Real Exchange Rate, Trade Balance and Economic Shocks : Evidence from Sino-Japanese Economic Relation

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Abstract

This paper uses a structural VAR model to estimate effects of economic shocks happened in China on the real exchange rate and the trade balance between China and Japan. We find that nominal shocks will give persistent effects on the real exchange rate and the trade balance. However, the variation in the real exchange rate is mostly occurred by both aggregate supply and aggregate demand shocks, while the variation in the trade balance is mostly occurred by nominal shocks.
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Keywords: Real exchange rate; Trade balance; Structural VAR; Economic shocks

1. Introduction

As China's economy has highly grown since 1978, China becomes one of the most important trade partners for Japan. China is Japan's second export partner from 2001 and the first partner of imports from 2002. Therefore, it is significant for studying effects of economic shocks happened in China on the Sino-Japanese economic relationship.

Sims (1980) argued that macroeconometric models with many restrictions are incredible and he proposed an unrestricted vector autoregression (VAR) model to investigate macroeconomic theory. However, the unrestricted VAR model does not necessarily tell us anything about the effect of policy interven-

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tions on an economy because it is only a reduced form of a structural model. Therefore, Blanchard and Quah (1989) proposed a structural VAR method. In their structural model, aggregate supply and aggregate demand shocks, by which an economic development is driven in the long run, are used as structural disturbances. Employing the Blanchard-Quah structural VAR method to the stochastic Mundell-Fleming model proposed by Obstfeld (1985), Clarida and Gali (1994) analyzed the effects of nominal economic shocks that are another structural disturbance on real exchange rates.

In order to identify a structural VAR model from an unrestricted VAR model, the purchasing power parity (PPP) is one of restriction conditions because it is commonly applied as a long-run equilibrium in many open economy model. The PPP restriction means that nominal shocks have no long-run effects on real exchange rate. Clarida and Gali (1994) used the PPP as an identification condition of a structural model and so concluded that nominal shocks have no long-run effects on real exchange rate. Prasad (1999) extended the model of Clarida and Gali (1994) to include trade balance and they concluded that nominal shocks have no long-run effects on both real exchange rate and trade balance. Many empirical evidence, however, don't support the PPP restriction.[1] Furthermore, Lane (2001) found that nominal shocks have long-run effects on both real exchange rate and trade balance in an open economy model with sticky price. Considering potential effects of nominal shocks on both real exchange rate and trade balance, Fisher and Huh (2002) did not use the PPP as a long-run identifying restriction condition of a structural VAR model. In their model, nominal shocks have significant long-run effects on both real exchange rate and trade balance for G-7 countries.

Based on the model proposed by Fisher and Huh (2002), this paper analyzes effects of economic shocks happened in China on the relative real output, the real exchange rate and the trade balance between China and Japan. Considering potential effects of nominal shocks on both the real exchange rate and the trade balance between China and Japan, this paper also does not use the PPP as a restriction condition for identifying the struc-

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1 See Lothian and Taylor (1996), Engel (2000), etc.

tural VAR model. This paper finds that the real exchange rate and the trade balance between China and Japan will be affected not only by aggregate supply and aggregate demand shocks but also by nominal shocks. Based on the forecast error variance composition, however, this paper finds that the variation in the real exchange rate between China and Japan is mostly occurred by both aggregate supply and aggregate demand shocks, while the variation in the trade balance is mostly occurred by nominal shocks.

This paper is organized as follows. Section 2 provides a method to explain how to estimate a structural VAR model from an unrestricted VAR model. Section 3 provides empirical results. Section 4 estimates impulse responses of the relative real output, the real exchange rate and the trade balance on aggregate supply, aggregate demand and nominal shocks and assesses a relative importance of the three-dimensional shocks by decomposing forecast error variance. Section 5 provides some conclusions.

2. Model

An unrestricted VAR model is given by

$$\mathbf{x}_t = \sum_{j=1}^{k} \mathbf{A}_j \mathbf{x}_{t-1} + \mathbf{e}_t, \tag{1}$$

where

$$\mathbf{x}_t = \begin{bmatrix} \Delta(y_t - y_t^*) \\ \Delta\varepsilon_t \\ \Delta TB_t \end{bmatrix}, \quad \mathbf{A}_j = \begin{bmatrix} a_{11,j} & a_{12,j} & a_{13,j} \\ a_{21,j} & a_{22,j} & a_{23,j} \\ a_{31,j} & a_{32,j} & a_{33,j} \end{bmatrix}, \quad \mathbf{e}_t = \begin{bmatrix} e_{1,t} \\ e_{2,t} \\ e_{3,t} \end{bmatrix},$$

in which, y_t and y_t^* are the logarithms of China's and Japan's real GDP at time t, ε_t is the bilateral real exchange rate between China and Japan that is defined as the nominal exchange rate (measured in per one China yuan) between China and Japan times the ratio of China's consumer price index (CPI) to Japan's CPI, TB_t is defined as the ratio of the trade balance (China's nominal exports to Japan minus China's nominal imports from Japan) to China's nominal GDP, and $\mathbf{e}_t$ is the unrestricted shocks vector of the reduced form model with $E(\mathbf{e}_t) = 0$ and $E(\mathbf{e}_t\, \mathbf{e}_t') = \mathbf{\Omega}$.

Eq. (1) is an appropriate specification of the unrestricted VAR model of the first differences of the relative real output, the real exchange rate and the trade balance. From Eq. (1), a Wold vector moving-average representation can be given by

$$\mathbf{x}_t = \left(\mathbf{I} - \sum_{j=1}^{k} \mathbf{A}_j L^j\right)^{-1} \mathbf{e}_t = \sum_{j=0}^{\infty} \mathbf{C}_j L^j \mathbf{e}_t = \mathbf{C}(L)\mathbf{e}_t, \qquad (2)$$

where L is the lag operator, and $\mathbf{C}(L) = \sum_{j=0}^{\infty} \mathbf{C}_j L^j$ with $\mathbf{C}_j = \sum_{i=1}^{j} \mathbf{C}_{j-i}\mathbf{A}_i (j \geq i \geq 1)$ and $\mathbf{C}_0 = \mathbf{I}$.

Eq. (2) means that $\mathbf{x}_t$ is represented as the moving average representation of the unrestricted errors. Since the unrestricted VAR is only a reduced form of a structural VAR model, we cannot learn anything about the effects of economic shocks happened in China on the relative real output, the real exchange rate and the trade balance between China and Japan. Based on the stochastic Mundell-Fleming model proposed by Obstfeld (1985), an economy is driven by aggregate supply, aggregate demand and nominal shocks in the long run. The three-dimensional shocks are commonly used as structural errors in a structural VAR model. Therefore, the structural moving average representation of $\mathbf{x}_t$ is represented as follows:

$$\mathbf{x}_t = \sum_{j=0}^{\infty} \mathbf{F}_j L^j \mathbf{v}_t = \mathbf{F}(L)\mathbf{v}_t \quad (j = 0, 1, 2, \cdots, \infty), \qquad (3)$$

where $\mathbf{v}_t$ is the vector of the three-dimensional shocks with $E(\mathbf{v}_t) = 0$ and $E(\mathbf{v}_t\mathbf{v}_t') = \mathbf{I}$, and $\mathbf{F}(L) = \sum_{j=0}^{\infty} \mathbf{F}_j L^j$ is the one-sided matrix polynomial in the lag operator L.

From Eqs. (2) and (3), the relationships of parameters between the reduced form and the structural form can be given by

$$\mathbf{e}_t = \mathbf{F}_0 \mathbf{v}_t, \qquad (4)$$

and

$$\mathbf{C}_j \mathbf{e}_{t-j} = \mathbf{C}_j \mathbf{F}_0 \mathbf{v}_{t-j} = \mathbf{F}_j \mathbf{v}_{t-j} \quad (j = 0, 1, 2, \ldots, \infty). \qquad (5)$$

From Eq. (5), we can obtain

$$\mathbf{F}_j = \mathbf{C}_j \mathbf{F}_0 \quad (j = 0, 1, 2, \ldots, \infty). \qquad (6)$$

Since $\mathbf{C}_j$ is directly estimated from Eq. (2), $\mathbf{F}_j$ can be easy to estimate when $\mathbf{F}_0$ is determined. In the three-dimensional system, $\mathbf{F}_0$ is a 3×3 matrix with nine unique elements. In order to identify $\mathbf{F}_0$, we need nine pieces of information.

From Eq. (4), we can obtain the relationship between the covariance of the reduced form errors and the covariance of the structural form errors as follows:

$$\mathbf{\Omega} = \mathbf{G}'\mathbf{G} = \mathbf{F}_0\mathbf{F}_0', \tag{7}$$

where **G** is the unique upper triangular Choleski matrix decomposition of correlation matrix $\mathbf{\Omega}$.

Let $f_{ij,0}$ and g_{ij} be the ijth element of matrices $\mathbf{F}_0$ and $\mathbf{\Omega}$, respectively. From Eq. (7), we can obtain

$$\begin{aligned}
&f_{11,0}^2+f_{12,0}^2+f_{13,0}^2 = g_{11}^2\\
&f_{11,0}f_{21,0}+f_{12,0}f_{22,0}+f_{13,0}f_{23,0} = g_{11}g_{12}\\
&f_{11,0}f_{31,0}+f_{12,0}f_{32,0}+f_{13,0}f_{33,0} = g_{11}g_{13}\\
&f_{21,0}^2+f_{22,0}^2+f_{23,0}^2 = g_{12}^2g_{22}^2\\
&f_{21,0}f_{31,0}+f_{22,0}f_{32,0}+f_{23,0}f_{33,0} = g_{12}g_{13}+g_{22}g_{23}\\
&f_{31,0}^2+f_{32,0}^2+f_{33,0}^2 = g_{13}^2+g_{23}^2+g_{22}^2
\end{aligned} \tag{8}$$

Eq. (8) provides six restriction conditions in nine unknowns. We still need three additional pieces of information to identify $\mathbf{F}_0$.

Considering long-run effects of economic shocks, we can obtain the following equation:

$$\mathbf{F}(1) = \mathbf{C}(1)\mathbf{F}_0, \tag{9}$$

where

$$\mathbf{C}(1) = \sum_{j=0}^{\infty}\mathbf{C}_j = \left(\mathbf{I}-\sum_{j=1}^{k}\mathbf{A}_jL^j\right)^{-1},$$

$$\mathbf{F}(1) = \sum_{j=0}^{\infty}\mathbf{F}_j.$$

As discussed by Obstfeld (1985) and Blanchard and Quah (1989), neither aggregate demand shocks nor nominal shocks have a persistent effect on real output. Therefore, we can obtain two additional restriction conditions as follows:

$$\begin{aligned}
&c_{11}(1)f_{12,0}+c_{12}(1)f_{22,0}+c_{13}f_{32,0} = f_{12}(1) = 0\\
&c_{11}(1)f_{13,0}+c_{12}(1)f_{23,0}+c_{13}f_{33,0} = f_{13}(1) = 0\,'
\end{aligned} \tag{10}$$

Gali (1992) discussed that real output does not respond immediately to nominal shocks but it will respond to nominal shocks subsequently through resulting changes in real exchange rates and other relative prices. Therefore, we also obtain another additional restriction condition as follows:

$$f_{13,0} = 0. \tag{11}$$

Since Eqs. (8), (10) and (11) form a system of nine equations in nine unknowns, we can estimate $\mathbf{F}_0$ by solving $f_{ij,0}$ in Eqs. (8), (10) and (11).

3. Data and empirical results

Since monthly and quarterly data is not available, this paper uses annual data from 1972 when the diplomatic relations between China and Japan are established to 2002.

The real GDP measured in 1995 prices (in the U.S. dollar) in China and Japan and the nominal GDP in China are from World Development Indicator 2004. In Japan, CPI is also from World Development Indicator 2004. In China, CPI from 1972 through 1984 is from Comprehensive Statistical Data and Materials on 50 years of New China and the data from 1985 to 2002 are from China Statistics Year Book (2004). In order to calculate the real exchange rate between China and Japan, the CPI in 1995 is treaded as the based year in both China and Japan. The bilateral nominal exchange rate between China and Japan is obtained by calculating the ratio of the exchange rate of the yen (per one U.S. dollar) to the exchange rate of the yuan (per one U.S. dollar) and the two nominal exchange rates are also from World Development Indicator 2004. The trade balances between China and Japan are from Japan External Trade Organization (JETRO).

Since the relative real output, the real exchange rate and the trade balance are driven by aggregate supply, aggregate demand, and nominal shocks in the long run, no long-run or cointegration relationships among the three series need to be required. In order to estimate whether cointegration relationships among the series do exist or not, we must first do unit root test on the relative real output, the real exchange rate and the trade balance and on their first differences, respectively.

Table 1 provides the results of unit root tests by the weighted symmetrical (WS) and the augmented Dickey-Fuller (AEG) tests.[2] The two tests for unit root include a constant, a linear time trend and optimal lags of a dependent variable for the three level variables and only include a constant and optimal lags of a dependent variable for the first difference of the three level variables. We see that the null hypothesis that unit root exists is not rejected by both two tests for all the three level variables. On the other hand, for the first differences of the three variables, the estimate results of unit root tests are different by the two methods. For the first difference of the relative real output, the null hypothesis of a unit root is rejected at the 10% significance level by the WS test and at the 1 % significance level by the ADF test. For the difference of the real exchange rate, the null hypothesis of a unit root is rejected at the 5 % significance level by the WS test, but it is not rejected by the ADF test. For the first difference of the trade balance, the null hypothesis of a unit root is rejected at the 5 % significance level by both the WS test and the ADF test. Since the WS test has a higher power than the ADF test, we can conclude that no unit root exists in all the first differences of the three variables. Table 1 also represents the result of cointegration test on the relative real output, the real exchange rate and the trade balance by the augmented Engle-Granger (AEG) test. We obtained an expected result that the null hypothesis that the three level variables have no cointegration relationships is not rejected at the 5 % significance level by the AEG test.

Since Eq. (1) is a reduced form of a structural VAR model, we can use ordinary least squared (OLS) method to estimate it, in which its optimal lag is determined as one by Schwarz's BIC. Based on the method in Section 2, we can estimate Eq. (3).

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2 The WS test is a method of unit root test proposed by Pantura et al (1994). The power of the WS test is higher than the ADF test. The Phillips-Perron (1987, 1988) test, a nonparametric or distribution-free method, is also commonly applied. Since ADF test is sensitive to lag selection, the Phillips-Perron test is important additional tool for making inferences about unit roots. However, the power of the Phillips-Perron test is the most poorest in the three unit root tests. So the Phillips-Perron test is not used in the paper.

Table 1 Unit root and cointegration tests for the relative real output, the real exchange rate and the trade balance

Unit root tests for the relative real output, the real exchange rate and the trade balance:

Variables	WS test			ADF test		
For level variables:	Statistics	P-value	Optimal lags	Statistics	P-value	Optimal lags
The relative real output	0.027	0.999	2	-0.917	0.954	10
The real exchange rate	-1.143	0.960	2	-0.497	0.984	4
Trade balance	-2.057	0.609	3	-2.203	0.488	3
For its first differences:	Statistics	P-value	Optimal lags	Statistics	P-value	Optimal lags
The relative real output	-3.122	0.061	2	-5.587	0.000	10
The real exchange rate	-3.680	0.012	2	-2.824	0.188	3
Trade balance	-4.235	0.002	2	-3.867	0.013	2

AEG test for the relative real output, the real exchange rate and the trade balance:

Statistic	P-value	Optimal lags
-3.279	0.290	3

Note: The unit root test for a level variable includes a constant, a linear time trend and lags of the dependent variable, and the unit root test for its difference includes a constant and lags of the dependent variable only. The optimal lags for all the unit root tests and the AEG cointegration test are determined by AIC2 proposed by Pantura et al (1994).

4. Impulse responses and forecast error variance decomposition

Eq. (3) shows the responses of the first differences of the relative real output, the real exchange rate and the trade balance to aggregate supply, aggregate demand and nominal shocks. From Eq. (3), we can obtain the responses of their level variables to the three shocks as follows:.

$$\mathbf{X}_{t+k} = \mathbf{F}_0 \mathbf{v}_{t+k} + (\mathbf{F}_0 + \mathbf{F}_1)\mathbf{v}_{t+k-1} + \cdots + \left(\sum_{j=0}^{k} \mathbf{F}_j\right)\mathbf{v}_t + \cdots \quad (k = 0, 1, 2, 3, \cdots), \tag{12}$$

where $\mathbf{X}_{t+k} = [(y_{t+k} - y^*_{t+k}) \ \ \varepsilon_{t+k} \ \ TB_{t+k}]'$, that is, $\mathbf{X}_{t+k}$ is a column vector of the relative real output, the real exchange rate and the trade balance at time $t+k$.

Eq. (12) means that the responses of the relative real output, the real exchange rate and the trade balance at time $t+k$ to positive one-standard deviations of aggregate supply, aggregate demand and nominal shocks happened at time t in China are $\sum_{j=0}^{k} \mathbf{F}_j$.

From Eq. (12), the forecast error variance of the relative real output, the real exchange rate and the trade balance at time $t+k$ is give by

$$E[(\mathbf{X}_{t+k} - E(\mathbf{X}_{t+k}))(\mathbf{X}_{t+k} - E(\mathbf{X}_{t+k}))']$$
$$\mathbf{F}_0\mathbf{F}_0' + (\mathbf{F}_0 + \mathbf{F}_1)(\mathbf{F}_0 + \mathbf{F}_1)' + \cdots + \left(\sum_{j=0}^{k-1} \mathbf{F}_j\right)\left(\sum_{j=0}^{k-1} \mathbf{F}_j\right) \quad (k = 1, 2, 3, \cdots), \tag{13}$$

In turn, we first use Eq. (12) to analyze responses in forecast horizons of the relative real output, the real exchange rate and the trade balance to positive one standard deviations of aggregate supply, aggregate demand and nominal shocks happened at time t in China, respectively. And then we use Eq. (13) to assess a relative importance of the structural shocks in forecast horizons by decomposing the forecast error variance of the relative real output, the real exchange rate and the trade balance.

(1) Responses to aggregate supply shock

Figs. 1-3 show that the responses of the relative real output, the real exchange rate and the trade balance in forecast horizons to a positive one-standard deviation of aggregate supply shocks happened at time t in China, respectively. We see that the aggregate supply shocks lead to permanent effects on the relative real output, the real exchange rate and the trade balance. For the relative real output, the aggregate supply shocks will lead to its rise immediately and to a continued rise in the long run. For the real exchange rate, the aggregate supply shocks will lead to its depreciation immediately and a continued depreciation in the long run. For the trade balance, the aggregate supply shocks will lead to an immediate deficit and to a continued deficit at the one-year forecast horizon, because the positive output effect of the aggregate supply shocks, which will worsen the trade balance, cannot be offset by the depreciation of the real exchange rate, which will improve the trade balance. However, the trade deficit brought by the aggregate supply shock will be gradually improved from the two-year forecast horizon because the depreciation of the real exchange rate begins to show more initiative for improving the trade balance.

Figure 1 The response of the relative real output to aggregate supply shocks

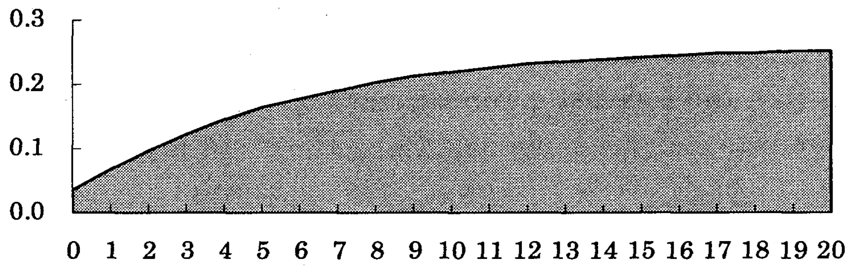


Figure 2 The response of the real exchange rate to aggregate supply shocks

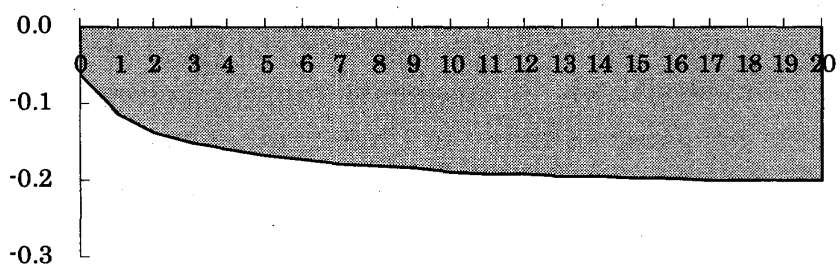
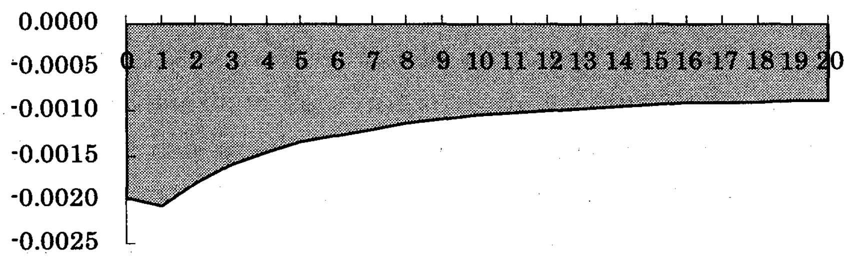


Figure 3 The response of the trade balance to aggregate supply shocks



(2) Responses to aggregate demand shock

Figs. 4-6 show that the responses of the relative real output, the real exchange rate and the trade balance in forecast horizons to a positive one-standard deviation of aggregate demand shocks happened at time t in China, respectively. We see that the aggregate demand shock will lead to a permanent appreciation of the real exchange rate and a permanent deficit of the trade balance, but it has no permanent effect on the relative real output. For the relative real output, we see that the aggregate demand shocks lead to a temporary rise immediately and at the one-year forecast horizon. From the two-year forecast horizon, however, the positive effect of the aggregate demand shocks on the relative real output will decrease and vanish gradually. For the real exchange rate, the aggregate demand shocks

Figure 4 The response of the relative real output to aggregate demand shocks

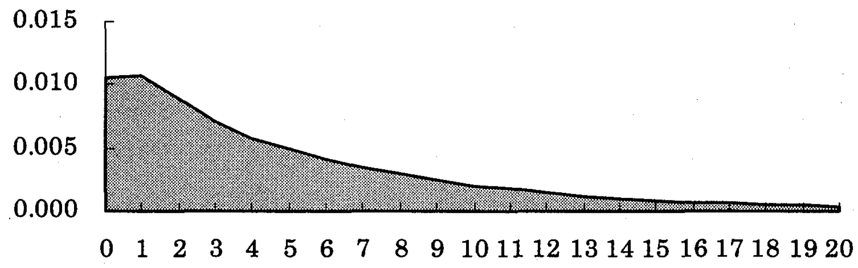


Figure 5 The response of the real exchange rate to aggregate demand shocks

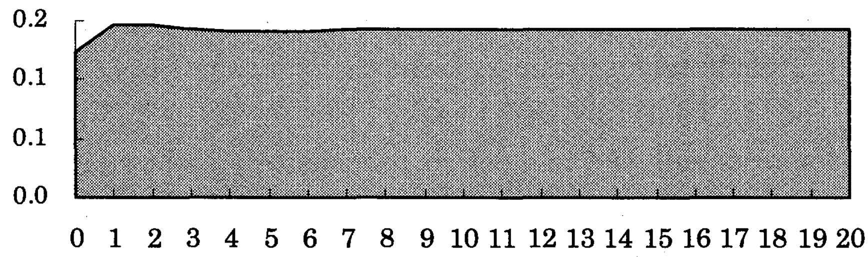
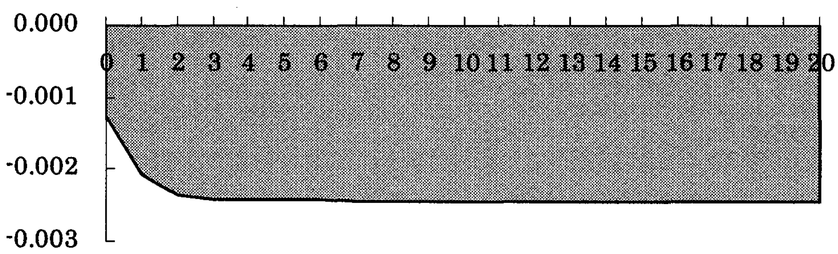


Figure 6 The response of the trade balance to aggregate demand shocks



will lead to its appreciation immediately and a continued appreciation at one-year forecast horizon. From the two-year forecast horizon, the real exchange rate shows almost unchanged. For the trade balance, the aggregate demand shocks will lead to a continued deficit from the year the shocks happened to the three-year forecast horizon because both the appreciation of the real exchange rate and the positive output effect will worsen the trade balance between China and Japan. From the four-year forecast horizon, the trade balance shows almost unchanged because the positive output effect will vanish gradually and the exchange rate shows unchanged from the two-year forecast horizon.

(3) Responses to nominal shock

Figs. 7- 9 show that the responses of the relative real output, the real exchange rate and the trade balance in forecast horizon to a positive one-standard deviation of nominal shocks happened at time t in China, respectively. We see that the nominal shocks will lead to permanent effects on the real exchange rate and the trade balance, but it has no permanent effect on the relative real output. For the relative real output, we see that the nominal shocks do not give any effect on the relative real output immediately. However, it will lead to a continued fall at the one-year and two-year forecast horizons. From the three-year forecast horizon, the effect of nominal shocks on the relative real output will decrease gradually and vanish finally. For the real exchange rate, the aggregate demand shocks will lead its appreciation immediately. However, from the one-year forecast horizon, the shocks will lead to a continued depreciation. For the trade balance, the aggregate demand shocks will lead to a deficit immediately and to a continued deficit at the one-year forecast horizon because the relative real output will not get any effect of the nominal shocks immediately and the appreciation of the real exchange rate will worsen the trade balance. From the two-year forecast horizon, the trade balance shows unchanged because the improvement in the trade balance brought by the depreciation of the real exchange rate is almost offset by the deficit of trade balance brought by the recovery of the relative real output.

Figure 7 The response of the relative real output to nominal shocks

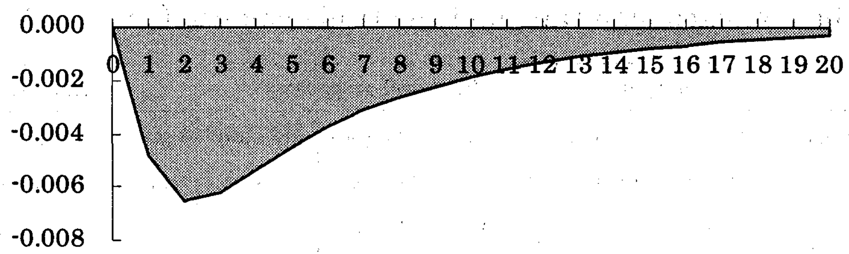


Figure 8 The response of the real exchange rate to nominal shocks

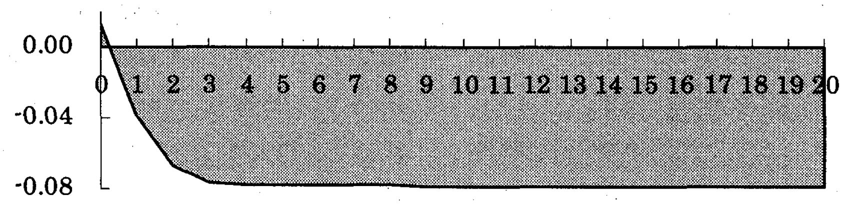
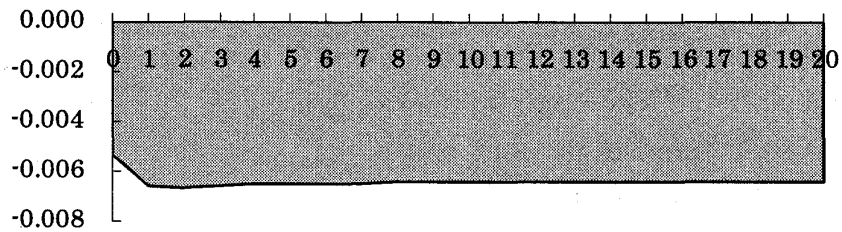


Figure 9 The response of the trade balance to nominal shocks



(4) Forecast error variance decomposition

Forecast error variance decomposition provides a way to assess a relative importance of the three structural shocks in accounting for the variation in the relative real output, the real exchange rate and the trade balance.

Table 2 presents the composition of forecast error variance for the relative real output, the real exchange rate and the trade balance after positive one-standard deviations of aggregate supply, aggregate demand and nominal shocks happened in China at the at time 0.

For the relative real output, the aggregate supply shocks share more than 90% of the total variation immediately and the share expand to more than 99% at the four-year forecast horizon. On the other hand, both aggregate demand and nominal shocks give poor effects for the relative real output. Aggregate demand shocks share only less than 10% of the total

Table 2 Forecast error variance decompositions for the relative real output, the real exchange rate, and the trade balance (percents)

Year	Relative real output			Real exchange rate			Trade balance		
	Aggregate supply shocks	Aggregate demand shocks	Nominal shocks	Aggregate supply shocks	Aggregate demand shocks	Nominal shocks	Aggregate supply shocks	Aggregate demand shocks	Nominal shocks
0	92.38	7.62	0.00	20.56	78.56	0.88	11.37	4.61	84.02
1	96.07	3.56	0.36	30.40	66.60	3.00	9.45	6.80	83.75
2	97.70	1.89	0.41	35.92	57.97	6.11	8.20	8.21	83.59
3	98.54	1.13	0.33	39.46	52.58	7.97	7.33	9.09	83.58
4	99.01	0.74	0.25	42.02	49.05	8.93	6.68	9.66	83.66
5	99.69	0.22	0.09	48.57	41.40	10.03	4.94	10.86	84.20
10	99.85	0.10	0.05	52.13	37.91	9.95	4.01	11.34	84.65
15	99.87	0.09	0.04	52.65	37.43	9.92	3.87	11.41	84.72

variation immediately and the share decreases to less than 1 % since the four-year forecast horizon. The nominal shocks don't give any effect on the relative real output immediately and share only less than 1 % of the total variation at all forecast horizons.

For the real exchange rate, the aggregate supply and the aggregate demand shocks share more than 90% of the total variation and the nominal shocks share only less than 10% at all forecast horizons. The aggregate supply shocks account for as high as 20% of the total variation immediately and then tend to expand up to more then more than 40% since the four-year forecast horizon, while the aggregate demand shocks account for as high as 80% immediately and then tend to decrease down to less than 50% since the four-year forecast horizon.

For the trade balance, nominal shocks account for more than 80% of the total variation immediately and at all forecast horizons. On the other hand, the share of aggregate supply shocks will decrease from about 10% at the year shocks happened down to about 5 % at the four-year forecast horizon, while aggregate demand shocks will increase from about 5 % in the year shocks happened up to 10% at the five-year horizon.

5. Conclusions

This paper used a structural VAR model to estimate effects of economic shocks happened in China on the relative real output, the real exchange rate and the trade balance between China and Japan. In the structural VAR model, aggregate supply, aggregate demand, and nominal shocks are used as structural disturbances because an economy is driven by the three-dimensional shocks in the long run. In order to identify the structural VAR model, this paper does not use PPP as an identifying restriction condition of the structural VAR model because nominal shocks may give potential effects on real exchange rate and trade balance.

Based on the structural VAR model, this paper estimated the responses of the relative real output, the real exchange rate and the trade balance to positive one-standard deviations of the three-dimensional shocks and assessed a relative importance of the three-dimensional structural shocks in accounting for the variation in the relative real output, the real exchange rate and the trade balance, respectively. We found that aggregate demand and nominal shocks will give persistent effects on the real exchange rate and the trade balance and only a temporary effects on the relative real output, while aggregate supply shocks will give persistent effects on all the three variables. On the other hand, this paper found that the three-dimensional shocks play different roles in accounting for the variation in the relative real output, the real exchange rate and the trade balance. The variation in the relative real output is almost occurred by aggregate supply shocks and the variation in trade balance is almost occurred by nominal shocks, while the variation in real exchange rate is occurred by both aggregate supply and aggregate demand shocks.

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