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The Impact Monetary and Fiscal Policy Shock on Indonesian Stock Market

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ABSTRAK

Kajian yang menggunakan kaedah simulasi yang menarik betul-betul dari pengedaran posterior model SVAR telah muncul baru-baru ini. Sampler terhingga siri yang digunakan dalam model kadang-kadang tidak cekap dalam membuat beberapa kesimpulan. Kesimpulan berdasarkan sampler terhingga secara serius boleh memutarbelitkan tafsiran ekonomi. Dalam kertas kerja ini, kita cuba untuk meneliti kesan kejutan dasar kewangan dan fiskal pada harga saham Indonesia menggunakan monte carlo algoritma untuk model Near-SVAR (Jika ada persamaan VAR mempunyai regressors tidak termasuk dalam persamaan lain-lain). Dalam kes Near-SVAR, Seemingly Unrelated regressions (SUR) boleh digunakan untuk anggaran pekali. Kaedah ini dapat menyekat matriks kovarians dari sisa dikurangkan bentuk (reduced form residuals) untuk mendapatkan jawapan dorongan interpretable ekonomi. Kita menggunakan monte carlo algoritma untuk Near SVAR yang dibangunkan oleh [Waggoner, D.F., Zha, T., 2003. A Gibbs sampler for structural vector auto regressions. Journal of Economic Dynamics and Control 28, 349-366]. Kertas kerja ini juga cuba untuk mengkaji kesan dasar fiskal dan kewangan pada pecahan sektor indeks harga saham utama dalam pasaran saham Indonesia seperti pertanian, perlombongan, pembuatan, dan indeks sektor kewangan. Kami mendapati bahawa terdapat satu respons positif harga saham kepada kejutan dasar kewangan sama ada agregat dan pecahan. Dalam jangka interaksi antara kejutan dasar fiskal dan pasaran saham, kita mendapati bahawa semua sektor respons homogeneously berhubungan negatif

ABSTRACT

The study that use the simulation method that draw exactly from posterior distribution of SVAR model has emerged recently. The finite samplers of the series used in the model are sometimes inefficient in making some inferences. The inferences based on the finite sampler can seriously distort economic interpretations. In this paper we attempt to scrutinize the impact of monetary and Fiscal policy shock on Indonesian stock price using monte carlo algorithm to Near-SVAR models (If some of the VAR equations have regressors not included in the others). In the case of near SVAR, Seemingly Unrelated Regressions (SUR) can be used for estimation of the coefficients. This method is able to restrict the covariance matrix of reduced-form residuals to obtain economically interpretable impulse responses. we employ monte carlo algorithm to Near-SVAR that developed by [Waggoner, D.F., Zha, T., 2003. A Gibbs sampler for structural vector auto regressions. Journal of Economic Dynamics and Control 28, 349-366]. This paper also attempt to investigate the effect of fiscal and monetary policy on disaggregated main sector stock price index in Indonesian Stock market such as agricultural, mining, manufacture, and financial sector indexes. We found that there is a positive stock price respons to monetary policy shock both aggregated and disaggregated. In term of interaction between fiscal policy shock and stock market, we found that all sectors respond homogeneously negative relationship.

Keywords: Monetary Policy Shock, Fiscal Policy shock, Stock Price, Monte Carlo Integration Near SVAR model, Impulses Response.

INTRODUCTION

The stock market plays an important role in channeling from the surplus spending sides to deficit spending ones in the economy. The capital owners can directly invest their fund on the prospectus and well organized companies. The stock market has a function as a medium to mobilization and allocation of funds among alternative resources that are useful to the growth and efficiency of the economy. Through capital mobilization, the stock market enhances economic growth by issuing of shares, stocks, and other equities for firms that need finance to expand their business. Stock prices have close relationship to economic business prospect because a firm's financial health depends on the health or weakness of the economy and the "true" value of a firm's stock must be equal to the discounted expected cash flow or dividends. Expected dividends, in turn, should reflect real economic activity as measured by real output or industrial production index. Hence, the overall development of the economy reflects the stock market performance and this become the main condition for economic growth.

As a good leading indicator of real economic activity, stock price has been a concern of study to both academicians and practitioners in many decades. The relations between stock market neither in terms of stock returns nor prices and between fundamental economic activities are well documented. Numerous studies attempted to analyze the relation between stock market and real economic activities in terms of industrial production index, growth rate of gross national product, gross domestic product, dividend yields, and so forth (Fama, 1970, 1990, 1991; Barro, 1990; Schwert, 1990; Cheung and Ng, 1998; Mauro, 2003; Binswanger, 2000, 2001, 2004; and Tsouma, 2009).

Nevertheless, in the last two decades, numerous studies that emphasized on investigating the stock market movement found that real economic activity could not explain the behavior of stock market movement alone but both domestic and external factors should take into account. Laopodis (2005) argued that the significant increase in equity prices during the second part of the 1990s in the US was not caused by only the fundamental values such as projected earnings growth, or dividends but also to exogenous shocks, and/or market irrational behavior. In addition, Dungey and Fry (2009) stated that good economic management depends on understanding how shocks from monetary policy, fiscal policy and other sources affecting the economy and their subsequent interaction.

Many empirical studies attempted to scrutinize both impact fiscal and monetary policies on output and inflation rather than stock price. The reason why we use stock prices are because they are the most responsive, while output and inflation are the most sluggish due to many restriction to various sort of adjustment costs in determining the quantities of most goods and services (Sims and Zha, 2006; Cheng and Jin, 2013). Nowadays, numerous empirical studies in the financial literature that focused on the effect of monetary policy and fiscal policy both in separated analysis as well as the joint analysis on stock market have increased recently. Below, we provide the explanation both theoretically and empirically discussion of each interaction of policy shocks on the stock market.

Numerous researchers view the stock market as an independent source of macroeconomic volatility to which policy makers may wish to respond. Stock prices often exhibit volatility leading to deviations from their 'fundamental' values and once corrected may have significant adverse consequences for the broader economy (Bernanke and Kuttner, 2005; Ioannidis and Kontonikas, 2008). Hence, establishing quantitatively the existence of a stock market response to monetary policy changes will not only be closely related to the study of stock market determinants itself but will also contribute to a deeper understanding of the conduct of monetary policy and of the potential economic impact of policy actions or inactions. 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 and, furthermore, increase a firm's ability to fund the production level through credit channel. 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, and employ them as short-run leading indicators for the stance of monetary policy.

Several authors have discussed in detail the effect of monetary policy shock on stock market recently. Using the interest rate as the instrument of monetary policy, Thorbecke (1997) demonstrates that shifts in monetary policy help to explain US stock returns. Bernanke and Gertler (2005) employ a macroeconomic model and explore how the macro economy may be affected by alternative monetary

policy rules which may or may not take into account the asset price bubble. They conclude that there is no need for a direct central bank response to asset prices because a central bank that is responding to general price inflation is already responding to asset price movements. Using structural vector autoregression, Cheng and Jin (2013) found that monetary policy reacts directly to the term spread and indirectly to stock prices and house prices via output and inflation. Using a combination of short-run and long-run restrictions in structural vector autoregressive (SVAR) methodology developed by Christiano,et al (1999), Bjornland and Leitemo (2009) found the existence of interdependence between the interest rate setting and real stock prices. Real stock prices immediately fall by seven to nine percent due to a monetary policy shock that raises the federal funds rate by 100 basis points. Contrary to Bjornland and Leitemo (2009), The research conducted by Bouakez, et.al., (2010), concluded that the interaction between monetary policy and stock returns is much weaker than suggested by earlier empirical studies using a flexible SVAR. In particular, using data prior to the latest financial crisis, they find that stock returns are not very sensitive to US monetary policy and have little effect on its propagation at a monthly frequency. Laeven and Tong (2012) studies how US monetary policy affects global stock prices. They find that global stock prices respond strongly to changes in US interest rates, with stock prices increasing (decreasing) following unexpected monetary loosening (tightening). They suggest that US monetary shocks affect firms' stock prices by influencing local interest rates, and offer new evidence that financial sector play an important role in the transmission of monetary policy to the real economy. Pirovano (2012) study presents evidence on the effect of Euro Area monetary policy on stock prices in four new EU member states of Central Europe. Using structural vector autoregressive models identified with short-run restrictions, Pirovano (2012) find that stock prices in the considered new EU member states are more sensitive to changes in the Euro Area interest rate than to the domestic one.

Meanwhile, according to the Keynesian economic theory, fiscal policy can boost aggregat demand through injection of government expenditure, and in turn influence the stock market performance. On the other hand, from the market agent's perspective, an increase government's budget deficit will reduce the asset market performance, particularly stock and bond prices because they increase interest rates. A rise in interest rates, in turn, will reduce investment because of raising the cost of borrowing (as well as consumption expenditure) and eventually lead to dampen economic activity. Finally, higher interest rates and weaker economic activity may worsen further the fiscal capacity and may lead to the vicious circle (Chatziantoniou, 2013). The impact of fiscal policy then will crowd out the money market and the productive sectors of the economy. In addition, from a Ricardian perspective, fiscal policy is impotent and this will not influence the stock markets.

On empirical grounds, testing the impact of fiscal policy on stock market has produced mixed results. Darrat (1990) test the efficiency of fiscal policy actions on three developed countries' namely, Germany, the United Kingdom, and Canada, respectively, and finds that the government budget deficits will influence the stock market performance. On the other hand, Ali and Hasan (2003) found that Canada's stock market is not inefficient with respect to fiscal policy. Laopodis (2009) examines the extent to which fiscal policy actions affect the US stock market's behavior. Using standard form of VAR, They found that the stock market is inefficient in a responds about future fiscal policy actions. Laopodis argue that the reason behind this conclusion is that market participants do not believe much on news about the budget deficits as they do not believe that deficits could adversely influence the stock market. The market participants consider the news about monetary policy rather than fiscal policy. Afonso and Sousa (2011,2012) in series of paper investigated the relation between fiscal policy shocks on asset markets on selected OECD Countries U.S., Germany, U.K., and Italy. Their results show that spending shocks have a negative effect on stock prices. The most relevant findings of their paper regarding the effect of fiscal policy shock on asset market including stock prices are (i) government spending shocks lead to a quick fall in stock prices, and (ii) government revenue shocks lead to a positive effect on stock prices. Agnello and Sousa (2012) study the role played by fiscal policy in explaining the dynamics of asset markets. Using a panel Vector Autoregression (PVAR) of ten industrialized countries, they found several findings. The findings are (i) a positive fiscal shock has a negative impact in stock prices, (ii) a contraction effect of fiscal policy on output in line with the existence of crowding-out effects, (iii) an increase of the sensitivity of asset prices to fiscal policy shocks following the process of financial deregulation and finally, and (iv) the changes in equity prices may help governments towards consolidation of public finances.

From aforementioned explanation, both monetary policy and fiscal policy have an important effect on stock return (For further discussion, see Patelis, 1997; Thorbecke, 1997; Laopodis, 2009). According to Tobin's theory of general equilibrium, stock market plays an important role as an intermediation between the real and financial sectors of the economy. Hence, actions by the fiscal authorities that increase spending (and increase debt) have larger opportunities to increase the interest

rate. A higher interest rate will depress the economic growth, and then the Central Bank will be forced to conduct a loose monetary policy by increasing money supply. Therefore, the combinations of the conduct of fiscal and monetary policy are able to control the stock market performance. Furthermore, under Efficient Market Hypothesis (EMH) theory, It simply argues that market price of a company's stock reflects company's fully rational value, given current information about the company's business prospects. Hence, all past information related to those variables represented in the value of current stock prices including the money supply or budget deficit changes should have a significant effect on stock prices.

The potential conflicting objectives between fiscal and monetary policies will lead to a crucial strategic interaction between two policy instruments particularly for the some country that implement the inflation-targeting framework. The interaction arises as both monetary and fiscal policies have implication for the output gap and inflation. Fiscal authorities concern more on output, otherwise the monetary authorities emphasize on controlling inflation. Under standard economic theory, the sign of the budget deficit is expected to be positive, which mean that the larger the budget deficits will lead to larger the interest rate. Under these circumstances, Central Bank needs to stabilize the economy from overheating and inflationary pressure.

On empirical grounds, there is lack of the study incorporating the effect of fiscal and monetary policy on the stock market performance. Using a flexible semi parametric varying coefficient model specification, Jansen, et. al. (2008) examines the role of fiscal and monetary policy on the US asset markets (stocks, corporate and treasury bonds). The results show that the impact of monetary policy on the stock market varies, depending on fiscal expansion or contraction. There is evidence that a fiscal deficit is not a direct information variable for the stock and Treasury bond markets. Their results are consistent with the notion of strong interdependence between monetary and fiscal policies. Chatziantoniou (2013) study the effects of monetary and fiscal policy shocks on stock market performance in Germany, the UK and the US using structural VAR model. They find evidence suggesting that both fiscal and monetary policies affect stock market, either directly or indirectly. They find evidence that the interaction between the two policies is very important in explaining stock market developments rather than the individual policy.

In the context of Indonesia, to our best knowledge, study relating to stock market response on both fiscal and monetary policy shocks is not well documented and sometimes only in individually rather than interaction. Praptiningsih (2013) investigates the effect of monetary policy on macroeconomic objective including stock market using Vector Error Correction Models and finds that the monetary policy instruments are statistically significant in affecting the macroeconomic variables and stock market. Meanwhile, studies relating both the effect of monetary and fiscal policy analysis emphasized on those policies shocks on macroeconomic objective mainly on inflation and output not on stock market. Surjaningsih, et.al., (2012) examines the impact of fiscal policy on output and inflation using VECM and find that an increase in government spending has a positive effect on output, while a government tax levied increase has a negative effect. They also find that influence of government spending on output in the short term is greater than taxation policies. They suggest that government spending is more effective to stimulate economic growth especially in times of recession, compared to taxation policies. Hermawan and Munro (2008) study the stabilization role of fiscal policy in Indonesia. They use an estimated open economy DSGE model that features sticky prices and wages, non-Ricardian agents and tax distortions to explore the potential role for fiscal policy in stabilization. The results suggest that fiscal policy can and does contribute meaningfully to macroeconomic stabilization in Indonesia, leading to better outcomes than monetary policy alone.

From the methodological perspective, The SVAR approach has become a popular tool in empirical investigations of stock prices as it allows analysis of the movements of stock prices in relation to various shocks, which can be identified by imposing specific restrictions on an estimated VAR that includes stock prices and other variables. The aim of a Structural VAR is to use economic theory (rather than the Cholesky decomposition) to recover the structural innovations from the residuals. In our paper, we employ a near-SVAR model because some of the VAR equations have regressors not included in the others. This model provides an extension of the structural VAR approach, as it does not impose the same variables treated in all right-hand side of the equations of the reduced form model since we employ the world oil price as an exogenous variables and unaffected by any domestic variables. In the context of the present paper, the near-SVAR model is estimated using the method of seemingly unrelated regressions (SUR) that offers a robust statistical framework with the ability to gives consistent and efficient estimates of the coefficients (Enders, 1995; Zaidi and Fisher, 2010; Piroli et al, 2012) particularly if the lag length is long, this wil erode the degree of freedom.

Numerous studies have attempted to improve the better SVAR methods by applying bayesian analysis to obtain accurate infinite sample inferences from the posterior distribution (Sims and Zha, 1999; Wagonner and Zha, 2003). Furthermore, the finite samplers of the series used in the model are sometimes inefficient in making some inferences. The inferences based on the finite sampler can seriously distort economic interpretations. In this paper, our next contribution is that we employ the monte carlo simulation method, in particularly Gibbs Sampler to our near SVAR model which has been proposed by Sims and Zha (1999), and developed by Wagonner and Zha (2003). Their methods have proved that by implementing Monte Carlo algorithm particularly Gibbs Sampler systematically on SVAR model and the Sampler perform well. Hence, the goal of the paper is to improve our near-SVAR model due to taking into account the simultaneity and the restrictions on the covariance matrix and the regression coefficients. In addition, this method is able to restrict the covariance matrix of reduced-form residuals to obtain economically interpretable impulse responses.

Our next contribution is that this paper attempt to investigate the effect of monetary and fiscal policy on composite and disaggregated main sector stock price index in Indonesian Stock market such as agricultural, mining, manufacture, and financial sector indexes. Figure 1 provides the data about the performance of sectors stock price indexes from 2001 until 2011. As shown, we decompose the performance of 10 sectors stock price index into three categories of sectors: top, medium and low stock price index sectors. Top sectors consist of agriculture and mining, while medium sectors consist of manufacture industry; miscelaneous industry; consumer goods; and infrastructure and transportation sectors and the low index sectors include finance and banking; trade; basic industry and property sectors. We use only 4 main sectors in our analysis instead of all 10 sectors that represent three kinds of aggregated development sectors group namely primary, secondary and tertiary sectors. We use mining and agriculture sectors to represent the primary sector as well as the top stock price index. As a developing country, The contribution of these two sectors are still quite high to national output which are 12.7% and 7.67% in 2011, repectively. Meanwhile, the manufacture and financial sectors contribute 25.7% and 10.7% of total output, respectively. The last two sectors represent secondary and tertiary sectors as well as the medium and the low stock price sector index.

As aforementioned discussion, any particular unanticipated both fiscal and monetary policies conducted by authorities will affect stock price through interest rate channel. This analysis is crucial in order to investigate the strength of such an association whether tend to varies extensively across sectors. Under these circumstances, sector stockholder will be affected by the change of the policies and then, in turn the firm's ability to finance the production level will vary across sectors due to different consumption (wealth effect) and investment pattern.

This paper is organized as follows. Section 2 explore the data used in the models. Section 3 mentions the methodological and model identification strategy. Section 4 reports the estimation result and discuss the empirical result. Section 5 concludes with the main findings and policy implications.

DATA DESCRIPTION

As a small open economy, we employ the world oil price rather than output or commodity price as the foreign variables that affect Indonesian economy. Our studies decompose variables into two blocks as a standard form model of SVAR for small open Economy. The first block consists of one foreign variable that is world oil price. The reason why we use the world oil price is that regarding the fact that since 2000, Indonesia becomes net importer oil country and suffer from any increase of such shock in which the deficit of trade balance on oil become larger as the world oil price tend to rise for over the last decade. 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 stock market will receive considerable attention from investors. Hence, rising oil prices are bad for stock market of oil importing country such as Indonesia. Kim and Roubini (2000) use oil prices rather than commodity prices as a proxy for future inflation. On the other hand, Zaidi et al (2010, 2011) in their series of paper use the commodity prices for Malaysia cases due to the fact that Malaysia is oil producing country and the oil price in the domestic market is heavily regulated.

The second block contains the domestic variables consists of; industrial production index (LY), Debt to GDP ratio (DYR), the inflation rate (INF), money market interest rate (3 month SBI rate or R), real effective exchange rate (LXR), and stock price both in composite index (LSP) and sector price index (LAGR for agriculture, LMINE for mining, LFINE for banking and finance). We use Industrial production index to represent national output (we also use 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 and 3 months SBI rate for monetary policy variable. For this

purpose, we decompose the shock of domestic and foreign shock on stock price both composite index and sectors index into 5 models; model 1 for the composite index, model 2 (mining), model 3 (agriculture), model 4 (finance), and model 5 (manufacture industry). We use industrial production index rather than GDP that has been used in stock market studies, such as Binswanger (2000, 2001, 2004), and Mackowiak (2006). 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, we 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 SVAR 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.

We use monthly data from 2000.1 until 2011.12. We start our data from January in year 2000 is to avoid the turbulence 1998 economic Crisis and of course data treatment using structural break are no longer needed. 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), our world oil price data 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.

METHODOLOGY AND IDENTIFICATION

We investigate the dynamic relationship among fiscal and monetary policies and the stock market performance using near SVAR framework. As discussed earlier, Our SVAR model does not impose the same variables treated in all right-hand side of the equations of the reduced form model since We employ the world oil price as an exogenous variables and unaffected by any domestic variables. In estimation, we emphasized on identifying only the monetary and fiscal policies shock and we do not aim to identify all structural shock. Our estimation follow the step by the step the methodology developed by Wagonner and Zha (2003). In order to choose the optimal lag length for our SVAR model, the residual of each equation are examined for evidence of serial correlation using Akaike's Information Criterion (AIC) and Schwarz Bayesian Criterion (SBC).

Following Wagonner and Zha (2003), the structural VAR models typically take the form of

$$\boldsymbol{y}_t'\boldsymbol{A} = \sum_{t=1}^{p} \boldsymbol{y}_{t-l}'\boldsymbol{A}_l + \boldsymbol{z}_t'\boldsymbol{D} + \boldsymbol{\varepsilon}_t', \quad \text{for } t = 1, \dots, T, \tag{1}$$

where A and A_l are 7×7 parameter matrices, D is an $h \times 7$ parameter matrix, y_t is an 7×1 column vector of endogenous variables at time t, z_t is an $h \times 1$ column vector of exogenous variables at time t, ε_t is an 7×1 column vector of structural disturbances at time t; p is the lag length, and T is the sample size. The parameters of individual equations in (1) correspond to the columns of A, A_l and D. The structural disturbances have a Gaussian distribution with

$$\boldsymbol{E}(\varepsilon_t | \boldsymbol{y}_1, \dots, \boldsymbol{y}_{t-1}, \boldsymbol{z}_1, \dots, \boldsymbol{z}_T) = \boldsymbol{0} \text{and } \boldsymbol{E}(\varepsilon_t \varepsilon_t' | \boldsymbol{y}_1, \dots, \boldsymbol{y}_{t-1}, \boldsymbol{z}_1, \dots, \boldsymbol{z}_T) = \boldsymbol{I}. \tag{2}$$

The structural disturbances in (2) are normalized to have an identity covariance matrix. Right multiplying the structural form (1) by A^{-1}, we will obtain the usual representation of a reduced-form VAR with the reduced-form variance matrix being

$$\Omega = (AA')^{-1}. \tag{3}$$

Equation (4) below indicates the set of restriction that are imposed on the contemporaneous parameters of the SVAR model of Indonesian Stock market. Our identification structures are more likely the upper triangular rather than the lower one. The coefficient β_{ij} indicates of how variable j contemporaneously influence on variable i. The coefficients on the diagonal are set to be unity, while

the number of zero restriction on the coefficient is 23, hence the model is over-identified since exactly identified require 49-7=42/2=21 restrictions. The short-run restrictions applied in this model are the following:

$$\begin{bmatrix} \varepsilon_{LSP} \\ \varepsilon_{LXR} \\ \varepsilon_{R} \\ \varepsilon_{INF} \\ \varepsilon_{DYR} \\ \varepsilon_{LY} \\ \varepsilon_{LOIL} \end{bmatrix} = \begin{bmatrix} 1 & A_{12} & A_{13} & A_{14} & A_{15} & A_{16} & A_{17} \\ A_{21} & 1 & A_{23} & A_{24} & 0 & A_{26} & A_{27} \\ 0 & A_{32} & 1 & A_{34} & 0 & 0 & A_{37} \\ 0 & 0 & 0 & 1 & 0 & A_{46} & A_{47} \\ 0 & 0 & 0 & 0 & 1 & A_{56} & A_{57} \\ 0 & 0 & 0 & 0 & 0 & 1 & A_{67} \\ 0 & 0 & 0 & 0 & 0 & 0 & 1 \end{bmatrix} x \begin{bmatrix} e_{LSP} \\ e_{LXR} \\ e_{R} \\ e_{INF} \\ e_{DYR} \\ e_{LY} \\ e_{LOIL} \end{bmatrix} \quad (4)$$

Where, industrial production index (LY), Debt to GDP ratio (DYR), the inflation rate (INF), money market interest rate or 3 month SBI rate (R), real effective exchange rate (LXR), and stock price both in composite index (LSP) and World oil price (LOIL). We put the foreign variables at the last ordering to adjust the equation in the SUR model that place the oil equation at the last. Consequently, our restriction structure is more likely upper triangular rather than the lower one. In addition, Waggoner and Zha (2003) stated that for the methodological purpose, the Gibbs sampler will produce independent draws of A matrix if the transformed form of A matrix is upper triangular after an appropriate reordering of equations and variables (for detailed discussion, see Waggoner and Zha, 2003).

We focus on examining the interaction between the macroeconomic policies and stock price. Our restrictions follow the previous studies that concern on macroeconomic modelling and stock market analysis. Below we provide the explanation of the model's restriction. Stock prices are contemporaneously influenced by all variables (Afonso and Sousa, 2011; Bouakez.et.al., 2010; Chatziantoniou et.al, 2013). Exchange rate is contemporaneously influenced by all variables except debt to GDP ratio (Kim and Roubini, 2000; Zaidi,et.al., 2011; Dungey and Fry, 2009). Monetary policy is also contemporaneously influenced by exchange rate. The interdependence between exchange rate and interest rate has been assumed because it helps to solve the exchange rate puzzle (Kim and Roubini, 2000; Zaidi et.al., 2011). The foreign shock contemporaneously affects all domestic variables including inflation. Inflation reacts contemporaneously only to income shock and foreign shock (Bjornland and Leitemo, 2009; Kim and Roubini, 2000; Chatziantoniou et.al, 2013). Monetary policy tool is contemporaneously affected by inflation. However the national income cannot be contemporaneously influenced by any other domestic variables (Kim and Roubini, 2000). In contrast, it can contemporaneously influence all domestic variables.

We conduct inference from a Bayesian approach, as is common in the VAR literature (see Sims and Zha, 1998, 1999; Waggoner and Zha, 2003). We take draws from the posterior pdf of the parameters of the reduced-form VAR. This pdf is a product of an inverse-Wishart density for Ω and a Gaussian density for the equation's coefficients $B(s)$ for all $s > 0$, conditional on Ω. In the past, researchers have used an importance sampler to approximate the posterior density function of A. The steps to compose the algorithm for simulating draws from the posterior distribution of b see Waggoner and Zha, 2003

ESTIMATION RESULT

To begin with, we start our estimation with determining optimal lag length using Akaike Information Criteria (AIC) and Schwartz bayesian Criterion (SBC). According to the two tests, our five model both composite index and 4 sector index recommend to employ two lag orders. By using 2 lag orders, our models are expected to have consistent and efficient coefficient since they do not consume degrees of freedom. Next, we develop our Seemingly Unrelated Regression (SUR) model to estimate our near-SVAR model. We treat world oil price as an exogenous variable against all equation and only be influenced by its own lag.

Tabel 1 presents the estimates of the coefficients in A Matrix in equation (4). From the table, we found that all models produce the same sign on each coefficients, except coefficient (a_{17}) in model 5 and (a_{26}) in model 2 and 3. The coefficient significancies across the models vary. For the stock price variable, all coefficients are of expected sign except the national income. Stock price decreases contemporaneously with an increase in exchange rate and interest rate whereas the other variables such

as inflation rate, fiscal policy rate and oil price move the opposite way. In order to test the overidentifying restrictions on the SVAR model (model 1), we employ a chi-squared with 2 degrees of freedom provided by RATS program output[1]. We find the value of chi-square test of 3.9994 with the x^2value of 0.1353. It means that the overidentifying restrictions cannot be rejected. The same test perform the same result except model 5 which the p value below 10 percents but still above 5%. In our calculation, all models also perform well since they converge below 100 iteration.

Now consider the monetary policy rule and fiscal policy rule shown by R and DYR, respectively. The monetary policy rate is increased in a response to an appreciation in the real effective exchange rate for model 2,3 and 4 which is significant at 5% level and to a decrease in domestic inflation for all models and this indicated that price puzzle does not exist. Otherwise, the monetary policy is increased in a reponse to a rise in the world oil price. For the fiscal policy rule, it is increased in a response to an increase in oil price shock since it will suffer the government budget deficit due to budget subsidy for oil will also increase.

Figure 2, and 3 plot the the impulse response function of macroeconomic (stock price, exchange rate, inflation and output) response to one standard deviation shocks in monetary policy and fiscal policy for the aggregated stock price (model 1), respectively over 100 months. Figure 4 and 5 plot the the sectors stock price response to one standard deviation shocks in monetary policy, fiscal policy and oil price, respectively over 100 months. The figure 6 plots the impulse response of all shock to all variables for aggregated model. The solid line corresponds to the median response and we provide 68% and 95% posterior confidence intervals from near-SVAR model. The confidence bands are constructed by using a Monte-Carlo Gibbs sampling algorithm as proposed Sim and Zha (1999) and developed further for SVAR model by Waggoner and Zha (2003) and calculated by taking the estimated coefficient in structural model to form the data generating process on 2000 burns and 10,000 draws.

The Effect of Monetary Policy Shocks

As shown, in a response to the positive innovation in the central bank policy rate (tightening monetary policy shock), Composite Stock price (fig. 1) rise initially and then fall until reaches the peak in 16 months. Similar pattern exist in all models (see figure 4). This finding is in line with the work of Praptiningsih (2013) These delayed responses of stock prices suggest that stock prices adjust sluggishly to a monetary policy shock. This occur also because the mining sector experiencing good business prospect through windfall profit for over the last decade (price of some mining sectors keep rising such as oil, iron ore, coal mine, etc). The falling of stock price initially is to earn the higher discount factor which reduces the present value of expected future earnings of firms. Theoretically, a rise in interest rate is predicted to have a negative effect on the stock market. Meanwhile, the finance sector response to monetary policy shock is the most sluggish compared to other sector because investing in the banking and finance sector in Indonesia grow significantly the last decade and become an interesting option for the investor to expand their business for both local and foreign investors regardless the policy taken by the central bank.

As many studies on investigating in monetary policy shocks, the model has an appropriate behaviour of the components of the model to domestic interest rate. The Impulse response functions for a domestic interest rate shock shown in Fig 1 reveal that many problems associated with identification of interest rate effects in small open economy SVAR models are not present in model. A rise in domestic interest rate generates a decline in domestic output and the exchange rate (REER) appreciates. As the consequences of a decline in domestic income and the appreciation of the exchange rate, inflation rate fall. The inflation rate fall immediately after the increase in the domestic interest rate, the peak decline occurs 38 months after the shock. From this finding, the prize puzzle and the exchange rate puzzle do not exist in our model.

In fig. 6, our model also able to produce the responses the innovations of composite stock price. In response to a rise in stock price, the income increase immediately. This income responses is consistent with a Tobin's q effect. The increase in income in turn will lead to create higher investment demand by firms and a wealth effect will lead to higher consumption demand by household.

The Effect of Fiscal Policy Shocks

[1] The results are available upon request

Stock market response to one standard deviation increase in fiscal policy is homogenous since all models perform the similar pattern of initially response which all falls both composite stock price (see figure 3) and sectors stock price (figure 5). Looking at the reaction of stock price both composite and its sectors, the fiscal shock has a negative impact but it is less persistent. This finding is in line with the findings of Darrat (1988), Agnella and Sousa (2010), Afonso and Sousa (2011) which stated that there is a negative response of stock prices to fiscal policy shocks.

In fig. 3, the effect of fiscal policy shock on output is positive and relatively large in magnitude peaking at third month. This is in line with the study of Blanchard and perotti (2002), Perotti (2004) who also find a positive effect of government budget deficit on GDP. With reference to inflation, we have evidenced that They react positively to fiscal policy shock. This finding is also in line with the work of Perotti (2004).

Response of interest rate seems to react positively to a fiscal shock. This reaction of the interest rate to fiscal policy is in the direction with the crowding out hypothesis. From this empirical finding, fiscal policy crowd out private sector activity in market, thus, its effect will be impotent in economy. We provide this evidence to prove that not only both policies able to influence the stock price individually, but also the interaction between monetary and fiscal policy is important in explaining stock market performance.

SUMMARY AND CONCLUSION

In this paper, we have estimated the impact of monetary and fiscal policy shock on Indonesian stock market both composite and sector index. Our study use the simulation method that draw exactly from posterior distribution of SVAR model has emerged recently. In particular, we employ monte carlo algorithm to Near-SVAR models (If some of the VAR equations have regressors not included in the others) that developed by [Waggoner, D.F., Zha, T., 2003. A Gibbs sampler for structural vector auto regressions. Journal of Economic Dynamics and Control 28, 349-366]. Hence, in the case of near SVAR, Seemingly Unrelated Regressions (SUR) can be used for estimation of the coefficients. This method is able to restrict the covariance matrix of reduced-form residuals to obtain economically interpretable impulse responses.

Our main conclusion is that the interaction between monetary policy shock and stock market respond positive and the degree of respond vary especially in sector level. Some sector respond immediately while others respond sluggishly to a monetary policy shock. In term of interaction between fiscal policy shock and stock market, we found that all sectors respond homogeneously negative relationship. From this empirical finding, fiscal policy crowd out private sector activity in market, thus, its effect will be impotent in economy. This finding is supported by the finding about the response of interest rate that react positively to a fiscal shock. This reaction of the interest rate to fiscal policy is in the direction with the crowding out hypothesis. From this empirical finding, fiscal policy crowd out private sector activity in market, thus, its effect will be impotent in economy. We provide this evidence to prove that not only both policies able to influence the stock price individually, but also the interaction between monetary and fiscal policy is important in explaining stock market performance.

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APPENDIX 1. Assessing Posterior distribution of Gibbs Sampler Algorithm

In this section, we derive a Gibbs sampler for the non-standard posterior distribution of b (Waggoner and Zha, 2003). Theorem 1, following, provides a theoretical foundation for our Gibbs sampler. For a fixed i_*, where $1 \le i_* \le n$, the central result states that drawing from the posterior distribution of b_{i_*} conditional on $b_1, \dots, b_{i_*-1}, b_{i_*+1}, \dots, b_n$ is equivalent to drawing independently from a number of univariate normal distributions and one special univariate distribution.

Before we state Theorem 1, a few notations are in order. Let w be an non-zero $n \times 1$ vector perpendicular to each vector in $U_i b_i | i \neq i_*$. Since the restrictions are assumed to be non-degenerate, the $n-1$ vectors $U_i b_i$ for $i \neq i_*$ will almost surely be linearly independent and $U_{i_*}' w$ will be non-zero. Define $w_1 = T_{i_*}' U_{i_*}' w / \| T_{i_*}' U_{i_*}' w \|$, (5)

where T_i is a $q_{i_*} \times q_{i_*}$ matrix such that $T_{i_*} T_{i_*}' = S_{i_*}$. Choose $w_2, \dots, w_{i_*}$ so that $w_1, w_2, \dots, w_{i_*}$ form an orthonormal basis for $R^{q_{i_*}}$. Since $b_{i_*} \in R^{q_{i_*}}$, we can write b_{i_*} as

$$b_{i_*} = T_{i_*} \sum_{j=1}^{q_{i_*}} \beta_j w_j \qquad (6)$$

Theorem 1: The posterior random vector b_{i_*} conditional on $b_1, \dots, b_{i_*-1}, b_{i_*+1}, \dots, b_n$ is a linear function of q_{i_*} independent random variables denoted by β_j such that

- ✓ the density function of $\square_1$ is proportional to $|\beta_1|^T exp(-T\beta_1^2/2)$,,
- ✓ for $2 \le j \le q_{i_*}, \beta_j$ is normally distributed with mean zero and variance $1/T$.

Like any Gibbs sampler, the Gibbs sampler laid out in Theorem 1 produces, in general, serially correlated draws of $\mathbf{b}$ (and thus $\mathbf{A}$). But for a VAR model with unrestricted Ω, our Gibbs sampler is as efficient as the method of Doan (1992) that produces independent draws, and thus it includes Doan's method as a special case. To see this result, note that Ω can always be decomposed to $\mathbf{A}$ according to (3), as long as $\mathbf{A}$ can be transformed to be upper triangular after an appropriate reordering of the equations and variables in the system (1). It follows that the posterior distribution of Ω is of inverted Wishart. If the Gibbs sampler generates independent draws of $\mathbf{A}$, independent draws of Ω are readily available via (3).

Theorem 2: The posterior distribution of $\mathbf{b}_{i_*}$ will be independent of $\mathbf{b}_1, \dots, \mathbf{b}_{i_*-1}, \mathbf{b}_{i_*+1}, \dots, \mathbf{b}_n$ if there exists a permutation matrix Π and an orthogonal matrix Γ such that the matrix $\Gamma\mathbf{A}\Pi$ is upper triangular for all matrices $\mathbf{A}$ satisfying the restrictions given by (4).

Clearly, draws of $\mathbf{A}$ are independent if and only if the posterior distribution of $\mathbf{b}_{i_*}$ is independent of $\mathbf{b}_1, \dots, \mathbf{b}_{i_*-1}, \mathbf{b}_{i_*+1}, \dots, \mathbf{b}_n$ for $1 \le i_* \le n$. Theorem 2 applies directly to the situations where the transformed form of $\mathbf{A}$ is upper triangular after a reordering of the equations and variables in the system (1). Reordering the equations is equivalent to right multiplying $\mathbf{A}$ by a permutation matrix and reordering the variables is equivalent to left multiplying $\mathbf{A}$ by a permutation matrix (which is orthogonal). It follows from Theorem 2 that the Gibbs sampler will produce independent draws of $\mathbf{A}$ if the transformed form of $\mathbf{A}$ is upper triangular after an appropriate reordering of equations and variables.

(a) Choose the arbitrary values $\mathbf{b}_1^{(0)}, \dots, \mathbf{b}_n^{(0)}$ (typically the estimate at the peak of the posterior density function, if available).

(b) For $s = 1, \dots, \mathbf{N}_1 + \mathbf{N}_2$ and given $\mathbf{b}_1^{(s-1)}, \dots, \mathbf{b}_n^{(s-1)}$, obtain $\mathbf{b}_1^{(s)}, \dots, \mathbf{b}_n^{(s)}$ by

(b.1) simulating $\mathbf{b}_1^{(s)}$ from the distribution of $\mathbf{b}_1 | \mathbf{b}_2^{(s-1)}, \dots, \mathbf{b}_n^{(s-1)}$

(b.2) simulating $\mathbf{b}_2^{(s)}$ from $\mathbf{b}_2 | \mathbf{b}_1^{(s)}, \mathbf{b}_3^{(s-1)}, \dots, \mathbf{b}_n^{(s-1)}$,

:

(b.n) simulating $\mathbf{b}_n^{(s)}$ from $\mathbf{b}_n | \mathbf{b}_1^{(s)}, \dots, \mathbf{b}_{n-1}^{(s)}$.

(c) Collect the sequence $\left\{\mathbf{b}_1^{(0)}, \dots, \mathbf{b}_n^{(0)}, \dots, \mathbf{b}_1^{(N_1+N_2)}, \dots, \mathbf{b}_n^{(N_1+N_2)}\right\}$ and keep only the last $\mathbf{N}_2$ values of the sequence.

In step (b) of Algorithm 1, all simulations are carried out according to Theorem 1. The only computational complication involves the simulation from the less standard distribution of β_1 and the construction of the orthonormal basis $\boldsymbol{w}_1, \dots, \boldsymbol{w}_{q_{i_*}}$, the implementation of which will be described in the next section. The rest of the computation is to sample independently from the univariate normal distributions of $\beta_2, \dots, \beta_{q_{i_*}}$ and the univariate distribution of β_1.

Step (c) of Algorithm 1 concerns a choice of $\boldsymbol{N}_1$ and $\boldsymbol{N}_2$. If the initial values $\boldsymbol{b}_1^{(0)}, \dots, \boldsymbol{b}_n^{(0)}$ are random but not drawn from the target distribution, the first $\boldsymbol{N}_1$ draws are usually discarded to protect against a very unlikely initial draw.

TABLE 1: SVAR Result – Contemporaneous Coefficient

Variables	Coefficient	Model1	Model2	Model3	Model4	Model5
LSP	a_{12}	-7.506	-9.897	-7.629*	-9.28	-9.005
	a_{13}	-30.892	-39.932	-27.796	-36.9214	-32.679
	a_{14}	1.473	0.022	0.862	2.187	1.194
	a_{15}	0.489	0.656	0.5975*	0.639	0.604
	a_{16}	-0.751	-0.581	-0.479*	-0.732	-0.678
	a_{17}	0.069	-0.43	-0.383	-0.026	0.133
LXR	a_{21}	0.801*	0.567	0.363*	0.73*	0.907*
	a_{23}	1.054	0.923	1.843	-0.303	2.347

	$\square_{24}$	0.801*	0.012	0.298	1.439*	0.415
	$\square_{26}$	-0.039	0.054	0.057	-0.047	-0.089
	$\square_{27}$	-0.116*	-0.247	-0.163*	-0.106	-0.052
R	$\square_{32}$	-0.048*	-0.047	-0.046*	-0.044*	-0.046*
	$\square_{34}$	-0.201*	-0.002	-0.195*	-0.194*	-0.199*
	$\square_{37}$	0.007	0.008	0.008*	0.07	0.08*
INF	$\square_{46}$	0.022	1.869	0.002	0.023	0.029
	$\square_{47}$	-0.002	-0.758	-0.003	-0.001	-0.001
DYR	$\square_{56}$	0.438	0.134	0.212	0.188	0.458
	$\square_{57}$	1.055*	1.025	1.164*	1.044*	1.253*
LY	$\square_{67}$	0471	0.039	0.051	0.058	0.069
Diagnostic Test:						
Chi Square		3.999	4.37	3.767	3.403	5.1
p-value		0.135	0.112	0.152	0.182	0.077
Convergence in (iteration)		73	74	52	70	73

Note: Sign * Indicates that the coeeficients are statistially significant at the 5% level. Model 1-5 represent model for composite stock price index, mining, agriculture, finance and manufacture industrial sectors index, respectively.

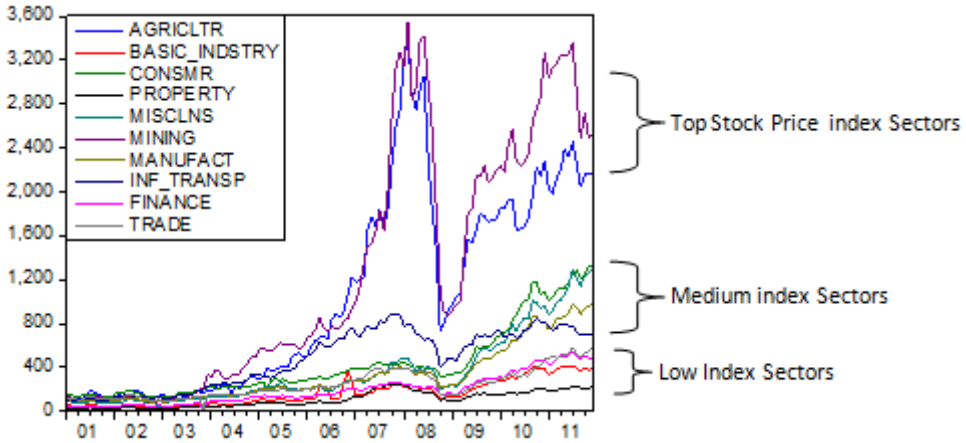
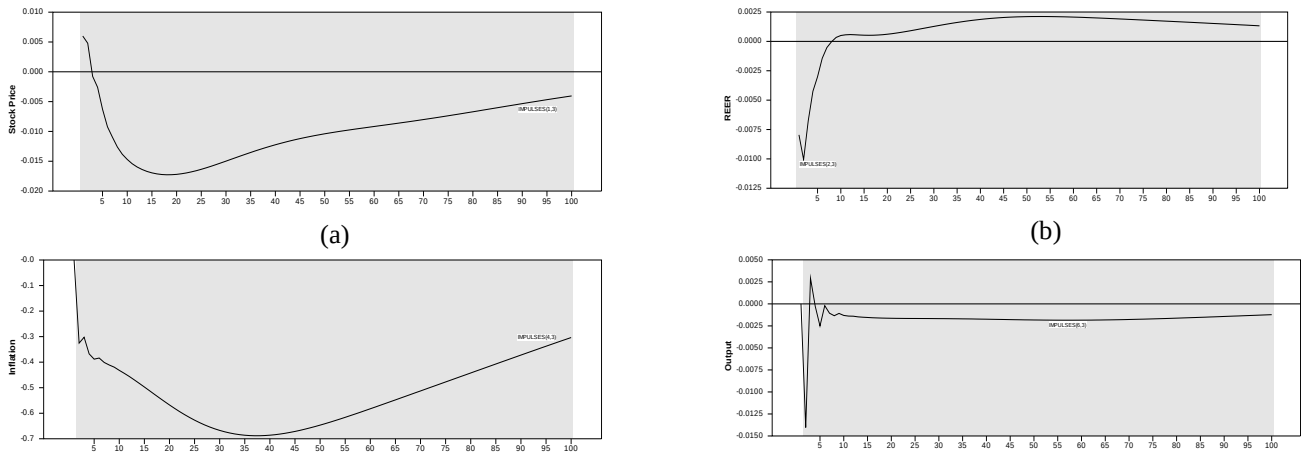


FIGURE 1: The Performance of Sectors Stock Price Index

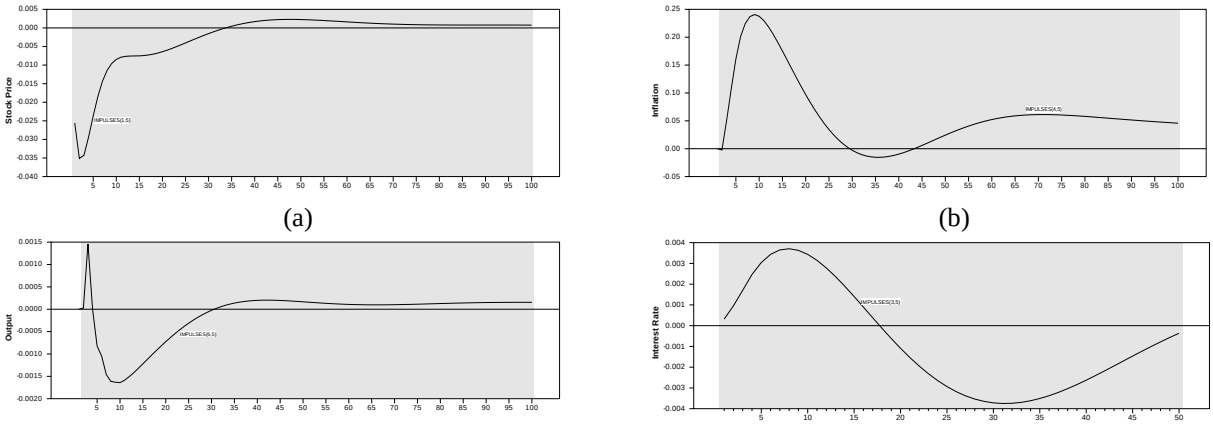


(a) (b)

(c) (d)

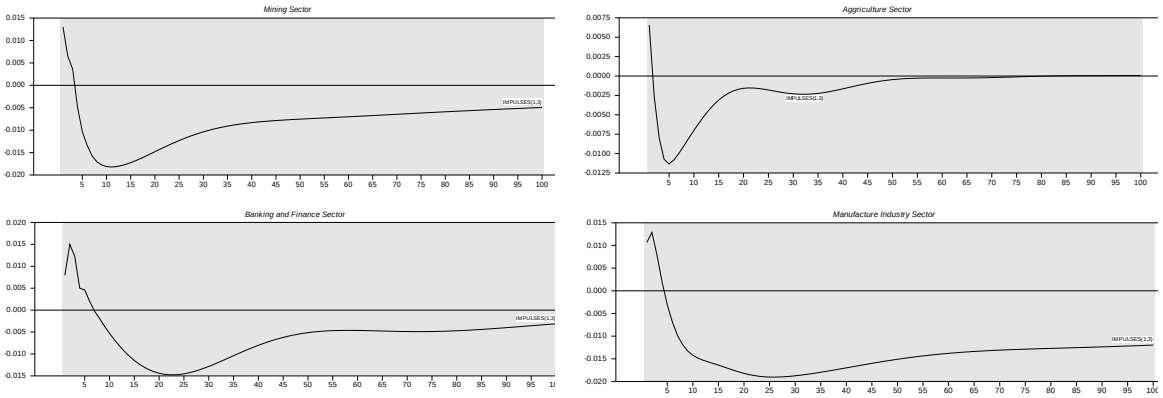
Note : (a). Stock Price, (b)REER, (c) Inflation, (d) Output

FIGURE 2: Dynamic Response to Monetary Policy Shock for Model 1 (Composite Stock Price Index)



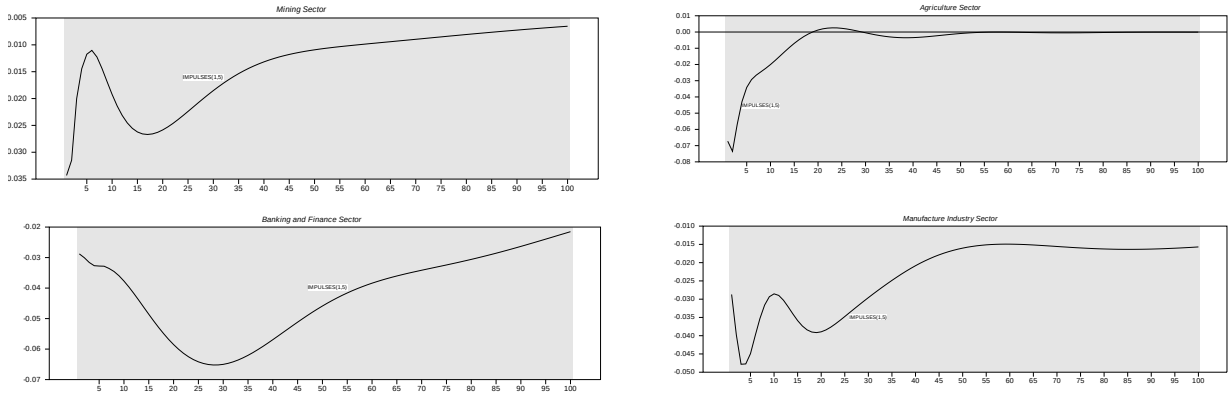
Note: panel (a) Stock price, (b) Inflation, (c) Output, (d) interest rate

FIGURE 3: Dynamic Response to Fiscal Policy Shock for Model 1 (Composite Stock Price Index)



Note : panel (a) mining sector, (b) Agriculture Sector, (c) finance and Banking sector, (d) manufature industry sector.

FIGURE 4: Sector Stock Price Responses to Monetary Policy Shock



Note : panel (a) mining sector, (b) Agriculture Sector, (c) finance and Banking sector, (d) manufature industry sector.

FIGURE 5: Sectors Stock Price Response to Fiscal Policy Shock

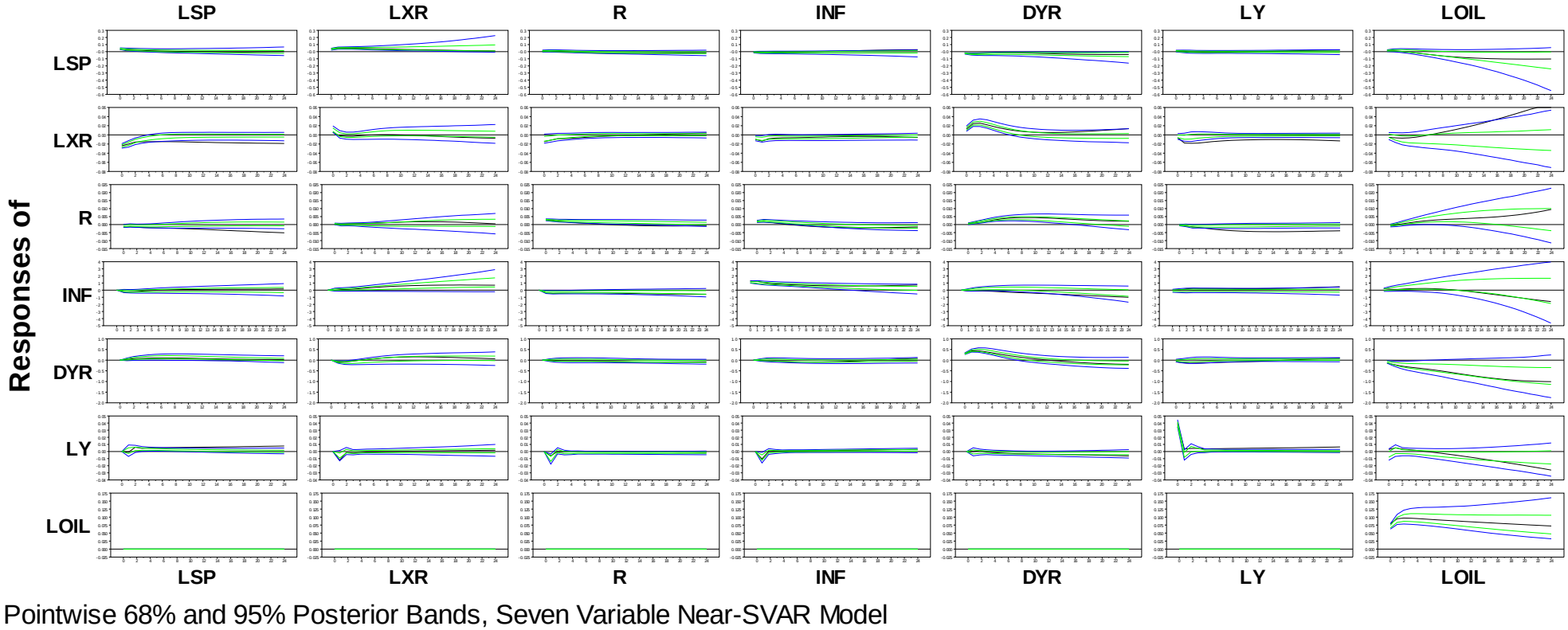


FIGURE 6: Impulse Responses Of All Variables Shock For Model 1 (Composite Index Stock Prices)