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Analysis of Financial Stability Determinants in Indonesia

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ABSTRACT

Financial Stress Index (FSI) is one of the indices to measure financial stress which can lead to a financial crisis. Quantitative analysis was conducted to some banking sector performance indicator which impacts financial stability with FSI as a proxy. Data population was taken from banking company listed in Indonesian Stock Exchange, sampling using purposive sampling of 38 banks. Using pooled data regression analysis was founded that NPL, CAR, and ROA positively significant to financial stability, while NIM negative but not significant to financial stability. The research found that NPL and NIM are not in line with the hypothesis. NPL is an indicator for bad debt, which means that increase in NPL will make financial stability vulnerable, but the research shows that an increase in NPL causes financial stability incline to increased, this could have happened if any other factors maintain financial stability tend to increase. On the other hand, NIM is decreasing which means the productivity of banks decreased but financial stability tends to increase because other factors that maintain financial stability tend to increase.

INTRODUCTION

Financial Stability is very important for all countries because it is related to the effectiveness of the market economy function. A stable condition in the financial system becomes mandatory for rational decision making to allocate resources and improve the investment climate for any country (Crockett, 1997).

Andrew D. Crockett (Crockett, 1997) proposed financial stability refers to the smooth functioning of the markets that create the financial system. McFarlane (1999) describes financial stability as avoidance of financial crisis, which financial crisis is a more modern term to describes banking panics, bank runs, and banking collapse. Schinasi (2010) defining financial stability as the ability to facilitate and improve economic processes, risk risks and absorb shocks, financial stability is considered a continuum that may change over time and are consistent with some combination of the constituent elements of finance.

Financial stability is a condition that should be maintained to [1] creates a trustworthy and supportive environment for customers and investors to invest in financial institutions; [2] encouraging efficient financial intermediation; [3] encourage market operations and improve resource allocation in the economy.

Macfarlane (MacFarlane, 1999) and Anwar Nasution (2003) explained that the stability of the financial system depends on five main elements which are interrelated, i.e. [1] Stable macroeconomic environment; [2] Well managed financial institution; [3] Efficient financial market; [4] Sound prudential surveillance framework; [5] Safe and reliable payment system. Financial Crisis will occur because it is triggered by various risks originating from these elements.

Since the 1970s Indonesia has already experienced a lot of financial crises (Hadi Soesastro, 2001; Pangestu & Habir, 2003), but the most impactful crisis are the Asian Financial Crisis of 1997 until 1998 and the Global Financial Crisis within the year 2008 to 2009 (Basri & Rahardja, 2011; Zhuang & Dowling, 2010).

For Indonesia, the financial crisis causes decreasing economic growth, a rise in fiscal cost, and rising unemployment and poverty rates, and significant social costs. The most severe impact was social and political chaotics which was happened within the year 1998 (L. Smith, 2003).

Following the crisis and the contagion evident around the region, The Asian Development Bank (ADB) uses their knowledge to help monitor the financial recovery and report objectively on potential vulnerabilities and policy solutions. Financial Stress Index (FSI) is being used by ADB to monitor the recovery by measuring the degree of financial stress in four financial markets within the Asia Region. Figure 1 shows the Financial Stress Index (FSI) for The Asia Region.

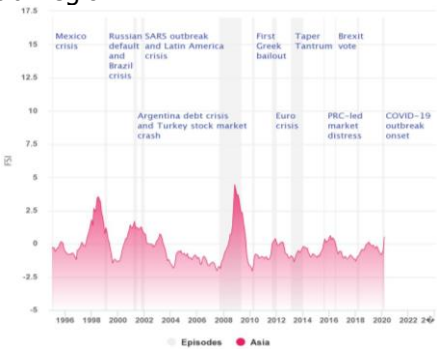

Figure 1. Asia Financial Stress Index
(Source: Asian Development Bank, 2020)

Some policymakers and academic researchers have been focusing on some quantitative measures to measure financial stability. Financial Stress Index (FSI) which was developed by The Asian Development Bank (ADB) measures the degree of financial stress in four financial markets—banks, foreign exchange, equity, bonds. The methodology for computation was developed by Park and Mecardo (2013) which computed using measures for 4 major financial sectors with the equation presented as follows:

$$FSI = \beta + StockReturns + StockVolatility + DebtSpreads + EMPI$$

Where, β is a measure of banking stress which measures the ratio of bank share prices to total share prices given by:

$$\beta = \frac{cov(r,m)}{var(m)}$$

where r is the returns to the banking sector stock price index and m is the overall stock price index. If β is larger than 1, then the banking sector is relatively risky because the volatility of returns on bank shares is greater than the volatility of returns for the overall market. The higher β, the greater the banking sector's stress.

StockReturns is a measure of Equity Market Returns given by:

$$y_t = \ln(y_t) - \ln(y_{t-1})$$

Where y_t is the current period's equity return and $y_{(t-1)}$ is the previous period's equity returns.

Stockvolatility is a measure of Equity Market Volatility which follow GARCH (1,1) process and given by:

$$\sigma_t^2 = \omega + \varphi_1 \varepsilon_{t-1}^2 + \varphi_1 \sigma_{t-1}^2$$

Where σ^2 refers to the variance, and ε the error term in the regression is given by:

$$y_t = \alpha_{i,t} + \beta y_{t-1} + \varepsilon_{i,t}$$

Where y_t is the current period's equity return and $y_{(t-1)}$ is the previous period's equity returns.

EMPI represents a currency crisis which is defined as periods of significant devaluations, losses in foreign exchange reserves, and/or defensive interest rate hikes. The EMPI captures the depreciation of the local currency against US dollar and the reduction in foreign exchange reserves. It is given by:

$$EMPI_{i,t} = \frac{(\Delta e_{i,t} - \mu_{i,\Delta e})}{\sigma_{i,\Delta e}} - \frac{(\Delta RES_{i,t} - \mu_{i,\Delta RES})}{\sigma_{i,\Delta RES}}$$

where Δe and ΔRES denote month-on-month percent changes in the foreign exchange rate of local currency per US dollar and foreign exchange reserves. While σ and μ are standard deviation and mean, respectively.

Non-Performing Loan (NPL) is a measure of the ability of a bank to resist the risk of credit default by debtors (Gunadi, Taruna, & Harun, 2013). From the debtor's point of view, Mudrajad Kuncoro &

Suhardjono (2002) mentioned that NPL is a condition of debtors are unable to pay part or all of their obligations to the bank as committed in the contract. Bank of Indonesia defined NPL as follows:

$$NPL = \frac{BadDebt}{TotalDebt} \times 100\%$$

Capital Adequacy Ratio (CAR) is a Capital ratio to measure the health of a bank which indicates the adequacy of capital owned by the bank (Gunadi et al., 2013). With the increase in its capital, the health of a bank related to the capital ratio is increasing. This indicator reflects the level of bank resilience from the internal side (pressure) as it relates to bank liquidity.

CAR is calculated based on the ratio between the capital owned by the bank and the number of Risk-Weighted Assets (ATMR), where ATMR is the total value of each bank's asset after being multiplied by the respective risk weightings for these assets. Assets that are least risky are assigned a weight of 0% and most risky assets are assigned a weight of 100%.

Steps to calculate Capital Adequacy Ratio (CAR) is described as follows (Dendawijaya, 2009):

a. ATMR of balance sheet assets are calculated by multiplying the nominal value of the respective assets with the risk weight of each item on the balance sheet assets;
b. ATMR of administrative assets are calculated by multiplying the nominal value of the administrative account concerned with the risk weight of each account item;
c. Total ATMR = (ATMR of Balance sheet assets) + (ATMR of administrative assets
d. *The bank capital ratio is calculated by comparing the bank capital (core capital + supplementary capital) and the total ATMR. The ratio can be formulated as follows*

$$CAR = \frac{BankCapital}{Total\ ATMR} \times 100\%$$

Return on Asset (ROA) is a measure of the effectiveness of banking in generating profits by utilizing its assets. The greater the ROA, the better the banking performance (Gunadi et al., 2013). The higher the ROA, the more stable the condition of the banking financial system. ROA is given by:

$$ROA = \frac{Net\ Income}{Average\ Total\ Assets} \times 100\%$$

Net Interest Margin (NIM) is a ratio between net interest income to average earning assets, it measures a bank's ability to earn net interest income compared to the amount of credit delivered. The ratio illustrates the level of the amount of net interest income earned by using the productive assets owned by the bank (Achmad & Kusumo, 2003). Taswan (2009) defines NIM as a ratio that measures a bank's ability to earn net interest income by earning assets placement. NIM is formulated as follow:

$$NIM = \frac{InterestRevenue - InterestExpenses}{Average\ Earning\ Assets}$$

Indrastuti S. et al. (2017) conducted research which results that there are significant changes in bank performances when Global Crisis Economy (GEC) happened in 2008. She examines Operating Expenses to Operating Income, Capital Adequacy Ratio (CAR), Cost of Fund (COF), Gross Profit Margin (GMP), Loan to Deposit Ratio (LDR), Net Interest Margin (NIM) dan Return on Asset (ROA). That is, Operating Expenses to Operating Income, CAR), GMP, LDR, NIM dan ROA was increased after the crisis while COF was decreased.

Ari et al. (2003) and Mubeen & Bashir (2017) was also analyzed another bank performance indicator, i.e. Non-Performing Loan (NPL) which was still high after the GFC until one decade. While Mubeen & Bashir (Mubeen & Bashir, 2017) was also found that ROA was decreased after the GFC.

Previous research was revealed that the financial sector through banks as financial institutions was vulnerable to a crisis that affects financial stability, therefore, surveillance on important parameters of banks performance indicators is needed (Bank Indonesia, 2003; Ghesquiere, McAfee, & Burnett, 2019).

This article aimed to analyze the effect of Non-Performing Loan (NPL), Capital Adequacy Ratio (CAR), Return on Asset (ROA), and Net Interest Margin (NIM) of banks on Financial Stability proxied by Financial Stress Index (FSI) in Indonesia.

METODE

This research used a quantitative research approach, where the theoretical framework, ideas from experts, and understanding from the researcher are developed based on previous research. Analysis of data using pooled data analysis.

Secondary data was taken from The Asian Development Bank and published financial report derived from the Indonesian Stock Exchange from the second semester of 2015 until the second semester of 2019 (semi-annual) of 38 listed banks in the Indonesian Stock Exchange. The framework for this research is shown in Figure 2.

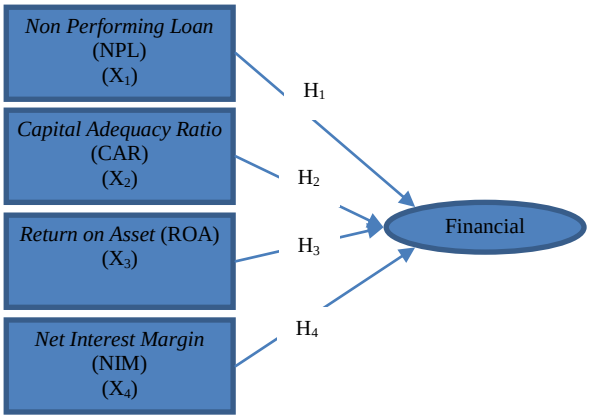

Figure 2. Research Framework

The analysis was performed using Pooled Data Regression which is a combination between cross-section data and time-series data with *Performing Loan* (NPL), *Capital Adequacy Ratio* (CAR), *Return on Asset* (ROA), and *Net Interest Margin* (NIM) as independent variable and Financial Stress Index (FSI) as a dependent variable.

The research model in this paper was derived from the pooled data regression analysis which is choosing between *Common Effect Model* (CEM), *Fixed Effect Model* (FEM), or *Random Effect Model* (REM) which represents the best model for the analysis. The common equation of pooled data analysis is given by:

$$FSI_{it} = \alpha + \beta_1 NPL_{it} + \beta_2 CAR_{it} + \beta_3 ROA_{it} + \beta_4 NIM_{it} + e_{it}$$

Where α is a constant, t is period, i is the entity of independent variable, and e is variable from outside of the model.

RESULTS AND DISCUSSION

Pooled data regression estimation in this researched aimed to predict regression model parameters including constant (α) and regression coefficient (β). Widarjono (2007) explained that a pooled data estimation model performed using the approach of three models, i.e. Common Effect Model / Pooled Least Square (PLS), Fixed Effect Model (FE) dan Random Effect Model (RE).

Common Effect Model / Pooled Least Square (PLS)

Common Effect Model (CEM) / Pooled Least Square (PLS) is the simplest pooled data model that combines time series and cross-section without considering the time and individual dimensions. This model uses The Ordinary Least Square (OLS) approach or the least square technique to estimates the panel data model.

The form of panel data regression equation is given by:

$$FSI = \alpha + \beta_1 NPL_{it} + \beta_2 CAR_{it} + \beta_3 ROA_{it} + \beta_4 NIM_{it} + e_{it}$$

Where α is a constant, β is the regressor, and e is the error. The index i and t are company index and period, respectively.

Table 1. Common Effect Model Estimation

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	4.792065	1.327634	3.609476	0.0004
NPL	2.956969	1.169328	2.528776	0.0119
CAR	0.565149	0.211001	2.678420	0.0078
ROA	-2.972100	1.292923	-2.298745	0.0221
NIM	-1.836032	1.313827	-1.397469	0.1632

Fixed Effect Model (FE)

Fixed Effect Model (FE) assumes that differences between individuals can be accommodated from different intercepts. When estimating, the Fixed Effects model panel data using a dummy variable technique to capture the differences between intercept companies, different intercepts can occur due to differences in NPL, CAR, ROA, and NIM.

Table 2. Fixed Effect Model Estimation

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	7.454446	1.813911	4.109599	0.0001
NPL	6.142568	1.668505	3.681481	0.0003
CAR	1.146135	0.313614	3.654606	0.0003
ROA	-5.654533	1.776543	-3.182886	0.0016
NIM	-4.500321	3.526077	-1.276297	0.2028

The form of panel data regression equation is given by:

$$FSI = \alpha_i + \beta_1 NPL_{it} + \beta_2 CAR_{it} + \beta_3 ROA_{it} + \beta_4 NIM_{it} + e_{it}$$

Where α is a constant, β is the regressor, and e is the error. The index i and t are company index and period, respectively.

Random Effect Model (RE)

Random Effect Model (RE) will estimate panel data where interference variables may be interconnected between time and between individuals. The differences between intercepts are accommodated by the error terms of each company. The advantage of using the model is to eliminate heteroskedasticity.

The form of panel data regression equation is given by:

$$FSI = c + \beta_1 NPL_{it} + \beta_2 CAR_{it} + \beta_3 ROA_{it} + \beta_4 NIM_{it} + w_{it}$$

Where $w_{it} = u_i + e_{it}$, u and e are individual error and combination error between time series and cross-section respectively.

Table 3. Random Effect Model Estimation

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	4.792065	1.382114	3.467200	0.0006
NPL	2.956969	1.217312	2.429098	0.0157
CAR	0.565149	0.219659	2.572844	0.0105
ROA	-2.972100	1.345978	-2.208134	0.0279
NIM	-1.836032	1.367740	-1.342384	0.1804

Chow Test

Chow Test is a test to determine the model of whether Common Effect (CE) or Fixed Effect (FE) is most appropriately used in estimating panel data. The test was applied to The Fixed Effect Model. The hypothesis of the test as follows:

H_0 : has the same intercept, choose Common Effect Model (p>0.05)

H_1 : has different intercept, choose Fixed Effect Model (p<0.05)

Table 4. Chow Test Result

Effects Test	Statistic	d.f.	Prob.
Cross-section F	0.296115	(37,300)	1.0000
Cross-section Chi-square	12.26747	37	1.0000

Table 4 shows the result of the Chow Test where the probability of cross-section F is 1.0000 which is more than 0.05 (>0.05) which means that H_0 is accepted, thus The Common Effect Model is selected as the best model. According to the result, the next test shall perform is Lagrange Multiplier Test.

Lagrange Multiplier Test

Lagrange Multiplier (LM) test is a test to determine whether the Common Effect model is better than Common Effect (PLS) method used. The test was applied to The Common Effect Model using the hypothesis as follows:

H_0 : there is no random effect, choose Common Effect Model (p>0.05)

H_1 : there is a random effect, choose Random Effect Model (p<0.05)

Error! Reference source not found. shows the result of the LM Test where the probability for both of cross-section and period is 0.0000 which is less than 0.05 (<0.05) which means that H_0 is rejected, thus The Random Effect Model is selected as the best model.

Table 5. Lagrange Multiplier (LM) Test Result

Null (no rand. effect) Alternative	Cross-section One-sided	Period One-sided	Both
Breusch-Pagan	15.38333 (0.0001)	5950.034 (0.0000)	5965.418 (0.0000)
Honda	-3.922159 (1.0000)	77.13647 (0.0000)	51.77033 (0.0000)
King-Wu	-3.922159 (1.0000)	77.13647 (0.0000)	68.29090 (0.0000)
GHM	-- --	-- --	5950.034 (0.0000)

Multicollinearity Test

A multicollinearity test is performed to examines any correlation between the independent variables because in a good panel regression model there should be no correlation between the independent variables (Ghozali, 2006).

Table 6. Correlation Matrix between independent variables

	NPL	CAR	ROA	NIM
NPL	1.000000	-0.104272	**0.636115**	-0.250144
CAR	-0.104272	1.000000	0.130568	0.108191
ROA	**0.636115**	0.130568	1.000000	-0.494455
NIM	-0.250144	0.108191	-0.494455	1.000000

Table 7. Variance Inflation Factor (VIF) test

Variable	Coefficient Variance	Uncentered VIF	Centered VIF
C	1.910238	4080.639	NA
NPL	1.481847	5.770283	1.829493
CAR	0.048250	5.978111	1.143847
ROA	1.811657	4129.118	2.362596
NIM	1.870712	11.01922	1.411962

Table 6 and Table 7 show the result of The multicollinearity test. Table 6 shows that the maximum value of the correlation matrix is

0.636115 which is less than 10 indicate that there is no significant multicollinearity within the independent variables. While in Table 7 shows that Centered VIF values are less than 10, which means that there is no multicollinearity within the independent variables.

Table 8. Coefficient of determination (R^2)

Weighted Statistics			
R-squared	0.031874	Mean dependent var	1.859678
Adjusted R-squared	0.020382	S.D. dependent var	0.388328
S.E. of regression	0.384350	Sum squared resid	49.78343
F-statistic	2.773759	Durbin-Watson stat	0.976984
Prob(F-statistic)	0.027148		
Unweighted Statistics			
R-squared	0.031874	Mean dependent var	1.859678
Sum squared resid	49.78343	Durbin-Watson stat	0.976984

Coefficient of determination (R^2)

Variance in the dependent variable caused by the independent variable must be analyzed. This paper is using Adjusted R-square for analysis because more than one independent variable is involved.Table **8** shows the Coefficient of determination (R^2) of the model, which is 0.020382 or 2.0382% which means that independent variables explain the dependent variable about 2.0382%, while the rest is caused by another variable outside the model.

F-Test

F-Test performs to evaluate the significance of all independent altogether of the regression model. The hypothesis of this test as follows:

H_0 : $\beta_1 = \beta_2 = \beta_3 = \beta_4 = 0$, independent variables together have no effect on the dependent variable

H_1 : $\beta_1 \neq \beta_2 \neq \beta_3 \neq \beta_4 \neq 0$, independent variables together affect the dependent variableTable **8** shows the result of Prob.(F-Statistic) equal to 0.027148 or 2.7148 (<0,05) which means that H_0 is rejected, thus the independent variables altogether affect the dependent variable.

t-Test

A *t-test* was conducted to examine the significance of the independent variables toward the dependent variable individually.

Table 9 shows that the independent variable NPL, CAR, and ROA have probability 0.0157, 0.0105, 0.0279 respectively which are less than 0.05 (>0.05), which means that NPL, CAR, and ROA affect FSI significantly. On the other hand, NIM has a probability of 0.1804 which is more than 0.05 (>0.05) which means that NIM not affecting the dependent variable.

Table 9. *t-test*

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	4.792065	1.382114	3.467200	0.0006
NPL	2.956969	1.217312	2.429098	0.0157
CAR	0.565149	0.219659	2.572844	0.0105
ROA	-2.972100	1.345978	-2.208134	0.0279
NIM	-1.836032	1.367740	-1.342384	0.1804

Analysis

The analysis in this paper gives some result as follows:

a. Non-Performing Loan (NPL) is significantly positive affecting the Financial Stress Index (FSI), which means that any increases in NPL will reduce financial stability.
b. Capital Adequacy Ratio (CAR) is significantly positive affecting the Financial Stress Index (FSI), which means that any increases in CAR will reduce financial stability.
c. Return on Asset (ROA) is significantly positive affecting the Financial Stress Index (FSI), which means that any increases in CAR will also increase financial stability.
d. Net Interest Margin (NIM) does not significantly affect the Financial Stress Index (FSI) which means that any changes within NIM will not affect financial stability significantly.

CONCLUSION

Financial Stress Index (FSI) is an index that has been used by The Asian Development Bank (ADB) to measures the degree of financial stress in four financial markets—banks, foreign exchange, equity, bonds all Asian countries. The index is representing the financial stability condition of all countries within the Asian region. In the banking market, performance indicators i.e. Non-Performing Loan (NPL), Capital Adequacy Ratio (CAR), Return on Asset (ROA), and Net Interest Margin (NIM)

examined in this paper for their relation with the Financial Stress Index (FSI) as a proxy of financial stability.

Non-Performing Loan (NPL), Capital Adequacy Ratio (CAR), Return on Asset (ROA), and Net Interest Margin (NIM) are altogether affecting Financial Stress Index (FSI) which represents financial stability. The analysis result shows that Non-Performing Loan (NPL), Capital Adequacy Ratio (CAR), Return on Asset (ROA) are significantly affecting Financial Stress Index (FSI) which means that any changes in NPL, CAR, and ROA will be affecting financial stability, on the other hand, the Net Interest Margin (NIM) not affecting financial stability. NPL, CAR, and ROA are significantly positive affecting financial stability while NIM is negatively affecting financial stability.

This paper concluded that NPL, CAR, and ROA can be used as variables that affect financial stability, which implies that the indicators must be controlled and managed by financial institutions to prevent financial instability.

The research implies that some banking performance indicators can be used as an early warning indicator for financial stability from the banking sector. All countries can use their banking sector performance indicators to detect financial stress which may cause vulnerability in financial stability.

This paper has limited independent variables involved for analysis which was derived from the banking sector. In the context of financial stability, there are lots of performance indicators of the banking sector that can be involved which may cause financial stability vulnerability. Further research can be conducted using another banking performance indicator.

Financial Stress Index (FSI) is an index developed by The Asian Development Bank (ADB). Since 1997, financial stability had become a concern for many countries in the world, thus many indicators or indices were developed, therefore those indicators or indices can be compared to each other to examine the best indicator or index that could be used for a country.

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