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Oil Price, Monetary and Fiscal Policy: The Ase of Indonesia

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Abstract

The aim of the paper is to investigate the effect of oil price shock, business cycles, monetary and fiscal policy shocks on Indonesian macroeconomic variables. In this paper, we employ Sign restriction VAR model. We find that monetary policy has practically no effect on real output. The response of stock prices is positive to monetary policy shock. From these empirical findings, fiscal policy crowd out private sector activity in market, thus its effect will be impotent on the economy and particularly on the financial market. Fiscal variable is not responsive to the oil price shock. We also find the negative relationship between fiscal policy and inflation

Keywords— Oil Price, Monetary Policy, Fiscal Policy, Macro Economy, Sign Restriction VAR model, Impulse Response

Introduction

Background

The past experience of 1970 oil price shocks indicate that oil price movements are so fragile with factors not just economic but also non economic. In the 1970 oil price shock, Indonesia gain benefit from an increase in oil price (namely "oil bonanza moments") because Indonesia became net exporter oil country. But since 2003, Indonesia's oil production had decreased and at the same time the oil consumption had increased significantly due to economic growth. Indonesia becomes net importer oil country and suffer from any increase of such shock due to oil price in domestic market is heavily regulated by the authority and set to be lower than the international market through fiscal subsidy ever since. Oil price shock then will lead to deficit of trade balance, increase domestic inflation, increase in fuel subsidy and depress economic activity. Under these circumstances, Indonesia is inevitably affected by international oil price shock. As result, observing whether the shocks in energy price are transmitted to Indonesia macroeconomic variables including stock market will receive considerable attention from economic agents including the government.

The relationship between oil price and fiscal policy can be described in figure 1. From the graph, Indonesia's debt reaches the peak in 2010 (130 billion US dollars) when the world's oil price approaches 120 dollars per barrel. From this point of view, it seems there is positive relationship between world oil price and Indonesian fiscal debt. Eyeball Econometrics such as Figure 1 can be deceptive. Many things are going on simultaneously in the economy and we have to keep in mind the misleading of this single cause-and-effect perspective.

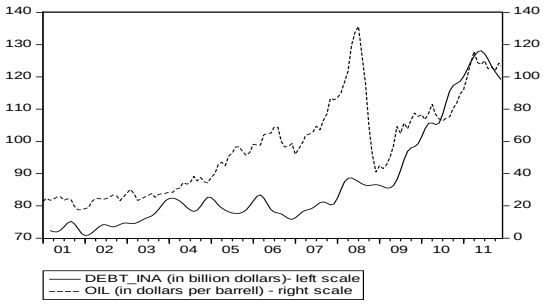

Figure 1: The relationship between Oil Price and Indonesian Fiscal Debt
Source: Ministry of finance, 2013

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The impact of high oil price on fiscal budget and other macroeconomic variables has dominated national economic agenda for the last decades. The international high oil price recently reflect the growing demand from Asia especially China and India and geopolitical issues in Middle East. Figure 1 shows the fluctuation of the 2004 of the world oil price. In 2001 the price was about 29 USD/barrel, increase to 40 USD/barrel, approach the peak at 130 USD/barrel in mids 2008, fall to 65 USD/barrel in mid 2009 and 100 USD/barrel in last 2011. For comparison, Indonesian government has spent much fiscal budget on energy subsidy: 5% of its GDP (Son, 2008), 27.93% of its total budget on energy subsidy and 80% of this was allocated for fuel subsidies (Agustina, 2008) and in 2013 17% of budget spent for fuel subsidy (Dartanto, 2013).

The government regulates the domestic oil price through the fuel subsidy especially for household's consumption, public transportation, small and medium enterprises, and other public and social services, but it does not regulate fuel price (non subsidy price) for large industries or factories and foreign-flagged vessels. The purpose of this fiscal policy is to prevent the fall of people's purchasing power from the increase in oil price and at the same time to prevent economy from high inflation and economy expected to continue grow steadily. The sharp reduction of fuel subsidy took place in 2005 as the part of phasing out of fuel subsidy program lead to increase in price level, lower the purchasing power and then in turn reduced household consumption in the short run, but in the long run able to increase the fiscal sustainability.

The consequences of an increase of budget deficit due to fuel subsidy will influence the macroeconomic variables including stock market. Figure 2 shows series on budget deficit (debt to GDP ratio) and stock prices from 2001 to 2011. Figure 2's descriptive data display tells us the inverse direction between fiscal debt and stock market, meaning that the Ricardian perspective hold in Indonesian case and this should be interest of fiscal policymakers.

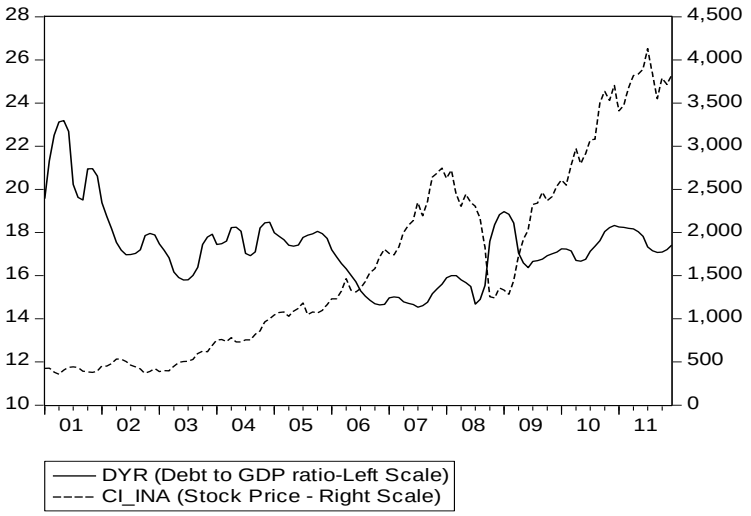


Figure 2: Indonesian Budget Deficit and Stock Price
Source: Ministry of Finance, 2013

Despite the fiscal policy, in order to combat oil price hikes that will pass-through to inflation, the government also implements the monetary policy. In the context of an increase in oil price, Bank Indonesia has obligation to response to such an adverse supply shock that potentially raises prices and decrease output through raising its policy rate to reach the established inflation target. On the other hand, the consequences of such monetary policy will lead to bust the economic activity, the output will fall, unemployment rise, including the effect on stock market and employ them as short-run leading indicators for the stance of monetary policy. Theoretically, any particular unanticipated policy movement conducted by the central bank is likely to influence stock prices through the interest rate (discount) channel, and indirectly through its influence on the determinants of dividends and the stock price. An increase in asset prices, in turn may influence consumption through a wealth channel and investments through the Tobins'q effect. The central bank that has obligations to control aggregate demand particularly to control inflation and output thus has to monitor asset prices in general, particularly stock prices.

For the net importer oil and developing country, particularly such as Indonesia, it is important to manage the economy by understanding the cause and the source of both internal and external shocks that influence the economy and their subsequent economic interaction. Any interaction between external shock with macroeconomic variables, or monetary policy shocks with other macroeconomic variables, or fiscal policy shocks with other macroeconomic

variables or business cycles shocks with other macroeconomic variables should be taken into account by policy makers to mitigate any adverse macroeconomic conditions.

From the aforementioned discussion, this study proposes some questions that need to be undertaken by the policy makers. What are the effect of oil price, business cycles, monetary and fiscal policy shocks on the economy and stock market in particular? What are the impact of fiscal shock with delayed when there is announcement from the fiscal authority before its implementation? What are the effect of joint of anticipated shocks from both oil price and fiscal policy on the economy and the stock market in particular?

This study includes the business cycles shock with regards to the fact that economy will experience the period of expansion and recession based on Real Business Cycles (RBC) theory. Under the period of recession, the government economic policy is important to combat the recession and in turn, to stabilize the economy. One heard opinions of fiscal policy ranging from the view that no recession has ever ended without fiscal expansion to the view that fiscal stimulus has always come too late. Similarly, for monetary policy, there was disagreement about whether looser policy has been a primary engine of recovery from recessions or whether it has been relatively unimportant in these periods.

This paper aims to answer these questions by applying the method developed by Mountford and Uhlig (2009) with some adjustment based on the scenario that would be developed. Their method is an extension of Uhlig (2005)'s agnostic identification method of imposing sign restrictions on impulse response functions. One of the major contributions of Mountford and Uhlig (2009) is to take into account the identification of multiple fundamental shocks. Previous studies that used sign restriction in Vector Auto Regression (VAR) only consider one single shock in various areas although the original application were to model the monetary policy. Sign identified VAR models have been used to study monetary policy shock (e.g., Rafiq and Malik 2008; Vargas-Silva 2008; Franta 2011; Jääskelä and Jennings 2011; Tachibana 2013), capital inflows shocks (e.g., Tillmann 2013), demand and supply shock (e.g., Lütkepohl and Netšunajev 2013), oil shock (e.g., Lippi and Nobili 2008; Kilian and Murphy 2012), technological shock (e.g., Dedola and Neri 2007; Peersman and Straub 2009), external shocks (e.g., Zaidi and Karim 2012) and fiscal shocks (e.g., Canova and Pappa 2007; Pappa 2009; Caldara 2012; Mountford and Uhlig 2009).

Despite implementing multiple shock, instead of single shock as proposed by Uhlig's (2005), Mountford and Uhlig (2009) also developed the model by implementing the orthogonality restriction to the previous shocks (business cycles and monetary policy shocks in their survey) prior to fiscal shock as well as the penalty function approach that extended approach of sign restriction. One of the advantages of Penalty function approach is that it delivers impulse response functions with small standard errors as it goes as far as possible in imposing certain sign restrictions (for detailed discussion; see Uhlig, 2005).

The general objective of this study is to investigate the effect of oil price shock, business cycles' shock, monetary and fiscal policy shocks on the stock market and some macroeconomic variables. The other objectives of this study are also to analyze the impact of fiscal shock with delayed when there is announcement from the fiscal authority before its implementation, and to investigate the effect of joint of anticipated shocks from both oil price and fiscal policy on the economy and the stock market in particular.

This study employs the method proposed by Mountford & Uhlig (2009) model by identifying the multiple fundamental shocks. This study uses the budget deficit as fiscal policy instead of using the government revenue and government spending as proposed by the Mountford and Uhlig (2009). The use of debt to GDP ratio itself is in line with the study of Bohn (1998), Muscatelli, et.al., (2004), Favero and Giavazzi, (2007) and Laopodis (2009). The analysis is decomposed into three scenarios. Below is the explanation.

First of all, this study separates the fiscal policy shock from the direct response of fiscal variable to other shocks such as business cycle shock and monetary policy shock. In this scenario, this study identifies business cycle shock and monetary policy shock and require the fiscal shock be orthogonal to them and this study also impose the sign restriction in all shocks except oil price shock. The oil price shock is ordered to the last order since this variable has the strong exogenous ones. Hence, perhaps this should be the contribution of this study comparing to the previous studies.

Secondly, this study considers the fact that the impact of fiscal variable sometimes occurs the delayed shock between the announcement from the President in front of the house of representative (in Indonesia it takes place usually every August 16th to implement the next fiscal year) and its implementation. This study assumes the lag between the announcement and the implementation of fiscal policy is about four months.. This study defines the fiscal shock as a shock where budget deficit rises for four months after the shock and which is orthogonal to two previous shocks which are business cycle shock and monetary policy shock. Such restriction of the impulse response is called as "the announcement effect". This scenario attempts to identify the fiscal policy variable that will not response the

fiscal policy shock for four months and then rise afterwards (a positive impulse response for the next eight months or 12 months after the shock).

Lastly, this study extends the Mountford and Uhlig (2009)'s scenario which assume that the macroeconomic policy shocks exist in two dimensional space spanned by two basic shocks, which are the government revenue and spending shocks. However, this study employs the oil price shock and fiscal policy shock instead and these are orthogonal to business cycles shock and monetary policy shock. These two shocks can be described to scrutinize the behavior of the different linear combination of the two basic shocks. In this scenario, this study also assumes that fiscal policy makers will announce the policy stance to give direction to the economic agents and at the same time, the firm and the individual are able to anticipate the oil price change. Hence both shocks can be regarded as anticipated shocks. This study chooses to restrict responses for four months following the shocks. This method also imposes sign restrictions on impulse response function as proposed by Uhlig (2005) based on theoretical foundation to some macroeconomic variables. This study will also allow the stock market to response freely to shocks (no sign restriction imposed) to investigate the key responses.

The rest of the paper is organized as follows. Section 2 outlines the literature surveys regarding the issue in these topics. Section 3 outlines data description and the methodology. Section 4 will discuss the result of VAR analysis and section 5 concludes.

Literature Review

The influence of monetary policy on output and prices has been a long debate from theoretical and empirical perspectives. In classical perspectives, money is neutral. It means that money does not affect real variables but nominal ones. The changes in money supply will only influence price not output. On the other hand, in classical view, money affects both real and nominal variables because there is rigidity in economy. Workers will not automatically lower the real wage when the economy experience slowdown (wage rigidity). Firms also do not want to adjust the price when cost of production changes immediately. One of the big contributions of Keynesian view is modelling the economy in the equilibrium of IS-LM model (the equilibrium in goods market and money market).

In the 1960s, neoclassical economist believes that the money may affect output and prices in the short term (Neoclassical Synthesis). In that period, structure of the labor market is represented in Phillips curve as aggregate supply (Blanchard, 2009). Neoclassical Synthesis model explained that the occurrence of rigidity prices and wages because of the assumptions in the price mark-up of wages. When the firm increases the mark up price, this will lead to increase the price and then in turn the real wage will fall. Expectation also plays the behaviour of economy. Two important hypothetical of expectations in the economy are rational expectation and adaptive expectation. Milton Freidman introduced the adaptive expectation that the observations of current inflation will form the expectation of economic agents. Friedman emphasized on the importance of expectation on the aggregate supply so that revised Phillips curve as expectation-augmented Phillips curve.

In the 1970s, Lucas (1976) and Sargent-Wallace (1975) introduced the rational expectation that assume economic agents use all relevant information to establish expectation or forecast economic variables in the future. Under this circumstance, monetary and fiscal policies affect inflation and expectation of inflation. Lucas (1976) criticize the results of parameter estimation econometric model that is not stable because occurring the changes policy maker behaviour affect expectation of the private agent and then it will affect the parameters in the econometric model. This critique affects on two the revised macroeconomic model with rational expectation of entering and strengthening macroeconomic model with micro foundation.

In 1980s, the New Classical paradigms, Kydland - Prescott (1982) introduced the real business cycle theory (RBC), which begins with microeconomic assumption of household consumption preference, the production firm and market structures. With the intertemporal optimization of consumption of households and future profit of firms and the market is competitive then the solution obtained by dynamic general equilibrium model. RBC model assume output is always in the natural level of output and all of output fluctuations are the movement of natural level of output itself. The cause of output fluctuations in Prescott point of view is a shock or a change in technology. Similarly, in the RBC model, change in money supply does not affect output. After the 1980s, research on RBC develop in many models. Debate on technology shock provides inspiration for researchers to develop various models incorporate various aspects, among others such as oil shock, fiscal shock, and the multiple equilibrium model (Rebelo, 2005).

It is generally assumed that oil price influenced the macro economy at the demand and supply levels. As to the demand level, on the one hand, Cunado and Perez (2005) find that the rise of oil price could cause inflation in some Asian countries. On the other hand, Wang and Yang (2013) find the rise in oil price may transfer wealth from oil-importing countries to oil-exporting countries. On the supply level, the rise of oil price will raise production costs and in turn will lower the production.

Numerous studies attempt to capture the effect of oil price shock on stock market for some decades. Market participants want a framework that identifies how oil-price changes affect macroeconomic variables, in particular stock prices or stock market returns. On theoretical grounds, oil-price shocks affect stock market returns or prices through their effect on expected earnings (Jones et al., 2004). Kaul and Seyhun (1990), Sadorsky (1999), Papapetrou (2001) report a negative effect of oil-price volatility on stock prices. El-Sharif et al. (2005), through a sector-based analysis, investigate the relationship between oil prices and stock returns, listed on the London Stock Exchange. They evidenced that the relationship is always positive, often highly significant and reflects the direct impact of volatility in the price of crude oil on share values within the sector. Narayan and narayan (2010) find that stock prices, oil prices and nominal exchange rates are cointegrated and oil prices have positive and statistically significant impact on stock price. Masih et al., (2011) result that dominance of oil price volatility on real stock returns and emphasize how this has increased over time. Their empirical findings display that a significant positive association between oil prices and stock returns and/or oil-related stock returns is present.

From a neoclassical perspective, the role of monetary policy on macroeconomic stabilization is important. The response of business cycles to both external and internal shock is the central debate; however rigidities and distortions are not crucial issues. They believe that in the long run fiscal policy would still be largely impotent since based on Ricardian perspective. Households would change their behavior when there is an effect of a rise in government spending through saving and borrowing. An increase in government spending would have a small effect on wealth and consumption.

Studies on the role of monetary policy in the economy has been varied from many decades particularly in those who use vector autoregressions in their analysis. The studies that attempt to address anomalies in the shocks such as prize puzzle and exchange rate puzzle have been employing more additional variables such as non borrowed reserves, non borrowed reserves, GDP deflator, commodity price index and monetary aggregates in VAR analysis (see e.g. Bernanke and Mihov, 1998; Christiano et.al., 1999; Sims and Zha, 1999; Uhlig, 2005; Mountford and Uhlig, 2009).

On empirical ground, few studies attempted to analyze the effect of oil price shocks on the macroeconomic variables and how the monetary policy reacts. Cologni and Manera (2005) study the direct effects of oil price shocks on output and prices, and the reaction of monetary variables to external shocks. Using structural cointegrated VAR model for the G-7 countries, they found that for U.S., a significant part of the effects of the oil price shock is due to the monetary policy reaction function. For other countries (like Canada, France and Italy), the total impact is offset by an easing of monetary conditions. Kormilitsina (2011) evaluate claim that tightening of interest rates in the aftermath of the post-World War II oil price hikes led some to argue that U.S. monetary policy exacerbated the recessions induced by oil price shocks. They find that monetary policy amplified the negative effect of the oil price shock. The optimal response to the shock would have been to raise inflation and interest rates above what had been seen in the past.

From a Keynesian perspective, rigidities and distortions are central to business cycle dynamics and business cycles are associated with allocative inefficiencies. Under these circumstances, fiscal policy perhaps can be the solution. The effectiveness of fiscal policy, however, depends on the existence of distortions and rigidities such as limited access to credit that leads to non-Ricardian behavior e.g., consumption out of current income rather than lifetime income, as in the ISLM model (Hermawan and Munro, 2008). In the presence of such rigidities, a rise in Government spending would lead to an increase in income and therefore consumption.

Related to these issues, the studies that relate the oil price shocks to fiscal variables are lacking, particularly in the developing oil importing country like Indonesia. Eika and Magnussen (2000) analyze the effects of the high oil prices in the first half of the 1980s on the Norwegian economy since Norway is oil exporting country. They demonstrated that without any fiscal policy change in Norway, negative effects from lower foreign demand and higher interest rates are dominating. However, a more expansionary fiscal policy, based on a prudent spending strategy, is shown to more than outweigh the negative effects from the international environment. El Anshasy and Bradley (2012) investigate the role that oil prices play in determining fiscal policy in oil-exporting countries. They find that in the long run, higher oil prices induce larger government size. In the short run, however, government expenditures rise less than proportionately to the increase in oil revenues, reflecting increasing prudence in fiscal policy in oil producing countries. Shah (2012) examines the dynamic effects of oil price shocks in addition to the aggregate supply and demand shocks on macroeconomic fluctuations in four sample economies: Indonesia, Malaysia, Pakistan and Thailand. They find evidence that it is less likely that oil price shocks have a substantial impact on macroeconomic fluctuation. The aggregate supply and demand shocks are the main sources of fluctuation in output and domestic price respectively in Malaysia, Pakistan and Thailand. In Indonesia, aggregate supply shocks are the key reason for both output fluctuation and inflation. Employing the IS-MP model, HsingYu (2012) study potential impacts of selected macroeconomic variables and external shocks including crude oil prices on real GDP for Indonesia. The results show that a higher real stock prices and a higher real crude oil price are expected to increase Indonesia's real GDP. More deficit spending as a percent of GDP would not cause real output to rise. Hence,

Indonesia would not suffer declining output because of higher oil prices. Due to the insignificant coefficient of the government deficit as a percent of GDP, fiscal prudence needs to be pursued.

Data and Methodology

Identification strategy in this study follows the study of Bernanke and Mihov (1998), Christiano, et.al. (1999), Sims and Zha (1999), Uhlig (2005), Mountford and Uhlig (2009) that use real output, inflation, monetary aggregate, interest rate, international reserve, exchange rate and stock price to their model. In order to consider the Keynesian perspective in the model, Blanchard and Perotti (2002); and Mountford and Uhlig (2009) consider the government revenue and government spending as the fiscal shock and real wage and consumption as the response variable to fiscal shock. However, this study includes the debt to GDP ratio as the fiscal variable and this study uses the real output and real investment as response variable to fiscal shock. This study also uses oil price as the foreign variable in the model since Indonesia is a small open economy and developing oil-importing country. This study uses overnight call rate as interest rate for monetary policy variable. The use of the short term interest rate as a measure of monetary policy is also in line with the study of Sims (1992), Bernanke and Mihov (1998), Christiano, et.al. (1999), Sims and Zha (1999), Uhlig (2005), Li, et.al. (2010), Zaidi and Karim (2012) and Karim (2013).

This study uses Industrial production index to represent real output (the use of this indicator due to the data availability in monthly basis instead of national income that employed in quarterly basis). All variables (except the inflation rate, Debt to GDP ratio and interest rate) are transformed by taking natural logarithms. All variables are in real term (constant price at certain base year depending the published report or if not available, this study calculated them ourselves with base year 2003, similar to BPS or Indonesian Statistic Agency base year) and seasonally adjusted using X11 multiplicative provided by Eviews6 and RATS.

This study uses monthly data from January 2001 until December 2011. Data are collected from various sources such as the Monthly Indonesian Economics and Financial Statistics produced by Bank Indonesia (www.bi.go.id), Economic Indicators of Indonesian Statistics Agency or BPS/Badan Pusat Statistik (www.bps.go.id), Indonesian Stock Exchange market (www.idx.co.id), Directorate General of Debt Management of treasury department (www.djpu.kemenkeu.go.id), the world oil price data is taken From the website www.indexmundi.com. Some variables that are not available in monthly data, such as GDP (data in quarterly basis) and Debt (data from 2000 until 2008 are not provided in monthly but quarterly) are interpolated using cubic match last (option for interpolating from low to high frequency data provided by the Eviews 6. The detailed formula of cubic match last is available at EVIEWS 6 user's guide).

The reduced form model is an unrestricted VAR. This study uses an unrestricted VAR since it is a good approximation to the DGP of any vector of time series, as long as enough lags are included (see e.g. Canova and Nicolo, 2002) and the VAR model is specified in level(The data used in this study in levels form because implicit cointegration relationships exist in the series (see Sims et. al., 1990). In addition, this study does not want to lose any information if the VAR is estimated in first difference compare to the loss of efficiency (when the VAR is estimated in levels, but without imposing any cointegrating relationships), for further discussion see Ramaswamy and Sloek (1998), Zaidi and Fisher(2010)). The studies that employ the reduced form VAR models, which include real activity, inflation and measures of interest rates and money have been examined by many authors such as Sims and Zha (1999), Canova and Nicolo (2002), Uhlig (2005), Vargas-Silva (2008), Scholl and Uhlig (2008), Rafiq and Mallick (2008), Mountford and Uhlig (2009), Dungey and Fry (2009), and Peersman and Straub (2009), however Peersman and Straub (2009) also use the first difference in their analysis for the robustness check purposes.

One widely used strategy for estimating the effect of any shock is Vector Auto Regression. This study follows the strategy based on the recursiveness assumption embedded in VAR model, according to which the shocks are orthogonal to the information set of the monetary authority, for example (Christiano et.al., 1999).

$$S_t = f(\Omega_t) + \sigma_s \varepsilon_t^s \qquad (1)$$

Here S_t is the instrument of the monetary authority, say overnight call rate or monetary aggregate, f is a linear function that represents the monetary autorithy's feedback rule and Ω_t is the monetary authority's information set. The random variable $\sigma_s \varepsilon_t^s$, is a monetary policy shock. Here, ε_t^s is normalized to have unit variance and this study refers to σ_s as the standard deviation of monetary policy shock. Below, this study discuss the identification problem involved in measuring the dynamic response of economic aggregates to a fundamental economic shock. The basic problem as Christiano,et.al., (1999) mentioned is that a given set of second moments is consistent with many such dynamic response functions. Recall a VAR for a k-dimensional vector of variables, Z_t, is given by

$$Z_t = B_1 Z_{t-1} + \cdots + B_q Z_{t-q} + u_t, \qquad E_{u_t u_t'} = V \qquad (2)$$

Here, q is nonnegative integer and u_t is uncorelated with all variables dated $t-1$ and earlier. Consistents estimates of $B_i^{'}$ the can be estimated by running ordinary east squares equation by equation on (1). One then can estimate V from the fitted residuals. This study assumes the relationship between the VAR disturbances and the fundamental economic shocks,ε_t , is given by $A_0 u_t = \varepsilon_t$. here,A_0 is an invertible ,square matrix and $E\varepsilon_t\varepsilon_t^{'} = D$, where D is a positive definite matrix. Premultiplying (2) by A_0, it obtains

$$A_0 Z_t = A_1 Z_{t-1} + \cdots + A_q Z_{t-q} + \varepsilon_t \quad (3)$$

Here, A_i is a $k\ x\ k$ matrix of constants, $i = 1, \ldots q$ and

$$B_i = A_0^{-1}\ A_i, i = 1 \ldots, q, and\ V = A_0^{-1} D (A_0^{-1})' \quad (4)$$

This indicates how the recursiveness assumption restricts A_0 in (3). Partition Z_t into three blocks: the k_1 variables, X_{1t}, whose contemporaneous values appear in, the k_2 variables, x_{2t}, which only appear with a lag in Ω_t and S_t itself. Then $k = k_1 + k_2 + 1$, where k is the dimension of Z_t. That is $Z_t = \begin{pmatrix} X_{1t} \\ S_t \\ X_{2t} \end{pmatrix}$ and consider $k_1, k_2 \geq 0$. To make the analysis interesting, it assumes that if $k_1 = 0$, so that X_{1t} is absent from the definition of Z_t, then $k_2 > 1$. Similarly, if $k_2 = 0$, then $k_1 > 1$. The recursiveness assumption places the following zero restrictions on A_0

$$A_0 = \begin{bmatrix} \underbrace{a_{11}}_{(k_1 x k_1)} & \underbrace{0}_{(k_1 x 1)} & \underbrace{0}_{(k_1 x k_2)} \\ \underbrace{a_{21}}_{(1 x k_1)} & \underbrace{a_{22}}_{(1x1)} & \underbrace{0}_{(1 x k_2)} \\ \underbrace{a_{31}}_{(k_2 x k_1)} & \underbrace{a_{32}}_{(k_2 x 1)} & \underbrace{a_{33}}_{(k_2 x k_2)} \end{bmatrix} \quad (5)$$

Here, expressions in the parentheses indicate the dimension of the associated matrix and $a_{22} = 1/\sigma_s$, where $\sigma_s > 0$. The zeros in the middle row of this matrix reflect the assumption that the policy maker does not see X_{2t} when S_t is set. The two zero blocks in the first row of A_0 reflect the assumption that the fundamental shock is orthogonal to the elements in X_{1t}. These blocks correspond to the two distinct channels by which a fundamental shock could affect the variables in X_{1t} . The first of these blocks corresponds to the direct effect of S_t on X_{1t} . The second block corresponds to the direct effect that operates via the impact of a monetary policy shock on the variables in X_{2t}.

In VAR approach, it assumes that the error term u_t, are related to the structural macroeconomic shocks ε_t, via matrix A such that $u_t = A\varepsilon_t$. The jth coloumns of A represents the immediate impact on all variable of the jth innovation. The approach assumes there are n fundamental shocks which are mutually orthogonal and normalized to be of variance one. Hence,

$$\Sigma = E[u_t, u_t^{'}] = AE[\varepsilon_t, \varepsilon_t^{'}]A^{'} = AA^{'} \quad (6)$$

where equation can be desribed as the covariance matrix. The identification method here, searches over the space of possible impulse vectors $A_i\varepsilon^i$ to find those impulse responses that agree with the sign restriction. As a result a is an impulse vector if there is an n-dimensional vector α of unit length so that $a = A^{'}\alpha$ and hence

$$\Sigma = AA^{'} = \sum_{i=1}^{n} a_i a_i^{'}. \quad (7)$$

Once the impulse vector a has been defined, the impulse response is calculated as

$$\Sigma = AA^{'} = \sum_{i=1}^{n} \alpha_i \varepsilon_i(k) \quad (8)$$

Where $\varepsilon_i(k) \epsilon \Re^n$ is the vector response at horizon to the th shock in the Cholesky decomposition of Σ (Uhlig, 2005). Uhlig (2005) then find a vector $\tilde{b} \neq 0$ with $(\Sigma - aa^{'})\tilde{b} = 0$ normalized so that $b^{'}a = 1$. Then the real number $\varepsilon_t^{(a)} = b^{'}u_t$ is the scale of the shock at date t in the direction of of the impulse vector a and vector $\varepsilon_t^{(a)}$ is part of u_t, which is attributable to that impulse vector. Essentially, b is the appropriate row of A^{-1}.

In the case of monetary policy shock, given some VAR coefficient matrices $B = \left[B_i^i, \ldots, B_l^{'}\right]$, some error variance-covariance matrix Σ, and some horizon K, let $A(B, \Sigma, K)$ b eset of all monetary policy impulse vectors. Furthermore, Uhlig (2005) proposed penalty function approach. The point is that this approach will find the best impulse vector a for any given (B, Σ). If the set $A(B, \Sigma, K)$ is empty, the penalty function approach will find an impulse vector a which comes as close as possible satisfying the sign restrictions by minimizing a penalty for sign restriction violation,for the detailed discussion see Uhlig (2005).

This paper implements the method proposed by Mountford and Uhlig (2009) that extended the method of Uhlig (2005). Suppose that Σ is positive definit matrix. Let a given impulse matrix $[a^{(1)}, \ldots, a^{(n)}]$ of size n be a submatrix of two m x m matricesA, $\widetilde{A}$ with $AA' = \widetilde{A}\widetilde{A}' = \Sigma$. They identified at least four fundamental shocks (business cycles shock, monetary policy shock, fiscal policy shock and oil price shock) and so needs to characterize an impulse matrix $[a^{(1)}, a^{(2)}, a^{(3)}, a^{(4)}]$ of rank 4 rather than all A. This can be done by implementing sign restriction on the impulse response. They set the covariance between the fundamental shocks $\varepsilon_t^{(1)}, \varepsilon_t^{(2)}, \varepsilon_t^{(3)}, \varepsilon_t^{(4)}$ corresponding to $a^{(1)}, a^{(2)}, a^{(3)}, a^{(4)}$ zero (these fundamental shocks are orthogonal). The detailed methodology can be found in Mountford and Uhlig's (2009).

Identification Strategy

This section discusses the model based identification strategy. This study orders 10 variables in the VAR model consist of oil price (OP), real output (Y), debt to GDP ratio (DYR), inflation (π), money supply (M), interest rate (ir), non borrowed reserve (Res), real investment (Inv), real exchange rate (XR), and stock price (SP) (see equation 3.9). The model follows the empirical approach in some studies. Bernanke and Mihov (2008) and Uhlig (2005) used real GDP, the GDP deflator, commodity price index, non borrowed reserve, nonborrowed reserve and federal fund rate for US case. Mountford and Uhlig (2009) used VAR in GDP, private consumption, total government expenditure, total government revenue, real wage, private non-residential investment, interest rate, adjusted reserves, the producer price index for crude material and GDP deflator for the US case. This study takes into account the oil price (in the first order), money supply (in the fifth order), the real exchange rate (in the ninth order) and the stock price (in the last order) to accommodate the small open economy model and this is similar to the study of Jarocinski and Smets (2008), Scholl and Uhlig (2008), Jääskelä and Jennings (2011), An and Wang (2012). The identification ordering can be described as below.

$$\begin{bmatrix} OP \\ Y \\ DYR \\ \pi \\ M \\ ir \\ \mathrm{Res} \\ Inv \\ XR \\ SP \end{bmatrix} = \begin{bmatrix} 1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ A_{21} & 1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ A_{31} & A_{32} & 1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ A_{41} & A_{42} & A_{43} & 1 & 0 & 0 & 0 & 0 & 0 & 0 \\ A_{51} & A_{52} & A_{53} & A_{54} & 1 & 0 & 0 & 0 & 0 & 0 \\ A_{61} & A_{62} & A_{63} & A_{64} & A_{65} & 1 & 0 & 0 & 0 & 0 \\ A_{71} & A_{72} & A_{73} & A_{74} & A_{75} & A_{76} & 1 & 0 & 0 & 0 \\ A_{81} & A_{82} & A_{83} & A_{84} & A_{85} & A_{86} & A_{87} & 1 & 0 & 0 \\ A_{91} & A_{92} & A_{93} & A_{94} & A_{95} & A_{96} & A_{97} & A_{98} & 1 & 0 \\ A_{101} & A_{102} & A_{103} & A_{104} & A_{105} & A_{106} & A_{107} & A_{108} & A_{109} & 1 \end{bmatrix} x \begin{bmatrix} OP \\ Y \\ DYR \\ \pi \\ M \\ ir \\ \mathrm{Res} \\ Inv \\ XR \\ SP \end{bmatrix} \quad (9)$$

Tabel 1 shows the identification of the sign restriction on impulse response's VAR analysis. In the model, oil price shock enters the VAR model as exogenous processes and this study assumes that domestic shocks do not affect the oil price. As Uhlig (2005) proposed, this study employs sign restriction approach based on the theoretical background. This study also remains agnostic about the response of stock price to all the shocks in the model. By construction, this study avoids the price, exchange rate, liquidity, exchange rate and output puzzles by assuming that inflation, monetary aggregate, exchange rate and output fall in response to a contractionary monetary policy for the k impact period (this study assumes *k* equal 6 months) and left unrestricted after 6 months. Furthermore, In order to support the monetary theory, the effect of non borrowed reserve and real investment also will fall in response to contractionary monetary policy shock and perhaps this could avoid an extra puzzles call "reserve puzzle" and "investment puzzle".

Tabel 1:
Constructing the Sign Restriction

Shock to	Response Of								
	OP	*Y*	*DYR*	π	*M*	*ir*	*Res*	*Inv*	*XR*
Business Cycles	0	↑	0	↑	−	−	−	↑	↑
Monetary Policy	0	↓	0	↓	↓	↑	↓	↓	↓
Fiscal Policy	0	−	↑	−	−	−	−	−	−
Oil Price	↑	−	↑	↑	−	↑	↓	−	↑

Notes: (↑↓) means the sign imposed in the response variables to the shock, (−) means no sign restriction

imposed, (**0**) no response as the variable is treated as exogenous process. (***OP***) represents Oil price, (***Y***) real output, (***DYR***) debt to GDP ratio, (***π***) inflation, (***M***) money supply, (***ir***) interest rate, (***Res***) non borrowed reserve, (***Inv***) real investment, (***XR***)real exchange rate, and (***SP***) stock price.

As a small open economy, this study employs world oil price (OP) rather than output or commodity price as the foreign variable that affect Indonesian economy. The second block contains the domestic variables consisting of; (Y) real output, (DYR) debt to GDP ratio, (π) inflation, (M) money supply, (ir) interest rate, (Res) non borrowed reserve, (Inv) real investment, (XR) real exchange rate, and (SP) stock price. This study uses Industrial production index to represent national output (This study also uses this indicator due to the data availability in monthly basis instead of national income that employed in quarterly basis), Debt to GDP ratio for the fiscal policy variables, the growth rate of consumer price index for inflation, Aggregate money supply (M1) for money supply, money market overnight call rate for monetary policy variable, international foreign exchange reserve for non borrowed reserve, gross fix capital formation for real investment, nominal exchange rate that is adjusted with foreign price over domestic price for real exchange rate and stock price index for stock price. All variables (except the inflation rate, Debt to GDP ratio and interest rate) are transformed by taking natural logarithms. All variables are in real term (constant price at certain base year depending the published report or if not available, this study calculated them ourselves with base year 2003, similar to BPS or Indonesian Statistic Agency base year) and seasonally adjusted using X11 multiplicative provided by Eviews6 and RATS. Our VAR model is specified in levels rather than in the first difference following Zaidi et al (2011) since there is no theoretically foundation to impose cointegration restriction on VAR model.

This study uses monthly data from January 2001 until December 2011. Data are collected from various sources such as the Monthly Indonesian Economics and Financial Statistics produced by Bank Indonesia (www.bi.go.id), Economic Indicators of Indonesian Statistics Agency or BPS/Badan Pusat Statistik (www.bps.go.id), Indonesian Stock Exchange market (www.idx.co.id), Directorate General of Debt Management of treasury department (www.djpu.kemenkeu.go.id), The world oil price data are taken from the website www.indexmundi.com. Some variables that are not available in monthly data, such as GDP and Debt (data from 2000 until 2008 are not provided on monthly but quarterly) are interpolated using cubic match last (option for interpolating from low to high frequency data) provided by the Eviews 6. The detailed formula of cubic match last is available at EVIEWS 6 user's guide.

This study imposes sign restriction on an increase in budget deficit, inflation, interest rate, and exchange rate and fall in non borrowed reserve in response to oil price shock. These identifying restrictions assume that budget deficit and interest rate should rise in response to oil price shock. The co-movement between oil price and inflation exist in accordance with the theory of oil price-inflation-pass through and this is relevent with the study of Cuñado and Pérez (2003, 2005) and Valcarcel and Wohar (2013).

Meanwhile, this study defines business cycles shock as a shock where inflation, real investment and exchange rate move the same direction while non borrowed reserve move at the opposite direction. This study employs the real investment instead of consumption as in many new Keynesian theorists' studies e.g. Blanchard and Perotti (2002), Giordano et.al. (2007), and Mountford and Uhlig (2009). It is expected that the co-movement between output and investment exist to represent the supply and demand shock under real business cycles theory. Finally, this study identifies the fiscal policy shock where the budget deficit increases for k periods after the shock (six months in this study). This identification will allow stock prices remains agnostic since this is the focus of the study.

This study employs the penalty criterion function in constructing all shocks meaning that the model will give more rewards largely to impulse response with the correct sign than those that the small response and penalizes the responses to the wrong sign. For example in the models, it is defined that the monetary policy impulse vector is an impulse vector a minimizing a given criterion function f(.) on the space of all impulse vectors, which penalizes positive impulse responses of output, inflation, money supply, reserve, investment, and exchange rate and negative impulse responses of the interest rate at horizon $k = 0, \dots, K$. This approach will find an impulse vector a which comes as close as possible to satisfying the sign restrictions by minimizing a penalty for sign restriction violation (Uhlig, 2005). Define, the penalty funtion

$$f(x) = \begin{cases} x & if\ x \leq 0, \\ 100 * x & if\ x \geq 0 \end{cases}$$

which penalizes positive responses in linear proportion and rewards negative responses in linear proportion but at a slope 100 times smaller than the slope for penalties on the positive side. Note that the parameters (B, Σ) are drawn from a Normal-Wishart prior and the sign of the penalty direction is flipped for the interest rate. To draw inference from the posterior for the penalty function approach, this study took $n = 100$ draws as proposed by Uhlig (2005) instead of 250 (proposed by Mountford and Uhlig, 2009) and employed Monte-Carlo method to optimize the shape of the impulse response. This study chooses two lag order since it is sufficient to capture the dynamics of the variables and hence the models are expected to have consistent and efficient coefficient since they do not consume too many degrees of freedom.

As mentioned above, in the first scenario, this study orders the business cycles shock as the first shock, the monetary policy as the second, the fiscal policy as the third and the oil price shock as the fourth. This study constructed that the monetary policy shock to be orthogonal to business cycle shock, the fiscal policy shock to be orthogonal to business cycle shock and the monetary policy shock, finally the oil price shock to be orthogonal of those three shocks. A consequence of the identification strategy is that this shock represents that part of the unanticipated monthly change in monetary policy (in case for monetary policy shock) that is not accounted for by systematic responses over the period to unanticipated business cycle shocks (Mountford and Uhlig, 2009). Moreover, this study identifies the fiscal policy shock is the shock that represents the unanticipated monthly change in fiscal policy that is not accounted for by systematic responses over the period to unanticipated monetary policy shocks and business cycles shocks. Finally, this study identifies the oil price shock is the shock that represents the unanticipated monthly change in oil price that is not accounted for by systematic responses over the period to unanticipated of fiscal policy shocks, monetary policy shocks, and business cycles shocks. This structural shocks identification is similar with the study of Rafiq and Malik (2008).

Recall in the second scenario, this study assumes that the impact of fiscal variable sometimes occurs with delay between the announcement from the President in front of the house of representative (In Indonesia it takes place usually every August $16^{th}$to be implemented for the next fiscal year) and its implementation. This study assumes the lag between the announcement and the implementation is about four months and these circumstances may lead the macroeconomic response. This study defines the fiscal shock in this scenario as a shock where budget deficit rises for four months after the shock and which is orthogonal to business cycles shock and monetary policy shock. Thus, this study places the fiscal shock and oil price shock to be mutually orthogonal in the third shock after the first two shock. Such restriction of the impulse response is called as "the announcement effect" or anticipated fiscal policy shock. This scenario identifies the fiscal policy variable will not response the fiscal policy shock for four months and then rise afterwards (a positive impulse response for the next eight months or 12 months after the shocks).

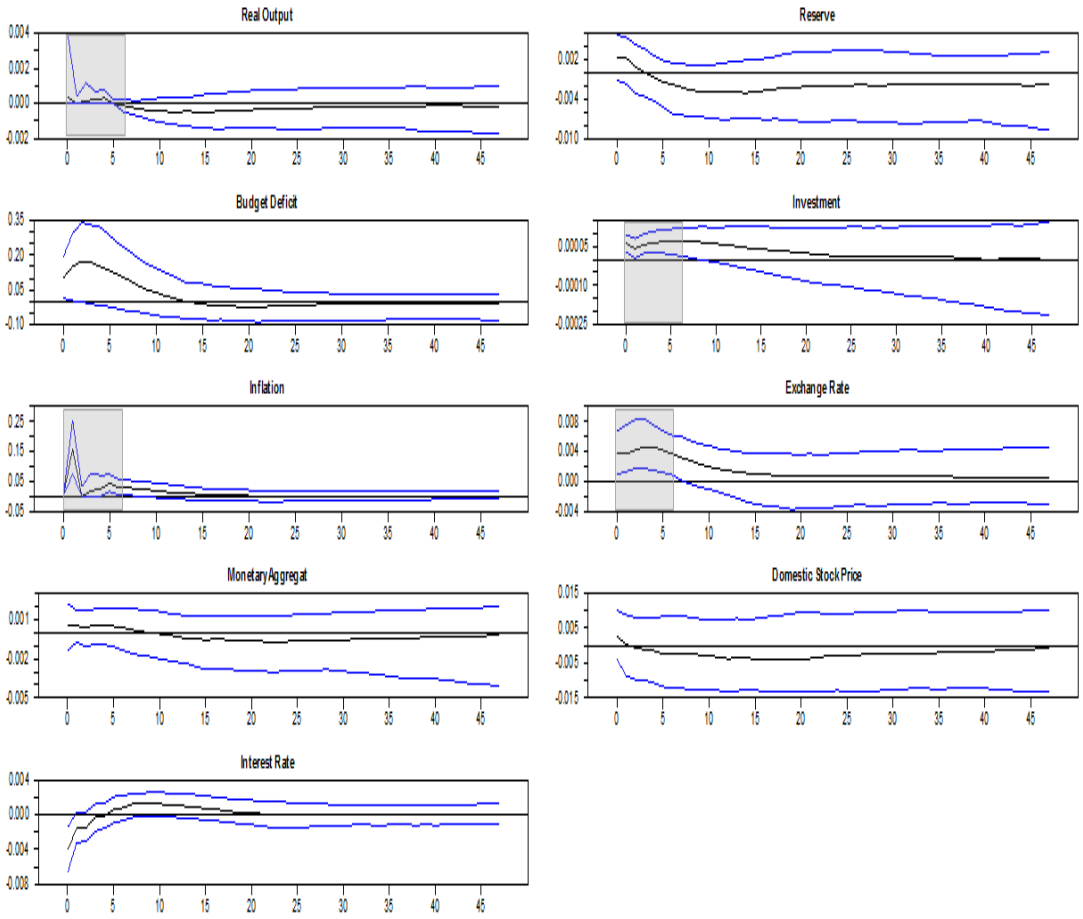
In the third scenario, this study extended the Mountford and Uhlig (2009)'s scenario which assume that the macroeconomic policy shocks exist in two dimensional space spanned by two basic shocks, which are government revenue and spending shock but this study employs the oil price shock and fiscal policy shocks instead and this is orthogonal to business cycles shock and monetary policy shock which in turn also identified using sign restriction. As Mountford and Uhlig (2009) stated that there is no need for these two shocks to be mutually orthogonal. These two shocks can be described to scrutinize the behavior of the different linear combination of these two basic shocks. Under this scenario, this study assumes that fiscal policy makers will announce the policy stance to give direction to the economic agents and in the same time the firm and the individual are able to anticipate an increase in the oil price, hence both shocks are anticipated ones.

Estimation Results

This section discusses the results of impulse responses of all variables (except the oil price) to each shock. This study aims to analyze the responses of key variables only, not to all variables. The shocks are identified for each draw from the posterior and 68% posterior band of the median response function is used. The problems that arise when using vector of pointwise posterior medians of the impulse responses as a measure of the central tendency of the impulse response functions is that the vector of pointwise posterior median responses will have no structural economic interpretation (see Inoue and Kilian, 2011). The second shortcoming is that median response functions are not a valid statistical summary of the admissible set of impulse response functions. In order to take into account this perspective, this study also attempts to use the impulse responses at the original estimates for the VAR and it can be used for robustness check compared to the median ones.

The First Scenario

Figure 3 shows the response of all variables (except oil price) to a business cycles shock. It is clear that all responses meet the identification strategy with $K = 6$. That is the response of real output, inflation, real investment and real exchange rate have been restricted no to be negative for the 6 months ($k = 0, \dots, 5$) following the shock. As shown, real outputs behave in a pro-cyclical fashion. They increase slowly and then the response is basically zero. Inflation initially rise largely and positively reaching the peak at 15% 2 months after shock and then decline sharply in the next months, back to zero basis point. With a $2/3$ probability, the impulse response of real investment is within ± 0.005% interval around zero at any point during 48 months following the shock. The real exchange rate response positively as expected, reach plateau of 0.004% and approach the zero point at 30 months after shock. Given that, no restriction is placed on these responses after six periods, it is notable that all of these responses are persistent. Meanwhile, the response of fiscal, monetary and financial variables to the business cycle shock were not restricted and the findings on these variables are quite interesting. This study finds that budget deficit, interest rate and the stock prices have positive response to business cycle shock. These findings are in line with the study of Romer and Romer (1994) and Mountford and Uhig (2009). This could be caused by a systematic counter-cyclical response to monetary variable, whereas fiscal and financial variables still responds pro-cyclical.

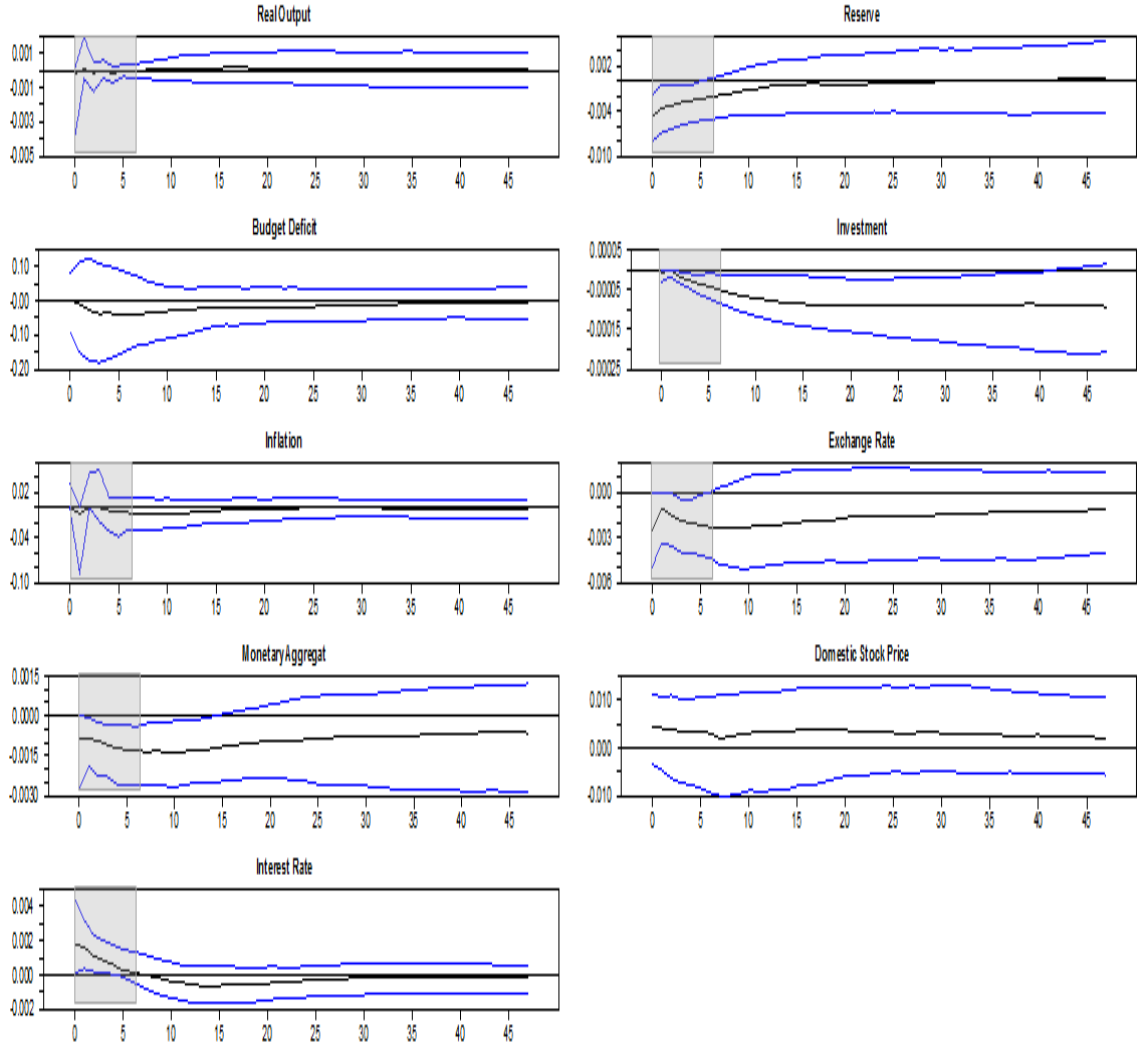


Note: Business Cycles shock ordered first. The shaded areas indicate the horizon ($k = 6\ months$) that impulse responses restricted by the sign identification construction

Figure 3: Responses to Unanticipated Business Cycles Shock

Figure 4 shows the response of all variables (except oil price) to a monetary policy shock. It is clear that all responses meet the identification strategy. That is the response of real output, inflation, monetary aggregate, real investment and real exchange rate have been restricted no to be positive for the 6 months following shock and they require to orthogonal to the business cycle shock. Output, inflation, non borrowed reserve and investment fall in response to monetary policy shock as expected by construction although interestingly by very small. This finding is consistent with the study of Uhlig (2005) which concluded that monetary policy has practically no effect on real GDP even though the study have employed the sign restriction by construction. This could be due to monetary policy shock having little real effect or due to Central Bank remain focus on reaching the inflation targeting rather than output targeting. Monetary aggregate also fall in response to monetary policy shock within 0.0015% over the long horizon.

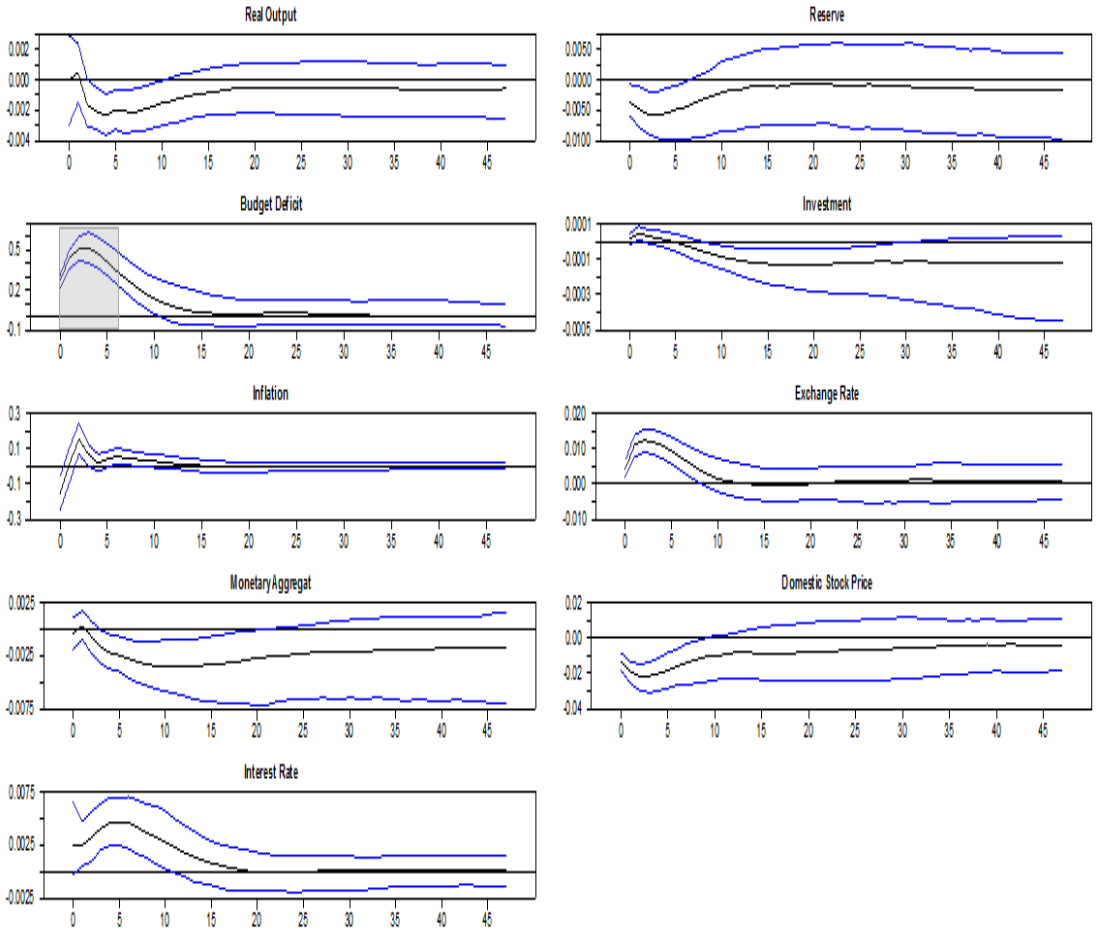
These findings confirm that the model avoid the puzzle. As for interest rate, note that these impulse responses contain the endogenous reaction of monetary policy shock to its own. The interest rate rise initially and then fall after six months into negative territory but it is basically zero over the long run. This finding is in line with the Uhlig's (2005) finding. There are several reason behind this finding. First, this may reflect that monetary policy shocks really arise as errors of assessment of the economic situation by the Central Bank. The central Bank may tipically try to keep the steering wheel steady. When they accidentally make an error and lead to shock to the economy, then they will try to reverse course soon afterwards. Second, this may reflect a reversal from a liquidity effect to a Fisherian effect. With inflation declining, a decline in the nominal rate may nonetheless indicate a rise in the real rate. Third, Central Bank tends to implement prudent monetary policy when the fiscal authority pursues its objective to keep the fiscal budget more sustainable, for example by increasing the domestic oil market. Then, in turn, Central Bank will increase the interest rate initially. After the economic agents make adjustment and economy back to normal and Central Bank will reduce the interest rate back to its long run equilibrium.



Note: Monetary policy shock ordered second and orthogonal to the business cycle shock. The shaded areas indicate the horizon $(k = 6\,months)$ that impulse responses restricted by the sign identification construction

Figure 4: Responses to Unanticipated Monetary Policy Shocks

The stock prices respond positively to monetary policy shock. Theoretically, a rise in interest rate is predicted to have negative effect on stock price. In addition, contractionary monetary policy would contract aggregate demand and subsequently leading to fall in stock prices; inversely expansionary monetary policy would lead to an increase in stock prices. There are several reasons for this finding. First of all, this may be due to the probability of the asset price bubble increase for the last decade regardless the policy actions conducted by monetary authority. Investors expect that as long as the future business prospect still profitable and the government perform the economy well, the demand for the asset still high. Secondly, this finding confirms that monetary policy is not effective for the Bank Indonesia to intervene the Stock market. This is because the rapid development in financial market is not only affected by the monetary policy alone but also by the liberalization policy and reform in the financial sector that has been done so far such as abolition of foreign exchange control, investment policies consistent with global economic development, free flow of foreign exchange, the development of technology in communications and trading systems, the introduction of innovative financial product, information availability, implementation of international accounting standard and the relaxation of foreign ownership.

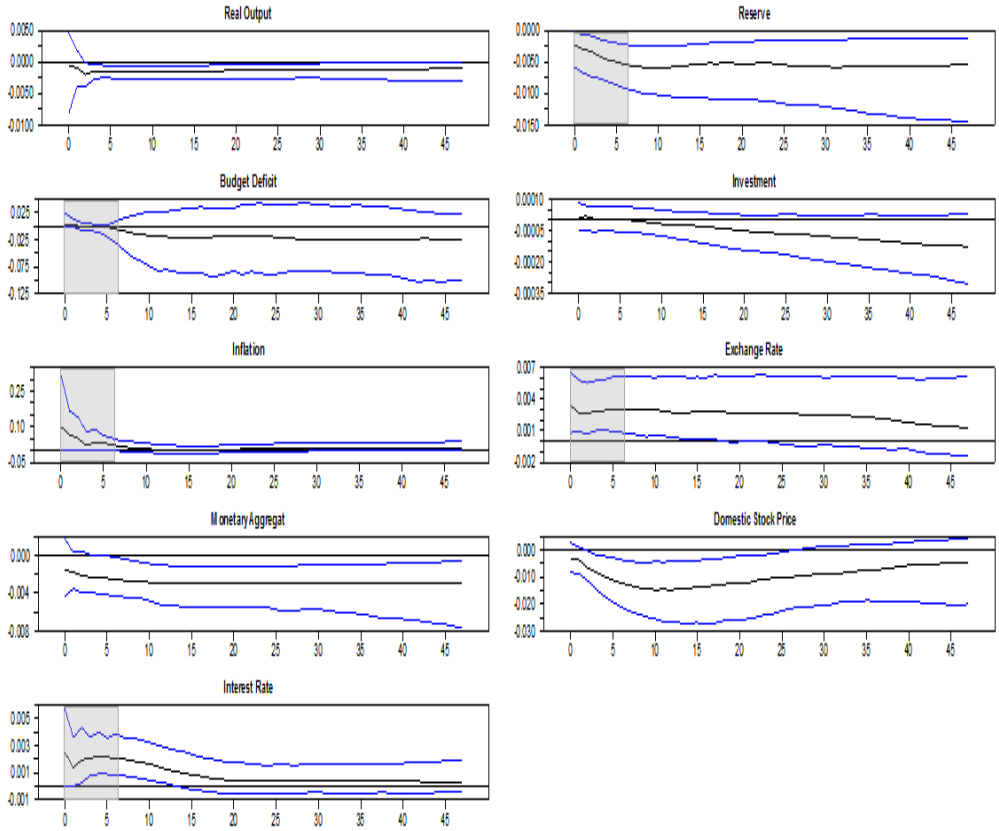


Note: Fiscal Policy Shock ordered third and orthogonal to the business cycle shock and monetary policy shock. The shaded areas indicate the horizon $(k = 6\ months)$ that impulse responses restricted by the identification construction

Figure 5: Responses to Unanticipated Fiscal Policy Shocks

Figure 5 shows the response of all variables (except oil price) to a fiscal policy shock. Again, in this scenario, this study assumes that fiscal policy shocks are identified only through restricting the impulse responses of the fiscal variable to be negative for the 6 months following the shock and they require to orthogonal to the business cycle shock and monetary policy shock. No restrictions were imposed on other variables. The response of fiscal variable are as expected. The variables that respond initially positive to the fiscal policy shock are real output, interest rate, real investment, real exchange rate and the other responses are negatively impact. Under these circumstances, it seems that monetary policy conduct the counter-cyclical fashion to reduce the impact of fiscal policy shock since the Bank Indonesia has single objective to maintain the low and stable inflation. In this case, both fiscal and monetary policies seem to be working to decrease growth in their aims to maintain inflation and return to the previously pertaining debt to GDP equilibrium. This study is in line with the study of Chung and Leeper (2007) and Dungey and Fry (2009).

The response of real output to an increase in unanticipated fiscal policy shock is positive initially but then decline in the second months after shock reaching the peak negative at 0.003% and persistent over the long run. The responses of inflation to an increase in budget deficit experience puzzle since it declines. These findings are about to support the argument of counter cyclical fashion. Negative relationship between fiscal policy and inflation is in line with the study of Canova and Pappa (2007) and Mountford and Uhlig (2009). Meanwhile, the responses of stock prices are quite interesting since they fall in response to an increase budget deficit. This finding is in line with the findings of Darrat (1990), Afonso and Sousa (2011), and Agnella and Sousa (2012) which confirm the negative response of stock prices to fiscal policy shock. From above empirical findings, fiscal policy crowd out private sector activity in stock market, thus its effect will be impotent on the economy.



Note: Oil price shock ordered the last and orthogonal to the business cycle shock, monetary policy shock and fiscal policy shock. The shaded areas indicate the horizon $(k = 6\,months)$ that impulse responses restricted by the identification construction

Figure 6: Responses to Unanticipated Oil price Shock

Figure 6 shows the response of all variables (except oil price) to oil price shock. Under this scenario, the response of budget deficit, inflation, interest rate and real exchange rate have been restricted no to be negative and non borrowed reserve not to be positive for the 6 months following the shock. Inflation reacts largely and positively immediately, reaching 10% and then fall reach the zero line at 10 months after shock. Monetary policy responses positively to oil price shock within 0.6 basis points during the first 4 years after shock. Non borrowed reserve drop initially and five months after shock the drop decline with the interval from 0.25 basis points to 0.75 basis points. Real exchange rate reacts swiftly approach at 0.4% in the first month and drop to 0.1% over the long horizon. The response of real output, monetary aggregate, real investment and stock prices to the oil price shock were not restricted and perhaps the result make sense after all. All these variables are negatively responding to the oil price shock.

From the above findings, this study can produce some interesting insights into the challenging policy choices faced by oil-importing country such as Indonesia. As shown, fiscal variable is not responsive to the oil price shock. This finding is quite surprise since it is expected to be positive response. A primary concern for fiscal policy in responding the oil price shock is how much of current fuel subsidy should be spent on current government spending to prevent the social welfare loss but still have space to secure the fiscal sustainability in the long run. This study finds evidence that the government will not increase the budget deficit to compensate an unanticipated oil price shock. There are many reasons of this finding. The main reason is that the cause of an increase of Indonesian budget deficit is not only from oil price shock but the other factor. For instance, as a new democratic country since 1998 reform post-Soharto regime, the budget for democracy also increase at the same time such as budget for presidential election, central and local parliament election and the local leader election. As one of the larger debted country (approach 200 billion dollars in 2011), Indonesia spent 30%-40% of the government spending to pay the high interest of debt and its principal. Furthermore, to avoid the bad impact of oil price shock, the government conduct the prudent fiscal policy through an increase of domestic oil price particularly in 2005 and 2008, hence the burden of fiscal deficit can be reduced through this mitigation policy. Obviously, other reasonable interpretation can be found.

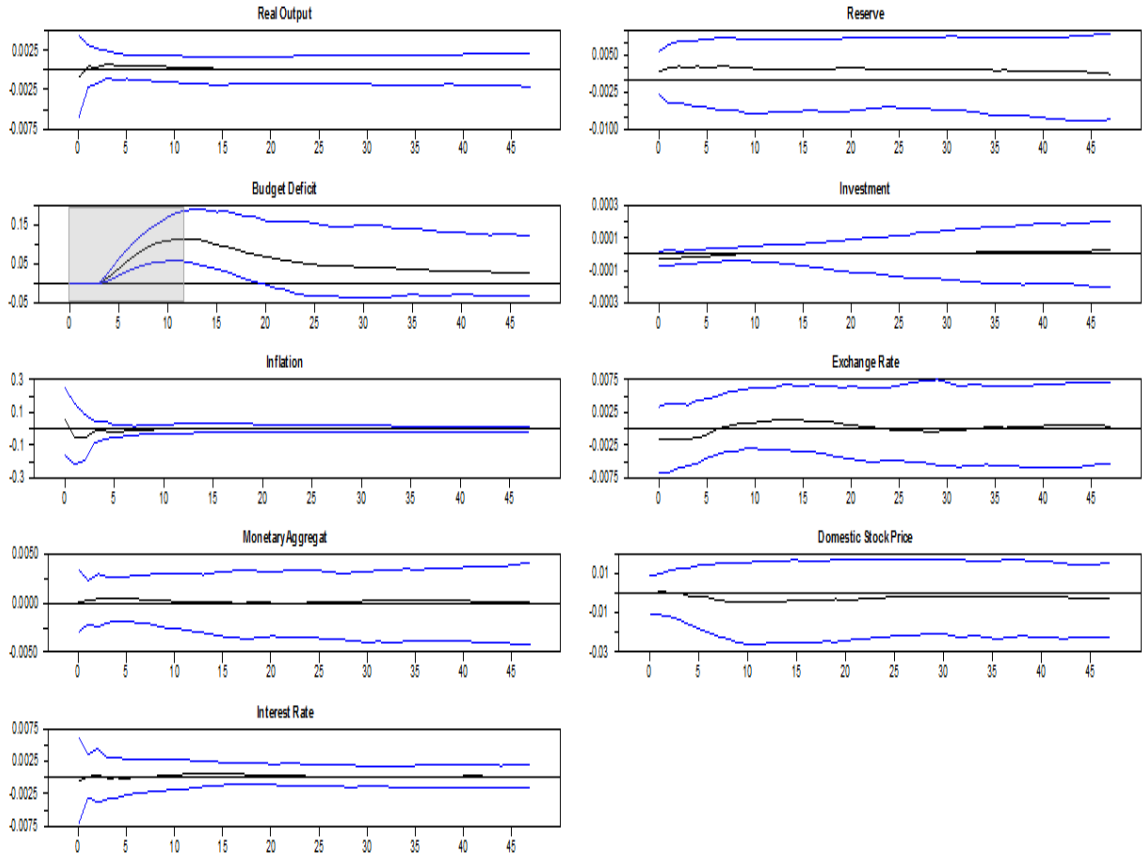
For the monetary policy, in order to combat the oil price hikes that will pass through to domestic price, the central bank reacts positively, although this policy can worsen the economic growth and this finding is as expected since the

sign restriction is imposed on the model. Moreover, this study finds evidence that inflation is variable that respond to oil price shock positively immediately and this is consistent with theory. In addition, non borrowed reserve and real exchange rate reacts the opposite way to oil price shock since an increase in oil price will lead to deficit of trade balance and exchange rate to depreciate regarding an increase in oil import. The stock prices response the opposite direction to the oil price shock and these circumstances has motivated the investor to adjust their portfolio to move their capital to other asset in order to avoid the capital loss regarding the slowdown of Indonesian economy since Indonesia become net importer oil country.

The Second Scenario

Recall in the second scenario, it is assumed that the impact of fiscal variable sometimes occurs the delayed shock between the announcement from the President in front of the house of representative (In Indonesia it takes place usually every August 16th to implement the next fiscal year) and its implementation. It is assumed that the lag between the announcement and the implementation about four months and it may lead the macroeconomic response. Such restriction of the impulse response is called as "the announcement effect" or anticipated fiscal policy shock. This scenario attempts to identify the fiscal policy variable that will not response the fiscal policy shock for four months and then rise afterwards (a positive impulse response for the next eight months or 12 months after the shock) is orthogonal to two previous shocks which are business cycle shock and monetary policy shock. The responses of this shock are displayed in figure 7.

As shown, the responses of most variable are less responsive except Inflation, non borrowed reserve and exchange rate. This irresponsiveness may be due to smoothing and prudent behavior of economic agents. They still have to "wait and see" the true policy that the government will implement for the next fiscal year although the policies have been stated formally in front of the house of representatives.



Note: The announced or anticipated fiscal policy shock identified by orthogonality to the business cycle shock and monetary policy shock as well as a zero impulse response for the first four months and a positive impulse response for the next eight months (or 12 months after the shock). The shaded areas indicate the horizon ($k = 12\ months$) that impulse responses restricted by the identification construction.

Figure 7: Responses to Announced (Anticipated) Fiscal Policy Shock

The Third Scenario

In the third scenario, this study scrutinizes the linear combination of shock between fiscal policy shock and oil price shock at the same time. In this scenario, it is assumed that the oil price shock increase by 1% for four months while fiscal policy shock remains unchanged. Finally, it is also assumed that both shocks increase by 1% for four months. This study follows this additional identifying power employing Mountford and Uhlig (2009)'s method. For example in the first experiment, it is assumed that $r_{j,a}(k)$ as the response at horizon k of variable j to the impulse vector a then the combination of shocks require that

$$0.01 = \sum_{j=0}^{k} (r_{BD,BDS}(k-j)BDS_j + \sum_{j=0}^{k} r_{BD,OPS}(k-j)OPS_j) \quad for\ k = 0, \dots, K$$

$$0 = \sum_{j=0}^{k} (r_{OP,BDS}(k-j)BDS_j + \sum_{j=0}^{k} r_{OP,OPS}(k-j)OPS_j) \quad for\ k = 0, \dots, K$$

Where K = 4, BD and OP are Budget Deficit and Oil Price respectively and BDS_j and OPS_j are the scale of the standard basic budget deficit and oil price shocks in period j.

The figure 8 below shows the similar responses as in figure 3.6. Figure 8 shows the Inflation reacts largely and positively immediately then fall reach the zero line at 10 months after shock as in figure 3.6. Interest rate responses positively and monetary aggregate response negatively to these shocks. Reserve drop initially and persistent in negative zones and real exchange responses positively over the long horizon.

The response of stock prices to these shocks is negative as in figure 3.6. This finding is about to support the market agent's perspective that the increase in oil price shock is more dominance than the fiscal policy shock. As explained previously, although oil price in domestic market is heavily regulated, the government still does not regulate (non subsidy) oil price for large industries or factories and foreign-flagged vessels (Government regulate the domestic oil price through the fuel subsidy especially for household's consumption, public transportation, small and medium enterprises, and other public and social service). This means that the firms are still affected much from the fluctuation of the oil price over the last decade. Any increase in oil price shock will, in turn, influence the firms' cost of production. Consequently, this policy worsens the economy although the government attempt to minimize the impact of the oil shock by increasing its spending and in turn increasing the budget deficit. This is the reasons why the impact of the combination of these two shock are dominated more on by the oil price shocks rather than the fiscal policy shock.

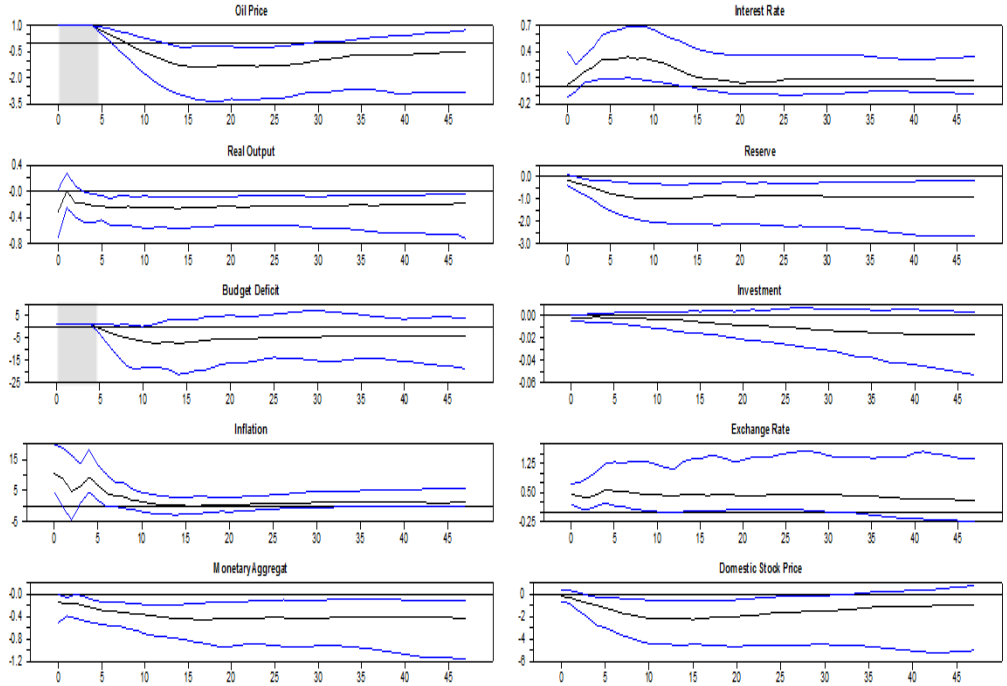


Figure 8: Responses to 1% Increase in Budget Deficit and Oil Price for four months

Robustness Check

This section attempts to check the robustness of the empirical results. In particular, we investigate the findings of the VAR analysis using four basic aspects. First of all, this study investigates whether the specification of the variables in first differences for the results different from those on the basic model. Second of all, this study runs the VAR model using the central bank policy rate (certificate bank Indonesia) to replace the interbank offer rate (IBOR) as in basic model and analyze whether the second specification perform similar to the basic model. Thirdly, the study re-estimates the basic model using various of lag such as 4, 6, and 8 and check the difference with the original model which use lag 2. The results from the visual inspection of the responses to all shocks on these four specifications show that model is robust (The results of the robustness check is upon request).

Conclusion and Policy Recommendation

The aim of the study is to investigate the effect of oil price shock, business cycles, monetary and policy shocks on stock market and some macroeconomic variables using sign restriction VAR developed by Mountford and Uhlig (2009). Overall, the results of the study are consistent with standard economic theory. In the first scenario, the findings stated that budget deficit, interest rate and the stock prices have positive response to business cycle shock. Monetary policy has practically no effect on real GDP even though this study employed the sign restriction by construction. This study also found the negative relationship between fiscal policy and inflation. From this empirical findings, fiscal policy crowd out private sector activity in market, thus its effect will be impotent on the economy and particularly on the financial market.

In the second scenario, the responses of most variable are less responsive except Inflation, non borrowed reserve and exchange rate. This irresponsiveness may be due to smoothing and prudent behavior of economic agents. They still have to "wait and see" the true policy that the government will implement for the next fiscal year although the policies have been stated formally in front of the house of representatives. In the third scenario, this study found that individual and firm attempt to make some adjustment before the policy implement and hence this is one form of forward looking manner of market agents.

This study concludes that fiscal variable is not responsive to the oil price shock. This finding is quite surprise since it is expected to be positive response. A primary concern for fiscal policy in responding to the oil price shock is how much of current fuel subsidy should be spent on current government spending to prevent the social welfare loss while still having space to secure the fiscal sustainability in the long run. This study finds evidence that the government will not increase the budget deficit to compensate an unanticipated oil price shock. One main reason behind this finding is that to avoid the bad impact of oil price shock, the government conduct the prudent fiscal policy through an increase in domestic oil price, hence the burden of fiscal deficit can be reduced from this mitigation policy. Since the government set the domestic price to be lower (and in fix of price) than the international price, when the international oil prices keep increasing over time, the government must increase its subsidy and this, in turn, will increase the budget deficit. Under this circumstance, the increase of budget deficit is not effective in stimulating the economic growth. Furthermore, in 2024, Indonesia oil reserve will be exhausted and Indonesia will become completely oil-importing country (The Statistical Review of World Energy, 2013). Hence, in the future, government should phase out the fuel subsidy completely, set the domestic price equal to international market, and government can use the money to finance the infrastructure sector or other important sectors and this policy perhaps will improve the economic activity.

Limitation of the Study

As in other time series modeling, this study also has some limitations. First of all, as mentioned earlier, this study uses monthly data from January 2001 until December 2011. This study covers sample period from January 2001 to avoid the effect of 1998 economic crisis. Nevertheles, the sample period still covers the period of global financial crisis of 2008. Then there exist a structural break and one should treat it carefully. These studies do not take into account the structural break.

Secondly, in developing the model of Indonesian stock market, the oil price is the only variable that represents the foreign variable. Many studies have taken into account other foreign variables such as world commodity price, US monetary policy, US output, US inflation and energy price in constructing macroeconomy model and stock market model in particular.

Direction for the Future Research

This study can be developed further by taking into account the regime switching model. The Markov Switching model can be developed extensively by combining with impulse response function. The studies on this perspective are few. Impulse–response functions (IRFs) provide a global picture of what happens in a system hit by an exogenous shock within a given horizon. With nonlinear specifications, the analysis reaches the richer field of asymmetries (see

for instance Ehrman, et.al, 2003; Karame, 2010; Lane and Lutkehpol, 2010). These IRFs are somehow different from the ones posed by the traditional VAR literature insofar as they study the impact of a change in regime or a variable and not of an identified structural shock. For example, the approach proposed by Ehrmann et al. (2003) is fully-parameterized MSVARs and deals more specifically with the problem of state asymmetry. They proposed a regime-dependent IRF (RD-IRF hereafter) to study the response of the system conditionally to the regime in which the shock occurs

References

Afonso, A., Sousa, RM. (2011). *What are the effects of fiscal policy on asset markets? Economic Modelling, 28*(4), 1871-1890.

Agnello, L., Castro, V., Sousa, R.M. (2012). How does fiscal policy react to wealth composition and asset prices? *Journal of Macroeconomics, 34*(3), 874-90.

Agustina, C., Dian R.D., del Granado, Javier A., Bulman, T., Fengler, W., Ikhsan, M. (2008). *Black hole or black gold? the impact of oil and gas prices on Indonesia's public finances*. The World Bank.

An, L., & Wang, J. (2012). *Exchange rate pass-through: Evidence based on vector autoregression with sign restrictions*. *Open Economies Review, 23*(2), 359-80.

Bernanke, B. S., & Mihov, I. (1998). The liquidity effect and long-run neutrality. In *Carnegie-Rochester conference series on public policy* (Vol. 49, pp. 149-194). North-Holland.

Blanchard, O., Perotti, R. (2002), *An empirical characterization of the dynamic effects of changes in government spending and taxes on output*. *The Quarterly Journal of Economics, 117*(4), 1329-1368.

Bohn, H. (1998). The behavior of US public debt and deficits. *The Quarterly Journal of Economics, 113*(3), 949-963.

Canova, F., Pappa, E. (2007). *Price Differentials in Monetary Unions: The Role of Fiscal Shocks*. *The Economic Journal, 117*(520), 713-737.

Canova, F., & Nicoló, G. (2003). On the sources of business cycles in the G-7. *Journal of International Economics, 59*(1), 77-100.

Christiano, L. J., & Eichenbaum, M., Evans, C. L. (1999). *Monetary policy shocks: What have we learned and to what end?*.

Chung, H., & Leeper, E.M. (2007). What has financed government debt? *National Bureau of Economic Research*.

Cuñado, J., & de Gracia, F. P. (2003). Do oil price shocks matter? Evidence for some European countries. *Energy Economics*, *25*(2), 137-154.

Cunado, J., & De Gracia, F. P. (2005). Oil prices, economic activity and inflation: evidence for some Asian countries. *The Quarterly Review of Economics and Finance*, *45*(1), 65-83.

Darrat, A. F. (1990). Stock returns, money, and fiscal deficits. *Journal of Financial and Quantitative Analysis, 25*(03), 387-398.

Dartanto, T. (2013). Reducing fuel subsidies and the implication on fiscal balance and poverty in Indonesia: A simulation analysis. *Energy Policy, 58*, 117-134.

Dedola, L., & Neri, S. (2007). *What does a technology shock do? A VAR analysis with model-based sign restrictions*. *Journal of Monetary Economics, 54*(2), 512-549.

Dungey, M., & Fry, R. (2009). The identification of fiscal and monetary policy in a structural VAR. *Economic Modelling, 26*(6), 1147-1160.

Ehrmann, M., Ellison, M., & Valla, N. (2003). Regime-dependent impulse response functions in a Markov-switching vector autoregression model.*Economics Letters*, *78*(3), 295-299.

Favero, C., & Giavazzi, F. (2007). Debt and the effects of fiscal policy. *National Bureau of Economic Research*.

Franta, M. (2011). *Identification of monetary policy shocks in Japan using sign restrictions within the TVP-VAR framework*. Institute for Monetary and Economic Studies, Bank of Japan.

Giordano, R., Momigliano, S., Neri, S., & Perotti, R. (2007). *The effects of fiscal policy in Italy: Evidence from a VAR model. European Journal of Political Economy, 23*(3), 707-733.

Jääskelä, J. P., & Jennings, D. (2011). Monetary policy and the exchange rate: Evaluation of VAR models. *Journal of International Money and Finance, 30*(7), 1358-1374.

Smets, F. R. (2008). House Prices and the Stance of Monetary Policy. In*Federal Reserve Bank of St Louis Review*.

Karamé, F. (2010). Impulse–response functions in Markov-switching structural vector autoregressions: A step further. *Economics Letters, 106*(3), 162-165.

Karim, Z. A. (2013). Interest Rates Targeting of Monetary Policy: An Open-Economy SVAR Study of Malaysia. Paper presented at *The Malaysian National Economic Conference / Persidangan Kebangsaan Ekonomi Malaysia (PERKEM) VIII, Malaysia*.

Kilian, L., & Murphy, D. P. (2012). Why agnostic sign restrictions are not enough: understanding the dynamics of oil market VAR models. *Journal of the European Economic Association*, *10*(5), 1166-1188.

Lanne, M., Lütkepohl, H., & Maciejowska, K. (2010). Structural vector autoregressions with Markov switching. *Journal of Economic Dynamics and Control*, *34*(2), 121-131.

Laopodis, N. T. (2009). Fiscal policy and stock market efficiency: Evidence for the United States. *The quarterly Review of Economics and finance*, *49*(2), 633-650.

Li, Y. D., İşcan, T. B., & Xu, K. (2010). The impact of monetary policy shocks on stock prices: Evidence from Canada and the United States.*Journal of International Money and Finance*, *29*(5), 876-896.

Lippi, F., & Nobili, A. (2008). *Oil and the macroeconomy: A structural VAR analysis with sign restrictions*. Bank of Italia

Lütkepohl, H., & NetŠunajev, A. (2014). Disentangling demand and supply shocks in the crude oil market: How to check sign restrictions in structural VARs. *Journal of Applied Econometrics*, *29*(3), 479-496.

Mountford, A., & Uhlig, H. (2009), *What are the effects of fiscal policy shocks? Journal of applied Econometrics*, *24*(6), 960-992.

Muscatelli, V.A., Tirelli, P., & Trecroci, C. (2004). Fiscal and monetary policy interactions: Empirical evidence and optimal policy using a structural New-Keynesian model. *Journal of Macroeconomics*, *26*(2), 257-280.

Pappa, E. (2009). The effects of fiscal shocks on employment and the real wage. *International Economic Review*, *50*(1), 217-244.

Peersman, G., & Straub, R. (2009). Technology shocks and robust sign restrictions in a Euro area SVAR. *International Economic Review*, *50*(3), 727-750.

Rafiq, M. S., & Mallick, S. K. (2008). The effect of monetary policy on output in EMU3: A sign restriction approach. *Journal of Macroeconomics*, *30*(4), 1756-1791.

Scholl, A., & Uhlig, H. (2008). New evidence on the puzzles: Results from agnostic identification on monetary policy and exchange rates. *Journal of International Economics*, *76*(1), 1-13.

Sims, C. A. (1992). Interpreting the macroeconomic time series facts: The effects of monetary policy. *European Economic Review*, *36*(5), 975-1000.

Sims, C. A., & Zha, T. (1999). Error bands for impulse responses.*Econometrica*, *67*(5), 1113-1155.

Son, H. H. (2008). *Conditional cash transfer programs: An effective tool for poverty alleviation?* : Asian Development Bank.

Tachibana, M. (2013). How have inflation-targeting central banks responded to supply shocks? *Economics Letters*, *121*(1), 1-3.

Tillmann, P. (2013). Capital inflows and asset prices: Evidence from emerging Asia. *Journal of Banking & Finance*, *37*(3), 717-729.

Uhlig, H. (2005). What are the effects of monetary policy on output? Results from an agnostic identification procedure. *Journal of Monetary Economics*,*52*(2), 381-419.

Valcarcel, V. J., & Wohar, M. E. (2013). Changes in the oil price-inflation pass-through. *Journal of Economics and Business*, *68*, 24-42.

Vargas-Silva, C. (2008). Monetary policy and the US housing market: A VAR analysis imposing sign restrictions. *Journal of Macroeconomics*, *30*(3), 977-990.

Zaidi, M. A. S., & Karim, Z. A. (2012). Relative Importance of Singapore, US and Japanese Shocks on Malaysian Economy: An SVAR with Sign Restriction Analysis. Paper presented at the *Persidangan Kebangsaan Ekonomi Malaysia* VII (PERKEM VII), Malaysia.