RMB Revaluation and China's Trade: Does RMB Have Limited Effect on China's Surplus?

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Abstract

This study examines the influence of the RMB variation on trades of primary, intermediate, and final goods between China and its 49 major trading partners over the period 1992-2009. We employ the technique of GMM model for dynamic panel data to deal with the problems of endogeneity and panel unit root. The empirical result shows that the sensitivity of trade to exchange rate change for various commodities varies substantially. Overall, China's exports are more sensitive to exchange rate than imports. Among the results, we find a counterintuitive one that an RMB appreciation will reduce China's intermediate goods imports. The possible explanation for this finding is that the appreciation will harm China's final goods exports in assembly sector, thus indirectly lower the demand for the required intermediate goods imports. This finding, along with the other one that the final goods exports, the major source of the surplus, are not sensitive to exchange rate change, are probably the main reasons why the RMB appreciation has limited effect on restraining China's rising surplus. To deal with the trade imbalance issue between China and its partners, other than the RMB revaluation, our estimation results suggest China to also speed its economic transformation from export-led to domestic-oriented model, because they show that the effect of China's stronger domestic demand on imports dominates that of an appreciating RMB.

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1. Introduction

China has experienced spectacular economic growth since it implemented the open-door policy in the late 1970s. Among China's economic reform measures that explaining its remarkable growth, one critical development strategy is the export-led growth model (Kwan and Kowk, 1995) that also applies to the growth path of other East Asian economies such as Taiwan. Along with the deepened globalization, China utilized its advantages in cheaper labor and policy measures to attract foreign direct investment (FDI) and export labor-intensive as well as final assembly products. After China joined the WTO in 2001, it further was able to fully integrate into the world system and capitalize its abundant labor force. China is called "the World's Factory" as it dominates the production in many manufacturing goods: its share in world trade has ballooned from approximate 1.7% in 1990 to 9.7% in 2009.

To coordinate with the export-led growth model, China implemented a weak RMB exchange rate policy pegging to the US dollar at the rate of 8.7 RMB/dollar in 1994 and remained it until the exchange rate reform in 2005.[1] The weak exchange rate policy enables China to create an unfair competitive advantage in world trade and induce an extraordinary upsurge in trade surplus. China's trade balance grew from 3.3 % of GDP in 1990 to the peak of 10.6% in 2007. To respond to the demand for the RMB revaluation, China announced an unprecedented regime change of exchange rate policy on July 21, 2005. This announcement represents a more flexible RMB exchange rate with China's intrinsic value based more on market mechanism.[2] However, China's trade surplus continued to increase substantially. The extraordinary upsurge raised increasing disputes among China's major trading partners, especially the U.S. The critics mainly argue that the

[1] Bahmani-Oskooee and Wang, (2008) argues that while the nominal rate of the RMB seemed to be effectively pegged to the US dollar, the real exchange rate continued to depreciate.

[2] The new regime of the RMB exchange rate is a managed floating exchange rate regime relied upon market supply and demand with reference to basket of currencies. It allows the RMB to rise by 2% with a daily 0.3% trading band based on the price of the previous day (Zheng *et al.,* 2006).

RMB was seriously undervalued due to the exchange rate manipulation.[3]

Nowadays, the issue regarding the RMB exchange rate remains at the center of ongoing debate over the source of global current account imbalance, because the appreciation of the RMB seems to have little effect on reducing China's trade surplus. Figure 1 displays the trend of the RMB exchange rate and China's trade surplus. Despite the RMB's gradual appreciating from the average of 8.192 (US dollar in terms of RMB) in 2005 to 6.831 in 2009, a 4.4% annual appreciation rate in the period 2005-2009, the amount of trade surplus has been still rising rapidly between 2005 and 2008.[4] It casts a debatable issue of whether the revaluation of the RMB has any effect on China's surplus? That is, are China's exports and imports sensitive to the change in the exchange rate?

[Insert Figure 1 approximately here]

Recently, emerging studies begin to investigate the effect of RMB variation on China's trade or current account, most of which report that an RMB appreciation will reduce China's exports or trade surplus, e.g. Bahmani-Oskooee and Wang (2006), Narayan (2006), Thorbeck (2006), Zheng *et al.* (2006), Groenewold and He (2007), Baak (2008), Hua (2008), Yu (2009), and Rahman (2009). However, as indicated in Athukorala (2006), fragmentation trade has played a pivotal role in the continuing dynamism of the East Asian economies and deepened increasing intra-regional economic interdependence.[5] This view suggests that the aggregated trade data contains little information regarding the feature of Asian production network where China serves as the main final assembly exporter in the global manufacturing chain. Therefore, using disaggregated data to revisit the RMB variation and trade nexus for China may provide us more insightful implications. Some potential drawbacks in the studies above are worth improving as follows. First,

[3] Cline and Williamson (2008) provides a survey of the extent of possible RMB undervaluation estimates. They showed the typical range of the degree of undervaluation of Chinese real effective exchange rate is 8% to 55%.

[4] The sharp shrink in China's surplus in 2009 was caused by global financial crisis.

[5] Athukorla (2006) defines the fragmentation as the cross-border dispersion of component production/ assembly within vertically integrated production processes.

previous literature focused mostly on the movements of the RMB before 2006 without considering its fluctuations between 2006-2009, after the exchange rate reform was launched in mid-2005. Second and more crucially, most studies assume that the price elasticity of different trading commodities responding to the RMB variation is identical. Though few researches divide China's trade into ordinary and processing trade (use domestic and imported intermediates respectively), none of them examine the effect of the RMB variation on both exports and imports for the division of primary, intermediate, and final goods. A sound exchange rate policy considers not only exports but also imports, and not only final goods but also intermediate and primary goods. It is particularly relevant to China, because (1) its final assembly exports in the global vertical integrated supply chain depend heavily on importing components and intermediate goods; (2) China, to maintain its persistent growth, is now a major importing country of primary goods, usually argued as a main reason for their mounting international prices. The previous studies are telling a partial story since they fail to consider these aspects. To examine the real effect of the RMB appreciation on China's trade surplus, a wider study on both exports/imports and primary/intermediate/final goods, we believe, will bring us more insights about the exchange rate policy.

This paper attempts to fill this important gap in the literature and extends the preceding works in following ways. First, we observe a longer and more recent trade data to revisit the impact of the RMB variation on trade between China and its 49 major trading partners. The time span of the sample is 1992 to 2009, including the RMB reform after 2005. Second, we categorize China's trading commodities into primary, intermediate, and final goods by applying the standard of Broad Economic Classification (BEC) system to coordinate with our 6-digit HS code trade data This enables us to examine whether and how much various exporting and importing goods are sensitive to exchange rate. Moreover, this study sheds lights on how the exchange rate of the RMB adjusts along with

the change of trade structure in different economic development stages. Third, to deal with the potential well recognized problems that the time series data of trade is non-stationary and the decision of exchange rate is endogenous, we employ the technique of Generalized Method of Moment (GMM) for dynamic panel data in this paper.

The remainder of this paper is organized as follows. Section 2 briefly reviews related literature of the effect of the RMB appreciation on China's trade balance by using disaggregated data. Section 3 discusses some stylized facts of China's trade. Section 4 presents the empirical model and data. Section 5 reports and analyzes the empirical results. Concluding remarks are summarized in the final section.

2. Literature Review

There is an emerging body of literature examining the response of China's trade balance to the real exchange rate with disaggregate data, e.g., commodity or industry trade data. Bahmani-Oskooee and Wang (2007, 2008) claim that using aggregated data to investigate the short-run and long-run effects of exchange rate depreciation on trade surplus will suffer from aggregation bias.[6] They, thus, employ the industry-level trade data to examine the hypothesis of short-run effect (J-curve effect) in trade between U.S. and China, and conclude that there is no evidence that changes in the exchange rate will cause the trade deficit to rise in the short run; however, the real RMB-dollar rate has played a significant role in the long run. Their findings contradict most previous researches that use the aggregated trade data.

Additionally, another line of research focuses on estimating exchange rate elasticity of China's trade. Mann and Plück (2005) estimate the exchange rate elasticity of U.S. trade flow employing the commodity-level bilateral trade data for 31 countries. The authors find that the trade pattern between the U.S. and China is pretty different from those between

[6] Bahmani-Oskooee and Wang (2007, 2008) define the aggregation bias is the effect of exchange rate on trade will be offset by some insignificant industry's trade. This implies disaggregated data is appropriate for evaluating the effect of exchange rate.

the U.S. and the rest of the world, especially in terms of American imports of capital goods and exports of capital and consumption goods.

Marquez and Schindler (2007) attempts to figure out the relationship between the shares of China's exports and imports in global trade volume and the real effective value of the RMB, using monthly trade data disaggregated as the two categories of ordinary and processing goods. They find that a 10% real appreciation of the RMB lowers the share of aggregate Chinese exports by nearly 1%. In addition, they find that ordinary and processing trades exhibit different responses to exchange rate changes.[7]

Thorbecke and Zhang (2009) examine the impact of revaluation of the RMB on China's labor-intensive manufacturing exports, and report that an appreciation of the RMB will substantially reduce exports in clothing, furniture and footwear industries. Their findings, an appreciation among China's competitors would raise China's exports, highlight the importance of third party effect.

Thorbecke and Smith (2010) investigate the impact of joint appreciation of East Asian currencies on China's trade, using a panel data in processing trade that includes China's exports to 33 countries. They report that a 10% RMB appreciation will reduce ordinary and processing exports by 12% and less than 4%, respectively. Furthermore, as processing exports are sophisticated, capital-intensive goods, an appreciation in East Asia currencies will lead to more of their expenditure transferring towards U.S. and European goods and contribute more in ameliorating the global imbalance than merely an appreciation in only RMB or other single Asian currency alone.[8]

[7] Thorbecke and Smith (2010) report that China's processing exports are produced through intricate production and distribution networks centered in East Asian countries e.g., Japan, South Korea, Taiwan, and multination corporations in ASEAN. These processing exports account for about 53% of China's total exports in 2006.

[8] There are also some working papers examining how exchange rate change affects China's processing trade, such as Ahmad (2009), Cheung *et al*. (2009), Garchia-Herreroand and Koivu (2009), Thorbecke (2010), and Xing (2011).

3. Data and the stylized facts of China's trade

To examine the effect of the RMB revaluation on China's trade, we utilize the yearly trade data between China and its 49 major trading partners over the period 1992-2009.[9] The sample set not only contains the period when China's trade regime was transformed from state-controlled to market-oriented, but also includes the post 2005 exchange rate reform period. Moreover, in order to disaggregate the data, we compile the Harmonized System (HS) codes at the 6-digit level with the BEC system and classify both China's exports and imports into primary, intermediate, and final goods. This helps to depict the characterization of China's trade. (See the Appendix Table). Besides, the sample set is representative since the trade volume with these countries accounts for approximately 90% of China's trade during the sample period.

Before introducing the empirical specification, we first illustrate some stylized facts of China's trade. Figure 2 portrays the trend of China's trade balance for all goods and for different stages of production, i.e., primary, intermediate, and final goods. This figure reveals that China's outstanding export performance is mainly related to its integration in the international production division. Overall, the trade surplus rose steadily before 2004 and increased much faster till 2008, the year of global financial crises. By dissecting China's trade surplus, we find that the trade in final goods is the only force driving overall surplus to increase. The surplus of trade in final goods increased stably in the 1990s. After China joined the WTO in 2001, it fully integrated into the world system and enjoyed the relative advantage in the international division, especially in the assembly export sector. China's trade surplus in final goods increased sharply: it reached the historical high of around US$ 557 billion in 2008. However, China's final assembly exports depend heavily on importing intermediate goods from its East Asian neighbors, inducing trade deficit in

[9] The sample countries include: Angola, Argentina, Australia, Brazil, Canada, Chile, Denmark, Finland, France, Germany, Hungary, India, Indonesia, Iraq, Italy, Japan, Kazakhstan, Korea, Kuwait, Malaysia, Mexico, Netherlands, Nigeria, Oman, Pakistan, Panama, Peru, Philippines, Poland, Russian Federation, Saudi Arabia, Singapore, Spain, Sudan, Sweden, Switzerland, Taiwan, Thailand, Turkey, Ukraine, United Arab Emirates, United Kingdom, United States, Venezuela, Vietnam.

intermediate goods trade. As for the trade in primary goods, to sustain the spectacular growth, China has to not only import them as inputs for final assembly production, but also invest heavily in infrastructure. Therefore China's demand on primary goods upsurges sharply, leading to an increasing trade deficit in primary goods since 2002 and onward. The trade deficits from primary and intermediate goods were about US$ 221 billion and US$ 83 billion in 2009, respectively. Actually the trade in primary goods has already become the largest source of China's overall trade deficit since 2005.

[Insert Figure 2 approximately here]

We now analyze the change of China's trade structure in terms of its trading partners for goods in different categories. For exports, we see from Table 1 that final goods exports always have the highest proportion of 60% and 61% in overall exports, with the highest shares of 69% and 52% to the destinations of advanced regions (Europe, U.S. and Hong Kong), for the year of 1992 and 2009, respectively. For imports, it is the intermediate goods imports that have the highest proportion of 61% and 44% in overall imports, with the highest shares of 66% and 55% from the destinations of neighboring East Asian region (Taiwan, South Korea, Japan, and Hong Kong), for year 1992 and 2009, respectively.[10] This can be explained by China's role of serving as a main producer of final assembly goods in the vertically integrated production processes in Eastern countries and thus importing intermediate inputs from this area. Besides, we can also observe China's becoming a major primary goods consumers and importers since its importing share rises drastically from 9% to 22% while exporting share falls largely from 10% to 1% between 1992 and 2009.

[Insert Table 1 approximately here]

[10] Hong Kong plays an interesting role in 1992, especially for China's exports: due to its functions of transship and entrepot, Hong Kong is usually not the final destination in most China's trade. To avoid overestimation, we exclude Hong Kong in our sample in this paper.

4. Empirical Specification

To evaluate the effect of the RMB variation on China's trade, we apply the commodity version of imperfect substitute model developed in Goldstein and Khan (1985). They assume that the trading activity depends on the real exchange rate and trading partner's income level. The basic model is specified as follows:

$$EX_{ijt} = \alpha_1 + \alpha_2 RER_{ijt} + \alpha_3 RGDP_{jt} + u_{ijt} \quad (1)$$

$$IM_{ijt} = \beta_1 + \beta_2 RER_{ijt} + \beta_3 RGDP_{it} + u_{ijt} \quad (2)$$

where EX_{ijt} represents country *i's* exports to country *j* in year *t*; IM_{ijt} represents country *i's* imports from country *j* in year *t*, both variables measured in real term; RER_{ijt} stands for the bilateral real exchange rate between countries *i* and *j* in year t; $RGDP_{jt}$ and $RGDP_{it}$ represent country *j*'s and country *i*'s real income, respectively. Hereafter country *i* will represent China, the home country, while country *j* the foreign country.

As is well known, most economic time series data are non-stationary, implying that there exist the potential problems of unit root and autocorrelation. Also, trade is usually thought to be habitual, namely, the trading behavior may be influenced by its behavior in previous years. The most common approach in the empirical trade literature to test such a hysteresis effect is adding a lagged term in the specification: a positive and significant estimated coefficient of this lagged one-year term may suggest the presence of habitual behavior. We therefore augment the earlier specifications as follows:

$$\ln EX_{ijt} = \alpha_1 \ln EX_{ijt-1} + \alpha_2 \ln RER_{ijt} + \alpha_3 \ln RGDP_{jt} + \alpha_4 \ln FDI_{it} + \alpha_5 WTO + \lambda_i + u_{ijt} \quad (3)$$

$$\ln IM_{ijt} = \beta_1 \ln IM_{ijt-1} + \beta_2 \ln RER_{ijt} + \beta_3 \ln RGDP_{it} + \beta_4 \ln POP_{it} + \beta_5 \ln FDI_{it} + \beta_6 WTO + \lambda_{it} + u_{ijt} \quad (4)$$

where EX_{ijt} and IM_{ijt} represent China's real exports and imports in different

categories in year *t* (i.e., total trade, primary, intermediate, and final goods trade). As indicated in Thorbecke (2010), most of Hong Kong's exports are re-export from China, it is proper to use Hong Kong's export price as the deflator for China's exports and vice versa for imports. We then deflate export (import) variables by Hong Kong export (import) price indexes. The terms EX_{ijt-1} and IM_{ijt-1} are one-year lagged exports and imports controlling for the persistent effect in trade structure and both variables are expected to have positive coefficients.

The term RER_{ijt} symbolizes the bilateral real exchange rate between China and its trading partner *j* and is deflated by the consumer price index (CPI). This variable is our main concern that may reduce China's exports and augment imports as it increases (appreciates). The overall effect of the RMB appreciation on trade surplus, however, depends on the relative magnitudes of elasticity of different categories of trading commodities. The terms $RGDP_{it}$ and $RGDP_{jt}$ represent the real GDP of China and its trading partner at year *t*, respectively. The two variables capture the economy scale or demand size and are expected to have positive effect on trade. Moreover, POP_{it} donates China's population size to capture the effects of China's massive labor force and potential market opportunity. FDI_{it}, the variable for China's foreign direct investment stock, measures China's production capacity (Ahmed, 2009; Garcia-Herrero and Koivu, 2009; Thorbecke, 2010; Xing, 2011).[11] In addition, we consider the effect of trade liberalization of China's access to the WTO by using a dummy variable equal to one for years 2002-2009.[12] All variables above enter the equation in the form of logarithm except the WTO dummy variable. Finally, λ_i is a time-invariant individual country effect, and the

[11] Some studies use the Chinese capital stock in manufacturing as the proxy for production capacity, e.g., Rahman and Thorbecke (2007), Thorbecke and Zhang (2009), Thorbecke and Smith (2010) and Thorbecke (2010). These papers often quote the capital stock estimates from Bai et al. (2006); however the data are only available during 1978 to 2006.

[12] China joined the WTO on November 10, 2001, and became an official member on January 1, 2002.

error term u_{ijt} is assumed to be log normally-distributed.

Again, our main purpose is to differentiate the potential differences in the effects of exchange rate on different categories of trading commodities. In particular, we will estimate equations (3) and (4) for primary, intermediate, and final goods. Table 2 summaries the sources and definitions for all variables above.

[Insert Table 2 approximately here]

The data in this paper is a panel data. Two econometric problems emerge: First, the decision of exchange rate is widely recognized as an endogenous strategy for a country. This problem of endogeneity should be well dealt with for ensuring consistent estimates. Second, the time dimension of panel data might be non-stationary due to the existence of a unit root. We, thus, test the time series property of our data using the panel unit root test proposed by Levin *et al*. (2002) and Im *et al*. (2003). As shown in Table 3, the statistics for all variables are all smaller than the critical value at the 10% statistical significance level. This implies that the null hypothesis of existing panel unit root cannot be rejected. For dealing with the problems of panel unit root and endogeneity, we employ the dynamic generalized method of moments (GMM) estimator developed by Arellano and Bond (1991) to implement the estimation.

[Insert Table 3 approximately here]

5. Empirical Results

5.1 The effect of the RMB appreciation on China's total trade

Does the RMB appreciation restrain China's trade surplus? We first look at the overall effects of exchange rate change on exports and imports. Table 4 displays the estimating results using the dynamic panel GMM method (model (1) and (2) for total exports and total imports, respectively). The Sargan's test shows that, with 10% significance level, the

joint null hypothesis that the dynamic panel data GMM model is correctly specified and that the instruments are valid cannot be rejected. Besides, the second-order serial correlation test suggests that, also with 10% significance level, there is no serial correlation as assumed. The two tests ensure the adequateness of our estimating strategy.

[Insert Table 4 approximately here]

We first find that the effect of the real bilateral exchange rate between China and its trading partner on exports (imports) is significantly negative (positive) at the 1% level, implying that the appreciation in RMB will significantly decrease (increase) the volume of China's exports (imports) in general. In particular, we find that a 10% RMB appreciation will result in 6‰ decrease (3‰ increase) in China's export (import). Combining the two effects together, a 10% RMB appreciation will on average have a 9‰ negative impact on trade balance, consistent with the findings in most previous studies.

The signs of the effects of other variables conform to our expectation. The presence of a habitual behavior is confirmed since the estimated coefficients of the lagged exports and imports are positive and significant at the 1% significance level. The foreign real GDP is positively related to China's exports, consistent with the fact that China's main exporting markets concentrate on developed countries. It is worth noting that the coefficient of foreign income (2.29) dominates that of the *RER* (-0.06), implying that even though the RMB appreciates, the foreign demand on China's exports will still be solid if the world economy is still blooming. This finding, to some extent, verifies the opposite trend between China's trade surplus and the movement of the RMB in the past few years. China's real GDP and population have positive and significant impacts on imports (with coefficients 0.89 and 21.23, respectively), indicating that higher real GDP and population will enhance China's demand for importing goods. Also, the effects of these two variables also dominate that of the RMB. As for China's accumulated FDI and the dummy WTO, as expected, they play an export-enhancing role (significant coefficients of 0.33 and 0.29),

probably because more inward FDI would induce more assembly exports, and WTO access enables China to integrate into the world trade system. FDI and WTO access negatively influence China's imports, however, after controlling for other variables. One possible explanation may be that China developed import-substitution industries in post-WTO period.

5.2 The effect of the RMB appreciation on China's trade by stages of production

Now we focus on the question of whether and how various trading commodities respond to exchange rate variation? Table 5 presents the estimates of the dynamic GMM model for China's various exporting commodities (model (3), (4), (5) for primary, intermediate, and final goods, respectively).

[Insert Table 5 approximately here]

The real exchange rate variation, our main focus variable, still has negative and significant effects on exports of various commodities, suggesting that an RMB appreciation will reduce China's exports in various commodities in general. The coefficients for primary, intermediate, and final goods exports are −0.14, −0.11 and −0.08, respectively, meaning that a 10% appreciation of RMB will reduce the exports of various commodities by 1.4%, 1.1%, and 0.8%, all not large. Obviously, primary goods exports are most sensitive to the change in real exchange rate, then intermediate goods exports, and final goods exports are the least sensitive ones. Two observations here: First, as depicted in Figure 2, China's trade deficit of primary goods became larger since the early 2000s and till 2008, a period before and after the RMB revaluation. Before the revaluation, it must be other factors driving this deficit up other than the exchange rate change; after the revaluation, since the elasticity is not large, it also must be other factors for the even sharper increase.[13] One possible explanation, we think, for this rising trade deficit in

[13] The effect of real exchange rate change on primary goods imports is also not large, a significant coefficient

primary goods is that China needs more primary goods as resources to sustain its economic growth. Second, that China's final goods export is not sensitive to the exchange rate appreciation implies that the RMB appreciation may not harm final goods export considerably.

Why is China's final goods export not sensitive to the RMB variation? One possible reason may be that China plays a pivotal role in international production division. China and other East Asian countries form a firm vertical specialization network and it mainly focuses on final goods production in this global supply chain, which is irreplaceable in the short run. Hence, although the RMB appreciation will increase China's exporting price, China's role as the top supplier of final goods is still hard to sway.[14]

The influences of other variables remain similar to those in Table 4. The lagged one-year exporting commodity is associated with a significantly positive coefficient in all categories, indicating that China's various commodities exports exhibit a persistent property. The FDI variable has significant but mixed impacts on exports of various commodities: the coefficient is -0.9 for primary goods but 0.11 and 0.38 for intermediate and for final goods. As more foreign affiliates are established in China by multinationals, they demand more primary goods, both from domestic and foreign, possibly leading to a decrease in China's primary goods exports. These affiliates, however, are expected to export final goods through assembly production. Among them, some with even higher technological capability may produce and export intermediate goods for other low-labor-cost Southeast developing countries for further assembly production. Finally, we find that joining the WTO statistically improves China's export for all kinds of commodities.

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of 0.05 as shown in Table 6.

[14] Athukorala and Yamashita (2009) concludes that the Sino-US trade imbalance is basically a structural phenomenon resulting from the pivotal role played by China as the final assembly centre in East Asia-Centered global production networks.

The estimating results of the dynamic GMM model for China's various importing commodities are shown in Table 6 (model (6), (7), (8) for primary, intermediate, and final goods, respectively). [Insert Table 6 approximately here]

How does the RMB variation affect China's imports of various commodities? Economic theory predicts that, other things being equal, currency appreciation of the home country will raise the purchasing power of its people and then induce more imports. As shown in Table 6, this prediction holds for the imports of primary and final goods with significant and positive estimated coefficients for the variable *RER* of (0.05 and 0.06, respectively). Nevertheless, this prediction does not hold for the imports of intermediate goods with a significant and negative coefficient of -0.06, which implies that the RMB appreciation will not induce, as expected, but lower the imports of intermediates. The possible explanation is as follows: Reasonably we may argue that an expensive RMB will help China's final assembly exporters by reducing their costs of purchasing intermediates from the main source East Asian countries. Recall that, however, this same expensive RMB will also reduce (elasticity equal to -0.08) their volume of final goods exports, the lion's share in the trade balance, and thus indirectly reduce their demand of imports of foreign intermediates.

As for the influences of other variables, they by and large demonstrate similar effects on imports of various commodities. The persistent effect of trade still holds for imports of various commodities. Specifically, the coefficient attached for the lagged one-year primary goods imports is significantly larger than both intermediate goods and final goods. The result indicates that the persistent need of importing primary goods for China. In contrast, the low magnitude for the coefficient of lagged one-year final goods import may be attributed to the increasing final goods supplied by domestic firms in China. China's real GDP and population exhibit positive impacts on all categories of imports and their impacts both dominate that of the RMB. This tells us that China's domestic demand may be a

critical stimulus for imports of various goods. Accumulated FDI shows a negative impact on imports of all goods suggesting that multinationals' establishing foreign affiliates in China may help build stronger import-substitution industries.[15] The effect of WTO dummy is mixed: it has positive effects on the imports of primary and intermediate goods but negative one for final goods. The latter negative effect, then, may be explained by domestic firms' increasing supply of final goods in the import-substitution sectors.

In summary, we find that China's exports are more sensitive to the RMB variation than imports. The RMB appreciation, according to our estimation results, seems not to be able to reduce China's trade surplus by much because: (1) the sizes of the impacts of the exchange rate revaluation are not large, for the trade of goods with "correct" signs (negative for exports of all goods, and positive for imports of primary and final goods); (2) the decrease in China's import of intermediates due to the RMB appreciation will even raise, instead of lower, the trade surplus. China's trade surplus will rise, even though the RMB is appreciating, if there are other positive factors such as a blooming global economy. Notice that, this does not imply that China can allow RMB to appreciate freely at will, since most of China's final assembly exporters are labor-intensive, low-technology, and low domestic value-added (Koopman *et al.,* 2009; Thorbecke and Smith, 2010) and they are highly vulnerable to small RMB appreciation. China's monetary authority may want to take into account their sustainability under RMB appreciation before implementing any change in exchange rate policy

6. Concluding Remarks and Policy Implications

Many studies argue that it is China's maintaining a weak exchange rate policy and thus creating an unfairly competitive advantage that should be responsible for its enormous trade surplus. China's major trading partners, especially the U.S. and some European

[15] In fact, the literature doesn't reach a conclusive about the effect of accumulated FDI on China's imports. For example, Garcia-Herrero and Koivu (2009) and Thorbecke (2010) obtain contradicted effects of FDI stock on Chinese processing import or general import.

countries, have urged Chinese monetary authorities to launch exchange rate reform or shift to a more flexible exchange rate regime. In response to this pressure of the RMB revaluation, Chinese government began the exchange rate reform in the mid-2005. The appreciation of the RMB does not seem to have any effect on curbing China's trade surplus. It casts an important debate of whether the revaluation of the RMB can affect China's surplus. In particular, the question is: does the appreciation of the RMB reduce China's exports and boost imports?

In this paper, we categorize China's trading commodities into different categories according to their production stages (primary, intermediate, and final goods) and examine the impacts of the RMB variation on trade of various commodities. Different from previous studies that mostly focus on the little variation of the RMB before the exchange rate reform in 2006, we utilize disaggregated trade data between China and its 49 major trading partners over 1992-2009 for this investigation. The stylized facts show that the trade in final goods is the main source of China's trade surplus, while China's trade deficit largely arises from the trade in primary goods, especially since 2005 and onward. The higher needs of primary imports come not only from China's final assembly exporting sectors, but also from its domestic sectors.

The empirical results draw some important findings and implications. First, China's exports are more sensitive to the RMB revaluation than imports are in general, but all the magnitudes of the sensitivity are not large. Second and counter-intuitively, the RMB revaluation affects the imports of intermediates negatively, probably because the intermediate imports are mostly induced demand of final goods exporting sectors. Third, together with the first finding, we may explain why the RMB appreciation has limited effects on curbing China's trade surplus. Lastly, according to our estimates, the effect of China's domestic demand on imports dominates that of the RMB, suggesting in order to deal with the trade imbalance issue, China may also want to speed its economic

transformation from export-led to domestic-oriented model.

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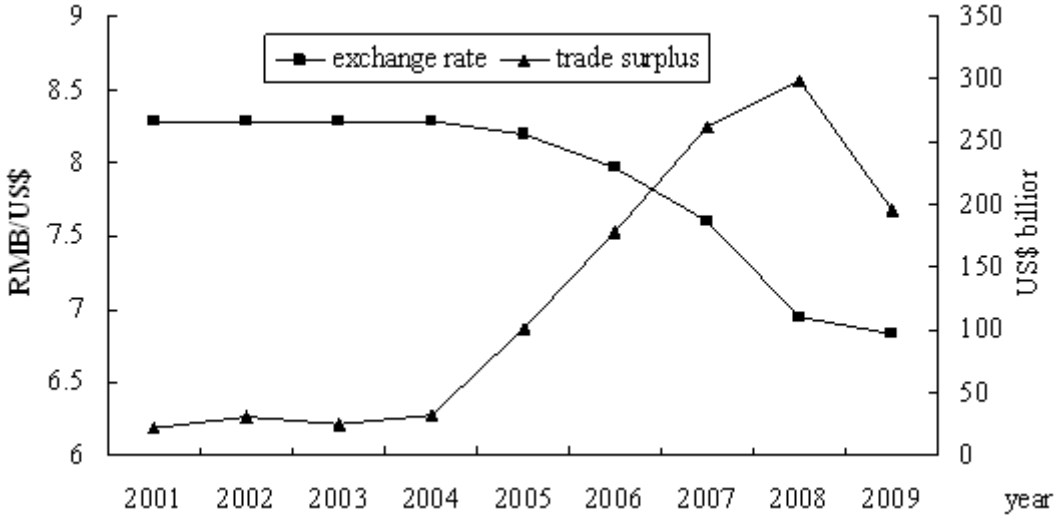
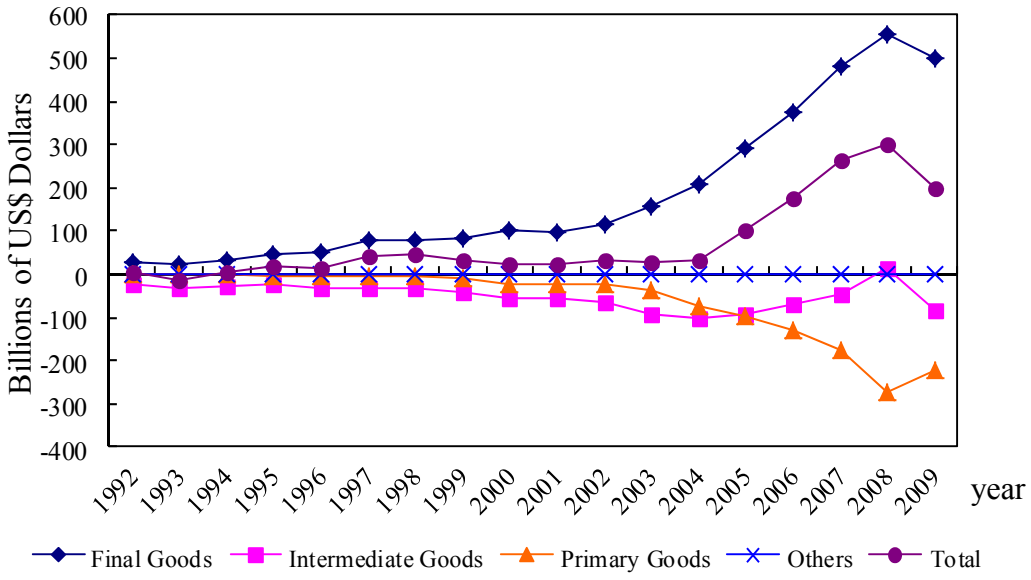


Figure 1. China's exchange rate and trade surplus



Source: Author's calculations based on data provided by Bureau of Foreign Trade, Ministry of Economic Affairs, Taiwan

Figure 2. China's trade balance of different commodities

Table 1. China's commodity trade by stages of production in 1992 and 2009

	Imports (%)							
	World	Europe	U.S.	Hong Kong	S. Korea & Taiwan	Japan	ASEAN-6	ROW
1992								
Total imports	100	12	11	25	11	17	5	19
Final goods	30	21	13	18	10	23	1	13
Intermediate goods	61	9	9	32	12	17	5	16
Primary goods	9	4	16	4	1	3	18	54
Others [a]	0	11	1	1	0	8	0	78
2009								
Total imports	100	11	8	1	19	13	11	38
Final goods	23	22	10	1	19	15	10	22
Intermediate goods	55	10	7	1	26	17	12	27
Primary goods	22	3	8	1	1	2	6	81
Others [a]	0	1	1	0	0	0	77	20
	Exports (%)							
	World	Europe	U.S.	Hong Kong	S. Korea & Taiwan	Japan	ASEAN-6	ROW
1992								
Total exports	100	8	10	44	4	14	5	15
Final goods	60	8	12	49	1	12	2	16
Intermediate goods	30	8	7	45	6	10	9	16
Primary goods	10	7	8	13	14	37	10	11
Others [a]	0	0	1	6	1	1	73	17
2009								
Total exports	100	15	18	14	6	8	9	30
Final goods	61	17	22	13	4	8	6	29
Intermediate goods	38	13	13	15	8	7	12	32
Primary goods	1	8	6	10	30	18	11	16
Others [b]	0	9	6	3	20	28	12	22

Notes: ASEAN-6 includes Indonesia, Malaysia, Philippines, Singapore, Thailand, and Vietnam; Europe countries are Denmark, Finland, France, Germany, Hungary, Italy Netherlands, Poland, Spain, Sweden, and Switzerland.

Source: Author's calculations based on data provided by Bureau of Foreign Trade, Ministry of Economic Affairs, Taiwan

a. Other goods imports are around 0.05% and 0.1% in 1992 and 2009, respectively.

b. Other goods exports are around 0.09% and 0.26% in 1992 and 2009, respectively.

Table 2. Data source and variable definition

Variable	Definition	Data source
$\ln EX_{ijt}$	China's real exports flow to country j in year t, deflated by Hong Kong export price index.	Bureau of Foreign Trade, Ministry of Economic Affairs, Taiwan
$\ln IM_{ijt}$	China's real imports flow from country j in year t, deflated by Hong Kong import price index.	Bureau of Foreign Trade, Ministry of Economic Affairs, Taiwan
$\ln RER_{ijt}$	Bilateral real exchange rate between China and its trading partner in year t, deflated by consumer price index (CPI). An increase in $\ln RER_{ij}$ represents an RMB appreciation.	World Bank
$\ln RGDP_{jt}$	Real GDP of China's trading partner in year t.	World Bank/ Directorate-General of budget, Accounting and Statistics, Taiwan
$\ln RGDP_{it}$	Real GDP of China in year t.	World Bank
$\ln POP_{it}$	Total population of China in year t.	World Bank
$\ln FDI_{it}$	Foreign investment stock of China in year t.	UNCTAD
WTO	WTO dummy, set 1 from 2002 to 2009.	World Trade Organization

Table 3. Panel unit root test

	LLC	Probability	IPS	Probability
Total export	17.880	1.00	1.513	1.00
Primary goods export	3.409	0.99	29.375	1.00
Intermediate goods import	17.183	1.00	1.491	1.00
Final goods export	17.013	1.00	2.085	1.00
Total import	12.165	1.00	4.596	1.00
Primary goods import	10.989	1.00	9.314	1.00
Intermediate goods import	11.291	1.00	8.653	1.00
Final goods import	7.594	1.00	19.951	1.00
lnRER	0.774	0.78	-0.801	0.21
$lnRGDP_j$	7.851	1.00	16.401	1.00

Notes: The null hypotheses assume individual unit root process.
*** and ** indicate significance at 1% and 5% levels, respectively.

Table 4. RMB and China's total trade over 1992-2009, GMM Estimation

Specifications	(1)		(2)	
	Total Exports	t-ratio	Total Imports	t-ratio
Total (-1)	0.31***	(62.19)	0.56***	(125.65)
lnRER	-0.06***	(-7.96)	0.03***	(11.84)
lnRGDPj	2.29***	(78.59)		
lnRGDPi			0.89***	(69.35)
lnPOPi			21.23***	(113.85)
lnFDI	0.33***	(15.12)	-1.42***	(-110.67)
WTO	0.29***	(31.81)	-0.11***	(-26.57)
Sargan test (p-value)[1]	45.79 (1.00)		45.34 (1.00)	
Serial correlation 2 test (p-value)[2]	-1.26 (0.21)		-1.64 (0.11)	
Observations	711		711	

Notes: *** and ** indicate significance at 1% and 5% levels, respectively.

1. Sargan test provides a test of the validity of the moment conditions. The null hypothesis is that the instruments are not correlated with the residuals.

2. The null hypothesis is that the error term in the first difference regression exhibits no second order serial correlation.

Table 5. RMB and China's various exports over 1992-2009, GMM Estimation

Specifications	(3)		(4)		(5)	
	Primary Goods	t-ratio	Intermediate Goods	t-ratio	Final Goods	t-ratio
Primary Goods (-1)	0.20***	(23.66)				
Intermediate Goods (-1)			0.44***	(90.18)		
Final Goods (-1)					0.31***	(36.69)
lnRER	-0.14***	(-7.25)	-0.11***	(-18.62)	-0.08***	(-5.61)
lnRGDP	4.41***	(102.45)	2.25***	(64.58)	2.15***	(50.49)
lnFDI	-0.90***	(-31.53)	0.11***	(6.17)	0.38***	(28.85)
WTO	0.17***	(10.68)	0.39***	(61.71)	0.22***	(36.90)
Sargan test (p-value)[1]	43.69 (1.00)		44.88 (1.00)		45.54 (1.00)	
Serial correlation 2 test (p-value)[2]	1.16 (0.25)		-1.72 (0.09)		-0.51 (0.61)	
Observations	711		711		711	

Notes: *** and ** indicate significance at 1% and 5% levels, respectively.

1. Sargan test provides a test of the validity of the moment conditions. The null hypothesis is that the instruments are not correlated with the residuals.

2. The null hypothesis is that the error term in the first difference regression exhibits no second order serial correlation.

Table 6. RMB and China's various import over 1992-2009, GMM Estimation

Specifications	(6)		(7)		(8)	
	Primary Goods	t-ratio	Intermediate Goods	t-ratio	Final Goods	t-ratio
Primary Goods (-1)	0.39***	(104.81)				
Intermediate Goods (-1)			0.25***	(119.96)		
Final Goods (-1)					0.04***	(23.91)
lnRER	0.05***	(4.70)	-0.06***	(-12.14)	0.06***	(8.09)
lnRGDPi	2.19***	(32.99)	1.55***	(60.68)	2.31***	(17.58)
lnPOPi	14.62***	(16.32)	9.34***	(23.29)	11.69***	(6.72)
lnFDI	-1.52***	(-52.26)	-0.83***	(-47.79)	-1.32***	(-37.31)
WTO	0.06***	(3.70)	0.10***	(42.95)	-0.04***	(-6.06)
Sargan test (p-value)[1]	44.87 (1.00)		44.88 (1.00)		44.84 (1.00)	
Serial correlation 2 test (p-value)[2]	-1.19 (0.23)		0.62 (0.53)		-1.43 (0.15)	
Observations	711		711		711	

Notes: *** and ** indicate significance at 1% and 5% levels, respectively.

1. Sargan test provides a test of the validity of the moment conditions. The null hypothesis is that the instruments are not correlated with the residuals.

2. The null hypothesis is that the error term in the first difference regression exhibits no second order serial correlation.

Appendix Table. Commodity classification of BEC system

Production Stages	BEC Code	Title BEC
Primary goods	111	Food and beverages mainly for industry
	21	Industrial supplies, n.e.c., primary
	31	Fuels and lubricants, primary
Intermediate goods	121	Food and beverages, processed, mainly for industry
	22	Industrial supplies, n.e.c., processed
	321	Motor spirit
	322	Other processed fuels and lubricants
	42	Of capital goods, except transport equipment
	53	Of transport equipment
Final goods	41	Capital goods except transport equipment
	521	Other industrial transport equipment
	112	Food and beverages, primary, mainly for household consumption
	122	Food and beverages, primary, processed, for house consumption
	51	Passenger motor cars
	522	Other non-industrial transport equipment
	61	Durable consumer goods n.e.c.
	62	Semi-durable consumer goods n.e.c.
	63	Non-durable consumer goods n.e.c.

Source: United Nations Statistics Division and Lemoine and Ünal-Kesenci (2007)