ASIAN ACADEMY of
MANAGEMENT JOURNAL
of ACCOUNTING
and FINANCE

AAMJAF Vol. 14, No. 2, 25–44, 2018

IMPACT OF CHINA ON MALAYSIAN ECONOMY: EMPIRICAL EVIDENCE OF SIGN-RESTRICTED STRUCTURAL VECTOR AUTOREGRESSION (SVAR) MODEL

Mohd Azlan Shah Zaidi[1], Zulkefly Abdul Karim[1*] and Zurina Kefeli @ Zulkefli[2]

[1]Center of Sustainable and Inclusive Development (SID), Faculty of Economics and Management, Universiti Kebangsaan Malaysia (UKM), 43600 Bangi, Selangor, Malaysia
[2]Faculty of Economics and Muamalat, Universiti Sains Islam Malaysia (USIM), Bandar Baru Nilai, 71800 Nilai, Negeri sembilan, Malaysia

[*]Corresponding author: zak1972@ukm.edu.my

ABSTRACT

China has been developing aggressively since its accession into the World Trade Organisation. Consequently, China has become one of the major trading partners to many countries in the world including Malaysia. To what extent China has affected Malaysian economy has been a hot issue facing the economists and practitioners. This paper examines the influence of China on Malaysian economic performances. Using structural vector autoregression (SVAR) methodology that takes into account the effect of other major trading partner countries such as the U.S., Japan and Singapore, the results indicate that different utilisation of foreign country variables to represent external sector in the model brings about different impact on domestic variables. It is shown that the U.S. is particularly important to affect domestic output while China is more important in influencing domestic inflation and the exchange rate, especially with regards to their respective income shocks. In addition, Singapore plays more dominant role in affecting domestic sector when foreign monetary policy shocks are considered. Japan is however more influential in affecting the exchange rate in some other shocks. While China is showing their dominance in the world economy, the study implies that knowing which country exactly affects which domestic

Published date: 31 December 2018

To cite this article: Zaidi, M. A. S., Karim, Z. A., & Kefeli, Z. (2018). Impact of China on Malaysian economy: Empirical evidence of sign-restricted structural vector autoregression (SVAR) model. *Asian Academy of Management Journal of Accounting and Finance, 14*(2), 25–44. https://doi.org/10.21315/aamjaf2018.14.2.2

To link to this article: https://doi.org/10.21315/aamjaf2018.14.2.2

variables is very crucial in mitigating the adverse impact of foreign policy change or shocks in the process of transforming Malaysia's economy toward high income nation in the near future.

Keywords: foreign shocks, China, monetary policy, SVAR, sign restrictions

INTRODUCTION

Since its accession into the World Trade Organisation (WTO), China has been an important trading partner country to most of the developed and developing economies. For Malaysia, apart from the U.S., Japan and Singapore, the importance of China has become more apparent since the middle of 2000. China only accounted for 6% of the total trade of the four largest trading partner countries of Malaysia (U.S., Japan, Singapore and China) while U.S., Japan and Singapore contributed about 30% respectively at the end of 2000. The contribution of China increased significantly to 27% while the shares of Japan and Singapore decreased to 25% and 27% respectively at the end of 2010. The share of U.S., decreased significantly to 22% in the same period. At the end of 2016, the share of China increased to 35% and was the highest among the four countries. The Japan share of the total trade, nevertheless decreased significantly to around 18%. This indicates that China has increasingly and relatively become more important to Malaysia.

As 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, and foreign income and monetary policy shocks, especially from these four countries. To what extent China and others have influenced the Malaysia's economy has been a major concern to investors, policy makers as well as the academicians. To maintain economic stability, understanding how the economy is affected by external shocks is crucial for Malaysia's policy makers in making better policy formulation.

Most previous studies on the effect of foreign shocks on Malaysia mainly take into account the influence of the U.S. and Japan (see Ibrahim, 2005; Tang, 2006; Maćkowiak, 2006; and Zaidi, Karim, & Azman-Saini, 2013). As China has become more important to Malaysia's economy, exclusion of the country in the Malaysian macro model might have made the impact of China shock on the Malaysian economy under estimated. Thus, the true consequences of the shock can only be verified by empirical research.

In view of this crucial matter, this paper investigates the effect of China on Malaysian economic performance. This is done by investigating the relative importance of China as well as other major trading partner countries, namely

Singapore, U.S. and Japan, on Malaysian income and inflation. A structural autoregressive (SVAR) model with sign restrictions approach is utilised in evaluating the relative response of Malaysian income and inflation to China and other countries' shocks. 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 different utilisation of foreign country variables to represent external sector in the model would bring about different impact on domestic variables. For example, the U.S. is particularly important to affect domestic output while China is more important in influencing domestic inflation. In addition, Singapore plays more dominant role in affecting domestic sector when foreign monetary policy shocks are considered. Japan is however more influential in affecting the exchange rate.

LITERATURE REVIEW

Studies on foreign shock effect on a small open economics are numerous (see for example, Cushman & Zha, 1997; Dungey & Pagan, 2000; Dungey & Fry, 2003; Buckle, Kim, Kirkham & Sharma, 2007; Kim & Roubini, 2000; Kim, 2001; Canova, 2005; Maćkowiak, 2007; Zaidi et al., 2013; Zaidi & Karim, 2014; Othman, Yusop, Zaidi & Karim, 2015). Most of the studies find that foreign factors (foreign income and foreign monetary policy) play significant roles in influencing the domestic economy. Cushman and Zha (1997), for instance uncover that external shocks (U.S. income, U.S. inflation, U.S. federal fund rate, and world total commodity export prices) have become significant sources of domestic output fluctuations in Canada, whereas, domestic monetary policy shock (an increase in interest rates) has only a small contribution on output. Similarly, Dungey and Pagan (2000) find that international factors are generally a substantial contributor to Australian economy while domestic monetary policy contributes to stabilise economic activity, but the effect is not large. In New Zealand, Buckle et al. (2007) find 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.

Kim and Roubini (2000) study for G-7 countries conclude that foreign shocks (oil price shocks and the U.S. monetary policy) have contributed more to output fluctuations while in the most countries, domestic monetary policy is not the major contributor to output fluctuations. Similarly, Kim (2001) finds that a U.S. monetary policy expansion has a positive spillover effect on the non-U.S. G-6 countries' output. Applying a structural VAR model as in Kim (2001), Canova (2005) also finds that U.S. monetary policy shocks significantly affect the interest rates in Latin America. In addition, such external shocks are an important source of macroeconomic fluctuations in Latin America. For emerging market countries, Maćkowiak (2007) also unveils that external shocks have an important impact on their macroeconomic fluctuations. The U.S. monetary policy shocks, in particular, have strong and immediate effects upon emerging market interest rates and exchange rates.

Besides looking at the U.S. as the foreign factors, some studies take into account the effect of Japanese economy. Callen and McKibbin (2001), for example, analyse the effect of Japanese economy on Asia Pacific region. Their findings imply that Japanese monetary policy shocks will not have significant effect on the rest of the region. Coenen and Wieland (2003) on the other hand, examine the effect Japanese monetary policy shocks on the country's main trading partners. Their findings reveal the Japanese monetary policy shocks have negative effect on its trading partner economies. Looking at the effect of Japanese monetary policy shock on the East Asia countries, Maćkowiak (2006) finds relatively modest effect of Japan's monetary policy shock on real output, trade balances and exchange rates in East Asia.

Studies on the impact of China on other countries are relatively limited. Of particular interest are the Koźluk and Mehrotra (2009) and Johansson (2012) studies. Koźluk and Mehrotra (2009) examine the effect of China monetary policy on East and Southeast Asia and find that China monetary policy has importance consequence on real output in other countries in the region. Johansson (2012) on the other hand, looks at the potential transmission of China's monetary policy shocks to equity markets in five Southeast Asian countries namely, Indonesia, Malaysia, Philippines, Singapore and Thailand. His results show some evidence of China's growing influence in financial markets of the Southeast Asia.

As for Malaysia, study that looks specifically on China's effect is rather limited. Besides Johansson (2012), most of the studies take into account U.S. or Japan or both as the foreign variables in the models (see Azali & Matthews, 1999; Ibrahim, 2005; Tang, 2006; Zaidi & Fisher, 2010; and Zaidi et al., 2013). Zaidi and Karim (2014) and Othman et al. (2015) add Singapore, other than U.S. and Japan economies as foreign factors to investigate the relative importance of U.S., Japan and Singapore on Malaysian economy and on Malaysians electronic and electrical (E & E) export demand respectively. Both studies find that Singapore is relative more important in influencing Malaysia's economy. As China becomes more involved in Malaysia's economy, investigating its impact is of important.

A study by Dizioli, Guajardo, Klyuev, Mano and Raissi (2016) indicates that China's growth slowdown would affect the countries with closer trade linkages with China (Malaysia, Singapore and Thailand) and net commodity exporters (Indonesia and Malaysia) the most.

Thus, based on this backdrop, this study adds to the existing literature especially for Malaysia case by employing a sign restricted SVAR technique to investigate further the impact of China effect on domestic economy. Unlike other previous studies, this study looks at relative importance of China and other important trading partner's countries namely the U.S., Japan and Singapore in influencing Malaysian economy.

METHODOLOGY

This section describes the variables used in the model and the estimation procedures. Basically, there are four models to be estimated and each model consists of three foreign country variables and three domestic variables. The first model takes into account the U.S. variables to represent an external sector while the other three models take Japan, Singapore and China respectively to represent the foreign sector.

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

For foreign output (Y^*), industrial production index is used as a proxy, while foreign inflation (π^*) is calculated by month-on-month change in consumer price index. Meanwhile, the foreign interest rates (i^*) are measured by the Federal Funds rate for the U.S., the call money rate for Japan, the three month interbank rate for Singapore and the bank rate for China.[1] For the internal block, the variables are industrial production index for aggregate output (Y), month-on-month percentage change in Consumer Index Price (CPI) for inflation (π), the interbank overnight money rate for the interest rate (i) and the real exchange rate of Malaysia, Singapore, U.S. 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.[2] Data are taken from International Financial Statistics (IFS) database and various publications of Monthly Statistical Bulletin of Bank Negara Malaysia (BNM). The sample period runs from 2000:1 until 2016:12, covering one global economic crisis of 2008/2009. Thus to capture the effect of the global economic recession, one dummy is used, Dummy for Global Crisis (DGC). DGC is set to equal to one from 2008:9 to 2009:12 and zero otherwise.

SVAR Models

Dynamic relationships for the selected economic variables in a SVAR approach are given by the following equation;

$$BY_t = C + \left(\Gamma_1 L + \Gamma_1 L^2 + \ldots + \Gamma_k L^k\right) Y_t + \varepsilon_t \tag{1}$$

where B is a square matrix that captures the structural contemporaneous relationships among the economic variables, Y_t is $n \times 1$ 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 $E(\varepsilon_t) = 0$, $E\left(\varepsilon_t \varepsilon_s^{'}\right) = \Sigma_\varepsilon$ for all $t = s$ and $E\left(\varepsilon_t \varepsilon_s^{'}\right) = 0$ otherwise.

Pre-multiplying Equation (1) with B^{-1}, produces a reduced form VAR equation:

$$Y_t = B^{-1}C + B^{-1}\left(\Gamma_1 L + \Gamma_1 L^2 + \ldots + \Gamma_k L^k\right) Y_t + B^{-1}\varepsilon_t \tag{2}$$

where $e_t = B^{-1}\varepsilon_t$ is a reduced form VAR residual which satisfies the conditions that $E(e_t) = 0$, $E\left(e_t e_s^{'}\right) = \Sigma_e$. Σ_e is a $(n \times n)$ 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_e is such that

$$\begin{aligned} \Sigma_\varepsilon &= E\left(\varepsilon_t \varepsilon_t^{'}\right) \\ &= E\left(Be_t e_t{}' B'\right) = BE\left(e_t e_t{}'\right) B' \\ &= B\Sigma_e B' \end{aligned} \tag{3}$$

Sufficient restrictions must be imposed in order for the system to be identified, so as to recover all structural innovations from the reduced form VAR residuals, e_t. Thus, for $(n \times n)$ 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. The coefficient β_{ij} indicates how variable j affects variable i, contemporaneously. The coefficients on the diagonal are normalised to unity, while the number of zero restrictions on the coefficients is 30, so the model is over identified.

$$BY_t \equiv \begin{bmatrix} 1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ \beta_{21} & 1 & 0 & 0 & 0 & 0 & 0 & 0 \\ \beta_{31} & \beta_{32} & 1 & 0 & 0 & 0 & 0 & 0 \\ \beta_{41} & \beta_{42} & \beta_{43} & 1 & 0 & 0 & 0 & 0 \\ \beta_{51} & \beta_{52} & \beta_{53} & \beta_{54} & 1 & 0 & 0 & 0 \\ \beta_{61} & \beta_{62} & \beta_{63} & \beta_{64} & \beta_{65} & 1 & 0 & 0 \\ \beta_{71} & 0 & 0 & \beta_{74} & 0 & \beta_{76} & 1 & 0 \\ \beta_{81} & \beta_{82} & \beta_{83} & \beta_{84} & \beta_{85} & \beta_{86} & \beta_{87} & 1 \end{bmatrix} \begin{bmatrix} OP \\ Y_t^* \\ \pi_t^* \\ i_t^* \\ Y_t^* \\ \pi_t \\ i_t \\ e_t \end{bmatrix} \tag{4}$$

Foreign output, inflation and the interest rate are assumed to contemporaneously affect most of the domestic variables. The only exception is that foreign output does not contemporaneously affect domestic policy interest rate. This 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 G-7 economies and Berkelmans (2005) for the case of Australia. Due to the fact that Malaysian economy is relatively small in size and therefore unlikely to have much impact on foreign variables, domestic variables are assumed not to contemporaneously affect the foreign variables. The restriction is also imposed on lagged values of the domestic 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 Equation (4), it is assumed that policy-makers in the BNM 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. 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.[3] The log likelihood function is

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

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

$$\chi^2 = \left|\Sigma_e^R\right| - \left|\Sigma_e\right| \tag{6}$$

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). Recently, new development in empirical studies using VAR/SVAR model focuses on sign restrictions approach as one of the identification strategies. 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 & Uhlig, 2009; Lippi & Nobili, 2012; Peersman & Straub, 2009; Canova & Pappa, 2007).

Following Uhlig (2005), the study also 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 months) while it affects the exchange rate positively (an appreciation of domestic currency) on impact. In this study, k is six months which is equivalent to two quarters. It is expected that the responses are in right direction in the first two 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 A.

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 criticised 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.

RESULTS

This section briefly describes the results of diagnostic tests conducted prior to estimating the SVAR models and discusses some selected findings of the impulse response functions from the sign restricted impulses responses. The results of lag length test indicate that for most of the models, two lag lengths is the optimal lag based on AIC but one lag length based on SBC. 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.[4]

Figure 1 shows the responses of domestic macroeconomic variables to domestic monetary policy shock. As depicted, the directions of all responses are in accordance with the theory. The responses of domestic output and inflation are negative for at least the impact period of six months, while the response of the exchange rate is positive. Due to the application of the sign restrictions method, all the price puzzles do not appear. There are four responses in each graph. Each indicates which foreign factors are under investigation. A shock in domestic monetary policy brings about greatest negative impact on domestic output when the Japanese factors are used in the model. On the other hand, negative impact of the shock on domestic inflation is more pronounced if Singapore factors are considered. However, when the Singapore variables are used as the only external sectors, its impact is more realised in the response of the exchange rate. Even though the initial response is not as big as the others, its impact takes longer time to diminish. The whole pictures indicate that different utilisation of foreign country variables to represent external sector in the model would bring about different impact of domestic variables.

Figure 2 shows the impact of shocks to foreign monetary policy on domestic variables. It seems that, the monetary policy shocks from Singapore and the U.S. (after 9 months) have positive effects on Malaysian output, whereas the monetary policy shocks from Japan and China (until 27 months) have negative effects on Malaysian output. While the U.S. monetary policy shock has positive and greater impact on Malaysian interest rates, the monetary policy shocks from Singapore, Japan and China (after 13 months) have negative effects on Malaysian domestic interest rates. In the meantime, each foreign monetary policy shock affects Malaysian inflation negatively. The effect of Singapore monetary policy shock is nevertheless more pronounced. When it comes to the exchange rate, the effect of each foreign monetary policy shock on the exchange rate is quite distinctive. The monetary policy shock from Singapore has greater and positive effect on Malaysian exchange rate, whereas the U.S. monetary policy shock has negative effect on the exchange rate. In the meantime, China monetary policy shock has positive effect on the exchange rate within 10 months only, whereas Japanese monetary policy shock has positive effect on the exchange rate after 3 months and stays positive until 24 months.

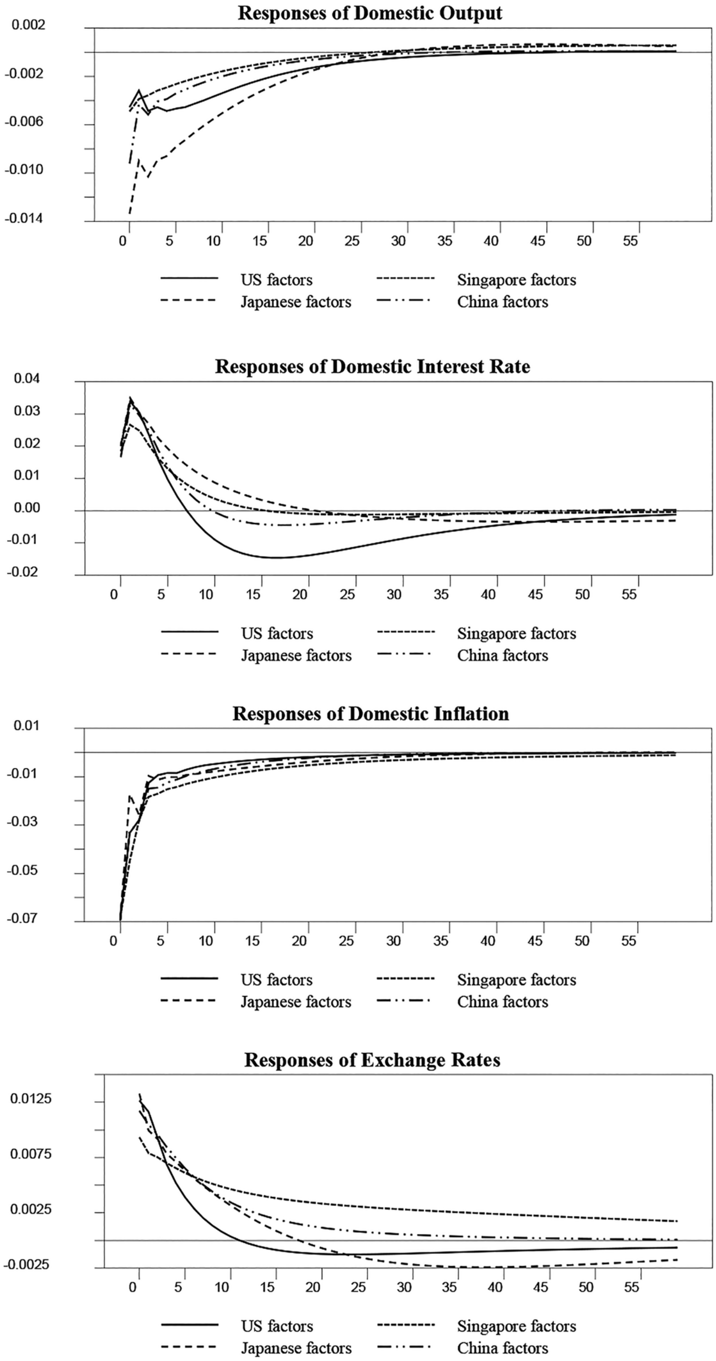

Figure 1. Response of Malaysian variables to domestic monetary policy shock: Sign restrictions approach

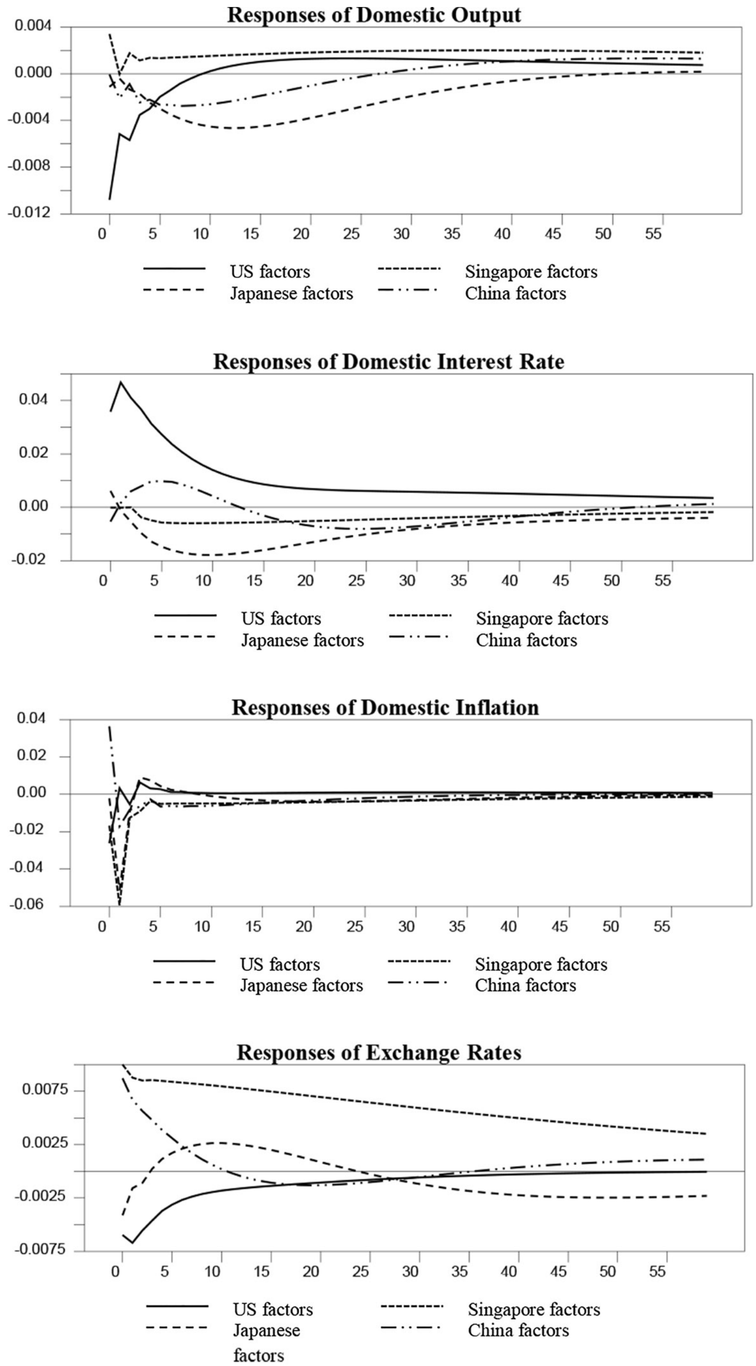

Figure 2. Response of Malaysian variables to foreign monetary policy shock: Sign restrictions approach

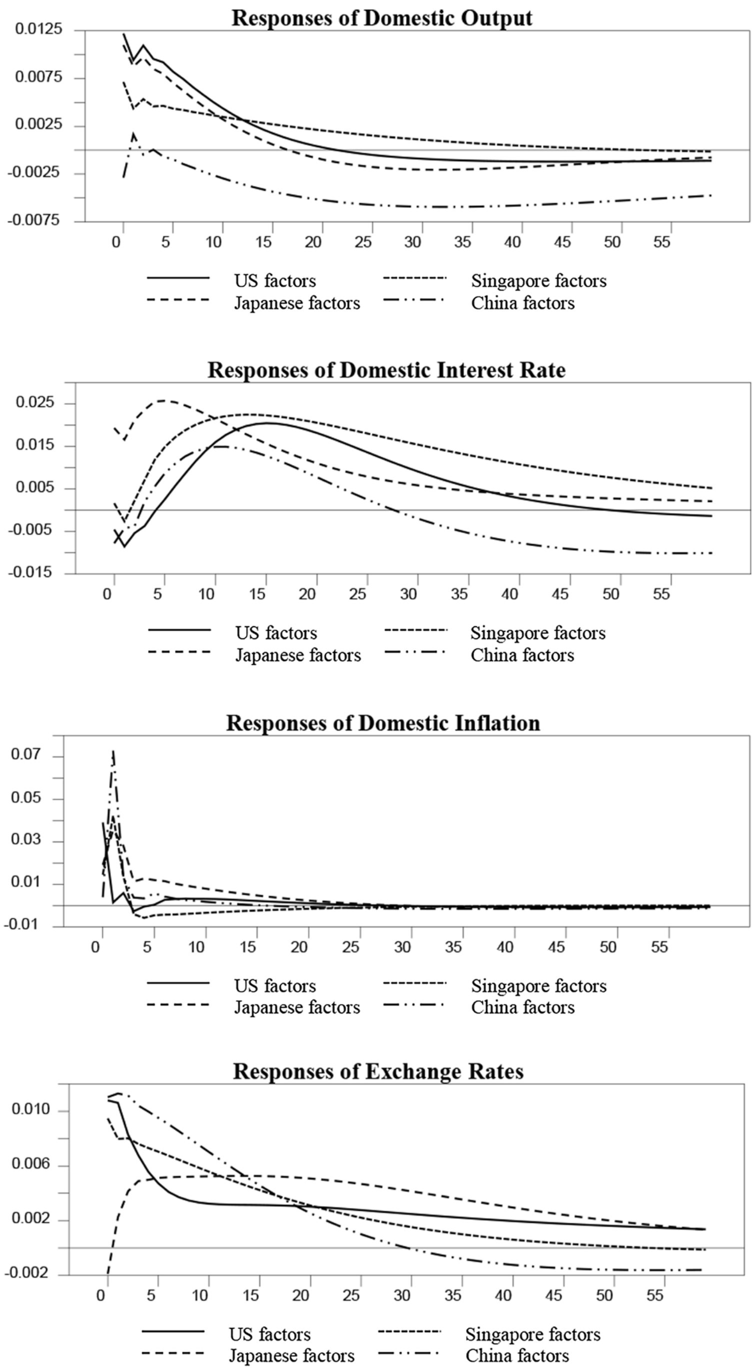

Figure 3. Response of Malaysian variables to foreign income shock: Sign restrictions approach

Figure 3 depicts the responses of Malaysian domestic variables to foreign output shocks. As can be seen, within 13 months, the income shock from the U.S. has the greatest influence on Malaysian output. However after 13 months, income shock from Singapore has more pronounced effect on Malaysian output. Interestingly, income shock from China has negative effect on Malaysian output throughout the time horizon. This indicates that there is a beggar-thy-neighbour effect (negative spillover) from an economic expansion in China to Malaysian output. China factors are also more dominant in terms of its income shock's effect on Malaysian inflation. This indicates that an economic expansion in China has triggered greater inflationary pressure in Malaysia than that of the economic expansion from the other countries. In addition, the China factors have also dominant effect on the exchange rate within 13 months, which after that is taken over by the Japanese factors. Furthermore, it seems that Malaysian interest rate has responded positively to all foreign income shocks, in which the shock from Japan is more dominant within 10 months, and then this role is taken over by Singapore after 10 months.

Figure 4 summaries the responses of domestic variables to foreign inflation shocks. As can be seen, China factors become more dominant than the others, after 20 months, in affecting Malaysian output. In general, Malaysian output has responded positively to inflation shocks from all countries. This indicates that inflationary pressures from foreign countries have positive effects on the Malaysian output. The responses of domestic interest rate upon foreign inflation shocks are heterogeneous across countries in terms of magnitudes and signs. The inflation shocks from China and Singapore have negative effects on Malaysian interest rate until 25 months. In contrast, the U.S. and Japanese factors have positive effects on Malaysian interest rate in the short run. For example, inflation shock from the U.S. has positive effect on Malaysian interest rate until 5 months, whereas inflation shock from Japan has positive impact on the interest rate until 17 months. Furthermore, the inflation shocks from all countries have negative effects on Malaysian inflation. In particular, an inflation shock in Singapore has caused the greatest negative response in Malaysian inflation. With regards to the exchange rate, shocks to inflation in all foreign countries have positive impacts on the variable at least in the short run.

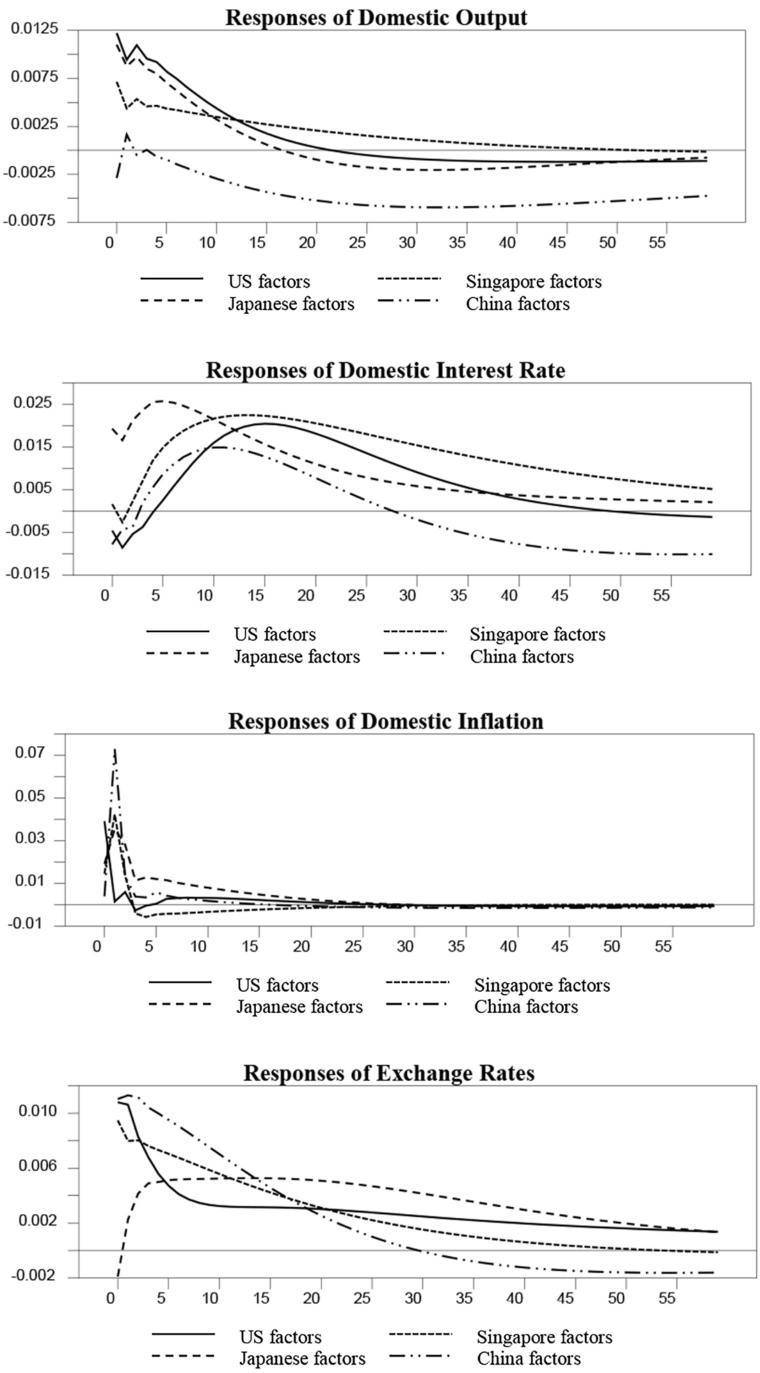

Figure 4. Response of Malaysian variables to foreign inflation shock: Sign restrictions approach

CONCLUSIONS

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 the U.S., Japan, Singapore and China on the domestic macroeconomic variables. A special attention is given on the effect of China since China has increasingly become more influential in the world economy. The paper employs anon-recursive SVAR identification scheme in examining the relative importance of the foreign shocks. There are four SVAR models estimated to deal with various measures of foreign factors that have often been ignored in previous studies, in particular the China factor. Block exogeneity assumption is mainly emphasised in building and estimating the structural VAR models. In order to identify the structural parameters, the paper utilises 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 in overcoming 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, in particular, that the U.S. is more dominant in affecting domestic output, while China plays prominent role in influencing domestic inflation and the exchange rate, especially with regards to their respective income shocks. As for foreign monetary policy shock, the effect of Singapore in influencing Malaysian inflation and the exchange rate is more pronounced. This is in line with the findings of Zaidi and Karim (2014) when quarterly data are used in their models.

The findings suggest that in order to model the impact of foreign sector on Malaysian economy, one has to look at which specific country the external shock comes from. Generalising one country, for example the U.S. to represent the world economy might have detrimental effect on the policy making since significant impact of other country might have been ignored. The study might have some benefits to policy makers especially in tackling issues pertaining to the impact of specific foreign country to domestic sector. This is particularly important for Malaysia in formulating policy to mitigate adverse impact of foreign policy change or shocks in the process of transforming its economy toward high income nation in the near future.

ACKNOWLEDGEMENTS

The authors thankfully acknowledge financial support from the Universiti Kebangsaan Malaysia research grant (Grant number: UKM-GGPM-PLW-016-2011).

NOTES

1. Singapore uses the exchange rate while China uses monetary aggregate as their monetary policy variable respectively. The inclusion of the interest rate as monetary policy variable for Singapore and China is for comparison purpose.
2. All unadjusted data at source are seasonally adjusted using X11 command in RATS.
3. 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.
4. The values are not shown in this paper.

REFERENCES

Akaike, H. (1973). Information theory and an extension of the maximum likelihood principle. In B. N. Petrov, & F. Csaki (Eds.), *Second international symposium on information theory* (pp. 267–281). Budapest: AkademiaiKiado.

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*(10), 1161–1170. https://doi.org/10.1080/000368499323382

Berkelmans, L. (2005). Credit and monetary policy: An Australian SVAR. *Research Discussion Paper No. 2005–06,* Reserve Bank of Australia.

Bernanke, B. S. (1986). Alternative explanations of the money-income correlation. *Carnegie-Rochester Conference Series on Public Policy*, *25*(1), 49–100.

Brischetto, A., & Voss, G. (1999). A structural vector auto regression model of monetary policy in Australia. *Research Discussion Paper 1999–11*, 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*(6), 990–1017. https://doi.org/10.1016/j.econmod.2007.04.003

Callen T., & McKibbin, W. (2001). Policies and prospects in Japan and the implications for the Asia Pacific Region. *IMF Working Paper WP/01/131*, International Monetary Fund. https://doi.org/10.5089/9781451855289.001

Canova, F., & De Nicolo, G. (2002). Monetary disturbances matter for business fluctuations in the G-7. *Journal of Monetary Economics*, *49*(6), 1131–1159.

Canova, F., & Pappa, E. (2007). Price differentials in monetary unions: The role of fiscal shocks. *Economic Journal*, *117*(520), 713–734. https://doi.org/10.1111/j.1468-0297.2007.02047.x

Canova, F. (2005). The transmission of US shocks to Latin America. *Journal of Applied Econometrics*, *20*(2), 229–251. https://doi.org/10.1002/jae.837

Coenen, G., & Wieland, V. (2003). The zero-interest-rate bound and the role of the exchange rate for monetary policy in Japan. *Journal of Monetary Economics*, *50*(5), 1071–1101.

Cushman, D. O., & Zha, T. (1997). Identifying monetary policy in a small open economy under flexible exchange rates. *Journal of Monetary Economics*, *39*(3), 433–448.

Dizioli, A., Guajardo, J., Klyuev, V., Mano, R., & Raissi, M. (2016). Spillovers from China's growth slowdown and rebalancing to the ASEAN-5 economies, *IMF Working Paper*, August 2016, International Monetary Fund.

Doan, T. A. (2010). *RATS handbook for vector autoregressions*. Retrieved from https://hhstokes.people.uic.edu/ftp/e538/VAR_Material/VAR%20Workbook.pdf

Dungey, M., & Fry, R. (2003). International shocks on Australia: The Japanese effect. *Australian Economic Papers*, *42*(2), 158–182. https://doi.org/10.1111/1467-8454.00193

Dungey, M., & Pagan, A. (2000). A structural VAR model of the Australian economy. *The Economic Record*, *76*(235), 321–342. https://doi.org/10.1111/j.1475-4932.2000.tb00030.x

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

Fry, R., & Pagan, A. (2011). Sign restrictions in structural vector autoregressions: A critical review. *Journal of Economic Literature*, *49*(4), 938–960. https://doi.org/10.1257/jel.49.4.938

Ibrahim, M. (2005). Sectoral effect of monetary policy: Evidence from Malaysia. *Asian Economic Journal*, *19*(1), 83–102. https://doi.org/10.1111/j.1467-8381.2005.00205.x

Johansson, A. C. (2012). China's growing influence in Southeast Asia: Monetary policy and equity markets. *The World Economy*, *35*(7), 816–837.

Kim, S., & Roubini, N. (2000). Exchange rate anomalies in the industrial countries: A solution with a structural VAR approach. *Journal of Monetary Economics*, *45*(3), 561–586.

Kim, S. (2001). International transmission of U.S. monetary policy shocks: Evidence from VAR's. *Journal of Monetary Economics*, *48*(2), 339–372.

Koźluk, T., & Mehrotra, A. (2009). The impact of Chinese monetary policy shocks: Evidence from VAR's. *Journal of Monetary Economics*, *48*, 339–372.

Lippi, F., & Nobili, A. (2012). Oil and the macroeconomy: A quantitative structural analysis. *Journal of the European Economic Association*, *10*(5), 1059–1083. https://doi.org/10.1111/j.1542-4774.2012.01079.x

Lutkepohl, H. (1993). *Introduction to multiple time series analysis* (2nd ed.). Berlin: Springer-Verlag. https://doi.org/10.1007/978-3-642-61695-2

Maćkowiak, B. (2006). What does the bank of Japan do to East Asia? *Journal of International Economics*, *70*(1), 253–270. https://doi.org/10.1016/j.jinteco.2005.10.001

Maćkowiak, B. (2007). External shocks, U.S monetary policy and macroeconomics fluctuations in emerging markets. *Journal of Monetary Economics*, *54*(8), 2512–2520. https://doi.org/10.1016/j.jmoneco.2007.06.021

Mountford, A., & Uhlig, H. (2009). What are the effects of fiscal policy shocks? *Journal of Applied Econometrics*, *24*(6), 960–992. https://doi.org/10.1002/jae.1079

Othman, N., Yusop Z., Zaidi M. A. S., & Karim, Z. A. (2015). Impact of external and domestic shocks on Malaysia's electronic and electrical (E & E) export demand. *International Journal of Economics and Management*, *9*(S), 1–20.

Peersman, G., & Straub, R. (2009). Technology shocks and robust sign restrictions in a euro area SVAR. *International Economic Review*, *50*(3), 727–750. https://doi.org/10.1111/j.1468-2354.2009.00546.x

Schwarz, G. (1978). Estimating the dimension of a model. *Annals of Statistics*, *6*(2), 461–464. https://doi.org/10.1214/aos/1176344136

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*(2), 381–419. https://doi.org/10.1016/j.jmoneco.2004.05.007

Zaidi, M. A. S., Karim Z. A., & Azman-Saini, W. N. W. (2013). Foreign and domestic shocks: Macroeconomic responses of ASEAN-3 countries. *Global Economic Review: Perspectives on East Asian Economies and Industries*, *42*(3), 215–237. https://doi.org/10.1080/1226508X.2013.835900

Zaidi, M. A. S., & Karim, Z. A. (2014). Impact of Singapore, US and Japanese macroeconomics shocks on Malaysian economy: A sign-restricted SVAR analysis. *Jurnal Pengurusan*, *41*, 113–122. https://doi.org/10.17576/pengurusan-2014-41-10

Zaidi. M. A. S., & Fisher, L. A. (2010). Monetary policy and foreign shocks: An SVAR analysis for Malaysia. *Korea and the World Economy*, *11*(3), 527–550.

Zha, T. (1999). Block recursion and structural autoregressions. *Journal of Econometrics*, *90*(2), 291–316.

APPENDIX A

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.