The persistent trade imbalance between the United States and China: *Explaining the anomaly*

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Abstract

The enormity of the growing bilateral trade deficit between the U.S. and China has been a source of concern for American politicians and voters. However, few policy-makers seem to comprehend the unique nature of the bilateral trade relationship between the U.S. and China; many politicians attribute the trade deficit to the CCP's currency manipulation policies. However, since the CCP began revaluing the renminbi in 2005, the trade imbalance between the nations has increased, thereby rendering the claims of U.S. politicians about currency manipulation's impact on the trade imbalance false. This study attempts to uncover the reason for the persistence of Chinese exports to the U.S. despite currency devaluation. This study hypothesizes that the relative differences in the trade elasticity of homogenous and differentiated goods can explain the unusual stickiness of Chinese exports to the U.S.

The results indicate that Chinese exports of differentiated and homogenous goods respond differently to fluctuations in the value of the renminbi; differentiated exports are inelastic to these shifts, whereas homogenous exports demonstrate more elasticity to fluctuations. Most interestingly, the results indicate that the increase in Chinese exports to the U.S. as a result of revaluation of the renminbi can be attributed to an expansion of Chinese exports of homogenous goods during the period of revaluation. The study concludes that this peculiar result may be explained by the findings of Thorbecke & Gordon (2010) that China's position as an exporter of intermediate processed goods renders its exports to the U.S. relatively inelastic.

I. Introduction

The unequal trade relationship between the United States and China has been a controversial discussion topic in US politics for the past 30 years. Politicians maintain that the Chinese Communist Party (CCP) continues to devalue the Chinese Yuan in order to gain an unfair advantage in promoting the competitiveness of Chinese exports worldwide. During the 2012 presidential debate, Mitt Romney called China a "currency manipulator". He maintained that "one of the ways that they don't play by the rules is (by) artificially holding down the value of their currency ....(which) makes them advantageous in the marketplace" (Bradsher, 2012). Romney is not alone in his assertion; many US politicians and voting groups share his perspective. In fact, politicians in Washington have proposed that if the Chinese government fails to implement more rapid currency revaluation, retaliatory tariffs should be imposed in order to correct the trade imbalance between the US and China.

Politician's concerns about the negative implications of China's currency manipulation policy are not unfounded; the theory that devaluation creates bilateral trade imbalances was explored by the economist Alfred Marshall during the era of the Gold Standard in 1929. Marshall (1929) argued that if price inequality exists between two nations as a result of fluctuations in currency values, a trade imbalance will develop as demand for the relatively cheaper exports from one nation will temporarily expand relative to the other (Marshall, 1929, pg.226). Marshall's observations apply directly to the current trade relationship between the United States and China; the CCP's commitment to maintaining an artificially low valuation of the renminbi has allowed Chinese goods to remain inexpensive relative to their US counterparts. If Marshall's observations are consistent with the case of US-Chinese trade, a shift in the

competitiveness of Chinese exports due to fluctuations in the value of the renminbi should cause a shift in the demand for Chinese exports in the U.S.

Marshall's observations are confirmed by Alexander (1952), who used the income absorption approach to examine the impact of currency devaluation on supply and demand conditions in the devaluing nation. Alexander derived the following equation in order to explain the impact of devaluation on income in the devaluing nation:

$$\Delta B = (1-c)\Delta Y$$

where B is the foreign balance, Y is the total production of goods and services, and c represents the marginal propensity to absorb. From this equation, he determined that devaluation improves the foreign balance of the devaluing nation due to the enhanced competitiveness of its exports (provided that the international market absorbs the additional exports of the devaluing nation) (Alexander, 1952, pg. 267-68). Logically, the reverse of Alexander's argument should also be true; revaluation of a nation's currency should negatively impact the foreign balance of the devaluing nation as the competitiveness of its exports declines.

However, evidence indicates that the relationship between the exchange rate and the bilateral trade balance described by Marshall (1929) and Alexander (1952) is not applicable to the trade relationship between the US and China. Statistical evidence demonstrates that renminbi revaluation has had a minimal, if any, impact in correcting the trade imbalance between the US and China. Figure A shows that revaluation of the renminbi between 2005 and 2011 was accompanied by an increase in the trade deficit between the U.S. and China. This puzzling relationship (or lack thereof) is confirmed by the statistical evidence from academic scholarship, which suggests that an appreciation of the renminbi, which is expected to erode the competitiveness of Chinese exports to the U.S., will not have the anticipated positive effect on

the U.S. current account balance. In a study which simulated a 25% revaluation of the renminbi, Zhang (2012) determined that the shift in the value of the Chinese currency had little impact on US economic variables. In fact, the demonstrated impact of the revaluation of the RMB on the current account balance between the two nations was an exacerbated status-quo in which China's current account surplus expanded while the current account balance in the US continued to deteriorate (Zhang, 2012, pg.180). The lack of correlation between the two factors implies that the bilateral trade imbalance between the U.S. and China (and, by extension, Chinese exports to the US) seems to be insensitive to fluctuations in the valuation of the renminbi.

Devereux and Genberg (2007) came to a similar conclusion: they discovered that contrary to popular perception, a revaluation of the renminbi has the potential to exacerbate the current account imbalances between the two nations. For exported goods with low trade elasticity, such as intermediate processed goods, it was estimated that due to the large expansionary income effect and the minimal expenditure switching effect of currency appreciation, the demand for China's intermediate exports in the US would be relatively insensitive to the revaluation of the renminbi. The impact of appreciation was minimal even for goods with high trade elasticity and large expenditure switching effects; the authors estimated that an appreciation of at least 33% is needed to generate a reduction in the current account balance equivalent to 5% of GDP (Devereux & Genberg, 2007, pg.14). This discovery corroborates Zhang's analysis: a revaluation of the RMB is a largely ineffective method of correcting the trade deficit between the two nations. The lack of correlation between the two factors implies that the dynamics of the trade relationship between the U.S. and China are significantly more complicated than is suggested by the widely-known explanations of Marshall (1929) and Alexander (1952).

Although the minimal impact of currency revaluation is clear, scholars continue to disagree on an explanation for the enduring trade imbalance between the US and China since the CCP began revaluing the renminbi in 2005. Therefore, the purpose of this study is contribute to this discussion by examining the composition of trade between the US and China between 2002 and 2011. Extending the research of Devereux and Genberg (2007) and Thorbecke and Smith (2010) I will attempt by explain the persistence of Chinese exports to the U.S. by examining the growth in the trade of homogenous as compared with that of differentiated goods. In order to conduct my research, I will utilize the commodity classification system developed by Rauch (1999) in order to categorize goods as "homogenous" or "differentiated".

The structure of this study is as follows: first, other scholars' theories concerning the persistence of the bilateral trade balance will be presented. Next, the data and statistical methods employed in this study will be explained. Finally, the results will be presented and analyzed, followed by a discussion of the implications and suggestions for future research.

II. Literature Review

Academic literature has cited a number of explanations for the lack of correlation between RMB appreciation and a decline in the trade imbalance between the United States and China. One explanation for the failure of the revaluation of the renminbi to stimulate an improvement in the bilateral trade imbalance is the impotence of a unilateral renminbi appreciation. Thorbecke and Smith (2010) propose that China's position as an intermediate assembler of processed goods renders unilateral currency appreciation an incomplete solution to the trade imbalance issue. In 2006, it was estimated that 53% of China's exports and 41% of its imports were processed goods; 70% of these processed imports were sourced from other East Asian countries. Therefore, although China enjoyed a trade surplus of $153 billion with the US

in 2006, it also simultaneously suffered a trade deficit of $100 billion with East Asia (Thorbecke & Smith, 2010, pg. 97). The authors concluded that the impact of a 10% unilateral renminbi appreciation would be muted, as it would only reduce processed exports by 4% (Thorbecke & Smith, 2010, 106). A joint appreciation of East Asian currencies is proposed as a more effective tool in reducing the imbalance of trade between China and the US.

In response to the demonstrated impotency of unilateral RMB appreciation as a policy of trade correction, the impact of a joint currency appreciation of East Asian currencies on the US-China trade imbalance was examined. Thorbecke and Smith (2010) championed cooperative regional currency appreciation as a solution to the bilateral trade imbalance between the US and China. It was calculated that a 10% joint appreciation in the currencies of supply-chain East Asian nations would proportionally reduce China's processed exports, which would cause significant expenditures to switch back towards the United States (Thorbecke & Smith, 2010, pg. 106). However, recent empirical work has questioned this conclusion. Zhang (2011) explores three solutions for correcting the bilateral current account balance: unilateral RMB appreciation, fiscal stimulus, and a joint appreciation of East Asian currencies. In Zhang's (2011) simulation of a cooperative 20% appreciation in East Asia's four emerging economies, it was determined that unilateral and joint appreciation are equally ineffective means of correcting the trade imbalance between the two nations. Zhang estimated that the improvement in the current account deficit as a result of a 20% joint appreciation would be only 3-5% of the $100-$140 billion improvement previously estimated by Goldstein and Lardy (Zhang, 2011, pg. 83). Statistical evidence suggests that in both unilateral and cooperative scenarios, currency appreciation is a questionable, if not entirely ineffective, means of correcting the US trade deficit with China.

Zhang proposed that renminbi appreciation would cause a decline in China's GDP that would significantly overshadow the fall in import prices. The disproportional decline in China's import demand as a result of the implementation of currency appreciation policy would exacerbate the trade deficit between the U.S. and China. Zhang also observes a delayed price pass-through process for Chinese exports in the US, which he attributes to low price elasticity and high income elasticity in both nations. The combination of a disproportionate decline in import demand in China and the muted increase in Chinese export prices would exacerbate the trade imbalance (Zhang 2012, pg. 180). The predicted erosion of purchasing power of Chinese consumers as a result of devaluation is not a particularly new concept, as it seems to corroborate Alexander's discussion of the income effect of devaluation. However, when presented in conjunction with a delayed effect on the price of Chinese exports in the United States, coerced renminbi appreciation seems to be a counterproductive method of correcting the trade imbalance between the U.S. and China.

In this paper, I will use a different approach to explain the lack of correlation between movements in the exchange rate and the trade deficit is product type. Significant attention has been devoted to explaining the trade implications of the distinction between homogeneous and differentiated goods. Rauch (1999) explores potential determinants and consequences of the variations between the trading processes for homogeneous and differentiated goods, particularly in terms of the network/search view. Evidence of a number of barriers to trade of differentiated goods was uncovered. Differentiated trade is 10.6-40% more elastic to distance than homogenous goods and 1.6-11.7% more elastic than reference priced goods. Differentiated trade is also 5.1-19.5% more elastic to linguistic and cultural linkages as compared to homogenous trade (Rauch, 1999, pg. 25-26). These statistics imply that distance and cultural commonalities

serve as more significant trade barriers in differentiated as opposed to homogenous goods trade. In addition, he found that given a significant level of disaggregation, search costs may deter differentiated goods trade more so than homogeneous goods trade (Rauch, 1999, pg. 27). As evidenced by Rauch's research, the particular difficulty of establishing differentiated trade relationships may explain the constancy of international trade relationships despite movements in exogenous factors such as foreign exchange rate.

The varied trade patterns that emerge when traded products are disaggregated into homogenous and differentiated goods have significant implications for the analysis of the formation and constancy of international trade relationships. Besedes and Prusa (2005) confirmed and furthered Rauch's hypothesis in their examination of the interaction between duration, product type, and size of initial purchase in the context of trade relationships. Abiding by the commodity classification model developed by Rauch, Besedes and Prusa determined that the duration of trade relationships was significantly longer for differentiated goods as opposed to reference priced and homogeneous goods. They estimated that 69% of trade relationships involving differentiated goods survived for at least two years, as opposed to 55% for homogeneous and 59% for reference priced goods (Besedes & Prusa, 2005, pg. 347). The longer average duration of differentiated goods trade may be explained by Rauch's previous postulations, particularly trade barriers such as higher search costs and significant cultural differences which determine consumer preferences (Rauch 33). The significance of product type in determining the duration of trade, as determined first by Rauch and then by Besedes et al., implies that differentiated product trade may persist despite movements in other exogenous variables, especially exchange rate. Therefore, disaggregating China's most prevalent exports

into homogeneous and differentiated categories may reveal an explanation for the persistence of the US-China trade deficit despite the gradual revaluation of the renminbi.

Based on a review of past literature, this study attempts to argue that the persistence of Chinese exports to the U.S. despite the revaluation of the renminbi can be explained by the different elasticity of trade for homogenous and differentiated goods. I predict that the relationship between the value of Chinese exports, disaggregated according to SITC 4-Digit (Rev. 2) commodity classifications, and the value of the renminbi will differ for homogenous and differentiated exports.

III. Data and Methods

In this investigation, a random-effects regression procedure was used to examine the composition of the U.S.'s imports from China and whether the expansion of trade in differentiated goods is contributing to the persistence of the trade imbalance between the two nations despite the CCP's efforts to gradually revalue the renminbi. In order to determine the effect of differentiated goods on the behavior of U.S. imports, I collect panel data and regress the value of U.S. imports from China by commodity classification (denoted by *lntradevalue*), the indirect quote of the exchange rate (*exch_ratelag*) as RMB/$, the binary classification of each commodity code as either differentiated or homogenous (*goodtype*) with 1 equal to differentiated goods, and an interaction between the variables for the exchange rate and commodity type (interact). As in a standard gravity model, I include controls for the gross domestic product of China and the United States (*ln_chinagdp* and *ln_usgdp*) as well as for trade policies limiting trade in high-tech products between the two nations (*hightech*) (Richardson, 2013, pg. 7).

My panel data was collected for the time period from 2002 to 2011 from the UN Comtrade Database and the World Bank data catalogue for foreign exchange rate, the nations'

respective GDPs, and the annual reported value of Chinese imports (by commodity) into the United States. The intention of this analysis is to examine whether the consistency of the trade deficit between the U.S. and China despite the CCP's gradual revaluation of the renminbi can be attributed to the composition of China's exports to the United States.

The panel variable, U.S, imports from China from 2002 to 2011, is classified as the Standard International Trade Classification (SITC) 4-Digit Revision 2 commodity codes. The SITC classification system was first developed by the UN in 1950 and was revised for the second time in 1974. The number of digits in the SITC code indicates the specificity of the commodity classifications, with a larger number of digits indicating more narrow classifications. The time period from 2002-2011 is selected strategically, as the Chinese government implemented its policy of state-controlled currency revaluation beginning in 2005. Therefore, data collected from 2002-2011 will account for the behavior of Chinese imports prior to and after the CCP's implementation of currency revaluation.

The dependent variable is the annual value of Chinese exports into the United States in the 4-Digit SITC classification codes (*tradevalue*). Since the resilience of U.S. imports from China is more relevant to the U.S.-China trade imbalance, I will focus on the value of U.S. imports first. Data estimating the value of U.S. imports from China for each 4-Digit SITC code is reported annually in U.S. dollars by the United States and is published by the U.N. Comtrade Database.

My first independent variable is an indirect quote of the foreign exchange rate between the Chinese renminbi and the U.S. dollar, meaning that it is measured in RMB/$ (*exch_rate*). The World Bank data catalogue calculates the exchange rate between the US and China. The widely-accepted theories of exchange rate developed by Marshall (1929) and Alexander (1952)

state that the indirect quote of the exchange rate should vary directly with the value of imports from China to the US. In other words, when the dollar depreciates, U.S. imports from China should have declined. However, as discussed previously, scholars have found that the response of the volume of Chinese exports to the devaluation of the renminbi clearly deviates from the behavior described in these theories. Therefore, in theory, the exchange rate variable should exhibit a positive relationship to the dependent variable. However, given the current pattern of U.S.-China trade, I expect the coefficient on exchange rate to be negative.

My second independent variable is a dummy variable which represents the identification of each commodity (as categorized by the SITC variable versus the U.S. dollar) as either a differentiated or a homogenous good (*goodtype*). Rauch (1999) developed a method for sorting SITC 4-Digit (Rev. 2) classification codes into "buckets" containing the codes for differentiated, reference-priced, and homogenous goods. This study adheres to a modification of Rauch's conservative classification system (in that SITC codes identified as "reference-priced" are excluded) when identifying the SITC 4-Digit (Rev. 2) classification codes as differentiated or homogenous. The qualitative *goodtype* variable identifies whether each SITC code for U.S. imports from China is identified as differentiated or homogenous; x_2=1 if the code is sorted as differentiated and x_2=0 if it is homogenous.

My third independent variable is an interaction variable (*interact*) between the direct quote of the foreign exchange rate and Rauch's classification model, and is defined as *exchange rate*goodtype*. This variable accounts for the dissimilar responses of the volume of differentiated and homogenous commodity imports to currency revaluation. The analysis in this study predicts that trade patterns for differentiated goods are more resilient in periods of revaluation, meaning that imports of differentiated goods from China to the US will be

unresponsive to the CCP's currency devaluation policy. Therefore, I expect that the interaction variable will have a relationship with the dependent variable which is similar to that of the exchange rate variable, albeit with an opposite sign. I also expect that the sign of the interaction variable will be directly opposite that of the exchange rate variable, which reflects my expectation that imports of differentiated goods should be resistant to the effects of currency revaluation.

I will also include three control variables in my analysis in order to account for outlying factors which may be related to the persistence of China's exports to the United States: the nations' respective GDPs (ln*usgdp* and ln*chinagdp*) and a dummy variable indicating whether each commodity code is classified as "high tech" (*hightech*). Data on the gross domestic product of both nations is calculated based on the purchasing power parity (PPP) and is collected from the World Bank data catalogue. I expect that the coefficients for both the U.S. and Chinese GDP will be positive due to the mutually-beneficial nature of the highly-interdependent trade relationship between the two nations.

The hightech independent variable was included in order to control for exogenous intervention in bilateral trade between the U.S. and China, namely restrictive trade policies. I chose to control for the effect of U.S. controls on high-tech exports to Tier 2, 3, and 4 nations (China is considered to be Tier 2) on the value of U.S. imports from China. Specific SITC 4-Digit (Rev. 2) commodity codes in the data sample are identified as "high-tech" according to the classification system developed by Richardson (2013) in his effort to demonstrate that U.S. export controls on high-tech products to 'threatening' nations have proven to be ineffective. Richardson (2013) identified the following ISIC codes as high-tech: 351-2 and 381-5. After converting these ISIC codes into SITC 4-Digit (Rev. 2) commodity codes, I proceed to identify

the SITC codes for U.S. imports as 'high-tech' or 'not high-tech'; the qualitative hightech variable equals zero if the SITC code is not categorized as high-tech, and equals one if high-tech.

Hypothesis: *Trade in differentiated goods is less sensitive to shifts in the exchange rate than trade in homogenous goods.*

In order to test my hypothesis, I will use the following ordinary least-squares regression model:

$$lntradevalue_{i,t} = \alpha_0 + \alpha_1 exch\_ratelag_t + \alpha_2 goodtype_i + \alpha_3 interact_{i,t} + \alpha_4 ln\_usgdp_t + \alpha_5 lnchinagdp_t + \alpha_6 hightech_i + u_{i,t}$$

H_0: $\alpha_1 + \alpha_3 = 0$

H_a: *not* H_0

Decision Rule: Reject if [t]>c

As the primary goal of this study is to examine the composition of China's exports to the United States and its impact on the resilience of the trade imbalance between the U.S. and China despite a gradual revaluation of the renminbi, my analysis will focus on the three relevant independent variables: exchange rate, good type, and the interaction variable.

IV. Analysis and Results

Descriptive Statistics

In Table 1, descriptive statistics reporting the means, standard deviations, minimums, and maximums for the dependent and independent variables for this strongly balanced data set are presented. The data sample includes the values of U.S. imports for 462 SITC 4-Digit commodity classifications (transformed into logarithmic form) recorded over the ten-year period spanning from 2002 through 2011. Accounting for the fact that 2.9% of these categorized values of U.S. imports were missing from the UN Comtrade database, the observations in the data sample totaled 4486. Table 2 is a correlation matrix which measures correlation between independent variables. Two independent variables in the model are highly correlated: lnusgdp and lnchinagdp

have a correlation coefficient of 0.97. However, since these are both control variables, the high degree of correlation between them is not anticipated to impact the estimation of the model.

An examination of the descriptive statistics for the *goodtype* variable demonstrates that the majority of Chinese exports to the U.S. can be classified as differentiated goods. Recall that *goodtype* is a qualitative variable where x_2=1 if the commodity code is classified as differentiated and x_2=0 if it is homogenous. The mean of the *goodtype* variable is reported as 0.8766, which indicates that Chinese exports to the U.S. are comprised primarily of differentiated goods.

Regression Results

Table 3 reports the results of an ordinary least squares regression. The coefficient of determination for the regression model is reported as 0.1825, meaning that 18.25% of the variation in the value of U.S. imports from China can be explained by the independent variables in the regression model. Although the signs for the coefficients are consistent with the expectations reported by previous scholarship, the variables which are of particular interest in this study do not have a significant effect on the value of U.S. imports; the p-values for the *interact* and *exch_ratelag* variables are calculated as 0.468 and 0.685 respectively.

I find that the minimal statistical significance of these two factors on the value of U.S. imports from China initially reported by the OLS regression model may be due to the presence of serial autocorrelation and heteroskedasticity. Tables 4 and 5 outline the results of the tests for heteroskedasticity and serial autocorrelation. The Wooldridge test for serial autocorrelation provides strong evidence of serial correlation across the U.S. import value equation; the F-statistic is calculated to be 85.492, meaning that the probability of rejecting the null hypothesis of no first-order autocorrelation is zero. The Breusch-Pagan Lagrangian multiplier test for

heteroskedasticity yields a chi-square statistic of 16.72, which provides strong evidence that the initial regression model suffers from heteroskedasticity.

In order to determine whether fixed-effects or random-effects transformation should be used in estimating the model, I use the Hausman Test. The results of the Hausman test, which are reported in Table 5, calculate a small chi-square statistic (χ^2= 1.53, P-value= 0.8208). This indicates that we are unable to reject the null hypothesis that a random-effects regression should be used at the 10% significance level; the model therefore is most appropriately estimated through random-effects regression. Therefore, Table 6 shows the results of this feasible generalized least squares regression, corrected for heteroskedasticity and serial autocorrelation. The coefficients derived in this corrected regression model are consistent with the predictions outlined in the previous section. The qualitative variable indicating whether the SITC 4-Digit commodity codes are classified as homogenous or differentiated is found have a significant impact on the value of U.S. imports at the 10 percent significance level. The results indicate that if the 4-Digit SITC commodity code of a Chinese export is classified as differentiated, controlling for all other independent variables, U.S. differentiated imports are 1.5 times more than homogenous goods.

The lagged value of the exchange rate was also found to be a significant predictor of the value of U.S. imports at the 10 percent significance level. The coefficient for the lagged exchange rate variable predicts that, when all other independent variables are held constant, a one-unit decrease in the exchange rate (translating into a revaluation of the renminbi by one unit) will increase the value of U.S. imports from China by 20.565 percent. This unusual inverse relationship between the exchange rate and the value of U.S. imports from China is consistent with the existing trade pattern between the U.S. and China. It is evident that, contrary to the

findings of Marshall (1929) and Alexander (1952), the CCP's policy of gradually revaluing the renminbi has not dampened the flow of Chinese exports entering into the United States.

The coefficient for the interact variable is of particular interest in the context of this study, as it indicates whether the value of differentiated goods imported into the U.S. from China responds differently to a revaluation of the renminbi as compared to that of homogenous goods. The results reported by the corrected regression model suggest that there is in fact a difference in the behavior of homogenous and differentiated goods in response to revaluation, and this difference in behavior is statistically significant at the 5 percent level. The results indicate that an interaction of differentiated goods and the exchange rate, controlling for all other independent variables, results in an expansion of U.S. imports from China by 20.55% as compared to homogenous goods. The negative effect of revaluation on the value of U.S. imports from China (recorded as a 20.656% decline in the value of U.S. imports as a result of a one-unit revaluation) is almost completely eliminated by the interact variable. The results of the t-test, which investigated the null hypothesis that the sum of the coefficient estimates for *exch_ratelag* and *interact* was equal to zero, yielded an extremely small t-statistic (t= -0.001659) which failed to reject the null hypothesis at the one percent significance level. This means that when U.S. imports from China are classified as differentiated, the effect of the exchange rate on the value of U.S. imports from China is almost entirely eliminated. This result is vital to the argument of this investigation, as it indicates that the volume of U.S. imports from China is insensitive to shifts in the exchange rate due to revaluation of the renminbi.

Although these results confirm the null hypothesis, they have a puzzling implication. Since Chinese exports of differentiated goods to the United States are insensitive to shifts in the exchange rate, the inverse relationship between the exchange rate (RMB/$) and the value of

Chinese exports can be explained by fluctuations in Chinese exports of homogenous goods. Therefore, the increase in the trade imbalance between the U.S. and China since the CCP began to revalue the renminbi in 2005 can be attributed to a rise in the value of Chinese exports of homogenous goods during this period. The conclusion that revaluation caused an increase in Chinese exports of homogenous goods directly violates the findings of Rauch (2009). However, this puzzling result is consistent with the findings of Thorbecke and Smith (2010), who claim that a bilateral revaluation of the renminbi will not correct the trade imbalance between the U.S. and China due to China's position in the international market as an exporter of intermediate goods. Since revaluation provides a price advantage to China in terms of the nation's imports of intermediate goods for processing, the price of China's intermediate exports may become more inexpensive despite a bilateral revaluation of the renminbi. I suspect that the majority of Chinese homogenous exports to the United States are comprised of intermediate processed goods, which renders revaluation ineffective in decreasing Chinese exports of homogenous goods.

The coefficients of the control variables warrant further analysis as well. The negative sign on the coefficient for Chinese GDP is unexpected, as it indicates that a one-unit increase in Chinese GDP will decrease the value of U.S. imports from China by 0.533 units. This counterintuitive sign may be explained by the degree of interdependence between the economies of China and the United States in the period from 2002-2011. The rapid growth of the Chinese economy over the past two decades can be attributed primarily by the explosive demand for Chinese exports in the United States. This highly lucrative trade relationship has created an interdependent relationship between the two nations such that the demand for Chinese exports in the U.S. is a given. In the period examined in this investigation, fluctuations in Chinese GDP can be attributed to shifts in domestic demand as opposed to import demand in the U.S.

Therefore, the explanation of the inverse relationship between the value of U.S. imports and Chinese GDP may be irrelevant to the focus of this regression analysis, as it may be due to shifts in the domestic demand of Chinese consumers rather than fluctuations in international demand for Chinese exports.

V. Conclusion and Implications

The results of this study have significant implications for future examination of the revaluation of the renminbi and its implications for the U.S.-China trade imbalance. This investigation draws two conclusions about U.S. imports from China: 1) the majority of U.S. imports from China can be classified as differentiated goods, 2) the volume of U.S. imports of differentiated goods from China is insensitive to shifts in the exchange rate caused by the revaluation of the renminbi by the CCP, and 3) the inverse relationship between the exchange rate (RMB/$) and the value of Chinese exports can be explained by fluctuations in Chinese exports of homogenous goods, meaning that the increase in the trade imbalance between the U.S. and China since the CCP began to revalue the renminbi in 2005 can be attributed to a rise in the value of Chinese exports of homogenous goods during this period.

The implications of the final two results are of particular significance. The dissimilar response of homogenous and differentiated goods to fluctuations in the exchange rate (RMB/$) outlined in the second result indicates that the trade imbalance and the bilateral trade relationship between the U.S. and China is more complex than initially anticipated. Therefore, U.S. politicians should consider the difference in trade behavior of China's differentiated and homogenous exports when creating and implementing trade policies. In addition, in order for realistic expectations of the bilateral trade relationship between the U.S. and China to develop,

the ineffectiveness of renminbi revaluation in dampening Chinese exports to the U.S. should be accepted both by U.S. politicians and by their constituents.

The third result holds particular importance in the direction of future scholarship. The finding that Chinese exports of homogenous goods to the U.S. respond positively to the revaluation of the renminbi due to China's position as an exporter of intermediate processed goods provides many avenues for future scholarship. Based on the results of this study, an investigation into which types of goods comprise China's homogenous exports (and how they have changed since 2002) would be appropriate, as I suspect that the volume of intermediately-processed, homogenous exports from China to the U.S. has increased over this period as a result of the greater purchasing power enjoyed by producers of these goods.

Table 1: Descriptive Statistics

Variable	Mean	Standard Deviation	Minimum	Maximum
ln_tradevalue	17.28955	3.142707	6.008813	24.45995
goodtype	0.8766234	0.3289046	0	1
hightech	0.4458874	0.497117	0	1
ln_usgdp	30.19625	0.1127506	29.99095	30.33849
ln_chinagdp	29.51196	0.3693412	28.93097	30.05502
exch_ratelag	7.562238	0.6972255	6.46	8.28
interact	6.630461	2.569873	0	8.28

Table 2: Correlation Matrix

	goodtype	hightech	lnusgdp	lnchinagdp	exch_ratelag	interact
goodtype	1					
hightech	0.3098	1				
lnusgdp	-0.0011	-0.0004	1			
lnchinagdp	-0.0009	-0.0003	0.97	1		
exch_ratelag	-0.0009	-0.0003	-0.4675	-0.4529	1	
interact	0.9672	0.2996	-0.2075	-0.2277	0.2371	1

Table 3: Estimation of U.S. Imports from China

Variable	Coefficient	Standard Error	t	[P]>z
ln_usgdp	5.312118**	2.419024	2.2	0.028
ln_chinagdp	-0.5540911	1.211009	-0.46	0.647
exch_ratelag	0.1450241	0.3572225	-0.41	0.685
interact	-0.1413885	0.1945989	-0.73	0.468
goodtype	4.41163***	1.475127	2.99	0.003
hightech	1.012116***	0.0893942	11.32	0
constant	-131.2928***	39.38204	0.001	0.001
R-Squared	0.1836		F(6, 4478)	167.88
Adjusted R-sq	0.1825		Prob > F	0

Table 4: Results of Breusch-Pagan LM Test for Heteroskedasticity

Breusch-Pagan LM Test		
Variable	Variance	Standard Deviation
ln_tradevalue	9.867519	3.141261
e	0.6085576	0.780101
u	7.642139	2.764442
Ho: Var(u)=0		
chi-sq(1)= 15733.11		
Prob > chi-sq= 0.00		

Table 5: Results of Wooldridge Test for Autocorrelation

Wooldridge Test for Autocorrelation	
H_0: no first-order autocorrelation Ha: not H_0	
F(1, 454)	85.492
Prob > F	0

Table 6: Results of the Hausman Test for Random Effects

Hausman Test for Random Effects	
H_0: difference in coefficients is not systematic (random effects) Ha: not H_0 (fixed effects)	
X^2	1.53
Prob > X^2	0.8208

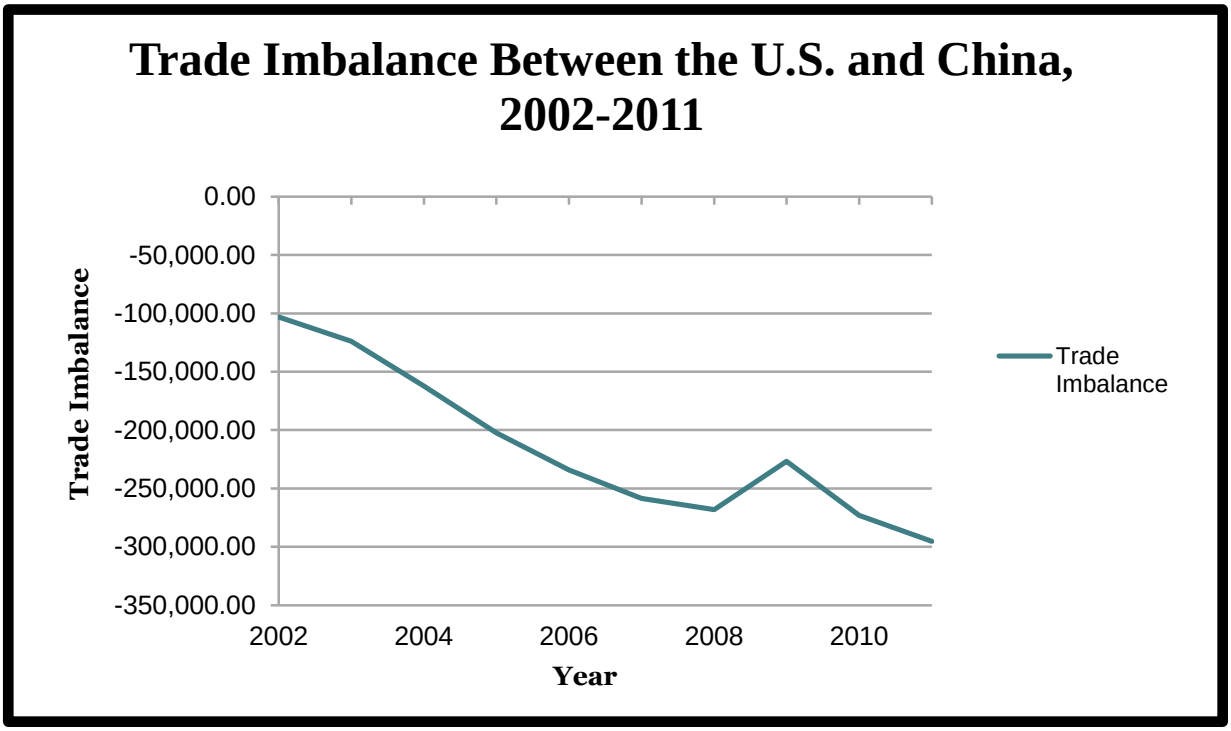
Table 7: Corrected FGLS Regression Results

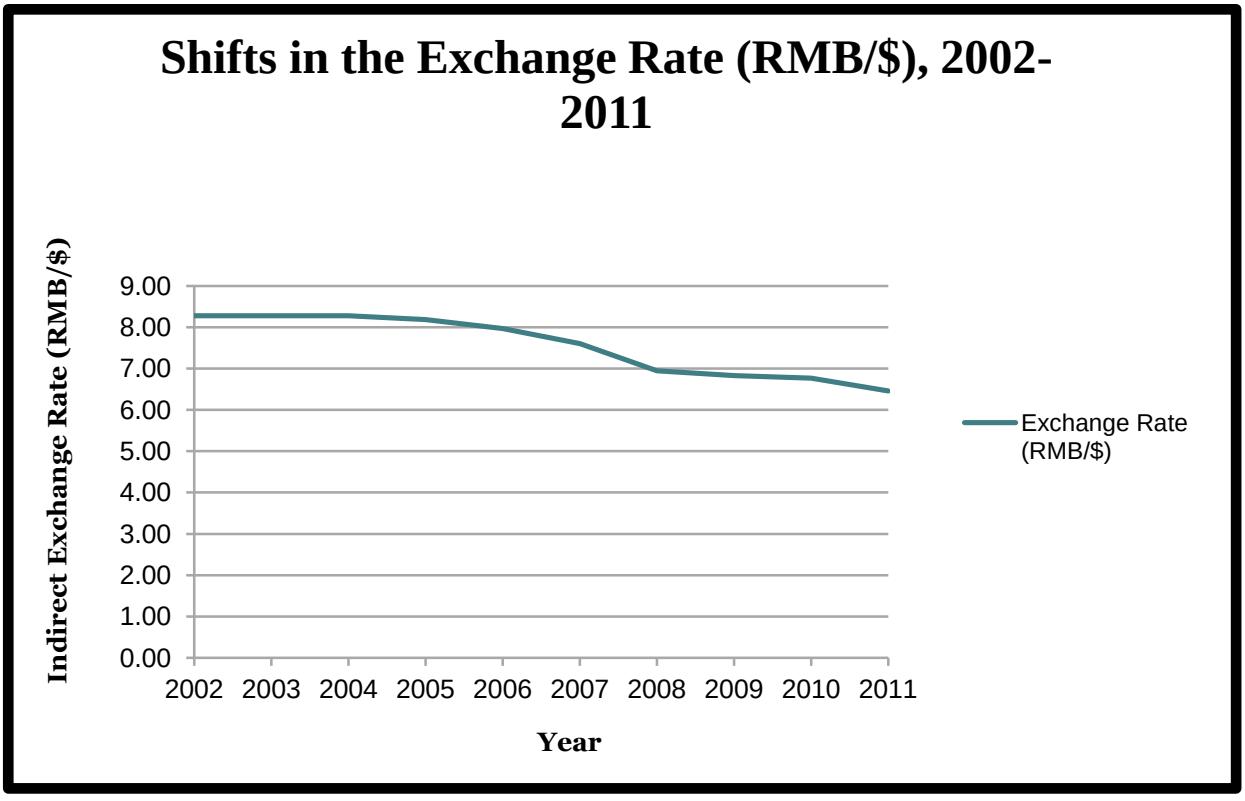
Variable	Coefficient	Standard Error	z	P > [z]
ln_usgdp	5.843438***	0.258938	22.57	0
ln_chinagdp	-0.6546064***	0.1148044	-5.7	0
exch_ratelag	-0.2056465*	0.1057633	-1.94	0.052
interact	0.2054729**	0.1046362	1.96	0.05
goodtype	1.57602*	0.8095356	1.95	0.052
hightech	1.035536***	0.0728765	14.21	0
constant	-141.0287***	5.15718	-27.35	0
Wald chi-sq (6)= 2209.46				
Prob > chi-sq= 0.00				

* denotes statistical significance at the 10% level
** denotes statistical significance at the 5% level
*** denotes statistical significance at the 1% level

Appendix

Figure A





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