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Revaluation of the Chinese Yuan and triad trade: A gravity assessment

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A R T I C L E I N F O

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A B S T R A C T

The literature had paid little attention to the endogenous nexus between exchange rates and bilateral trade. In this paper, I use a gravity model to investigate the two-way causality between exchange rates and bilateral trade with data from China, Japan, and the United States during the 2002–2007 period. After controlling for the simultaneous bias between exchange rates and bilateral trade, the extensive empirical evidence shows that the revaluation of the Chinese Yuan against the dollar significantly reduced China's exports to the United States but had no significant effects on China's exports to Japan. These findings are robust to different measures, econometric methods, and period coverage.

1. Introduction

After China acceded to the World Trade Organization (WTO) in 2001, China's exports increased dramatically. The annual export growth rate was 20.1% during 2002–2007. China's exports to Japan and the United States, the two largest trading economies in the world, also grew very quickly. Specifically, China's exports to the U.S. increased from U.S.$ 53.2 billion to U.S.$ 232.7 billion, a 29.5% annual growth rate during this period. By way of comparison, China's exports to Japan increased from U.S.$ 48.4 billion to U.S.$ 102.0 billion, a 14.9% annual growth rate during this period. Simultaneously, the exchange rate of Chinese Yuan (RMB) against U.S. dollar changed by around 20% during this period due to revaluation. As shown in Fig. 1, after the RMB's revaluation against U.S. dollar in 2005, the *proportion* of China's exports to the U.S. compared with China's overall export volume followed a downward trend whereas that of China's exports to Japan continued to decrease. It is therefore interesting to ask whether the revaluation of the RMB revaluation is reduced bilateral trade among China, Japan and the U.S.

This paper seeks to understand the endogenous nexus between the movements of the bilateral exchange rates and bilateral trade among the triad: China, Japan and the U.S. The intuition seems straightforward: the increase in RMB valuation against the U.S. dollar resulted in more expensive Chinese exports to the U.S., which in turn decreased China's exports to the U.S. However, there is a more fundamental mechanism underlying this conventional wisdom: the bilateral exchange rate is not exogenous itself. Surging Chinese exports could result in strong pressure to protect markets raised by the import-competing special interest groups in the importing country. Accordingly, the government in the importing country would push the exporting country to revalue its exchange rate. Put another way, exports have a reverse causality on bilateral exchange rates. Ignoring this fact may make estimation results imprecise.

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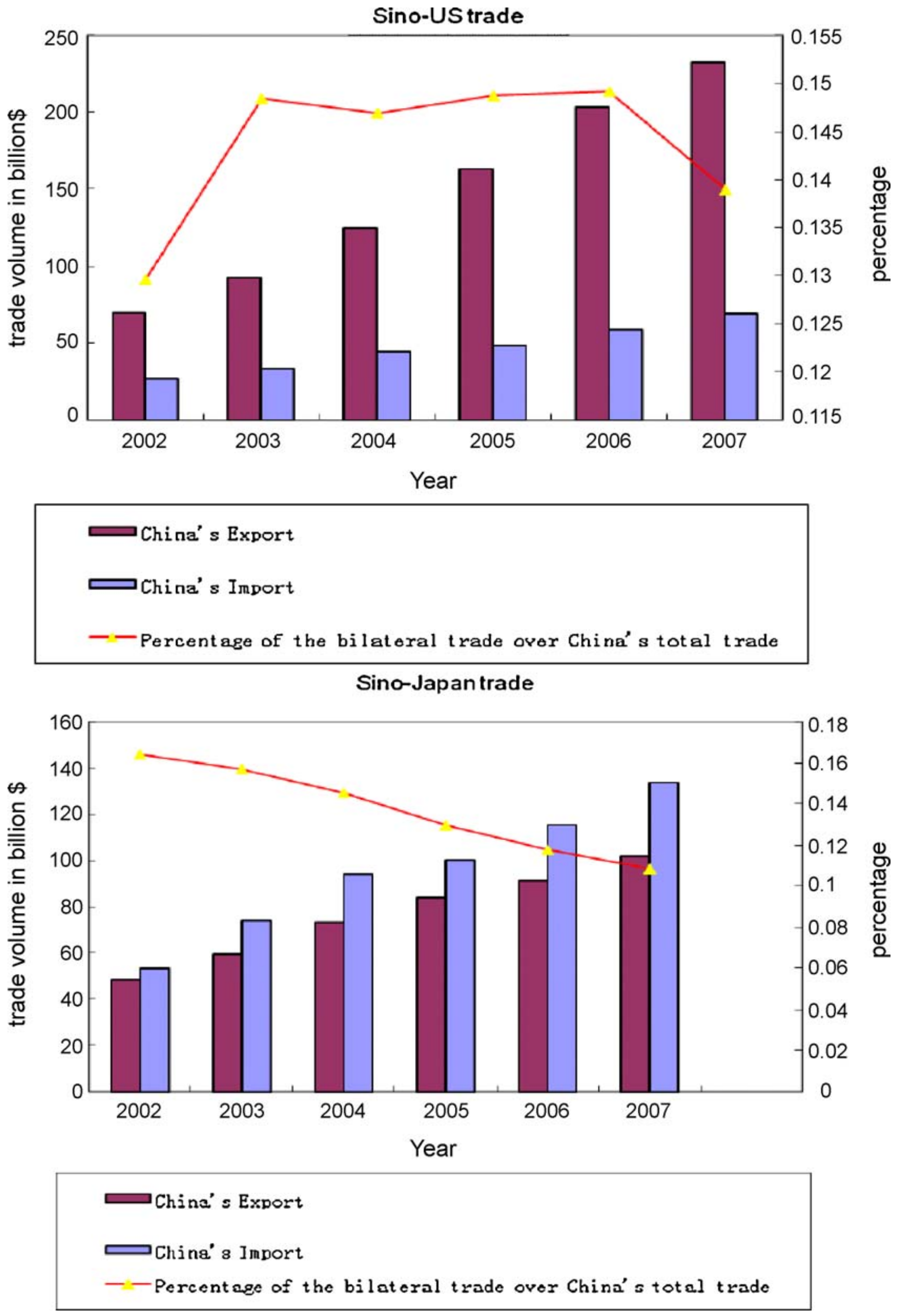

Fig. 1. Bilateral trade and the exchange rate: China and Japan.CEIC Database (2008).

Previous studies have paid little attention to this two-way causality. Most only mention one of the two causal connections. Some works focus on the impact of the bilateral exchange rate on bilateral trade, especially through the pass-through effect of the exchange rate (Goldberg & Knetter, 1997). When the nominal bilateral exchange rate is changed, it has a pass-through effect on the price of the imports, which in turn would affect bilateral trade. Previous studies like Feenstra (1989) find empirical evidence that the effect of the bilateral exchange rate on bilateral trade is like that of a tariff. Bergin and Feenstra (2009) also explored how a change in the share of U.S. imports from a country with a fixed exchange rate like China could affect the pass-through of the exchange rate to import prices in the U.S. On the other hand, a variety of papers consider the determinants of the bilateral exchange rate (Meese & Rose, 1991). Bilateral trade, among others, is one of the most important determinants. As mentioned above, in considering the endogenous nexus between these two variables, studies on a one-way causality would lead to simultaneous bias.

It is understood that an identical change of exchange rate could have different effects on industry-specific bilateral exports. The economic rationale is as follows. Some industries in China (*e.g.*, manufacture of special purpose machinery) may have higher productivity and hence enjoy a larger profit margin when they access to the foreign markets. When RMB appreciates, such industries can still earn positive profits. In contrast, some other industries (*e.g.*, manufacture of apparel, footwear and caps) only have slight profit margins when they entry to the export markets (Yu, 2008). Many firms within such industries would die and exit from the export market (Melitz, 2003). Therefore, an identical revaluation of RMB would induce different effects on bilateral exports across industries. Inspired by the theoretical industry-specific gravity model presented in Yu (in press), I am able to use the gravity model to capture the effect of bilateral exchange rate on industry-specific bilateral trade.

This work adds to a growing literature on China's trade and exchange rate, including work done by, among others, Thorbecke and Zhang (2006), Thorbecke and Smith (in press), Mann and Plueck (2007), Kwack, Ahn, Lee, and Yang (2007), and Marquez and Schindler (2007). By using Johansen maximum likelihood and dynamic OLS approaches, Thorbecke and Zhang (2006) found that the estimated real exchange rate in the long run for exports and imports between China and the U.S. is around a unit. They also rationalize that the appreciation of the RMB would help to reduce the bilateral Sino-U.S. trade deficit. By extending the dataset to include 33 China's trading partners, Thorbecke and Smith (in press) found that a 10% RMB appreciation leads to a decrease in 4% of processing exports and 12% of ordinary exports. Similarly, Marquez and Schindler (2007) also distinguished the role of processing trade from that of the ordinary trade. By way of comparison, Mann and Plueck (2007) emphasized that the price elasticities for American imports from China have an expected sign by using dynamic panel empirical specification. Following standard literatures, all of these works take bilateral exchange rate as given.

I therefore estimate the bidirectional causality between the bilateral exchange rate and bilateral trade using data from China, Japan and the U.S. during the period 2002–2007. My first estimation equation in the system is the bilateral export equation. Since the gravity model is successful in explaining the growing trade volume since World War II (Feenstra, 2003), I therefore use an augmented gravity equation to estimate the effect of the bilateral exchange rate on exports. My second estimation equation is the bilateral exchange rate equation, which takes various determinants into account. I use a three-stage-least-squares (3SLS) estimation to take full account of the joint correlations of the error terms between the two equations.

Overall, I find that the revaluation of the RMB against the U.S. dollar reduces China's exports to the United State whereas there is no significant impact on China's exports to Japan. Simultaneously, the effect of exports on the bilateral exchange rate is insignificant for both the Sino-U.S. and the Sino-Japan cases. Various robustness checks confirm these findings by using different measures of exchange rates, econometric methods, and data period coverage.

The rest of this paper is organized as follows. Section 2 introduces the evolution of China's bilateral exchange rate and its trade with Japan and the U.S. Section 3 discusses the determinants of both bilateral trade and the exchange rates. The main estimation results and robustness checks are presented in Section 4. Section 5 concludes the paper.

2. China's exchange rate and triad trade

According to China's Statistical Yearbook (2008), the bilateral trade between China and Japan increased dramatically since 2002. After China acceded to the WTO in 2001, the bilateral trade volume (*i.e.*, exports plus imports) between China and Japan reached U.S.$ 101.9 billion, with a 16.1% annual growth. Japan was China's largest trading partner in 2002: the bilateral trade volume accounted for 16.5% of China's overall trade volume, which was higher than 12.9% with the U.S. Since then, the average growth rate of Sino-Japanese bilateral trade has been about 25%. In 2006, bilateral trade between China and Japan reached U.S.$ 207.4 billion, which accounted for 11.7% of China's overall trade volume. This volume is smaller than the Sino-U.S. trade volume, worth U.S.$ 262.7 billion, making Japan China's second largest trading partner in the world since 2004.

In the overall whole trade volume, Japan has maintained a modest trade surplus with China in the new century. The bilateral trade imbalance was U.S.$ 5 billion in 2002. China then became Japan's largest source for imports for a share of 18.3% of Japan's total import volume, which is higher than 17.1% from the U.S. The imbalance gap has widened over time. In 2006, China had a trade deficit with Japan worth U.S.$ 24 billion, which accounted for around 12% of the overall bilateral trade volume.

According to reports by China's General Administration of Customs and the Department of Commerce in the U.S., Sino-U.S. bilateral trade also increased rapidly after China acceded to the WTO. Simultaneously, China maintained a huge bilateral trade surplus with the U.S. In 2004, the bilateral trade was worth U.S.$ 161 billion. More importantly, the Multi-Fiber Agreements, which set an upper bound for textile exports from China to the U.S. in the Uruguay round of the GATT, were automatically terminated in January 2005. Accordingly, China's textile exports to the U.S. increased dramatically soon after that. In 2005, the trade imbalance gap widened to around U.S.$ 200 billion. Due in part to appreciation, of the RMB China's bilateral trade surplus with the U.S. reduced from U.S.$ 232 billion in 2006 to U.S.$ 213 billion in 2007. In 2008, the Sino-U.S. trade volume did not increase by very much because of the stronger RMB and the shrinking demand in the United States caused by the financial crisis. However, China still maintained a U.S.$ 170 billion trade surplus with the United States, accounting for 57.8 percent of China's total trade surplus.

Due to the surge in the Sino-U.S. bilateral trade, special interest groups, such as labor unions, in the United States appealed to the U.S. government by arguing that China had manipulated its currency at a unreasonable level. They argued that China had a serious real exchange rate misalignment such that China could maintain a huge bilateral trade surplus. In response to the demand by special interest groups, the U.S. congress threatened to impose trade sanctions on China if China did not "voluntarily" restrain its exports to the U.S., or revalue the RMB. To avoid a possible trade war, China adjusted its fixed exchange rate against the U.S. dollar, which had been adopted for one decade. In July 2005, the RMB against the dollar was revalued by 2%. It was no longer solely pegged to U.S. dollar but it was pegged a basket of currencies including, among others, the U.S. dollar and the Japanese Yen. Since then, the RMB was continuously revalued. In the next three years, the RMB against the dollar was revalued by around 20% from 8.3 to 6.8 RMB per dollar.

3. Review of related theory

This section specifies the bilateral trade equation, the exchange rate equation, and the simultaneous bilateral export and exchange rate equations.

3.1. The determinants of bilateral trade

Feenstra (2003) highlighted three reasons that explain the growing bilateral trade since World War II: growing GDP, declining transportation costs, and trade liberalization. The gravity model is expected to be the only successful model to explain the growing trade volume.

It is easy to understand that the GDP growth of two trading partners plays a significant role in determining their bilateral trade. The gravity model suggests that larger countries trade more since they produce more commodities.[1] Also, two countries trade more if the sizes of their economies are similar (Helpman, 1987). Later, Anderson and van Wincoop (2003) provided a solid theoretical micro-foundation for the typical gravity model by carefully introducing the ‘‘multilateral trade resistance’’ term, which specifies the implicit price indices in the gravity equation.

Traditional wisdom suggests that international trade agreements foster international trade. After a 15-year long march, China successfully acceded to the WTO as its 143rd member in 2001. The impact of WTO accession on the Chinese economy has been substantial. Some researchers like Woo (2001) argued that WTO accession was a key component to reconstruct the Chinese economy. At the very least, the accession to WTO helped China enjoy a larger foreign market, which in turn fostered exports.

Besides multilateral trade agreements, trade liberalization, such as tariff reduction and non-tariff barriers, is important to bilateral trade growth. Shortly after it began its economic reforms, China set up a whole system of tariffs in the 1980s. After the Uruguay Round of the WTO, China experienced huge tariff reductions due, in large part, to its eagerness for WTO accession. China cut its tariffs from 35% in 1994 to around 17% in 1997. In 2001, China further cut its average tariff rate from 16.4% to 15.3%.

Equally importantly, the bilateral exchange rate plays another key role in bilateral trade. Previous studies like Feenstra (1989) argued that there is a symmetric response of import prices to changes in an import tariffs and the bilateral exchange rates. This hypothesis is supported by Japanese and the U.S. industrial data. The economic rationale for the effect of the exchange rate on bilateral trade seems straightforward. A change in the nominal bilateral exchange rate has a pass-through effect on import prices. Accordingly, both of these changes affect the bilateral trade. Put another way, an appreciation in the real exchange rate, which is defined as an increase in the relative price of tradable to non-tradable goods, would lead to a decrease in bilateral trade.

Of the particular interest in this paper is the effect of movements in China’s exchange rate on its bilateral trade with two other giants: Japan and the U.S. To estimate its effect, I control GDP of China and its trading partner in the estimations inspired by the gravity model. I drop data before 2002 to avoid the structural change in Chinese economy caused by China’ WTO accession in 2001. Also, to keep the model neat, the usual variables of transportation costs such as bilateral geographic distance are captured in an error term in the empirical model.[2]

3.2. The determinants of the exchange rate

As summarized by Meese and Rose (1991), there are five models to explain the determinants of nominal exchange rates: a flexible-price monetary model, two sticky-price models, and two Lucas-type (1982) models. In all of these models, the bilateral spot exchange rate (e_j) is determined, at least, by both the nominal domestic (*i.e.*, China) money supply relative to foreign money supply (M_{CH}/M_j) and domestic industrial production relative to the foreign industrial production (Y_{CH}/Y_j). These common variables gain special theoretical support in Lucas’s (1982) model of a two-good, two-country, pure exchange economy. Shortly after that, Hodrick (1988) extended Lucas’s (1982) and Svensson’s (1985) models to include the change in the relative money growth rate in the model to capture the timing of money market transactions.

The other three models have different extensions to the benchmark setup introduced by Lucas (1982). In particular, the flexible-price monetary model includes a nominal interest differential since it assumes that the purchasing power parity (PPP) still holds when the home country faces an exogenous real exchange rate shock. In contrast, the two sticky-price-type

[1] Though not inspired by theoretical literature, it may be worthwhile to include trading partners’ GDP per capita in the gravity equation (Carrère, 2006).

[2] The inclusion of various bilateral geographic variables did not change my estimation results since such variables will be dropped automatically in the two-way fixed-effects estimations.

models emphasize that the adjustment of goods prices is lower than that of asset prices. Therefore, one of the sticky-price-type models assumes that the real interest differential, measured by the difference between interest rates and inflation, is included in the estimation. Another sticky-price-type model instead argues that the relative cumulated trade balance (TB_j) is an appropriate explanatory variable. That is,

$$e_j = f\left(TB_j, \frac{M_{CH}}{M_j}, \frac{Y_{CH}}{Y_j}\right) + \text{error}, \tag{1}$$

where the bilateral nominal exchange rate e_j is measured as China's price of a unit of domestic exchange. Since my main interest in this paper is to explore the endogenous nexus between bilateral trade and bilateral exchange rates, I therefore adopt specification (1) to capture the effect of China's bilateral trade on its exchange rate.

It is also worthwhile to point out that the stick-price-type model above typically applies to developed economics with open capital market. China, as the largest developing economy, currently still has capital control. Put another way, capital control may still play a role to determine China's exchange rate. In specification (1), capital control is included in the error term as omitted variable, which reinforce the endogeneity of the bilateral exchange rate. We will address this endogeneity issue shortly.[3]

Previous research on real exchange rates takes special interest in the extent of its misalignment. It is usually believed that there exists an equilibrium exchange rate in which both internal and external balances are achieved. The gap between the estimated equilibrium and the actual exchange rate is the so-called real exchange rate misalignment (Hinkle & Montiel, 1999; Williamson, 1994). There are two major approaches to identifying the misalignment (Zhang, 2001). One of them is based on the idea that the equilibrium concept is derived from the macroeconomic balance. Based on this, the misalignment is measured either by PPP or the black market exchange rate. Another approach is the so-called Behavioral Equilibrium Exchange Rate (BEER): the equilibrium exchange rate is determined by a variety of explanatory variables of economic fundamentals. Since my objective in this paper is to estimate the effect of the exchange rate on trade, I do not attempt to measure the misalignment of China's real exchange rate. However, I use the real exchange rate as another indicator of the exchange rate to estimate its effect on bilateral trade.

3.3. Empirical methodology

Since my main interest of the present paper is to explore the endogenous nexus between bilateral trade and bilateral exchange rate, it is worthwhile to conduct the unit root tests to check whether these two variables have unit autogregessive roots or deterministic time trends.[4] I therefore construct the following specification to perform a unit-root test on $AR(p)$ model:

$$\Delta Y_t = \mu + \theta Y_{t-1} + \sum_{j=1}^{p} \alpha_j \Delta Y_{t-j} + \nu_t, \tag{2}$$

where Y_t denotes two key variables, respectively: China's industry k's exports to country j in year t (X_{jkt}^{CH}) and China's bilateral exchange rate with country j in year t (e_{jt}). To fully explore the time-series properties of the data, I then take a step forward to check whether these two variables are cointergreated by using Johansen's (1995) maximum likelihood test. In particular, I use the trace statistic and the maximum eigenvalue statistic to perform the diagnostic tests for the cointegration of this two series. Several information criteria such as Akaike's (1974) information criterion (AIC), the final prediction error (FPE) criterion, Hannan and Quinn's (1979) information criterion (HQIC), and Schwarz's (1978) Bayesian information criterion (SBIC) are used to determined the appropriate number of lags to use in the vector autoregressions. In addition, I also check whether the error term (ν_t) has whiteness properties.

As mentioned above, an identical line of exchange rate could generate heterogenous effects on industry-specific bilateral exports. Hence, in this paper I adopt a panel dataset to explore such a characteristic. Accordingly, I introduce the following simultaneous equation model (SEM) for the panel estimations:

$$\begin{aligned} \ln X_{jkt}^{CH} &= -\beta_0 + \beta_1 e_{jt} + \beta_2 \ln Y_{kt}^{CH} + \beta_3 \ln Y_{jkt} + \eta_k + \varphi_t + \mu_{kt}, \qquad e_{jt} \\ &= -\gamma_0 + \gamma_1 \ln X_{jkt}^{CH} + \gamma_2 \ln Y_{kt}^{CH} + \gamma_3 \ln Y_{jkt} + \gamma_4 \ln M_t^{CH} + \gamma_5 \ln M_{jt} + \varepsilon_{kt}. \end{aligned} \tag{3}$$

In Eq. (3), the bilateral export is a main determinant of bilateral exchange rate. This is inspired by the theoretical discussion stated above: the bilateral trade balance is one of important explanatory variables of the bilateral exchange rate.[5]

[3] I gratefully thank a referee for pointing this out.

[4] I gratefully thank a referee for suggesting this point.

[5] Note that bilateral import is not specified as a regressor but is absorbed into the error term of (3) given that my main interest of the present paper is to discover the endogenous nexus between bilateral export and bilateral exchange rate. Of course, to fully explore the effect of bilateral exchange rate on bilateral trade imbalance, one can go further to estimate the effect of bilateral exchange rate on bilateral imports, which is a possible topic for future research.

In addition, the new variables in the bilateral exchange rate Eq. (3) M_t^{CH} and M_{jt} are China and its trading partner *j*'s monetary bases, respectively.[6] I also include, though not listed in the equations above, the *j*-period time lag of the exchange rate e_{jt-l} in both equations as robustness checks. Following Feenstra (1989), the expected exchange rate in each quarter is a log-linear function of the current and past three quarterly average spot rates.

As theoretically recognized by Anderson and van Wincoop (2003), standard gravity estimations on bilateral trade could suffer from the bias caused by "multilateral trade resistance," which measures the implicit price indices in the gravity model. Such multilateral trade resistance could be varied by industries and time as well given that the effect of bilateral exchange rate on bilateral trade are different across industries as introduced above. Hence, when the dataset is a panel, the regular OLS estimates are biased if the trade resistance is ignored.[7] To control for multilateral resistance among trading partners, inspired by Rose and van Wincoop (2001), I use fixed effects to control for other unobservable features *within* each industry of the trading partners over time. In particular, η_k captures the unobserved industry-specific time-invariant fixed-effects whereas φ_t is the time-varying fixed-effects. Since the samples are quarterly data, both year-specific and quarter-specific fixed effects are included to completely capture the time-specific fixed-effects. Turning to the exchange rate equation, in addition to bilateral trade, the bilateral exchange rate is affected by trading partners' GDP and monetary base, as inspired by the sticky-price-type models. The error terms (μ_{kt}, ε_{kt}) are a bivariate residual vector.

In this SEM, the coefficients β_1 and γ_1 consider the simultaneous feedback from bilateral trade and the exchange rate, which are my main interests. Since the error terms in the SEM are generally correlated with the dependant variables, the conventional methods such as Ordinary Least Squares (OLS) and Generalized Least Squares (GLS) are inconsistent. In this case, the 3SLS, as a full-information likelihood approach, is appropriate to take the error-term correlations between the two equations into account (Wooldridge, 2002).

4. Data, econometrics, and results

In this section, I first describe the dataset used in the paper, followed by a discussion of the Sino-U.S. estimations and the Sino-Japanese estimations. I then address the possible endogeneity problem. Finally, I close the section with various robustness checks.

4.1. Data

My data coverage is from the first quarter of 2002 to the last quarter of 2007.[8] The economic rationale of focusing on this window is that China's economy was significantly affected by its WTO accession in 2001 whereas China's exchange rate was stable at that time. Since my objective in this paper is to estimate the effect of the exchange rate on bilateral trade, I therefore drop observations before 2001 to avoid the possible structural change caused by the WTO accession shock.

I use log directional industrial imports of the U.S. (Japan) from China to measure bilateral trade among China, Japan and the U.S.[9] This is because directional imports are consistent with the prediction of the gravity model, which only emphasizes one-way trade flow (Baldwin & Taglioni, 2006). It is recognized that there is a mismatch problem between using data on China's exports and American imports due to China's re-export (via Hong Kong) problem (Feenstra & Hanson, 2004): Exports from China via Hong Kong are counted as American imports from China but they are not counted as China's exports to the U.S. To be consistent with previous works using the standard gravity model, I use American import data to measure Sino-U.S. trade. In addition, I use quarterly average rates to measure the bilateral nominal spot exchange rate. In this way, I can avoid the daily random error caused by adopting spot rates instead (Feenstra, 1989).

Unless specified, all data are from the CEIC database, which is publicly available.[10] The directional import data is at the SITC two-digit level. Trading partners' GDPs are measured in constant U.S. dollars. Data on American GDP is disaggregated by sectors (NAICS) and are available from the Bureau of Economic Analysis (BEA). China's producer price index can be accessed from China's Statistical Yearbook (2008) by National Bureau of Statistics of China. The American PPI is obtained from the Bureau of Labor Statistics. Similarly, I get the data on Japanese PPI (base year: 2003) from the Bank of Japan. All other Japanese data are from the CEIC database as introduced above. Finally, as usual, I use M1 to measure the monetary base.

[6] Of course, money supply could be endogenous in the sense that bilateral exchange rate could be reversely affect money supply. However, in the present paper I only care about the correlation between bilateral exchange rate and money supply in trading partners since the latter variables are just control variables in the Eq. (3).

[7] This omitted variable bias (*i.e.*, omitted terms correlated with the trade-cost term) was called the "gold medal" of classic gravity model mistakes (Baldwin & Taglioni, 2006).

[8] Due to the restriction of data availability, I am not able to update the data till the last quarter of 2008, which would be a possible extension for future research.

[9] Different from using data on goods and service trade as generally discussed in Section 2, I use industrial trade data only for estimations due to data availability. I thank Rachel McCulloch for pointing this out.

[10] Data source: http://www.ceicdata.com.

Table 1
Summary statistics.

Variables	Observation	Mean	Std. Dev.	Minimum	Maximum
Panel A: basic statistics of Sino-U.S. bilateral trade (2002–2007)					
Log GDP of U.S. (million)	1488	3.967	.531	2.679	5.147
Log GDP of China	1488	5.723	.120	5.560	5.919
PPI for China	1488	100.250	32.752	27.328	313.420
PPI for the U.S.	1312	143.349	33.626	82.133	286.933
Log exchange rate ($/RMB)	1488	−.888	.102	−.918	−.398
Log real exchange rate ($/RMB)	1312	−1.043	.039	−1.325	−.632
1-Lag of log exchange rate ($/RMB)	1426	−.909	.012	−.918	−.889
2-Lag of log exchange rate ($/RMB)	1364	−.911	.012	−.918	−.885
3-Lag of log exchange rate ($/RMB)	1302	−.913	.008	−.918	−.889
Log China's Monetary Base (M1)	1488	3.968	.110	3.775	4.171
Log American Monetary Base (M1)	1488	3.121	.022	3.075	3.140
Year	1488	2.004	1.708	2002	2007
Industrial Code for Sino-U.S. Trade	1488	31.5	17.901	1	62
Panel B: basic statistics of Sino-Japan bilateral trade (2002–2006)					
Log GDP of Japan (million)	820	3.636	.373	2.903	4.447
Log GDP of China	820	6.599	.088	6.478	6.724
PPI for China	820	111.440	48.360	81.412	303.105
PPI for Japan	780	103.038	14.060	97	184.3
Log exchange rate (¥/RMB)	820	1.147	.028	1.101	1.204
Log real exchange rate (¥/RMB)	780	1.151	.136	.856	1.661
Log exchange rate (¥/$)	820	2.059	.026	2.012	2.118
Log exchange rate ($/RMB)	820	−.913	.006	−.924	−.901
Log Chinese Monetary Base (M1)	820	3.935	.089	3.775	4.086
Log Japanese Monetary Base (M1)	820	6.037	.031	5.949	6.078
Year	820	2004	1.415	2002	2006
Industrial Code for Sino-Japan Trade	820	21	11.839	1	41

Sixty-two industries are covered in the Sino-U.S. trade observations for six years (*i.e.*, 2002–2007), whereas only 41 industries are covered in the Sino-Japanese trade observations for five years (*i.e.*, 2002–2006). I have 1482 quarterly observations for the Sino-U.S. estimations, whereas I have only 770 quarterly observations for the Sino-Japanese estimations.[11] In Table 1, Panel A presents the descriptive statistics for each variable in the Sino-U.S. bilateral trade estimations whereas Panel B reports that in the Sino-Japan bilateral trade estimations.

4.2. The Sino-U.S. estimates

As mentioned above, to fully explore the endogenous nexus between bilateral trade and exchange rate, it is useful to examine the time series property of the data. I first conduct the Granger causality test to check whether the bilateral exchange rate is endogenous. It turns out that the Granger causality Wald test rejects the null hypothesis that the bilateral trade does not Granger cause the bilateral exchange rate at a 10% level (p-value = .07). This serves as a first evidence that the two variables are endogenously determined.

I then perform the augmented Dickey–Fuller tests to check whether each series is integrated of order one. Panel A of Table 2 reports the unit root tests results for the Sino-U.S. data. The p-value of the augmented Dickey–Fuller statistics for bilateral exchange rate is very high. After taking the first difference of the data, the Sino-U.S. bilateral exchange is still non-stationary whereas the Sino-U.S. bilateral trade follows an $I(1)$ process. This striking finding is not changed even including the time trend. By replacing the Newey–West standard errors to account for serial correlation, the Phillip–Perron tests still suggest that the Sino-U.S. bilateral exchange rate does not follow a stationary process.

At first glance, it is surprising to find that the Sino-U.S. bilateral exchange rate is not an $I(1)$ process.[12] However, one can easily understand this point if taking a careful observation in Fig. 2. The Sino-U.S. bilateral exchange rate clearly is a piece-wise time series. Before July 2005, the bilateral exchange rate is fixed at a level of 8.27, following by a declining trend since then. Therefore, the usual standard econometric technique of time series analysis seems inappropriate here.[13] I hence appeal to the 3SLS method for analysis.

Table 3 presents the estimation results in which Eqs. (2) and (3) are estimated separately. These serve as a benchmark for comparison with the estimated results from the simultaneous equation method (SEM).

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[11] There are six missing observations of Sino-US bilateral trade whereas 50 of Sino-Japan bilateral trade.
[12] Note that the time series does not follow a $I(2)$ process neither.
[13] Admittedly, it is possible to split the whole time series into two fragments by using July 2005 as a cutoff point and then perform the related diagnostic tests for the two new time series. However, I am not able to do that due to the short time periods covered.

Table 2
Time series properties of the data.

Panel A: unit root tests

Variables	Level			First difference		
	ADF	ADF test with trend	Phillips–Perron test	ADF test	ADF test with trend	Phillips–Perron test
Sino-U.S. data						
Log exchange rate ($/RMB)	1.921 (.998)	2.257 (1.000)	3.427 (1.000)	2.206 (.998)	1.234 (1.000)	2.241 (.998)
U.S. from China	−1.531 (.517)	−2.472 (.341)	−2.074 (.255)	-4.880^{**} (.000)	-4.751^{**} (.000)	-4.858^{**} (.000)
Sino-Japan data						
Log exchange rate (¥/RMB)	−1.716 (.423)	−1.272 (.895)	−2.052 (.264)	-3.181^{*} (.021)	-3.975^{**} (.009)	-2.991^{*} (.035)
Log Imports to Japan from China	−.129 (.946)	−2.437 (.360)	−4.377 (.000)	-2.915^{*} (.043)	-2.971^{*} (.140)	-19.513^{**} (.000)

Panel B: determination of order of lags using Sino-Japan data

Number of lags	Likelihood	Likelihood ratio	FPE	AIC	HQIC	SBIC
0	61.161		3.3e−06	−12.871	−12.871	−12.871
1	73.271	24.221	1.3e−06	−13.825	−13.805	−13.629
2	86.023	25.505^{*}	$4.6e{-}07^{*}$	-14.855^{*}	-14.816^{*}	-14.462^{*}
3	87.916	3.7855	6.4e−07	−14.607	−14.548	−14.019

Panel C: Johansen tests for cointegration using Sino-Japan data

Maximum rank	Level			First difference		
	Eigenvalue	Trace statistics	5% Critical value	Eigenvalue	Trace statistics	5% Critical value
0		10.810	15.41		18.167	15.41
1	.414	1.174	3.76	.490	6.719	3.76
2	.063			.326		

Notes: Numbers in parenthesis are *p*-value in panel A. Double asterisks (**) denote the significance at 1% level, and single asterisk (*) denotes significance at 5% level.

Column (1) is the simple pooled OLS estimate. The coefficient of the log exchange rate is −1.226, which is significant at the conventional statistical level. The economic rationale is that a percent increase in the dollar to RMB exchange tends to have a 1.226 percent decrease in China's exports to the U.S. As introduced in Eq. (2), I also control for both trading partners' GDP. It turns out that the coefficients on trading partners' GDP have an anticipated positive sign, which is consistent with the theoretical prediction that larger countries trade more. Since my dataset is panel data, I also perform the fixed-effects estimation in Column (3) and find that the coefficient of the log of the exchange rate is still negative and significant.

We might expect that the previous realization of exchange rates could play a role in affecting current exports, inspired by the typical J-curve argument: in response to a domestic devaluation, a country's trade balance is typically worsen first before being better. I therefore include the past three quarterly average spot rates in Column (2) for the pooled OLS estimates and Column (4) for the fixed-effect estimates. It turns out that most of those past exchange rates do not have significant effects on exports. In any case, China's RMB appreciation (*i.e.*, an increase in the log exchange rate) is associated with lower exports from China to the U.S. Also, the coefficient of the bilateral exchange rate remains stable across these estimates.[14]

As predicted by the theoretical model (1), the bilateral exchange rate is not exogenously given but is indeed affected by bilateral trade. As discussed in the previous section, I include other determinants of the bilateral exchange rate such as trading partners' GDP and monetary base (M1) in Columns (5) and (6). The coefficients of exports on the bilateral exchange rate are significantly negative. This is a striking unexpected result: With greater exports from China, the U.S. government is more eager to push the Chinese government to revalue the RMB. Therefore, if China's surging exports play a role in the Sino-U.S. bilateral exchange rate, it should lead to a revaluation of the RMB. The unexpected estimated results in Columns (5) and (6) are possibly because of the lack of a control for the simultaneous bias in the estimations.

Table 4 reports the 3SLS estimates of the simultaneous equation system. In specification (1), I adopt a simple form of the gravity equation to estimate the effect of the bilateral exchange rate on bilateral trade. Aside from the bilateral exchange rate, Sino-U.S. bilateral trade is affected by the two trading countries' GDP. Simultaneously, the bilateral exchange rate is affected by the trading countries' GDP and monetary base. In the bilateral trade equation, the coefficient of the bilateral exchange rate is significantly negative. The elasticity of the exchange rate on bilateral trade is −.563, which is much lower in absolute value than the result in Column (3) of Table 4. This suggests that the effect of the current exchange rate on bilateral trade is overestimated if we do not control for the simultaneous bias caused by the reverse causality of bilateral trade on the exchange rate.

[14] It is worth pointing out that the sign and magnitude of the bilateral exchange rate do not change substantially even when the trading partners' per-capita GDP are included in the estimations, though the magnitude of trading partners' GDP would be affected instead. To save space, I do not report the estimation results with per-capita GDP in the text, though they are available upon request.

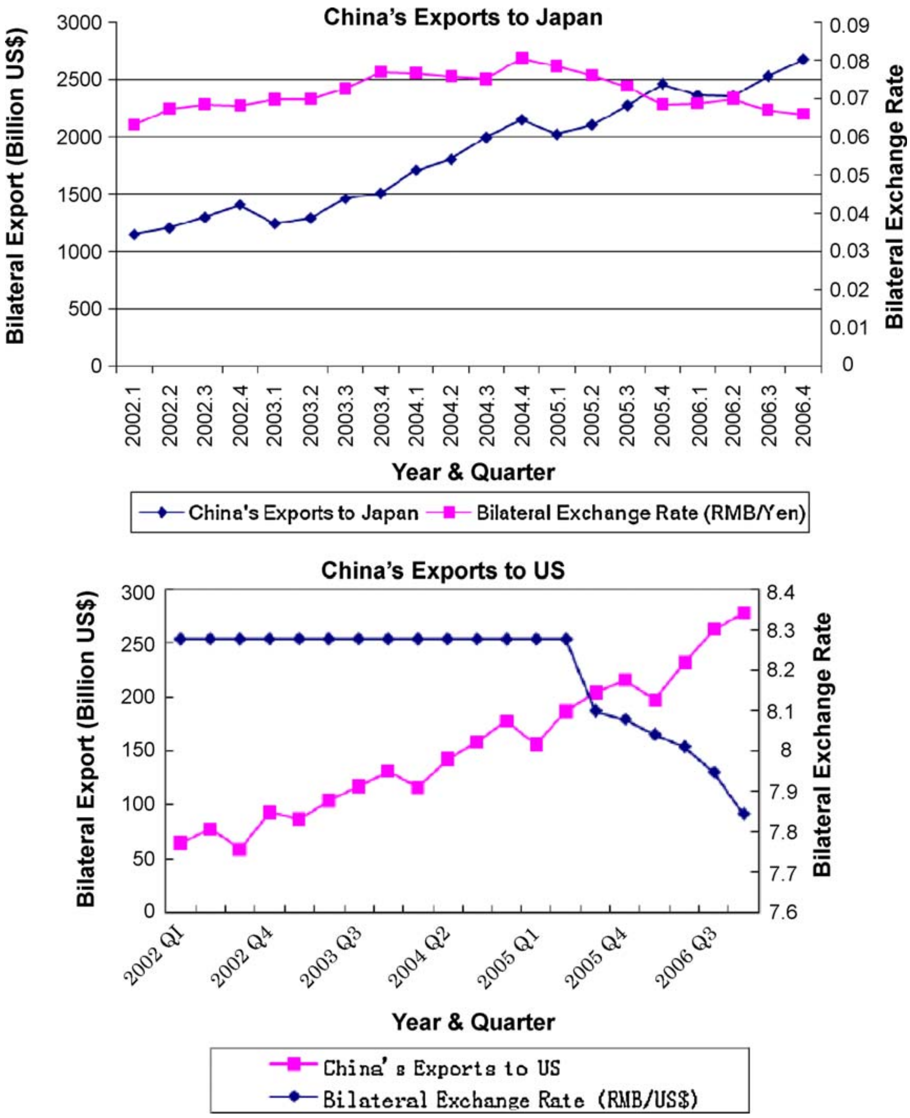

Fig. 2. China's bilateral exports and exchange rates.CEIC Database (2008).

Turning to the exchange rate equation, the coefficient of China's exports to the U.S. is insignificant. Also, its magnitude is close to nil. The idea behind this estimated result is that, once the simultaneous bias between the exchange rate and bilateral trade is taken into account, China's surging exports to the U.S. did not have a significant effect on the bilateral exchange rate, though the revaluation of the RMB did decrease China's exports to the U.S.

I now look for more evidence by adopting different specifications. I first check for the endogenous nexus between the exchange rate and bilateral trade by including previous exchange rate realizations in both equations. In this way, the past exchange rates are allowed to affect the current bilateral trade and provide additional information to form the current exchange rate due to rational expectations and other reasons. As shown in Column (2) of Table 4, the past three-period Sino-U.S. bilateral exchange rates have no significant effects on China's exports to the U.S., though they significantly affect the formation of its current bilateral exchange rate.

4.3. The Sino-Japan estimates

Turning to the Sino-Japan case, I first find that the Sino-Japan trade "Ganger" causes the Sino-Japan exchange rate at a 10% level (p-value = .06). I then conduct the unit root tests and find that both Sino-Japan bilateral exchange rate and bilateral trade follow an $I(1)$ process. Both the likelihood ratio test and the AIC are used to determine the number of lags included in the cointegrating equations. The two statistics suggest that the most appropriate lag order is two. I also use the final prediction error (FPE) criterion, which measures the mean square error of the 1-step ahead forecast, and obtain an identical lag order. However, one may be worried that both AIC and FPE would asymptotically overestimate the true lag order. I therefore include both the HQIC and SBIC as robustness checks given that these two criteria are strongly consistent with the true lag order. All the above tests suggest that the lag order should be two.

Table 3
Estimates of China's exports to the U.S. (2002–2007).

Separate estimation	Bilateral export equation			Exchange rate equation		
	(1)	(2)	(3)	(4)	(5)	(6)
Log imports from China to the U.S.					−.005** (−2.70)	−.003** (−2.15)
Log exchange rate ($/RMB)	−1.226** (−3.31)	−1.095** (−2.19)	−1.020** (−16.05)	−1.194** (−14.39)		
Log exchange rate (1-lag)		−.749 (−.03)		6.061* (1.67)		19.844** (12.26)
Log exchange rate (2-lag)		1.744 (.05)		−7.692 (−1.24)		−19.661** (−6.38)
Log exchange rate (3-lag)		−3.434 (−.13)		8.454* (1.87)		23.821** (7.19)
Log GDP of U.S.	.189** (2.72)	.172** (2.21)	.065** (2.41)	.060** (2.26)	−.023** (−6.64)	−.035** (−8.59)
Log GDP of China	1.116** (3.46)	1.079 (1.44)	1.035** (2.61)	.923** (2.41)	−.682** (−2.68)	−.329 (−1.08)
Log M1 of China					1.981** (6.03)	−2.070** (−4.58)
Log M1 of U.S.					−4.385** (−12.19)	6.421** (11.58)
Year-specific fixed effects	No	No	Yes	Yes	No	Yes
Industry-specific fixed effects	No	No	Yes	Yes	No	Yes
Prob. > F or Prob. > χ^2	.00	.00	.00	.00	.00	.00
Number of observations	1482	1296	1482	1296	1482	1296
R^2	.03	.02	.48	.46	.45	.59

Notes: Numbers in parenthesis are *t*-values. Asterisk * (**) indicates significance at the 1 (5) percent level.

Table 4
Simultaneous estimates between imports from China to the U.S. and the exchange rate (2002–2007).

Joint estimations	(1)		(2)	
	Export	Exchange rate	Export	Exchange rate
Log imports from China to the U.S.		−.001 (−.81)		−.001 (−.59)
Log exchange rate ($/RMB)	−.563** (−4.27)		−1.366** (−4.30)	
Log exchange rate (1-lag)			7.990 (1.63)	19.915** (12.48)
Log exchange rate (2-lag)			−7.982 (−1.24)	−19.809* (−9.40)
Log exchange rate (3-lag)			9.655** (2.19)	23.963** (13.80)
Log GDP of U.S.	.094** (2.79)	−.024* (−5.54)	.047 (1.17)	−.035** (−8.32)
Log GDP of China	1.135** (2.77)	−.713** (−9.57)	.926** (2.35)	−.319** (−3.75)
Log M1 of China		2.014** (21.90)		−2.086** (−9.15)
Log M1 of U.S.		−4.391** (−23.97)		6.414** (11.27)
Year-specific fixed effects	Yes	No	Yes	No
Industry-specific fixed effects	Yes	No	Yes	No
Prob. > F or Prob. > χ^2	.00	.00	.00	.00
Number of observations	1482	1482	1296	1296
R^2	.98	.45	.98	.59

Notes: Numbers in parenthesis are *t*-values. Asterisk * (**) indicates significance at the 1 (5) percent level.

I then go further to perform the Johansen MLE to test for cointegration. The trace statistic obtained by using Sino-Japan data suggests that the vector autocorrelations have zero rank. By taking the first difference, the vector autocorrelations are changed to full rank, which suggests that there is no cointegration for this vector. In addition, I also find that the error terms (ν_t) have whiteness properties. In this sense, the standard vector errors correction model seems unnecessary (Lütkepohl, 2007). I therefore use the 3SLS to conduct the analysis instead.

I first estimate the effect of the Sino-Japanese bilateral exchange rate on China's exports to Japan by using bilateral trade data from 41 industries during 2002–2006. As shown in Column (1) of Table 5, the coefficient of the exchange rate on trade is negative but insignificant. I suspect that this is due to the lack of consideration of the specific characteristics of the panel dataset. I therefore perform the two-way fixed-effects estimation in Column (2). Strikingly enough, the coefficient of the Sino-Japanese bilateral exchange rate on bilateral exports is significant and positive.

Given that the RMB maintained a fixed exchange rate with the U.S. dollar before 2005, the variation in the Sino-Japanese exchange rate must come from the movement of Japanese Yen against the U.S. dollar. I therefore decompose the bilateral exchange rate of the Japanese Yen against the RMB into two components: the bilateral exchange rate of the Japanese Yen against U.S. dollar and that of U.S. dollar against the RMB. Column (3) reports the estimated coefficients of these two variables. It turns out that the Japan-U.S. bilateral exchange rate did not have a significant effect on China's exports to Japan. The bilateral Sino-U.S. exchange rate instead had an expected positive effect on the Sino-Japanese bilateral trade. However, careful readers will observe that the variable of China's GDP drops in Columns (2) and (3) possibly due to multicollinearity in the estimations. This serves as side evidence that the simultaneous bias between trade and the exchange rate must be large.

I therefore perform the 3SLS to control for this simultaneous bias. As shown in Column (4) of Table 5, I include the Sino-Japan bilateral exchange rate and trading countries' GDP in the export equation. In the exchange rate equation, I instead add

Table 5
Estimates of China's exports to Japan (2002–2006).

Separate/joint estimations	OLS	FE		3SLS	
	(1)	(2)	(3)	(4-1)	(4-2)
Log Imports to Japan from China					−.001 (−.58)
Log exchange rate (¥/RMB)	−.483 (−.61)	1.075** (2.29)		.528 (.25)	
Log exchange rate (¥/$)			.582 (1.11)		
Log exchange rate ($/RMB)			3.223** (2.92)		
Log GDP of Japan	−.092 (−1.23)	1.605** (5.49)	1.447** (4.81)	1.650** (2.24)	−.003 (−1.30)
Log GDP of China	1.273 (3.21)	–	–	−.627 (−.87)	.303** (7.60)
Log M1 of China					−.126** (−2.63)
Log M1 of Japan					−.780** (−9.15)
Year-specific fixed effects	No	Yes	Yes	Yes	No
Industry-specific fixed effects	No	Yes	Yes	Yes	No
Prob. > F or Prob. > χ^2		.0000	.0000	.0000	.0000
Number of observations	770	770	770	770	770
R^2	.02	.39	.40	.97	.22

Notes: Numbers in parenthesis are *t*-values. Asterisk * (**) indicates significance at the 1 (5) percent level. In estimate (4), the dependant variable in the first equation is China's export to Japan whereas that in the second one is the Sino-Japan exchange rate.

the trading partners' monetary base in the estimation. The coefficient of the Sino-Japan bilateral exchange rate on the bilateral trade is positive but insignificant. Simultaneously, the coefficient of Sino-Japan trade on the bilateral exchange rate is negative and also insignificant. This suggests that, even when the endogenous nexus between trade and export is taken into account, the Sino-Japan bilateral exchange rate still has no significant effect on China's exports to Japan.

4.4. Additional robustness checks

4.4.1. Estimates using data on different periods

Finally, given that China's exchange rate against the U.S. dollar was changed only after July 2005, the impact of the bilateral exchange rate on the bilateral trade volume is underestimated if data before that are included. I therefore re-estimate the effects by only including the data since 2005. Table 6 first reports the Sino-U.S. 3SLS estimations for data for 2005–2007. I find few differences by comparing these results to the estimation results in Column (1) of Table 4 in terms of magnitude and sign. In the export equation, the coefficient of the Sino-U.S. bilateral exchange rate is still significantly negative. However, its magnitude, in absolute value, is higher than its counterpart in Column (1) of Table 4. This finding confirms that the effect of the bilateral exchange rate on bilateral trade is underestimated when we look at a longer period. Simultaneously, the effect of bilateral trade on the exchange rate is still insignificant. Turning to the Sino-Japan case, we observe a very similar finding compared to Column (4) of Table 5. The Sino-Japan bilateral exchange rate did not have a significant effect on China's exports to Japan, and vice versa.

As mentioned above, the movement of the nominal bilateral exchange rate has a pass-through effect on the price of the imports, which in turn would affect bilateral trade. Therefore, it is worthwhile to examine the joint effects of both nominal exchange rate and price change on bilateral trade. Put another way, one can check for the effect of real bilateral exchange rate on bilateral trade directly.

Table 6
3SLS simultaneous estimates (2005–2007).

Joint estimations	China and U.S.		China and Japan	
	Export	Exchange rate	Export	Exchange rate
Log Imports from China		−.002 (−.73)		.000 (.34)
Log exchange rate ($/RMB)	−.675** (−6.57)			
Log exchange rate (¥/RMB)			.670 (.23)	
Log GDP of China	.949** (2.76)	−.056 (−.73)	1.067 (.47)	−.287** (−10.01)
Log GDP of Japan			−1.756 (−.50)	−.000 (−.39)
Log GDP of U.S.	.098** (3.19)	−.645** (−4.34)		
Log M1 of China		2.145** (12.88)		.589** (26.11)
Log M1 of Japan				1.533** (18.11)
Log M1 of U.S.		−15.020** (−5.62)		
Year-specific fixed effects	Yes	No	Yes	No
Industry-specific fixed effects	Yes	No	Yes	No
Prob. > F or Prob. > χ^2	.00	.00	.00	.00
Number of observations	556	556	317	317
R^2	.98	.79	.98	.90

Notes: Numbers in parenthesis are *t*-value. Asterisk * (**) indicates significance at 1 (5) percent level.

Table 7
3SLS simultaneous estimates between trade and the real exchange rate (2002–2007).

Joint estimations	China and U.S.		China and Japan	
	Export	Real exchange rate	Export	Real exchange rate
Log imports from China		−.000 (−.99)		−.002 (−1.42)
Log real exchange rate ($/RMB)	1.835 (1.23)			
Log real exchange rate (¥/RMB)			1.863 (1.27)	
One-lag log real exchange rate	−1.363 (−1.25)	.729** (20.02)	−1.488 (−1.30)	.959** (24.34)
Two-lag log real exchange rate	−1.164* (−1.94)	.010 (.22)	−.175 (−.68)	−.046 (−.84)
Three-lag log real exchange rate	−.802 (−1.52)	.233** (6.84)	−.490** (−2.31)	.099** (2.29)
Log GDP of China	−.593 (−.41)	.380** (19.92)	−.260 (−.65)	−.038 (−.54)
Log GDP of Japan			1.205* (1.75)	−.004 (−.96)
Log GDP of U.S.	.252** (8.54)	−.002** (−2.02)		
Log M1 of China		−.340** (−17.69)		−.039 (−.54)
Log M1 of Japan				−.038 (−.14)
Log M1 of U.S.		−.018 (−.35)		
Year-specific fixed effects	Yes	No	Yes	No
Industry-specific fixed effects	Yes	No	Yes	No
Prob. > F or Prob. > χ^2	.00	.00	.00	.00
Number of observations	1120	1120	732	732
Years coverage	2002–2007		2002–2006	
R^2	.98	.97	.97	.95

Notes: Numbers in parenthesis are *t*-value. Asterisk * (**) indicates significance at 1 (5) percent level.

Table 6 reports the 3SLS simultaneous estimates between trade and real exchange rate (re_j) among the triad during the 2002–2007 period. Following literature, I proxy the real bilateral exchange rate as the product of the nominal bilateral exchange rate and a fraction consisting of China's producer price index (PPI_{CH}) in the denominator and its importer's producer price index (PPI_j) in the numerator. That is, $re_j = e_j \times (PPI_j/PPI_{CH})$. In addition, I include the past real exchange rate realizations in estimations to allow them affect current real rate formation.[15]

Estimation results in the SEM for the Sino-U.S. case show that current real exchange rate did not have a significant influence on their bilateral trade. At first glance, it is in sharp contrast to Cheung et al. (2009) which suggests a statistically significant effect of current real exchange rate on Chinese export to the U.S. One possible reason of the difference is that I clearly consider the endogenous exchange rate in the present paper. Furthermore, the real spot rate in half a year ago (*i.e.*, the two-period lag) has a significantly negative coefficient, which suggests that the past real exchange rate appreciation reduced the Sino-U.S. bilateral trade. Simultaneously, China's exports to the U.S. had no significant effect on real exchange rate formation. A similar finding can be obtained from the 3SLS estimates for the Sino-Japan case, as shown in Table 7.

In a nutshell, all my results are robust to show that the revaluation of the RMB against dollar significantly reduced China's exports to the U.S. but there were no significant effects on China's exports to Japan. These findings are robust to different measures, econometric methods, and data period coverage.

It is interesting to ask why the RMB revaluation has different effects on Sino-U.S. export and Sino-Japan export. It is no surprise that RMB revaluation reduces the Sino-U.S. exports. Such a finding is consistent with the traditional wisdom. Turning to the Sino-Japan trade, one possible reason of the insignificant effect of RMB valuation on the Sino-Japan export is that the bilateral exchange rate between RMB and Japanese Yuan does not have a much variation during 2002–2006. Before 2005, RMB kept fixed with the U.S. dollar whereas U.S. dollar depreciated against Japanese Yuan. As a result, RMB depreciated against Japanese Yuan. In contrast, after 2005, U.S. dollar indeed appreciates against Japanese Yuan though it depreciated against RMB. Accordingly, RMB is shown to appreciate against Japanese Yuan instead. Putting these two different trends together, it is reasonable to expect that the change of bilateral exchange rate between China and Japan should not have a significant effect on their bilateral trade.[16]

4.4.2. Estimates using 2SLS approach

As mentioned above, the 3SLS method, as a full-information likelihood approach, enjoys an advantage that is more efficient than 2SLS, a limited information likelihood approach. However, one might be worried about whether the empirical model in 3SLS is correctly specified. Otherwise, it would be a suspect. I therefore perform the 2SLS approach as a cross check.[17]

Table 8 reports the 2SLS estimation results. As the estimates in 3SLS, I adopt trading partners' monetary supply as instrument variables. It turns out that all the estimates are very similar their counterparts by using 3SLS approach. In

[15] Using wholesale price index (WPI) or consumer price index (CPI) does not substantially change the estimation results in Table 7.
[16] Of course, a caveat still exists: even focusing on the period 2005–2007, the bilateral exchange rate on China–Japan trade is still insignificant. Its reasons, though beyond the main interest of the present paper, deserve further exploration in the future.
[17] I thank a deligent referee for suggesting this point.

Table 8
Robustness checks: 2SLS estimates.

Dependant variable:	China and U.S.		China and Japan	
	Period 2002–2007	Period 2005–2007	Period 2002–2006	Period 2002–2006
Log exchange rate ($/RMB)	−.581** (−4.27)	−.679** (−6.26)		
Log exchange rate (¥/RMB)			−1.236 (−.59)	4.483 (1.44)
Log GDP of China	.543 (1.28)	.518 (2.07)	–	–
Log GDP of Japan			.824 (1.08)	3.263 (.85)
Log GDP of U.S.	.144** (4.13)	.135** (4.09)		
Instruments in the first stage				
Log M1 of China	2.058** (20.14)	2.489** (13.56)	.065** (2.46)	(
Log M1 of Japan			−.296** (−6.09)	−.984** (−36.59)
Log M1 of U.S.	−5.731** (−12.85)	−5.862** (−2.09)		
Year-specific fixed effects	Yes	Yes	Yes	Yes
Industry-specific fixed effects	Yes	Yes	Yes	Yes
Prob. > F or Prob. > χ^2	.000	.000	.000	.000
Number of observations	1,482	742	770	317
R^2	.45	.53	.34	.12

Notes: Numbers in parenthesis are *t*-value. Asterisk * (**) indicates significance at 1 (5) percent level.

particular, the effect of bilateral exchange rate on bilateral trade in Column (1), −.581, is pretty close to its counterpart in Column (1) of Table 4: −.563 The coefficients of trading partner's monetary supply are also similar to their counterparts in the 3SLS estimates. Moreover, the estimates for the shorter period (*i.e.*, 2005–2007) are close to the findings in Table 6. Turing to the Sino-Japan's case, the key findings in the previous 3SLS estimates still hold well even adopting the 2SLS estimates: the effect of the Sino-Japan bilateral exchange rate on its bilateral trade is insignificant. In short, our main findings in the 3SLS estimates are insensitive by adopting the 2SLS approach.

5. Concluding remarks

In this paper I investigate the effect of the revaluation of the RMB on bilateral trade among China, Japan, and the U.S. by using industrial panel data from 2002–2007. Different from previous one-way estimations, I use simultaneous equation methods to take into account the endogenous nexus between bilateral exchange rates and bilateral trade. Thanks to this method, I am able to explain the results both statistically and economically. The estimation results clearly suggest that the revaluation of the RMB against the dollar significantly reduced Sino-U.S. trade but it had no significant effects on Sino-Japan bilateral trade. The policy implication for this finding is that the revaluation of the RMB was helpful in reducing the bilateral Sino-U.S. trade imbalance, though in the long run such an imbalance could be caused by the over-saving behavior of China and over-consumption behavior in the U.S.

Several extensions and possible generalizations merit special consideration. One of them is to introduce a theoretical gravity model to serve as the empirical estimate. This way, the exchange rate pass-through channel can be more precisely presented. Another possible extension is to include other protection instruments like export tax rebates into the two equations so that the model can be closer to reality. Due to data restrictions, I am not able to explore these issues here. However, these are the topics that I will pursue in future work.

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