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Relative Importance of Singapore, US and Japanese Shocks on Malaysian Economy: An SVAR with Sign Restriction Analysis

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ABSTRACT

Most previous studies on the effect of foreign shocks on small open economies mainly take into account the influence of foreign effects of US, Europe or Japan. For a small open developing economy like Malaysia, the inclusion of US and/or Japan in the macro model is mostly due to the fact that these countries have consistently contributed a large part of the total trade and investment in the host country. While Singapore, the neighboring country, has also been one of Malaysia's' important trading partner, exclusion of it into the macro model of the country might has made the importance of US and/or Japanese effect overrated. This paper takes into account the Singapore effect and investigates the relative importance of Singapore, US and Japanese shocks on Malaysian economy. Employing sign restriction approach on SVAR impulse responses, the overall results suggest that Singapore has considerably large effect on Malaysian economy and one should take it into consideration when modeling the effect of external shocks on Malaysian economy.

Keywords: Foreign Shocks, Domestic Shocks, Monetary Policy, SVAR, Sign Restrictions

INTRODUCTION

Malaysia is a small and highly trade-dependent economy. It is undeniable that Malaysia's economy would be vulnerable to a variety of external shocks such as world oil price, foreign income and foreign monetary policy. Understanding how the economy is affected by external shocks is crucial for policy makers especially the Central Bank (Bank Negara Malaysia) in making better policy formulation for maintaining economic stability.

Most previous studies on the effect of foreign shocks on small open economies mainly take into account the influence of foreign effects of US, Europe or Japan. For Malaysia, the inclusion of US and/or Japan in the macro model is mostly due to the fact that these countries have consistently contributed a large part of the total trade and investment in the country. While Singapore, the neighboring country, has also been one of the country's important trading partner, exclusion of it into the macro model of the country might has made the importance of US and/or Japanese effect overrated. In other words, the significant impact of Singapore shock on the economy might be underestimated. Thus the true consequences of the shock can only be known by empirical study.

In view of this imperative issue, this paper takes into account the Singapore effect and investigates the relative importance of Singapore, US and Japanese shocks on Malaysian economy. The study contributes to the existing literature by improving and extending the analysis of foreign shocks effect upon small-open economy in three dimensions. First, it considers the role of more than one foreign country, namely Singapore, US and Japanin modeling the open-economy SVAR. Previous studies of monetary policy effects use either small-scale VAR in a closed-economy setup where no role of foreign variables is considered in the analysis or they utilize only one foreign country particularly the US to capture the foreign factors.[1] According to Dungey and Fry (2003), ignoring other important foreign country in the model would lead to misspecification in the model and the impact of the foreign country used would be largely overrated. In addition, this study also employs block exogeneity

[1]Some examples of related studies for Malaysia are Azali and Matthews (1999), Ibrahim (2005), and Tang (2006). For Thailand, studies by Disyatat and Vongsinsirikul (2003), Hesse (2007), Charoenseang and Manakit (2007), and Kubo (2008) are of related.

assumption whereby the foreign variables are block exogenous to the domestic variables. Failing to impose these restrictions for a small open economy is not only economically unappealing but also may result in misspecification of the model (Zha, 1999). Zaidi and Fisher (2010) have examined this issue for Malaysia but only US and Japan are under consideration.

Second, the study explores the relative importance of foreign shocks of the three most important major trading partners' countries(for example, an increase in foreign income)on domestic economy. Economic theory predicts that there is a positive spillover effect of an increase in foreign income to domestic economy, in which, it boosts home aggregate demand via an increase in home exports. This is usually known as locomotive effects. Knowing which country affects the most would be an important advantage for the policy maker in formulating better policy prescriptions.

Third, this study makes use of anon-recursive open economy structural VAR model which permits an identification strategy based on economic theory rather than the sometimes questionable assumptions which underlie a traditional recursive VAR. The model is used as it provides some theoretical backgrounds on the relationship between the variables used in the study. Furthermore, a sign restriction approach is employed in the identification strategy, as proposed by Uhlig (2005), whereby some impulse responses are constrained to follow economic theory while others are left unrestricted. Thus some of the puzzles that normally appear in macroeconomic modeling can largely be avoided.

The results of the study indicate that foreign shocks appear to play a prominent role in influencing domestic macroeconomic variables. When Singapore is the only foreign factor in the system, its shocks bring about significant variation to Malaysian variables especially the output. It can be said that among the three countries being investigated, Singapore effect is the most dominant.

The rest of the chapter is organized as follows. Next section presents a literature review relating to foreign shocks effects upon domestic macroeconomics fluctuation. The section after that briefly discusses the methodological framework and data. Next section that follows presents the empirical results by focusing on sign restricted impulse-responses function (SIRF). Finally, the last section summarizes and concludes.

LITERATURE REVIEW

The issues of foreign shock effects of a large economy country, such as US upon domestic macroeconomic fluctuations in a small open economy have been examined quiet extensively using an open-economy VAR/SVAR model. Most of the findings conclude that foreign factors (foreign income and foreign monetary policy) play a dominant role in influencing the domestic economy[2].For example, Cushman and Zha (1997) find that external shocks (US income, US inflation, US federal fund rate, and world total commodity export prices) have become dominant source of domestic output fluctuations in Canada, whereas, domestic monetary policy shocks (an increase in interest rates) has only a small contribution on output. Similar findings have been supported by Dungey and Pagan (2000) where they find that international factors are generally a substantial contributor to Australian economy while domestic monetary policy contributes to stabilize economic activity, but the effect is not large. Buckle et al. (2007) study the relative important of international and domestic shocks in New Zealand and also reveal that international business cycles and export and import prices fluctuations have been dominant influences to the New Zealand business cycle than international or domestic financial shocks.

Similarly, Kim and Roubini (2000) conclude that domestic monetary policy is not the major contributor to output fluctuations in the G-7 countries and in the most countries, however, foreign shocks (oil price shocks and the US monetary policy) have contributed more to output fluctuations. Kim (2001) finds that a US monetary policy expansion has a positive spillover effect on the G-6 countries' output, which affects the world capital market. Canova (2005) finds that US monetary policy shocks significantly affect the interest rates in Latin America. Moreover, such external shocks are an important source of macroeconomic fluctuations in Latin America. Mackowiak (2007) also unveils that external shocks are an important source of macroeconomic fluctuations in emerging market countries. In fact, US monetary policy shocks have strong and immediate effects upon emerging market interest rates and exchange rates.

[2]See, for example, Cushman and Zha (1997), Kim and Roubini (2000), Dungey and Pagan(2000), Kim (2001), Canova (2005), and Mackowiak (2007).

Besides foreign monetary policy, foreign income from a large economy also plays a significant role in influencing the macroeconomic fluctuations of a small open economy. Rodriguez et al. (2010), for instance, examines the impact of foreign shocks (interest rate, commodity price, and industrial production shocks) upon the macroeconomics variables in ten Central and Eastern European (CEE) countries using a near VAR model. They uncover that some countries such as Slovakia and Slovenia react stronger to foreign industrial production shocks than other countries. They also find that the effects of foreign income shocks on domestic economy are related to underlying economic structure, and the credibility of the monetary authority. In contrast, a study by Horvath and Rusnak (2008) in Slovakia finds that domestic prices are driven mainly by foreign factors, whereas, economic growth is primarily driven by domestic factors.

In developing ASEAN countries, study relating to foreign shock effects upon macroeconomics variables and policy is still limited in the literature. Most of the study use SVAR in a closed economy setup. For example, in the Malaysian context, Azali and Matthews (1999) and Ibrahim (2005) use a close economy model in examining the effect of domestic monetary policy shocks on economic activities, and find that there is a real effect of monetary policy. In comparison, Tang (2006)employ an open-economy recursive VAR model in examining the relative importance of the monetary policy transmission mechanism channels (interest rates, credit, asset price, and exchange rate channel). His finding concludes that the interest rates channel plays a pivotal role in influencing output and inflation. In addition, the asset price channel is also relevant for explaining output variability, but for inflation, the exchange rate channel is more relevant than the asset price channel.

Besides Malaysia, most of the literatures relating to monetary policy effects on macroeconomics variables in Thailand have focused on closed economy. Examples of these studies are Disyatat and Vongsinsirikul (2003), Hesse (2007), Charoenseang and Manakit (2007), and Kubo (2008). All studies (except Kubo, 2008) employ a small scale VAR in a closed-economy using Choleski decomposition (recursive VAR identification scheme). Disyatat and Vongsinsirikul (2003) reveal that investment is very sensitive to monetary policy shocks, and banks also act as an important conduit for monetary policy to real activity. However, the exchange rate and the asset price channel have been less significant as compared to other channels of monetary transmission. Kubo (2008) employs SVAR methodology in examining the domestic and international transmission of monetary policy. His finding reveals that the Bank of Thailand (BOT) has leverage over the real interest rates in the short run due to inflation inertia and affects the price level through the credit channel. There is a little evidence of expenditure-switching effects in the short run and medium runs. The volume of imports decreases quickly in the short run even though the import prices are failing at the same time.

Recently, new development in empirical studies using VAR/SVAR model focuses on sign restrictions approach as one of the identification strategy. Proposed by Faust (1998), Canova and De Nicolo (2002) and Uhlig (2005), the strategy accepts all the impulses that are in accordance with sign restrictions on impact while others are rejected. Since then a number of researchers have applied this strategy to examine the effect of fiscal, monetary policy as well as the demand and supply shocks (see among others Mountford and Uhlig (2009), Lippi and Nobili (2011), Peersman and Straub (2009), Canova and Pappa (2007)).

In view of the importance of foreign shock, this study adds to the existing literature especially for Malaysia case by employing a sign restriction technique to investigate the impact of Singapore effect on domestic economy.

METHODOLOGY

This section describes the estimation procedures and the variables used in the SVAR model for Malaysia. Essentially there are four models to be estimated. The first model takes into account the trade weighted variables of Singapore, US and Japanese variables as representing the foreign sector. The second, third and the fourth model use Singapore, US and Japanese variables by themselves respectively to represent the external sector. The preferred model is the first model as it takes into account the dynamics of more foreign countries as in the real world.

For each model, the variables are divided into two blocks; the foreign and domestic blocks. The foreign block consists of real foreign aggregate output, inflation and an interest rate, while the domestic block comprises real output, inflation, the interest rate and the real effective exchange rate. The international block is assumed to be block-exogenous to each of the domestic macroeconomic variable; see Cushman and Zha (1997) and Zha (1999). In other words, there are no contemporaneous or lagged effects from the domestic variables to the international variables.

The real foreign aggregate output (Y*) is a trade-weighted gross domestic product (GDP) of Singapore, the US and Japan. To construct this measure all foreign GDPs are converted to a common currency. In this case, Singapore and Japanese GDPs are converted to US dollars. For foreign inflation and interest rate, a similar trade-weighted approach is employed. Foreign inflation (π*) is calculated by a change in the consumer price index in all the respected countries. Meanwhile, the foreign interest rates (i*) are measured by the three month interbank rate for Singapore, the Federal Funds rate for the US and the call money rate for Japan.[3] For the internal block, the variables are real gross domestic product for aggregate output (Y), quarter-on-quarter percentage change in CPI for inflation (π), the interbank overnight money rate for the interest rate (i) and the real effective exchange rate of Malaysia, Singapore, US and Japan for the exchange rate variable (e).

All variables are transformed into natural logs except for foreign and domestic inflation and both foreign and domestic policy interest rates. Data are taken from International Financial Statistics database, DataStream and various publications of Monthly Bulletin of Bank Negara Malaysia (BNM). The sample period runs from 1982:2 until 2010:4, covering the two major economic crises of 1985/86,and 1997/98. To capture the effects of the economic recessions, two dummies are used, a 1985/86 economic recession dummy (DER) and a dummy for the 1997/98 Asian crisis (DAC). DER is set to equal to one from 1985:2 to 1986:2 and zero otherwise while DAC is one from 1997:4 to 1998:4 and zero otherwise. The recent global crisis of 2008/09 is not taken into account as it does not affect Malaysian economy as bad as the other two recessions.

With the possible exception of inflation, all of the variables in used in the study are potentially non-stationary due to the presence of either deterministic or stochastic trends. This raises the question as to whether the SVAR model should be specified in first-differences rather than in levels. Ramaswamy and Slok (1998) discuss the trade-off between the loss of efficiency (when the VAR is estimated in levels, but without imposing any cointegrating relationships) and the loss of information (when the VAR is estimated in first-differences). In essence, they recommend that in cases where there is no prior economic theory that can suggest either the number of long-run relationships or how they should be interpreted, it is realistic not to impose cointegration restrictions on the VAR model. This paper follows their recommendation and thus the SVAR model is specified in levels.

SVAR Models

In the SVAR approach the dynamic relationship for the selected economic variables is given by the following equation;

$$BY_t = C + (\Gamma_1 L + \Gamma_2 L^2 + ... + \Gamma_k L^k)Y_t + \varepsilon_t \qquad [1]$$

where B is a square matrix that captures the structural contemporaneous relationships among the economic variables, Y_t is n x 1 vector of macroeconomics variables, C is a vector of deterministic variables, $\Gamma(L)$ is a kth order matrix polynomial in lag operator, L and ε_t is a vector of structural innovations that satisfies the conditions that $E(\varepsilon_t) = 0$, $E(\varepsilon_t \varepsilon_s^{'}) = \Sigma_\varepsilon$ for all $t = s$ and $E(\varepsilon_t \varepsilon_s^{'}) = 0$ otherwise.

Pre-multiplying equation [1] with B^{-1}, yields a reduced form VAR equation

$$Y_t = B^{-1}C + B^{-1}(\Gamma_1 L + \Gamma_2 L^2 + ... + \Gamma_k L^k)Y_t + B^{-1}\varepsilon_t \qquad [2]$$

where $e_t = B^{-1}\varepsilon_t$ is a reduced form VAR residual which satisfies the conditions that $E(e_t) = 0$, $E(e_t e_s^{'}) = \Sigma_e$. Σ_e is a (nxn) symmetric, positive definite matrix which can be estimated from the data. The relationship between the variance-covariance matrix of the estimated residuals, Σ_e and the variance-covariance matrix of the structural innovations, Σ_ε is such that

[3] Singapore uses the exchange rate as its monetary policy variable. The inclusion of the interest rate as monetary policy variable for Singapore is for comparison purpose.

$$\Sigma_{\varepsilon} = E(\varepsilon_t \varepsilon_t^{'})$$
$$= E(Be_t e_t^{'} B^{'}) = BE(e_t e_t^{'})B^{'}$$
$$= B\Sigma_e B' \qquad [3]$$

In order for the system to be identified, sufficient restrictions must be imposed so as to recover all structural innovations from the reduced form VAR residuals, e_t. Thus for (nxn) symmetric matrix Σ_e, there are $(n^2+n)/2$ unknowns and hence $(n^2-n)/2$ additional restrictions need to be imposed to exactly identify the system.

The relationship between the structural innovations ε_t and the reduced-form residuals e_t is given by $Be_t = \varepsilon_t$. In a purely recursive SVAR model, the elements in B above the diagonal of the matrix are all set equal to zero. Equation [4] indicates the set of restrictions that are imposed on the contemporaneous parameters of the first SVAR model for the Malaysian economy. Similar structural model is also used for the second, third and fourth model. The coefficient β_{ij} indicates how variable j affects variable i, contemporaneously. The coefficients on the diagonal are normalized to unity, while the number of zero restrictions on the coefficients is 23, so the model is over identified.

$$BY_t \equiv \begin{bmatrix} 1 & 0 & 0 & 0 & 0 & 0 & 0 \\ \beta_{21} & 1 & 0 & 0 & 0 & 0 & 0 \\ \beta_{31} & \beta_{32} & 1 & 0 & 0 & 0 & 0 \\ \beta_{41} & \beta_{42} & \beta_{43} & 1 & 0 & 0 & 0 \\ \beta_{51} & \beta_{52} & \beta_{53} & \beta_{54} & 1 & 0 & 0 \\ 0 & 0 & \beta_{63} & 0 & \beta_{65} & 1 & \beta_{67} \\ \beta_{71} & \beta_{72} & \beta_{73} & \beta_{74} & \beta_{75} & \beta_{76} & 1 \end{bmatrix} \begin{bmatrix} Y_t^* \\ \pi_t^* \\ i_t^* \\ Y_t \\ \pi_t \\ i_t \\ e_t \end{bmatrix} \qquad [4]$$

The three foreign variables which are foreign output, inflation and the interest rate are assumed to contemporaneously affect most of the domestic variables. The only exceptions are that foreign output does not contemporaneously affect domestic policy interest rate. The zero restriction is based on the assumption that policy-makers in the BNM do not observe contemporaneous values of foreign output. This type of identifying assumption has been widely used in SVAR models; see Kim and Roubini (2000) for its application to the G7 economies and Berkelmans (2005) for the case of Australia. Domestic variables are assumed not to contemporaneously affect the foreign variables (the restriction is also imposed on lagged values of the domestic variables) due to the fact that Malaysian economy is relatively small in size and therefore unlikely to have much impact on foreign variables.

Restrictions in equation [4] indicate that all domestic financial variables (the interest rate and the exchange rate) respond contemporaneously to inflation shocks. Since the ultimate goal of monetary policy is to have low and stable inflation, a shock in inflation will require policy-makers to respond immediately by adjusting the policy rate. In [4] it is assumed that policy-makers in the BMN respond more rapidly to an inflation shock than they do to a shock to domestic output.

Finally the exchange rate only affects the interest rate contemporaneously. The interdependence of the exchange rate and the interest rate has been assumed in Kim and Roubini (2000) and Brischetto and Voss (1999) as it helps solve the exchange rate puzzle. It is known from Tang's (2006) study of Malaysia that when this structure is not assumed there is an exchange rate puzzle. As in other VAR studies, the exchange rate responds contemporaneously to all variables in the model. Even though some variables do not affect the others contemporaneously, lagged effects among variables are unrestricted, except that the foreign and domestic sectors are assumed to be block exogenous.

Technically SVAR model is estimated in its reduced VAR form. In order to estimate the SVAR parameters, this study follows a two-step procedure suggested by Bernanke (1986). First, from the reduced form VAR estimates, the residuals, e_t and the variance-covariance matrix, Σ_e are calculated. Second, through the sample estimates of Σ_e the contemporaneous matrix B is estimated. In this study, B is estimated using maximum likelihood.[4]The log likelihood function is

$$-\frac{T}{2}\ln\left|B^{-1}\Sigma_{\varepsilon}(B')^{-1}\right|-\frac{1}{2}\sum_{t=1}^{T}(\hat{e}_t^{'}B'\Sigma_{\varepsilon}^{-1}B\hat{e}_t) \qquad [5]$$

If there are more than $(n^2-n)/2$ additional restrictions, the system is over-identified. In this case the χ^2 test statistic

$$\chi^2=\left|\Sigma_e^R\right|-\left|\Sigma_e\right| \qquad [6]$$

with R (number of restrictions exceeding $(n^2-n)/2$) degrees of freedom can be used to test the restricted system. Σ_e^R is the restricted variance-covariance matrix while Σ_e is the unrestricted variance-covariance matrix.

In choosing an appropriate lag length for the VAR model, information criteria for the full system of equations are considered, viz. Akaike's (1973) Information Criterion (AIC) and Schwarz (1978) Bayesian Criterion (SBC). As a simple indicator of model stability test, the eigenvalues of the companion matrix of the VAR model are calculated. If all the eigenvalues are inside the unit circle, the model is stable (see Lutkepohl, 1993).

From the SVAR model, impulse response functions are produced to describe the direction of response of a variable of interest (e.g. the Malaysian output) to an exogenous shock (e.g. foreign interest rate shock).Following Uhlig (2005), the study employs sign restrictions to select the impulses that are in accordance with the theory. Specifically, restrictions are made so that a domestic monetary policy shock (an increase in the interest rate) will affect the domestic output and inflation negatively for the impact period (say for *k* quarters) while it affects the exchange rate positively (an appreciation of domestic currency) on impact. In this study, *k* is 4 quarters. Thus all puzzles, namely output, price and the exchange rate puzzle can be avoided. The responses of domestic variables to all foreign shocks are left unrestricted for analysis and comparison purposes. Table 1 provides a summary of sign restrictions imposed. A summary of how the sign restriction is done is given in appendix.

One issue of concern when using sign restriction approach is the practice of using the median of the distribution of responses as a location measure. As criticized by Fry and Pagan (2011), the median at each horizon and for each variable may be obtained from different candidate models. They suggest using unique draw that is closest to the median impulse responses for all variables. This study takes this matter into account when presenting the selected impulse response for discussion.

TABLE 1: Sign Restrictions

	Response of						
Shock to	Y*	π*	i*	Y	π	i	e
Y* (Demand)	↑	↑	↑	-	-	-	-
π* (Supply)	↑	↓	↓	-	-	-	-
i* (Foreign Monetary Policy)	↓	↓	↑	-	-	-	-
I (Domestic Monetary policy	0	0	0	↓	↓	↑	↑

Notes: ↑(↓) means positive (negative) response of the variables in column to shocks in row. – means no constraint is imposed while 0 means no response as to block exogeneity assumption.

[4]In RATS, *B* is estimated using the Broyden, Fletcher, Goldfarb and Shanno (BFGS) algorithm. The initial starting values for *B* are found using the genetic method.

RESULTS

This section briefly describes the results of diagnostic tests conducted prior to estimating the SVAR models and presents some selected results of the impulse response functions from the sign restricted impulses responses. The results of lag length test indicate that for the baseline model, two lag lengths is the optimal lag based on AIC but one lag length based on SBC. Similar optimum lag length is shown by model with US factors. However, other models show different lag level. The paper chooses two lag order since it is sufficient to capture the dynamics of the variables and do not involve the loss of too many degrees of freedom. Furthermore, for stability indicator, all the eigenvalues for the baseline model in absolute value are less than one, indicating that the model is stable.[5]

TABLE 2: Lag Length Tests

Baseline model		
k	AIC	SBC
4	-2859.14	-2424.01
3	-2860.09	-2518.88
2	**-2869.61**	-2623.07
1	-2825.45	**-2674.35**
Model with US Factors		
k	AIC	SBC
4	-3084.66	-2649.54
3	-3098.89	-2757.67
2	**-3131.31**	-2884.78
1	-3050.04	**-2898.94**
Model with Japanese Factors		
k	AIC	SBC
4	-3038.39	-2603.27
3	**-3067.32**	-2726.1
2	-3026.02	-2779.48
1	-3029.54	**-2878.44**
Model with Singapore Factors		
k	AIC	SBC
4	-2732.47	-2297.34
3	-2759.01	-2417.79
2	-2800.11	-2553.58
1	**-2807.65**	**-2656.55**

Note: AIC is the Akaike Information Criterion and SBC is the Schwarz Bayesian Criterion.

[5] The values are not shown in this paper.

Figure 1 depicts the responses of domestic macroeconomic variables to domestic monetary policy shock. As shown, the directions of all responses are as expected. The responses of domestic output and inflation are negative for at least the impact period of four quarters, while the response of the exchange rate is positive. All the price puzzles do not appear and this is due to the application of the sign restrictions method. There are four responses in each graph. Each indicates which foreign factors are under investigation. The solid line is the baseline impulse response in which the trade-weighted foreign factors are used in the model. One pattern that is clearly seen is the similarity of the pattern between the responses in the baseline model and the responses when Singapore is the only foreign factor. In other words, the impulse response with Singapore effect resembles the baseline impulse response. This indicates that Singapore factor contributes a considerably large portion of the formation of the baseline responses. Thus the effect of Singapore can be said as more dominant to other foreign factor effects.

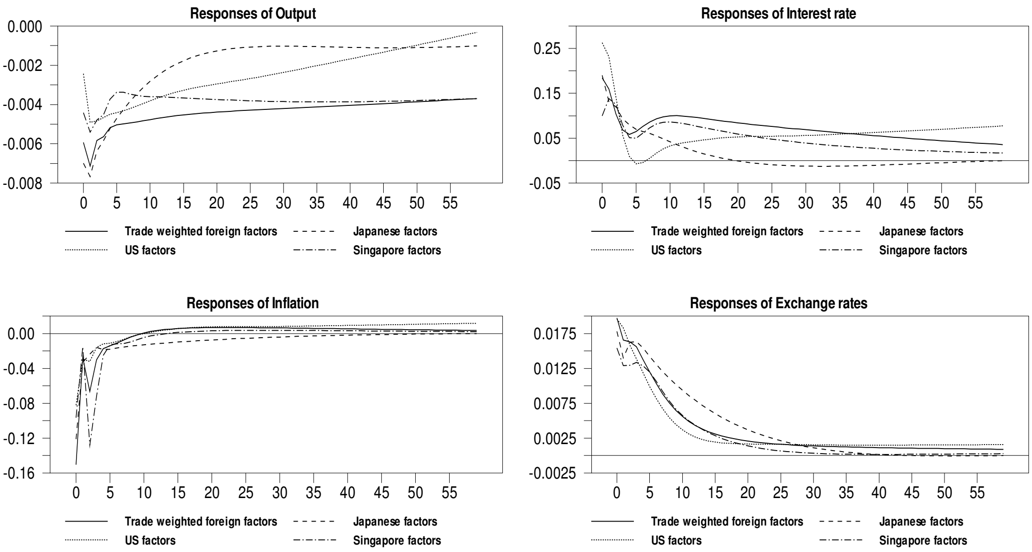

FIGURE 1: Response of Malaysian Variables to Monetary Policy Shock: Sign Restrictions Approach

Figure 2 to 4 show more clearly the effect of Singapore compared to other foreign factors. Figure 2 shows the responses of domestic variables to foreign output shock while figure 3 and 4 depicts the responses to foreign inflation and monetary policy shock respectively. All the responses are not sign restricted so that the data reflects the true responses.

As shown, the Singapore effect is more dominant compared to the other impulse responses which represent other foreign factors. This can be observed in two ways. First, the responses of domestic variables to foreign variables shock when Singapore is taken as the foreign factor are relatively large. For example, a shock to foreign output, as in figure2, results in relatively high response of domestic output, inflation, interest rate as well as the exchange rate when the Singapore effect is considered. Similar patterns can also be observed in the responses of domestic interest rate to foreign inflation (figure 3) and monetary policy shock (figure 4). Second the impulse response with Singapore effect resembles the baseline impulse response. This can be seen clearly in figure 2 – 4 which show that the path and direction of the domestic responses with Singapore factor are in line with that of the baseline model. Although, it is not very clear, the US factor can be considered as the second most influential factors while the Japanese factor is the least influential.

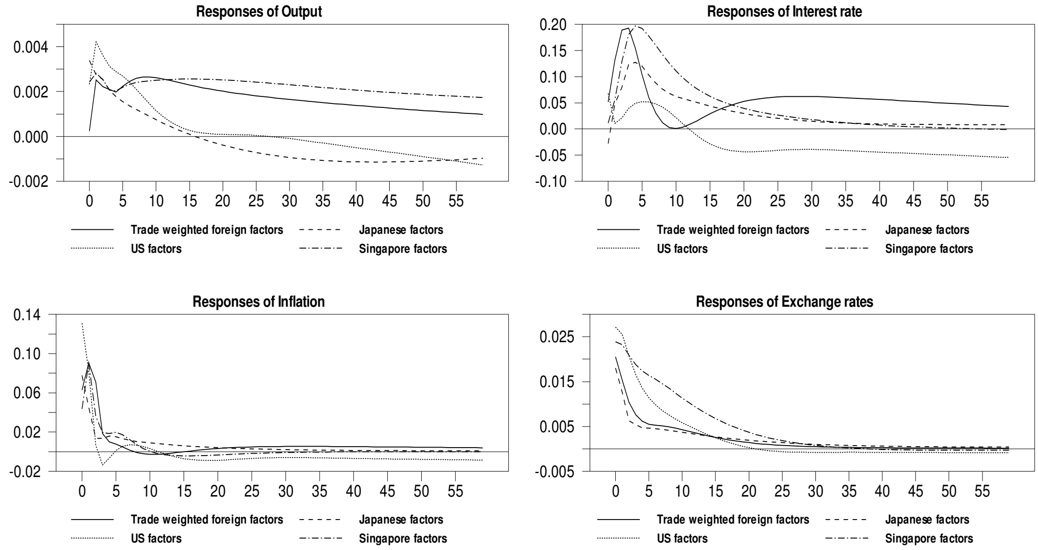

FIGURE 2: Response of Malaysian Variables to Foreign Income Shock: Sign Restrictions Approach

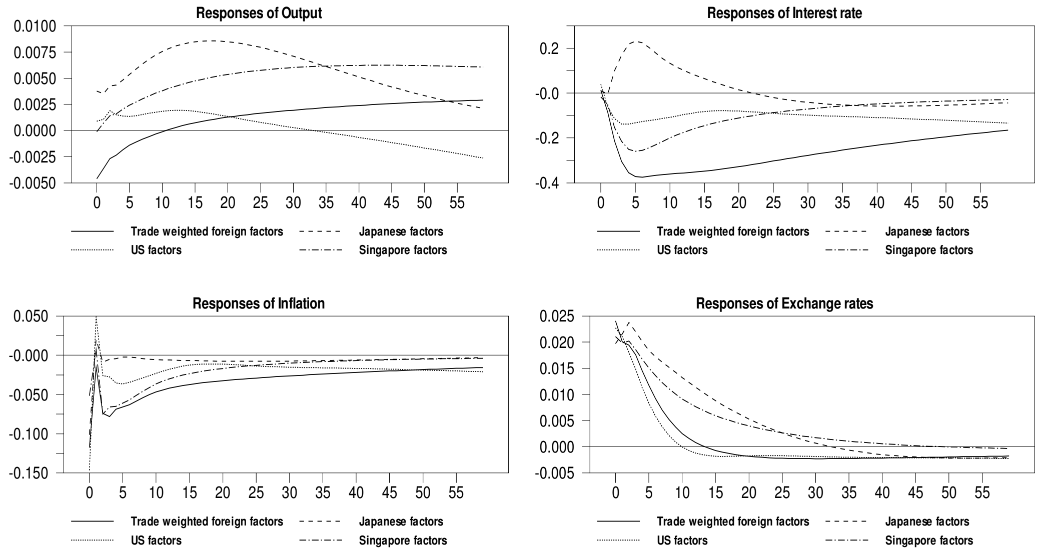

FIGURE 3: Response of Malaysian Variables to Foreign Inflation Shock: Sign Restrictions Approach

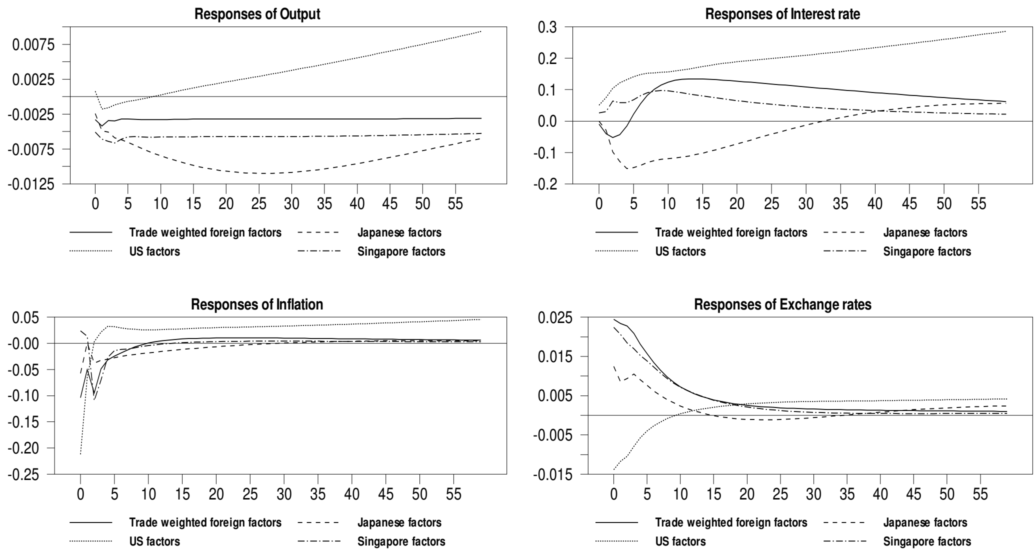

FIGURE 4: Response of Malaysian Variables to Foreign Monetary Policy Shock: Sign Restrictions Approach

CONCLUDING REMARKS

This paper provides new empirical evidence on the impact of foreign shocks (foreign income and foreign monetary policy) of Malaysia's major trading partners, namely Singapore, Japan, and US on the domestic macroeconomic variables. A non-recursive SVAR identification scheme is employed in examining the relative importance of the foreign shocks. In total, four SVAR models are estimated to deal with various measures of foreign factors that have often been ignored in previous studies. The first model which is the baseline model takes into account the dynamics of all foreign factors. Specifically the three foreign countries variables are combined using trade-weighted approach. The other three models make use of each foreign country separately. Block exogeneity assumption is particularly emphasized in building and estimating the structural VAR models. In order to identify the structural parameters, the paper utilizes short-run restriction as well as sign restriction technique. The sign-restricted impulse responses are generated in accordance with the suggestion of Uhlig (2005) and Fry and Pagan (2011).

Overall, the results show that applying the sign restriction approach helps the researchers to overcome the price puzzles. Since not all impulses are sign-restricted, the procedure manages to indicate the true responses of domestic variables to foreign factor shocks. The results indicate that Singapore is an important foreign factor that should be taken into account in modeling the effect of foreign factors on Malaysian economy. This is important as Singapore is not only one of Malaysia's major trading partners, but it is also the Malaysia's closest neighbor at border. Citizens of the two countries come in and go out every minute. Any disturbance that occurs in one country surely will affect the other almost instantaneously.

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REFERENCES

Akaike, H. (1973). Information theory and an extension of the maximum likelihood principle. In B.N. Petrov and F. Csaki (Eds), *Second International Symposium on Information Theory* (pp. 267-281).AkademiaiKiado, Budapest.

Azali, M. & Matthews, K. (1999). Money-income and credit-income relationships during the pre-and the post-liberalization periods: Evidence from Malaysia. *Applied Economics*, 31, 1161-1170.

Berkelmans, L. (2005). Credit and monetary policy: An Australian SVAR. *Research Discussion Paper,* Reserve Bank of Australia, 2005-06.

Bernanke, B. S. (1986). Alternative explanations of the money-income correlation. *Carnegie-Rochester Conference Series on Public Policy*, 25, 49-100.

Brischetto, A. & Voss, G. (1999).A structural vector auto regression model of monetary policy in Australia. Research Discussion Paper, Reserve Bank of Australia.

Buckle, R. A., Kim, K., Kirkham, H., H., M. & Sharma, J. (2007). A Structural VAR business cycle model for a volatile small open economy. *Economic Modeling*, 24, 990-1017.

Canova, F. and De Nicolo, G. (2002). Monetary disturbances matter for business fluctuations in the G-7, *Journal of Monetary Economics,* 49: 1131-1159.

Canova, F. and Pappa, E. (2007). Price differentials in monetary unions: The role of fiscal shocks, *Economic Journal*, 117: 713-734.

Canova, F. (2005). The transmission of US shocks to Latin America. *Journal of Applied Econometrics*, 20, 229-251.

Charoenseang, J. & Manakit, P. (2007).Thai monetary policy transmission in an inflation targeting era. *Journal of Asian Economics*, 18, 144-157.

Cushman, D. O. &Zha, T. (1997).Identifying monetary policy in a small open economy under flexible exchange rates. *Journal of Monetary Economics*, 39, 433-448.

Disyatat, P. & Vongsinsirikul, P. (2003). Monetary policy and the transmission mechanism in Thailand. *Journal of Asian Economics*, 14, 389-418.

Doan, T. A. (2010). RATS Handbook for Vector Autoregressions.

Dungey, M. & Fry, R. (2003). International shocks on Australia – The Japanese effect. *Australian Economic Papers*, June, 158-182

Dungey, M. & Pagan, A. (2000).A Structural VAR Model of the Australian Economy. *The Economic Record*, 76, 321-342.

Faust, J. (1998). The robustness of identified VAR conclusions about money, *Carnegie-Rochester Conference Series in Public Policy*, 49: 207-204.

Fry, Renee, and Pagan, A. (2011), Sign Restrictions in Structural Vector Autoregressions: A Critical Review, *Journal of Economic Literature,* 2011, 49:4, 938–960

Hesse, H. 2007. Monetary policy, structural break and the monetary transmission mechanism in Thailand. *Journal of Asian Economics*, 18, 649-669.

Horvath, R. and Rusnak, M. (2008). How important are foreign shocks in small open economy? The case of Slovakia. IES Working paper, Institute of Economic Studies, Faculty of Social Sciences, Charles University in Prague.

Ibrahim, M. (2005). Sectoral effect of monetary policy: Evidence from Malaysia. *Asian Economic Journal*, 19, 83-102.

Kim, S. & Roubini, N. (2000). Exchange rate anomalies in the industrial countries: A solution with a structural VAR approach. *Journal of Monetary Economics*, 45, 561-586.

Kim, S. (2001). International transmission of U.S monetary policy shocks: evidence from VAR's. *Journal of Monetary Economics*, 48, 339-372.

Kubo, A. (2008). Macroeconomic impact of monetary policy shocks: Evidence from recent experience in Thailand. *Journal of Asian Economics*, 19, 83-91.

Lippi, F. and Nobili, A. (2011). Oil and the macroeconomy: A quantitative structural analysis, *Journal of the European Economic Association* .

Lutkepohl, H. (1993). *Introduction to Multiple Time Series Analysis*.2nd ed., Springer-Verlag Berlin.

Mackowiak, B. 2007. External shocks, U.S monetary policy and macroeconomics fluctuations in emerging markets. *Journal of Monetary Economics*, 54, 2512-2520.

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

Peersman, G. and Straub, R. (2009).Technology shocks and robust sign restrictions in a euro area SVAR, *International Economic Review* 50: 727{750.

Ramaswamy, R. &Slok, T. (1998). The real effects of monetary policy in the European Union: What are the difference? IMF staff papers, 45, 2, 374-396.

Schwarz, G. (1978). Estimating the dimension of a model. *Annals of Statistics*, 6, 461-464.

Tang, H. C. 2006. The relative important of monetary policy transmission channels in Malaysia. *CAMA Working Paper Series*. The Australian National University.

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

Zaidi.M. A. S. and Fisher, L. A. 2010. Monetary policy and foreign shocks: A SVAR analysis for Malaysia, *Korea and the World Economy*, Vol. 11, No. 3, 527-550.

Zha, T. 1999. Block recursion and structural autoregressions. *Journal of Econometrics*, 90, 291-316.

APPENDIX

Summary of Sign Restriction Approach (Taken from Doan (2010))

This is a summary of sign restriction approach as suggested by Uhlig (2005) and Canova and De Nicolo (2002). This is with the assumption that the full reduced form VAR is estimated.

1. Generate a draw for the VAR coefficients and covariance matrix using standard methods.
2. Compute a Choleski factor and the responses to it.
3. Generate a random unit vector (α) in *m*-space (dimensional unit sphere). This is the start of a "subdraw".
4. Weight the impulse responses from step 2 by α to get the responses to the chosen impulse vector.
5. If the impulse responses meet the restrictions, save them.
6. Repeat steps 3-5 a certain number of times for each main draw.
7. Repeat steps 1-6 until the desired number of draws have been accepted.