The Approach to Vector Autoregression Analysis In Explaining Financial Inclusion Relationship to Financial System Stability In Emerging Market Countries

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Abstract: *The research aims to determine if financial inclusion through the Bank Z-score and Non-Performing Loan (NPL) lines can control the stability of financial systems in the Emerging Market state in both the short, the long and the longer term. The data analysis technique used is a vector autoregression (VAR) approach, with samples used by 5 countries, namely Brazil, Russia, India, China and Indonesia, the period from 2000 to 2017. Data used are GDP Percapita (GDPP), private credit ratio of deposits of banks and other financial institutions against GDP (CGDP), a ratio of current assets to deposits and short-term financing (LIQ), Non-FDI Capital Flow against GDP (NFDI), Bank Z-Score, and Non-Performing Loan (%). The results showed that financial inclusion through the Bank's Z-score line was able to control the stability of the financial system in the Emerging Market state in both the short-term, the long and the longer. Financial inclusion through the Non-Performing Loan (NPL) line can control the stability of financial systems in the Emerging Market in both the short-term, middle, and the long-term.*
Keywords: *Bank Z-Score, NPL, Financial system stability, Emerging Market*


I. Introduction

Financial inclusion has become an important agenda at the national and international level because there are 2.6 billion people or more than 50% of the world population has no access to credit, insurance, and savings. The Agenda of financial inclusion is expected to encourage inclusive growth in many countries. This is because increasing financial inclusion can increase the base of savings and improve financing for the community to facilitate the banking intermediation function and improve performance in the real sector. This will reduce the poverty rate, increase revenue equality, and improve financial system stability so that the growth is achieved by the whole community (Khan 2011). At the international level, financial inclusion has become a global agenda discussed in international forums such as the Group of Twenty (G20), Organization for Economic Co-operation and Development (OECD), Alliance for Financial Inclusion (AFI), Asia Pacific Economic Cooperation (APEC), and the Association of Southeast Asian Nations (ASEAN). The application has also been conducted by various in countries both high-income countries, upper-middle income countries, lower-middle income Countries, and low income Countries.

The research on the impact of financial inclusion on financial system stability is carried out by Dienillah (2016) for seven Asian countries the result that financial inclusion can improve financial system stability. Besides, research conducted by Cull (2012) gained that increased diversification of bank deposits can be achieved by improving access as well as public use of bank deposits which means increased financial inclusion. By increasing the diversification of assets from different circles of the community will increase the resilience of the financial system from a shock that means increased stability of the financial system. This is because the customer with a relatively high deposit value will be more quickly withdraw money from the banking when there is a crisis than the customer with a relatively low deposit value (Huang, 2011). Therefore diversification into society with low deposit value can improve financial system stability.

With the opportunity to increase financial system stability because of the diversification by low-income customers, the low and middle-income countries have the opportunity of good financial system stability if it has the inclusion of high-income countries. But according to Allen's research (2012), financial inclusion in middle- and low-income countries is less than good than financial inclusion in high-income countries. . Then based on research conducted by Dupas (2012) in Kenya, increased financial inclusion did not cause an increase in the stability of the financial system in such low-income countries. Moreover, according to Khan (2011), increased financial inclusion in the majority of countries is a middle-income country that has the opportunity to improve the stability of the financial system and also have the potential for instability.
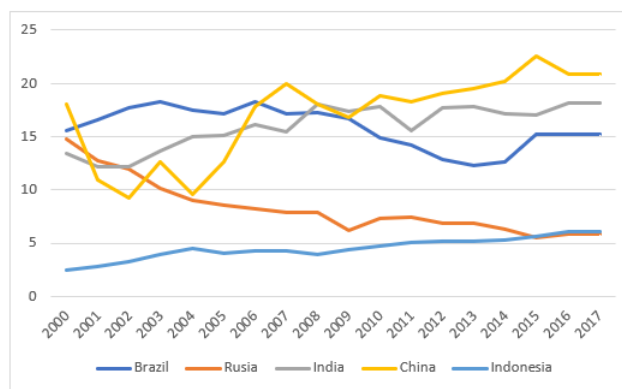
Source: World Bank

Figures 1. Bank Z-Score Emerging Market State, 2000-2017 (%)
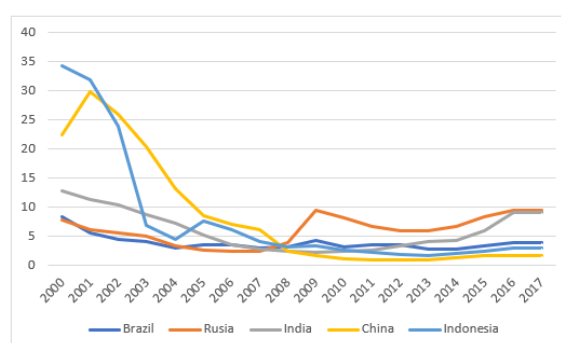
Source: World Bank

Figures 2. Non-Performing Loan (NPL) Emerging Market State, 2000-2017 (%)

Based on Figure 1 above, it can be noted that there is a bank fluctuation of Z-score in the Emerging Market from 2000 to 2017, where the highest Z-score bank in China and the lowest in the country in India. For the NPL (Non-performing Loan) the country of China and Indonesia had experienced considerable improvement in the year 2000s. But from 2006 to 2017 it has begun to stabilize in all emerging market countries.

This research is important to see the impact of financial inclusion on financial system stability at every income level between countries. Financial system stability based on the indicator of Bank Z score (BZS) and NPL. The Bank's Z score is a score or index that is used to predict and assess the probability of bankruptcy of a company in the future. While the NPL is a value that indicates the situation where the customer has not been able to pay part or all of its obligations to the Bank on the loan done as has been promised.

II. Literature Review

1. Financial Inclusion

The term financial inclusion to be the trend of post-crisis 2008 is primarily based on crisis impact to the generally unbanked group at the bottom of the pyramid which is very high recorded outside the developed world. Although they belong to the bottom of the pyramid and have no reliable savings between them still have unproductive moving objects that are used daily such as a ring or necklace that can be spent and used for such as for the capital of non-formal micro-enterprises or farming and livestock

Financial inclusion is a form of everyone's right to have full access and service from the financial institution in a timely, convenient, informative and affordable manner. Financial inclusion is a situation where the majority of individuals can utilize the available financial services as well as minimize the presence of a group of individuals who have not yet been aware of the benefits of financial access through access that is available without the cost High. According to Dixit (2013), Financial inclusion is a comprehensive activity aimed at eliminating all forms of barriers both in the form of price and non-price to public access in using or utilizing services Financial.

Otoritas Jasa Keuangan (OJK) defines financial inclusive as any effort aimed at eliminating any form of price and non-price barrier to public access in utilizing financial services so that it can provide significant benefits to the improvement of living standards of society, especially for areas with difficult-to-reach geographical regions and conditions or border areas (www.ojk.go.id).

Sarma (2012) says financial inclusion promotes savings and develops the culture of saving, improving access to credit, both entrepreneurship and consumption and also enabling efficient payment mechanisms, thereby strengthening the source base Financial institutions capable of providing economic benefits as resources and the availability of efficient and allocative payment mechanisms. Empirical evidence suggests that countries with a large population, do not have extensive access to the formal sector of financial institutions and also show higher ratios of poverty and higher inequality. Thus, today's financial inclusion is not an option, but being a necessity and banking is a key driver for its implementation.

2. Financial System Stability

According to Albulescu (2010), financial system stability (SSK) is a stable financial system that can allocate funding sources and absorb shocks that occur to prevent disruption to real sector activities and financial systems. The stable financial system is a strong financial system and resistant to various economic disruptions so that it still able to perform intermediation function, implement payment and spread risk well. Financial system stability is a condition where economic mechanisms in pricing, fund allocation, and risk management work well and support economic growth.

Financial system stability Indicators according to Albulescu (2010) is:
1) Bank Z score
   The Bank's Z score is a score or index that is used to predict and assess the probability of bankruptcy of a company in the future.
2) Non-performing loan (NPL)
   A non-performing loan is a value that indicates the situation where the customer is not able to pay part or all of its obligations to the Bank on the loan that is done as promised.

III. Method Of Research

This research is conducted in emerging market countries namely Brazil, Russia, India, China and Indonesia period 2000 – 2017. The analysis model in this study uses the VAR analysis model (Vector Autoregression) to determine whether there is a simultaneous (interconnected) relationship between variables, as an exogenous variable and an endogenous variable by inserting a time element (lag), With the following equation:

$$GDPP_t = \beta_1 GDPP_{t-p} + \beta_2 CGDP_{t-p} + \beta_3 LIQ_{t-p} + \beta_4 NFDI_{t-p} + \beta_5 BZS_{t-p} + \beta_6 NPL_{t-p} + \varepsilon_1$$
$$CGDP_t = \beta_1 CGDP_{t-p} + \beta_2 GDPP_{t-p} + \beta_3 LIQ_{t-p} + \beta_4 NFDI_{t-p} + \beta_5 BZS_{t-p} + \beta_6 NPL_{t-p} + \varepsilon_2$$
$$LIQ_t = \beta_1 LIQ_{t-p} + \beta_2 GDPP_{t-p} + \beta_3 CGDP_{t-p} + \beta_4 NFDI_{t-p} + \beta_5 BZS_{t-p} + \beta_6 NPL_{t-p} + \varepsilon_3$$
$$NFDI_t = \beta_1 NFDI_{t-p} + \beta_2 GDPP_{t-p} + \beta_3 CGDP_{t-p} + \beta_4 LIQ_{t-p} + \beta_5 BZS_{t-p} + \beta_6 NPL_{t-p} + \varepsilon_4$$
$$BZS_t = \beta_1 BZS_{t-p} + \beta_2 GDPP_{t-p} + \beta_3 CGDP_{t-p} + \beta_4 LIQ_{t-p} + \beta_5 NFDI_{t-p} + \beta_6 NPL_{t-p} + \varepsilon_5$$
$$NPL_t = \beta_1 NPL_{t-p} + \beta_2 GDPP_{t-p} + \beta_3 CGDP_{t-p} + \beta_4 LIQ_{t-p} + \beta_5 NFDI_{t-p} + \beta_6 BZS_{t-p} + \varepsilon_6$$

Where:
$GDPP$ = GDP per capita (US $)
$CGDP$ = The ratio of private loans to Bank deposits and other financial institutions against GDP (%)
LIQ = ratio of current assets to deposits and short-term financing (%)
$NFDI$ = Non Foreign Direct Investment Capital Flow against GDP (%)
BZS = Bank Z-score (%)
NPL = Non Performing Loan (%)
ε = Random Disturbance
p = Length of lag

IV. Result And Discussion

Stationary Test

The result of Augmented Dickey-Fuller test is as follows:

Tables 1. ADF Test at Level and First Difference

Variable	Level			First Difference		
	ADF	t-statistic	Prob.	ADF	t-statistic	Prob.
GDPP	-1.7238	-3.5055	0.4159	-9.3373	-3.5064	0.0000
CGDP	-2.3426	-3.5055	0.1611	-9.0441	-3.5064	0.0000
LIQ	-1.7725	-3.5055	0.3918	-10.7680	-3.5064	0.0001
NFDI	-1.8396	-3.5055	0.3593	-9.2783	-3.5064	0.0000
BZS	-2.1061	-3.5055	0.2429	-9.4210	-3.5064	0.0000
NPL	-4.4124	-3.5064	0.0006			

Granger Causality Test
The result of Granger causality test are as follows:

Tables 2. Granger Causality Test

Null Hypothesis:	F-Statistic	Prob.
CGDP does not Granger Cause BZS	0.32927	0.7204
BZS does not Granger Cause CGDP	0.43078	0.6514
GDPP does not Granger Cause BZS	0.31756	0.7288
BZS does not Granger Cause GDPP	0.09249	0.9118
LIQ does not Granger Cause BZS	0.43781	0.6469
BZS does not Granger Cause LIQ	0.65308	0.5231
NFDI does not Granger Cause BZS	1.43765	0.2433
BZS does not Granger Cause NFDI	0.75301	0.4741
NPL does not Granger Cause BZS	1.24177	0.2942
BZS does not Granger Cause NPL	1.25360	0.2908
GDPP does not Granger Cause CGDP	0.66500	0.517
CGDP does not Granger Cause GDPP	0.71436	0.4925
LIQ does not Granger Cause CGDP	0.36488	0.6954
CGDP does not Granger Cause LIQ	1.01621	0.3664
NFDI does not Granger Cause CGDP	0.08331	0.9201
CGDP does not Granger Cause NFDI	0.03279	0.9678
NPL does not Granger Cause CGDP	0.23668	0.7898
CGDP does not Granger Cause NPL	3.96207	0.0227
LIQ does not Granger Cause GDPP	2.83518	0.0644
GDPP does not Granger Cause LIQ	0.66070	0.5192
NFDI does not Granger Cause GDPP	0.44998	0.6392
GDPP does not Granger Cause NFDI	0.17469	0.84
NPL does not Granger Cause GDPP	0.20503	0.815
GDPP does not Granger Cause NPL	0.35983	0.6989
NFDI does not Granger Cause LIQ	0.84331	0.4339
LIQ does not Granger Cause NFDI	0.16815	0.8455
NPL does not Granger Cause LIQ	0.25186	0.7779
LIQ does not Granger Cause NPL	0.73084	0.4846
NPL does not Granger Cause NFDI	0.05288	0.9485
NFDI does not Granger Cause NPL	1.49954	0.2292

Cointegration Test

The results of the Johansen cointegration test are as follows:

Tables 3. Cointegration Test

No. of CE(s)	Eigenvalue	Statistic	Critical Value	Prob.**
None *	0.404332	99.95344	95.75366	0.0249
At most 1	0.229076	54.36307	69.81889	0.4460
At most 2	0.173273	31.46848	47.85613	0.6412
At most 3	0.069692	14.72381	29.79707	0.7977
At most 4	0.059863	8.366719	15.49471	0.4270
At most 5	0.032797	2.934501	3.841466	0.0867
Trace test indicates 1 cointegrating eqn(s) at the 0.05 level				
* denotes rejection of the hypothesis at the 0.05 level				
**MacKinnon-Haug-Michelis (1999) p-values				

VAR Test
The results of the VAR analysis which includes GDPP, CGDP, LIQ, NFDI, BZS and NPL variables are as follows:

Tables 4. VAR Test

Variable	Greatest Contribution 1	Greatest Contribution 2
GDPP	BZS_{t-1} 64,847	LIQ_{t-1} 8,631
CGDP	$GDPP_{t-1}$ 1,984	$CGDP_{t-1}$ 0,988
LIQ	LIQ_{t-1} 0,793	$NFDI_{t-1}$ 0,746
NFDI	$GDPP_{t-1}$ 8,124	$NFDI_{t-1}$ 0,835
BZS	$NFDI_{t-1}$ 1,218	BZS_{t-1} 0,887
NPL	$NFDI_{t-1}$ 2,107	NPL_{t-1} 0,979

VAR Analysis of GDPP
The greatest contribution to GDPP was BZS the previous period and was followed by the tax receipt itself in the previous period. When an increase in GDP per capita of one percent increases the stability of the

financial system. Increasing the GDP per capita will lead to an increase in formal accounts in banking institutions. Upgrading to a formal account will cause an increase in the savings base and improve the intermediate process.

VAR Analysis of CGDP

The greatest contribution to CGDP is GDPP in the previous period and followed by the previous period exchange rate. The private credit ratio variable to GDP has a connection to GDPP. The increase in private credit ratios on GDP by one percent will have an impact on GDPP. When there is an increase in GDP per capita of one percent will increase GDPP.

VAR Analysis of LIQ

The greatest contribution to the LIQ is the LIQ itself in the previous period. Variable asset ratio smoothly against deposits and short-term funding has a positive relationship to financial system stability. When there is an increase in the ratio of current assets to deposits and short-term funding of one percent will increase financial system stability. When an increase in current assets will increase the trust of the customer to the formal financial institution when the shock occurs.

VAR Analysis of NFDI

The greatest contribution to the NFDI is GDPP IN the previous period. THE FDI Flow's non-capital ratio variable to GDP has a positive and negative relationship to financial system stability. Increasing the non-capital ratio of FDI Flow to GDP by one percent will lead to a decline in the NPL. When an increase in non-capital FDI Flow against GDP by one percent lowers the stability of the financial system. This positive relationship is because NFDI can increase bank deposits thereby increasing credit. Besides, NFDI can increase the reserve OF foreign exchange for a country.

VAR Analysis of BZS

The greatest contribution to BZS is NFIN the previous period and followed by THE amount of money circulating in the previous period. The Bank's Z score is a score or index that is used to predict and assess the probability of bankruptcy of a company in the future.

VAR Analysis of the NPL

The greatest contribution to the NPL is the NFIN the previous period and followed by the investment itself IN the previous period. With the opportunity to increase financial system stability because of the diversification by low-income customers, the low and middle-income countries have the opportunity of good financial system stability if it has the inclusion of high-income countries.

Impulse Response Function (IRF) Test
The results of the IRF test for GDPP variables are as follows:

Table 5. IRF Test for GDPP

Variable	Short-Term	Mid-Term	Long-Term
GDPP	+	+	+
CGDP	+	-	+
LIQ	+	+	+
NFDI	+	-	+
BZS	+	+	+
NPL	+	-	+

The results of the IRF test for CGDP variables are as follows:

Tables 6. IRF Test for CGDP

Variable	Short-Term	Mid-Term	Long-Term
GDPP	+	+	-
CGDP	+	+	+
LIQ	+	-	-
NFDI	+	-	+
BZS	+	+	+
NPL	+	+	+

The results of the IRF test for LIQ variables are as follows:

Tables 7. IRF Test for LIQ

Variable	Short-Term	Mid-Term	Long-Term
GDPP	+	+	+
CGDP	-	-	+
LIQ	+	+	+
NFDI	+	+	+
BZS	+	+	+
NPL	+	-	+

The results of the IRF test for NFDI variables are as follows:

Tables 8. IRF Test for NFDI

Variable	Short-Term	Mid-Term	Long-Term
GDPP	-	-	-
CGDP	-	-	-
LIQ	-	-	-
NFDI	+	+	-
BZS	+	-	-
NPL	+	-	-

The results of the IRF test for BZS variables are as follows:

Tables 9. IRF Test for BZS

Variable	Short-Term	Mid-Term	Long-Term
GDPP	+	-	-
CGDP	+	+	+
LIQ	-	-	-
NFDI	+	+	+
BZS	+	+	+
NPL	+	-	-

The results of the IRF test for NPL variables are as follows:

Tables 10. IRF Test for NPL

Variable	Short-Term	Mid-Term	Long-Term
GDPP	-	+	-
CGDP	-	+	-
LIQ	+	-	-
NFDI	-	-	+
BZS	-	-	+
NPL	+	+	-

GDPP Financial Inclusion analysis on financial system stability

When an increase in GDP per capita of one percent increases the stability of the financial system. Increasing the GDP per capita will lead to an increase in formal accounts in banking institutions. Upgrading to a formal account will cause an increase in the savings base and improve the intermediate process.

CGDP Financial Inclusion analysis on financial system stability

The private credit ratio variable to GDP has a positive relationship to financial system stability. The increase of private credit ratios on GDP by one percent will lead to a decline in the NPL. When an increase in GDP per capita of one percent increases the stability of the financial system.

LIQ Financial inclusion analysis on financial system stability

Variable asset ratio smoothly against deposits and short-term funding has a positive relationship to financial system stability. When there is an increase in the ratio of current assets to deposits and short-term funding of one percent will increase financial system stability. When an increase in current assets will increase the trust of the customer to the formal financial institution when the shock occurs.

NFDI financial inclusion analysis on financial system stability

The FDI Flow's non-capital ratio variable to GDP has a positive and negative relationship to financial system stability. Increasing the non-capital ratio of FDI Flow to GDP by one percent will lead to a decline in the

NPL. When an increase in non-capital FDI Flow against GDP by one percent lowers the stability of the financial system. This positive relationship is because NFDI can increase bank deposits thereby increasing credit. Also, NFDI can increase the reserve of foreign exchange for a country.

V. Conclusion

Financial inclusion either through the Bank Z-score line and the Non-performing Loan (NPL) line can control the stability of the financial system in the Emerging market in both the short, medium and long term. For the Government, especially the governments of Brazil, Russia, India, China, and Indonesia should encourage increased GDP Percapita (GDPP), the ratio of private loans from Bank deposits and other financial institutions to GDP (CGDP), the ratio of current assets to Deposits and short-term financing (LIQ) and Non FDI Capital Flow (NFDI) against GDP (NFDI) are due to increase the stability of the financial system of the period and one future period.

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