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### An Analysis of Mutual Relationship Between the Province of North Sumatra in Indonesia and Singapore Economies'

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**Abstract:** This study aims to determine the effect of Singapore's economy on exports of North Sumatera Province in Indonesia to Singapore and also to determine the impact of North Sumatera's economy to Singapore's real investment in North Sumatera. Furthermore, this research explains the reciprocal relationship between the economy of North Sumatera to that of Singapore. This study uses data time series of 1990 – 2015. The testing tools and analysis used are descriptive statistical analyses, Ordinary Least Square (OLS), the unit root test, cointegration test, Vector Autoregression (VAR), impulse response function, granger causality test. The research results show that Singapore's economy has significant effect on North Sumatera's exports to Singapore and the coefficient is positive. This means that Singapore's economic growth will have impact on the increased North Sumatera's exports to Singapore. Likewise, North Sumatera's economy has significant effect on Singapore's real investment in North Sumatera and the coefficient is positive. This means that North Sumatera's economic growth will have impact on the increased Singapore's real investment in North Sumatera. The results granger analysis show that North Sumatera's economy, when included as a variable that predicts Singapore's economy, has significant impacts. This relationship is a one way causal relationship, also referred to as Unidirectional Causality from At to Bt. The results of the VAR analysis of Singapore's economy affected by North Sumatera's economy in lag – 1 is significant. The shock in North Sumatera's economy has caused Singapore's economy to rise at the beginning of the period, then decline in the middle of the period and slope down at the end of the period. Furthermore, a shock on Singapore's economy to North Sumatera's economy has caused North Sumatera's economy to decline in the early period and then rise in the middle of the next period and slope upwards at the end of the period.

**Keywords:** North Sumatera' exports, Singapore's real investment in North Sumatera, North Sumatera's economy, Singapore's economy, VAR.

## INTRODUCTION

Singapore is one of the countries bordering the North Sumatra province in the east of the Strait of Malacca, a very strategic position when viewed geographically which is central to the development of economic activities at regional and international levels with high level of economic activities. The region is also home to many industries and also a center for regional and international trades. Singapore's economy is dominated by export sector and the processing of imported goods for export. In 2015, Singapore's GDP 27% came from manufacturing sectors, especially electronics sector, petroleum processing and chemicals.

North Sumatra as a region neighboring Singapore will economically interact one another. Some economic variables of North Sumatra can be expressed as follows: the export volume of North Sumatra in 2015 reached 9.00822 million tons and the amount of the value is US \$ 7,752,786 thousand, while exports to Singapore reached US \$ 208,902 thousand or 2.69 percent. North Sumatra's import volume in 2015 amounted to 6,854,082 tons or US \$ 3,988,411 thousand, while imports from Singapore's value is US \$ 1,116,219 thousand, a foreign trade deficit on North Sumatra's side.

North Sumatra's main export commodities are vegetable oil and animal fats as well as raw materials and industrial products. Meanwhile, North Sumatra's imports are largely in the form of raw/ auxiliary materials, consumer goods and capital goods.

North Sumatra has natural resources that are attractive to foreign investors, in addition to a strategic geographical location and a population large enough as a driver of business activities that are expected to bring profit. The amount of foreign capital investment in North Sumatra in 2015 was US \$ 1,246,096.20 thousand, while the amount of the previous year of 2014 was US \$ 550,835.10 thousand, an increase of US \$ 695,261.1 thousand. Specifically, Singapore's realization of investment in North Sumatra in 2015 was US \$ 2,975 thousand or 0.24 percent.

Significant increase in the realization of Singapore's real investment in North Sumatra was in 2014, reaching US \$ 306,783.40 thousand, while the lowest point of Singapore's real investment realization in North Sumatra was in 2001, which was only US \$ 1,679.63 thousand. The increase in real investment of Singapore in North Sumatra in 2014 was viewed as a result of North Sumatra's improved economy in this year, seen from North Sumatra's increased PRDB.

The tourism industry also has impacts on North Sumatra and Singapore's economies. Annually, 12723 Singaporeans on average visited North Sumatra from 1993 and 2015. While the number of tourists from North Sumatra to Singapore from 1993 to 2015 on average was 10106.

North Sumatra and Singapore are geographically neighbors with mutual interactions in economic activities. Singapore is economically an economic region that is the center of industry, trade, and services that have relatively complete facilities as well as facilities in economic activities. Singapore in its economic activities is in much need of natural resources, when in fact its region has limited natural resources, while North Sumatra has sufficient natural resources and is expected to become one of suppliers to meet Singapore's needs of natural resources. On the other hand, North Sumatra, in its economic activities, is still in a shortage of capital goods and half-finished goods. Singapore as an industrial region is expected to meet North Sumatra's needs of these items. Mutualism symbiosis of relations between the two regions will benefit both regions.

The inter-regional linkage in the economy may take the forms of the flow of goods, half-finished goods, final goods, consumer spending, revenue streams including transfers and remittances, capital flows, seasonal migration of labor (Bendavid, 1991).

Based on the identification and revelation of the phenomena explained, the issues of this research are as follows:

1. Is there any influence of Singapore's economy on North Sumatra's exports to Singapore ?
2. Does North Sumatra's economy affect Singapore's real investment in North Sumatra?
3. Is there a reciprocal relationship between the economies of North Sumatra and Singapore?

## **OVERVIEW OF REGIONAL ECONOMY THEORY**

### **Theory of Regional Comparative Competitiveness**

Trades between the regions came about because of mutual benefits. Such benefits come from differences in resources ownership, technologies possessed and management used as well as economic scales in production. If a region produces a certain specific goods goods at a larger scale, it is more efficient for the region to do this instead of producing different types of goods. This concept is known as comparative advantage. Ricardo (1817) describes when two areas have mutual trade relationship and each concentrates on exporting goods which have a comparative advantage, both regions will benefit.

At first comparative advantages arise because of differences in labor productivity between regions. Other inputs follow suit resulting in the creation of variaton in productivity between regions. With trades, this trading productivity differences between regions can be utilized resulting in gains for these regions.

### **Export Base Theory**

The increase in the economy of a region can be caused by two triggers. One originates from within a region or endogenous factors and the other from outside of a region or exogenous factors. The endogenous factors are economic elements found within the region, namely the factors of production owned by it. While the exogenous factor is the volume of demand from other regions for the goods and services produced by the region. According to the theory of export base, the economy in a region are grouped into two groups: 1) base activities and 2) non-base activities. Base activity group economic activities carried out in a region associated with processing the production factors of land, labor, capital and skills (management) at a certain scale level so that efficient goods and service production of goods and services is obtained. The goods and services produced is intended to be traded to other areas or to be exported.

The second group is a non-base activity group i.e. the economic activities that produce goods and services aimed at meeting the needs of people who live in an area (for locals). As the economic activities of production and consumption are undertaken to meet local needs (in the region), the demand for goods and services in the non-base sector is strongly influenced by the level of income of the local communities (local). Thus this non-base sector is tied to economic conditions, income and money owned by the local community (locals) and it is difficult for this sector to grow and develop more than the regional economic growth.

Export relationship with the exchange rate, and overseas earnings can be formulated as follows:

$$X_f = \beta_0 + \beta_1 NK + \beta_2 Y_f + \varepsilon$$

Where:

- $X_f$  : Overseas export
- $NK$  : Exchange rate
- $Y_f$  : Overseas income
- $\beta_0$  : Constant
- $\beta_1 - \beta_2$  : Estimate coefficient
- $\varepsilon$  : error term

Overseas revenue has positive effect on exports. Increased overseas income means increased demand for exported goods. In addition to overseas income, the exchange rate also affects exports. Exchange rates have positive effect on exports. The rise in the exchange rate (depreciation of the Rupiah) increases exports.

### Inter-regional Investments

When the region has reached a steady state, operating costs become expensive and the rate of return received by employers gradually decreases. This condition prompts investors to move their capital from this region to other areas adjacent to the area, which has a growing income levels in the hope of getting a higher return rate. Foreign investment is affected by foreign interest rates and domestic income. Overseas investment relationship with foreign interest rates and domestic income can be formulated as follows:

$$I_f = \rho_0 + \rho_1 SB_f + p_2 Y_t + \varepsilon$$

Where:

- $I_f$  : Foreign investment
- $SB_f$  : Foreign interest rate
- $Y_t$  : Domestic income
- $\rho_0$  : Constant
- $\rho_1, p_2$  : Estimate coefficient
- $\varepsilon$  : error term

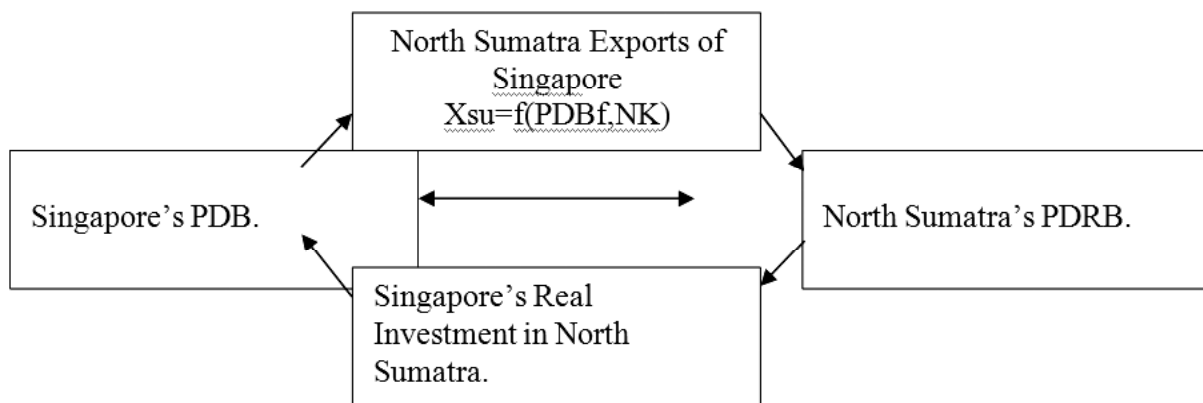
Foreign interest rate is negatively related to foreign investment. When foreign interest rates declines, foreign investment increases. Domestic revenue is positively related to foreign investment. Increased domestic revenue will increase overseas investment.

### PREVIOUS RESEARCH

Geographic proximity between regions may lead to a mutual relationship, the results Audretsch research (2004) suggests that geographic proximity plays an important role in the process of mutual relations for

innovative activities, which is an expansion of knowledge. Furthermore, Yamasita et al (2003) conducted a study in the United States and Asia Pacific region, the result of which shows that there are reciprocal relationship between the United States and the Asia Pacific region, in the forms of trade, investment, financial matters, and through the stock market. Glaeser et al (1992) explains that the externalities of geographic proximity is the transfer of knowledge (Knowledge Spillover) which serves as important determinant for economic growth. Cheshiro and Carbonaro in Armstrong and Taylor (2001) explain that one or regional economic growth determinants is the existence of influence by the neighboring regions referred to as Spillover effects from other regions. Mody and Wang (1997), explain that the area immediately bordering areas that have a high economic growth rate may be affected by high growth rates as well.

Based on the explanations above, a simple scheme that shows the relationship between variables studied can be made as follows:



**Figure 1: Scheme of Reciprocal Economic Relations between North Sumatra and Singapore's Economies.**

Remarks :

$X_{SU}$  : North Sumatra's Exports to Singapore.

$PDB_f$  : Singapore's Economy.

$NK$  : Exchange Rate.

$I_f$  : Singapore's Real Investment in North Sumatra.

$SB_f$  : Singapore's Interest Rate.

$PDRB_{SU}$  : North Sumatra's Economy.

North Sumatra's export is a function of Singapore's PDB. Singapore can increase North Sumatra's exports to Singapore. Singapore's real investment in North Sumatra is a function of North Sumatra's PRDB, North Sumatra. The increase in the North Sumatra's PRDB can increase Singapore's real investment in North Sumatra. The increased exports of North Sumatra to Singapore will increase revenue for the North Sumatra and thus, can increase North Sumatra's PRDB. Similarly, Singapore's increasing real investment in North Sumatra will increase revenue for Singapore, thus increasing Singapore's PDB.

The pattern of this relationship leads to the reciprocal relationship between North Sumatra's PRDB and Singapore's PDB.

### METHOD OF ANALYSIS

Variables examined include the economy of Sumatra Utara (North Sumatra's PRDB), Singapore's economy (Singapore's PDB), North Sumatra – Singapore exports, Singapore's real investment in North Sumatra. The data used is those from 1990 to 2015, from North Sumatra's statistics agency and Singapore's department of statistics.

#### Ordinary Least Squares (OLS).

OLS is used of the analysis tool. This tool is used to analyze Singapore's exports and real investment variables to North Sumatra. The analysis model of North Sumatra's exports to Singapore can be demonstrated as follows:

$$X_{su} = \beta_0 + \beta_1 PDB_f + \beta_2 NK + \varepsilon$$

Dimana :

$X_{su}$  : North Sumatra's Exports to Singapore.

$PDB_f$  : Singapore's Economy.

$NK$  : Exchange Rate.

$\beta_0$  : Constant

$\beta_1 - \beta_2$  : Estimate coefficient.

$\varepsilon$  : Error term.

Singapore's economy has positive influence on the export of North Sumatra to Singapore. The depreciation of the rupiah has positive influence on the export of North Sumatra to Singapore.

While Singapore's real investment model in North Sumatra is as follows :

$$I_f = \rho_0 + \rho_1 PDRB_{su} + \rho_2 SB_f + \varepsilon$$

Dimana:

$I_f$  : Singapore's real investment in North Sumatra.

$PDRB_{su}$  : North Sumatra's Economy.

$SB_f$  : Singapore's interest rate.

$\rho_0$  : Constant.

$\rho_1 - \rho_2$  : Estimate coefficient.

$\varepsilon$  : Error term.

The economy of North Sumatra is positively related to real investment of Singapore in North Sumatra, while the interest rate in Singapore is negatively related to Singapore's real investment in North Sumatra.

### Vector Autoregression (VAR)

The VAR model VAR used is:

$$YDSU = \alpha_0 + \sum_{i=1}^{\rho} \alpha_i YDSU_{t-1} + \sum_{i=1}^{\rho} \lambda_i YFSI_{t-1} + \varepsilon_1$$

$$YFSI = \beta_0 + \sum_{i=1}^{\rho} \beta_i YFSI_{t-1} + \sum_{i=1}^{\rho} \gamma_i YDSU_{t-1} + \varepsilon_2$$

Where :

YDSU : North Sumatra's economy.

YFSI : Singapore's economy.

$\rho$  : Optimal lag length.

## EMPIRICAL RESULTS

### North Sumatra – Singapore Exports.

The biggest contributors to North Sumatra's PRDB are dominated by agricultural sector, especially farm products followed by industrial sector. North Sumatra's exports to Singapore are farm produce i.e. rubber, coffee, cacao, spices, tea, etc, as well as industrial products such as animal/ vegetable oils, chemicals, aluminum, etc. The exports value of plantation, agriculture products, rubber, coffee, cocoa, tea and spices in 2014 was US \$ 105,978 thousand and US \$ 208,902 thousand in 2015, an increase of US \$ 102,924 thousand that was made possible due to the increased productivity of the plantation and agriculture sectors.

The estimate results of the export function of North Sumatra to Singapore can be shown in Table 5.1. below:

**Table 1**  
**Estimate Results of Fncion of North Sumatra's Exports to Singapore**

<i>Variable</i>	<i>Coefficient</i>	<i>Standard Error</i>	<i>t. Statistics</i>	<i>Probability</i>	<i>Significance</i>
LYSI	1,052296	0.015543	67,70423	0,0000	Significant
Rupiah Value	-7,40E05	2,24E-05	-3,299738	0,0030	Significant

*Sources:* Processed Results

North Sumatra's exports to Singapore are influenced by Singapore's economy i.e. positively and significantly with 99% confidence level, and a coefficient of 1.052296. It means that an increase of 1% of Singapore's economy will increase exports of North Sumatra to Singapore on average of 1.05%.

Furthermore, North Sumatra's exports to Singapore are also influenced by the value of the rupiah i.e. negatively and significantly at 99% confidence level, and a coefficient value of the rupiah of -7,40E-05. It means that the depreciation of the rupiah at Rp 1 will increase the export of North Sumatra to Singapore, on average at US \$ 7.40.

The results of this research was supported by Rahman (2008), in his research in SAARC countries (Bangladesh, India, Nepal, Pakistan, and Sri Lanka) that shows that regional trade i.e. Export - import in regions with geographic proximity has influence on the economy of neighboring countries and reciprocal benefits, and increases the income of these countries. Other studies done by Goicelea, Herce and Delucio (1998) explains that economic growth between regions are affected by trade intensity and distance between these regions. The intensity of trade and closer distances between regions result in the establishment of regions that are mutually influencing. Likewise, Yusuf (2009) explains that the economy of North Sumatra is affected by inter-provincial trade and foreign trades.

### Singapore’s Real Investment in North Sumatra

There has been long business relationship between Singapore and North Sumatra as proven by investment activities undertaken by Singaporean businessmen in North Sumatra. Foreign investment activities and investment by Singaporean businessmen in North Sumatra can be shown as follows: Foreign investors’ investment 2014 in North Sumatra in 2014 amounts to US \$ 550,833.10 thousand and Singaporean businessmen invested US \$ 306783.40ribu in North Sumatra, or 55.6%, compared to 44.4% by other foreign investments. In 2014 Singaporean businessmen had a high motivation to invest in North Sumatra that their investments exceeded other foreign investments in North Sumatra.

In 2015 there was a change. Foreign investment in North Sumatra increased to US \$ 1,246,096.20 thousand, while Singapore’s investment in North Sumatra was only US \$ 2,975 thousand or 0,24%. This change was made possible due to the weakening of the Singapore’s economy caused by the slowing down of global economic growth. The estimate results of the function of Singapore’s real investment in North Sumatra can be shown in the table 5.2 below.

**Table 2**  
**Estimate Results of the Function of Singapore’s Real Investment in North Sumatera**

<i>Variable</i>	<i>Coefficient</i>	<i>Standard of Error</i>	<i>t. Statistics</i>	<i>Probability</i>	<i>Significance</i>
ln Ysu	0,659788	0,247955	2,660921	0,0137	Significant
ln Rsi	-1,330751	2,589999	-0,513804	0,6121	Not Significant

Source: Processed Results

Table 5.2 above explains that Singapore’s real investment in North Sumatra is affected by North Sumatra’s income (ln YSU) i.e. positive and significant impact with a 95% confidence level as the probability value is 0.0137. North Sumatra’s income coefficient is 0.659788. This means that increased North Sumatra’s revenues by 1% will increase Singapore’s real investment in North Sumatra on average by 0.65%. These figures show that Singapore has the business confidence in North Sumatra that encourages them to invest their capital in North Sumatra. This investment is expected to would boost the economy of North Sumatra and benefit for Singapore

The results of this study is in harmony with Intrilligator (1964) in his second study that shows that the allocation of investment will shift from areas high-productivity to those with rapid pace of growth. Likewise, Joseph (2009) finds that North Sumatra’s economy is influenced by several variables, including domestic and foreign investments.



### North Sumatra – Singapore’s Economies Relationship Analysis.

North Sumatra’s PRDB is the proxy its economy and Singapore’s GDB is the proxy of its economy. These proxies give a picture to both economies. In 2014 North Sumatra’s economy was Rp149991790, - million and in 2015 the number increased to Rp15764137, - million, growing by 5.1%. Likewise, Singapore’s economy in 2014 was S \$ 315,076 million and in 2015 it increased to S \$ 391348.5 million, an increase of S \$ 76271.9 million

The analysis of relationship between North Sumatra and Singapore’s economies is made Autoregression vector models (VAR). Based on the lag -3 result in the calculation of estimated VAR, the summary can be shown as follows:

**Table 3**  
**Summary of VAR Estimate Results**  
**of North Sumatra and Singapore’s.**

<i>Exogenous Variable</i>	<i>Endogenous Variable</i>					
	<i>Koef. Reg.</i>	<i>LYSU</i>	<i>Significance of <math>\alpha</math></i>	<i>DDYSI</i>	<i>Significance of <math>\alpha</math></i>	
		<i>t<sub>hitung</sub></i>		<i>Koef. Reg.</i>	<i>t<sub>hitung</sub></i>	
LYSU (-1)	0.129495	0.46242	Not Sign.	15868.34	2.24899	5%
LYSU (-2)	0.134703	0.39297	Not Sign.	3489.938	0.40409	Not Sign.
LYSU (-3)	0.032927	0.09116	Not Sign.	1905.966	0.20943	Not Sign.
DDYSI (-1)	-3.69006	-0.19283	Not Sign.	0.399988	0.82938	Not Sign.
DDYSI (-2)	2.640006	0.13342	Not Sign.	-0.516354	-1.03554	Not Sign.
DDYSI (-3)	3.220006	0.21071	Not Sign.	0.384946	0.99909	Not Sign.
Constant	12.80136	1.32651	Not Sign.	-367988	-1.51344	Not Sign.
R-Squared	0.045814	0.413387				

*Source:* Processed Results

The table 5.3 of VAR results summary indicates that the DDYSI’s endogenous variables (Singapore’s economy) can be explained 41% by LYSU’s exogenous variables (North Sumatra’s economy) i.e. in the period of t-1, R-Squared of 0.413387. Viewed from the DDYSI series partially related positively to the economy of North Sumatra, this can be seen from LYSU-t-1’s exogenous variables sitting significantly at  $\alpha = 5\%$ , which means an increase in North Sumatra’s economy at lag -1, affecting Singapore’s economy, which has also increased. This is in line with publications issued by the United Nations (1998) and the results researches conducted by Butten (1995) and Joseph M (2009)

### Impulse Response Function Analysis.

Related to this research, the impulse response test analysis aims to determine the economy of North Sumatra’s response over the shock of the variable itself and of Singapore’s economy variable, and vice versa.

When illustrated in the form graph, the response to the shock can be seen in figure 5.1. as follows:

Response to Cholesky one S.D. Innovations  $\pm 2$  S.E.

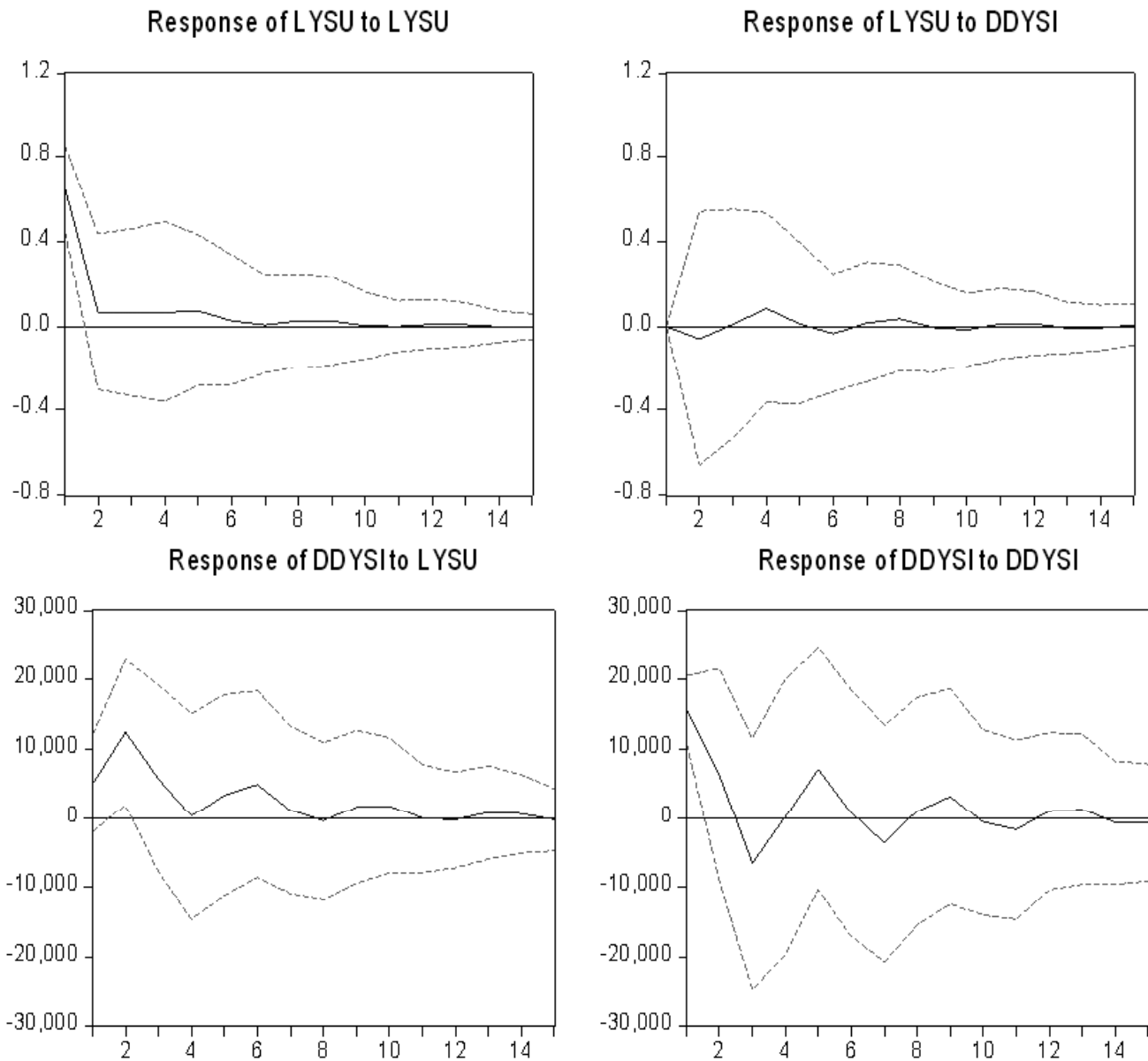


Figure 2: The Graphic of Response of the economy of North Sumatra's economy to the Shock from Singapore's Economy's Variable, and vice versa.

The figure 2 above shows that the shock of North Sumatera's Economy variable leads Singapore's Economy variable to increase at the initial period, then decline in the middle of the period, and slope down the end of the period. The next graph illustrates that the shock in Singapore's Economy variable leads to North Sumatra's Economy variable dropping in the initial period, then increasing in the middle of the the period and then sloping upwards at the end of the period.

**Granger Causality Analysis**

The Granger Causality Analysis is meant to see the relationship direction of the two variables, i.e. whether one variable one can improve the performance of the other variable? And vice versa. This study also wants

to find out the relationship of LYSU variable (North Sumatra's economy) and DDYSI variable (Singapore's economy) i.e. whether Singapore's economy improve North Sumatra's economic performance and vice versa. The following is the table of Granger Causality Test between the economies of North Sumatra and Singapore.

**Table 5**  
**The Granger Causality Test between the Economies of North Sumatra and Singapore**

<i>Lag Interval</i>	<i>Null Hipotesis</i>	<i>OBS</i>	<i>F Statistics</i>	<i>Probability</i>	<i>Test Result</i>	<i>Type of Relationship</i>
Lag -1	LYSU does not granger cause DDYSI DDYSI does not granger cause LYSU	23	7.88595 0.02733	0,0109 0,8703	Tolak Ho Terima Ho	One way relationship of North Sumatra's economy to Singapore's economy
Lag -2	LYSU does not granger cause DDYSI DDYSI does not granger cause LYSU	22	3.76415 0.15291	0,0443 0,8594	Tolak Ho Terima Ho	
Lag -3	LYSU does not granger cause DDYSI DDYSI does not granger cause LYSU	21	1.79050 0.05582	0.1951 0.9819	Terima Ho Terima Ho	

*Source:* Processed Result

Table 5.5. indicates that in lag-1 North Sumatra's economy causes Singapore's economy, and vice versa, Singapore's economy does not cause North Sumatra's economy. Furthermore, lag -2 has similar results with lag -1, while there is no relationship at all in lag -3. These results indicate that North Sumatra's economy variable will have significant econometrics results when included as a variable to predict Singapore's economy variable. The results of this Granger Causality, according Gujarati, constitute a one-way causality from At to Bt.

## CONCLUSION

Based on the analysis, conclusions can be made as follows:

1. Every 1% of increase in Singapore's economy will increase North Sumatra's exports to Singapore by 1.05% on average. Increasing exports from North Sumatra to Singapore means improvement in North Sumatra's economy.
2. Singapore's Real investment in North Sumatra is affected by North Sumatra's economy positively and significantly at 95% confidence level. Every 1% increase in North Sumatra's economy will increase Singapore's real investment in North Sumatra Singapore by 0.65% on average. Singapore's real investment in North Sumatra will enhance both economies.
3. VAR analysis shows that Singapore's economy is affected by North Sumatra's economy in Lag -1 with a confidence level of 95%.
4. The results of Impulse Response Function analysis show that a shock in North Sumatra's economy affects Singapore's economy leading the latter to the Singapore economy to rise at the beginning of the period and then

decline in the middle of the period and slope down at the end of the period. On the other hand, a shock in Singapore's economy variable affects North Sumatra's economy, causing the latter to move downward in the early period and then rise in the middle of the period and slope down at the end of the period.

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