.net/publication/370928163 .

3. Financial Stability Report(2022),central bank of Iraq.

4. Gadanecz, Blaise & Jayaram,Kaushik (2009), Measures of financial stability – a review, IFC Bulletin No 31.

5. Geršl ,Adam & Heřmánek, Jaroslav (2007), FINANCIAL STABILITY INDICATORS: ADVANTAGES AND DISADVANTAGES OF THEIR USE IN THE ASSESSMENT OF FINANCIAL SYSTEM STABILITY.

6. Guindos, Luis de (2024), Financial Stability Review, European central bank.

7. Imanov, G.C. & Alieva, H.S. & Yusifzadeh, R.A.(2017), FINANCIAL STABILITY IN AZERBAIJAN: THE APPLICATION OF FUZZY APPROACH, Buletin Ekonomi Moneter dan Perbankan, Volume 19, Nomor 3.

8. Jakubík, Peter & Teplý, Petr (2010), SCORING AS AN INDICATOR OF FINANCIAL STABILITY, https://www.researchgate.net/publication/241754171 .

9. Kashyapa ,Anil K. & Siegertb, Caspar (2020), Financial Stability Considerations and Monetary Policy, International Journal of Central Banking, Vol. 16 No. 1.

10. Mishkin, Frederic S. (1998), The Causes and Propagation of Financial Instability: Lessons for Policymakers.

11. Morgan, Peter J. & Pontines, Victor (2014), Financial Stability and Financial Inclusion, Asian Development Bank Institute.

12. Patel, Sakshi & Sihmar, Shivani & Jatain, Aman (2015), A Study of Hierarchical Clustering Algorithms, International Conference on Computing for Sustainable Global Development.

13. Schinasi, Garry J. (2004), Defining Financial Stability, International Monetary Fund.

14. Stefaniak, Stanisław (2018), Defining "financial stabilit y", POLISH REVIEW OF INTERNATIONAL AND EUROPEAN LAW, Vol. 7, Issue 1.

15. Toniolo, Gianni & White, Eugene N. (2015),THE EVOLUTION OF THE FINANCIAL STABILITY MANDATE:FROM ITS ORIGINS TO THE PRESENT DAY, NBER Working Paper No. 20844.