The Effect of China's RMB Exchange Rate Movement on Its Agricultural Export: A Case Study of Export to Japan

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Abstract

This paper attempts to examine the relationship between changes and volatility of China's RMB exchange rates and its agricultural export. A model is constructed to analyze the effect of RMB exchange rate movements on agricultural exports facing two constraints including China's particular exchange rate system and TBT / SPS in agricultural trade. The model reveals that the net trade effect of RMB exchange rate movements relies on the comparison of exchange rate level change (appreciation or depreciation) effect and exchange rate risk effect.

Taking China's agricultural exports to Japan as a case, this paper makes an empirical examination. A GARCH (1, 1) model is specified to measure the exchange rate volatility and ADL regression with structural break dummy variables is estimated based on the results of unit root test with structural break. The results show RMB depreciation against yen will promote export growth while appreciation hinder export, and exchange rate volatility positively stimulates agricultural exports to Japan. However, the effect of exchange rate volatility on the export is much smaller than that of exchange rate level, which leads to a negative net effect to the export. The policy implications among the empirical results are also discussed.

Keywords: Exchange rate; Agricultural export; China

1 Introduction

Since the reform of Chinese RMB exchange rate formation mechanism in July 2005, Chinese RMB has been in frequent fluctuations and appreciating gradually. In this context, close attention has been paid to the impact of the RMB exchange rate fluctuations on China's export. Since each industry has its own characteristics, the exchange rate movements may have different effects on different industries. Therefore, as Klein (1990) pointed out, the impact of real exchange rate fluctuations on export trade must be further investigated in the commodity level. In general, compared to manufactured goods, agricultural products have such special industry nature as lower initial cost of investment, the existence of long-term contracts etc.. It is generally acknowledged that the impact of exchange rate movements on agricultural trade is different from that on manufactured goods trade. Gue, Sheldon & McCorriston (2002) has confirmed, compared to other industries, the real exchange rate uncertainty has a more significant negative effect on agricultural trade.

Then as for China, what is the effect of RMB appreciation and associated risks of volatility[1] on its agricultural export? A study on this issue has important academic and practical significance. On one hand, there are still no clear-cut theoretical and empirical conclusions on trade effects of exchange rate fluctuations among the economic community. Moreover, the vast majority studies have probed the trade effects of exchange rate fluctuations in developed countries and have neglected the study on those in developing countries like China. Developing countries have the characteristics different from the developed countries, such as the different exchange rate system, lack of a sound foreign exchange forward market, lack of effective financial derivatives, etc., which will impose important constraints on the behaviors of exporters. As for China, there are two important constraints: First, China runs particular foreign exchange management system; Second, China's agricultural exports have encountered serious TBT and SPS. This means the trade effects of exchange rate movements in developing countries should not be overlooked; On the other hand, the current appreciation of RMB will bring certain negative impact on China's agricultural economy and the welfare of farmers (Kong & Li, 2006), while farmers are still the majority of the population in China. Therefore, probing the effect of RMB exchange rate changes on the agricultural export has an extremely important practical significance.

Based on the above understanding, this paper, taking China’s agricultural exports to Japan as an case, attempts to explain the impact of RMB exchange rate level changes and volatility on China's agricultural exports.

2 Brief literature review

The study on the impact of exchange rate changes on agricultural trade is launched first by Schuh (1974), which made the fundamental argument that the exchange rate was

[1] Exchange rate volatility may be defined as the risk associated with unexpected movements in the exchange rate(McKenzie, 1999).

an omitted significant variable in economic analysis of the U.S. farm sector. After his pioneering research, a considerable amount of researches evaluated quantitatively the impact of nominal and real exchange rate on agricultural trade. In recent years, the representative research results includes Susanti (2001), (2003), Gervais, Larue & Olivier (2004), Mathew, Terry & Agapi (2006) etc.. Different empirical methods and exchange rate variables were used in these studies, but leading to the consensus: exchange rate fluctuations have significantly impeded agricultural trade flows, and compared to other sectors, such negative effect is more noticeable.

Some empirical literatures compared the different effects of exchange rate changes on agricultural sector and other sectors. Both Gue, Sheldon & McCorriston (2002) and Sheldon (2003) showed the different influences of exchange rate changes on machinery, chemicals, other manufacturing, and agriculture. Compared to other sectors, the negative impact on agricultural trade is much greater than for total trade or for any other specific sector studied. Donald, Mauricio & Bittencourt et al (2005) found the impacts of exchange rate volatility varied across sectors and were significantly negative on the agricultural trade. Some literatures only inspected the influences of exchange rate changes on agricultural sector trade, such as Jennifer (2006), Gu, Li & Zhong (1994), Song (2005). These studies reached similar conclusions, namely: Overall, the exchange rate changes significantly negatively affected agricultural trade.

Susanti (2001) and Mathew, Terry & Agapi (2006) investigated the effects of exchange rate changes on agricultural trade at both sector and product level. Susanti (2001) examined Indonesia’s total exports of agricultural products and five products export and revealed that all of them were significantly negatively affected by Indonesia's exchange rate movements. Mathew, Terry & Agapi (2006) investigated the total agricultural exports and 12 agricultural products such as maize exports of the United States and drew similar conclusions of negative effects.

Some researchers sought the evidence of negative effects of exchange rate movements on agricultural trade in the level of products. From the early investigation of Robert & Richard (1981) on American wheat, cotton and soybean to recent investigation of Jose, Kranti & Koo (2006) and Li & Li(2005) on soybean, the researchers investigated the impacts of exchange rate movements of a number of countries on their major agricultural trade flows including barley, wheat, pork, cotton, coffee, cocoa, living pig, corn etc.. These studies have generally supported the conclusion of the negative impacts of exchange rate movements on disaggregated agricultural trade. However, some studies (such as Anderson & Garcia，1989； Abdulkudos, 2003) indicated that, for a certain agricultural product, the impacts of exchange rate movements vary across countries, and for a certain country, the impacts vary across agricultural products as well.

In an era of floating exchange rate system, there are conflicting arguments in theory on if the volatility risk of exchange rate impedes international trade: some models find support for the negative hypothesis yet other models have been derived to support the positive hypothesis. The results of empirical studies which have focused on the exchange volatility are no less confusing but most of them support the negative effects. Sheldon (2003), Gervais, Larue & Olivier (2004) etc. indicated that the risk of exchange rate volatility significantly reduced agricultural trade flow. However, Jin, Gue & Koo (2003) showed that whether the effect of exchange rate volatility is positive or negative is related to the measurement of volatility and the effect of third country as well[1].

A number of Chinese researchers have made investigations on the influences of RMB exchange rate changes on China's agricultural trade with focus in two areas. One is to estimate J-curve effect and the exchange rate elasticity of import and export of agriculture-related products, including early studies of Cai (1994), Gu, Li & Zhong (1994) and recent studies of Song (2005) and Zhu, Tian & Wang (2006). The other is to simulate the impact of RMB appreciation on China's agricultural imports and exports within macro models, focusing the influences in different contexts of appreciation. Wei (2006) found the following results within a general equilibrium model: in a 5% appreciation scenario, agricultural exports fall 0.9 percent and imports increase by 1%; in a 20% appreciation scenario, agricultural export drops by 21%, import increases by 8.1%. Wang etc. (2005) showed that agricultural exports would be reduced by 580 million US dollars while imports increased by 2.8 billion dollars for 5% appreciation of RMB.

Although the above studies have achieved considerable success, there is still something that should be noticed. First, the theoretical models based on the assumptions of developed countries does not necessarily fit the circumstances of developing countries therefore these models need to be developed based on assumptions of developing countries; Second, close attention should be paid to possible structural break in data generating process (DGP) in order to prevent from "spurious cointegration"; Third, developing countries should receive more concern in future studies. There is still a big difference of the exchange rate system between the developing countries and developed countries, and agricultural exports have played a more important role on developing countries' economic development.

3 Model

This section will construct a model on the basis of Kawai (1981), Fabiosa (2002), Barkoulas & Baum et al (2002), Dekle & Jeong (2006). The impacts of both exchange rate level changes and the risk of exchange rate volatility will be incorporated into the model.

3.1 Monopolistic competition model

Below we present the basic monopolistic competition model of the exporting firm. Let China be the export country and the foreign country be the import country. A representative household of the foreign country consumes differentiated goods that are arranged on the unit interval, [0, 1]. Among the goods, goods z will be indexed for

[1] They used the autoregressive residuals, moving average of the standard deviation, ARCH, GARCH to measure volatility risks of exchange rate, and estimated equations with and without a third country effect.

China's agricultural product, where $0 < z < n$, and goods z^{*} [1] for foreign product, where $n < z^{*} < 1$. Assuming that domestic and foreign goods markets are segmented. The monopolistically competitive firm has the ability to engage in price discrimination by setting a domestic price for domestic sales that differs from the price it sets for exports (pricing-to-market). Based on the pricing-to-market model of Betts & Devereux (2000), we assume that the exporting firm sells h_{zt} units of output in the home market and exports x_{zt}^{s} to the foreign country. Total output of the exporting firm is

$$q_{zt} = h_{zt}^{s} + x_{zt}^{s} \tag{3.1}$$

The foreign representative household seeking to maximize utility gets utility from the CES aggregate consumption bundle Q_t^{*} at time t:

$$Q_t^{*} = \left[\int_0^1 q_{it}^{\frac{q-1}{q}} di \right]^{\frac{q}{q-1}} \tag{3.2}$$

Let $c_t^{*}(z)$ be the foreign representative household's consumption of the imported Chinese agricultural good z, and $c_t^{*}(z^{*})$ be the consumption of the foreign good z^{*}.Therefore (3.2) can be rewritten as:

$$Q_t^{*} = \left[\int_0^n c_t^{*}(z)^{\frac{q-1}{q}} dz + \int_n^1 c_t^{*}(z^{*})^{\frac{q-1}{q}} dz^{*} \right]^{\frac{q}{q-1}} \tag{3.3}$$

where $q > 1$ is the elasticity of substitution between the varieties.

The foreign money price index is

$$P_t^{*} = \left[\int_0^n p_t^{*}(z)^{1-q} dz + \int_n^1 p_t^{*}(z^{*})^{1-q} dz^{*} \right]^{\frac{1}{1-q}} \tag{3.4}$$

where $p_t^{*}(z)$ is the foreign currency price of good z; $p_t^{*}(z^{*})$ the foreign currency price of good z^{*}.The foreign demand for individual good z can be attained by maximizing Q_t^{*} subject to

$$p_t^{*}(z)c_t^{*}(z) + p_t^{*}(z^{*})c_t^{*}(z^{*}) = I_t^{*} \tag{3.5}$$

where I_t^{*} is a total nominal expenditure such that

$$x_t^{d} = c_t^{*}(z) = \left[\frac{p_t^{*}(z)}{p_t^{*}} \right]^{-q} \frac{I_t^{*}}{p_t^{*}} = \left[\frac{p_t^{*}(z)}{p_t^{*}} \right]^{-q} Q_t^{*} \tag{3.6}$$

[1] * means this variable is set for the foreign country in this paper.

3.2 Export supply function

The exporting firm uses domestic inputs and imported inputs to produce the export good z. Following Pick (1990), assuming a constant input-output ratio d for imported inputs k_t^f, the output can be presented as

$$q_{zt} = d\,k_t^f \tag{3.7}$$

Thus, given linear cost function[1],

$$C(w_t, w_t^*, q_{zt}) = w_t\,q_{zt} + w_t^* e_t \frac{q_{zt}}{d} \tag{3.8}$$

Where w_t is the price index for domestic inputs and w_t^* price index for imported inputs.

Considering that TBT and SPS have severely hampered the growth of China's agricultural export, TBT and SPS factors must be introduced into the model. Because of TBT and SPS agricultural exporters have to pay additional costs in order to satisfy a new technology or other requirements, thus, the cost function is amended as follows:

$$C(w_t^b, w_t, w_t^*, q_{zt}) = w_t\,q_{zt} + w_t^* e_t \frac{q_{zt}}{d} + w_t^b q_{zt} \tag{3.9}$$

Where w_t^b is the shared unit additional cost in local currency due to TBT/ SPS.

Assume there is no foreign exchange forward market to hedge for the firm facing exchange rate changes and the risks of unanticipated changes in exchange rate[2]. The exchange rate e_t is assumed to have a normal distribution, $e_t \sim N(e, s_e^2)$. The firm's net profit in RMB is defined as revenue less cost, that is,

$$p_t = h_{zt}^s p_t(z) + x_{zt}^s p_t^*(z) e_t - (w_t^b + w_t + d^{-1} w_t^* e_t)(h_{zt}^s + x_{zt}^s) \tag{3.10}$$

From (3.10), profit is also normally distributed with mean p and variance s_p^2.

The objective function of the firm is to maximize the utility on the basis of profits. Assuming the firm is risk aversive, along with Fabiosa (2002), given a CARA utility function[3], the expected utility can be expressed in the form

$$E(v) = -e^{-l\left(p - 0.5\,l\,s_p^2\right)} \tag{3.11}$$

It is a common result that the maximization of (3.11) can be equivalently expressed as

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[1] There are different assumptions about the form of cost function in available literatures. Some studies such as Kawai (1981) were based on linear form; some assumed that the cost was a quadratic function of the output, such as Fabiosa (2002); Dekle & Jeong (2006) used amended nonlinear C-D cost function.

[2] China's forward foreign exchange market develops slowly and it is not easy to avoid exchange rate risk through forward foreign exchange market operations for Chinese firms.

[3] As for utility function, Clark (1973) assumed that utility was a quadratic function of profits; Kawai (1981) assumed utility equaled the mean less the variance of profit; Fabiosa (2002) used a CARA form.

$$\begin{aligned} \underset{(h_{zt}^{s}, x_{zt}^{s})}{Max} \; \{ & h_{zt}^{s} p_t(z) + x_{zt}^{s} p_t^{*}(z) e - (w_t^{b} + w_t + w_t^{*} e d^{-1})(h_{zt}^{s} + x_{zt}^{s}) \\ & - 0.5 l [x_{zt}^{s} p_t^{*}(z) - d^{-1} w_t^{*} (h_{zt}^{s} + x_{zt}^{s})]^2 s_e^2 \} \end{aligned} \tag{3.12}$$

The solution to the first-order conditions gives

$$p_t(z) - p_t^{*}(z) e + l s_e^2 p_t^{*}(z) [x_{zt}^{s} p_t^{*}(z) - d^{-1} w_t^{*} (h_{zt}^{s} + x_{zt}^{s})] = 0 \tag{3.13}$$

Using (3.13), comparative static analysis gives

$$\frac{\partial x_{zt}^{s}}{\partial e_t} = \frac{1}{l s_e^2 [p_t^{*}(z) - d^{-1} w_t^{*}]} > 0 \tag{3.14}$$

$$\frac{\partial x_{zt}^{s}}{\partial s_e^2} = \frac{x_{zt}^{s} p_t^{*}(z) - d^{-1} w_t^{*} (x_{zt}^{s} + h_{zt}^{s})}{s_e^2 [p_t^{*}(z) - d^{-1} w_t^{*}]} \tag{3.15}$$

That is, it is expected that an increase in the level of the exchange rate increases supply, while the impact of volatility in the exchange rate on export supply is not definitive, depending on the comparison of $x_{zt}^{s} p_t^{*}(z)$, the export foreign exchange earnings, with $d^{-1} w_t^{*} (x_{zt}^{s} + h_{zt}^{s})$, the total foreign exchange expenditure for imported inputs[1].

Using the solution to the first-order condition in (3.12) and equation (3.6), the supply function for export good z is given by

$$x_t = x_{zt}^{s} = g(\overset{+}{e_t}, \overset{+}{p_t^{*}}, \overset{+}{Q_t^{*}}, \overset{-}{w_t}, \overset{-}{w_t^{*}}, \overset{-}{w_t^{b}}, s_e^2) \tag{3.16}$$

Where the signs of “+” and “-” refer respectively to positive and negative elasticity, but for s_e^2, $\frac{\partial x_t}{\partial s_e^2} > 0$ or $\frac{\partial x_t}{\partial s_e^2} < 0$ or $\frac{\partial x_t}{\partial s_e^2} = 0$.

That is, agricultural export volume is determined by four factors: 1) the nominal exchange rate e_t and associated exchange rate risk s_e^2; 2) foreign demand Q_t^{*}; and the foreign market price level p_t^{*}; 3) the price index for domestic inputs w_t and the price index for imported inputs w_t^{*}; and 4) w_t^{b}, TBT/SPS in agricultural trade .

4 Empirical estimation

4.1 Empirical specification

To capture the dynamics, following Fang & Lai (2001), the empirical framework is

[1] This conclusion is specially related to the model assumptions: both the exported good and imported raw materials are priced in foreign currency.

specified as an autoregressive distributed lag (ADL) process combined with a GARCH (1,1) model used for the measurement of exchange rate volatility risks.

$$\ln x_t = w + \sum_{i=1}^{a} l_i \ln x_{t-i} + \sum_{i=0}^{b} a_i \ln e_{t-i} + \sum_{i=0}^{c} b_i s^2_{e,t-i} + \sum_{i=0}^{d} d_i \ln p^*_{t-i} + \sum_{i=0}^{f} g_i \ln Q^*_{t-i} + \sum_{i=0}^{h} y_i \ln w_{t-i} + \sum_{i=0}^{j} j_i \ln w^*_{t-i} + \sum_{i=0}^{k} h_i w^b_{t-i} + e_{x,t} \quad (3.17)$$

$$e_t = u_0 + u_1 e_{t-1} + e_{e,t} \quad (3.18)$$

$$s^2_{e,t} = f_0 + f_1 \cdot e^2_{t-1} + f_2 \cdot s^2_{e,t-1} \quad (3.19)$$

Equations (3.17)–(3.19) constitute two-step estimation with $s^2_{e,t}$ generated by (3.18)–(3.19) and then used in (3.17) to estimate its effect on export. As Fang & Miller (2004) pointed out, the statistical significance and sign of the estimated a_i and b_i coefficients in equation (3.17) provide a simple and straightforward test of the relationship between real export growth and exchange rate depreciation and its volatility. If $\sum_{i=0}^{b} a_i > 0$, then exchange rate depreciation improves exports. If $\sum_{i=0}^{c} b_i < 0$, exchange rate volatility reduces exports through exporters' responses to perceived risk, while $\sum_{i=0}^{c} b_i > 0$ it stimulates exports. The equation also shows that the net effects relies on the comparison of exchange rate level change effect and exchange rate risk effect..

4.2 Data sources and processing

This paper employs bilateral agricultural exports from China to Japan on a monthly basis from January 2002 to April 2007. Seasonally adjusted real agricultural export revenue with base month January 2002 equals nominal export revenue in U.S. dollar deflated by the consumer price index (CPI) of the U.S. and the export price index. CPI comes from the International Financial Statistics and Direction of Trade of the IMF, nominal export revenue and the export price index from the Monthly Statistical Report on China's Agricultural Import and Export.

The monthly average of bilateral nominal exchange rate, defined as the RMB price of the Japan yen, is calculated based on the bilateral nominal exchange rate of RMB against the U.S. dollar and the Japan yen against the U.S. dollar. The data come from ERS of the United States Department of Agriculture. The exchange rate volatility is calculated by GARCH(1,1) model. Foreign price level equals the CPI of Japan from the Statistics Bureau of the Ministry of International Affairs and Communications of Japan. Foreign demand equals Japan monthly industrial production index from the EuroStats.

We also calculate the purchasing price index of agricultural material products with base month January 2002 from China's Economic Statistics Bulletin and substitute it for the price index of domestic inputs. The price index for imported inputs is substituted by the world agricultural raw materials index from IFS of the IMF. The number of restrictions in frequency measures is employed for quantifying the TBT/SPS, on the basis of the number of SPS and TBT in agricultural trade notified to the WTO by Japan.

The raw data come from WTO/TBT-SPS Notification and Enquiry of China.

4.3 Unit root test and parameter Estimation

Non-stationary and unit root tests are conducted to avoid spurious regression. The tests follow two steps: First, all the data of variables are tested using ADF test without structural changes; Second, those non-stationary variables in ADF test will be further tested employing unit root test with structural break contributed by Perron (1989).The results of unit root test indicate that all the variables are stationary except that nominal exchange rate, the price index for domestic inputs and the price index for imported inputs are stationary variables with structural break[1]. Therefore, we introduce the structural break dummy into the regression equation. Among these break dummies, DU^{e}_{0501} and DT^{e}_{0501} are respectively the intercept dummy and the slope dummy of nominal exchange rate, DU^{w}_{0307} and DU^{w*}_{0303} respectively the intercept dummy of the price index for domestic inputs and the price index for imported inputs.

Table 1 Results of parameter estimation

Variable	coefficient	Std. Error	t-statistic	Prob.
Agricultural export (-1)	-0.912174	0.147570	-6.181285	0.0000
Agricultural export (-2)	-0.906026	0.185431	-4.886063	0.0000
Nominal exchange rate	2.752423	0.548562	5.017520	0.0000
Nominal exchange rate (-1)	-1.975862	0.557367	-3.544992	0.0012
Nominal exchange rate (-2)	1.164885	0.367640	3.168550	0.0034
Nominal exchange rate (-5)	0.842774	0.283463	2.973139	0.0056
exchange rate volatility (-3)	123.8748	54.74149	2.262905	0.0306
exchange rate volatility (-5)	130.5264	66.75569	1.955285	0.0593
exchange rate volatility (-6)	-189.6536	66.78196	-2.839893	0.0078
Foreign demand	-2.318674	0.667581	-3.473246	0.0015
Foreign demand (-2)	3.408787	0.850856	4.006301	0.0003
Foreign demand (-3)	4.692517	1.178295	3.982463	0.0004
Foreign price level	-8.202678	3.674486	-2.232333	0.0327
Foreign price level (-1)	11.60420	3.268355	3.550472	0.0012
The price index for domestic inputs (-1)	-1.043216	0.449366	-2.321527	0.0268
The price index for domestic inputs (-2)	-1.036991	0.473977	-2.187850	0.0361
The price index for imported inputs (-1)	-2.165033	0.472288	-4.584141	0.0001
The price index for imported inputs (-3)	1.667806	0.445045	3.747499	0.0007
TBT/SPS	-0.019918	0.003718	-5.357730	0.0000

[1] The details omitted here because of words limits are available from the author.

TBT/SPS (-1)	-0.015462	0.003844	-4.022677	0.0003
TBT/SPS (-2)	-0.013350	0.003854	-3.464245	0.0015
TBT/SPS (-3)	-0.010300	0.004230	-2.435112	0.0206
C	-30.33920	14.68518	-2.065975	0.0470
DU^{e}_{0501}	0.097059	0.027791	3.492431	0.0014
DU^{w*}_{0303}	-0.102313	0.031165	-3.282934	0.0025
R-squared	0.793915	AIC	-3.034269	
Adjusted R-squared	0.639351	SC	-2.138194	
Log Likelihood	111.4767	F-statistic	5.136478	
D.W.	2.299408	Prob.（F statistics）	0.000013	
Q statistic(-1)	1.8114	possibility	0.178	
Q statistic (-3)	4.3655	possibility	0.225	
Q statistic (-6)	7.5566	possibility	0.272	

Note：Number in parentheses is the number of lags.

4.4 Findings and further discussion

The results show that both the bilateral nominal exchange rate and its volatility risk are important factors affecting China’s agricultural export to Japan. In general, exchange rate exhibits the expected positive effect, which means that the depreciation of RMB against Yen will increase the export of agricultural products while the appreciation will reduce the export. The significance of nominal exchange rate level with 5 lags indicates the impact of exchange rate changes lasts relative long period of up to five months. This coordinates with the features of a long production cycle and a long period of delivery of the majority agricultural products.

Exchange rate volatility risk, in general, possesses a significantly positive impact on agricultural exports, indicating that exchange rate risk will increase the exports instead of negatively decreasing the export as usually expected. Exchange rate risk variables with 3 lags and 5 lags exhibit significantly positive signs while the variable with 6 lags shows significantly negative sign, which implying that, on one hand, agricultural exporters might be risk preferred and increase exports when facing the increased exchange rate risk; On the other hand, as DeGrauwe (1988) pointed out that high degree of risk aversive exporters, fearing the drastic decline of export earnings, may increase exports when facing increased risk of the exchange rate, other low degree of risk aversive exporters, however, reduce exports because of lower exports earnings associated with increased risk.

In addition, the above results imply that the exchange rate level changes make a rapid and lasting effect on agricultural exports to Japan, especially a strong impact in a short term, while the exchange rate risk appears to have a strong effect in a longer period instead of a short term. Therefore, in a short term, the effect of exchange rate movements on agricultural export is completely determined by the changes of exchange rate level, but in a relatively longer period, jointly by the changes of both exchange rate level and its volatility risk.

The net effects of exchange rate on agricultural exports depend on the comparison of the effect of exchange rate level changes and its volatility risks. Figure 1 and Figure 2 display respectively the effect of exchange rate level changes and its volatility risks from September 2002 to April 2007.

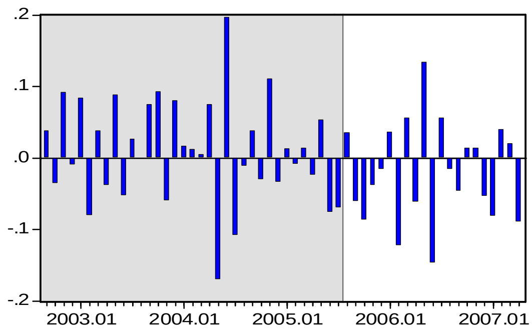

Figure 1 The monthly effect of exchange rate level changes on agricultural export

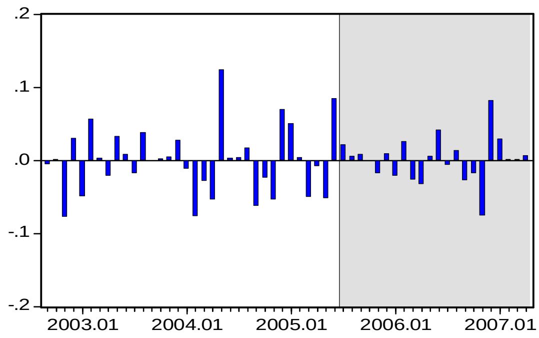

Figure 2 The monthly effect of exchange rate volatility on agricultural export

From Figure 1, the effects of exchange rate level changes on agricultural export fluctuate with mixed positive effect of RMB depreciation and negative effect of appreciation due to the frequent changes of exchange rate. Before the reform of RMB exchange rate formation mechanism in July 2005, it can be found that, there are more positive effects than negative effects, but the contrary after the reform. This is because RMB exchange rate against Yen had been in an upward trend (depreciation) till July 2005 but has been in a downward trend (appreciation) after July 2005. In addition, the magnitude of the effect before July 2005 is larger than that after July 2005, the explanation is that the reform of exchange rate formation mechanism make changes in the exchange rate level more gentle.

Figure 2 shows that exchange rate risks exhibit the monthly effect with a mixture of positive and negative effects. Besides, when comparing Figure 2 with Figure 1 (same calibration), we find that, on the whole, the effects of exchange rate level changes are much larger than that of exchange rate risks, which indicates that, despite the positive effect of increased exchange rate risk on agricultural export, the effect of exchange rate level changes dominates the exchange rate risk effect in magnitude, leading to a net effect (Figure 3) dominated by the former.

However, Figure 1 to Figure 3 fail to display the effect of RMB exchange rate movements on China's agricultural exports to Japan in a longer period of time because the effects are calculated using monthly data. Therefore, the cumulative effects from September 2002 to June 2005 (RMB depreciation period) and from July 2005 to April 2007 (appreciation period) are calculated as depicted in Figure 4. From September 2002 until June 2005, the cumulative effects of exchange rate level changes are in a rising trend, meaning that the depreciation generally has promoted China's exports of agricultural products to Japan. But from July 2005 to April 2007, the cumulative effects are of obviously increasing negative, indicating that the RMB appreciation during this period has hampered the exports.

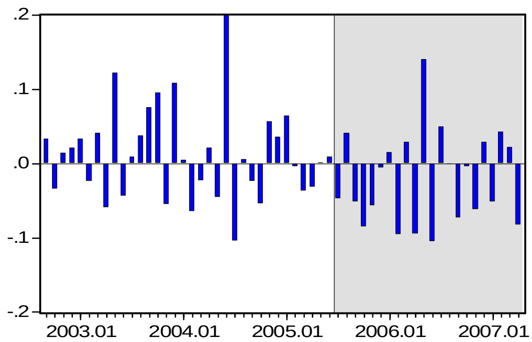

Figure 3 The monthly net effect of exchange rate movements on agricultural export

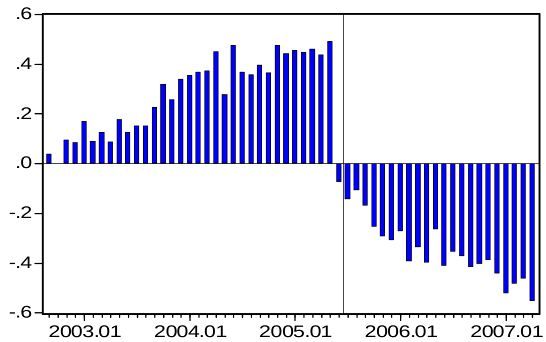

Figure 4 The cumulative effects of RMB depreciation and appreciation on export

5 Conclusions and policy implications

This paper attempts to examine the relationship between changes and volatility (risks) of China's RMB exchange rates and its agricultural export. Empirical results indicate that the RMB appreciation after exchange rate formation mechanism reform in July 2005 possesses a significantly negative impact on China’s agricultural exports while the exchange rate volatility risk, in general, possesses a significantly positive impact. However, exchange rate risk effect is much smaller than that of exchange rate level changes, the net effect of exchange rate movements has been dominated by the latter, meaning that RMB appreciation is still a main factor in determining China’s agricultural export to Japan.

Therefore, the negative impact of RMB exchange rate movements on China’s agricultural export should not be underestimated. It is very essential for the government to adjust its policy. Due to the difficulty of exchange rate policy adjustment, the government can start from agricultural policy adjustment to reduce or relieve the negative effect of exchange rate movements. According to the dominant negative effect of RMB appreciation, policy adjustment in short term is to further improve the support system of agricultural export so as to reduce the unit cost of agricultural export. While policy adjustment in long term lies in improving the quality and advancing technology of agricultural products, which will upgrade price competitiveness to quality competitiveness.

In addition, special attention is paid to exchange rate risk. Although this paper finds that the risk of nominal exchange rate volatility positively affects China’s agricultural exports to Japan, the possibility that the majority of small and medium manufacturers are risk aversive and will reduce export in the face of increased risk of exchange rate, can not be excluded because of the use of aggregate data. Thus, the government cannot neglect the stability of foreign exchange market. Meanwhile, providing guidance and financial instruments of foreign exchange for risk aversive exporters is also important to minimize foreign exchange rate risk and maintain stable growth of agricultural export.

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