The Impact of RMB's Appreciation on China's Trade*

Guihuan Zheng,[ab] Li Guo,[b] Xuemei Jiang,[b] Xun Zhang,[ab] and Shouyang Wang[ab#]

[a] *Academy of Mathematics and Systems Science, Chinese Academy of Sciences, Beijing 100080, China*

[b] *Graduate University of Chinese Academy of Sciences, Beijing 100080, China*

Abstract

With the announcement on 21 July 2005 that the RMB exchange rate regime would be reformed, great attention has been paid to the impact of the RMB's appreciation on China's trade. Since China is in transition from a pegged to a managed floating regime, no existing appropriate model and method can be utilized to investigate this question directly. In this paper, a scenario analysis technique is used to study this issue, coupled with the introduction of the substituted variables: Japanese yen and Euro exchange rate. Our results show that RMB appreciation would not bring severe effects on China's trade in 2005; however, a possible sustained reduction of export growth in 2006 should be given more attention. It is also necessary and urgent to press forward with the reform of RMB exchange rate regime, and put in place the related supporting policies to avoid sudden fluctuations such as the Japanese situation after the "Plaza Accord".

JEL Classification: C53, F17, F31

Keywords: RMB appreciation; China trade; scenario analysis

1. Introduction

The RMB exchange rate became a hot topic after the announcement on 21 July 2005 of exchange rate regime reform. The new regime, a managed floating exchange rate regime based on market supply and demand with reference to a basket of currencies, allows RMB to rise by 2 percent, with a daily 0.3 percent trading band based on the price of the previous day. With its rapid development, China's economy has become an

* Supported by NSFC and the Ministry of Commerce of the People's Republic of China. The authors are very grateful to the anonymous referees and the editor-in-chief for their very valuable comments and suggestions.

Contact author: Shouyang Wang, Academy of Mathematics and Systems Science, Chinese Academy of Sciences, No. 55 Zhongguancun East Road, Beijing 100080, China. Email: sywang@amss.ac.cn. Fax: (86-10) 6262-1304.

increasingly important feature in global economic development and integration. Against this backdrop, the impact of RMB appreciation on China's trade attracts great attention.

Before the announced reform of the RMB, a vast body of theoretical literature has emerged concentrated on the impact of the RMB's revaluation (Liu, 2004; Zhang, 2001). However, relatively little research has been undertaken on the empirical analysis of this issue. Cyn-Young Park (2005) analyzed the macroeconomic impact of a "one-off" appreciation of the RMB against the US dollar using the Oxford Economic Forecasting (OEF) model. This work may shed light on the dynamics between global imbalances and revaluation. The OEF model framework (Burridge et al., 1991) allows simulation analyses based on the global econometric structure, which might provide some quantitative results for the impact of a revaluation on relevant economies, such as those of the PRC, Japan, US, and other Asian countries. The stability of an equilibrium state may be damaged when the regime shifts, however this cannot be examined in this model. Zhang (2005) presented a study on this issue using elasticity analysis. Both of these results suggested that the impact of a revaluation on China's economy might change in proportion to the scale of the appreciation. However, in the short term, the reasonableness of this proportionate result should be questioned.

The main body of existing literature has so far mainly centred on quantitative discussion describing the relation between trade and exchange rates (Arize, 1996; Bailey et al., 1987; Cheng et al., 2003; Chou, 2000; Cushman, 1983; Gotur, 1985; Koray and Lastrapes, 1989; Mckenzie, 1999; Sauer and Bohara, 2001; Swift, 2004; Viaene and de Vries, 1992; Wang and Dunne, 2003). There has been surprisingly little empirical work that focuses on the exchange rate regime shift (Zheng, 2005), especially that of going from being pegged to the US dollar to a managed floating regime. No existing appropriate model or method can be found to support this kind of research directly. Therefore, some indirect methods should be tested for studying this issue with the substitute variables introduced.

In this paper, a scenario analysis technique is used to give a sensitivity analysis of China's trade to the appreciation of the RMB. The first type of scenario is a hypothetic scenario being based on the current appreciation of RMB by 2 percent; while the second is a historical scenario and is based on historical events – the Japanese yen's variability after subscribing to the "Plaza Accord".

The rest of this paper is organized as follows. The theory and method of scenario analyses are introduced in Section 2; models and their evaluation are outlined in Section 3; forecasting results from scenario analysis are presented in Section 4; and Section 5 concludes the paper.

2. Scenario Analysis

Scenario analysis (Committee on the Global Financial System, 2000) is a form of stress test which serves to estimate potential extreme losses in a portfolio's value and give helpful suggestions to the decision maker for managing risk in a company or a financial institution. Generally, scenario analysis is a means to explore a possible future economic situation, and to identify what might happen and how an organization can act or react upon future developments.

2.1 Method

In this work, scenario analysis serves to estimate the changes in trade if different scenarios were to occur. The essence of this methodology is the creation of user-defined scenarios, fed into a calculation engine to produce estimates of the impact. Moreover, such analysis should be based on the evaluated model. Generally, the scenarios in stress testing fall into three main types:

(1) The typical scenario uses predefined or set-piece scenarios that have proven to be useful in practice, such as one x percent change of exchange rate may result a y percent fall in the stock index.
(2) The hypothetical scenario reports the worst-case results through some subjective assumption based on one special event.
(3) The historical scenario stimulates the historical track for estimating the impacts based on one actual event.

After setting the scenarios and establishing the valuation functions, the values of trade are estimated by running the model for each scenario.

2.2 Set scenarios

In this paper, two types of scenarios, the second one and the third one are introduced. They are based on the assumption that the RMB will appreciate against the US dollar while other economies may maintain their current exchange rate regimes.

2.2.1 The hypothetical scenario

As we all know, the RMB was appreciated 2 percent with a daily 0.3 percent trading band based on the price of the previous day. To illustrate the effect caused by this regime shift, one hypothetical scenario (Scenario I) is introduced. In this scenario, it is assumed that the RMB/USD exchange rate would appreciate to a threshold value of 2 percent in August 2005, and maintain such value until the end of the following year. Since the effect of the related factors' changes on the macroeconomic structure is less than that on portfolios, it is reasonable to assume that the domestic and international markets keep stable and should not suffer a sudden change in the short term. The scenario of a one-off appreciation will be discussed assuming such a macroeconomic background.

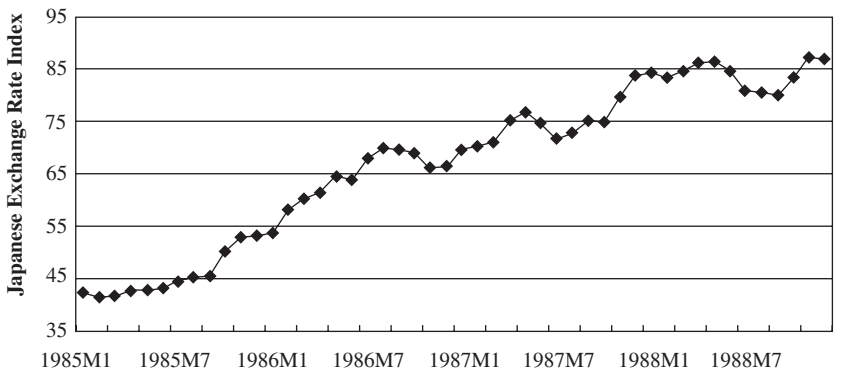
2.2.2 The historical scenario

Historically, there are many cases that can be used as a reference for a similar situation, such as Japan, Germany and Indonesia. The case of Japan following its subscribing to the "Plaza Accord" is an especially good comparison.

On 22 September 1985, finance ministers from the world's five biggest economies – the United States, Japan, West Germany, France and the UK – announced the formation of the Plaza Accord at the eponymous New York hotel. Each country made specific promises on economic policy: the United States pledged to cut the federal deficit, Japan promised a looser monetary policy and a range of financial-sector reforms, and Germany proposed tax cuts. All countries agreed to intervene in currency markets as necessary to get the

dollar down. By the end of 1987, the dollar had fallen by 54 percent against both the Deutsche mark and the yen from its peak in February 1985. The Japanese yen experienced a severe appreciation from an exchange rate index of 45.53 in September 1985 to 53.13 in December 1985, an increase of 20 percent (see Figure 1) (data are taken from *International Financial Statistics* in IMF). The appreciation trend of the Japanese yen lasted around a further 10 years.

Figure 1: Japanese Exchange Rate Index after the "Plaza Accord"



After studying the data on exports, imports, and exchange rates in Japan over the period 1982 to 1990, we find that the Japanese yen's appreciation has not caused changes in the long equilibrium relation between exports and exchange rates. It is feasible, therefore, to set scenarios assuming a stable economic structure. However, with different international environments and historical conditions, the regime's shift from being pegged to US dollar may damage the equilibrium. Thus, two historical scenarios are examined to ensure sufficient reference:

(1) Scenario II: the RMB starts to appreciate against the US dollar in August 2005, experiencing the same appreciation pattern from September 2005 to December 2006 as the Japanese yen from December 1985 to February 1987. However, the state of economic equilibrium remains stable.
(2) Scenario III: this scenario experiences the same appreciation pattern as Scenario II, but the state of economic equilibrium is assumed to change, with the absolute value of elasticity coefficient increasing by 10 percent.

These scenarios may be unlikely to occur in the future, but they can help to illustrate the impact that RMB appreciation might have on China's trade and economy.

3. Models and Their Evaluation

The RMB's appreciation will undoubtedly generate extensive and far-reaching implications for China's economy, especially for exports. This research should be based on

establishing and testing econometric models. We will look at the evaluated models for export and trading forms respectively. In the following empirical work, these models are used in the scenario analysis of China's trade. The sample data are collected over the period from January 1995 to July 2005. Data on export and import are taken from *China's Customs Statistics*. The exchange rate data are obtained from the University of British Columbia's website (http://fx.sauder.ubc.ca/data.html).

3.1 Constructing the valuation function of exports

3.1.1 Total exports

The export function, constructed by Wang et al. (2003) for discussing the effects of the Japanese yen's depreciation on China's exports via the stress testing analysis, is used in this research. It is reasonable to assume that foreign income, the domestic and foreign price levels remain constant in a small economy. So the effects of the exchange rate on China's exports will be analyzed using this assumed macroeconomic background. That is:

$$X = f(E) \tag{1}$$

where X represents China's exports, E is the exchange rate of the RMB.

It is well known that the Japanese yen is a dominant currency in Asia, and in the world. Its change will affect bilateral trade between China and Japan, as well as exports to Asia and America; and all of these will ultimately affect China's exports. Moreover, the exchange rate of the RMB to the US dollar had been kept relatively stable since 1994, while the Japanese yen has been characterized by floatability and flexibility. Such evidence implies that it is appropriate to choose the Japanese yen as the substitute variable for the exchange rate. In addition, bilateral trade between China and Europe is becoming increasingly important. China's exports to the EU reached US$ 107.16 billion in 2004, accounting for 18.1 percent of China's total exports. It is obvious, therefore, that the euro is a chosen substitute variable.

The export equation can be rewritten as

$$X = f(E_{japan}, E_{euro}) \tag{2}$$

where X represents the monthly data series on China's exports, (E_{japan}, E_{euro}) are the nominal exchange rates of RMB to Japanese yen and euro respectively. The variable of export growth rate DX, is defined as

$$DX = \ln X - \ln X(-12)$$

where $\ln X$ is the natural logarithm of X. Because the growth rate of China's exports is defined as the rate over the corresponding period of the previous year, the seasonal adjustment in the series of China's exports need not be considered. The growth rate of RMB/YEN exchange rate is defined as

$$DE_{japan} = \ln E_{japan} - \ln E_{japan}(-1) \tag{3}$$

where $\ln E_{japan}$ is the natural logarithm of the exchange rate of RMB/YEN data series, and DE_{euro} is defined similarly. The results of unit root tests on DX, DE_{japan} and DE_{euro} displayed in Appendix Table A.1 show that all of these series are stationary.

However, the coefficient of the exchange rate variable DE_{euro} is insignificant in this study, which indicates that the impact of the euro on the total exports cannot be seen. It requires further examination in terms of the main export markets such as Asia, EU, and USA. It is found that the impact of the fluctuation of the Japanese yen on China's exports is lagged from 5 to 10 months. The other finding is the autoregressive feature in China's exports. Based on these phenomena, an ADL (Auto-regressive Distributed Lag) model is applied, and the estimated regression is as follows (the value in parentheses is t-statistic for each coefficient):

$$DX = \underset{(2.7778)}{0.0330} + \underset{(6.0607)}{0.4445}DX(-1) + \underset{(4.9982)}{0.3610}DX(-2) + \underset{(2.9985)}{0.5060}DE_{japan}(-5) + \underset{(2.9657)}{0.4990}DE_{japan}(-10) \quad (4)$$

$R^2 = 0.67$, $DW = 2.07$

From the above results, we may also find the coefficients of variables are significant at the level of 1 percent. Consequently, our hypothesis using assumptions about small economies is reasonable in the short term.

3.1.2 Main export markets

The impact of the RMB's appreciation on China's exports to different markets may differ depending on different trade patterns, commodity structures, trade terms, etc. The systematic model should be used to estimate export substitution. Furthermore, a VAR model for China's exports to the major markets is established and, as in the above model, the exchange rate is considered to be the only exogenous variable.

Since China's exports to Asia, EU and USA account for almost 89 percent of China's total exports, our model will consider only these three markets. Because the exchange rate of the RMB had been pegged to the US dollar with a fluctuation of less than 0.04 percent before 22 July 2005, China's exports to the US was influenced more so by the RMB's exchange rate fluctuations with other currencies. Therefore, the exchange rates of RMB/YEN and RMB/EURO are used in the model.

The VAR model can be described as:

$$DX_t = c + \sum_{i=1}^{n} A^i DX_{t-i} + \sum_{j=1}^{m} B^j DE_{t-j} + \varepsilon_t \quad (5)$$

where DX_t is the vector of monthly growth rates of China's exports to Asia, the EU and the US, that is $DX = (DX_{Asia}, DX_{EU}, DX_{USA})'$, DX_{Asia} is the monthly growth rate of China's exports to Asia calculated in twelfth difference of the natural logarithm of China's exports to Asia, DX_{EU} and DX_{USA} are defined similarly. DE_t is the vector of monthly change rate of E_{japan} and E_{euro}, that is $DE = (DE_{japan}, DE_{Euro})'$. n and m are the lags for each variable in the model, A and B are 3x3 matrices of parameters, c is the constant vector and ε_t is the vector of error terms.

The dataset used in this model is limited to the period January 1999 to July 2005. We do not use data before January 1999 because the robustness and stability of this model was influenced by the financial crisis in Eastern Asia in 1997. The model VAR(2) can be used because it has the smallest AIC and SC of all the models with different lag lengths. Its results are displayed in Appendix Table A.2. As can be seen in that table, the adjusted R-squared value for each equation is around 0.70. This represents a strong explanatory statement.

3.2 Constructing the valuation function of trading forms

In the research on the impact of the RMB's appreciation on China's imports, we established an ADL model with domestic demand and exchange rates. Industry added value is used as the substitute variable to represent the domestic demand because of the absence of monthly GDP data. Since the coefficient of the exchange rate variable is insignificant, we conclude that the factors affecting China's total imports are complicated and that further research in the trading forms is necessary.

Foreign trade mainly consists of processing trade and general trade, and the effect of the RMB's appreciation on China's foreign trade varies with the trading forms. It is necessary, therefore, to construct the models with four variables: general trade export, general trade import, processing trade export and processing trade import. As in 3.1.1, E_{japan} and E_{euro} are considered as two substitute variables of the exchange rate. We assume that foreign income (reflecting the foreign market demand) and trade policy remain constant. For the interaction between export and import through processing trade, it is reasonable to apply the VAR model, described as:

$$DT_t = c + \sum_{i=1}^{n} \mathrm{A}^i DT_{t-i} + \sum_{j=1}^{m} \mathrm{B}^j DE_{t-j} + \sum_{k=1}^{p} \gamma_k Diav_{t-k} + \varepsilon_t \tag{6}$$

where DT_t is the vector of monthly growth rates of different trading forms, that is $DT_t = (DX_p, DI_p, DX_g, DI_g)'$, where DX_p, DI_p, DX_g, and DI_g denote the monthly growth rate measured in twelfth difference of the natural logarithm of China's processing trade exports, processing trade imports, general trade exports and general trade imports respectively. While DE_t is defined in 3.1.1, and $Diav_t$ is the change rate of *iav* (industry added value) measured as follows:

$$Diav = \ln iav - \ln iav(-12) \tag{7}$$

n, *m* and *p* are the lags for each variable in the model, A and B are 4x4 matrices of parameters, γ is coefficient vector, *c* is constant vector and ε_t is the vector of error terms.

The estimation results over the period January 1995 to July 2005 (reported in Appendix Table A.3) indicate that the adjusted R-squared values are above 0.7, which again represents a strong explanatory statement.

4. Forecasting Results from Scenario Analysis

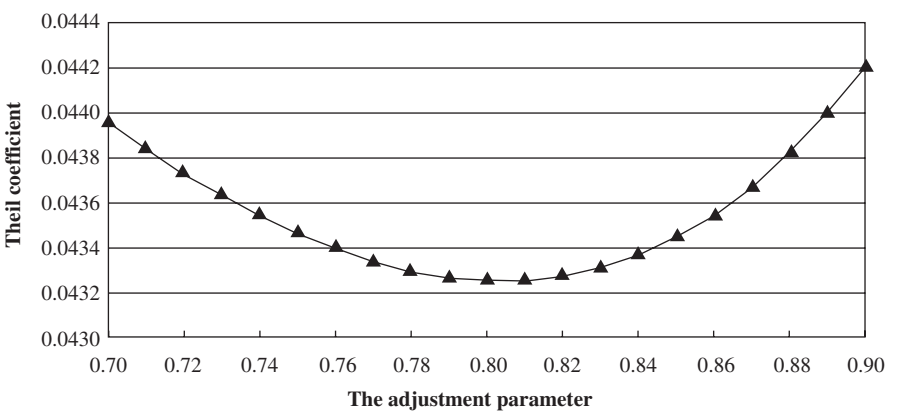
We now run the models and compare the results for the different scenarios. In our work, the growth rate of industry added value from August 2005 to December 2006 is defined as the previous average growth between January 2000 and July 2005:

$$\bar{g}(k)=\begin{cases}\frac{1}{6}\sum_{i=2000}^{2005} g_i(k) & k=1,\cdots,7\\ \frac{1}{5}\sum_{i=2000}^{2004} g_i(k) & k=8,\cdots,12\end{cases} \tag{8}$$

where $\bar{g}(k)$ denotes the estimated growth rate of the month k, and $g_i(k)$ is the real growth rate of month k in year i.

Moreover, as can be seen from the figures from January to July 2005, the growth rates of general trade exports, general trade imports and processing trade imports continued to decline. This indicates that they have been moved from a rapid growth period to a stable development stage. Therefore, for these three series, the driving force of the first autoregressive term on the current value might be weakened. Accordingly, some corresponding autoregressive coefficients, including a_{22}, a_{33}, a_{44} in A[1] of the function (6), should be adjusted to be smaller when the estimated model is used to forecast. We define the adjustment parameter as ξ that varies in [0.70,1]. Then, based on the model estimated over the period January 1995 to December 2004, DT_t from January to July 2005 are forecasted under the different adjustment parameters. The optimal adjustment parameter, $\xi = 0.80$, can be selected according to the Theil inequality coefficient which is the criteria of the forecasting precision (see Figure 2).

Figure 2: Theil Inequality Coefficient under Different Adjustment Parameters



Running the established model under these three scenarios, the estimated results are achieved and summarized in Appendix Tables A.4, A.5 and A.6.

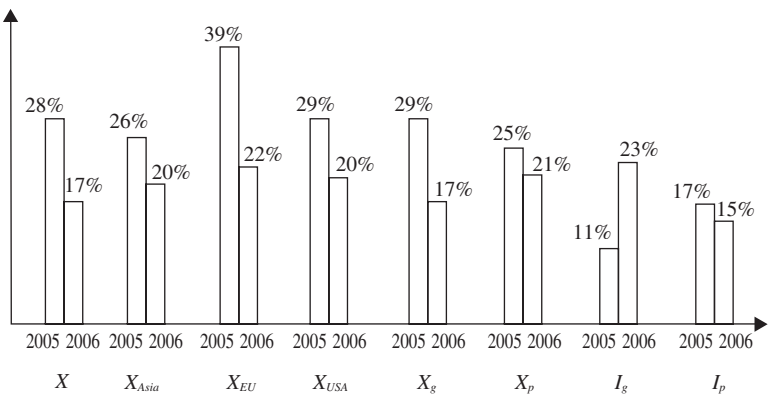
4.1 The hypothetical scenario analysis

Figure 3 depicts the annual growth rate under the hypothetical scenario. It suggests that an appreciation of the RMB by 2 percent would not cause a severe impact on China's exports in 2005, although the increasing trend of China's exports would become slower. The rapid decline in growth rate may be seen in the first half of 2006, which will be head back in the second half of 2006 except the exports to Asia (see Table A.5). Of the three major export markets, the drop in growth rate for exports to the US is the smallest.

As to trading forms, compared with exports through processing trade, exports through general trade would be confronted by more pressure from the appreciation and would be more lagged; while it would be the reverse for imports. Exports through general trade would suffer from a decrease of approximately 21 percent in the first half of 2006, with exports through processing trade experiencing a decrease of 13 percent in the second half of 2005 (see Table A.6).

For imports through general trade, growth rate will increase significantly from 11 percent in 2005 to 23 percent in 2006. However, a 2 percent reduction may appear for imports through processing trade in 2006. This may be as a result of various factors, such as the impact of appreciation on exports through processing, the expectation of future appreciation and a change in domestic demand.

Figure 3: The Results of Scenario I



4.2 The historical scenario analysis

After an examination of Tables A.4, A.5 and A.6, we find that there is little difference between Scenario II and Scenario III. Therefore, the implications of appreciation under the change of an economic equilibrium structure should be examined over the long term. Here, we focus only on Scenario II (see Figure 4).

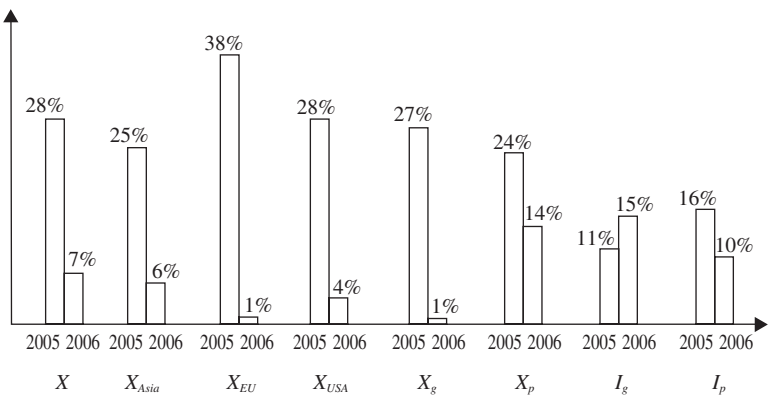
In this scenario, total exports will exhibit a significant slowing down in 2006. In the second half of 2006, its exports may produce a growth of less than 4 percent.

With regard to the three main export markets, under the historical scenario, a severe adverse effect on exports would result in 2006, when compared with that of hypothetical

scenario. Especially for exports to EU, it will register a small increase of approximately 1 percent in 2006 (see Table A.5).

Compared with exports through processing trade, which are still increasing at a rate of more than 10 percent, exports through general trade would on the whole stop increasing in 2006. Moreover, exports through processing trade would begin to show signs of increasing growth. For imports, there would be less growth than that experienced in the results of the hypothetical scenario since the economic development and domestic demand would be affected by the sharp appreciation.

Figure 4: The Results of Scenario II



5. Conclusions and Prospects

In this paper, scenario analysis is used to analyze the effects of the RMB's appreciation on China's trade in 2005 and 2006. Our evidence shows that China's exports would continue a strong growth trend in the hypothetical scenario using a one-off appreciation of 2 percent. As can be seen in currently with the RMB, similar favourable results may be expected to occur if the RMB exchange rate regime would mark a sound operation. We conclude, therefore, that China's exports would not be affected much by the current appreciation of the RMB, and would continue its increasing trend in 2005. On the other hand, despite the rapid increase in China's exports – a result of China's strong economic development, as well as strong international competitiveness in export goods – there still exists a risk due to the drop in growth in 2006, which may impede the rapid growth of exports. Domestic demand should also be promoted to counteract the risk of fluctuations in the international market.

Even if the RMB appreciates to a nearly impossible level in the historical scenarios, China's exports in 2005 would still keep growing. What's more, the assumption of the seventeen-month severe appreciation of the RMB is unlikely to happen. The increasing trend of China's exports is very strong and exports will have a strong future in 2005. Nevertheless, the growth rates in 2006 might be so low that the vast and severe influences on economic development might appear only over the long term. Consequently, it

is necessary and urgent to press forward on the reform of the RMB exchange rate regime and to develop the related supporting policies. A timely follow-up study should also be carried out to monitor the situation of trade development closely.

Appendix

Table A.1
ADF Tests on DX and DE_{japan}

Series	ADF statistic
DX	-2.7443***
DX_{japan}	-10.0653*
DX_{eruo}	-2.6348***

* Significant at 10%;
*** Significant at 1%.

Table A.2
Results of theVAR Model for DX_t

Variables	DX_{Asia}	DX_{Eu}	DX_{USA}
DX_{Asia} (-1)	0.1125(0.6725)	-0.3475(-1.8558)	0.1804(1.2048)
DX_{Asia} (-2)	-0.0486(-0.2770)	-0.2357(-1.2019)	0.0978(0.6235)
DX_{EU} (-1)	0.3917(3.1143)	0.6765(4.8062)	0.0838(0.7447)
DX_{EU} (-2)	-0.2686(-2.0818)	0.0586(0.4059)	-0.1969(-1.7050)
DX_{USA} (-1)	-0.3465(-2.0910)	0.0751(0.4049)	0.0539(0.3633)
DX_{USA} (-2)	0.5993(3.3986)	0.3700(1.8753)	0.5368(3.4019)
c	0.1068(4.9901)	0.0890(3.7171)	0.0571(2.9827)
DE_{japan} (-2)	0.9269(2.3240)	1.4106(3.1607)	0.7675(2.1506)
DE_{japan} (-5)	1.6162(3.9220)	1.6389(3.5542)	1.8456(5.0053)
DE_{japan} (-7)	1.1287(2.6883)	0.4028(0.8573)	-0.2314(-0.6159)
DE_{japan} (-9)	0.9837(2.3927)	0.6635(1.4423)	0.9494(2.5807)
DE_{japan} (-10)	0.4484(1.1415)	1.3540(3.0802)	-0.0959(-0.2730)
DE_{euro} (-6)	0.5420(1.4888)	0.4272(1.0488)	1.1190(3.4350)
DE_{euro} (-7)	-1.5430(-3.9144)	-0.8352(-1.8936)	-1.1484(-3.2558)
DE_{euro} (-8)	0.7614(1.9605)	0.7956(1.8307)	1.0629(3.0585)
Adjusted R-squared	0.7363	0.8319	0.8045
F-statistic	10.7674	19.0937	15.8726
Akaike AIC	-2.4223	-2.1974	-2.6446
Schwarz SC	-1.9366	-1.7117	-2.1589
Akaike Information Criterion		-8.1225	
Schwarz criterion		-6.6655	

The value in parentheses is t-statistic for each estimated coefficient.

Table A.3
Results of the VAR Model for DT_t

Variables	DX_p	DI_p	DX_g	DI_g
DX_p(-1)	0.0692(0.4840)	-0.2256 (-1.5958)	-0.5137 (-2.5761)	-0.1751(-0.6091)
DX_p(-2)	0.0431 (0.3072)	-0.2089(-1.5035)	0.0567(0.2894)	-0.295 (-1.0480)
DI_p(-1)	0.2503(1.9499)	0.6802(5.3554)	0.5621 (3.1382)	-0.2381(-0.9221)
DI_p(-2)	0.0788(0.6317)	0.2202(1.7839)	-0.3727(-2.1413)	0.1572 (0.6265)
DX_g(-1)	-0.0627(-0.9474)	0.0298(0.4550)	0.5055(5.4735)	0.1224(0.9192)
DX_g(-2)	0.0276(0.4303)	-0.0270 (-0.4265)	0.2012(2.2495)	-0.0879(-0.6816)
DI_g(-1)	-0.0898 (-1.7440)	-0.1109 (-2.1764)	-0.3658(-5.0891)	0.4497 (4.3412)
DI_g(-2)	-0.0206 (-0.4011)	0.0092 (0.1816)	0.1703 (2.3752)	0.2908 (2.8137)
c	0.0785 (5.2594)	0.0524 (3.5505)	0.0761 (3.6546)	0.0631 (2.1029)
Diav	0.8380(7.5347)	1.2992(11.8049)	0.4306(2.7741)	0.9212(4.1176)
Diav (-1)	-0.4276(-3.2500)	-0.8632 (-6.6304)	0.0657(0.3578)	-0.3648(-1.3783)
DE_{euro} (-2)	-0.1253 (-0.4249)	-0.2215 (-0.7591)	-0.1496 (-0.3636)	-1.3902(-2.3433)
DE_{euro} (-7)	-0.2793(-0.9481)	-0.5246 (-1.7998)	-0.8019(-1.9507)	-0.5955 (-1.0051)
DE_{japan} (-2)	0.5471 (2.0590)	0.6029 (2.2928)	0.7710 (2.0790)	1.6522 (3.0910)
DE_{japan} (-5)	0.7449(2.9751)	0.6453(2.6044)	1.1537 (3.3019)	0.8514 (1.6906)
DE_{japan} (-7)	0.2691 (1.0156)	0.5409(2.0625)	1.2357(3.3413)	0.9701(1.8199)
DE_{japan} (-10)	0.8699 (3.6221)	0.6036(2.5395)	1.3513 (4.0316)	0.2880 (0.5962)
Adj. R-squared	0.7005	0.8154	0.7976	0.6999
F-statistic	17.5196	32.1965	28.8374	17.4738
Akaike AIC	-2.5552	-2.5762	-1.8886	-1.1574
Schwarz SC	-2.1472	-2.1681	-1.4806	-0.7494
Akaike Information Criteria			-8.4446	
Schwarz Criteria			-6.8125	

The value in parentheses is t-statistic for each estimated coefficient.

Table A.4
China's Total Exports under Scenarios I, II and III

Year (Scenario) (Unit: 0.1 billion USD)	Scenario I			Scenario II			Scenario III		
	Exports	Growth rate[a](%)	Changes in growth rate[b](%)	Exports	Growth rate[a](%)	Changes in growth rate[a](%)	Exports	Growth rate[a](%)	Changes in growth rate[a](%)
Jan.-Jun., 2005	3424	32.66%	-3.04%	3424	32.66%	-3.04%	3424	32.66%	-3.04%
Jul.-Dec., 2005	4203	25.36%	-9.81%	4203	25.36%	-9.81%	4202	25.33%	-9.84%
Jan.-Jun., 2006	4024	17.54%	-15.12%	3805	11.15%	-21.51%	3772	10.18%	-22.49%
Jul.-Dec., 2006	4919	17.03%	-8.33%	4370	3.97%	-21.39%	4308	2.52%	-22.82%
2005	7627	28.48%	-6.91%	7627	28.48%	-6.91%	7626	28.46%	-6.92%
2006	8943	17.26%	-11.22%	8175	7.19%	-21.28%	8080	5.95%	-22.51%

[a] Growth rate over the corresponding period of the previous year.
[b] Changes in growth rate compared with the corresponding period of the previous year.
The exports from January to July 2005 are real values.

Table A.5
China's Exports to Major Export Markets under the Scenarios

Year (Scenario) (Unit: 0.1 billion USD)	Scenario I			Scenario II			Scenario III		
	Exports	Growth rate (%)	Changes in growth rate (%)	Exports	Growth rate (%)	Changes in growth rate (%)	Exports	Growth rate (%)	Changes in growth rate (%)
China's exports to Asia									
Jan.-Jun., 2005	1,659	27.93%	-5.21%	1,659	27.93%	-5.21%	1,659	27.93%	-5.21%
Jul.-Dec., 2005	2,091	24.42%	-9.65%	2,060	22.63%	-11.45%	2,058	22.48%	-11.60%
Jan.-Jun., 2006	1,944	17.21%	-10.73%	1,752	5.61%	-22.32%	1,726	4.05%	-23.88%
Jul.-Dec., 2006	2,533	21.17%	-3.25%	2,195	6.54%	-16.08%	2,162	5.06%	-17.41%
2005	3,749	25.95%	-7.72%	3,719	24.94%	-8.73%	3,717	24.85%	-8.81%
2006	4,478	19.42%	-6.53%	3,947	6.13%	-18.81%	3,888	4.61%	-20.24%
China's exports to the EU									
Jan.-Jun., 2005	658	47.30%	3.38%	658	47.30%	3.38%	658	47.30%	3.38%
Jul.-Dec., 2005	810	33.65%	-14.04%	791	30.52%	-17.17%	790	30.31%	-17.38%
Jan.-Jun., 2006	785	19.31%	-27.99%	675	2.53%	-44.77%	660	0.27%	-47.03%
Jul.-Dec., 2006	1,006	24.26%	-9.39%	791	0.07%	-30.45%	771	-2.34%	-32.65%
2005	1,468	39.44%	-6.62%	1,449	37.64%	-8.42%	1,448	37.52%	-8.54%
2006	1,792	22.04%	-17.40%	1,466	1.19%	-36.46%	1,431	-1.15%	-38.68%
China's exports to the US									
Jan.-Jun., 2005	727	34.25%	-1.34%	727	34.25%	-1.34%	727	34.25%	-1.34%
Jul.-Dec., 2005	891	24.74%	-11.06%	879	23.18%	-12.62%	878	22.97%	-12.83%
Jan.-Jun., 2006	853	17.37%	-16.88%	752	3.50%	-30.75%	739	1.69%	-32.55%
Jul.-Dec., 2006	1,084	21.71%	-3.04%	919	4.53%	-18.65%	903	2.81%	-20.16%
2005	1,618	28.84%	-6.87%	1,606	27.95%	-7.75%	1,605	27.83%	-7.87%
2006	1,937	19.76%	-9.08%	1,672	4.06%	-23.89%	1,642	2.30%	-25.53%

Table A.6
Trading Forms under the Scenarios

Year (Scenario) (Unit: 0.1 billion USD)	Scenario I			Scenario II			Scenario III		
	Exports	Growth rate (%)	Changes in growth rate (%)	Exports	Growth rate (%)	Changes in growth rate (%)	Exports	Growth rate (%)	Changes in growth rate (%)
Exports through general trade									
Jan.-Jun., 2005	1462	36.86%	5.39%	1462	36.86%	5.39%	1462	36.86%	5.39%
Jul.-Dec., 2005	1675	22.41%	-13.26%	1644	20.12%	-15.55%	1639	19.80%	-15.87%
Jan.-Jun., 2006	1697	16.03%	-20.83%	1491	1.94%	-34.93%	1466	0.22%	-36.64%
Jul.-Dec., 2006	1983	18.38%	-4.03%	1656	0.78%	-19.34%	1624	-0.92%	-20.72%
2005	3137	28.75%	-5.05%	3106	27.46%	-6.33%	3102	27.28%	-6.51%
2006	3680	17.29%	-11.46%	3147	1.33%	-26.14%	3090	-0.38%	-27.66%
Exports through processing trade									
Jan.-Jun., 2005	1836	28.92%	-8.92%	1836	28.92%	-8.92%	1836	28.92%	-8.92%
Jul.-Dec., 2005	2256	21.43%	-12.73%	2229	19.99%	-14.17%	2225	19.77%	-14.39%
Jan.-Jun., 2006	2206	20.13%	-8.79%	2070	12.72%	-16.20%	2054	11.83%	-17.08%
Jul.-Dec., 2006	2743	21.58%	0.15%	2557	14.72%	-5.27%	2538	14.05%	-5.72%
2005	4093	24.68%	-11.05%	4066	23.86%	-11.86%	4062	23.74%	-11.99%
2006	4949	20.93%	-3.75%	4628	13.81%	-10.05%	4592	13.05%	-10.69%
Imports through general trade									
Jan.-Jun., 2005	1322	7.89%	-32.65%	1322	7.89%	-32.65%	1322	7.89%	-32.65%
Jul.-Dec., 2005	1423	13.67%	-10.62%	1416	13.11%	-11.18%	1413	12.92%	-11.37%
Jan.-Jun., 2006	1594	20.62%	12.73%	1489	12.67%	4.78%	1476	11.68%	3.79%
Jul.-Dec., 2006	1772	24.56%	10.89%	1664	17.55%	4.43%	1652	16.90%	3.98%
2005	2744	10.81%	-21.02%	2737	10.53%	-21.30%	2735	10.43%	-21.40%
2006	3366	22.66%	11.85%	3153	15.19%	4.66%	3128	14.38%	-3.94%
Imports through processing trade									
Jan.-Jun., 2005	1222	22.31%	-19.43%	1222	22.31%	-19.43%	1222	22.31%	-19.43%
Jul.-Dec., 2005	1368	12.22%	-19.52%	1352	10.97%	-20.77%	1350	10.77%	-20.97%
Jan.-Jun., 2006	1397	14.33%	-7.98%	1325	8.37%	-13.94%	1316	7.69%	-14.62%
Jul.-Dec., 2006	1574	15.09%	2.87%	1496	10.62%	-0.35%	1488	10.20%	-0.57%
2005	2590	16.77%	-19.30%	2575	16.08%	-19.98%	2572	15.97%	-20.09%
2006	2971	14.73%	-2.03%	2821	9.55%	-6.53%	2804	9.01%	-6.96%

References

Arize, A.C., 1996, "The impact of exchange rate uncertainty on export growth: evidence from Korean data", *International Economic Journal* 10, 49–60.

Bailey M.J., G.S. Tavlas and M. Ulan, 1987, "The impact of exchange-rate volatility on export growth: some theoretical considerations and empirical results", *Journal of Policy Modeling* 9, 225–243.

Burridge M., S. Dhar, D. Mayes, G. Meen, E. Neal, N. Tyrrel and J. Walker, 1991, "Oxford economic forecasting's system of models", *Economic Modelling* 8, 227–414.

Cheng S.W., R. Ho, S.Y. Wang and J. Zhang, 2003, "The empirical analysis of the impacts of US Dollar's exchange rate changes on Chinese exports", *Financial Systems Engineering*, S. Chen, S.Y. Wang, Q.F. Wu and L. Zhang, Hong Kong: Global-Link Publisher, 237–256.

Chou W.L., 2000, "Exchange rate variability and China's exports", *Journal of Comparative Economics* 28, 61–79.

Committee on the Global Financial System, 2000, "Stress testing by large financial institutions, current practice and aggregation issues", Bank For International Settlement CGFS Publications, No. 14.

Cushman D.O., 1983, "The effects of real exchange rate risk on international trade", *Journal of International Economics* 15, 45–63.

Gotur P., 1985, "Effects of exchange rate volatility on trade: some further evidence", IMF Staff Papers 32, 475–512.

Koray F. and W.D. Lastrapes, 1989, "Real exchange rate volatility and U.S. bilateral trade: a VAR approach", *Review of Economic Statistics* 71, 708–712.

Liu L.G., 2004, "A structural and macroeconomic approach to RMB's valuation", *China & World Economy* 12, 11–20.

Mckenzie, M.D., 1999, "The impact of exchange rate volatility on international trade flows", *Journal of Economic Surveys* 13, 71–106.

Park C.Y., 2005, "Coping with global imbalance and Asian currencies", ERD Policy Brief No.37, Asian Development Bank.

Sauer, C. and A.K. Bohara, , 2001, "Exchange rate volatility and exports: regional differences between developing and industrialized countries", *Review of International Economics* 9, 133–152.

Swift R., 2004, "Exchange rate changes and endogenous terms of trade effects in a small open economy", *Journal of Macroeconomics* 26, 737–745.

Viaene, J.M. and C. de Vries, 1992, "International trade and exchange rate volatility", *European Economics Review* 36, 1311–1321.

Wang P. and P. Dunne, 2003, "Real exchange rate fluctuations in East Asia, generalized impulse-response analysis", *Asian Economic Journal* 17, 185–203.

Wang S.Y., Z.Q. Wang and J. Zhang, 2003, "Stress testing analysis of the effects of Japanese yen's depreciation on Chinese exports", *Applied Economics Letters* 10, 185–190.

Zhang, Z., 2001, "Real exchange rate misalignment in China: an empirical investigation", *Journal of Comparative Economics* 29, 80–94.

Zhang S.G., 2005, "RMB exchange, appreciation and cost-benefit analysis", *Economic Research Journal* 40, 17–30.

Zheng G.H., L. Guo, X.M. Jiang and S.Y. Wang, 2005, "The impact of RMB's appreciation on China's trade and economy", Working Paper No. MADIS0511, Academy of Mathematics and Systems Science, Chinese Academy of Sciences, June.