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Analyzing the Predictive Relationship between Systemic Risks and Financial Shocks: An Analytical Study in the Iraqi Banking Sector

Abtihal Raheem Abd[1], Dr. Mahdi Atiyah Mohi aljbouri[2]

Abstract

The research aims to provide a basic quantitative description of a comprehensive summary of current systemic risk measures, while exploring individual measures in separate papers. It studies the correlation between financial shocks and the assessment of systemic risk measures with respect to a specific empirical criterion and determines the quality of these measures in predicting changes in the future distribution of financial shocks. It also identifies whether statistical dimension reduction techniques help discover a strong relationship between a large set of systemic risk measures and financial shocks. The study assumes there is no predictive ability for systemic risk measures to predict future financial shocks; in a group of banks within the banking sector in the Iraq Stock Exchange. According to the ARDL model, the study found no significant effect of the banking sector's return on the general index of the Iraq Stock Exchange. The research arrived at a set of conclusions, including Iraqi banks' exposure to financial shocks during the study period, with the Iraqi Al-Ahli Bank being one of the most affected by financial shocks, while the Kurdistan Bank is one of the least affected. The study recommended a set of recommendations, including banks' compliance with all liquidity and capital regulations, using a policy consistent with the disposal of non-performing debt, and reducing risks.

Keywords: *Financial Shocks, Banking Sector, ARDL model.*

Introduction

The ability of the financial system's pressures to cause a sharp decline in the overall economy has made systemic risks a focal point of research and policy. Many measures of systemic risk have been proposed in the aftermath of the 2007-2009 financial crisis. Technological advances and communication development are considered crucial means of transmitting shocks and crises, and transferring their impact between local, regional, and international economies, especially with their negative effects in the financial and monetary aspects. The issue of financial shocks is a sensitive and important topic, as it is directly linked to the economic changes that occur in the world and affect economic activity, and thus the economic growth rate; its importance is highlighted by the negative effects that these shocks leave on countries that face them.

The traditional view of the financial system as a mechanism for supporting economic growth has gained many criticisms following the 2008 global financial crisis. After this

[1] Master's student at Department of Finance and Banking, College of Administration and Economics, University of Babylon, Iraq, Abtihalraheem@gmail.com

[2] Professor at Department of Finance and Banking, College of Administration and Economics, University of Babylon, Iraq, Bus.Mahdi.Atiyah@uobabylon.edu.iq

criticism, there was a need for a new, more realistic vision of the financial system. In particular, economists began to pay greater attention to systemic risks as a negative effect of the development of the financial system.

However, due to the lack of research on actual state-level measures of systemic risks, there has not been a deep analysis of the effects of financial systemic risks on achieving the goals of the banking and financial sector and contributing to economic growth. To address this gap, this topic addresses indicators and measures of systemic risks through analysis and evaluation. Comprehensive systemic risks are a well-established term that refers to risks or the possibility of losses in the entire system, as opposed to losses in individual parts or components, and the common approach to estimating these risks is evident from the common movements (correlation) between most or all of the parts.

Research methodology:

First: Research Importance:

The research provides empirical insights over several business cycles, in a time series unlike the focus of other literature over the past years. In the absence of a clear standard for judging the performance of systemic risk measures, it has been difficult to establish experimental patterns among many papers in different countries. There are many possible criteria that one can take into account, such as the benefit of risk management by financial institutions or the ability to predict fluctuations in asset prices. This research focused on analyzing the interactions between systemic risks and financial shocks to highlight valuable measures as inputs to regulatory or policy options.

Secondly: Research Objectives:

1- Provide a basic quantitative description of a comprehensive summary of current systemic risk measures, while exploring individual measures in separate papers. And study their correlation with financial shocks.

2- Evaluate systemic risk measures in relation to a specific empirical standard and determine the quality of these measures in predicting changes in the distribution of financial shocks in the future.

3- Determine whether statistical dimensionality reduction techniques help discover a strong relationship between a large set of systemic risk measures and financial shocks.

Thirdly: Research problem:

Many systemic risk measures lack a strong statistical link to financial shock indicators. This may be due to the noise and interference of the measurement that obscures the useful content of this series, or because different measures capture different aspects of systemic risks. Therefore, the problem of the study can be formulated in the following questions:

1- How can systemic risks in the banking system be measured?

2- How can the potential exposure of the banking system to regression risks be evaluated?

3- Is it possible to integrate systemic risk measures into a more informative systemic risk index?

4- Is it possible to propose a quantitative statistical model that can monitor risks?

Fourthly: Research hypotheses:

Based on the research problem and its objectives, the following hypotheses have been formulated:

There is no predictive ability for systemic risk measures to predict future financial shocks in a group of banks within the banking sector in the Iraqi Stock Exchange.

Chapter One - The Conceptual Aspect of Systemic Risks and Financial Shocks

First Requirement: The Concept of Risks

Risk refers to a situation where both possibilities are likely to occur without doubt. The cases we face with a single possibility are cases of zero risk*(1). Risks are events that are invisible and undesirable in the future, and there are examples of this in recent times. Any person on the street can name multiple events that may be considered a type of risk. Chernobyl in the Soviet Union or Bhopal in India and others may be at the forefront of these events. These events and others have certainly dominated headlines, but they are only the beginning and prelude to an iceberg of risks. Such risks are the main headlines and news bulletins, yet they are far from the everyday types of risks that occur continuously. The real level of danger consists of the constant ringing of accidents, fires, thefts, explosions, and similar events, and it is rare for these events to dominate the front pages of daily newspapers*(2).

Risks are an integral part of any job or association, but studying risks becomes particularly important when it becomes part of the financial decision-making process for an economic unit. There is no guarantee that any asset can achieve expected practical returns, so we always strive to examine the influential and strategic forces that can affect the ability of this asset to generate returns*(3). Generally, there are many definitions of risks, including the following:

Risk: The likelihood of not achieving the expected return, or the degree of change in the expected return compared to the expected return*(4).

The second requirement: the concept of systemic risks:

Systemic risk is that part of the risks that the investment entity is exposed to and that is caused by factors affecting the market as a whole and is called market risk. These risks cannot be avoided or eliminated by diversifying investments because they are related to the market system as a whole and not to a particular company or industry. These factors are linked to all social, economic, and political conditions such as general disturbances, recessionary conditions, inflationary conditions, wars, political coups, or interest rates*(5).

Likewise, I recognized systemic risks as all the risks that may affect commercial banks as a result of economic, social, and political factors, which are difficult for banks to avoid or control*(6). These risks include exchange rate fluctuations, interest rate fluctuations, financial crises, and changes in global economic conditions*(7). The European Central Bank (2009) defines systemic risks as "the risk of widespread financial instability to the extent that it disrupts the financial system to the degree that economic growth and material well-being suffer", and the percentage of market risk that belongs to total risk. It is the part of the return that is caused by factors that simultaneously affect all securities prices traded in the market. These changes that occur in the social, economic, and political environment that affect securities markets are sources of systemic risks*(8).

The third requirement: measuring systemic risks.

Alternative risk measures have recently received significant attention to compensate for the failure of VaR to absorb the financial crisis and its potential contribution to systemic risks by each institution.

The conditional value at risk (VaRCO) is a new form of risk measurement that aims to incorporate the fact that losses generally spread across financial institutions during financial crises. Adrian and BrunnerMeier*(9) designed a measure of systemic risk to estimate the level of external risk factors for financial institutions. VaRco is the risk of a financial institution (sector or system) conditional on another institution (or sector or system)

"And this means that if it increases compared to (absolute value), there are greater risks of external factors and correlation across institutions. Many studies have proposed a variety of alternative quantitative measures for systemic risks with other methods and variables. For example, a systemic risk index has been proposed. Huang*(10) determined that the insurance rate compared to the systemic financial distress resulting from pre-default measures of default risk for each bank and expectations of shareholder return correlation. The systemic importance of financial institutions has been evaluated by Zhou through the multivariate extreme value theory (EVT) framework, proposing two measures of systemic risks: the systemic impact index (SII), which calculates the size of the systemic impact in the event of bank failure, and the vulnerability index (VI), which calculates the impact on a particular institution when other areas of the system are under financial distress. Similarly, a framework has been used to evaluate contagion between markets*(11), giving a measure of dependence on extreme events that depends on the occurrence of many market conditions. When investigating the spread of financial institution risks, the value-at-risk approach was used for state sensitivity (SDSVaR)."

Systemic risk is measured by the beta β coefficient, as the beta coefficient measures the yield-per-share sensitivity of changes in market return. A beta coefficient per share can be interpreted as in the following table *12:

Table (1) Interpretation of beta coefficient per share

Value of beta coefficient	Its connotation
$\beta = 0$	If the value of beta per share is equal to one, this means that the stock is closely linked to changes in the market, as the movements of the stock track market movements both higher and lower, so adding another share to the investment portfolio with a beta coefficient equal to zero does not increase the risk and, conversely, does not lead to an increase in the rate.
$\beta < 1$	If beta is smaller than one, it means that the stock moves up and down are lower than market movements, so adding another share to the investment portfolio has a beta coefficient of less than one whose returns and risks will be lower than those of the market.
$\beta > 1$	If the value of beta is greater than one, it means that the stock moves up and down are greater than the market moves, so adding another share to the investment portfolio has a beta coefficient higher than one whose returns and risks will be lower than those of the market.

Source: The researcher

The general purpose of measuring risks is to digitally identify all expected losses in any type of risk that an economic unit may be exposed to. Measuring risks and reporting them provides decision-makers with information that helps in implementing decisions and monitoring results that mitigate risks. There are many ways to measure risks, including measuring systematic risks*(13).

Systematic risks, based on the concept, are referred to as market risks or non-diversifiable risks. They highlight the uncertainty of future returns, estimating the sensitivity of investment returns to changes in market returns as a whole*(14).

To measure systematic risks, the relationship between market returns and asset returns must be determined, and this relationship can be calculated through the statistical correlation between market returns and asset returns, with this relationship being determined through the calculation of the Beta value.

The Beta value is calculated through the following equation*15:

( ).$\beta = Cov(Rj, Rm) / \sigma 2Rm$

That:

Cov (Rj, Rm): Represents the common contrast between the rate of return on the market and the rate of return on the share.

σ 2Rm: Represents the yield variance on the market.

The Capital Asset Pricing Model (CAPM) requires a positive relationship between beta value and return.

To calculate systemic risks, a coefficient quotient (beta in the variation of the market portfolio rate of return) is generated and the coefficient is calculated beta depending on the previous time periods because investor expectations are based partly on historical data and partly on future or future forecasts, and systemic risk is calculated through the following equation*16:

Systematic risk = $\beta 2 * \sigma 2Rm$

The fourth demand - the concept of financial shocks

Credit cycles arise from collateral constraints and financial disturbances, as confirmed by (Kiyotaki and Moore) *(17). This inflation mechanism is already well understood, and therefore taking this potential inflation into better consideration can lead to improvement, rather than radical change, in policy behavior after the shock. Additionally, the literature has shown that the degree of inflation resulting from credit constraints is extremely limited experimentally outside of shock periods *(18/19).

The financial shock can be interpreted primarily as a shock to the financial sector, i.e. a sectoral shock, consistent with the interpretation of (Hirakata) (20): the positive financial shock is the conversion of net wealth from the non-financial sector to the financial sector. The distribution of net wealth between the financial and non-financial sectors is important for investment. This concept is closely related to the definition of financial shock provided by (Hall) (21), as the positive financial shock resembles the selective decline in taxes imposed on financial intermediation, making financial intermediation less costly and more efficient.

As a result of this shock similar to the offer, financial mediation services - financial brokers - become more profitable, and extend to more credit. Nolan and Thoenissen*(22) provide a similar definition as financial disruption shocks "are shocks to the efficiency of contractual relationships between borrowers and lenders. Gilchrist*(23) defines financial shock as an additional shock to the external finance premium. Meh and Moran*(24) define financial shock as an external change in bank net wealth (such as a tax on bank capital). Given that bank capital is a key tool for the ability to produce financial intermediaries' debt, the shock may have broader consequences on financing conditions and the real economy. Positive shocks lead to a positive improvement in the variable value, while negative shocks lead to the collapse or decrease in the variable value, which is called financial crises and economic crises that increase with the strength of the shock*(25). Financial crisis is defined as the collapse of the financial system, accompanied by the failure of a large number of financial and non-financial institutions, and the economic activity is exposed to a sharp contraction*(26).

The fifth requirement - the structure of the standard model:

The design of the standard model must comply with the study hypothesis and its variables, as these variables can be clarified as follows:

1- The independent variable: Banking sector return, represented by (X).

2- The dependent variable: General market index, represented by (Y).

Chapter Tow: formulating the standard model:

The standard model can be formulated, through which various equations are measured and analyzed, estimating the return on the banking sector in the general market index as follows:

$$Log (Y) = \beta 0 + \beta 1X + Ut$$

Where:

Log (Y) represents the natural logarithm of the general market index.

$\beta 0$ represents the constant value.

X represents the return on the banking sector.

$\beta 1$ represents the estimated parameter.

Ut represents the margin of error.

Chapter Three: Presentation and analysis of the results of the standard model:

The statistical program (EViews 12) was used to measure the impact of the banking sector's return on the general market index. Quarterly data for these variables were employed for the period from 2014 to 2021, with a total of 32 observations. Natural logarithms were then taken for the dependent variable in order to obtain homogeneous data for both the independent and dependent variables.

1- Stability results

According to table (13) and after conducting the stability test for the study variables using the ADF test, it was found that the variables (Log y, x) were stable at both the level and the first difference, with or without a trend, and at a significant level of (1%, 5%, 10%).

Table 2 Stability of study variables

UNIT ROOT TEST RESULTS TABLE (ADF)						
Null Hypothesis: the variable has a unit root						
	At Level					
		LOG_Y_	X			
With Constant	t-Statistic	-3.5036	-4.0119			
	Prob.	*0.0149*	*0.0042*			
		**	***			
With Constant & Trend	t-Statistic	-3.2140	-2.8778			
	Prob.	*0.1008*	*0.1828*			
		n0	n0			
Without Constant & Trend	t-Statistic	0.4354	-2.2057			
	Prob.	*0.8018*	*0.0285*			
		n0	**			
	At First Difference					
		d(LOG_Y_)	d(X)			
With Constant	t-Statistic	-5.1999	-5.2852			
	Prob.	*0.0002*	*0.0002*			
		***	***			
With Constant & Trend	t-Statistic	-3.8214	-6.0386			
	Prob.	*0.0303*	*0.0001*			
		**	***			

Without Constant & Trend	t-Statistic	-5.1975	-5.2367			
	Prob.	*0.0000*	*0.0000*			
		***	***			

Source: Researcher preparation based on Eviews 12 outputs

2- Model estimation

After conducting the stability test and determining the order of integration for the study variables, the next step is to estimate the model using the ARDL methodology. After estimating the model, the determination coefficient (R2) was found to be 58%, which means that 58% of the variations in the dependent variable (market index) are caused by the independent variable (banking sector returns), while 42% of the variations in the dependent variable are caused by variables not included in the model. The adjusted R-squared is 55%. Additionally, the calculated F-test value is 20, which is significant at the 1% level, leading to the rejection of the null hypothesis and acceptance of the alternative hypothesis that the model is significant as a whole.

Table 3 Model Estimate by Methodology (ARDL)

Dependent Variable: LOG_Y_				
Method: ARDL				
Date: 05/28/23 Time: 11:00				
Sample (adjusted): 2 32				
Included observations: 31 after adjustments				
Maximum dependent lags: 1 (Automatic selection)				
Model selection method: Akaike info criterion (AIC)				
Dynamic regressors (2 lags, automatic): X				
Fixed regressors: C				
Number of models evalulated: 3				
Selected Model: ARDL(1, 0)				
Note: final equation sample is larger than selection sample				
Variable	Coefficient	Std. Error	t-Statistic	Prob.*
LOG_Y_(-1)	0.614949	0.145961	4.213110	0.0002
X	-0.411084	0.545052	-0.754211	0.4570
C	2.687627	1.166258	2.304487	0.0288
R-squared	0.588246	Mean dependent var		6.194060
Adjusted R-squared	0.558835	S.D. dependent var		0.560058
S.E. of regression	0.371992	Akaike info criterion		0.951875
Sum squared resid	3.874576	Schwarz criterion		1.090647
Log likelihood	-11.75405	Hannan-Quinn criter.		0.997111
F-statistic	20.00090	Durbin-Watson stat		1.753590
Prob(F-statistic)	0.000004			
*Note: p-values and any subsequent tests do not account for model selection.				

Source: Researcher preparation based on Eviews 12 outputs

1- Bound Test and Long-Term Horizon:

Through table (15), it is observed that the calculated value of the (F) test is (3.110290), which is within the bounds of the tabular value of the (F) test at a significant level of (1%, 5%, 10%). This indicates the existence of a long-term equilibrium relationship, and thus we reject the null hypothesis and accept the alternative hypothesis. It is also observed that the estimated parameter for the independent variable is (-1.067610), which is insignificant at a (1%) level. This confirms the absence of an effect of the independent variable on the dependent variable in the long term

Table 4 Bound test and long term Horizon.

Levels Equation				
Case 2: Restricted Constant and No Trend				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
X	-1.067610	1.187478	-0.899057	0.3763
C	6.979928	0.777451	8.977966	0.0000
EC = LOG_Y_ - (-1.0676*X + 6.9799)				
F-Bounds Test		Null Hypothesis: No levels relationship		
Test Statistic	Value	Signif.	I(0)	I(1)
			Asymptotic: n=1000	
F-statistic	3.110290	10%	3.02	3.51
k	1	5%	3.62	4.16
		2.5%	4.18	4.79
		1%	4.94	5.58

Source: Researcher preparation based on Eviews 12 outputs

1- Short-Term Horizon Test:

After confirming the existence of a long-term equilibrium relationship between variables, we estimate the relationship in the short term. Through table (16), it is observed that there is no effect of the independent variable (banking sector returns) on the dependent variable (general market index) in the short term. It is also observed that the error correction parameter, or what is called the structural adaptation speed, is (-0.385051), which means that deviations in the long term are corrected in the short term by (0.38) and take (0.65) years to return to equilibrium.

Table 5 Short-term estimate

ARDL Error Correction Regression				
Dependent Variable: D(LOG_Y_)				
Selected Model: ARDL(1, 0)				
Case 2: Restricted Constant and No Trend				
Date: 05/28/23 Time: 11:06				
Sample: 1 32				
Included observations: 31				
ECM Regression				
Case 2: Restricted Constant and No Trend				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
CointEq(-1)*	-0.385051	0.121780	-3.161860	0.0037
R-squared	0.237041	Mean dependent var		0.053101
Adjusted R-squared	0.237041	S.D. dependent var		0.411435
S.E. of regression	0.359378	Akaike info criterion		0.822842
Sum squared resid	3.874576	Schwarz criterion		0.869100
Log likelihood	-11.75405	Hannan-Quinn criter.		0.837921

Durbin-Watson stat	1.753590			
* p-value incompatible with t-Bounds distribution.				
F-Bounds Test		Null Hypothesis: No levels relationship		
Test Statistic	Value	Signif.	I(0)	I(1)
F-statistic	3.110290	10%	3.02	3.51
k	1	5%	3.62	4.16
		2.5%	4.18	4.79
		1%	4.94	5.58

Source: Researcher preparation based on Eviews 12 outputs

1- Self-correlation test:

After estimating the model and identifying the presence or absence of a long-term equilibrium relationship, the next step is to test the model's integrity from the problem of serial correlation. As observed through Table (17), the test value (F) reached (0.454142) and it is insignificant at the (5%) level. Therefore, the null hypothesis, which states the absence of a self-correlation problem, is accepted, and the alternative hypothesis is rejected.

Table 6 Self-correlation test

Breusch-Godfrey Serial Correlation LM Test:				
Null hypothesis: No serial correlation at up to 2 lags				
F-statistic	0.454142	Prob. F(2,26)		0.6399
Obs*R-squared	1.046399	Prob. Chi-Square(2)		0.5926
Test Equation:				
Dependent Variable: RESID				
Method: ARDL				
Date: 05/28/23 Time: 11:09				
Sample: 2 32				
Included observations: 31				
Presample missing value lagged residuals set to zero.				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
LOG_Y_(-1)	-0.097275	0.396455	-0.245362	0.8081
X	-0.272023	1.092438	-0.249005	0.8053
C	0.775933	3.110994	0.249416	0.8050
RESID(-1)	0.212093	0.444144	0.477531	0.6370
RESID(-2)	-0.093703	0.295074	-0.317559	0.7534
R-squared	0.033755	Mean dependent var		-1.44E-15
Adjusted R-squared	-0.114898	S.D. dependent var		0.359378
S.E. of regression	0.379463	Akaike info criterion		1.046569
Sum squared resid	3.743791	Schwarz criterion		1.277857
Log likelihood	-11.22182	Hannan-Quinn criter.		1.121963
F-statistic	0.227071	Durbin-Watson stat		2.009802

Prob(F-statistic)	0.920746			

Source: Researcher preparation based on Eviews 12 outputs

1- Model stability test:

In order to test the stability of the model, a (cusum) test must be conducted, which represents the cumulative sum of residuals. As shown in Figure (47), it can be observed that the test falls within the critical value limits and at a significant level of (5%), which confirms the stability of the estimated parameters.

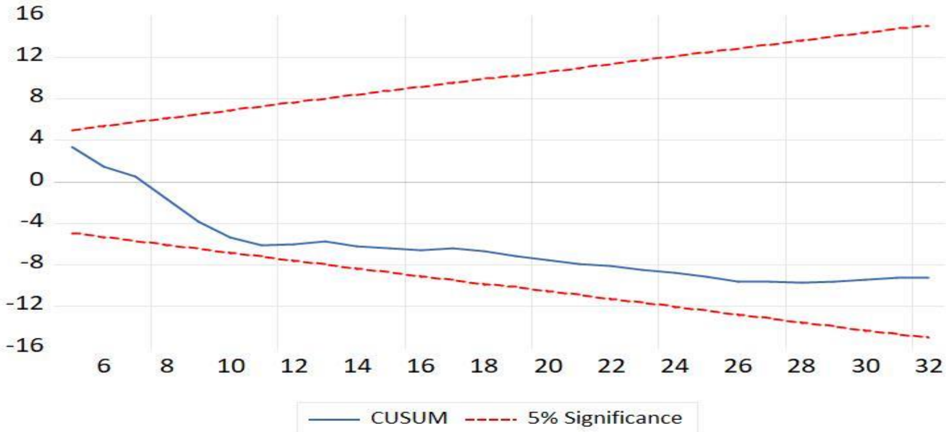

Figure 1. Model stability test

Source: Researcher preparation based on Eviews 12 outputs

1- Wald Test:

When looking at Table (17), it is noticed that the short-term estimated parameters for the model's growth were significant, indicating the existence of a short-term causal relationship between the banking sector's return and the general index.

Table (7) Self-correlation test

Wald Test:			
Equation: Untitled			
Test Statistic	Value	df	Probability
F-statistic	20.00090	(2, 28)	0.0000
Chi-square	40.00180	2	0.0000

Source: Researcher preparation based on Eviews 12 outputs

Conclusions and recommendations:

Firstly, Conclusions:

1- The results show that the roots of financial shocks lie in political, social, and economic events that led to the deterioration of banks' performance and the variability of their indicators.

2- The results shed light on the importance of risk disclosure and its primary role in risk management in banks as a means of predicting financial and economic conditions and mitigating their effects.

3- The Iraqi Al-Ahli Bank is one of the most affected banks by financial shocks, while the Kurdistan Bank is the least affected.

4- The Iraqi Al-Ahli Bank is the most affected bank in the study sample by systemic risks, while the Kurdistan Bank is the least affected.

5- The standard analysis results showed that the determination coefficient (R2) reached (58%), meaning that (58%) of the changes in the general index of the Iraqi Stock Exchange were caused by the banking sector's return, while (42%) were variables not included in the standard model.

6- Through the ARDL model, it was found that there is no significant effect of the independent variable (banking sector return) on the dependent variable (general index of the Iraqi stock market).

7- The study proves the hypothesis that there is no predictive ability of systemic risk measures to predict future financial shocks in a group of banks within the banking sector in the Iraqi stock market.

Secondly: Recommendations:

Based on the researcher's findings, this study recommends the following:

1- Banks should comply with all liquidity and capital regulations and use a policy compatible with disposing of non-performing debts and reducing risks.

2- Banks should improve their capital levels and direct them towards more efficient models for generating profit, as good capitalization helps increase their financial soundness and profitability during times of contraction.

3- Due to the increase in uncertainty in financial markets and the economy, it is necessary to work on removing items that involve budgetary risk by disposing of some non-core businesses.

4- The need for more adaptable business models to ensure profitability in a changing operating environment, particularly as regulatory changes will be important in affecting different components of profits, liquidity, leverage, and capital.

5- Relevant entities such as the central bank, ministry of finance, and others should take into consideration financial shock indicators, followed by early warning indicators for systemic risks to the financial system in general and thus the economic system.

6- Emphasis on the overall and partial impacts of financial risks and shocks, direct and indirect links that have an impact over time on prices, which can reduce risks and shocks.

7- Emphasis on potential fruitful ways of future research and combining models that combine market features with non-homogeneous banks that include variable price signals and closely related financial frictions for better understanding and achievement of price behavior.

8- The necessity to urge researchers, management, and investors to study beta and financial leverage and their interaction through the multiple regression model using time series.

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