Can Appreciation of RMB Improve Trade Status of Sino Japanese and Sino-U.S.? 
Studies Based on Pass-Through Effect of Exchange Rate

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Abstract

Some scholars argue that the undervalued RMB is the key factor which results in Chinese trade surplus and global imbalance. So the appreciation of RMB can improve trade status between China and the West. Obviously, the logics inside this argument are that the appreciation of RMB will increase the export prices from China, and reduce the relative prices of foreign goods and service, that is to say the pass-through effect of the appreciation RMB is great. Through studying the pass-through effect of RMB, this paper founds that the appreciation of RMB cannot improve American trade status, but Japanese trade status. The reasons for this difference between America and Japan lay in the different pricing in trade.

Keywords: RMB Appreciation, Pass-Through Effects, Trade Status, Exchange Rate.

1. INTRODUCTION

Before July 2005, the policy of RMB exchange rate, which only peg against dollar, had attracted a great deal of criticisms which regarded that fixed exchange rate artificially suppresses the value of the RMB, so unfairly raised the competitive advantage of Chinese exports. Even some scholars advocated that the undervalued RMB was one of the most important factors of Chinese trade surplus and global trade imbalances, and the appreciation of the RMB is one of the effective methods to solve Chinese and western trade imbalance (Li et al., 2017; Xiao and Chankong, 2017).

Recently, the exchange rate of RMB has depreciated sharply against the dollar especially after the middle of November 2016(Figure1). Then the issues of RMB exchange rate once again became the focus of attentions.
of the west academics and policy makers. Although different scholars or politicians have their own different expressions, their core meanings are consistent with each other and generally agreed that the RMB depreciation robbed of their jobs, worsened the terms of trade of other countries, and put their enterprises in the unfair competitive position. For example, the President-elect Donald Trump accused China on Dec. 4, 2016 of deliberately belittling the value of the RMB, which had deteriorated the terms of trade of the United States and pushed the American companies in an unfair competitive position.

Can appreciation of RMB improve trade status of Sino-Japanese, and Sino-U.S.? Basing on pass-through effects of exchange rates, the paper tries to answer this question.

2. INTERNAL LOGIC ANALYSES OF THE QUESTIONS

The internal logic of these views is very clear, that is the appreciation of the RMB will raise the price of Chinese exports as well as reduce the price of imported goods and services. As the change of relative price levels, foreign demand for Chinese goods will decline, but China's demand for foreign goods and services will rise, as a result, China's trade surplus will decrease, trade status of China's trading partners must be improved.

Obviously, whether this logic founds or not mainly depends on to what extent the appreciation of the RMB can be conducted to the trading partner import prices. There is a core of conception of pass-through effect of exchange rate. The pass-through effect of exchange rate refers to the percentage changes in imports price denominated in the local currency caused by the 1% exchange rate changes between the import and export countries. If the import prices react to the exchange rate change one by one, it is completely pass-through effect. In fact, the size of the exchange rate pass-through effect is a complex problem.

On the one hand, when the relative price of Chinese export commodities rises due to the appreciation of the RMB, the Chinese exporters may alleviate the price pressure from the appreciation of the RMB by sacrificing profits. In this case, the prices of Chinese exports could change very little. In other words, the transmission mechanism from appreciation of currency to trade balance depends on the pass-through effect of exchange rate. If it could not be conducted to export prices, the impact of appreciation of the RMB on trade deficit of Chinese trading partners and the global imbalance is very small.

On the other hand, the real exchange rate is the difference between nominal exchange rate and the relative price. Basing on the assumption of completely pass-through effect, many scholars and politicians emphasize the changes in nominal exchange rate of RMB, as well as the influence on export. The pass-through effect is the first step from changes in nominal exchange rate to the actual export and trade balance. So the underlying premise of prophesies of these scholars and politicians is that the relative price between China and its trading partners is fixed. Therefore, we cannot assert that the RMB exchange rate appreciation will inevitably lead to Chinese export commodities prices raise.

3. LITERATURES REVIEW

The theoretical studies about the pass-through effect of exchange rate relay on the model of industrial organization and emphasize the market structure and price behavior. Basing on the assumption that the shocks of exchange rate are exogenous, literature (Dornbusch, 1987) indicated that the stronger the industry competition, the greater the pass-through effects of exchange rate, and the greater the share of imports in total sales, the greater the pass-through effect of exchange rate. (Yang, 1997) utilized the adaptive Dixit-Stiglit model to expound the role of the productive difference in deciding the behaviour of pass-through effect of exchange rate and concluded that the pass-through effects of the industries which have greater productive difference as well as lower elasticity of marginal cast maybe greater.

According to literature (Goldberg and Kneter, 1997), it must meet two necessary conditions for changes in exchange rate to produce completely pass-through effect. Firstly, the marginal costs of export commodities are fixed, and second, the prices of export commodities are fixed gains based on the marginal costs. Under these conditions, exporters will be passed on any gains resulted from changes in exchange rates to the purchasers, to ensure the complete pass-through effect of exchange rates.

In a dynamic model, (Klempererm and Exchange, 1989) linked the pass-through effect of exchange rates to the company's market share, and tested the differences between the impacts of temporary changes in exchange rates
on the price behaviours of export companies and that of permanent changes in exchange rates. They founded that if the export companie can predict the changes in exchange rates be temporary, the pass-through effect of exchange rate will be lower. On the other hand, when the domestic currency appreciating, in order to maintain market share, permanent exchange rate changes will encourage export companies to reduce the export prices.

There are a lot of empirical studies to estimate the pass-through effects of exchange rate, but most of the studies are concentrated in industrialized countries. For example (Campa and Goldberg, 2005) tested the impacts of pass-through effects on export prices among 23 OECD countries. They concluded that company strategic behaviours play a vital role in deciding the pass-through effects of exchange rate.

In order to maintain price stability, the companies may adjust the price gainsto absorb shocks resulted from change in exchange. This is the so called "price - market" (PTM) as mentioned in many literatures. (Knetter, 1993) studied the working mechanism of PTM, and asserted that the currencies of exporters appreciated against the currencies of importers, the exporters would reduce the export prices to stabilize the import prices. Market competition and elasticity of demandforce exporters to constraint their price behaviours, which limited the pass-through effects from the changes in exchange rates to the import prices of trade partners. (Gagnon and Knetter, 1991) researched and concluded that during the Japanese auto export, about 70% impacts of the changes in exchange rate would be offset through export prices adjustment. So the pass-through effects of Yen to importers of Japanese goods are insignificant.

In addition to reduce the pricing power, Taylor (2000) suggested that the reasons for inflations declining in many countries could be due to lower pass-through effects. A lower inflation environment reduces the expected the sustainability of changes in cost and prices, which resulted even lower pass-through effects of exchange rates. Through testing the prices behaviour dominated by local currency, (Vigfusson et al., 2007) found that it was stronger for the United States export prices to react to the changes in exchange rates than these of other countries. About the pass-through effects of exchange rates, there are a large number of theoretical and empirical literatures, but most of the researches focused in the industrialized countries, such as the United States, Japan and Germany. Of course, there are some exceptions, for example (Goldberg and Tille, 2005).

4. DISTINCT RESULTS: THE HISTORICAL VIEWS

Since July 2005, China has translated the system of RMB exchange rate which pegged only to dollar into to peg world main currencies basket. This innovation opened the door of appreciation of the RMB. What happened during the period of appreciation of the RMB?

We normalize both exchange rate of RMB against dollar and the price index of imported commodities from China to 100 in 2004. Figure 2 shows the monthly statistics of exchange rates of RMB against the dollar, as well as the American price index of imported commodities from China during 2005-2010. By the end of December 2010, the nominal exchange rate of RMB against the dollar gradually dropped from 8.3 to 6.5, the cumulative appreciation of 21%. But the price index of imported commodities from China only raised 4.5% during the period. Obviously the commodities price index imported from China responded indistinguishly to the appreciation of RMB.

![Figure 2. Exchange Rate of RMB/dollar and CPI Imported from China(Data from: US Bureau of Labor Statistics, 2010)](image-url)
Before July 2005, the fluctuations of exchange rate of the Japanese yen against RMB mainly reflect fluctuations of the exchange rate of the Japanese yen against the dollar, because the exchange rate of RMB against the dollar is fixed. The fluctuation of exchange rate of the Japanese yen against RMB is very big before 2005. From August 1998 to October 1999, the RMB depreciated against the Japanese yen, falling to 15.6 from 12.4. Then the RMB began to appreciate to 16.1 in February, 2002. After then the exchange rate began to depreciate again until to 12.5.

Figure 3 shows the Japanese price index of all imported commodities from China. Because of the high volatility of the exchange rate the Japanese yen against the RMB, the Japanese price index of all commodities imported from China, as well as the price index of manufactured commodities imported from China responded significantly. Obviously, the correlation coefficient between the exchange rate and the Japanese price index imported from China is very high.

From these two distinct historic facts, we see that whether the appreciation of RMB can improve Chinese the terms of trade of trade partners is ambiguous.

\[
p^{ex} = (1 + \Delta)MC
\]

(1)

Obviously, the imported prices which are paid by the foreign exporter for Chinese goods are twins of the prices of Chinese exported goods under certain under the specific exchange rate. We assume that the nominal exchange rates denoted by \( E \), which is the number of RMB measured by a unit foreign currency. Then the value of the imported prices of Chinese goods from the perspective of foreign importers can be expressed:
\[ p_{im} = E(1 + \Delta)MC \]  
\[ (2) \]

We take logarithm on both sides of the equation (2), and the corresponding lowercase letters corresponding to the numerical:

\[ p_{im} = e + \delta + mc \]  
\[ (3) \]

Basing on function (3), we can test the pass-through effect of exchange rate through the following econometric model:

\[ p_{it} = \alpha + \beta e_{it} + \gamma mc_{it} + \epsilon_{it} \]  
\[ (4) \]

The coefficients of the exchange rate calculate the size of imported prices reacting to the changes in exchange rate. If \( \beta \) equals to 1, then the pass-through effect is complete. If \( \beta \) is smaller than 1, then the pass-through effect is incomplete. In order to get import prices gradually adjust and control the instability of all potential variables, we deal with the function (4) through a first order difference, as well as considering the lagging marginal cost and lagging nominal exchange rate:

\[ \Delta p_{it} = \alpha + \sum_{i=0}^{m} \beta_i \Delta e_{i-1} + \sum_{i=0}^{k} \gamma_i \Delta mc_{i-1} + \epsilon_{it} \]  
\[ (5) \]

In the above dynamic model, \( \beta_0 \) measures the elasticity of the exchange rate to import price in the short-term, while the cumulative coefficient \( \sum_{i=0}^{\infty} \beta_i \) of exchange rate measures the elasticity of the exchange rate to import price in the long-term.

Through function (5), we first test the pass-through effect of the appreciation of RMB on the economies of the United States and Japan. The selected sample period is from the third quarter of 2005 to the third quarter of 2016. The empirical researches involve three variables, namely price index \( p \), exchange rate \( e \) and the marginal costs of China’s exporters \( mc \). The correspondingsources of data of various variables are as follows:

The import price indexes of commodities imported from China come from the Labor Statistics agency (US Bureau of Labor Statistics). The marginal costs of China’s exporters have no direct statistical data, sowe use the unit labor costs as the alternative of marginal costs. However even the costs of unit labor are not available too, so we use a month's producer price index (PPI) as the alternative of the marginal costs. Some scholars had proved that such replacement is reasonable, which generated little impact on the empirical results, for example (Jabara,2009; Marston, 1990) also used the PPI or CPI as the alternatives of the marginal costs in their research. The exchange rates of RMB against dollar and the Japanese yen come from the website of the Customs of the People’s Republic of China (http://www.customs.gov.cn). The Japan’s Ministry of the Treasury not only compiled the index of prices of imported goods from China, but also created different kinds commodity price index. These data can be available on its website too.

6. THE EMPIRICAL RESULTS

In empirical researches, both the exchange rates of RMB against dollar and the Japanese yen are indirect quotation, namely a unit RMB. So the numerical values rise means the appreciation of RMB against both currencies. If the estimated coefficients of exchange rates and the lagging exchange rates are positive and statistically significant, then the pass-through effects of RMB on the American and Japanese economies exist.

We use Akaike information criterion (referred to as AIC) to determine the optimal lag. The model does not include the lagging terms and we gradually add the lagging terms in the model. Once the AIC value begins to rise, it reaches the optimal lag, without adding more lagging terms again. Because the all variables are time series, the article adopts the ADF test first, and the results are showed in table 1.
Table 1 ADF Test of Variables

<table>
<thead>
<tr>
<th>Variables</th>
<th>Observed values of the sample</th>
<th>First-order differences of the sample</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>The fixed values</td>
<td>The fixed values</td>
</tr>
<tr>
<td></td>
<td>with tendency</td>
<td>without tendency</td>
</tr>
<tr>
<td>Yen/RMB</td>
<td>-3.89659</td>
<td>-0.19685</td>
</tr>
<tr>
<td>Chinese PPI</td>
<td>-3.01807</td>
<td>-2.95183</td>
</tr>
</tbody>
</table>

(Note: for the model with the linear tendency, the critical values corresponding to 1%, 5% and 10% statistically significant levels are 4.12, 3.49 and 3.49 respectively, while for the model without the linear tendency, the critical value are 3.55, 2.91 and 2.91 respectively.)

Tested results show that the observed values of the variables are not stable, but the first-order differences are stable. Therefore, it is appropriate for us to use the first-order differences of variables to test. For the United States, exchange rate, the optimal lag of exchange rate (Δε) is 2, and the optimal lag of the marginal cost (Δmc) is 1. Tested resultsof the pass-through effect of RMB on the American economy are shown in table 2.

Table 2 The Pass-through effects of RMB on the US Price Index of Commodities Imported from China

<table>
<thead>
<tr>
<th>Variable</th>
<th>Δε$t^{S/RMB}$</th>
<th>Δε$t_{t-1}^{S/RMB}$</th>
<th>Δε$t_{t-2}^{S/RMB}$</th>
<th>Δmc</th>
<th>Δmc$_{t-1}$</th>
<th>Adj R$^2$</th>
</tr>
</thead>
<tbody>
<tr>
<td>coefficient</td>
<td>0.319a(0.066)</td>
<td>0.325(0.126)</td>
<td>0.322a(0.082)</td>
<td>0.030(0.023)</td>
<td>0.051b(0.054)</td>
<td>0.891</td>
</tr>
</tbody>
</table>

(Note: a, b and c denote the statistically significant levels of 1%, 5% and 10% respectively. The values showed in parentheses are standard deviations.)

The estimated coefficients of the exchange rate (Δε$t^{S/RMB}$), the one-lagged exchange rate (Δε$t_{t-1}^{S/RMB}$) and the two-lagged exchange rate (Δε$t_{t-2}^{S/RMB}$) are 0.319, 0.325 and 0.322 respectively. The estimated coefficients of the exchange rate (Δε$t^{S/RMB}$) and the two-lagged exchange rate (Δε$t_{t-2}^{S/RMB}$) are both statistically significant at 1% level, while the values of one-lagged exchange rate (Δε$t_{t-1}^{S/RMB}$) is not statistically significant even at 10% level. This suggests that if the RMB appreciates 1% against the dollar, the American price index of commodities imported from China will rise about 0.219% in the short term and 0.222% in the long term.

The estimated coefficient of the marginal cost (Δmc) is 0.03 and not significant at any level. While the estimated coefficient of one-lagged the marginal cost (Δmc$_{t-1}$) is 0.051 and significant at 5% level. It means that the marginal costs of Chinese exporters can hardly influence the American price index of commodities imported from China.

For Japan, the corresponding estimated results are showed in table 3. As to the price index of all commodities imported from China, the estimated coefficients of the exchange rate, the one-lagged exchange rate and the two-lagged exchange rate (Δε$t^{S/RMB}$) are 0.541, 0.684 and -0.102 respectively. The estimated coefficients of the exchange rate and the two-lagged exchange rate are both statistically significant at 1% level, while the values of one-lagged exchange rate (Δε$t_{t-1}^{S/RMB}$) is not statistically significant even at 10% level. The estimated coefficient of the marginal cost is 0.214 and significant at 5% level. While the estimated coefficient of one-lagged the marginal costs is 0.093 and not significant at any level.

The results suggest that if the RMB appreciates 1% against the dollar, the Japan price index of all commodities imported from China will rise about 0.561% in the short term and 0.684% in the long term. As for the raw and processed materials, the corresponding values even reach 0.711% in the short term. That to say, the pass-through effect of exchange rate of RMB against the Japan yen can even reach at about 70%.

The estimated coefficient of the marginal cost is 0.214 and significant at 5% level. While the estimated coefficient of one-lagged the marginal cost is 0.093 and not significant at any level. It means that the 1% innovation of marginal costs of Chinese exporters can result in 0.214% fluctuation of the Japan price index of all commodities imported from China.
The pricing currency in Japan are almost bided through the dollar. So this pricing is not LCP, so the pass through effects of exchange rate of RMB against dollar is less than a quarter while that against the Japanese yen is bigger than 68%. This difference can be explained by difference of the denominated currency in world trade.

In the world trade, the exporters can not only bid prices through the local currency, which is be called producer currency pricing (PCP) but also through importer’s currency, which is call local currency pricing (LCP). According to (Gopinath et al.,2008; Engel, 2008) and, the choice of the pricing currency will impact the pass-through effect of exchange rate. If the exporter chooses PCP, then the change of exchange rate will be completely conducted on import prices. If the exporter chooses Choose LCP, on the other hand, the prices of imported commoditieswill be completely independent of the exchange rate, at least in the short term. The ratio of RMB being used as the denominated currency in world trade is very small. The prices of the commodities exported from China to the US are almost bided through the dollar. So the LCP restricts Chinese exporters conduct the appreciation of the RMB the exported prices. So the pass-through effects of exchange rate of RMB on theUS are smaller. While the commodities are exported from China to Japan, the Chinese exporters also bid through dollar not the Japan yen. So this pricing is not LCP, so the pass-through effects of exchange rate of RMB on Japan are bigger.

Obviously, the simple appreciation of RMB against the dollar does not necessarily improve the American trade status. For the US, themost effective way is to use the RMB as the denominated currency in Sino-US trade. This is maybe the costs for the US to pay for cracking down on Chinese trade.

Table 3 The Pass-through effects of RMB on the Japan Price Index of All Commodities Imported from China

<table>
<thead>
<tr>
<th>All Commodities</th>
<th>Foodstuff</th>
<th>Raw and Processed Materials</th>
<th>Garment</th>
<th>Manufacturing</th>
<th>Machinery Manufacturing</th>
<th>Other</th>
</tr>
</thead>
<tbody>
<tr>
<td>( \Delta \epsilon^\text{yen}/\text{RMB} )</td>
<td>0.561a (0.069)</td>
<td>0.423a (0.085)</td>
<td>0.711a (0.126)</td>
<td>0.508a (0.120)</td>
<td>0.510a (0.060)</td>
<td>0.400a (0.100)</td>
</tr>
<tr>
<td>( \Delta \epsilon^\text{yen}/\text{RMB} ) (\text{t-1})</td>
<td>0.684a (0.087)</td>
<td>0.459a (0.094)</td>
<td>0.261a (0.126)</td>
<td>0.640a (0.132)</td>
<td>0.513a (0.084)</td>
<td>0.331a (0.095)</td>
</tr>
<tr>
<td>( \Delta \epsilon^\text{yen}/\text{RMB} ) (\text{t-2})</td>
<td>-0.102 (0.082)</td>
<td>-0.023 (0.073)</td>
<td>0.005 (0.205)</td>
<td>-0.25c (0.142)</td>
<td>-0.097 (0.082)</td>
<td>-0.047 (0.095)</td>
</tr>
<tr>
<td>( \Delta m\epsilon ) (\text{t})</td>
<td>0.214b (0.151)</td>
<td>0.180b (0.075)</td>
<td>0.927b (0.419)</td>
<td>0.094 (0.106)</td>
<td>0.517a (0.130)</td>
<td>0.195 (0.225)</td>
</tr>
<tr>
<td>( \Delta m\epsilon ) (\text{t-1})</td>
<td>0.093 (0.148)</td>
<td>-0.052 (0.067)</td>
<td>-0.278 (0.512)</td>
<td>-0.161 (0.135)</td>
<td>-0.093 (0.145)</td>
<td>-0.283 (0.194)</td>
</tr>
<tr>
<td>( \text{Adj } R^2 )</td>
<td>0.812</td>
<td>0.803</td>
<td>0.821</td>
<td>0.890</td>
<td>0.828</td>
<td>0.816</td>
</tr>
</tbody>
</table>

(Notes: a, b and c denote the statistically significant levels of 1%, 5% and 10% respectively. The values showed in parentheses are standard deviations.)

7. CONCLUSIONS AND THE ECONOMIC INTERPRETATIONS

The results of both exposures of historical facts and empirical studies show that the pass-through effects of exchange rate of RMB against dollar and the Japanese yen are varying widely. In the long term, the pass-through effect of exchange rate of RMB against dollar is less than a quarter while that against the Japanese yen is bigger than 68%. This difference can be explained by difference of the denominated currency in world trade.

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