International Journal of Scientific Research in Science, Engineering and Technology (www.ijsrset.com)
© 2020 IJSRSET | Volume 7 | Issue 2 | Print ISSN: 2395-1990 | Online ISSN : 2394-4099
DOI : https://doi.org/10.32628/IJSRSET2072123

Financial Stress and Economic Activity Analysis in Indonesia

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ABSTRACT

Financial Stress marks the beginning of a crisis and may occur in all countries. This period is certainly unanticipated as it may disrupt a country's financial and monetary stability. An unstable financial system tends to be vulnerable to various stresses and may also hinder the transmission of monetary policy to function normally, thus resulting in ineffective monetary policy. This study aims to analyze financial and monetary stability in Indonesia using time series monthly data from January 1996 to January 2018. We used Vector Autoregressive (VAR) model. Our estimates suggest that the response of consumer price index to financial stress index takes longer to stabilize. This also applies to consumer price index response to consumer price index.

Keywords: Financial Stress, Economic, Vector Autoregressive (VAR)

I. INTRODUCTION

The financial sector is part of the economy which is a group of service industry companies consisting of the bank's financial sub-sector and the non-bank financial sub-sector. The financial sector has an important role in maintaining financial stability and spurring the economic growth of a country both in the bank financial sub-sector and the non-bank financial sub-sector. Those roles can be in the form of accumulation of capital, savings, and investment that lead to accelerating economic growth. Within the scope of macroeconomic policies, financial sector stability is closely related to monetary stability, where the shock is experienced by the financial sector also affects the effectiveness of monetary stability. This happened to Indonesia and several other countries in 1997 in the Asian financial crisis.

The 1997 Asian financial crisis caused several countries to experience large enough shocks to reach the monetary crisis. Figure 1 shows the increase in interest rate in Indonesia in 1997 and 1998. The interest rate in Indonesia reached the highest in July 1998, that was one of the reasons why Indonesia liquidated 16 banks. That makes Indonesia fell into a monetary crisis and political disruption. Besides the banking sector, at that time the capital market in Indonesia was also affected when the Jakarta Composite Index decreased by about 35 percent. Figure 2 shows the Jakarta Composite Index decreased from 426 to 270 in August 1998. In October 2008 Jakarta Composite Index decrease from 2304 to 1241. After the 1997 and 1998 Asian financial crisis, the crisis occurred again in 2008. The global financial crisis of 2007-2009 showed that stress events in the financial sector can have severe adverse consequences for real economic activity (Monin, 2019).

Source: International Financial Statistic IMF, 2019

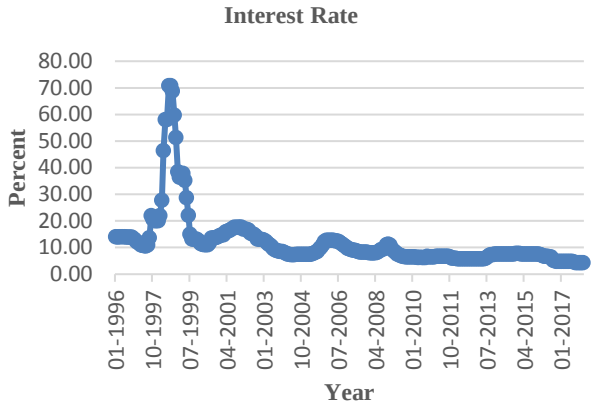

Figure 1. Interest Rate Indonesia

Kaminsky and Reinhart's (1999) research showed the link between the financial crisis and the economic crisis. The financial crisis usually preceded by a problem in the banking sector which then causes a currency crisis. The currency crisis deepens the crisis in the banking sector in the form of a kind of vicious cycle in the economy. The anatomy of these episodes showed that the crisis occurred when the economy entered a recession, following an explosion of prolonged economic activity driven by credit, capital inflows, and accompanied by currencies that were overvalued. This showed that the financial sub-sector of banks and capital markets has an important influence on monetary stability.

Source: Bloomberg, 2019

Figure 2. Jakarta Composite Index

Financial stress is a condition of financial pressure that can cause an individual, company, and government to experience a disruption in the financial intermediation function (Balakrishnan et al 2009). A stable financial system is certainly able to allocate sources of funds and absorbs shocks that occur to prevent disruption to the activities of the real sector and financial system. Furthermore, it can be strong and survive economic disruption. The use of an aggregate Financial Stress Index (FSI) contributes to a better understanding of financial stability (Apostolakis, 2016). FSI in this paper construct following Park and Mercado 2014.

The link between financial stress and macroeconomics has been extensively studied before, including Hubrich et al (2013) who used the time-varying Panel Vector Autoregressive model to analyze the transmission of financial stress to real variables in the European region, Park and Mercado (2014) who used the structural Vector Autoregressive model (SVAR) to investigate interdependencies between financial stress indices in all emerging market economies (EME). Apostolakis (2016) used a Vector Autoregressive (VAR) model to examines financial stress spillovers in five Asian countries.

The history of Indonesia which was affected by the Asian economic crisis in 1997 and 1998 and the global economic crisis in 2008 makes this paper focus to create an indicator that is particularly adjusted for the case of Indonesia and with its help to precisely identify the periods of financial distress. The rest of the paper is organized as follows: Section II presents methods and material. Section III provides the results and discussion. Finally, section IV delivers a conclusion.

II. METHODS AND MATERIAL

The type of data used in this study is monthly time series data from January 1996 to January 2018. The

object of this research in Indonesia. Variables in this study are Financial Stress Index (FSI) Consumer Price Index (LNCPI), and Interest Rate (IR). The data in this study were obtained from various sources, including the ASEAN Development Bank (ADB), International Financial Statistics (IFS), Bloomberg, and CEIC Data. Data analysis methods used to support and answer the objectives of this study is Vector Autoregressive (VAR). The advantages of using VAR are its simple estimation and implementation often leading to better results than theory-based systems of simultaneous equations (Malega, 2015).

The Vector Autoregressive (VAR) model was introduced by Christopher Sims in 1980. The model used in this study was adopted from research conducted by Malega (2015) to analyze financial and monetary stability in Indonesia. The specification includes 3 variables: Financial Stress Index (FSI) Consumer Price Index (LNCPI), and Interest Rate (IR). The general VAR specification is:

$$y_t = \alpha_0 + \beta_1 y_{t-1} + \beta_2 y_{t-2} + \beta_3 y_{t-3} + \cdots \beta_p y_{t-p} + \varepsilon_t$$

where:

y_t	= endogenous variable in period t
α_0	= a constatnt
p	= stands for number of lags
$\beta_p y_{t-p}$	= is the matrix of coefficients to be estimated
ε_t	= error term

One of the advantages of VAR specifications is that it allows for the computation of Impulse Response Functions (IRF), i.e. functions of the response of any endogenous variables to one standard deviation shock in any other endogenous variable in the system (Rad, 2011). We use Impulse Response Functions (IRF) to complete the analysis of the system. Our financial stress index serves as a proxy for financial stress and to describe monetary stability we used the following variables consumer price index and interest rates.

III.RESULTS AND DISCUSSION

A. Stationarity

The first step of the time series analysis is to investigate the properties of the series individually. Identifying the time series properties of the model variables enables the researchers to avoid the problem of spurious estimates (Rad, 2011). We used Augmented Dickey-Fuller (1979) test to check the order of integration of model variables. The test results are shown in Table I. The absolute value of the Augmented Dickey-Fuller test (ADF)/t-ADF for all variables is greater than the absolute value of the MacKinnon Critical Values, the data is considered stationary at the level I(0).

TABLE I. STATIONERY TEST

	None	Constant	Constant & Trend	Trend
FSI	-1,615*	-2,572*	-3,136*	-3,567*
LNCPI	-1,616	-2,572*	-3,137	-3,567
IR	-1,615*	-2,572*	-3,136*	-3,567*

Note: *stationary level at 10%

This finding is consistent with Gujarati (2004) that time series data must be stationary. The variable that has the most significant value is FSI INA where FSI INA is Stationary with none, constant, constant & trend criteria and Trend.

B. VAR Stability

VAR stability test calculates the roots of polynomial functions. VAR model is considered stable if all of the modulus values are less than 1 so that the IRF analysis is considered valid (Firdaus 2011). Table II demonstrated the modulus values of the model. All of the modulus values were less than 1.

TABLE II. VAR STABILITY TEST

Root	Modulus
0.9916	0.9916
0.8075 - 0.1613	0.8235
0.8075 + 0.1613	0.8235
0.8002	0.8002
0.2131 - 0.4983	0.5420
0.2131 + 0.4983	0.5420
-0.2263 - 0.3971	0.4570
-0.2263 + 0.3971	0.4570
-0.2520	0.2520

VAR stability test results are at the modulus value in the unit circle between -0.2520-0.9916. Based on these results, it can be concluded that VAR is stable. These results are consistent with Meilila (2019) which shows that if the modulus is smaller than one, the VAR model is stable so that the resulting IRF analysis is valid.

C. Optimal Lag

The selection of lag to VAR model is a very important step. the optimal lag is useful to eliminate the problem of autocorrelation in a VAR system (Firdaus, 2011). The optimal lag length was derived according to the following tests. The lag length test is using Akaike Information Criterion (AIC), Schwarz Bayesian Criterion (SC), Hannan-Quinn Criterion (HQ).

TABLE III. OPTIMAL LAG TEST

Lag	SC
0	12.1661
1	1.5505
2	0.9707
3	0.8526*
4	0.9422
5	0.9116
6	0.8735
7	0.9687
8	1.0588

The lag order of the VAR model is selected based on the Schwarz Bayesian Criterion (SC) criteria. The optimal lag test results are shown in Table III, the order of VAR was in lag three, with value 0,8526.

A. Impulse Response Function

Dynamic behavior in the VAR model can be seen by using the Impulse Response Function (IRF) which works by looking at how endogenous variables react to a shock in the variable itself or other endogenous variables (Zahrotunnisa, 2015). The results of impulse response from VAR modeling are measured by 1-standard deviation.

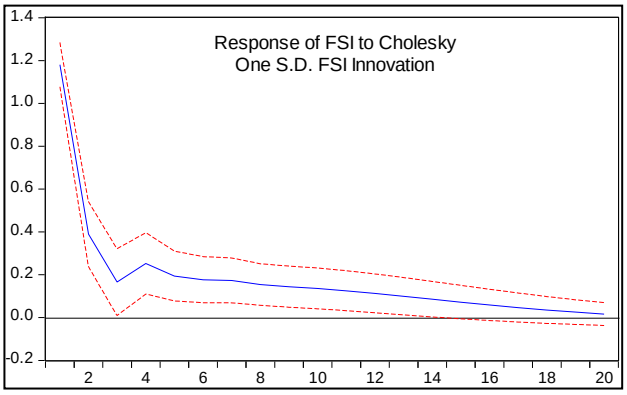

Figure 3. Impulse response of FSI to FSI

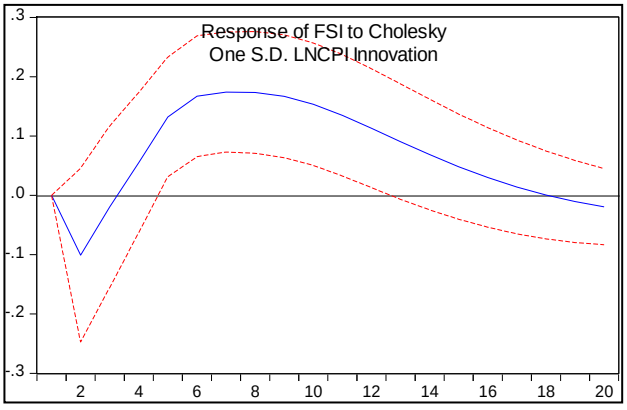

Figure 4. Impulse response of FSI to LNCPI

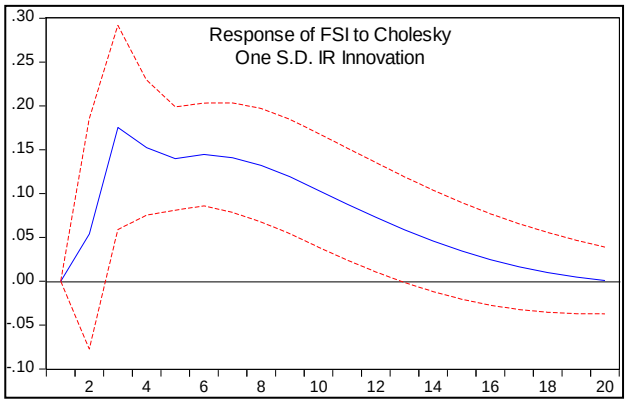

Figure 5. Impulse response of FSI to IR

Figure 3,4,5 shows impulse responses function of financial stress index to financial stress index, consumer price index, and interest rate. We observed effects during 20 months period (on a horizontal axis). The Vertical axis describes responses in units of the dependent variable. Response of FSI to FSI in figure 3 shows how a positive shock of one standard deviation in FSI affects its behavior in the long term. It takes approximately one year to recover after a positive shock of one standard deviation is applied.

Figure 4 shows the response of FSI to LNCPI went decline in period 2 then the response went upward to the positive direction in the fourth period but eventually dragged down in the eighteen period. Our findings are also following with results of Malega (2015), where he claims that price stability is an important factor for financial stability and therefore the elevated level of inflation affects FSI positively. It reached the stability stage in the nineteen period. Figure 5 shows the response of FSI to IR went upward until third period then a gradual decrease in six periods. It reached the stability stage in the tenth nineteen period. Figure 4 and 5 takes approximately nineteen months to recover after a positive shock of one standard deviation is applied.

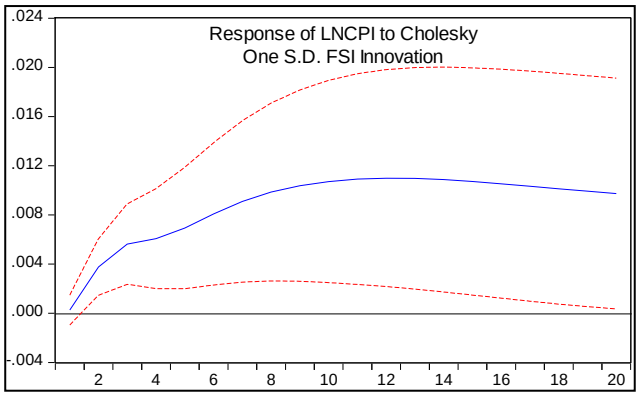

Figure 6. Impulse response of LNCPI to FSI

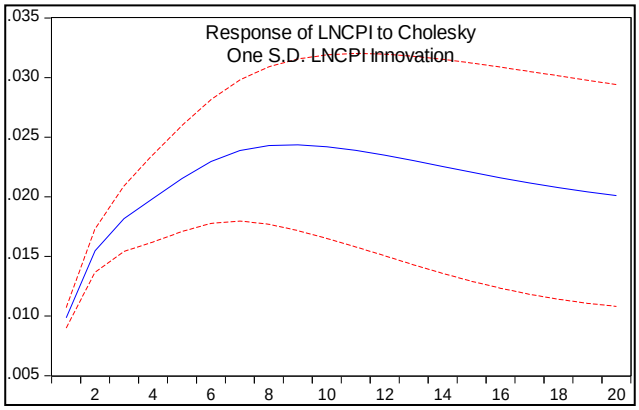

Figure 7. Impulse response of LNCPI to LNCPI

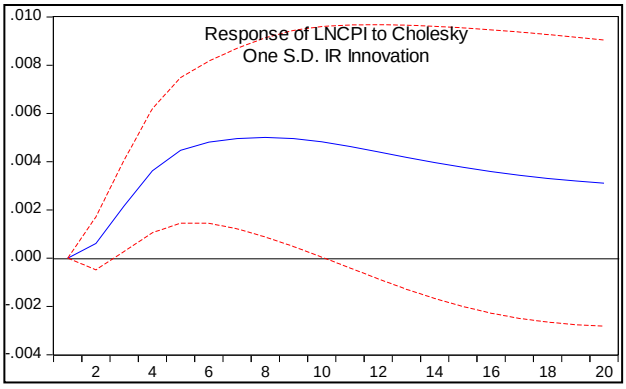

Figure 8. Impulse response of LNCPI to IR

Figure 6,7,8 shows impulse responses function of consumer price index to financial stress index, consumer price index, and interest rate. When comparing figures 6,7 and 8, we observe almost the same results regarding the shape and timing. Figure 7 shows the first plot is gradually increase consumer price index when shocked by itself. Response LNCPI

to FSI in figure 6 and response LNCPI to IR in figure 8 also showing a gradual increase in two periods. The high interest rates in 1998 could effectively reduce the money supply but increase lending rates in the real sector. In 20 months the response in figures 6,7 and 8 starts heading recover and stable. But it takes more than 20 months.

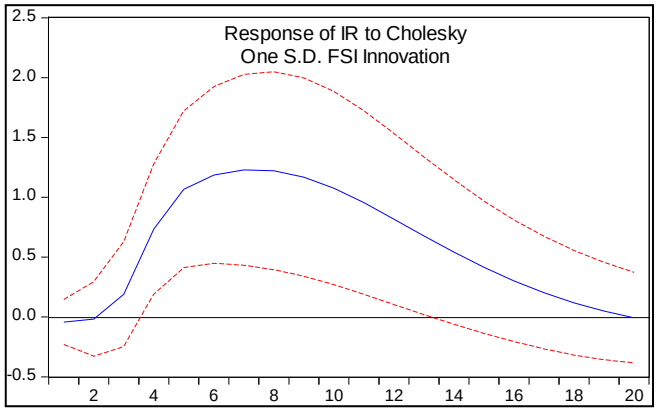

Figure 9. Impulse response of IR to FSI

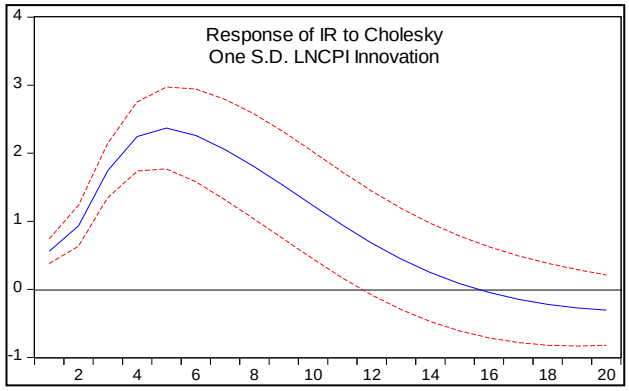

Figure 10. Impulse response of IR to LNCPI

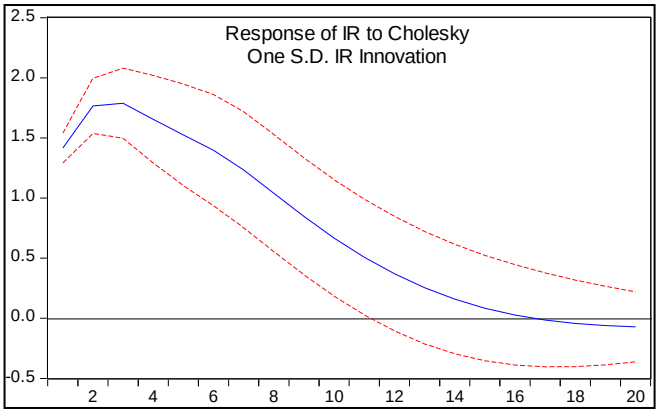

Figure 11. Impulse response of IR to IR

Figure 9,10,11 shows impulse responses function of interest rate to financial stress index, consumer price index and interest rate itself. we observe almost the same results regarding the shape and timing. The first plot shows a gradual increase in interest rate when shocked by itself. Response IR to FSI in figure 9, response IR to LNCPI in figure 10 also shows a gradual increase in two period*s.* The highest inflation ever occurred in Indonesia was 77.63%. This happened during the economic crisis in 1998. In figure 10 and 11 it takes approximately 16 months to recover after a positive shock of one standard deviation is applied. However in figure 9 it takes more time to recover, it takes approximately 20 months to recover after a positive shock of one standard deviation is applied.

IV.CONCLUSION

The recent financial and economic crisis illustrated a strong relationship between financial stress and economic activity. Impulse response analysis confirmed interactions between financial stress and economic activity. Our financial stress index reported episodes of heightened financial stress especially the period of financial recession during 1997-1998. We observed almost the same results regarding the shape and timing. Response of FSI to FSI, LNCPI, and IR takes approximately 18 months to recover after a positive shock of one standard deviation is applied. Response LNCPI to FSI, LNCPI, and IR takes more than 20 months to recover. Response of IR to FSI, LNCPI, and IR takes approximately 16 months to recover after a positive shock of one standard deviation is applied.

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Cite this article as :

Sri Wulan Fatmawati, Iman Sugema, Syamsul Hidayat Pasaribu, "Financial Stress and Economic Activity Analysis in Indonesia", International Journal of Scientific Research in Science, Engineering and Technology (IJSRSET), Online ISSN : 2394-4099, Print ISSN : 2395-1990, Volume 7 Issue 2, pp. 637-643, March-April 2020. Available at doi : https://doi.org/10.32628/IJSRSET2072123
Journal URL : http://ijsrset.com/IJSRSET2072123