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How Vulnerable is Indonesia's Financial System Stability to External Shock?

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Abstract

The main objective of the study is to measure the vulnerability of Indonesia's financial system stability in response to external shocks, including from regional economies namely three biggest Indonesia major trading partners (China, the U.S and Japan) and other external factors (oil price and the federal funds rate). Using Autoregressive Distributed Lag (ARDL) model and Orthogonalized Impulse Response Function (OIRF) with quarterly data over the period Q4 2002 - Q1 2016, results confirm that, 1) oil price response has the largest effect to Indonesia financial stability system and the effect period is the longest compared to others, represented by NPL and IHSG; 2) among those three economies, only China's economic growth has significantly positive effect to Indonesia financial stability system. Based on the findings it is better for the authorities to: 1) Diversify international trade commodities by decreasing share of oil, gas, and mining export and boosting other potential sectors such as manufacture, and fisheries; 2) Ensure the survival of Indonesia large coal exporter companies without neglecting burden of national budget; and 3) Create buffer for demand shock from specific countries by diversifying and increasing share of trading from other countries particularly from ASEAN member states.

Keywords: Financial Stability, External Shocks, Regional Economies.

JEL Classification Code: F65, G20.

1. Background

External shocks are considered as major determinants of financial stability and have significant effects on emerging markets (Almansour, Aslam, Bluedorn, & Duttagupta, 2015). The recovery of global economic downturn in 2015 that was slower than expected has created a risk-off behavior amongst investors; most notable is spillover effects on emerging markets. To what extent the downturn is mainly related to the economic slowdown in China, the uncertainty over U.S monetary policy normalization, and the sustained fall in commodity prices including oil prices (Cashin, Mohaddes, & Raissi, 2016; International Monetary Fund, 2016; Maćkowiak, 2007). Cashin et al. (2016) find that China negative output shock brings significant spillovers and larger impact on all ASEAN-5 countries except for the Philippines than the Asia-Pacific region, showing countries exposing more trading with advanced economies are much more vulnerable to negative shocks. Nguyen, Tran, and Le (2014) confirm findings that the U.S monetary policy shocks is likely impacting East Asia indirectly through the role of China that slowdowns in imports and exports and weaken commodity prices. Such conditions make market confidence drop, capital inflows decrease (Maćkowiak, 2007), currency depreciate, corporate and household performance depress, NPL rises and credit weaken (Bank Indonesia, 2015).

In terms of global recovery challenges, it is also compelling by the fact that the contribution of EMs to global economic growth is bigger than advanced economies, accounted 58%. Indeed, Indonesia's Financial System Stability (IFSS) have been marked moderate at least in the last quarter of 2015 after having undergone a slowing trend since 2012, reflected by inflation reached 3.35% (yoy), which hits farther than inflation target range of 4±1%. To be more detailed, here is a brief description of Indonesian economic structure as follows:

> Indonesia is a small open economy with domestic oriented economic structure, commodity exporter, and

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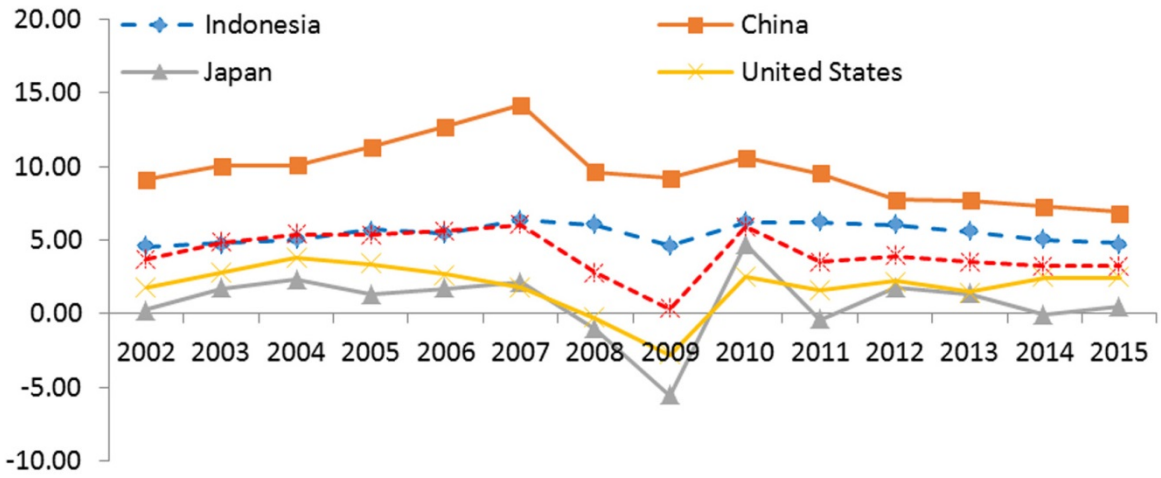
free-foreign exchange system. About 65% of the economy comes from consumption, 32% from investment, and 21% from exports. In one aspect, this economic structure makes Indonesia is more resilient against external shocks. Nonetheless, as commodity exporter's country, Indonesia exports rely significantly on primary commodities such as oil and gas, palm oil, rubber, coal, thin and other minerals, and are subjected to global commodity price cycle (Warjiyo, 2015).

Warjiyo (2015) discusses further that important vulnerabilities in IFSS relate to global financial market and capital flows. By the fact that over the period of 2009 – 2011 Indonesia as a commodity exporter has experienced high economic growth which corresponded to high global commodity price and huge capital inflows. However, the growth begun to decline in 2012 because of the slowdown in China economy followed by the decline in commodity prices. In other words, financial market can be developed by creating an environment, benefiting capital inflows.

Furthermore, Figure 1 highlights that Indonesia growth depicts moving along with its major trading partner dynamics (China, the U.S and Japan), in particularly during the busts. In other word the growth shocks from advanced economies is relatively important in Indonesia growth dynamics and spillovers vary by countries that are more integrated with Indonesia through trade and commodity price linkage.

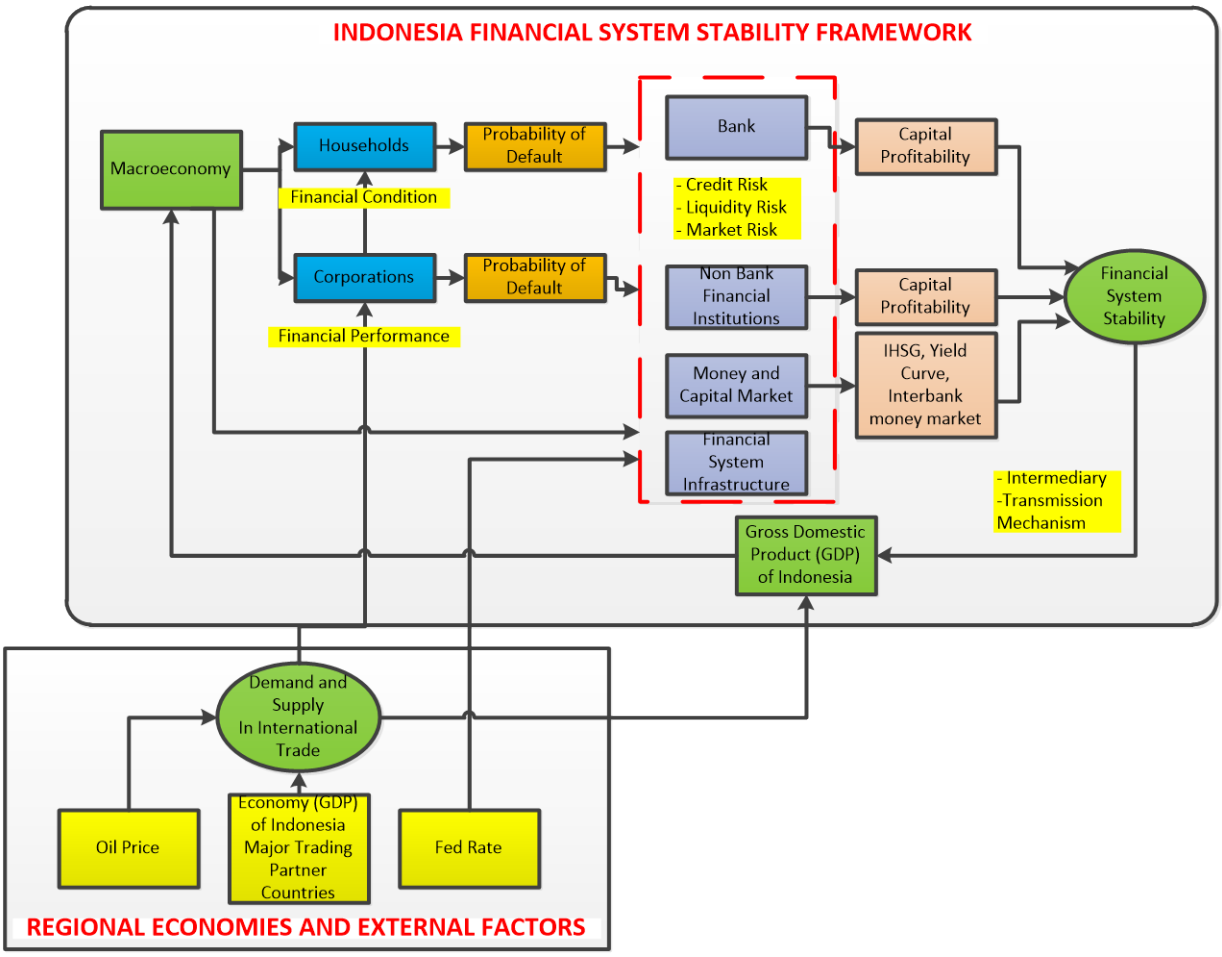
The major thought of this study seen mostly from international trade aspect, our hypotheses is economic resilience of other economies and oil price affecting demand from them, and eventually it will influence IFSS. To be clear, if downturn happened in a country's economy of Indonesia trading partner, consequently it is likely to decrease they demand of Indonesian goods and/or services that will also decrease GDP from export side, and at the same time resulting decline of Indonesian exporter firms' revenue. This decline is going to decrease their repayment capability that increases Non-Performing Loan (NPL), and if they are public listed companies, it will decrease their stock valuation and adjust (lowering) their stock price which is part of IHSG calculation. In the case of household, the decrease of GDP in a broad spectrum will decrease per capita income which make household ability to consume and to pay their loan decrease.

Similar flow also applies in oil price, demand shock of commodity resulting the downturn of oil price, consequently it will reduce the revenue of commodity exporter corporations and Indonesian GDP in a broader coverage. In terms of the federal funds rate (FFR), the increase of FFR will trigger capital outflow from Indonesian financial institutions and Indonesian capital market and consequently affect the soundness of Indonesian financial system. Ideally, to measure IFSS comprehensively we should encompass four aspects of IFSS (bank, non-bank, money and capital market, and financial system infrastructures) as can be seen in Figure 2. However, due to data limitation and considering their contribution to Indonesian financial market, we only take two aspects, namely banking aspect proxied by NPL- and capital market proxied by Indonesian Stock Exchange composite index (IHSG).



Source: World Development Indicators, The World Bank

<Figure 1> Economic Growth of Indonesia and Its Major Trading Partners 2002-2014



Note. This figure is modified from illustration of Bank Indonesia definition of financial system stability

<Figure 2> IFSS and its External Factors Framework

Generally, the framework used is Autoregressive Distributed Lag (ARDL) model to investigate magnitude of the effect of external movement to IFSS, and Orthogonalized Impulse Response Function (OIRF) to see how IFSS response to external shocks with the dataset used over the period Q4 2002 - Q2 2016, examining to what extent external shocks, namely GDP China, U.S, and Japan, oil prices and FFR impact on IFSS indicators, represented by NPL and IHSG.

The paper is organized as follows. Section 2 is research objectives. Section 3 highlights literature reviews. Section 4 presents data and research methods. Section 5 analyzes empirical results and finally section 6 is conclusion and policy recommendation.

2. Research Objectives

In this study, we intend to investigate how is the response of IFSS to economic dynamics of Indonesia's trade major partners and other external factor shocks and how vulnerable it is.

3. Literature Review

In the era where the world economies have been integrated globally both in real and financial sectors, not only does domestic shocks fluctuate domestic macroeconomic but also by external ones. Almansour et al. (2015) using structural VAR estimate the growth effects of external factors and conclude that EMs remain vulnerable to

external shocks. Nguyen et al. (2014) also apply structural VAR and IRF, investigating whether or not external shocks play important role in macroeconomic fluctuations of East Asian countries over the period 2001-2012. Authors find that the trade impact of the U.S. in Southeast Asia has been imparted through China. Bermingham and Conefrey (2014) employ VAR and IRF analysis to assess the slowdown on mortgage delinquency in Irish. Their results further suggest that a negative shock to U.S GDP growth impacts on an increase in number of mortgages. Cashin et al. (2016) studies how shocks to China's GDP are spread internationally using global VAR over period Q1 1981 to Q1 2013. Additionally, Horvath, Rusnák, & others (2009) focus on responses of small open economy to external shocks, study case in Slovakia using VAR model and IRF analysis. Their findings show that external shocks are very important source in fluctuations of Slovak price level. Another study case in Croatia done by Krznar, Kunovac, and others, (2010) finds similar result with Horvath et al. (2009) that external shocks impact on domestic economic activity and prices. Finally, Aghion, Bacchetta, and Banerjee (2004) emphasize the role of financial sectors to small open economies as determinant factors affecting instability through capital liberalization, assuming firms facing credit constraint.

Some key important indicators of external shocks are advanced economies' GDP, oil price and FFR. In the context of small open economy framework, the degree of openness is attributed by the part of GDP, reflecting the amount of export. GDP movements can be used to identify the demand shocks (Krznar et al., 2010), the extent to which these shocks are responsible for volatility in financial market. Furthermore, role of financial sectors can be as important as determinants of instability in which funding sources potentially increase the response to shocks and the scope for volatility (Aghion et al., 2004). They assume firms facing financial constraints with the constraint being tighter at a lower level of financial development, full capital account liberalization therefore may destabilize the economy. Nations need to improve the risk-management procedures and to maintain the external debt at sustainable levels in response to rising Non-Performing Loans (NPL). Additionally, capital market enables economic agents to pool, price and exchange risk. To extent, countries with deeper capital market face less severe business cycle output contraction and lower chances of an economic downturn compared to those with less developed capital market (Tharavanij, 2007).

Furthermore, the oil price affects the domestic macroeconomic fluctuations through global supply and demand for oil by the fact that the fourth largest oil consuming countries in 2014 were the U.S, China, Japan and India, consecutively (Khan & Ahmed, 2011; Nguyen et al., 2014; Ratti & Vespignani, 2016). Besides the oil prices have a simultaneous impact on U.S real output and U.S monetary policy (Leeper, Sims, Zha, Hall, & Bernanke, 1996), that when a positive oil-price shock happens, real GDP declines and the overall price level increases (Cavallo, Wu, & others, 2012). The FFR influences EMs economies through trade channel for the U.S is reported as the second largest importer after euro area and the third largest exporter after the euro and China. Known as the world's dominant economy in term of proportion in global GDP and its financial markets account the largest, reflecting both of the size and depth of the economy. In particular, correlations across national stock markets are highest when the U.S. stock market is declining.

Vector Autoregression (VAR) and Impulse Response Function (IRF) models have been applied broadly in macroeconomics. In the context of a small open economy, a VAR is used to identify the impact of external shocks to financial stability; to what extent macroeconomics fluctuations in the EMs are affected by external shocks; IRF is used to estimate size of external spillover effects (Bermingham & Conefrey, 2014; Cashin et al., 2016; Horvath et al., 2009; Krznar et al., 2010; Maćkowiak, 2007; Nguyen et al., 2014). The contributions of this paper are the following. To our knowledge, no other research addresses the determinants of IFSS indicators (NPL and IHSG) to economic dynamics of Indonesia's trade major partners (The U.S, Japan and China) and other external factor shocks (oil prices and FFR). Not only using IRF, the results of our model is also obtained by implementing a different approach that is ARDL model. The use of ARDL analysis has the advantage that, (1) settles endogeneity issues (Pesaran & Shin, 1999; Pesaran, Shin, & Smith, 2001); (2) determines cointegration of small sample cases (Tang, 2003); (3) captures both long run and short run coefficients through its bound test and conditional unrestricted error correction model (UECM); and (4) allows independent variables to have different number of lags.

4. Data and Research Methods

Using quarterly data over the period of Q4 2002 to Q1 2016, this study analyzes the response of Indonesia's financial system stability to external shocks.

Furthermore, models implemented in this study are as follows:

$$\begin{aligned} \mathrm{NPL_t} = {} & \beta_0 + \beta_1 \mathrm{Ch\_GDP_t} + \beta_2 \mathrm{US\_GDP_t} + \beta_3 \mathrm{JP\_GDP_t} \\ & + \beta_4 \mathrm{LnOilPrice_t} + \beta_5 \mathrm{FFR_t} \\ & + \beta_6 \mathrm{ID\_GDP_t} + \mu_t \end{aligned} \quad (1)$$

$$\text{LnIHSG}_t = \alpha_0 + \alpha_1 \text{CH\_GDP}_t + \alpha_2 \text{US\_GDP}_t + \alpha_3 \text{JP\_GDP}_t + \alpha_4 \text{LnOilPrice}_t + \alpha_5 \text{FFR}_t + \alpha_6 \text{ID\_GDP}_t + \mu_t \quad (2)$$

The remarks of variable on equation (1) and (2) are as follows (see Table 1):

China, the U.S, and Japan GDP represent Indonesia major trading partner factor, considering these countries are the three biggest trading partners of Indonesia respectively-that their GDP movements are likely to affect and trigger fluctuation to Indonesia economy. Meanwhile, FFR and crude oil price are considered as external factors besides economy of countries mentioned above, which may influence the Indonesia as their movements and value cannot be determined by any Indonesian authorities or institutions. In addition, GDP growth of Indonesia is embedded into the model as a control variable since the main driver of Indonesian financial system stability is its domestic economy itself.

Consider the dataset is time series; prior to determining the methodology used, this study applies unit root test to identify the stationary level of each variable in order to determine the robust method. Following is results of Unit Root Test using Augmented Dicky Fuller with a constant and trend (see Table 2).

<Table 1> Variables of Study

No	Variables	Description	Source
1	NPL	Ratio of commercial banks' non-performing loan in percentage	Bank Indonesia
2	IHSG	Composite index price of Indonesia Stock Exchange (IDX)	Yahoo Finance
3	CH_GDP	Seasonally adjusted real growth (%)of China GDP over the same quarter in the preceding year (YoY)	System of National Accounting (SNA) of China
4	US_GDP	Seasonally adjusted real growth (%) of United States GDP over the same quarter in the preceding year (YoY)	Federal Reserve Economic Data
5	JP_GDP	Seasonally adjusted real growth (%) of Japan GDP over the same quarter in the preceding year (YoY)	National Accounts of Japan
6	LnOil Price	Natural logarithm of West Texas Intermediate (WTI) crude oil price	Federal Reserve Economic Data
7	FFR	U.S federal funds rate	Federal Reserve Economic Data
8	ID_GDP	Seasonally adjusted real growth (%) of Indonesia GDP over the same quarter in the preceding year (YoY). This variable is meant to control the most important factor that may affect both NPL and IHSG	OECD Statistics

<Table 2> Unit Root Test Results

Variables	t-statistic		Order of Integration
	Level	First Difference	
NPL	-2.108	-6.330***	I(1)
LnIHSG	-3.251*	-5.508***	I(0)
CH_GDP	-2.665	-6.369***	I(1)
US_GDP	-2.935	-5.608***	I(1)
JP_GDP	-4.175***	-6.667***	I(0)
FFR	-4.182***	-3.169	I(0)
LnOil Price	-1.846	-7.234***	I(1)
ID_GDP	-3.317*	-5.651***	I(0)

Notes: (i) critical values with trend and intercept at 1%, 5%, and 10% are -4.072, -3.465, and-3.159 respectively, and value t-statistic that lower than critical values indicates the variable is stationer (ii) ***,**,* indicates it is significant at 1%, 5 %, and 10% level respectively.

From the above result, we can see that all of variables are stationer either at I(0) or at I(1). Therefore, we can apply Autoregressive Distributed Lag (ARDL) as the methodology as Pesaran et al. (2001) stated that ARDL can be used for set of variables with different order of stationary as long as it does not exceed first difference level of stationary, whereas Johansen's cointegration only allows same difference order.

Then the next step is to identify the long run relationship by estimating the following ARDL representation of equation for both NPL and IHSG as dependent variables:

$$\begin{aligned}\Delta\mathrm{NPL}_t = {} & \alpha_0 + \sum_{i=1}^{p} \omega_i \Delta\mathrm{CH\_GDP}_{t-i} + \sum_{i=1}^{p} \varphi_i \Delta\mathrm{US\_GDP}_{t-i} \\ & + \sum_{i=1}^{p} \omega_i \Delta\mathrm{JP\_GDP}_{t-i} \\ & + \sum_{i=1}^{p} \rho_i \Delta\mathrm{LnOilPrice}_{t-i} + \sum_{i=1}^{p} \phi_i \Delta\mathrm{FFR}_{t-i} \\ & + \sum_{i=1}^{p} \phi_t \Delta\mathrm{ID\_GDP}_{t-i} + \beta_1 \mathrm{NPL}_{t-1} \\ & + \beta_2 \mathrm{CH\_GDP}_{t-1} + \beta_3 \mathrm{US\_GDP}_{t-1} \\ & + \beta_4 \mathrm{JP\_GDP}_{t-1} + \beta_5 \mathrm{OilPrice}_{t-1} \\ & + \beta_6 \mathrm{FFR}_{t-1} + \beta_7 \mathrm{ID\_GDP}_{t-1} + \mu_t \end{aligned} \quad (3)$$

$$\begin{aligned}\mathrm{LnIHSG}_t = {} & \alpha_0 + H + \sum_{i=1}^{p} \varphi_i \Delta\mathrm{US\_GDP}_{t-i} \\ & + \sum_{i=1}^{p} \omega_i \Delta\mathrm{JP\_GDP}_{t-i} \\ & + \sum_{i=1}^{p} \rho_i \Delta\mathrm{LnOilPrice}_{t-i} + \sum_{i=1}^{p} \phi_i \Delta\mathrm{FFR}_{t-i} \\ & + \sum_{i=1}^{p} \phi_t \Delta\mathrm{ID\_GDP}_{t-i} + \delta_1 \mathrm{LnIHSG}_{t-1} \\ & + \delta_2 \mathrm{CH\_GDP}_{t-1} + \delta_3 \mathrm{US\_GDP}_{t-1} \\ & + \delta_4 \mathrm{JP\_GDP}_{t-1} + \delta_5 \mathrm{OilPrice}_{t-1} \\ & + \delta_6 \mathrm{FFR}_{t-1} + \delta_7 \mathrm{ID\_GDP}_{t-1} + \mu_t \end{aligned} \quad (4)$$

Where Δ is first difference of related variables, $\alpha 0$ is intercept, p is optimal lag length, and μt is white noise residuals.

Furthermore, the bound test under Pesaran et al. (2001) is used to investigate the presence of long run relationship between dependent variable and joint independent variables. The bound test is basically based on F-test method. The null and alternative hypotheses both for NPL and IHSG as dependent variables are as follows respectively:

<H0> β1 = β2 = β3 = β4 = β5 = β6 = β7 = 0, i.e., no presence of long run relationship; (5)

<H1> β1 ≠β2 ≠β3 ≠β4 ≠β5 ≠β6 ≠β7 ≠0, i.e., there is a long run relationship between dependent variable and joint independent variables.

<H0> $\delta 1 = \delta 2 = \delta 3 = \delta 4 = \delta 5 = \delta 6 = \delta 7 = 0$, i.e., no presence of long run relationship; (6)

<H1> $\delta 1 \neq \delta 2 \neq \delta 3 \neq \delta 4 \neq \delta 5 \neq \delta 6 \neq \delta 7 \neq 0$, i.e., there is a long run relationship between dependent variable and joint independent variables.

Moreover, the ARDL bound test applies Wald-test (F-statistic). Pesaran et al. (2001) provides two critical values which are I(0) or lower critical bound and I(1) or upper bound. The former assumes that there is no cointegration or long run relationship between dependent variable and joint independent variables, whereas the latter assumes otherwise. In short, if the F-statistic value exceeds I(1) or upper bound, it implies that there is a long relationship among variables. If the F-statistic value is below I(0), it means otherwise; other than the F-test that has a value in between I(0) and I(1) cannot be concluded.

The next step is to investigate short run elasticity between dependent variable and independent variables. This is implemented by running ARDL Error Correction Model from equation (3) and (4) expressed as follows respectively:

$$\begin{aligned}\Delta\mathrm{NPL}_t = {} & \alpha_0 + \sum_{i=1}^{p} \beta_1 \Delta\mathrm{NPL}_{t-i} + \sum_{i=1}^{p} \beta_2 \Delta\mathrm{CH}_{\mathrm{GDP}_{t-i}} + \sum_{i=1}^{p} \beta_3 \Delta\mathrm{US\_GDP}_{t-i} + \sum_{i=1}^{p} \beta_4 \Delta\mathrm{JP\_GDP}_{t-i} + \sum_{i=1}^{p} \beta_5 \Delta\mathrm{LnOilPrice}_{t-i} \\ & + \sum_{i=1}^{p} \beta_6 \Delta\mathrm{FFR}_{t-i} + \sum_{i=1}^{p} \beta_7 \Delta\mathrm{ID\_GDP}_{t-i} + \lambda \mathrm{EC}_{t-1} + \mu_t \end{aligned} \quad (7)$$

$$\begin{aligned}\Delta\mathrm{LnIHSG}_t = {} & \alpha_0 + \sum_{i=1}^{p} \delta \Delta\mathrm{LnIHSG}_{t-i} + \sum_{i=1}^{p} \delta_2 \Delta\mathrm{CH\_GDP}_{t-i} + \sum_{i=1}^{p} \delta \Delta\mathrm{US\_GDP}_{t-i} + \sum_{i=1}^{p} \delta_4 \Delta\mathrm{JP\_GDP}_{t-i} \\ & + \sum_{i=1}^{p} \delta_5 \Delta\mathrm{LnOilPrice}_{t-i} + \sum_{i=1}^{p} \delta_6 \Delta\mathrm{FFR}_{t-i} + \sum_{i=1}^{p} \delta_7 \Delta\mathrm{ID\_GDP}_{t-i} + \lambda \mathrm{EC}_{t-1} + \mu_t \end{aligned} \quad (8)$$

Where λ is the speed of adjustment parameter, and EC is residuals estimated form cointegration model of equation (2).

In addition, we adopted Orthogonalized Impulse Response Function (OIRF) in order to capture the response of Indonesian financial system stability indicators (in this paper represented by NPL and IHSG) to one standard deviation shock of each external factor over specific period of time.

5. Analysis Based on Empirical Results

Firstly, in order to examine the presence of long run relationship of joint variables (all external factors variables and IFSS indicators, we look into the result of ARDL bound testing procedure as reported in Table 3.

<Table 3> Bound Test Result

Dependent Variable	F-statistic value	Critical value of 5% significance level	
		Lower bound	Upper bound
NPL	4.212	2.45	3.61
IHSG	4.418	2.87	4

As seen from Table 3, the F-statistic values of both NPL and IHSG as dependent variables exceed critical value of the upper bounds, implying there is a cointegration among the joint variables. In other words, there is a long-run relationship among the joint variables.

5.1. Magnitude of external factors' effect to Banking system stability

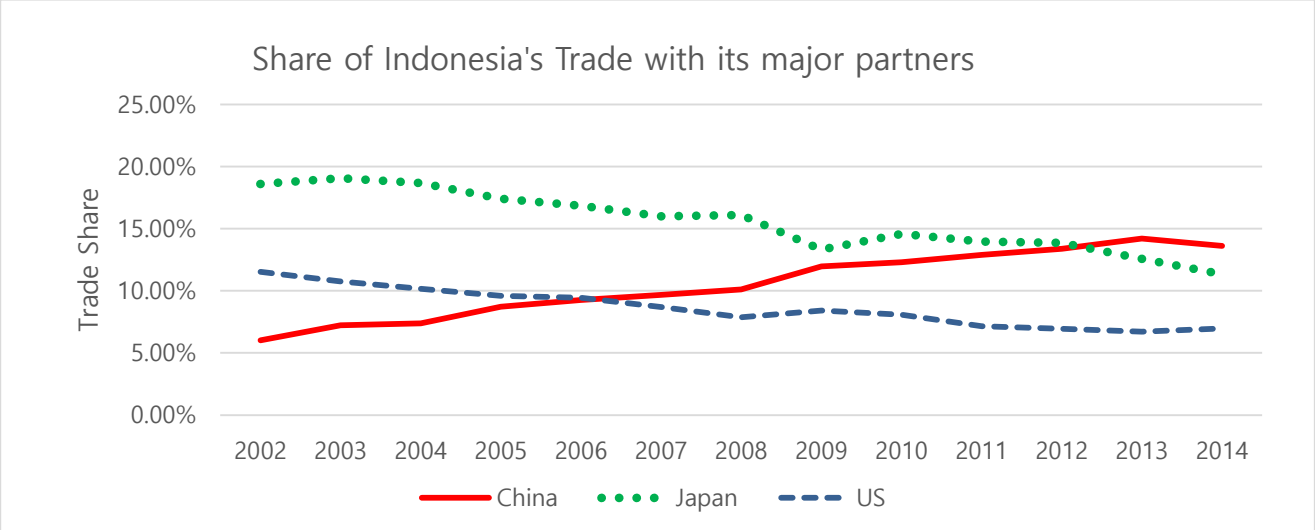
Secondly, by running ARDL estimation from the equation (3) and (7) we can obtain both the short run and long run estimation results as reported in Table 4.

Table 4 presents both the short run and long run estimations. In the short run, China's GDP is significantly affecting NPL and the effect directly influences NPL since the first quarter with coefficient of -0.3% meaning that 1% increase of China's GDP is likely to decrease Indonesia's NPL by about 0.3%. Surprisingly, two variables representing the U.S economy and its monetary tool, U.S GDP and FFR, do not have significant impact on Indonesia's NPL. In contrast, Japan's GDP is significantly positive affecting NPL in lag order of 1 which is the effect will happen on the next quarter.

<Table 4> ARDL Estimation of NPL as Dependent Variable

Dependent Variable: NPL								
Section A: short run coefficients estimation								
Lag order	ΔLnNPL	ΔCH_GDP	ΔUS_GDP	ΔJP_GDP	ΔLnOil	ΔFFR	ΔID_GDP	EC
0	-	-0.314** (0.123)	-0.138 (0.123)	-0.069 (0.069)	0.482 (0.542)	-0.008 (0.356)	0.122 (0.233)	-
1	-	0.967*** (0.154)	-0.300 (0.197)	0.234*** (0.011)	1.878** (0.709)	-	0.591** (0.306)	-0.125 (0.109)
2	-	-0.369*** (0.101)	0.054 (0.184)	-	-1.896** (0.694)	-	-1.174*** (0.300)	-
3	-	-	-	-	2.201*** (0.523)	-	0.631** (0.010)	-
4	-	-	-	-	-	-	-	-
Section B: long run coefficients estimation								
Constant		CH_GDP	US_GDP	JP_GDP	LnOil	FFR	ID_GDP	
12.894 (13.208)		-2.298 (2.608)	1.581 (1.775)	-2.660 (2.205)	-1.600 (3.880)	2.864 (2.215)	2.582 (3.665)	

Note: (i) *, **, *** indicates it is significant at 10%, 5%, and 1 % level respectively, (ii) Number of lag determined automatically using Akaike Info Criterion (AIC) with maximum number of lags is set to 4 lags (iii) EC is error correction.



Note: Trade share is calculated as (tij/TI), where tij is the total trade of Indonesia with country "j" and TI is the total international trade of Indonesia.

<Figure 3> Trade share of Indonesia's major trading partner with Indonesia over Total of Indonesia's international trade

If we look at Figure 3, reasons behind the different effect of each country are simply as follows: (1) the increase of China's GDP is significantly decreasing Indonesia's banking NPL, the extent to which because over the years share of China's trade with Indonesia to Indonesia's total international trade was increasing about 125% from 2002 to 2014, (2) the U.S's GDP does not significantly affect NPL of Indonesian banking due to the share of Indonesia trade with the U.S did not differ much over that period, and (3) the effect of Japan's GDP is contrary to the effect of China that Indonesia trade share with Japan was constantly declining. Japan is losing more than a third of its total trade share with Indonesia over the period of 2002 to 2014. That declining trend share does not merely mean Japan has no important role to Indonesian economy, yet because Japan has changed its strategy instead from trade oriented to investment oriented in relation with ASEAN countries. For instance, Japanese automotive companies have built factories in ASEAN countries during that period. Consequently, Indonesia automatically reduced the number of vehicles imported from Japan since it produced domestically in Indonesia, yet it did not count as Japan's export instead of it increased Japan's GNI (Gross National Income).

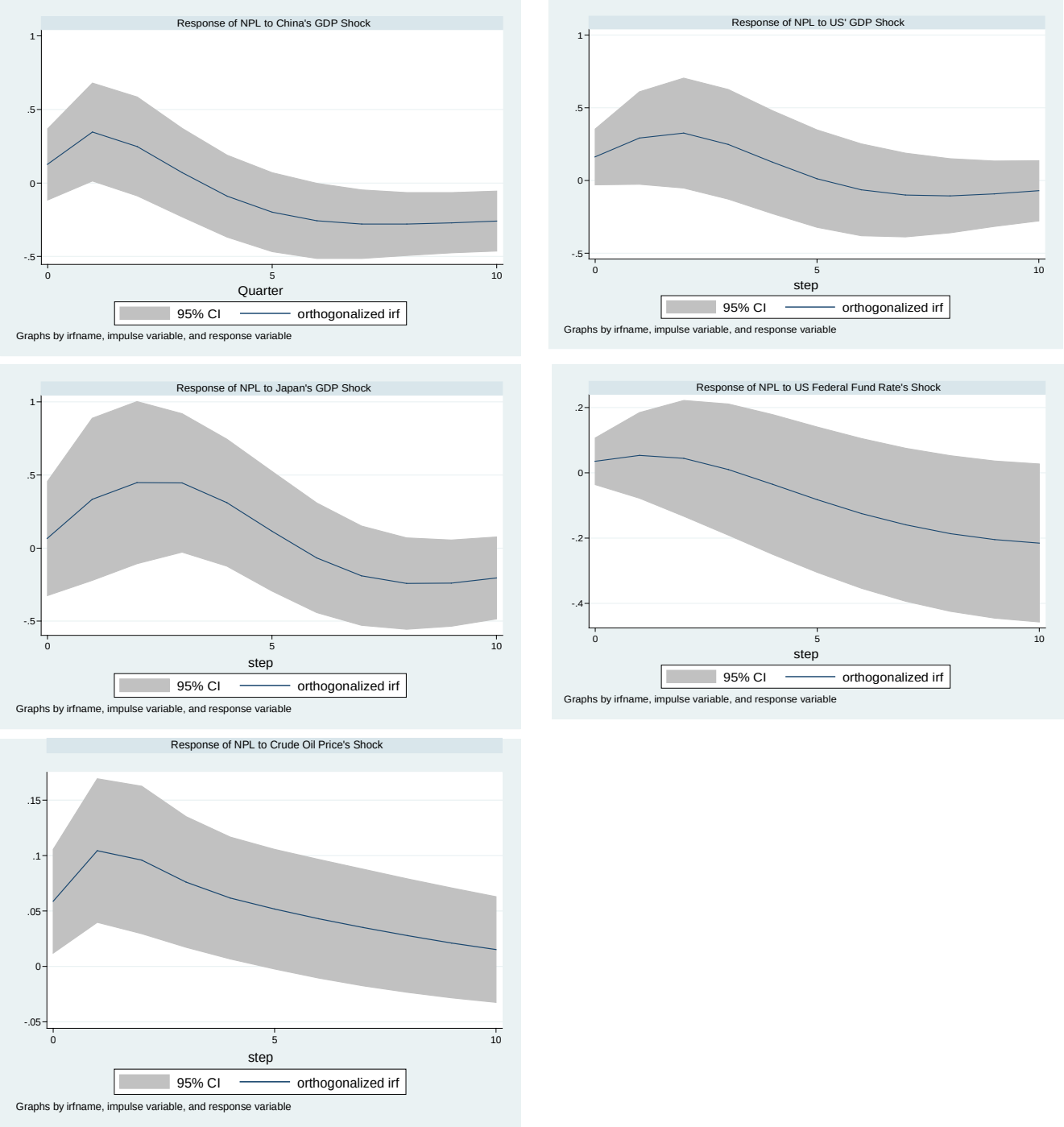
Interestingly, among other external factors, oil price movement has shown the largest effect to Indonesian NPL with coefficient of -1.9% from two lag order, meaning 1% increase in current world crude oil price is expected to decrease NPL by approximately 1.9% in the next two quarters. This is because within the period of the study Indonesia's oil and gas export ratio to total export is large, averaged approximately 20% of total export, that did not even include mining and agriculture commodities which both affect directly e.g., coal that is substitute product of oil. The decrease of oil price is likely followed by the decline of coal price, and indirectly affects other mining and agriculture commodities e.g., gold, crude palm oil, and etc.

This also strengthen by the fact that within the last decade which is mostly covered by the period of study, commodities (which the price of them are generally adjusting crude oil price) has become one of growth engines for Indonesia, besides there is also so called 2000s commodity boom where price of crude oil increased dramatically since 2000 and peaked to USD 140 per barrel in Q2 2008. As a consequence, in that period, Indonesia's economic growth also rose steadily and hit 6.3% growth before it began to fall gradually starting from 2014 in line with the constant decrease of oil price which bottomed to USD 28.5 in the beginning of 2016 caused by slower demand of energy from China and world awareness to use clean energy. This also triggered slower economic growth of Indonesia which consequently increases banking non-performing loan ratio as also supported by Khandelwal, Miyajima, & Santos (2016) and Miyajima (2016) that stated downturn in oil price could lead to slower credit and deposit growth and the increase of NPL.

In terms of long run, there is no significant effect of any external factors covered in the model. This is because the effect of external factors to Indonesian banking stability system is immediately experienced in the short time.

5.2. Response of NPL to external factors' shock

By implementing Orthogonolized Impulse Response Function (OIRF), below is the result of the response of NPL to external factors' shock.



<Figure 4> Response of NPL to external factors' shock

Figure 4 indicates that in terms of other countries' economy factor, China's GDP shock has the steepest impulse meaning it has the largest effect; an increase in China GDP will cause NPL to decrease starting from the 2nd quarter after the increase of GDP until the effect dies out on the 5th quarter. In addition, regarding the longest effect of external shock to NPL is given by oil price. From the figure 4 we can see that the decrease even does not stop on the 10th quarter which is our maximum lag period.

5.3. Magnitude of external factors' effect to Banking system stability Index

By running ARDL estimation from the equation (4) and (8) we can get both short run and long run estimation result as reported in Table 5.

<Table 5> ARDL Estimation of IHSG as Dependent Variable

Dependent Variable: IHSG								
Section A: short run coefficients estimation								
Lag order	ΔLnIHSG	ΔCH_GDP	ΔUS_GDP	ΔJP_GDP	ΔLnOil	ΔFFR	ΔID_GDP	EC
0	-	0.019 (0.016)	0.020 (0.019)	0.012 (0.012)	0.267*** (0.074)	0.020 (0.015)	0.068** (0.029)	-
1	0.252*** (0.133)	-	-0.046 (0.030)	-0.006 (0.011)	-	-	-	-0.072*** (0.161)
2	-	-	-	-0.026** (0.010)	-	-	-	-
3	-	-	-	-	-	-	-	-
4	-	-	-	-	-	-	-	-
Section B: long run coefficients estimation								
Constant		CH_GDP	US_GDP	JP_GDP	LnOil	FFR	ID_GDP	
5.004 (0.002)		0.027 (0.020)	-0.036 (0.028)	0.026 (0.024)	0.172 (0.079)	0.028 (0.023)	0.093*** (0.031)	

Note: (i) *, **, *** indicates it is significant at 10%, 5%, and 1 % level respectively, (ii) Number of lag determined automatically using Akaike Info Criterion (AIC) with maximum number of lags is set to 4 lags (iii) EC is error correction.

<Table 6> Volatility of IDX Sectoral Indices

Year	**Percentage Change From the Previous Year**										
	IHSG	**Agri**	**Mining**	**Basic**	**Misc**	**Consu**	**Prop**	**Infra**	**Finance**	**Trade**	**Manuf**
2007	52.08%	126.09%	250.41%	61.83%	68.01%	11.10%	104.87%	13.28%	26.14%	42.59%	41.49%
2008	-77.01%	-150.68%	-256.36%	-70.06%	-92.36%	-27.82%	-120.67%	-49.73%	40.78%	88.67%	58.44%
2009	86.98%	90.81%	151.06%	102.93%	179.84%	105.39%	41.85%	48.57%	70.94%	85.91%	123.65%
2010	46.13%	30.30%	48.59%	41.37%	60.78%	63.06%	38.35%	12.45%	54.82%	71.92%	55.60%
2011	3.20%	22.41%	14.93%	49.04%	117.99%	96.03%	56.17%	-3.99%	63.15%	111.12%	87.60%
2012	12.94%	-3.87%	-26.41%	28.97%	1.94%	18.99%	42.44%	29.75%	11.86%	27.27%	15.66%
2013	-0.98%	3.73%	-23.31%	-8.70%	-9.84%	13.81%	3.20%	2.52%	-1.77%	4.84%	0.24%
2014	22.29%	9.86%	-4.22%	13.09%	8.47%	22.21%	55.76%	24.71%	35.41%	13.11%	16.04%
2015	-12.13%	-26.87%	-40.75%	-24.98%	-19.11%	-5.19%	-6.47%	-15.42%	-6.10%	-3.31%	-13.75%
2016*	19.44%	16.38%	28.72%	41.17%	31.50%	18.48%	23.94%	22.97%	18.39%	-0.64%	25.69%
B*		**1.54**	**2.71**	**1.04**	**1.47**	**0.66**	**1.11**	**0.56**	**0.22**	**0.03**	**0.36**

Note: Agri = agriculture, Basic= basic industry and chemicals, Misc = miscellaneous industry, Consu = consumer goods industry, Prop = property and construction, Infra = infrastructure and utilities, Trade = trade, services, and investment, Manuf = manufacturing.

$* \beta_i = \frac{\mathrm{cov}(R_{i,t} - R_{\mathrm{M},t})}{\sigma^2(R_{M,t})}$

Where $R_{i,t}$ denotes average stock return of sector i in specific period of time, σ ($R_{i,t}$)denotes standard deviation of average stock return of sector i, $R_{M,t}$ denotes average return of benchmark index, which in this case is IHSG, in specific period of time, and β_i score reflects its volatility towards benchmark index. the higher the beta the more volatile the sector, β=1 indicates that the sector *i* moves along with the market or IHSG (same volatility), β<1 indicates that sector *i* is less volatile than IHSG, whereas β>1 indicates that sector *i* is more volatile than IHSG e.g: β=1.25 means that sector *i* is 1.25 times more volatile than IHSG.

** : 2016 figure statistics is up to August 2016

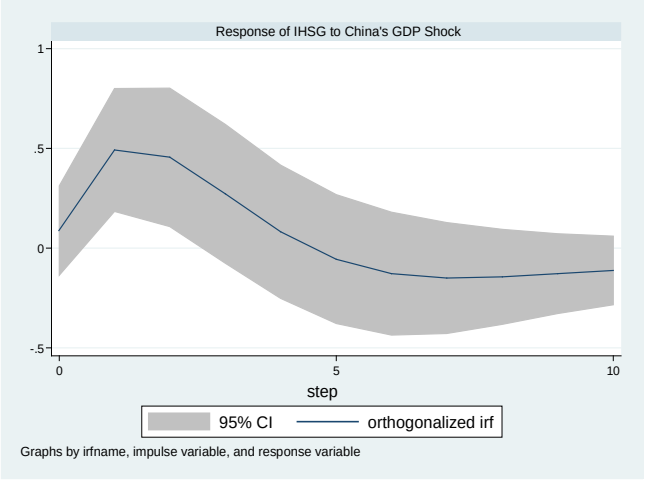
Regarding short run effect, interestingly we can see that the only external factor that significant is oil price with the coefficient of 0.27% implying that 1% increase of crude oil price is expected to increase IHSG by 0.26%. This is because mining sector, which its performance heavily affected by oil price, is the most volatile sector in IDX in period of 2007 to 2016 as can be seen its beta (β) higher than any other sectors (the higher the beta the more volatile the sector) (see Table 6).

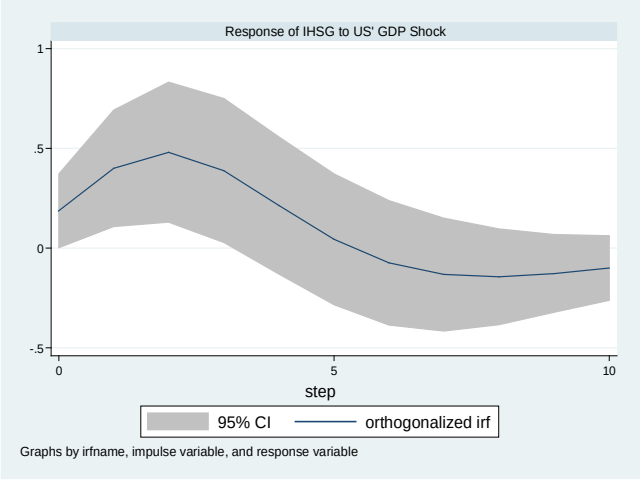
Similar to effect of external factors to NPL, in the long run there is no single external factor that has a long run impact to IHSG. The only variable matters in the long run is economic resilience of Indonesia itself which in this study measured by GDP growth.

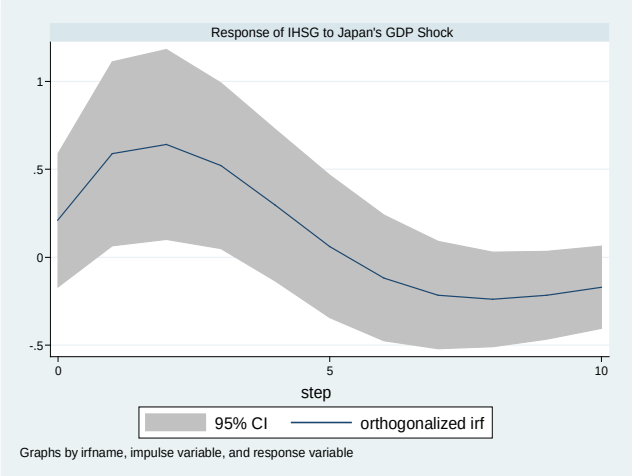
5.4. Magnitude of external factors' effect to capital market system stability Index

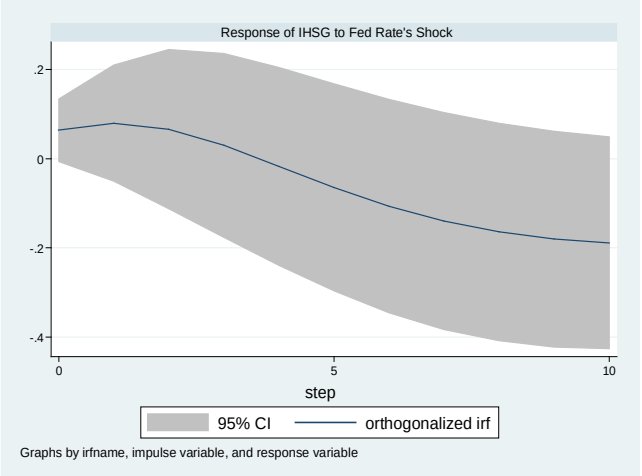
By implementing Orthogonolized Impulse Response Function (OIRF), Figure 5 is representing the result of the response of IHSG to external factors' shock.

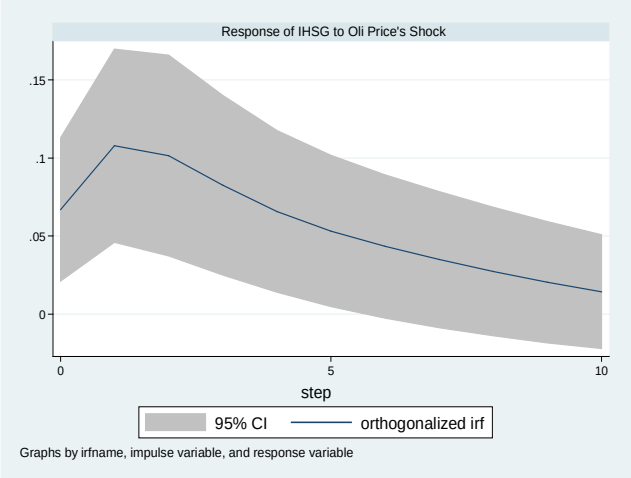
Figure 5 shows that the steepest graph is noted by oil price implying that oil price shock has the biggest impact to IHSG which the effect peaked in the second quarter before it gradually decreases. In addition, in term of other countries economy, the graph pattern is similar among China, US, and Japan meaning that the response of IHSG to those three external factors is quite similar with nearly the same magnitude which reaches the peak at the second quarter before the effect begins to flatten starting from seventh quarter.











<Figure 5> Response of IHSG to external factors' shock

6. Conclusion and Policy Recommendations

The study tries to test the vulnerability of Indonesia's financial system stability on external shocks using an ARDL and OIRF framework with quarterly data over the period Q4 2002 to Q1 2016. Results are the following. First, oil price responses emerged the largest and the longest effect to Indonesia financial stability system, represented by NPL and IHSG. Second, only China's economic growth has significantly positive effect to Indonesia financial stability system.

Finally, according to the analysis and empirical results there are some recommendations which should be better to be implemented by Indonesian authorities to improve the soundness of Indonesian financial system. First, considering oil price has the largest effect to IFSS, Indonesia should diversify its international trade product commodities by decreasing share of oil, gas, and mining export share and boosting other potential sectors such as manufacture, and fisheries.

Second, taking into account the spillover effect of recent downturn of oil price followed by low coal price that threaten the balance sheet (financial balance) of Indonesia large coal exporter companies (such as Adaro, PT Bukit Asam, Indo Tambang Raya Megah, etc.) government should think carefully and have win-win solution to ensure the survival of those companies without neglecting burden of national budget, a good example of such kind of policy is the recent project of 35,000 Mega Watt which involving those companies as the electricity supplier by giving them share of the target by allowing them to build power plant and giving subsidy to the price of electricity paid by consumers. The bankruptcy of those companies will lead to vulnerability of IFSS from both aspects of corporation and household considering they are labor intensive companies.

Third, to buffer demand shock from specific country, particularly in this study is China, it is better for government authority establish policies that attract Indonesian exporter firms' to geographically diversify their country markets especially to ASEAN countries as it currently is benefiting them with the presence of ASEAN Economic Community (AEC) Agreements. In addition, this Intra-Regional Geographical Diversification buffer has proven able to lowering the volatility of international trade output (Brixiová, Meng, & Ncube, 2015; Newfarmer, Shaw, & Walkenhorst, 2009).

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