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Response of Malaysia's Palm Oil Export to Domestic and Foreign Macroeconomic Shocks

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ABSTRACT

Palm oil industry contributes significantly to Malaysia's economic growth. The sustainability of palm oil industry depends on how well the Malaysian economy adapts to ever-changing world demand. Nevertheless, as a small open economy, Malaysia is susceptible to macroeconomic shocks coming from external as well as internal sources. Palm oil export fluctuates considerably to reflect market demand and supply which are vulnerable to adverse macroeconomic shocks. This paper investigates macroeconomic effects of domestic and foreign shocks on Malaysia's palm oil export. Specifically, the study attempts to identify relative importance of domestic and foreign shocks on palm oil export. In addition, the study assesses which trading partner countries have relatively more important effects on Malaysia's palm-oil export. The results indicates that palm oil export is more susceptible to the foreign shocks than the domestic shocks. Furthermore, output shock in Singapore and inflation shock in US bring about relatively significant negative impact on the Malaysia's palm oil export to those countries. In addition, effect of Renminbi-Ringgit exchange rate shock is also vital in influencing the export of palm oil to China. The findings shed some light to policymakers in planning and ensuring the good health of the palm oil industry.

Keywords: Palm oil Export, Foreign Shocks, SVAR.

INTRODUCTION

Malaysia's palm oil industry is one of the important players for world food market and a rising player for renewable energy market. The development of the industry stimulated by its intensive research and developments provide opportunities for other economic sectors to grow hand in hand. Sustaining the growth of the industry is vital for overall economic growth, yet it faces some concern. As a major exporter of palm oil to the world, Malaysia is exposed to economic fluctuations caused by changes in domestic factors as well as external ones. As Malaysia is vulnerable to adverse internal and external economic shocks, the palm oil industry also faces similar threat. Thus to mitigate the adverse effects, knowledge about the consequence of the shocks and the anticipation of the occurrence might be advantageous to policy makers.

Figure 1 shows the value of export of palm oil to largest trading partners of Malaysia, namely China, US, Japan and Singapore.[1] As can be seen, China is the largest importer of palm oil among the largest trading partners of Malaysia. There are significant ups and downs and the most glaring one is during the global economic crisis of 2008/2009. Similar trends are observed for Malaysia export to US, Japan and Singapore. This indicates, among others, the significant effect of global economic shocks to Malaysia's palm oil industry.

Consequently, this paper examines macroeconomic effects of domestic and foreign shocks on the Malaysia's palm oil export. Specifically, this study attempts to investigate relative importance of domestic and foreign shocks on palm oil export as well as to determine which trading partner country has relatively more dominant role in affecting the palm oil export.

The study contributes to existing literature in two aspects. First, it enlightens the role of domestic and foreign macroeconomic variables in influencing the palm oil export. In achieving this objective, several SVAR models will be developed. Previous studies using structural models do not look into this area specifically. Second, using impulses response and variance decomposition analysis, the study is able to determine relative importance of major trading partner countries in influencing the palm oil export. As China, Singapore, USA and Japan have consistently been Malaysia's major trading partner countries; economic shocks that occur in those countries would undeniably affect the Malaysia's palm oil export differently.

This paper is organized in five sections. Section two presents related literature on macroeconomic modelling of Malaysia palm oil industry. Third section briefly discusses method and the selection of data while section four present empirical results. Finally, the last section concludes.

LITERATURE REVIEW

Past studies related to palm oil as food and energy products and as an industry are numerous. In general, previous studies can be divided into two categories namely scientific studies and social science studies. Recent scientific studies focus more on palm oil product and by-product itself especially with regards to palm oil as source of renewal energy. Studies by Abdullah (2009), Lam et al. (2009), Foo et al. (2011), M.H.M. Ashnani et al. (2014) are some of the examples.

In term of social science studies, especially in macroeconomic field, there have been quite a number of studies in modelling palm oil market. These include studies by Yusoff (1988), A. Talib and Darawi (2002), A. Talib et al. (2007). These studies look at factors affecting the palm oil market, using structural equations. In term of palm oil export, the studies are unable to specifically explain factors that affect the export industry.

There are studies which look at relative importance of domestic and foreign shocks on economic variables of a country. Focusing on Malaysian economy, some studies are particularly of interest. These include studies by Zaidi et al. (2013) and Zaidi and A. Karim (2014). Zaidi et al. (2013) looks at the relative importance of domestic and foreign shocks on three selected Asean (Malaysia, Thailand and Indonesia) macroeconomic variables. The study finds that foreign factors especially the Japanese factors are more dominant in affecting most of the countries under studied. This study however, does not include export variable. Further study by Zaidi and A. Karim (2014) includes Singapore effect in the structural vector autoregressive (SVAR) modelling of the Malaysia's economy. The study finds the importance of Singapore effect. Similarly, no export variable is particularly examined.

Thus, this paper contributes to existing literature by including the palm oil export variable in the SVAR system to analyse its response to other macroeconomic variables' shocks. The findings would help policymakers formulate actions as to mitigate any adverse effects facing by the palm oil industry.

METHODOLOGICAL FRAMEWORK

This section describes the estimation procedures and the variables used in the SVAR models. Basically, there are five models to be estimated. For each model, the variables are divided into two blocks; the foreign and domestic blocks. The foreign block consists of real commodity prices, real foreign output

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[1] The countries are selected based on the four largest trading partners of Malaysia. In term of palm oil export, other countries such as India, Pakistan and Netherlands are among the largest importing countries of palm oil from Malaysia.

and inflation rate. Meanwhile, the domestic block comprises real output, inflation, palm oil export and the real exchange rate. Except for Singapore model, the foreign block in the other models is assumed to be block-exogenous to Malaysian macroeconomic variables; see Cushman and Zha (1997) and Zha (1999). In other words, there are no contemporaneous or lagged effects from the domestic variables to the foreign variables.

The first model takes into account the trade weighted variables of the US, Japanese, Singapore and China variables as representing the foreign sector. Those four countries are the four largest trading partners of Malaysia. The other five models use the US, Japanese, Singapore and China 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.

Commodity prices (LCP) are included in the model as it may serve as a proxy for inflationary expectations to policy-makers (see Sims, 1992; Christiano et al., 1996). In addition, they are relevant as Malaysia is also a commodity exporting country. Kim and Roubini (2000) use oil prices rather than commodity prices in their SVAR analysis of the non-US G7 countries. The study opts not to use this indicator for Malaysia as Malaysia is also an oil producer and the oil price in the domestic market is heavily regulated.[2]

As in the first model, the real foreign aggregate output is a trade-weighted real industrial production index (IPI) of the US, Japan, Singapore and China. It is short formed as LTWFY. The other four models use real IPI of US (LUSY), real IPI of Japan (LJY), real IPI of Singapore (LSY) and real IPI of China (LCY) respectively to represent foreign output. For foreign inflation rate, a similar trade-weighted approach is employed for the first model. This is short formed as TWINF. All other Inflation variables are calculated as month-on-month change in consumer price index (CPI). The foreign inflation for the other models are short formed as USINF (US inflation), JINF (Japanese inflation), SINF (Singapore's inflation) and CINF (China's inflation).

For the internal block, the first two variables are real output or IPI (LMY) and inflation (MINF) of Malaysia. As for palm oil export, export to the world (LXPOW), export to US (LXPOUS), export to Japan (LXPOJ), export to Singapore (LXPOS) and export to China (LXPOC) are used for each model respectively. These variables would indicate the responses of Malaysia's palm oil export to that particular trading partner country when there are shocks occurred in that country. Lastly the real effective exchange rate (LREER) is used for the first model while the bilateral exchange rates of Malaysia and its trading partner are employed for the other models (i.e. LRUSDRM, LRYENRM, LRSDRM and LRRENRM for bilateral exchange rates of Malaysia with US, of Malaysia with Japan, of Malaysia with Singapore and of Malaysia with China respectively). An increase in the real exchange rate means an appreciation of domestic currency (Ringgit Malaysia).

All variables are transformed into natural logs except for foreign and domestic inflation.[3] Data are taken from International Financial Statistics database and various publications of Monthly Bulletin of Bank Negara Malaysia (BNM). The sample period runs from 2004:1 until 2012:5, covering one global economic crisis of 2008/2009. Thus to capture the effect of the global economic recession, one dummy is used, DGC. DGC is set to equal to one from 2008:9 to 2009:12 and zero otherwise.

The variables used in the study, with the possible exception of inflation, are potentially non-stationary due to the presence of either deterministic or stochastic trends. This raises an issue as to whether the SVAR model should be specified in first-differences or in levels. There are 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 (Ramaswamy and Slok, 1998). It is recommended 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 plausible not to impose cointegration restrictions on the VAR model. Following this, the SVAR models are specified in levels.

The SVAR model

This study utilizes SVAR method to examine the relative effect of domestic and foreign shocks on palm oil export. Specifically, the effects of output and inflation shocks from domestic and trading partner economies on the palm-oil exports are examined using impulse response functions derived from the SVAR estimation.

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[2] Recently the Malaysian government has reduced the oil price subsidy, thus making the domestic oil price more closely related to the world oil price.
[3] All unadjusted data at source are seasonally adjusted using X11 command.

The following structural equation shows dynamic relationship for selected economic variables in an economy;

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

where B is a square matrix that captures the structural contemporaneous relationships among the economic variables, Y_t is n x 1 vector of selected variables. C is a vector of deterministic variables while $\Gamma(L)$ is a k^th order matrix polynomial in lag operator, L. Structural innovations are represented by ε_t vector 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.

Equation [1] cannot be estimated directly as the error terms in one equation have correlation with other endogenous variables. By pre-multiplying equation [1] with B^{-1}, a following reduced form VAR equation is yielded.

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

where $e_t = B^{-1}\varepsilon_t$ is a reduced form VAR residual that satisfies the conditions that $E(e_t) = 0$, $E(e_t e_s^{'}) = \Sigma_e . \Sigma_e$ is a (nxn) symmetric, positive definite matrix which can be estimated from the data.

The variance-covariance matrix of the estimated residuals, Σ_e and the variance-covariance matrix of the structural innovations, Σ_ε are related and shown by equation [3]

$$\begin{aligned} \Sigma_\varepsilon &= E(\varepsilon_t \varepsilon_t^{'}) \\ &= E(Be_t e_t^{'} B^{'}) = BE(e_t e_t^{'})B^{'} \\ &= B\Sigma_e B' \end{aligned} \quad [3]$$

To recover all parameters in structural equation, sufficient restrictions need to be imposed. Consequently, for (nxn) symmetric matrix of 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 shown by $Be_t = \varepsilon_t$. Equation [4] indicates the set of restrictions that are imposed on the contemporaneous parameters of the SVAR model. The coefficient β_{ij} indicates the contemporaneous response of variable i to shock to variable j. The coefficients on the diagonal are normalized to unity. The identification structure is almost recursive. In fact, if the export variable is put at the last order, the structure is recursive. β_{76} is restricted to zero as it is assumed that palm oil export, which is only part of Malaysia's total export, would not have immediate impact on the exchange rate.

$$BY_t \equiv \begin{bmatrix} 1 & 0 & 0 & 0 & 0 & 0 & 0 \\ \beta_{21} & 1 & 0 & 0 & 0 & 0 & 0 \\ \beta_{31} & \beta_{32} & 1 & 0 & 0 & 0 & 0 \\ \beta_{41} & \beta_{42} & \beta_{43} & 1 & 0 & 0 & 0 \\ \beta_{51} & \beta_{52} & \beta_{53} & \beta_{54} & 1 & 0 & 0 \\ \beta_{61} & \beta_{62} & \beta_{63} & \beta_{64} & \beta_{65} & 1 & \beta_{67} \\ \beta_{71} & \beta_{72} & \beta_{73} & \beta_{74} & \beta_{75} & 0 & 1 \end{bmatrix} \begin{Vmatrix} LCP_t \\ LFY \\ FINF_t \\ LMY_t \\ INF_t \\ LXPO \\ LER \end{Vmatrix} \quad [4]$$

Akaike's (1973) Information Criterion (AIC) and Schwarz (1978) Bayesian Criterion (SBC) are employed to choose an appropriate lag length for the VAR model. 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 palm oil export) to an exogenous shock (e.g. foreign output shock). Furthermore the variance decompositions are utilized to indicate the percentage of a variable's forecast error variance attributable to innovations in each of the variables contained in the system

RESULTS

This section discusses the choice of lag length, model stabiblity for the SVAR models, the impulse response function and the variance decomposition of the selected SVAR models. The estimated coefficients of the structural model are not reported but are available upon request.

Table 1 shows the results of lag length tests while Table 2 reports the results of the model stability tests. As can be seen from Table 1, both AIC and SBC tends to select one lag. Thus the study chooses lag one as the optimal lag. Using lag two make the first model unstable as indicated by the eigenvalues (not shown). Table 2 reports the absolute value of the eigenvalues of the VAR companion matrix. Since the figures are all less then unity, this provides some evidence that the estimated VAR(1) model is stationary.

Figure 1 and Figure 2 depict impulse responses of palm oil exports to particular trading partner country to one-standard deviation shocks in foreign and domestic variables respectively. As indicated at the top figure of figure 1, a positive shock to commodity prices bring about positive responses to palm oil export to every trading partners. Even though palm oil export to Japan responds sluggishly in the beginning, it reaches the peak after about four months. Shocks to particular foreign outputs and inflation induce mixed responses of palm oil exports. It is interesting to find that export to Singapore fall quite considerably to a shock to Singapore output within one month. Similar pattern can be seen on export to US where it responds negatively to shock to the US inflation. This indicates that output shock in Singapore and inflation shock in US are relatively more influential than the output and inflation shocks in other trading partner countries.

As shown in Figure 2, most of the responses show similar patterns except the responses of palm oil export to China. A shock to Malaysian inflation has negative effect on palm oil export to China. The negative effect, nevertheless, ends after one month. On the other hand, a shock to the exchange rate has much bigger impact on the export of palm oil to China. In other words, a positive shock or an appreciation of Ringgit Malaysia against Renminbi leads to negative response of Malaysia's export to China for several months. These effects show that export to China is more susceptible than the exports of palm oil to other trading partner countries to shock to domestic inflation and exchange rates.

Table 3 reports two years variance decomposition of Malaysia's export of palm oil to each trading partner country. The last two column indicate the relative importance of foreign and domestic factors influencing palm oil export. Specifically, the column labeled FF indicates the sum of the proportions of forecast error variance of the palm oil export explained by the three foreign variables (i.e. LCP, LTWFY/LUSY/LJY/LSY/LCY and TWFINF/USINF/JINF/SINF/CINF). On the other hand, the column named DF shows the sum of the proportion of forecast error variance of the palm oil export explained by all the (other) domestic variables. Thus, when evaluating the variance decomposition of Malaysia's export to US, (LXPOUS), DF would refer to the sum of the proportion of forecast error variance explained by LMY, INFM, and LRUSDRM.

As indicated by Table 3, the forecast error variance of the palm oil export in the first month is explained largely by its own shocks. As the horizon expands, foreign factors especially the commodity prices are dominant in explaining the palm oil shock. It is interesting to note that for the first one month for the palm oil export to Singapore and for the first four month for the palm oil export to China, domestic factor has bigger impact. In fact the bilateral exchange rate between Renminbi China and Ringgit Malaysia explain more of the forecast error variance of the palm oil export for the first four months. This result supports the finding of the relatively significant response of export of palm oil to the Renminbi-Ringgit shock shown earlier.

CONCLUSION

This paper examines the relative importance of domestic and foreign macroeconomic shocks in affecting Malaysia's palm oil export to its trading partners. The results indicate that foreign factors are more dominant than the domestic ones in affecting palm oil exports. The study is also able to identify which trading partner country is more influential in effecting palm oil export. It shows that output shock in Singapore and inflation shock in US can bring about significant change in the Malaysia's export of palm oil to those countries. In comparison with other bilateral exchange rate shocks, Renminbi-Ringgit shock has bigger and detrimental impact on the palm oil export to China.

The results implies that in mitigating the negative impact of macroeconomic shocks on palm oil industry especially in the export sector, policymakers are encouraged to identify specifically the macroeconomic shocks and their origin. Mere visual inspection on the data would not help them formulating practical policy. The palm oil industry is very important for Malaysia as it contributes significantly to economic growth. Sustaining the industry has become a must for Malaysia. This is especially important when the nation has bigger objective of achieving high income economy in the near future.

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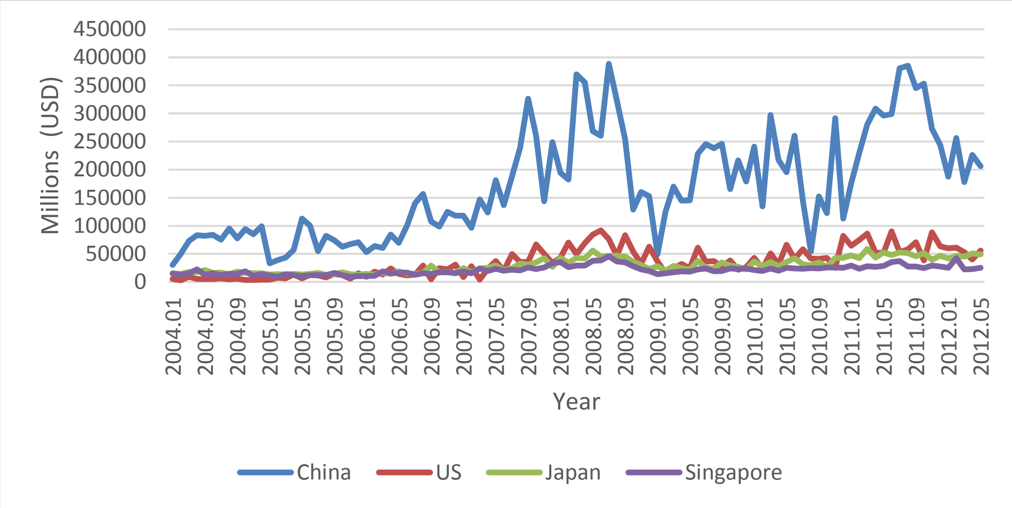

FIGURE 1: Export value of Malaysia's palm oil to China, US, Japan and Singapore

TABLE 1: Results of Lag Length Tests

Lag	Trade weighted model	US model	Japan model	Singapore model	China model
			AIC		
8	-3648.76	-3648.58	-3469.13	-3660.74	-3708.42
7	-3684.07	-3659.39	-3512.04	-3636.37	-3750.59
6	-3726.04	-3651.44	-3524.42	-3621.09	-3743.8
5	-3750.81	-3675.71	-3567.22	-3566.77	-3745.41
4	-3764.38	-3687.68	-3557.37	-3572.71	-3737.63
3	-3821.1	-3740.15	-3603.25	-3608.05	-3778.71
2	-3832.26	-3791.91	-3643.56	**-3618.32**	-3824.88
1	**-3835.69**	**-3797.6**	**-3673.23**	-3598.66	**-3835.29**
			SBC		
8	-2826.66	-2826.48	-2647.03	-2838.64	-2886.32
7	-2957.22	-2932.53	-2785.19	-2909.52	-3023.73
6	-3095.31	-3020.7	-2893.69	-2990.35	-3113.07
5	-3217.05	-3141.95	-3033.46	-3033.01	-3211.65
4	-3328.44	-3251.74	-3121.43	-3136.77	-3301.7
3	-3483.82	-3402.87	-3265.96	-3270.76	-3441.42
2	-3594.45	-3554.09	-3405.74	-3380.50	-3587.06
1	**-3698.15**	**-3660.05**	**-3535.69**	**-3461.12**	**-3697.75**

TABLE 2: Results of Model Stability Tests

Models	The Eigenvalues of the VAR Companion Matrix						
Trade Weighted	0.99389	0.8806	0.8806	0.73483	0.49973	-0.29141	0.12663
US	0.98263	0.90356	0.58405	0.58405	0.42754	0.1603	-0.12647
Japan	0.98123	0.89739	0.83094	0.47273	0.47273	-0.25855	0.06091
Singapore	0.98266	0.93077	0.63441	0.37529	0.37529	0.28956	-0.2777
China	0.99835	0.90045	0.65842	0.57177	-0.24936	0.19033	0.19033

Notes: For each model, the absolute values of all the figures are less than one. Thus the models are stable.

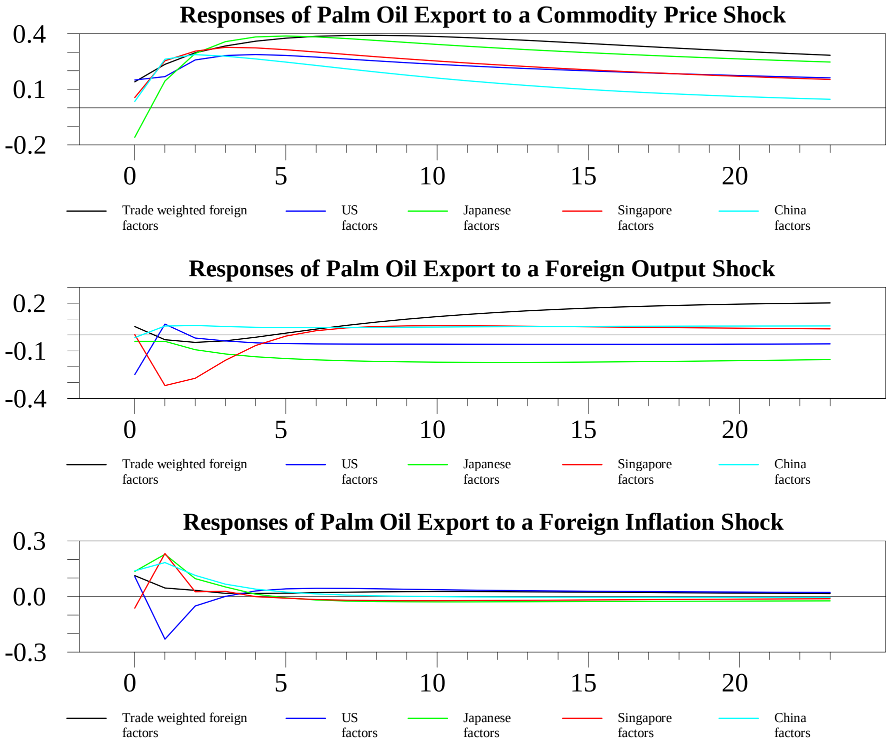

FIGURE 1: Relative Response of Palm Oil Export to Foreign Shocks

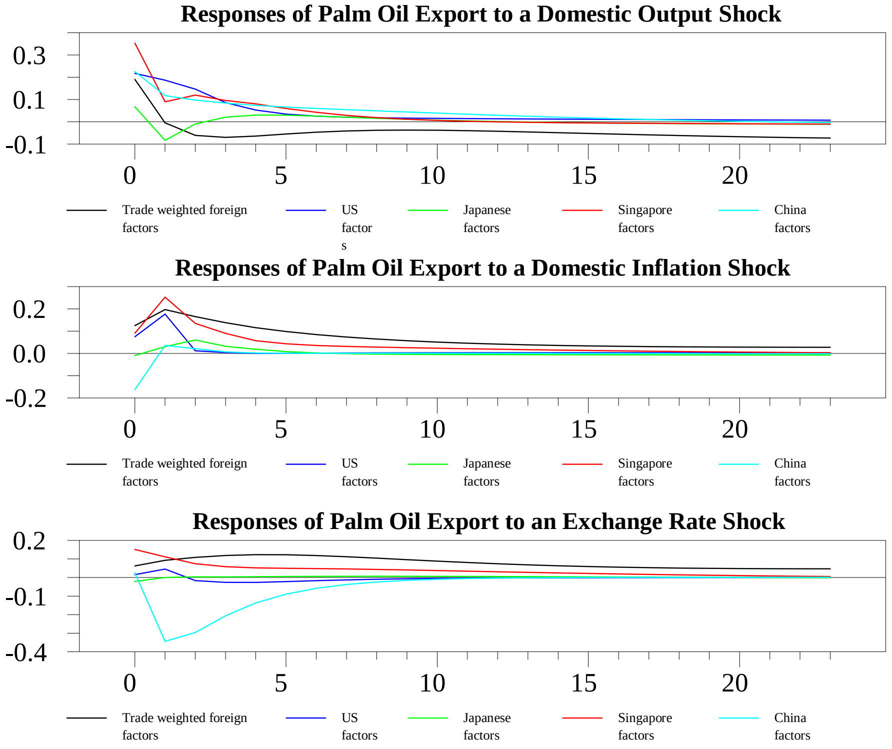

FIGURE 2: Relative Response of Palm Oil Export to Domestic Shocks

TABLE 3: Variance Decompositions of Palm oil Export to Trading Partner Countries

Decomposition of Variance for Series LXPOW

Step	Std Error	LCP	LTWFY	TWFINF	LMY	MINF	LXPOW	LREER	FF	DF
1	0.11	1.98	0.28	1.27	3.64	1.55	90.88	0.39	3.54	**5.58**
4	0.17	11.66	0.31	0.69	1.91	4.26	79.55	1.63	**12.65**	7.80
8	0.20	25.61	0.38	0.53	1.69	4.11	64.79	2.89	**26.52**	8.69
12	0.22	35.48	1.45	0.50	1.52	3.64	54.20	3.20	**37.44**	8.36
16	0.24	41.35	3.31	0.48	1.49	3.24	47.00	3.12	**45.14**	7.86
20	0.25	44.61	5.45	0.46	1.59	2.94	41.96	2.98	**50.53**	7.51
24	0.27	46.33	7.61	0.43	1.78	2.72	38.27	2.85	**54.37**	7.35

Decomposition of Variance for Series LXPOUS

Step	Std Error	LCP	LUSY	USINF	LMY	MINF	LXPOUS	LRUSDRM	FF	DF
1	0.40	2.26	6.23	1.16	4.72	0.56	85.04	0.02	**9.66**	5.30
4	0.47	14.36	4.99	4.90	8.05	2.68	64.77	0.24	**24.25**	10.98
8	0.53	29.54	4.72	4.32	6.78	2.16	52.19	0.29	**38.58**	9.23
12	0.57	37.50	4.80	4.06	5.97	1.89	45.52	0.26	**46.36**	8.11
16	0.59	42.27	5.00	3.87	5.46	1.72	41.44	0.24	**51.14**	7.42
20	0.61	45.43	5.26	3.73	5.11	1.60	38.65	0.22	**54.42**	6.94
24	0.63	47.68	5.52	3.62	4.85	1.52	36.61	0.21	**56.81**	6.58

Decomposition of Variance for Series LXPOJ

Step	Std Error	LCP	LJY	JINF	LMY	MINF	LXPOJ	LRYENRM	FF	DF
1	0.16	2.52	0.16	1.83	0.46	0.01	94.97	0.05	**4.52**	0.52
4	0.20	16.30	1.65	5.15	0.76	0.35	75.76	0.03	**23.10**	1.14
8	0.24	37.03	5.19	3.66	0.66	0.26	53.17	0.03	**45.88**	0.95
12	0.27	46.08	8.12	3.00	0.53	0.21	42.03	0.03	**57.19**	0.78
16	0.29	50.55	10.39	2.64	0.46	0.18	35.75	0.03	**63.59**	0.67
20	0.31	53.10	12.14	2.42	0.41	0.17	31.73	0.02	**67.66**	0.60
24	0.32	54.72	13.49	2.26	0.38	0.16	28.97	0.02	**70.47**	0.57

Decomposition of Variance for Series LXPOS

Step	Std Error	LCP	LSY	SINF	LMY	MINF	LXPOS	LRSDRM	FF	DF
1	0.14	0.31	0.00	0.39	12.51	0.82	83.69	2.28	0.70	**15.62**
4	0.19	14.62	11.02	3.23	8.57	5.35	54.81	2.41	**28.87**	16.33
8	0.21	28.69	9.30	2.66	7.56	4.69	44.71	2.39	**40.65**	14.64
12	0.23	35.92	8.73	2.43	6.71	4.25	39.60	2.35	**47.09**	13.30
16	0.24	40.14	8.50	2.31	6.20	3.96	36.62	2.28	**50.95**	12.43
20	0.24	42.86	8.36	2.22	5.88	3.77	34.72	2.19	**53.44**	11.84
24	0.25	44.73	8.26	2.16	5.67	3.63	33.43	2.12	**55.16**	11.42

Decomposition of Variance for Series LXPOC

Step	Std Error	LCP	LCY	CINF	LMY	MINF	LXPOC	LRRENRM	FF	DF
1	0.26	0.12	0.03	1.92	5.11	2.65	90.11	0.07	2.07	**7.82**
4	0.33	14.19	0.61	4.33	5.02	1.74	58.78	15.33	19.13	**22.09**
8	0.36	23.96	0.98	3.80	5.12	1.48	49.99	14.67	**28.74**	21.27
12	0.37	28.06	1.39	3.55	5.13	1.38	46.73	13.76	**33.00**	20.27
16	0.38	29.71	1.89	3.44	5.07	1.34	45.23	13.32	**35.04**	19.73
20	0.38	30.35	2.42	3.38	5.00	1.32	44.44	13.09	**36.16**	19.40
24	0.38	30.54	2.99	3.35	4.94	1.30	43.94	12.94	**36.88**	19.18