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Trade Balance, Foreign Exchange and Macroeconomic Impacts: An Empirical Assessment for China and Malaysia

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Abstract

China appears as the biggest trading partner for ASEAN economy but it is inconclusive whether the complementarities between China and regional economies offset China's competitive threat. We assess if real exchange fluctuations and the demand-supply channels determine the Malaysia-China trade balances in the global crises era, 1997-2010. The findings reveal that despite the long run effect of real exchange on trade balances, the Keynesian demand channel was not uphold during and after the global financial crisis – due to the contractionary effect on Malaysian output. Currency devaluation for exports gains is insufficient to sustain Malaysia output expansion against China. Further productivity growth in real and tradable sectors is essentially needed. Meanwhile, the Chinese inflation impact is not evident following the foreign exchange shock and, the study generally supports the complementary role of China in the Malaysia-China bilateral trading.

Keywords: Trade Balances, Contractionary effect, global crises, bootstrapping, VARX, VECMX

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1. Introduction

China has become the largest trading partner for many of the East Asian nations in the aftermath of Asian financial crisis 1997/98. For Southeast Nations (ASEAN-10), China accounted for 12.9% of the regional trade, surpassing the US (8.1%) and Japan (10.6%) in 2012. The figure was only about 2.2% and 1.9% respectively for total exports and imports of ASEAN-China, a decade ago ([ASEAN Statistical Yearbook](#)). A number of recent studies have thus documented the complementary effects of China for its trading neighbors in line with the improved economic link (e.g. [Cheong, 2000](#); [Hai, 2000](#); [Ahearne, *et al.*, 2003](#); [Wang, 2005](#); [Chan & Hooy, 2012](#)). Multinational corporations are incorporating China into the global production system along with earlier entrants and hence promoting regional trading ([Lall, 2004](#)). China's own enterprises are specializing, in coordination with regional counterparts, and so raising intra-industry trade in differentiated products. In other words, the emergence of China as a global economic power has resulted in an increase of labor diversification and intra-regional trading, which, in the long run, may lead to regional economic integration similar to the European Union or the North American Free Trade Agreement ([Chan, *et al.*, 2003](#); [Chan and Baharumshah, 2013](#)).

Yet, others have also pointed out the conflicting (competing) features of China's economic rise. China appeared as the world's leading exporter since 2007, and its current account surplus amounted to about \$260 billion ([Ministry of Commerce, China](#))¹, which ranked top globally in 2013. There are worries that China's yuan regime, investment magnetism, and low labor costs, as well as its accession to the World Trade Organization (November 2001), may have positioned the country as a formidable economic competitor that threatens to crowd out other developing Asian countries ([Lall, 2004](#); [Lall & Albaladejo, 2004](#); [Zhang & Wan, 2007](#); [Greenaway, *et al.*, 2008](#)). Malaysia, for instance, has suffered a continuous seven-year trade deficit with China since 2002 - which peaked at \$4.2 billion in 2007, before the major correction in 2009. Some observers have also, directly or indirectly, related the resurgence of China since the late-1980s and the devaluation of the renminbi (or, Chinese yuan) in 1994 to the Asia financial crisis² (e.g. [Makin, 1997](#); [Corsetti, *et al.*, 1999](#)). Such issues have gravely challenged the consensus of sustainable trade competitiveness at the

¹ Available at <http://english.mofcom.gov.cn/article/statistic/BriefStatistics/201401/20140100466521.shtml>

² The fall of the renminbi implied a real exchange rate appreciation for the dollar-pegged currencies in East Asia, which their fragile financial systems were unable to absorb. Some of them were thrown into prolonged current account deficits and forced to devalue their currencies in order to regain their export market share, which eventually led to the Asia financial crisis in 1997.

regional level. Until today, no conclusive consensus has been reached concerning the economic emergence of China. It is still difficult to assess whether the complementarities between China and regional economies offsets its competitive threat ([Lall, 2004](#); [Arroba et al., 2007](#); [Chen & Yang, 2013](#); [Chan et al., 2014](#)).

This study focuses on the Malaysia-China case to assess if the real exchange fluctuations as well as the demand and supply channels determine the performance of bilateral trade balances in the global crises era, 1997-2010. Among the ASEAN-10 members, Malaysia is presently the largest trading partner with China. In 2009, the Malaysia-China trade reached \$59 billion—about 18.9% of Malaysia's global trading, surpassing the Malaysia-US trade share (10.9%). The figure for Malaysia-China trade was only \$4.7 billion in 1990 or about 8% of Malaysian total trade.

To our best knowledge, previous studies have worked on the Malaysian or the Chinese case but not for Malaysia vis-a-vis China after the major adjustment of yuan and ringgit in July 2005. Likewise, no updated studies has assessed the period of post-subprime crisis³. Yet, it was well-noted in the literature that time period of the study being selected would have resulted in dissimilar results. Malaysia, for instance, has practiced various exchange rate regimes in the past four decades – the Bretton Woods system, managed floating, free floating, and basket of currency-floating eras. Different regimes have reflected varied policy responses, and the empirical results could be irreconcilable with the theoretical prediction, over time. As for China, the open policy started in 1978, but the progress of trade and exchange rate liberalization was slow prior to the 1990s. Both nations, however, share similar exchange rate regime since 1998. Though claimed as managed float by the Chinese authority, Chinese yuan was de facto pegged to the USD at RMB8.28 from 1998 through June 2005 ([Yongjian, et al., 2009](#)). Malaysia, on the other hand, was officially pegged to US\$ at RM3.80 in similar period. By July 2005, Chinese yuan was appreciated against the US\$ while Malaysian ringgit de-pegged from the US\$. Our study thus considers only 1997 to 2010 — a period of economic liberalization and trade expansion for both China and

³ For example, [Baharumshah \(2001\)](#) studied cases of Malaysia-US-Japan and Thailand-US-Japan for the period of 1980Q1-1996Q4; [Ahmad and Yang \(2004\)](#) studied China against G7 during 1974-1994; [Bahmani-Oskooee and Harvey \(2006, 2010\)](#) studied Malaysia vis-à-vis 14 trading partners for 1983Q1-2002Q1 and 1973Q1-2001Q3 respectively; [Bahmani-Oskooee and Wang \(2006\)](#) then studied China and 13 major trading partners during 1983-2002, but without Malaysia.

Malaysia, where potential structural breaks due to global and regional crises are taken into accounts.

The study contributes to the extant literature by taking concerns of several distinguished empirical issues. First, instead of measuring the trades balance as a function of the real exchange rate, domestic income and foreign income in the conventional way, we also incorporate domestic and foreign prices in our empirical model. The consideration emphasizes on the China's role in the supply and value chain of Malaysian economics and the assessment of potential imported inflation effect (or, deflation), which is of important issue to stabilize domestic economy.

Second, Malaysia is a small and open economy, with the exchange rate regime playing an important role in economic development. When compared to the Chinese population of 1.35 billion people with GDP (at PPP) amounted to US\$11,347 billion, the Malaysian market size is relatively small, with only 28 million residents and GDP (at PPP) of US\$464 billion. Though Malaysian trade openness is now among the highest in the world (about 200% of its GDP), its total trade volume is relatively still small. It is necessary, in the methodological sense, to develop an econometric model that allows the possibility of drawing a distinction between endogenous and exogenous variables, which are integrated of $I(1)$. This paper employs the VARX and VECMX modeling procedures put advanced by [Pesaran *et al.* \(2000\)](#) – which further applied in [Garratt *et al.* \(2003, 2006\)](#) and [Assenmacher-Wesche & Pesaran \(2009\)](#), to construct a cointegrating VARX in the presence of $I(1)$ exogenous or long-run forcing variables (which, in our case, the Chinese variables). A reduced-form error correction of the VECMX model can then be estimated, where variables are separated into the conditional model and marginal model, respectively. This approach allows us to impose long-run relationships and short-run dynamic restrictions based on economic theory.

In addition, the compilation and analysis of macroeconomic data of both nations by previous studies are also limited by the unavailability of higher frequency series – monthly data. We therefore focus on the post-liberalization period ([January 1997 to March 2010](#)) where both Malaysian and Chinese series are more valid and reliable. We reconstruct the series that sourced from Datastream, in consider of the seasonal and based-year effects. Our data are also cross-checked with the GVAR database provided by [Smith and Galesi \(2011\)](#).

Then we conduct a preliminary test of endogenous break(s)⁴ on each series and impose the break dates as dummy variables in the VARX and VECMX models.

What follows involves the estimation issue for small sample size, particularly, in regard to the size and power properties of time series analysis. Though with 159 monthly observations, our study only covers a 13-year length of time. Given this, we employ the nonparametric bootstrap method, an alternative to the large sample data tests based on asymptotic theory. It was well noted in the literature that bootstrap's ability to provide asymptotic refinements often leads to a reduction of size distortions in finite sample bias and it generally yields consistent estimators and test statistics ([Mantolos & Shukur, 1998](#); [Chang, Park and Song, 2006](#)). This method is later applied to test the number of VARX cointegrating ranks and to test the significance of log-likelihood ratio (LR) statistics of the over-identifying long-run restrictions. This method is also applied in the measures of estimation uncertainty and confidence intervals for generalized IRF and Persistent Profile.

Our study reveals that, despite the long run effect of real exchange on trade balances, the Keynesian demand channel was not uphold during and after the Asia financial crisis – due to the contractionary effect on Malaysian output. Though a potential depreciation of the Malaysian ringgit would have resulted in an overall surplus for Malaysia against China, the domestic and foreign income variables are only significant through lagged effects in the short run but not in the long run model, suggesting that the demand side effects are temporal. In other words, ringgit devaluation for exports gains is insufficient to sustain output expansion for Malaysia against China. Further productivity growth in real and tradable sectors is essentially needed. On the other hand, the inflation impact is not evidently observed following the foreign exchange shock, implying that China has yet to be Malaysia's main source of imported inflation. Meanwhile, the dummy of subprime crisis is excluded from the trade balance model as insignificant statistic was reported during the restriction test. Having the empirical facts being considered, our study generally supports the complementary role of China in the Malaysia-China bilateral trading.

To this end, our study is designed in the following manner. Section 2 shows the theoretical representation of the trade-exchange rate-output-price model that forms the basis

⁴ To determine the potential endogenous break(s), we follow the structural break tests of [Lumsdaine & Papell \(1997\)](#) and [Saikkonen & Lütkepohl \(2002\)](#).

of our empirical model. This is followed by the estimation procedures and data description. Estimation results are discussed in section 3. Finally, in section 4, conclusion and policy implications are drawn.

2. Research Methodology

The present study takes as a point of departure the standard trade model, variants of which are employed in the literature by [Shirvani & Wilbratte \(1997\)](#) and [Kandil & Mirzaie \(2005\)](#).

2.1 Trade-Exchange Rate-Output-Price Model

The model expresses the trade balance as a function of the real exchange rate and the levels of domestic and foreign incomes. Taking the natural logarithm of both sides, we have the following model, with a stochastic term added to capture short-term departures from long-run equilibrium:

$$\ln(TB_t) = \alpha_0 + \alpha_1 \ln(Y_t) + \alpha_2 \ln(Y_t^*) + \alpha_3 \ln(Q_t) + \mu_t \quad (1)$$

where \ln represents the natural logarithm, and μ is a white process. Note that expressing the trade balance as the ratio of exports to imports allows all variables to be expressed in log form and obviates the need for an appropriate price index to perform our basic statistical tests. However, given that China plays an important role in the supply chain of Malaysian economics, it is important to include the producer prices of both nations. Such consideration is vital to investigate the potential imported inflation or deflation effect following economic shocks. If the domestic and foreign prices are indeed non-constant and integrated of $I(1)$, the assessment of the price effects is possible. Then, Eq (1) can be represented by

$$\ln(TB_t) = \alpha_0 + \alpha_1 \ln(Y_t) + \alpha_2 \ln(Y_t^*) + \alpha_3 \ln(Q_t) + \alpha_4 \ln(PP_t) + \alpha_5 \ln(PP_t^*) + \mu_t \quad (2)$$

TB is a unit-free measure of the trade balance, which is defined as the ratio of Malaysian exports to imports vis-à-vis China. Q is defined as the real Malaysian Ringgit, while PP and PP^* are the domestic and foreign producer prices respectively. If the Marshall-Lerner condition holds, then $\alpha_3 > 1$ so that a real devaluation of domestic currency (RM) improves the trade balance of Malaysia-China trade. Conventionally, real domestic income will be negatively signed ($\alpha_1 < 0$) as an increase in Malaysian income is expected to increase its

imports of commodity j , and TB deteriorates. Real foreign income is to be positively signed ($\alpha_2 > 0$) because an increase in Chinese income implies more demand for Malaysian exports and hence TB improves. However, if a rise in Malaysian income is due to an increase in the production of substitute goods for j , the estimate of α_1 could be positive. In the same way, the estimate of α_2 could be also positive or negative (Bahmani-Oskooee & Mitra, 2009). In addition, we assume that changes of producer prices are reflected in import and export prices. A rise in the domestic producer price hampers export competitiveness, and so $\alpha_4 < 0$. Then, $\alpha_5 > 0$ because an increase in the foreign producer price will cause imports to be more expensive and reduce the demand for imports.

2.2 The VARX and VECMX estimation

Pesaran *et al.* (2000) modified and generalized the approach to the problem of estimation and hypothesis testing in the context of the augmented vector error correction model. Garratt *et al.* (2003, 2006) extended the idea and developed the VECMX model along the same lines. They distinguish between an $m_y \times 1$ vector of endogenous variables y_t and an $m_x \times 1$ vector of exogenous $I(1)$ variables x_t among the core variables in $z_t = (y_t', x_t')$ with $m = m_y + m_x$. Since our sample period consists of the Asia financial crisis, the dot-com bubble, and the global subprime crisis, structural break(s) are necessarily included in the model. Depending on the number of crisis detected by the break tests of Lumsdaine and Papell (1997) and Saikkonen and Lütkepohl (2002), we impose the shift dummy variable ($D_{crisis,t}$) and the impulse dummy variable ($\Delta D_{crisis,t}$), where $\Delta D_{crisis,t} = D_{crisis,t} - D_{crisis,t-1}$. The former captures the shift in the long-run relations, whereas the latter applies for the short-run dynamic models. The VECMX is then given by

$$\Delta y_t = -\Pi_y z_{t-1} + \Lambda \Delta x_t + \sum_{i=1}^{p-1} \Psi_i z_{t-i} + c_0 + c_1 t + c_2 D_{crisis,t} + v_t \quad (3)$$

$$\Delta x_t = \sum_{i=1}^{p-1} \Gamma_{xi} \Delta z_{t-i} + c_{x0} + u_t \quad (4)$$

where there are r cointegrating relation(s) among the 6×1 vector of variables z_t in the conditional model (3) contains four endogenous (Malaysia) variables, $y_t = \{TB_t, Y_t, Q_t, P_t\}$ and marginal model (4) with two weakly exogenous foreign (China) variables, $x_t = \{Y_t^*, P_t^*\}$. $\Pi_y = \alpha_y \beta'$, α_y is an $(m_y \times r)$ matrix of error correction coefficients and β' is an $(m_y \times r)$ matrix of long-run coefficients and Ψ_i and Λ are the short-run parameters, t is time trend, c_0 is the intercept, and p is the order of VECMX. In the marginal model, Γ_{xi} are the short-run

parameters, and c_{xo} is the intercept. It is assumed that u_t and v_t are serially uncorrelated and normally distributed. Notice that we need to restrict the trend coefficients in equation (3) in order to avoid the quadratic trends and the cumulative effects of $D_{crisis,t}$ in the level solution (Pesaran *et al.*, 2000), as follow:

$$c_1 = \Pi_y d_1, \quad c_2 = \Pi_y d_2 \quad (5)$$

where c_1 and c_2 are an arbitrary $(m_y \times I)$ vector of fixed constants. Note that d_1 and d_2 are unrestricted if Π_y is full rank; in that case $d_1 = \Pi_y^{-1} c_1$ and $d_2 = \Pi_y^{-1} c_2$. However, if Π_y is rank deficient, d_1 and d_2 cannot be fully identified from c_1 and c_2 but can be estimated from the reduced form coefficients. In this case, the reduced form trend coefficients are restricted.

2.3 Data description

The analyses are all based on monthly series, spanning from January 1997 to March 2010. Real exchange rates (Q) are compiled by having the nominal RM/yuan adjusted for relative price changes using consumer price indexes (CPI), whereas trade balance (TB) ratios are computed based on the export/import series. Since monthly observations of GDP are not available, domestic and foreign incomes (Y , Y^*) are proxy by the industrial production index (IPI). The aggregate trade series are sourced from the Direction of Trade Statistics compiled by the International Monetary Fund, whereas the CPI, IPI, producer price indexes, and foreign exchange series are sourced from DataStream. Our data are cross-check with the GVAR database prepared by Smith and Galesi (2011) and research team members (Gang Zhang, Ambrogio Cesa Bianchi, and Alessandro Rebucci) at the Inter-American Development Bank.

3. Empirical discussion

The preliminary examination of the data properties is conducted using the unit root tests by Lumsdaine & Papell (1997) and Saikkonen & Lütkepohl (2002). The data are overwhelmingly integrated of $I(1)$ where unit roots are rejected at first difference. These tests allow for endogenous structural break(s); for most cases, the break dates fall on the Asian financial crisis and subprime crisis periods.⁵ We thereby impose two dummy variables on the trade model.

⁵ Results of unit root tests are not presented here but are available upon request.

3.1 Dynamic long-run relationship and error correction modeling

Before proceeding to the cointegration test of long-run relationship, we first have to determine the lag orders of endogenous and exogenous variable outlined in Eq (3). For this purpose, the Akaike Information Criterion (AIC) and the Schwarz Bayesian Criterion (SBC) are applied to the underlying unrestricted VARX model. SBC has selected the lag orders of 3 for both conditional and marginal models, whereas AIC selected a higher and same order lag for the endogenous (4) and exogenous (3) variables, respectively. According to [Garratt et al. \(2003\)](#) and [Affandi \(2007\)](#), underestimating the lag orders is generally more serious than overestimating them. As such, the subsequent analyses are based on the VARX (4, 3).

Insert Table 1 here

Next, we need to determine the number of cointegrating relations given by $r = \text{rank}(\Pi_y)$, as defined by Eq (3). Following [Pesaran et al. \(2000\)](#), the modified [Johansen-Juselius \(1992\)](#) cointegration test is conducted using trace statistics for a model with weakly exogenous regressors. The test results are reported in [Table 1](#). It appears that the trace statistics suggest the presence of one cointegrating relation ($r = 1$) at 10% significant level, which is in line with the trade theory expectation. In order to exactly identify the long-run relationship, we then impose a normalized restriction to produce the long-run estimate of the Malaysia-China trade model ([Table 2](#)).

Insert Table 2 here

The log-likelihood ratio (LR) statistic for the normalized (exactly identified) restriction is identical to the value reported in the value of maximized log-likelihood function for the cointegration test. However, the dummy for the subprime mortgage crisis is excluded from the model, as insignificant statistics are reported during the restriction test. Then again, we are aware that for domestic coefficients (Y , PPI), the asymptotic standard errors are not statistically significant, suggesting that the income and demand effects presence only for foreign (China) variables. It is therefore reasonable to re-estimate the cointegration relation by imposing the over-identifying restriction on the variables. Yet, LR tests could over-reject in small samples ([Affandi, 2007](#); [Garratt et al., 2006](#)). The bootstrapped critical values based on 1,000 replications of the LR statistic are computed. Using the observed initial values of each variable, the estimated model, and a set of random innovations, an artificial data set is

generated for each of the 1,000 replications under the assumption that the estimated version of the model is the true data-generating process. The bootstrapped critical values for the joint test are reported at 22.9725 (95% confidence level) and 19.5385 (90% confidence level), while the LR statistic of over-identifying restriction is reported as 22.5245 (p-value = 0.001). Hence, the restriction can be rejected, and the macroeconomic variables included in our trade model are in fact the influential factors. The results also suggest that the presence of the Asian financial crisis (but not the subprime crisis) as dummy variable does affect the long-run relationships.

Long-run estimates reported in [Table 2](#) show that the trade balance is significant and responsive to changes in the real exchange rate of RM/yuan. Recall that the Marshall-Lerner condition implies that a real devaluation of domestic currency (RM) will improve the trade balance only if the sum of the price elasticity of demand for exports and imports is greater than unity. Since the $\ln TB$ is defined as the ratio of Malaysian exports to imports vis-à-vis China, the reported coefficient of $\ln Q = 3.0446 > 1$ is sufficiently large to support the Marshall-Lerner condition in the long run. As such, we foresee positive trade gains if the Malaysian ringgit is to depreciate against the Chinese yuan, which was evidently true during the Asia financial crisis. Conversely, if devaluation happens for the Chinese yuan, the conflicting feature may emerge because the bilateral imports and exports are sensitive to changes in RM/yuan, which will be reflected in the export and import prices. The finding is a theoretical prediction but not in line with recent studies that failed to support the trade-exchange rate relationship (e.g., [Rose & Yellen, 1989](#); [Bahmani-Oskooee, et al., 2006](#); among others).

The modeling of VECMX short run dynamics is presented in [Table 3](#) and several points are noteworthy⁶. First of all, the lagged error correction term (ECT_{t-1}) carries its expected negative and significant sign, indicating that the system – once being shocked, will necessarily adjust back to the long run equilibrium. However, the relatively small coefficient (-0.1933) would imply a rather slow speed of adjustment. Second, the negative lagged $\Delta \ln Q_{t-1}$ followed by a significant and positive lagged $\Delta \ln Q_{t-2}$ seems to support for the J-curve in short run, as suggested by [Bahmani-Oskooee and Mitra \(2009\)](#). Third, the dummy for Asia crisis is

⁶ In this paper, our priority is given to the trade balance model. Hence, only the error correction results for trade balance are presented and discussed. However, estimations for other endogenous variables when taken as independent variables (e.g. Y_t , Q_t , P_t) are available upon request from the corresponding author.

significant but other lagged endogenous variables are insignificant. As for the exogenous foreign variables, some weak significant lagged effects are detected for Chinese output and producer price.

Insert Table 3 here

Despite the R^2 reported as 0.46 in [Table 3](#), four additional diagnostic tests are also conducted. For serial correlation, we use the Lagrange Multiplier (LM) test. The error correction model is clean of autocorrelation problems as the null hypothesis of serial correlation in residuals failed to be rejected, in the presence of lagged dependent variable. The insignificant F -statistic is reported at 1.233 (p-value= 0.27) with 12 degrees of freedom. Using the square of the fitted values, the Ramsey Regression Equation Specification Error Test (RESET) then tests for functional misspecification. The model is considered as correctly specified with the F -statistic reported as insignificant (p-value=0.67, d.f. =1). Likewise, the heteroscedasticity test statistic is again insignificant (p-value=0.87). And lastly, the normality test of skewness and kurtosis of residuals also do not pose any problem to the VECMX model, with an insignificant chi-squared statistic reported at 3.475 (p-value=0.18).

A subsequent and important inspection of model stability is to apply the cumulative sum (CUSUM) and cumulative sum of squares (CUSUMSQ) tests to the residuals of the error-correction VECMX model and the long-run VARX coefficient estimates. For the CUSUM test, the recursive residuals are plotted against the break points, while the CUSUMSQ plots the squared recursive residuals against the break points. As a graphical presentation, these two statistics are then plotted within two straight lines, which are bounded by 5% significance level. If any point lay beyond this 5% level, the null hypothesis of stable parameters is rejected or otherwise. Clearly, [Figure 1](#) supports the stability of estimated coefficients for our Malaysia-China trade model as both statistics are within the critical lines.

Insert Figure 1 here

3.2 Shock Responses and Speed of Convergence

A good way of measuring the speed of convergence of the cointegrating relations to equilibrium is to examine the dynamic responses of the endogenous variables to various types of shocks, in particular shocks to the real RM/yuan, Malaysian output, and prices. We first consider the effect of system-wide shocks on the cointegrating relations using the Persistence Profile developed by [Pesaran and Shin \(1996\)](#). On impact, the Persistence Profile is

normalized to take the value of unity, but the rate at which it tends toward zero provides information on the speed with which the equilibrium correction takes place in response to shocks. In addition to the point estimates, the 95% Confidence Bounds — which are generated by employing the nonparametric bootstrap method using 1,000 replications — are also illustrated as dotted lines (Figure 2). The system-wide shock has affected all long-run relations significantly in the beginning, before the effects eventually disappear in the long run. The half-life is about two months, and the whole effect takes around six months to complete. The result seems to be consistent with the error correction process of the VECMX model.

Insert Figure 2 here

Next, to analyze the effect of a shock to a variable on the expected future values of the endogenous variables, we employ the generalized IRFs, which measure the change to the n -period forecast of each of the variables that would be caused by a shock to the particular variable. In contrast to the orthogonalized impulse response, the generalized IRFs do not require orthogonalization of shocks and is invariant to the ordering of the variables in the VAR (Pesaran and Shin, 1998) and in our case, the VARX model. In this section, we first consider the responses of the trade balance variable to a positive unit shock of most concerned endogenous variable — real RM/yuan. Shown in Figure 3, a unit shock (depreciation) of the real RM/yuan is followed by the response of an expansion in trade balance series. The impact lasted about a year and stabilized in the 13th month. When there is currency devaluation, we generally expect that the trade balance deteriorates at first, because the price change occurs quickly, while trade quantities (volume) change more slowly. After a moderate time period, the volume effect become large enough to offset the price effect and the trade balance improves to exhibit the so-called J-curve phenomenon. However, in Figure 3, a 1% depreciation of the Malaysian ringgit brings about a 6% gain in the trade balance almost immediately — in the first 2.5 months — which lowers to a 3% gain in the following months. In other words, depreciation of the RM/yuan resulted in an overall trade surplus for Malaysia against China, where the price effect failed to dominate the volume effect even in the early stage. Perhaps, this is the result of Chinese imports growing faster than exports (against ASEAN) in recent years. Though there is no clear pattern of a J-curve for Malaysia-China bilateral trade, the finding is consistent with the long-run estimation that the bilateral trade is sensitive to real exchange rate changes.

Insert Figure 3 and Figure 4 here

The generalized IRFs of the trade balance to a unit shock in output and producer prices are given in [Figure 4](#). The result indicates the extent to which demand and supply channels affect the bilateral trade balances. The trade balance series depicts a V-shape adjustment to Malaysian output (industrial production) shocks. Domestic consumers may increase their demand for Chinese goods due to the income effect, resulting in temporal trade balance deterioration, but this effect gradually ends within a year. Response to foreign (China) output demonstrates a similar magnitude effect, though the impact lasts longer, about 15 months. This could be due to the substitution effect under which Chinese consumers shift their demand for Malaysian exports to other goods and services. Conversely, IRFs of trade balance responses to Malaysian and Chinese producer prices follow an increasing path. The impacts remain positive and stabilize within a year. The figure seems to indicate some early signs of trade expansion following the producer price shocks.

The effects of real exchange rate shock on output and producer prices are shown in [Figure 5](#). The point estimates are bounded by the 95% bootstrapped confidence intervals using 1,000 replications. Clearly, Malaysia shows a greater response to the foreign exchange rate shock, perhaps due to the greater openness of the Malaysian economy. However, a positive unit shock (depreciation) of real RM/yuan is contractionary for Malaysian output. An initial 1% depreciation of the Malaysian ringgit results in a 1.2% reduction of industrial production in the first two months. The impact stabilizes after eight months at approximately 0.8% below its base value. Such a finding of the contractionary effect due to devaluation is along the lines of studies by [Rajan & Shen \(2002\)](#), [Ahmed, *et al.* \(2002\)](#), and [Bahmani-Oskooee & Miteza \(2003\)](#). Indeed, [Kim and Ying \(2007\)](#) have underlined that devaluation may be more contractionary than previously thought because of financial liberalization and improvement in information technology; devaluation worsens the balance of payments of countries with heavy foreign currency liabilities. There is also an adverse effect on the country's reputation, impairing its ability to raise foreign capital.

Insert Figure 5 here

Likewise, Chinese output responds negatively to the positive shock of RM/yuan (in which the yuan appreciates), but the impact is minor. The deterioration of production (about 0.2%) is observed in the second and third months and the impact stabilizes after nine months at approximately 0.1% below its base value. Keep in mind that China practices an export-led

growth policy based on maintenance of an undervalued yuan. The finding may partly justify China's rigid policy of keeping the yuan from appreciating against world currencies in the past decade. On the other hand, the response(s) of producer prices to foreign exchange shocks are muted and are generally insignificant statistically. As for the Malaysian producer price shock, the impact could be slightly inflationary, but the scale is small. It is still inconclusive whether devaluation has inflationary or deflationary effects.

Subsequent analysis uses the Variance Decompositions (VDCs) in an attempt to gauge the extent of shocks to a variable that can be explained by other variables considered in the VARX model. VDCs can be considered as an out-sample causality test, which provides a quantitative measurement of how much the movement in one variable can be explained by other variables in the VAR system in terms of the percentage of forecast error variance. However, the results based on conventional orthogonalized VDCs are found to be sensitive to the number of lag lengths used and the ordering of the variables in the equation. The errors in any equation in a VAR are normally serially uncorrelated by construction, but there may be contemporaneous correlations across errors of different equations. To overcome this problem, the generalized VDCs of forecast error is applied (see [Pesaran and Pesaran, 1997](#)).

Insert Table 4 here

[Table 4](#) presents the generalized VDCs for our VARX model. Among the six variables in the system, the Chinese variables (industrial production and producer price) seem to be the most exogenous variables, as most of the shocks are explained by their own innovations (87%–97%) over the horizon of 24 months. Such a finding provides the methodological support for the VARX and VECMX modeling approach employed in this study. On the other hand, trade balance and real foreign exchange rate are found to be endogenous. In line with the long-run estimates, innovation from the real foreign exchange rate explains a substantial portion of the forecast error variance in the trade balance (about 20%). As for the foreign exchange rate, the major innovation comes from Chinese producer price. Yet, the Malaysian producer price is relatively exogenously determined, though it was included in the conditional model as an endogenous variable.

4. Conclusions and policy implications

The present study explores the dynamic relationship of trade balance, exchange rates, outputs (demand), and producer prices (supply) for Malaysia-China in the era of global crises, e.g.

Asia financial crisis, subprime crisis. The empirical framework was constructed based on the VARX and VECMX modeling procedures. In addition, the application of Persistent Profile and IRFs shows how the core variables (TB, Y, PP, Q) evolve with respect to economic shocks. With additional scrutiny of generalized VDCs and forecasting assessment, the comprehensive analyses allow us to draw useful insights about the Marshall-Lerner condition, the J-curve phenomenon, and the output (expansion or contraction) and price effects (inflationary or deflationary) between Malaysia and China.

First of all, the Marshall-Lerner condition holds for Malaysia against China in the long run. The short-run J-curve pattern is not visible through the IRFs analysis but noticeable in the error correction modeling. This would suggest a potential gain in Malaysian balance of payment if ringgit depreciated against the yuan. Theoretically, in a Keynesian economy with excess capacity, devaluation boosts net exports and, through the multiplier effect, fosters economic growth. Such demand channel, however, does not work well in the Malaysia-China case during and after the Asia financial crisis. Based on the generalized IRFs, a positive unit shock of real RM/yuan (in which RM depreciates) results in a contractionary effect for Malaysian output. If we refer to the generalized VDCs analysis, the percentage variance of industrial production is not well explained by the innovations in variance of the real foreign exchange. Moreover, domestic and foreign incomes are only significant through lagged effects in the short run but not in the long run model, suggesting that the demand side effects are temporal. In other words, devaluation for export gains is insufficient to sustain output expansion for Malaysia against China. It is worth noting, that the success of currency depreciation in improving the trade balance largely depends on switching demand in the proper direction and amount, as well as on the capacity of the home economy to meet the additional demand by supplying more goods. Since the trade expansion due to currency shock is temporal and the short-run adjustments are slow, productivity growth in real and tradable sectors is essentially vital to enhance the external competitiveness and hence economic growth.

From the supply side's viewpoint, Malaysia is a typical semi-industrialized nation, where inputs for manufacturing are still largely imported and not produced domestically due to deficiency in economy of scale; for instance, the automobile, the chemical and allied industry production and textile manufacturing. Firms' input cost may increase following currency devaluation. However, our analysis of IRFs has not shown clear inflationary or

deflationary effect following the shock in real Malaysian ringgit. And, the lagged variables of the producer price were statistically insignificant in the error correction modeling of VECMX. Both the Malaysian and Chinese producer prices are also relatively exogenously determined, as indicated by the VDCs analysis. At the outset, the results suggest that negative impact from the higher cost of imported inputs from China (due to ringgit depreciation) does not dominate the production stimulus from lower relative prices for domestically traded goods. In other words, China has yet to be Malaysia's main source of imported inflation.

At the present stage, China has shown complementary features and been supportive of regional trading. In mid-August 2010, China began the trading of Malaysian ringgit against the yuan on its domestic foreign exchange market to promote bilateral trade between the two nations and to facilitate the use of the yuan to settle cross-border trade. Yet, the potential conflicting (competing) aspect of the trade relationship cannot be ignored. Manufacturing accounted for 92.4% of China's merchandise exports in 2006, and the trend persists. Malaysia remains competitive in machinery, electronic equipment, and energy supply, but not competitive in clothing and textile manufacturing, food, agricultural and leather-related products, and transportation. Malaysia needs to upgrade its export structure and reduce low-end and labor-intensive manufacturing. Malaysia's focus should be on high value-added production, design, and service sectors, before China overtakes it in these areas. Since both nations are now promoting the respective services sectors, further bilateral liberalization and strategic collaboration in services trading should be an important focus of Malaysia-China trade. These services may include education, medical tourism, transportation, and construction, as well as financial services. The two nations could experience economic gains in market structure and product diversification as well as economies of scale from regional trade integration. In addition, both nations have committed to bilateral trade integration, in addition to support for the multilateral framework within the ASEAN+6 regime. Despite the strong competition in manufacturing exports, China recognizes Malaysia as an influential player within ASEAN and various ASEAN-driven collaboration platforms, such as the ASEAN Regional Forum and the East Asian Summit. The trade expansion is likely to accelerate with the formalization of a bilateral trade liberalization pact on track under the ASEAN-China Free Trade Agreement.

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Table 1: Cointegraing Rank Test for VARX (4, 3) Trade Model

H_0	H_1	Trace Statistics	Bootstrapped Critical Values	
			95%	90%
$r = 0$	$r = 1$	86.92 ^a	87.6639	81.2677
$r \leq 1$	$r = 2$	48.83	57.6497	53.2201
$r \leq 2$	$r = 3$	20.49	34.4511	31.7246
$r \leq 3$	$r = 4$	7.40	16.2293	14.3547

Notes: ^a denotes significant at 90% confidence level. The 95% and 90% critical values are generated by bootstrap method using 149 observations and 1000 replications. The underlying VARX trade model is of lag order (4, 3) and contains unrestricted intercept.

Table 2: Normalized Long run Estimates and Restriction Test

$\ln TB_t = 0.5695 \ln Y_t - 0.4720 \ln PPI_t + 3.0446 \ln Q_t - 1.1416 \ln Y_t^* + 1.1472 \ln PPI_t^* - 0.3078 D97_t$
(1.3174) (0.4131) (0.8150) ^c (0.3837) ^b (0.9775) (0.1758) ^a
95% Bootstrapped CV for LR: 22.9725 LR test: 22.5245 [0.001]
90% Bootstrapped CV for LR: 19.5385

Note: ^{a, b, c} denote significant at the 10%, 5% and 1% level respectively. Asymptotic standard errors are reported in the parentheses () and p-value of LR statistics is reported in [].

Table 3: Error Correction Representation of the VECMX Trade Model

	Regressor	Coefficient	Std Error	T-sta [P-value]
<i>Conditional Model (Endogenous Variables)</i>	c	-0.4096 ^b	0.1897	-2.1588[0.033]
	$\Delta \ln TB_{t-1}$	-0.2696 ^c	0.0987	-2.7300[0.007]
	$\Delta \ln TB_{t-2}$	-0.1458 ^a	0.0876	-1.6631[0.099]
	$\Delta \ln TB_{t-3}$	-0.2569 ^c	0.0734	-3.4981[0.001]
	$\Delta \ln Y_{t-1}$	-0.7529 ^c	0.2836	-2.6545[0.009]
	$\Delta \ln Y_{t-2}$	-0.4516	0.3306	-1.3658[0.174]
	$\Delta \ln Y_{t-3}$	-0.1082	0.2766	-.39120[0.696]
	$\Delta \ln PP_{t-1}$	0.5848	0.9505	.61525[0.539]
	$\Delta \ln PP_{t-2}$	-0.3194	0.9520	-0.3355[0.738]
	$\Delta \ln PP_{t-3}$	0.4820	0.9548	0.5048[0.615]
	$\Delta \ln(Q_{t-1})$	-0.4646	0.4853	-0.9573[0.340]
	$\Delta \ln(Q_{t-2})$	1.7282 ^c	0.4810	3.5932[0.000]
	$\Delta \ln(Q_{t-3})$	-0.3928	0.5007	-0.7845[0.434]
	$\Delta D97$	-0.0942 ^b	0.0489	-1.9264[0.044]
	ECT_{t-1}	-0.1933 ^c	0.0878	-2.2014[0.030]
<i>Marginal Model (Exogenous Variables)</i>	$\Delta \ln Y^*_{t-1}$	0.8014 ^a	0.4192	1.9117[0.058]
	$\Delta \ln Y^*_{t-2}$	0.1541	0.5137	.30008[0.765]
	$\Delta \ln Y^*_{t-3}$	0.1575	0.4206	.37436[0.709]
	$\Delta \ln PP^*_{t-1}$	1.5930	1.8617	.85570[0.394]
	$\Delta \ln PP^*_{t-2}$	4.5957 ^b	2.1936	2.0950[0.038]
	$\Delta \ln PP^*_{t-3}$	-3.0073	1.9446	-1.5465[0.124]
Diagnostic Tests				
R^2	AUTO	RESET	Normal	Hetero
0.46	1.233[0.27]	0.183[0.67]	3.475[0.18]	0.026[0.87]

Notes: ^{a, b, c} denote significant at the 10%, 5% and 1% level respectively. AUTO is the LM test for serial correlation; RESET is the Ramsey Reset test for functional form, Normal is a test that examine for normality in the errors, and Hetero tests for heteroscedasticity. Except Normal test that uses chi-squared statistics, all diagnostic tests are conducted using the F -statistics.

Table 4: Generalized Variance Decomposition

	Horizon	% of Variance Explained by Innovations in					
		TB	Y	PP	Q	Y*	PP*
TB	4	70.78	1.29	4.48	15.76	2.39	5.22
	8	68.77	0.95	4.28	17.95	1.77	4.69
	12	67.56	0.75	4.30	19.25	1.39	4.29
	16	66.80	0.63	4.29	20.12	1.14	4.04
	20	66.29	0.54	4.27	20.71	0.96	3.86
	24	65.92	0.47	4.26	21.14	0.84	3.72
Y	4	5.51	65.68	2.03	6.50	8.80	20.28
	8	7.47	53.76	1.73	7.94	10.63	28.94
	12	8.64	48.46	1.69	8.35	11.30	32.75
	16	9.39	45.43	1.68	8.63	11.66	34.77
	20	9.89	43.53	1.69	8.80	11.89	36.01
	24	10.23	42.23	1.69	8.92	12.04	36.85
PP	4	1.82	2.22	89.14	1.04	0.19	8.87
	8	0.93	1.35	85.38	0.75	0.13	10.65
	12	0.83	1.00	83.04	0.53	0.08	11.43
	16	0.83	0.82	81.72	0.41	0.06	11.81
	20	0.85	0.71	80.92	0.34	0.05	12.03
	24	0.86	0.64	80.38	0.29	0.04	12.17
Q	4	6.68	0.47	5.79	78.70	5.23	6.16
	8	22.15	1.38	4.52	61.91	3.80	6.50
	12	29.73	1.83	4.23	53.26	3.10	6.48
	16	34.11	2.10	4.08	48.27	2.70	6.41
	20	36.91	2.27	3.99	45.09	2.44	6.36
	24	38.82	2.39	3.92	42.90	2.27	6.32
Y*	4	0.13	0.04	1.97	0.27	97.37	2.38
	8	0.17	0.04	2.33	0.19	97.07	2.03
	12	0.17	0.03	2.41	0.16	96.99	1.86
	16	0.16	0.03	2.46	0.14	96.95	1.76
	20	0.16	0.02	2.50	0.13	96.92	1.70
	24	0.16	0.02	2.52	0.13	96.89	1.65
PP*	4	0.27	0.13	8.81	0.01	3.31	90.90
	8	0.21	0.11	11.78	0.02	2.82	87.87
	12	0.13	0.08	12.79	0.02	2.71	86.67
	16	0.10	0.07	13.26	0.01	2.67	86.04
	20	0.07	0.06	13.53	0.01	2.66	85.66
	24	0.06	0.05	13.70	0.01	2.65	85.42

Figure 1: Diagnostic tests of CUSUM and CUSUMSQ

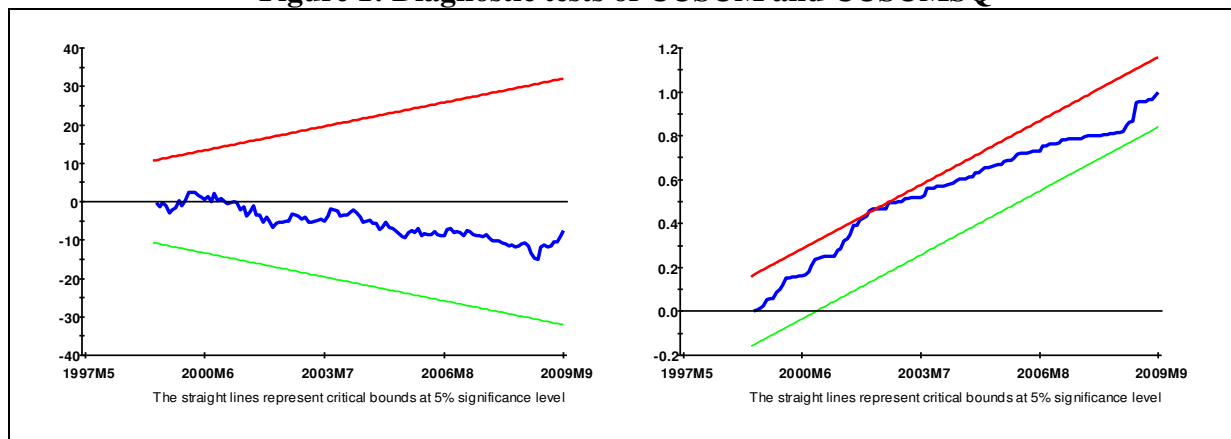


Figure 2: Persistence Profile of the Effect of a System-Wide Shock to Cointegrating Relation

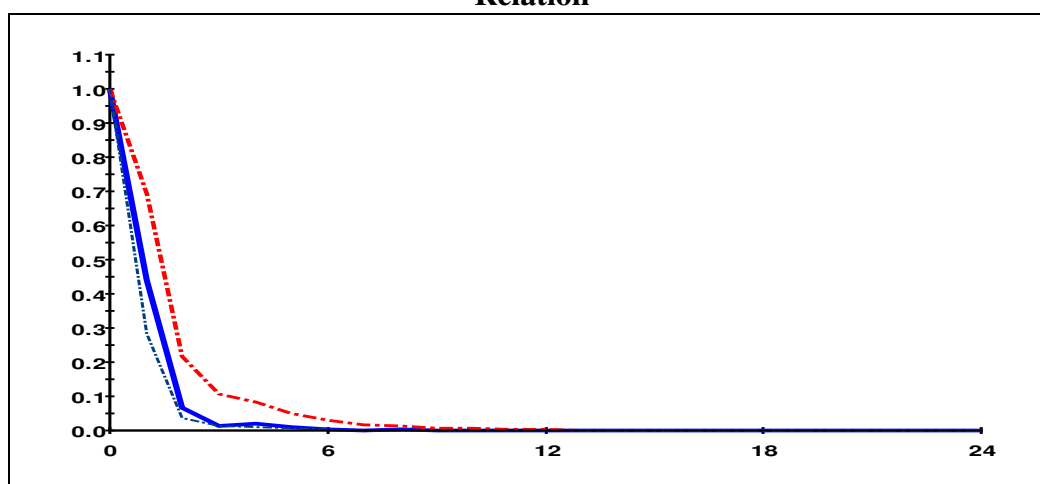


Figure 3: Response of Malaysia-China Trade Balance to Real RM/Yuan Shock

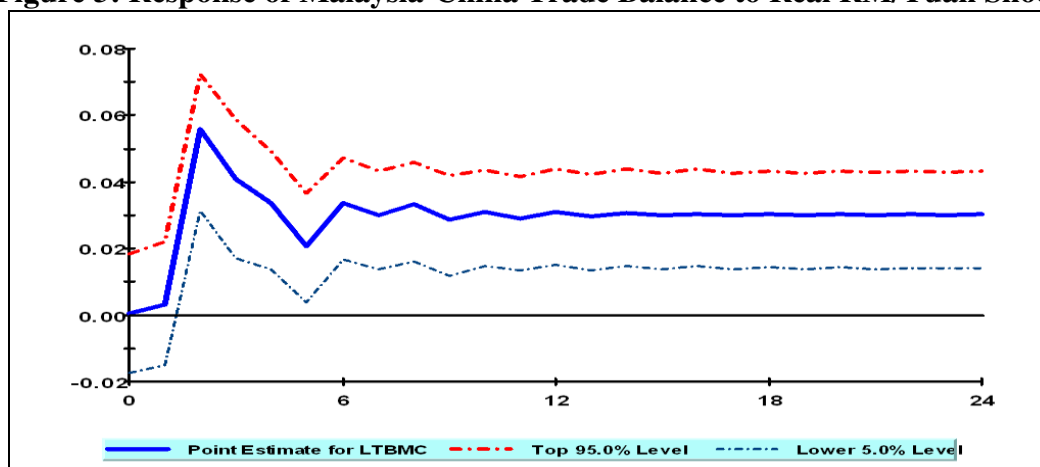


Figure 4: Responses of Malaysia-China Trade Balance to Shocks in Output and Prices

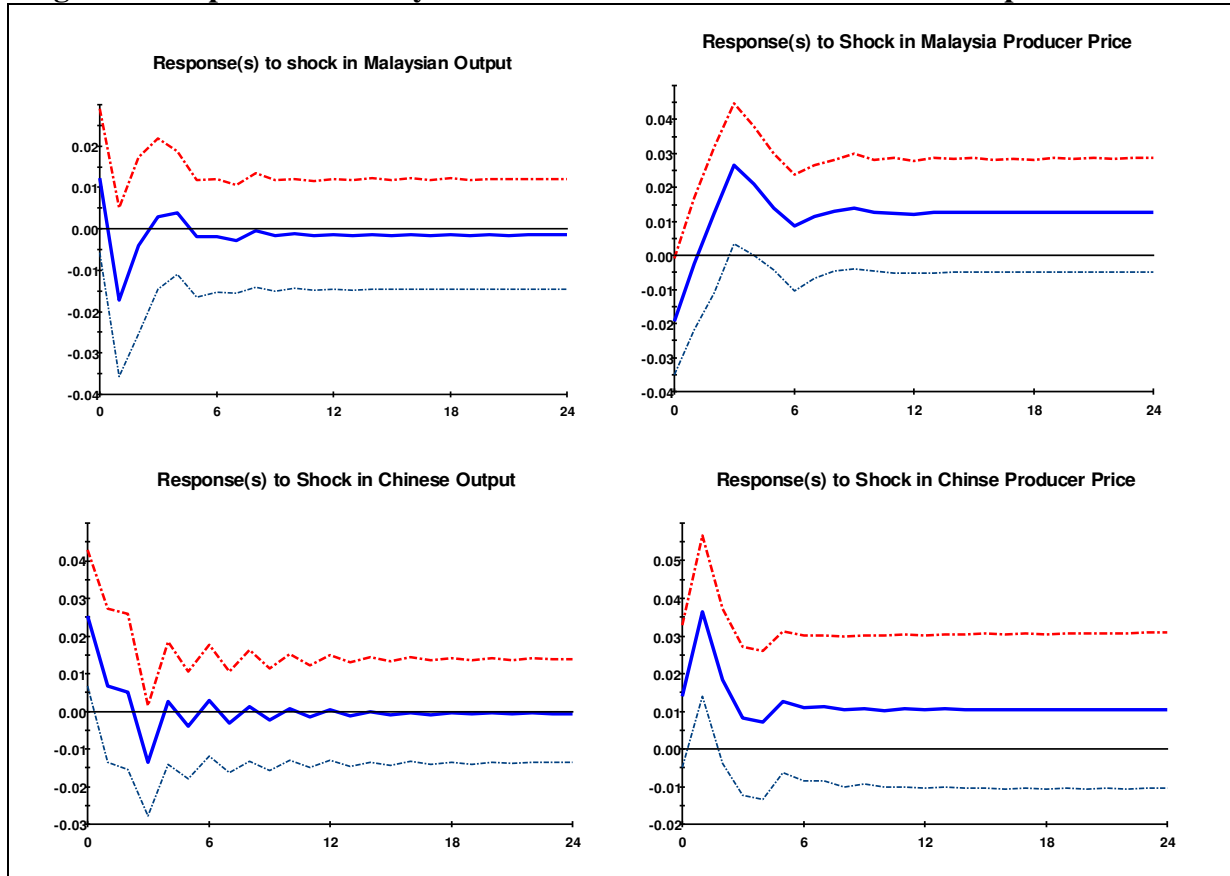


Figure 5: Response(s) of Output and Prices to Positive Unit Shocks in Real RM/Yuan

