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Beggar Thy Neighbor or Beggar Thy Domestic Firms? Evidence from 2000-2011 Chinese Customs Data

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Beggar Thy Neighbor or Beggar Thy Domestic Firms?

Evidence from 2000-2011 Chinese Customs Data*

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Abstract: A premise of beggar-thy-neighbor policies is that currency depreciations lead to export growth. This premise, however, does not seem validated as there is no consensus in the empirical literature regarding the impact of exchange rate changes on trade flows. We reexamine whether currency fluctuations are systematically associated with trade flows using a rich and unique Chinese customs dataset spanning the universe of bilateral Chinese transaction level trades over the 2000 to 2011 period. This dataset allows us to consider firm-level involvement in processing trade and firm-level dynamics in both export and import markets. Key findings of our firm-level estimations of trade elasticities include that the response of Chinese firms to exchanges rate changes depends strongly on the extent to which firms are involved in processing trade, i.e. heterogeneity in the extent of processing trade is crucial to understanding trade elasticities, and that the Chinese trade balance responds strongly to changes in the relative value of the Chinese Yuan, thereby implying that the influence of exchange rates on trade flows is significant and that currency depreciations do in fact lead to export growth and trade balance improvement.

Key words: Exchange Rate Changes, Processing Trade, Firm Dynamics, Trade Balance

JEL Classifications: F14, F31, F41

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1. Introduction

The generally slow growth rates in the aftermath of the global financial crisis have prompted several countries to pursue economic policies that could depreciate the relative value of their respective domestic currencies. These policies have been criticized for being beggar-thy-neighbor policies aimed at stimulating export-driven growth at the expense of trading partners. Interestingly, however, is the fact that an underlying premise of beggar-thy-neighbor policies, namely that currency depreciations lead to export growth and improvement of trade balance, is not uniformly validated by the empirical literature.[1]

Moreover, in the current context of a highly globalized world where exported goods often contain processed imports, the net-effect of currency movements on exports and imports in particular, and trade balance and economic growth in general, is less straightforward (e.g., Amit, Itskhoki, and Konings, 2014; World Economic Outlook, 2015; Patel, Wang, and Wei, 2017). Simply, a positive exchange rate effect experienced by pure exporting firms when the relative value of their domestic currency decreases may be more than off-set by a negative exchange rate effect experienced by importing as well as processing exporting firms, thereby leading to a possible scenario of beggar-thy-neighbor policies resulting in a net-effect of “beggar-thy-domestic firms”.

We attempt to bring new insights to the issue of whether exchange rate changes systematically

[1] Most of the existing empirical evidence on the effect of exchanges rate changes on the trade balance use aggregate trade data and find small or insignificant effects of exchange rate changes on trade. This is coined the “exchange-rate disconnect” puzzle and discussed in detail in contributions by Engel (2001 and 2014) and Obstfeld and Rogoff (2001). To illustrate, Thorbecke and Smith (2010) find a low exchange rate elasticity of exports when analyzing Chinese aggregate trade data. Hooper, Johnson, and Marquez (2000) find the elasticity of aggregate exports to real exchange rate only slightly below unity for most of the industrialized countries. Cheung, Chinn, and Fujii (2010) find no significant exchange rate effect on the trade balance. See also Park (2005), Thorbecke (2006), and Cheung, Chinn, and Qian (2012, 2015) for related contributions to the traditional trade literature. Indeed, when we aggregate our firm-level data and estimate the effect of exchange rate changes on the trade balance using the aggregated data, our aggregate estimate of the export elasticity to real exchange rate changes is 1.894, i.e. positive, but statistically insignificant. Our aggregate estimate of the import elasticity is -0.418, i.e. negative, but statistically insignificant (see Appendix Table 1). A possible explanation for why the literature, and we, obtain only small or insignificant coefficient estimates of exchange rate elasticities in the aggregate may be that the estimates are affected by heterogeneity bias. Put differently, estimations using aggregate data may be biased because aggregate data neglect the heterogeneous firm level responses to exchange rate changes (Imbs and Mejean 2014, Dekle, Jeong, and Kiyotaki, 2015, and Dekle, Jeong, and Ryoo, 2016). Although it is beyond the scope of our paper to attempt to solve the “exchange rate disconnect” puzzle, the fact that our findings stress the importance of firm-level heterogeneity in general and firm-level processing trade in particular is at a minimum consistent with the suggestion that heterogeneity bias should play a role in our understanding of this particular puzzle.

influence trade flows by providing a systematic empirical analysis of the impact of exchange rate changes on exports and imports using unique Chinese transaction-level data.[2] In doing so, we are bringing firm-level dynamics to the center of our analysis. Using reduced-form analysis we are able to focus on many features and nuances of exporting and importing firms (including the degree of processing trade, entry and exit, heterogeneous pass-through), examine how these features and nuances affect their responses to exchange rate changes, and in turn link firm-level estimates to the aggregate trade balance between countries. This richness comes at a cost in the sense that our modeling framework has to necessarily rely on a partial equilibrium approach for the framework to be tractable which in turn prevents us from providing the full-fledged explanation of the current account balance that a general equilibrium setting would facilitate (e.g Dekle, Jeong, and Kiyotaki, 2015).

First, following the standard decomposition method (e.g. Bernard, Jensen, Redding, and Schott, 2009, and Tang and Zhang, 2012), we decompose aggregate trade balance changes into firm-level outcomes: the changes of exports and imports of continuing firms, and the changes of exports and imports contributed by entry and exit firms, respectively. We then examine how exchange rate changes influence these firm-level outcomes, respectively. Second, facilitated by our detailed transaction-level trade data, we distinguish between ordinary and processing firms depending on the share of processing trade transactions over total trade values and examine whether different types of firms react differently to exchange rate changes. Finally, we use these firm-level estimates of exports and imports elasticities along with estimates of the impact of exchange rate changes on firm entry and exit to provide a quantification of the impact of exchange rate changes on the aggregate trade balance.

The foundation of our study is a rich and unique Chinese Customs data set that covers the universe of Chinese trade transactions over the 2000 to 2011 period. This data set and sample period enable us to focus on the effect of the CNY revaluation on the China-US trade balance. China and the

[2] China-US trade imbalances and their possible linkages to the CNY/USD exchange rate have received particular attention from researchers and policy-makers alike. Therefore, we focus on assessing the effects of CNY fluctuations vis-à-vis the USD on China-US trade flows. Subsequently, we also consider the effects of CNY fluctuations vis-à-vis non-USD currencies on associated bilateral trade flows.

China-US trade balance provide an ideal setting for examining the impact of exchange rate changes on the trade balance for several reasons. First, The China-US trade balance plays a major role in the global imbalance debate, thus an empirical analysis of how CNY revaluation influences the China-US trade balance may provide important policy implications in regards to how to address global imbalances.[3] Second, China undertook a major exchange rate reform in 2005 when a fixed exchange rate regime was replaced by a managed float. Since then and all through our sample period, the CNY has exhibited significant appreciation, e.g. the CNY appreciated by 22 percent against the USD in nominal terms from the beginning of 2005 to the end of 2011. This large appreciation of the CNY provides us with the exchange rate variation necessary for assessing the impact of exchange rate changes on the China-US trade balance. Third, processing trade has been a prominent feature of Chinese trade, accounting for over 50% of Chinese exports in recent years (Fernandes and Tang, 2012).[4] The larger the extent that the exports of a firm stems from imported inputs, the more muted the effect of a given exchange rate movement is likely to be on the export value of a firm (and, similarly, if the imported inputs of a firm are used to produce exports, exchange rate movements should have a muted impact on import values as well). Our data allows us to explicitly consider in our empirical analysis this very important aspect of firm dynamics and, as it turns out, show that the extent of processing trade engagement matters significantly for how firms respond to exchange rate movements and, in turn, how exchange rate changes affect the aggregate trade balance.

[3] Since the economic reform and transition towards a market based economy, China has experienced rapid export growth, especially vis-à-vis the US. The Chinese trade surplus accumulation began in 1985 and in 2011 the US-China trade deficit in goods reached roughly USD 300 billion according to the US Bureau of Economic Analysis. Some economists and policymakers propose that China should adjust its exchange rate policy to alleviate the imbalances between China and US (e.g. Krugman, 2010). However, according to the results of the existing empirical trade literature is far from clear is an appreciation of the CNY would have mitigated the China-US trade imbalances. As the results of our study will suggest, whether exchange rate manipulation can address trade imbalances will depend on the behavior of, in this context, Chinese micro trading firms and how they respond to exchange rate changes.

[4] Processing trade is a process in which a domestic firm obtains tariff-exempted intermediate inputs from abroad and after local processing exports the value-added final goods (see, for example, Feenstra and Hanson, 2005, and Yu, 2015). Within China, processing trade is pervasive across manufacturing industries with a heavier presence in labor-intensive industries than in capital-intensive industries (Dai, Maitra and Yu, 2016). Beyond China, processing trade has been prevalent in both developed and developing countries. By now, over 130 countries have established over 3500 Export Processing Zones (EPZs) (OECD, 2007). Our paper using Chinese data adds insights to the implications of this important feature of international trade.

Our paper belongs to the recent and growing literature on how heterogeneous firms respond to exchange rate changes (e.g. Baggs, Beaulieu, and Fung, 2009; Freund, Chang, and Wei, 2011; Berman, Martin, and Mayer, 2012; Tang and Zhang, 2012; Cheung and Sengupta, 2013; Amiti, Itskhoki, and Konings, 2014; Li, Ma, and Xu, 2015). Most papers in this literature have focused on one specific response of heterogeneous firms to exchange rate changes. For example, Berman, Martin and Mayer (2012), Amiti, Itskhoki, and Konings (2014), and Li, Ma, and Xu (2015) focus on the exchange rate pass-through to the prices of exporting firms. Our focus, however, is broader and pertains to a distinctly different research question, namely how CNY fluctuations influence the Chinese trade balance. We approach our research question by explicitly considering the role of processing trade and firm dynamics in affecting both firm-level exports and imports responses to exchange rate changes within a unified empirical framework. To the best of our knowledge, no previous paper has extended the Chinese customs dataset to 2011 and used this unique data to empirically explore the impact of, specifically, the large CNY appreciation on the China-US trade balance.

Our paper is also related to the literature that emphasizes the importance of outsourcing and processing trade in international trade (e.g., Amiti, Itskhoki, and Konings, 2014; Eichengreen and Tong, 2015). For example, Amiti, Itskhoki, and Konings (2014) use Belgium firm-level data to explore the role of imported inputs in exchange rate pass-through and find that firms with high imported inputs share indeed have low exchange rate pass-through. We add to this literature by studying how processing firms are different from ordinary firms in terms of their response to exchange rate changes and how these responses result in trade balance changes using micro-level Chinese Customs data.[5] It is well recognized in the literature that one key feature of Chinese importers and exporters is the extent to which they are involved in processing trade (e.g., Koopman, Wang and Wei, 2012; Kee and Tang, 2016). However, no previous study has systematically examined how this feature affects Chinese firms' exports and imports responses to exchange rate changes and its role in affecting trade balance adjustment.

[5] Following Feenstra and Hanson (2005), we define firms involved in processing trade as firms involved in international outsourcing thus interpreting a high degree of processing trade as indicative of a high degree of international outsourcing.

Our results show that the response of Chinese firms to exchanges rate changes (in terms of either export or import values or in terms of the likelihood of export or import market entry and exit) strongly depends on firm involvement, and degree of involvement, in processing trade. For ordinary firms with no processing trade involvement, we find large export and import elasticities to exchange rate changes. Specifically, we find that a 10% appreciation of the CNY vis-à-vis the USD is associated with a roughly 19% decrease in Chinese exports to US and a roughly 12% increase in Chinese imports from the US. For mixed firms with some transactions in processing trade, the estimated export and import elasticities are significantly smaller (approximately 10% for exports and 8% for imports). Interestingly, for pure processing firms, the negative impact of CNY appreciation on exports and the positive impact on imports are not statistically significant. Consistent with these findings, we obtain similar results when estimating the impact of exchange rate changes on firm export and import market entry and exit. Perhaps most importantly, the results of our firm-level estimation of trade elasticities show that, overall, the trade balance between China and the US responds strongly to changes in the CNY/USD rate. Our results suggest that the 2011 trade imbalance between China and the US would have been USD 42 billion less had the CNY appreciated by 10% (about 21% of 2011 China-US trade imbalance). Furthermore, we find that the strong firm-level response to exchange rate changes is driven by continuing firms adjusting their intensive margins. Overall, these results thus suggest that the influence of exchange rates on trade flows is significant and that a policy aimed at depreciating the relative value of a domestic currency could indeed have beggar-thy-neighbor effects in the aggregate.[6] Put differently, our results, at least in principle, lend credence to a key premise, and thus criticism, of exchange rate management as a beggar-thy-neighbor policy.

The remainder of the paper is organized as follows. Section 2 provides a brief overview of the evolution of the Chinese exchange rate regime and the China-US trade imbalance in goods. Section 3

[6] A recent paper by Mattoo, Mishra, and Subramanian (forthcoming) examines the beggar-thy-neighbor effects of China's exchange rate changes on exports of developing countries in third markets and finds a sizable beggar-thy-neighbor impact. Their estimations suggest that a 10 percent depreciation of the real Chinese exchange rate depresses developing countries' exports to a third market by 1.5-2.5 percent.

describes the data and key variables. Section 4 presents our empirical analysis and results. Section 5 discusses a counterfactual analysis of the magnitude of trade balance effects of exchange rate changes. Section 6 concludes the paper.

2. The Evolution of the Chinese Exchange Rate Regime and the China-US Trade Imbalance

During our 2000 to 2011 sample period, the Chinese exchange rate regime rotated between fixed and managed float regimes. From 1994 to July 2005, China maintained a fixed exchange rate regime with the Chinese currency pegged at CNY/USD 8.28 for most of the time. China revalued the CNY on July 21, 2005, to CNY/USD 8.11, and changed the exchange rate regime from fixed against the USD to a managed float against a reference basket of currencies. Under this regime, the CNY is highly managed but allowed to fluctuate within a narrow band. The band of fluctuation was widened slightly in 2007. China reverted to a fixed exchange rate regime with the CNY pegged to the USD at the rate of CNY/USD 6.83 in July 2008. This regime ended in June 2010 when China returned to a managed float.[7]

Figure 1 displays the evolution of the CNY/USD rate over the sample period and shows that, following the exchange rate reform in 2005, the CNY has appreciated by 22 percent vis-à-vis the USD from the beginning of 2005 to the end of 2011. As noted earlier, this large appreciation of the CNY relative to the USD provides us with the variation needed in order to investigate the China-US trade balance response to currency fluctuations.

The US have been running a persistent and increasing trade deficit against China since 1985. In 2011, the US-China trade deficit in goods reached roughly USD 200 billion, according to the Chinese National Bureau of Statistics (or roughly USD 300 billion according to the US Bureau of Economic Analysis).[8]

[7] See, for example, Liu, Lu, and Zhou (2013) for additional details.
[8] The trade balance in goods is an important measure of the US external economy. The bilateral trade imbalance in goods between China and US contributes to more than 90% of the US current account deficit towards China in 2011. It also accounts for about 40% of overall US trade deficit in goods in 2011 according to international transactions data from the US Bureau of Economic Analysis.

Figure 2 shows the bilateral exports, imports, and trade balance of goods between China and the US over the 2000-2011 period according to data from the Chinese National Bureau of Statistics. The figure shows that from 2000 to 2011 the US trade deficit with China increased continuously with the exception of the 2008-2009 global financial crisis peak period. Specifically, the imbalance in goods trading between China and the US increased from USD 30 billion in 2000 to USD 200 billion in 2011.[9]

As noted previously, most of the earlier literature largely relies on aggregate trade data to analyze the impact of exchange rate changes on the trade imbalance between China and the US and, typically, does not find strong evidence that appreciation of the CNY is associated with a shrinking of the trade imbalance (at least in the short run) (e.g., Cheung, Chinn, Fujii, 2010; Thorbecke and Smith, 2010). At a first glance, this is seemingly consistent with the evolution of the exchange rate and aggregated trade imbalance trends shown in Figures 1 and 2. The two figures show that Chinese exports and imports keep increasing alongside the CNY appreciation and, more importantly, exports from China to the US increase by a greater amount than Chinese imports from the US, thereby causing the trade imbalance between China and the US to expand despite the CNY appreciation. However, since aggregate data can hide heterogeneous firm responses to exchange rate changes the evolution of aggregate data does not constitute conclusive evidence regarding the influence of the exchange rate on the trade balance. It is also for this reason that, following an evolving literature pioneered by Berman, Martin, and Mayer (2012) and Amiti, Itskhoki, and Konings (2014), we in this paper employ firm-level trade transaction data to decompose how heterogeneous firms respond to exchange rate movements and, in turn, aggregate the firm level responses to shed light on how the trade balance responds to exchange rate changes.

3. Data Description and Key Variables

3.1. Chinese Customs Data 2000-2011

[9] The China-US trade imbalance based on US official statistics has shown a similar pattern as that based on Chinese official statistics. However, the magnitude of the trade imbalance is bigger according to official US statistics compared to official Chinese statistics, increasing from USD 83 billion in 2000 to USD 300 billion in 2011 according to US data. This discrepancy might stem from US trade data including entrepot trade via Hong Kong (e.g. Koopman, Wang, and Wei, 2012). These differences are discussed in detail in Schindler and Beckett (2005).

Our analysis is facilitated by access to transactions-level Chinese Customs data from 2000 to 2011, obtained from China's General Administration of Customs. This extremely disaggregated trade data is unique in terms of representativeness and comprehensiveness.

First of all, the data covers the universe of all Chinese import and export transactions between 2000 and 2011. By aggregating across all transactions covered by the Chinese Customs data we can obtain virtually the exact amount of the official Chinese trade balance. This allows for a counterfactual analysis in which we make use of our firm-level based empirical estimates to make predictions regarding trade balance changes induced by exchange rate changes.[10]

Second, the Chinese Customs data provides values (in USD) and quantity of exports and imports at the HS 8-digit level (with more than 7000 product categories) from a firm to counterpart country. More importantly, this rich data set also contains information regarding the customs regime pertaining to each transaction (e.g. processing versus ordinary trade). This provides us with the finest unit of observation possible for distinguishing between firms involved in international trade in different modes, thereby adding an unusual level of depth to the analysis of how different firms respond to exchange rate changes.

The Chinese Customs data is available at the monthly frequency from 2000 to 2006 and at the yearly frequency from 2007 to 2011. To construct a consistent sample we aggregate the monthly data to yearly data for the years 2000-2006. Since we focus our study on the impact of CNY/USD changes on the China-US trade balance we next discuss in detail our data and analysis of export and import transactions between China and the US.[11]

3.2. Ordinary and Processing Firms in China-US Trade

[10] As mentioned earlier, we have updated the data to 2011 in order to explore the impact of the large currency appreciation after the 2005 exchange rate reform. The same data set but ending in 2005 has been used in previous contributions (e.g., Ahn, Khandelwal, and Wei, 2011; Manova and Zhang, 2012).

[11] Table 1 provides a brief summary of the distribution of China-US trade during 2000-2011. The table shows that total exports from China to the US increased by 17% annually, from USD 52 billion in 2000 to USD 324 billion in 2011. Total imports increased by 15% annually, from USD 22 billion in 2000 to USD 122 billion in 2011. Table 1 also shows the increasing participation of Chinese firms in the China-US trade: the total number of Chinese exporting (importing) firms increased from less than 24,000 (20,500) in 2000 to over 99,000 (44,000) in 2011.

A key innovation of this paper is to study how firm-level exports and imports respond to exchange rate changes depending on the degree of firm involvement in processing trade.[12] The Chinese General Administration of Customs classifies 16 different types of Chinese processing trade.[13] Among all types of processing trade, “processing with assembly” and “processing with inputs” are by far the two most important modes of Chinese processing trade, accounting for more than 90% of all processing trade. We thus focus on these two modes of processing trade and refer to them collectively as “processing trade”.

Processing trade is defined as “business activities in which the operating enterprise imports all or part of the raw or ancillary materials, spare parts, components, and packaging materials, and re-exports finished products after processing or assembling these materials/parts” (General Administration of Customs of the People's Republic of China, 2004). One notable feature of processing trade, that is crucial for our research, is that firms involved in processing trade heavily depends on imported intermediate inputs in order to produce the final good for exporting.[14] Our prior is that this characteristic will likely affect how processing firms respond to exchange rate changes as exchange rate changes will simultaneously affect the value of their imported intermediate inputs as well as the value of their exported final goods.

In our baseline analysis, we use the following two definitions for defining firm engagement in processing trade. First, we follow Yu (2015) and define a firm as an ordinary exporter if none of the export transactions of a given firm is coded as processing trade. Second, to account for different degrees of involvement in processing trade, we define a firm as a pure processing exporter if all of the export transactions of a given firm are coded as processing trade, and we define a firm as a mixed exporter if a firm engages in both processing transactions and ordinary transactions. Similarly, we define a firm as an

[12] As an important part of trade liberalization, the Chinese government has since the early 1980s encouraged Chinese firms to import all or part of their raw materials and intermediate inputs, and re-export final value-added goods after local processing or assembly.

[13] The 16 types of processing trade include foreign aid, compensation trade, processing with assembly, processing with inputs, goods on consignment, goods on lease, border trade, contracting projects, outward processing, barter trade, customs warehouse trade, and entrepot trade by bonded area.

[14] Another notable feature of processing trade is that, for processing exporters, imported inputs used in the making of the finished products for export is exempt from any tariffs and import-related taxes. This feature has been explored extensive in the literature (i.e., Yu, 2015).

ordinary importer if a firm has no processing transactions, as a pure processing importer if all the import transactions of the given firm are coded as processing trade, and otherwise we define a firm as a mixed importer.

Table 2 shows the distribution of the above-defined three types of Chinese exporters and importers between 2000 and 2011. Ordinary exporters and importers account for the majority of the exporters and importers (69% and 48% on average, respectively). However, the export and import values generated by these firms are 22% each. As for pure processing exporters and importers, the share of the number of firms and the export and import values they generate kept decreasing over the sample period under study. On average, these firms account for 16% of the total number of exporters and 37% of the total number of importers, respectively, and together they generate 33% of total exports and 15% of total imports between China and US. Compared to pure processing trade firms, the average shares of the number of mixed exporters and importers are smaller (15% of total number of exporters and 15% of total number of importers, respectively). However, the mixed exporters and importers generate a larger share of export and import values than those of pure processing trade firms (45% of total value of exports and 63% of total value of imports, respectively).

Similar to Yu (2015), we also use in our empirical analysis the share of processing trade of total firm trade as a continuous measure of the extent of processing trade engagement of a given firm.

3.3. Firm Dynamics in China-US Trade

Another key innovation of this paper is that we examine how the firm-level dynamics affect the changes in the aggregate China-US trade balance. To do so, we follow Bernard, Jensen, Redding, and Schott (2009) and Tang and Zhang (2012) in decomposing the yearly changes in exports and imports between China and the US into changes due to continuing firms (C), entry firms (N), and exit firms (E) as follows:

$$\Delta x_t = \sum_{f \in C} \Delta x_{ft} + \sum_{f \in N} x_{ft} - \sum_{f \in E} x_{ft-1} \quad (1)$$

where Δx_t is the aggregate change in exports or imports between year *t* and *t-1*. This aggregate change of trade is composed of two terms. $\sum_{f \in C} \Delta x_{ft}$ is the sum of change of continuing firm *f*'s exports or imports between years *t* and *t-1* (the changes on the intensive margin of trade), and $\sum_{f \in N} x_{ft}$ and $\sum_{f \in E} x_{ft-1}$ are the sums of entering firm *f*'s exports or imports at year *t* and the sum of exiting firm *f*'s exports or imports at year *t-1* (the changes on the extensive margin of trade), respectively.

Using our unique firm-level trade data, we then decompose the yearly changes in aggregate exports and imports between China and the US into the firm dynamics described in Table 3. We define continuing exporters as firms that export in year *t-1* and continue to export in year *t*, entry exporters as any exporters that did not export in year *t-1*, but started exporting in year *t*, and exit exporters as those that export in year *t-1* but did not export in year *t*. Similarly, we classify different types of importers based on their import status in years *t* and *t-1*. As previously shown in Table 1, the number of exporters and importers between China and the US increased sharply during the 2000-2011 period. Behind this net increase there were significant turnovers of firms. Importantly, these firms contribute greatly to the aggregate yearly changes in trade between China and the US. As Table 3 shows, the average annual change in exports between China and the US is USD 25 billion, of which continuing firms contribute roughly 91% of the increase, entry firms contribute roughly 38% of the increase, and exit firms contribute roughly -28% of the increase. Similarly, continuing firms contribute 90% of the average annual increase in imports of about USD 9 billion, entry firms contribute 20%, and exit firms contribute -10% of the increase.[15]

These preliminary findings suggest that firm dynamics may play an important role for our understanding of the trade imbalance between China and the US.

[15] These decomposition findings are similar to those of Bernard, Jensen, Redding, and Schott (2009) but different from those of Tang and Zhang (2012). The former decomposes the yearly changes of US total exports and find that annual changes in US exports are almost exclusively driven by changes in the intensive margin (changes of exports by continuing exporters). However, the latter decomposes total Chinese exports and find that the intensive margin only accounts for about half of total export growth between 2000 and 2006.

4. Empirical Analysis

4.1. The Impact of Exchange Rates on Firm Exports and Imports

We first examine the impact of exchange rate changes on firm export and import values when explicitly considering firm involvement in processing trade. In contrast to the traditional approach of using aggregate trade data and time-series analysis (e.g. Thorbecke, 2006; Cheung, Chinn, and Qian, 2012), we follow the strand of literature that uses disaggregate firm-level trade data and panel-data estimations (e.g. Tang and Zhang, 2012; Amiti, Itskhoki, and Konnings, 2014). Specifically, we estimate the following regressions:

$$\Delta \ln(Exports_{fit}) = \alpha \Delta \ln(RER_t^{CPI}) + \beta \Delta \ln(WER_t) + \gamma \Delta \ln(GDP_t^{USA}) + \theta \Delta \ln(GDP_t^{CHN}) + \delta_f + \delta_i t + \varepsilon_{fit} \quad (2)$$

$$\Delta \ln(Imports_{fit}) = \alpha \Delta \ln(RER_t^{CPI}) + \beta \Delta \ln(WER_t) + \gamma \Delta \ln(GDP_t^{USA}) + \theta \Delta \ln(GDP_t^{CHN}) + \delta_f + \delta_i t + \varepsilon_{fit} \quad (3)$$

where *f*, *i*, and *t* represent firm, industry and year, respectively. $\Delta \ln(Exports_{fit})$ denotes the percentage change in Chinese firm *f*'s exports to the US, and $\Delta \ln(Imports_{fit})$ denotes the percentage change in Chinese firm *f*'s imports from the US from year *t-1* to *t*. $\Delta \ln(RER_t^{CPI})$ is the percentage annual change in the real CPI adjusted CNY/USD exchange rate.[16]

The sign and magnitude of the estimated parameter α is of main interest. Since the exchange rate is measured in CNY per USD terms, we expect α to be positive in our export regressions and negative in our import regressions (consistent with the notion that a depreciation of the CNY relative to the USD will, on average, lead to an increase in export values and a decrease in import values).

[16] As Tang and Zhang (2012) point out, most of the adjustments of Chinese firms in response to exchange rate changes take place in the first six months of the exchange rate change. Therefore, in our baseline analysis, we use the contemporary annual exchange rate change. In our robustness section in the Online Appendix we consider 1-year and 2-year lagged exchange rate changes. We also provide robustness checks using Weighted Least Square estimation with shares of firms' exports/imports as weights, excluding industry trends, adding WTO dummy, and dealing with potential endogeneity of exchange rate changes and present these robustness results in the Online Appendix tables.

$\Delta\ln(WER_t)$ is the log change of a weighted exchange rate index between CNY and currencies of other major Chinese trading partners.[17] In all our regressions, we include this variable to take into account the substituting impact of exchange rate changes between CNY and other currencies on China-US trade. We also use the percentage changes of US GDP and Chinese GDP to control for the impact of macro-level demand and supply factors on firm exports and imports. Furthermore, we use industry specific time trends to control for unobserved demand and supply trends at the industry level. Finally, since our context is panel data at the firm-level, we are able to use firm fixed effects to control for any time-invariant firm-specific characteristics that affect firm-level export or import changes. Our standard errors are clustered at the firm level.

Importantly, we extend our baseline regressions to consider the importance of processing trade involvement for the firm response to exchange rate changes. To do so, as discussed in Section 3, we classify firms into different groups depending on their degree of involvement in processing trade. In our baseline regressions we distinguish between ordinary, mixed, and pure processing firms and estimate Equations (2) and (3) for the three different groups of firms separately. Doing so allows us to answer our research question regarding whether different degrees of processing trade involvement is systematically related to the firm response to exchange rate changes.

We also extend our analysis by interacting the continuous variable, the share of processing transactions, with the change in the exchange rate in order to provide an additional layer of evidence in regards to how firms react to exchange rate changes given their degree of processing trade involvement. To do so we propose the following regression model:

$$\Delta\ln(Exports_{fit}) = \alpha\Delta\ln(RER_t^{CPI}) + \varphi\,\Delta\ln(RER_t^{CPI}) \times ProcessingTrade_{ft} + \beta\Delta\ln(WER_t) + \gamma\Delta\ln(GDP_t^{USA}) + \theta\Delta\ln(GDP_t^{CHN}) + \delta_f + \delta_i t + \varepsilon_{fit} \quad (4)$$

$$\Delta\ln(Imports_{fit}) = \alpha\Delta\ln(RER_t^{CPI}) + \varphi\,\Delta\ln(RER_t^{CPI}) \times ProcessingTrade_{ft}$$

[17] This weighted exchange rate index is calculated using time-varying trade weights across the top 30 trading partners of China (excluding USA) in each year and bilateral real exchange rates between the CNY and the respective trading partner currencies. See Thorbecke (2006) and Cheung, Chinn and Qian (2015) for additional details.

$$+\beta\Delta\ln(WER_t) + \gamma\Delta\ln(GDP_t^{USA}) + \theta\Delta\ln(GDP_t^{CHN}) + \delta_f + \delta_i t + \varepsilon_{fit} \qquad (5)$$

where $ProcessingTrade_{ft}$ denotes the share of processing export/import transactions for firm *f* in year *t*. An increasing share of processing exports indicates that firms need more imported inputs in order to export. When the CNY depreciates, the higher cost of imported inputs may increase the marginal cost of production and hence dampen the positive effects of the CNY depreciation on the export value (and vice versa for CNY appreciations). Accordingly, we expect the coefficient estimate φ to be negative in our export regressions and positive in our import regressions.

Panel A of Table 4 presents the baseline regression results regarding the influence of exchange rate changes on firm exports. As Column (1) shows (pertaining to Equation 2 without considering processing trade), our estimate of the overall export elasticity is 1.741, implying that a 10% depreciation (appreciation) of the CNY is associated with a 17.41% increase (decrease) in exports from China to the US. Columns (2) to (4) show the results of our analysis when we incorporate our classification of firms as being either ordinary, mixed, or pure processing firms (pertaining to Equation 2 with considering processing trade). The results are striking. For ordinary exporters the estimated export elasticity is 1.927 and statistically significant. The estimated export elasticity for mixed processing firm is also positive and statistically significant but smaller, at about 1.002, suggesting that partial involvement in processing trade dampens the positive (negative) effects of CNY depreciation (appreciation) on exports. For pure processing firms, however, the positive (negative) effect of CNY depreciation (appreciation) on exports is no longer statistically significant, implying that for processing firms there is no discernible exchange rate effect on exports. Importantly, the reported Chi-square test statistics show that the export elasticities across ordinary, mixed, and pure processing firms are statistically different.

Column (5) reports the estimates of the interaction effects of exchange rate and share of processing transactions on firm exports (pertaining to Equation 4). As expected, we find that the estimated coefficient on the interaction term is negative, and statistically significant, indicating that as the share of processing transactions increases, the positive (negative) effects of CNY depreciation (appreciation) on firm exports gets smaller.

Panel B of Table 4 presents the regression results pertaining to the impact of exchange rate changes on firm imports. Column (1) shows that our estimate of the overall import elasticity is 0.966, indicating that a 10% appreciation (depreciation) of the CNY is associated with a 9.66% increase (decrease) in imports from China to US (pertaining to Equation 3 without considering processing trade). Columns (2) to (4) display the baseline regression results for ordinary, mixed, and pure processing firms (pertaining to Equations 3 with considering processing trade). Once again the results are striking. The estimated import elasticity for ordinary importers is 1.23 and statistically significant. Partial involvement in processing trade dampens the positive (negative) effects of CNY appreciation (depreciation) on imports, i.e. the estimated impact is still significantly positive but much smaller for mixed processing firm, at 0.817. For pure processing firms, however, the positive (negative) effect of appreciation (depreciation) is, as in the case of exporters, insignificant.

Column (5) reports the results of our estimation of the interaction effects of exchange rate and share of processing transactions on firm imports (pertaining to Equation 5). Mirroring our findings for exporting firms, our results show that the estimated interaction term is significantly positive, indicating that as the share of processing transactions increases, the positive (negative) effects of appreciation (depreciation) on firm imports gets smaller.[18]

4.2. Estimating Different Elasticities across Different Groups of Firms

Firms may respond to exchange rate exchanges differently depending on their sizes and industries (Berman, Martin and Mayer, 2012; Amiti, Itskhoki, Konings, 2014). In this subsection, we explore these differentiated impacts of exchange rate changes by groups of firms. First, we focus on the size difference

[18] We find that the estimated coefficients of the trade-weighted exchange rate of the CNY relative to the currencies of other countries are always statistically insignificant. Furthermore, we find that the income elasticities of Chinese exports to and imports from the US are positive and statistically significant. These findings are generally consistent Thorbeck (2006), Cheung, Chinn, and Qian (2012) and others.

between firms. We classify firms into big and small firms based on whether their total exports/imports value is above or below the mean size of the exports/imports of each firm in each given year.[19] We then run our baseline regressions for the sample of big firms and small firms separately. The results are presented in Table 5. Comparing the estimated export elasticities for big firms in Panel A to those for small firms in Panel A', we find that the export responses of small firms to exchange rate changes are consistently larger than those of big firms. These different elasticities across small and big firms also show up within ordinary, mixed processing, and pure processing firms, respectively. When we move to compare the import elasticities for big firms and small firms in Panel B and B', similar findings are revealed thus again indicating that small firms adjust their imports more than big firms in response to exchange rate changes.

Second, we focus on the industry difference across firms. We classify firms into firms in homogenous industries and firms in differentiated industries based on the criteria in Rauch (1999).[20] Specifically, we match each HS 6-digit product that firms export to or import from the US to an indicator of homogenous goods or differentiated goods that Rauch (1999) created at the SITC 4-digit level (the goods is homogeneous if it is traded in organized exchange or reference priced; otherwise the goods is differentiated). We then aggregate the total export/import value of homogenous goods and differentiated goods for each firm in each year. If the total export/import value of homogenous goods is greater than that of differentiated goods for one firm, we classify this firm as a homogeneous firm. Otherwise, the firm is classified as a differentiated firm. We run the baseline regressions for homogenous firms and differentiated firms separately and present the estimation results in Table 6. As shown in Panel A and A' of Table 6, exports of homogenous firms indeed respond more to exchange rate changes than those of

[19] We also use the median value of exports/imports for each firm in each year to cut the samples into big and small firms and find similar results as indicated in Appendix Table 6.

[20] We also classify firms into primary-goods and manufacturing-goods exporters/importers following Cheung, Chinn and Qian (2015). Specifically, we identify the largest exported/imported HS 6-digit product for each firm. If the largest exported/imported product is primary goods (with HS 2-digit codes ranging from 01 to 27) we classify the firm as a primary-goods exporter/importer. If the largest exported/imported product is manufacturing goods (with HS 2-digit codes ranging from 28-97) we classify the firm as a manufacturing-goods exporter/importer. These robustness results are presented in Appendix Table 7. We find consistent results that primary-goods firms respond more to exchange rate changes than manufacturing-goods firms. We further classify firms based on their ownership and present the results in Appendix Table 8.

differentiated firms. The difference between the export elasticities is statistically significant but economically small. However, the difference of the import elasticities for homogeneous firms and differentiated firms are much bigger economically as indicated in Panel B and B' of Table 6.

To further explore the sources of different export/import elasticities across different groups of firms, we decompose the value of exports and imports into the unit price and quantities of exports and imports and take our empirical analysis to the HS 6-digit product level (where we can separately observe the detailed quantity information for firm's exports and imports). The regression results for unit value, quantity, and total value of exports and imports are presented in Table 7 (separately for big firms and small firms). Our estimates suggest that small firms show no pricing-to-market effect while big firms increase their price by 1.3% in response to a 10% depreciation of the exchange rate. This finding complements and extends the previous findings of Marston (1990) using Japanese data, Berman, Martin and Mayer (2012) using French data, and Li, Ma, and Xu (2015) using Chinese data. As for export quantity, small firms adjust more than big firms – the elasticity drops from 1.29 for small firms to 0.55 for big firms. We further extend previous findings by offering new results for big and small importers. We find that small importers are price-takers in the importing market, e.g. a 10% depreciation is associated with no discernable price drop facing small importers while the importing price of big firms drops by about 1%. Same for export quantity, small importers adjust more than big importers – the elasticity drops from -0.70 for small firms to -0.14 for big firms. Overall, the product-level results are consistent with our firm-level findings and, further, support that small firms respond more to exchange rate changes than big firms due to quantity adjustment dominating price adjustment.

In Table 8, we present the regression results of unit price, quantity, and value for homogeneous firms and differentiated firms respectively. Consistent with previous findings (Atkeson and Burstein, 2008; Berman, Martin and Mayer, 2012), we find that firms operating mainly in homogeneous-goods sectors face high elasticity of substitution and hence doesn't adjust their export prices in response to exchange rate exchanges. Instead, firms operating mainly in differentiated-goods sectors respond to exchange rate changes by adjusting their export and import prices. In addition, the elasticity of export/import quantity is bigger for homogeneous firms than that for differentiated firms. Together, this leads to greater adjustment in export/import value of homogeneous firms than that of differentiated firms.

4.3. The Impact of Exchange Rates on Firm Entry and Exit

We now turn to the analysis of the influence of exchange rate changes on firm entry and exit in China-US export and import markets. Once again, we consider whether firm responses differ across different degrees of processing trade involvement. Our starting point is the following regression models:

$$Prob\left(Entry_{fit} = 1\right) = \Phi(\Delta\ln(RER_t^{CPI}) + \beta\Delta\ln(WER_t) + \gamma\Delta\ln(GDP_t^{USA}) + \theta\Delta\ln(GDP_t^{CHN}) + \delta_i t) \quad (6)$$

$$Prob\left(Exit_{fit} = 1\right) = \Phi(\alpha\Delta\ln(RER_t^{CPI}) + \beta\Delta\ln(WER_t) + \gamma\Delta\ln(GDP_t^{USA}) + \theta\Delta\ln(GDP_t^{CHN}) + \delta_i t) \quad (7)$$

where *f*, *i*, and *t* represent firm, industry and year, respectively; $Entry_{fit}$ is the probability of export or import market entry and equals 1 if firm *f* does not export to the US or import from the US in year *t-1*, but starts exporting to the US or starts importing from the US in year *t*; $Entry_{fit}$ equals 0 if firm *f* keeps exporting to the US or keeps importing from the US during year *t-1* and *t*; $Exit_{fit}$ is the probability of export or import market exit and equals 1 if firm *f* exports to the US or imports from the US in year *t-1*, but not in year *t*; $Exit_{fit}$ equals 0 if firm *f* keeps exporting to the US or keeps importing from the US during year *t-1* and *t*.[21] Consistent with our discussion of the focal parameter estimate α in the context of our earlier regression models, we expect α to be positive in our firm export entry regressions and negative in our firm export exit regressions. Similarly, we expect α to be negative in our firm import entry regressions and positive in our firm import exit regressions.[22]

In the same fashion as before we also extend our entry/exit analysis to take into account firm involvement in processing trade using our distinction between ordinary firms, mixed processing firms,

[21] The empirical setup described by Equations (6) and (7) follows Tang and Zhang (2012) and Li, Ma, and Xu (2015).

[22] As in the previous estimations, we control for the weighted CNY exchange rate, the impact of demand on firm entry and exit, as well as the industry specific trend in firm exit and entry. We cluster the standard errors at the industry level to adjust for within-industry correlation of residuals.

and pure processing firm. To do so we estimate Equations (6) and (7) separately across each of the three types of firms and, in turn, compare the firm type specific parameter estimates of α.

Finally, also as before, we interact the share of processing transactions with the exchange rate variable and, to do so, estimate the following regression models:

$$Prob\ (Entry_{fit} = 1) = \Phi(\alpha\Delta\ln(RER_t^{CPI}) + \varphi\Delta\ln(RER_t^{CPI}) \times ProcessingTrade_{ft} + \beta\Delta\ln(WER_t) + \gamma\Delta\ln(GDP_t^{USA}) + \theta\Delta\ln(GDP_t^{CHN}) + \delta_i t) \quad (8)$$

$$Prob\ (Exit_{fit} = 1) = \Phi(\alpha\Delta\ln(RER_t^{CPI}) + \varphi\Delta\ln(RER_t^{CPI}) \times ProcessingTrade_{ft} + \beta\Delta\ln(WER_t) + \gamma\Delta\ln(GDP_t^{USA}) + \theta\Delta\ln(GDP_t^{CHN}) + \delta_i t) \quad (9)$$

where all variables are as previously defined. Since a depreciation (appreciation) of the CNY is associated with higher (lower) cost of imported inputs and thus an increase (decrease) in the marginal cost of production, an increasing (decreasing) share of processing exports is likely to partially offset the positive (negative) effects of CNY depreciation (appreciation) on export entry. Accordingly, we would expect the coefficient estimate φ to be negative in our export entry regressions and positive in our import entry regressions, and vice versa with respect to export and import exit.

Table 9 presents the results pertaining to Equations (6) and (8). We report the marginal effects of probit regressions in order to facilitate a comparison of magnitudes. Panel A reports the estimated probability of a Chinese firm entering into the export market. Column (1) of Panel A shows that there is a statistically significant and positive relation between CNY changes and the probability of firm entry into exporting. Importantly, this relationship between the exchange rate and the probability of export market entry differs significantly across firms with different degrees of processing trade involvement. As Columns (2) to (4) show, ordinary exporting firms are more likely to enter into exporting to the US in response to a CNY depreciation compared to mixed processing and pure processing firms. The results reported in Column (5) offer further evidence that the likelihood of export market entry in response to currency fluctuations depends on the intensity of processing trade in overall firm exports.

Panel B of Table 9 reports the estimation results of the probability of entering into importing from the US. Consistent with our priors, we find a statistically significant and negative relationship between changes in the CNY/USD rate and the probability of import market entry into. Again, as Columns (2) to (5) show, this relationship differs markedly across the different degrees of processing trade involvement.

Turning to the estimation results pertaining to Equations (7) and (9), Panel A of Table 10 shows the estimated probability of export market exit and Panel B of Table 10 shows the estimated probability of import market exit. Column (1) of Panel A shows that, overall, depreciation (appreciation) of the CNY decreases (increases) the probability of firm export market exit. The positive effect of CNY depreciation on firm survival in the export market is stronger for ordinary and mixed processing firms (Columns 2 and 3) but statistically insignificant for pure processing firms (Column 4). Interestingly, the magnitude of the positive effect on survival is decreasing as the share of processing trade is increasing (Column 5). The import market exit results reported in Panel B virtually mirror the export market exit results.[23]

5. Counterfactual Analysis of Economic Effects

We now use our firm-level estimates to facilitate a counterfactual "back-of-the-envelope" calculation in an attempt to quantify the China-US trade balance effect of a 10 percent appreciation of the CNY against the USD. Our starting point is to rewrite our Equation (1) decomposition of total exports and imports changes as follows:

$$\Delta Exports_t = \Delta Exports_t^C + N_t^N \overline{Exports}_t^N - N_{t-1}^E \overline{Exports}_{t-1}^E \quad (10)$$

$$\Delta Imports_t = \Delta Imports_t^C + N_t^N \overline{Imports}_t^N - N_{t-1}^E \overline{Imports}_{t-1}^E \quad (11)$$

Employing our regression models and associated coefficient estimates of the previous section, a 10 percent appreciation of the CNY will change exports and imports as follows:

$$\Delta Exports_t = (\alpha_{Ex}^C Exports_t^C + \alpha_{Ex}^N N_t \ \overline{Exports}_t^N - \alpha_{Ex}^E N_{t-1} \overline{Exports}_{t-1}^E) \times (-10\%) \quad (12)$$

$$\Delta Imports_t = (\alpha_{Im}^C Imports_t^C + \alpha_{Im}^N N_t \ \overline{Imports}_t^N - \alpha_{Im}^E N_{t-1} \overline{Imports}_{t-1}^E) \times (-10\%) \quad (13)$$

[23] In the Appendix, we further check the robustness of our main results by considering the firm level trade effects of exchange rates using alternative exchange rate measures, by employing alternative processing trade firm definitions, and by assessing the effects of lagged exchange rates. In addition, we extend our analysis to consider the impact of the exchange rate on the bilateral trade balance between China and its top 30 trading partners. Our baseline findings remain unchanged.

We start with applying the coefficient estimate for α_{Ex}^{C} from Column (1) of Table 4, the coefficient estimate for α_{Ex}^{N} from Column (1) of Table 9, and the coefficient estimate for α_{Ex}^{E} from Column (1) of Table 10, i.e. the respective coefficient estimates obtained in estimations that do not consider different degrees of processing trade involvement. Combined with the relevant 2011 Customs data statistics on $Exports_t^C$, N_t ,$\overline{Exports}_t^N$, N_{t-1},$\overline{Exports}_{t-1}^E$, we then calculate the consequential changes in exports and imports to, in turn, evaluate the aggregate effect on the China-US trade balance. The results, reported in Panel A of Table 11, suggest that the 2011 trade imbalance between China and the US would have been reduced by USD 46 billion had the CNY appreciated by 10% against the USD (about 23% of 2011 China-US trade imbalance).[24]

When we distinguish between ordinary, mixed, and pure processing firms we make use of the coefficient estimates from Columns (2) to (4) in Table 4 for α_{Ex}^{C}, the coefficient estimates from Columns (2) to (4) in Table 9 for α_{Ex}^{N}, and the coefficient estimates from Columns (2) to (4) in Table 10 for α_{Ex}^{E} and the corresponding statistics from 2011 Customs data. The counterfactual calculation results are reported in Panel B of Table 11. These results suggest that the 2011 trade imbalance between China and the US would have been USD 42 billion less had the CNY appreciated by 10% (about 21% of 2011 China-US trade imbalance). The results in Panel B also summarize the differential impact of exchange rate changes for ordinary, mixed, and processing firms, indicating that most of the trade balance changes are due to adjustment of exports and imports by ordinary firms while processing firms hardly contribute to the trade balance changes in response to exchange rate changes.

Although by construction imprecise and merely indicative, these counterfactual findings are particularly illuminating as they not only suggest that the economic effects of exchange rate changes in regards to the trade balance are very substantial, they also highlight the importance of explicitly

[24] The results shown in Panel A indicate that most of the hypothetical trade imbalance reduction (about 90%) stems from exchange rate induced changes in the exports and imports of continuing firms (decreased exports from China to the US by USD 52 billion and increased imports by China from the US by USD 10 billion).

considering firm level heterogeneity in the trade sector exchange rate response in order to fully capture the economic and distributional importance of exchange rate changes.

6. Conclusion

This paper provides an empirical micro-data analysis of the macro effects of exchange rate changes on the aggregate trade balance. Employing a rich and unique transactions-level Chinese customs dataset we decompose the Chinese trade balance into bilateral firm-level outcomes and examine how changes in the relative value of the CNY vis-à-vis the USD (as well as vis-à-vis non-USD currencies) affect these outcomes. We analyze how different types of firms in terms of processing trade involvement respond to exchange rate changes. Specifically, we provide a counterfactual assessment of the effect of a 10% CNY appreciation against the USD on the China-US trade balance using our firm-level based coefficient estimates.

Our results suggest that the influence of exchange rates on trade flows is strong and thus a key premise, that currency depreciations lead to export growth, underlying the policy debate on beggar-thy-neighbor policies is, in fact, valid. Moreover, our results indicate that the response of Chinese firms to exchanges rate changes in terms of either export or import values or in terms of the likelihood of export or import market entry or exit depends strongly on the extent to which firms are involved in processing trade. For ordinary firms with no processing trade involvement, we find large export and import exchange rate elasticities. As the degree of processing trade involvement increases, we find that the elasticities become smaller and, for pure processing firms, the (negative) impact of appreciation on exports and the (positive) impact on imports are both statistically insignificant. We find similar results when estimating the impact of exchange rate changes on export and import market firm entry and exit. Overall, the results of our firm-level based estimation of trade elasticities suggest that the Chinese trade balance respond strongly to changes in the relative value of the CNY.

In summary, our results offer three key insights. First, our results suggest that exchange rate changes have substantial trade balance effects. This is in and of itself a very important insight in light of the lack of consensus in the trade literature in regards to whether the economic exchange rate effects on the trade balance matter. It is also an important insight in regards to policy implications as it suggests that policy-induced currency depreciations are indeed, at least in principle, a possible path towards export-driven growth. Or, put differently, this insight provides a justification for criticizing trade-partners engaging in policies aimed at, or policies consistent with, a resulting depression of relative domestic currency values. Second, by nature of the origin of our findings, i.e. our use of transaction-level trade data, these findings add credence to the notion that firm-level rather than aggregate trade data is of particular importance when analyzing the trade effects of exchange rates in order to avoid that off-setting heterogeneous firm level responses that go undetected in aggregate data mask the true effect of exchange rate changes. Third and finally, our results overall suggest that in order to uncover the trade effects of exchange rate changes, at the aggregate as well as at the firm level, it is essential to explicitly consider firm heterogeneity in the form of processing trade involvement differences as failure to do so will lead to an incomplete understanding of the economics and economic effects of exchange rate changes on trade flows.

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Figure 1: The CNY/USD Rate 2000-2011

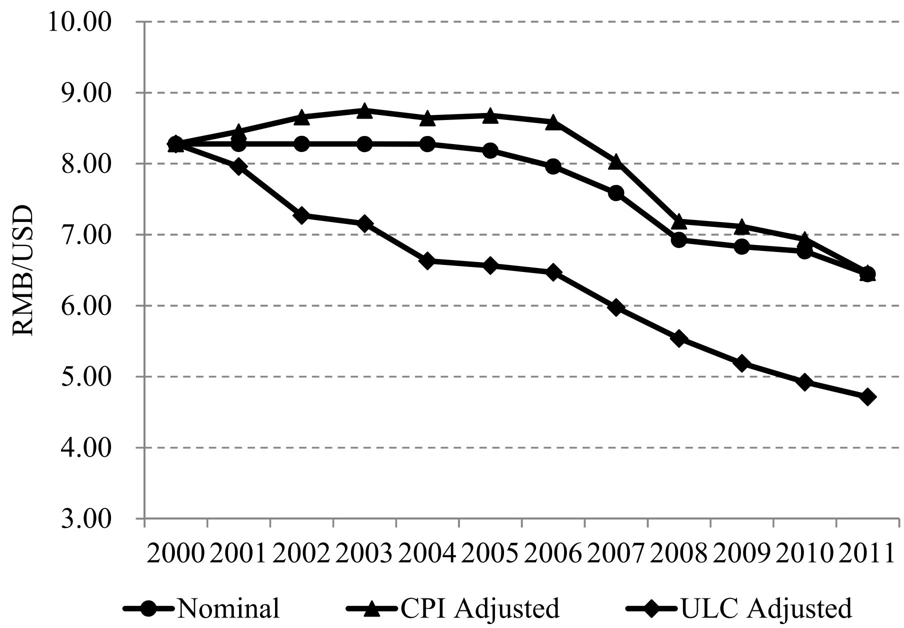
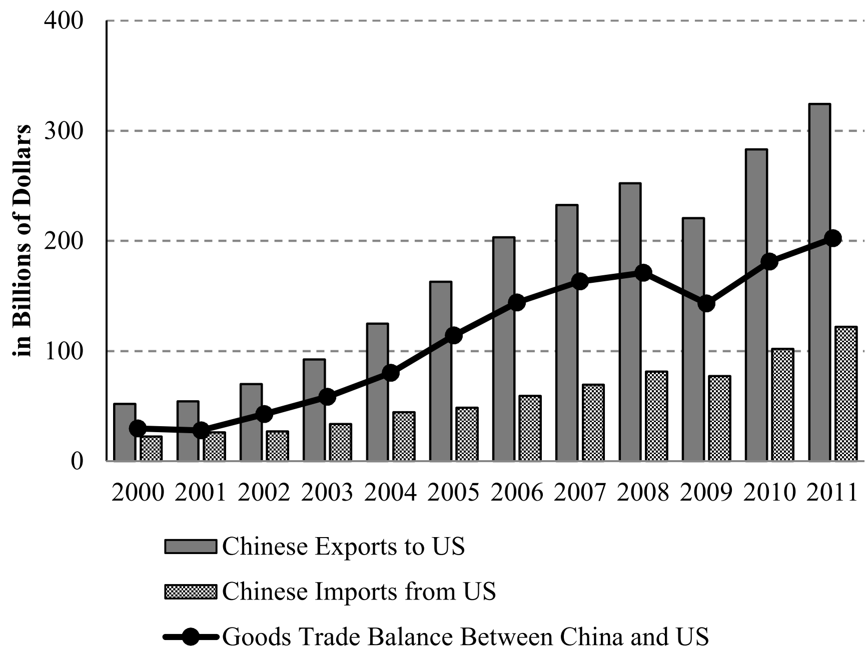


Figure 2: Goods Trade Balance Between China and US



Source: Chinese National Bureau of Statistics

Table 1: Exports and Imports of Goods Between China and US

Year	Exports		Imports	
	Total Number of Exporters	Total Exports (billions of USD)	Total Number of Importers	Total Imports (billions of USD)
2000	23,438	52	20,450	22
2001	26,172	60	21,141	29
2002	31,835	70	24,364	27
2003	39,555	93	28,702	34
2004	49,878	125	33,533	45
2005	63,193	162	36,924	48
2006	76,081	201	39,628	58
2007	77,845	232	36,990	69
2008	81,575	251	39,002	81
2009	83,681	214	38,791	77
2010	92,305	272	42,332	102
2011	99,681	324	44,635	122
Avg. Ann. Growth Rate	13%	17%	7%	15%

Notes: Authors' calculation based on 2000-2011 Chinese Customs Data.

Table 2: Distributions of Exporters and Importers by Different Modes of Trade:
Ordinary Trade, Pure Processing Trade, and Mixed Trade

	Ordinary Trade Firms		Pure Processing Trade Firms		Mixed Trade Firms	
	Panel A: Exporters					
Year	Total Number of Ordinary Trade Firms	Total Exports by Ordinary Trade Firms (billions of USD)	Total Number of Pure Processing Trade Firms	Total Exports by Pure Processing Trade Firms (billions of USD)	Total Number of Mixed Trade Firms	Total Exports by Mixed Trade Firms (billions of USD)
2000	12,851	7	5,778	16	4,809	28.6
2001	14,907	8	6,137	22	5,128	29.1
2002	19,119	11	6,841	24	5,875	35.2
2003	25,140	15	7,792	33	6,623	44.7
2004	33,824	21	8,492	45	7,562	58.3
2005	44,195	30	9,789	53	9,209	78.3
2006	56,236	42	9,824	70	10,021	89.6
2007	57,804	51	10,012	86	10,029	94.1
2008	60,224	63	9,992	91	11,359	96.8
2009	62,712	74	8,262	61	12,707	78.9
2010	70,328	89	9,204	77	12,773	105.3
2011	77,720	107	9,117	88	12,844	129.0
Average Share	69%	22%	16%	33%	15%	45%
	Panel B: Importers					
Year	Total Number of Ordinary Trade Firms	Total Exports by Ordinary Trade Firms (billions of USD)	Total Number of Pure Processing Trade Firms	Total Exports by Pure Processing Trade Firms (billions of USD)	Total Number of Mixed Trade Firms	Total Exports by Mixed Trade Firms (billions of USD)
2000	6,946	5	10,126	3	3,378	13.9
2001	8,057	7	9,591	4	3,493	18.4
2002	9,958	6	10,344	4	4,062	17.0
2003	12,719	8	11,050	6	4,933	20.6
2004	15,582	10	12,428	8	5,523	26.6
2005	17,656	12	13,141	9	6,127	27.8
2006	19,475	13	13,514	10	6,639	35.3
2007	19,557	16	12,909	11	4,524	42.0
2008	20,815	19	12,653	13	5,534	48.8
2009	21,603	11	12,070	9	5,118	57.0
2010	23,521	20	12,842	14	5,969	68.0
2011	24,826	24	13,598	16	6,211	82.2
Average Share	48%	22%	37%	15%	15%	63%

Notes: Authors' calculation based on 2000-2011 Chinese Customs Data.

Table 3: Firm Dynamics in China-US Trade

Year	Continuing Firms: Number of Firms	Continuing Firms: ΔExport Value (USD billion)	Continuing Firms: Share	Entry Firms: Number of Firms	Entry Firms: ΔExport Value (USD billion)	Entry Firms: Share	Exit Firms: Number of Firms	Exit Firms: ΔExport Value (USD billion)	Exit Firms: Share	All Firms: ΔExport Value (USD billion)
Panel A: Exporters										
2000-2001	18,045	5	73%	8,127	4	51%	5,393	2	23%	7
2001-2002	20,469	7	69%	11,366	5	47%	5,703	2	16%	10
2002-2003	25,681	17	77%	13,874	7	31%	6,154	2	7%	23
2003-2004	31,498	25	77%	18,380	10	30%	8,057	2	7%	32
2004-2005	39,482	29	78%	23,711	11	30%	10,396	3	8%	37
2005-2006	49,564	32	80%	26,517	12	31%	13,629	4	11%	40
2006-2007	53,163	72	237%	24,682	15	50%	22,918	57	187%	30
2007-2008	59,247	11	58%	22,328	18	92%	18,598	10	50%	19
2008-2009	60,574	-37	101%	23,107	16	-43%	21,001	16	-42%	-37
2009-2010	65,245	44	76%	27,060	24	41%	18,436	10	17%	58
2010-2011	73,046	38	72%	26,635	29	54%	19,259	14	26%	53
Average	45092	22	91%	20526	14	38%	13595	11	28%	25
Panel B: Importers										
2000-2001	13,289	5	75%	7,852	3	42%	7,161	1	17%	6
2001-2002	14,155	-3	163%	10,209	2	-150%	6,986	1	-88%	-2
2002-2003	16,662	4	66%	12,040	4	57%	7,702	2	22%	7
2003-2004	19,344	8	76%	14,189	4	41%	9,358	2	17%	11
2004-2005	22,257	3	78%	14,667	4	105%	11,276	3	84%	4
2005-2006	24,641	8	80%	14,987	5	50%	12,283	3	30%	10
2006-2007	22,481	14	125%	14,509	6	55%	17,147	9	80%	11
2007-2008	23,734	8	71%	15,268	8	65%	13,256	4	36%	12
2008-2009	24,256	-5	137%	14,535	7	-174%	14,746	5	-137%	-4
2009-2010	26,129	16	67%	16,203	13	53%	12,662	5	20%	25
2010-2011	28,633	11	53%	16,002	15	75%	13,699	6	28%	20
Average	21416	6	90%	13678	6	20%	11480	4	10%	9

Notes: Authors' calculation based on 2000-2011 Chinese Customs Data.

Table 4: The CNY/USD Rate and Chinese Firm-Level Exports to and Imports from the US

VARIABLES	All Firms	Ordinary Firms	Mixed Processing Firms	Pure Processing Firms	All Firms
	Panel A: Exports to US				
	(1)	(2)	(3)	(4)	(5)
$\Delta\ln(RER^{CPI})$	1.741***	1.927***	1.002***	0.910	1.773***
	(0.162)	(0.079)	(0.211)	(0.903)	(0.218)
$\Delta\ln(RER^{CPI})\times$Share of Processing Trade					-0.131***
					(0.037)
$\Delta\ln(WER)$	0.402	0.644	0.334	0.904	0.401
	(1.043)	(1.553)	(1.196)	(0.873)	(1.043)
$\Delta\ln(GDP^{CHN})$	2.280***	2.779***	2.440***	2.202*	2.190***
	(0.286)	(0.378)	(0.719)	(1.153)	(0.288)
$\Delta\ln(GDP^{USA})$	3.652***	3.109***	4.899***	3.384***	3.646***
	(0.290)	(0.367)	(0.805)	(0.225)	(0.290)
Firm Fixed Effect	yes	yes	yes	yes	yes
Industry Specific Trend	yes	yes	yes	yes	yes
Observations	496014	400535	55243	40236	496014
R-squared	0.324	0.365	0.534	0.523	0.324
Chi^2 Statistics			12.36***	15.68***	
	Panel B: Imports from US				
	(1')	(2')	(3')	(4')	(5')
$\Delta\ln(RER^{CPI})$	-0.966***	-1.230***	-0.817***	-0.459	-1.010***
	(0.102)	(0.220)	(0.218)	(0.472)	(0.105)
$\Delta\ln(RER^{CPI})\times$Share of Processing Trade					0.122***
					(0.027)
$\Delta\ln(WER)$	0.307	0.142	0.468	0.422	0.334
	(0.656)	(1.122)	(1.150)	(2.109)	(0.656)
$\Delta\ln(GDP^{CHN})$	1.499***	1.584***	1.138***	2.489***	1.212***
	(0.203)	(0.173)	(0.085)	(0.645)	(0.105)
$\Delta\ln(GDP^{USA})$	4.484***	2.270***	4.882***	9.213***	4.294***
	(0.516)	(0.261)	(0.930)	(1.772)	(0.518)
Firm Fixed Effect	yes	yes	yes	yes	yes
Industry Specific Trend	yes	yes	yes	yes	yes
Observations	235581	128272	57533	49776	235581
R-squared	0.281	0.405	0.442	0.529	0.281
Chi^2 Statistics			10.16***	17.27***	

Notes: Dependent variable is the percentage change of Chinese firm *f*'s exports to US or Chinese firm *f*'s imports from US over year *t-1* and *t*. OLS coefficients are reported with robust standard errors adjusted for clustering at the firm level. ***, **, and * indicate statistical significance at the 1%, 5%, and 10%, respectively. Chi^2 Statistics test the significant difference of elasticities between the specified firm group and the group of ordinary firms.

Table 5: Different Elasticities across Big Firms and Small Firms

VARIABLES	All Firms	Ordinary Firms	Mixed Processing Firms	Pure Processing Firms	All Firms
	Panel A: Exports to US - Big Firms				
	(1)	(2)	(3)	(4)	(5)
$\Delta\ln(RER^{CPI})$	1.469***	1.573***	1.432***	0.830	1.471***
	(0.213)	(0.140)	(0.211)	(0.874)	(0.213)
$\Delta\ln(RER^{CPI})\times$Share of Processing Trade					-0.431***
					(0.076)
Observations	99072	66555	23017	9500	99072
R-squared	0.532	0.596	0.561	0.591	0.532
	Panel A': Exports to US - Small Firms				
	(1')	(2')	(3')	(4')	(5')
$\Delta\ln(RER^{CPI})$	1.809***	1.897***	1.702***	0.965*	1.812***
	(0.198)	(0.138)	(0.221)	(0.545)	(0.199)
$\Delta\ln(RER^{CPI})\times$Share of Processing Trade					-0.553***
					(0.061)
Observations	396942	333980	32226	30736	396942
R-squared	0.370	0.398	0.654	0.577	0.370
Chi^2 Statistics	15.29***	17.81***	18.27***	20.09***	15.56***
	Panel B: Imports from US - Big Firms				
	(6)	(7)	(8)	(9)	(10)
$\Delta\ln(RER^{CPI})$	-0.763***	-0.966***	-0.622***	-0.471	-0.769***
	(0.048)	(0.065)	(0.050)	(0.482)	(0.049)
$\Delta\ln(RER^{CPI})\times$Share of Processing Trade					0.240***
					(0.032)
Observations	38036	17051	17664	3321	38036
R-squared	0.519	0.625	0.536	0.698	0.519
	Panel B': Imports from US - Small Firms				
	(6')	(7')	(8')	(9')	(10')
$\Delta\ln(RER^{CPI})$	-1.005***	-1.250***	0.987***	-0.434	-1.008***
	(0.136)	(0.163)	(0.109)	(0.782)	(0.134)
$\Delta\ln(RER^{CPI})\times$Share of Processing Trade					0.390***
					(0.037)
Observations	197545	111221	39869	46455	197545
R-squared	0.326	0.442	0.548	0.547	0.327
Chi^2 Statistics	17.78***	20.52***	25.45***	21.16***	19.70***

Notes: Dependent variable is the percentage change of Chinese firm *f*'s exports to US or Chinese firm *f*'s imports from US over year *t-1* and *t*. OLS coefficients are reported with robust standard errors adjusted for clustering at the firm level. We also control for weighted exchange rate between RMB and the currencies of other major trading partners, US GDP, Chinese GDP, firm fixed effects, and industry specific trend in all specifications. ***, **, and * indicate statistical significance at the 1%, 5%, and 10%, respectively. Chi^2 Statistics test the significant difference of elasticities between big firms and small firms.

Table 6: Different Elasticities across Homogenous Firms and Differentiated Firms

VARIABLES	All Firms	Ordinary Firms	Mixed Processing Firms	Pure Processing Firms	All Firms
	Panel A: Exports to US - Differentiated Firms				
	(1)	(2)	(3)	(4)	(5)
$\Delta\ln(RER^{CPI})$	1.712***	1.818***	1.611***	0.917	1.713***
	(0.063)	(0.136)	(0.238)	(0.912)	(0.063)
$\Delta\ln(RER^{CPI})\times$Share of Processing Trade					-0.326***
					(0.038)
Observations	396844	314209	46655	35980	396844
R-squared	0.532	0.596	0.561	0.591	0.532
	Panel A': Exports to US - Homogenous Firms				
	(1')	(2')	(3')	(4')	(5')
$\Delta\ln(RER^{CPI})$	1.772***	1.829***	1.617***	0.929*	1.775***
	(0.082)	(0.102)	(0.210)	(0.525)	(0.083)
$\Delta\ln(RER^{CPI})\times$Share of Processing Trade					-0.483***
					(0.050)
Observations	99170	86326	8588	4256	99170
R-squared	0.370	0.398	0.654	0.577	0.370
Chi^2 Statistics	10.84***	12.67***	15.32***	18.15***	11.03***
	Panel B: Imports from US - Differentiated Firms				
	(6)	(7)	(8)	(9)	(10)
$\Delta\ln(RER^{CPI})$	-0.895***	-0.993***	-0.942***	-0.598	-0.899***
	(0.128)	(0.082)	(0.078)	(0.763)	(0.128)
$\Delta\ln(RER^{CPI})\times$Share of Processing Trade					0.236***
					(0.051)
Observations	191332	102894	47075	41363	191332
R-squared	0.522	0.537	0.816	0.681	0.522
	Panel B': Imports from US - Homogenous Firms				
	(6')	(7')	(8')	(9')	(10')
$\Delta\ln(RER^{CPI})$	-1.275***	-1.412***	-1.296***	-0.836	-1.278***
	(0.152)	(0.120)	(0.170)	(0.810)	(0.152)
$\Delta\ln(RER^{CPI})\times$Share of Processing Trade					0.363***
					(0.047)
Observations	44249	25378	10458	8413	44249
R-squared	0.457	0.505	0.561	0.573	0.457
Chi^2 Statistics	35.62***	38.27***	35.76***	39.66***	35.16***

Notes: Dependent variable is the percentage change of Chinese firm *f*'s exports to US or Chinese firm *f*'s imports from US over year *t-1* and *t*. OLS coefficients are reported with robust standard errors adjusted for clustering at the firm level. We also control for weighted exchange rate between RMB and the currencies of other major trading partners, US GDP, Chinese GDP, firm fixed effects, and industry specific trend in all specifications. ***, **, and * indicate statistical significance at the 1%, 5%, and 10%, respectively. Chi^2 Statistics test the significant difference of elasticities between homogenous firms and differentiated firms.

Table 7: Exchange Rate Pass-Through and Trade Elasticities across Big Firms and Small Firms

VARIABLES	All Firms			Ordinary Firms			Mixed Processing Firms			Pure Processing Firms		
	Δln(uv)	*Δln(q)*	*Δln(v)*	*Δln(uv)*	*Δln(q)*	*Δln(v)*	*Δln(uv)*	*Δln(q)*	*Δln(v)*	*Δln(uv)*	*Δln(q)*	*Δln(v)*
	Panel A: Exports to US - Big Firms											
	(1)	(1')	(1")	(2)	(2')	(2")	(3)	(3')	(3")	(4)	(4')	(4")
$\Delta\ln(RER^{CPI})$	0.133***	0.550**	0.683***	0.143***	0.604***	0.747***	0.122***	0.491***	0.613***	0.096*	0.351	0.447
	(0.009)	(0.262)	(0.056)	(0.003)	(0.056)	(0.055)	(0.008)	(0.044)	(0.023)	(0.054)	(0.431)	(0.515)
Observations	509839	509839	509839	353560	353560	353560	86031	86031	86031	70248	70248	70248
R-squared	0.352	0.431	0.443	0.514	0.493	0.453	0.493	0.492	0.452	0.533	0.512	0.472
	Panel A': Exports to US - Small Firms											
	(5)	(5')	(5")	(6)	(6')	(6")	(7)	(7')	(7")	(8)	(8')	(8")
$\Delta\ln(RER^{CPI})$	0.049	1.289***	1.338***	0.054*	1.345***	1.399***	0.033	1.286***	1.319***	0.002	0.790**	0.792**
	(0.073)	(0.234)	(0.165)	(0.030)	(0.342)	(0.214)	(0.049)	(0.209)	(0.194)	(0.037)	(0.376)	(0.377)
Observations	1344120	1344120	1344120	1143526	1143526	1143526	120452	120452	120452	80142	80142	80142
R-squared	0.271	0.305	0.276	0.328	0.337	0.331	0.321	0.334	0.325	0.347	0.326	0.353
	Panel B: Imports from US - Big Firms											
	(9)	(9')	(9")	(10)	(10')	(10")	(11)	(11')	(11")	(12)	(12')	(12")
$\Delta\ln(RER^{CPI})$	-0.099***	-0.143***	-0.242***	-0.112***	-0.171***	-0.283***	-0.103***	-0.147***	-0.250***	-0.056*	-0.054	-0.110
	(0.007)	(0.032)	(0.050)	(0.012)	(0.011)	(0.047)	(0.005)	(0.019)	(0.036)	(0.030)	(0.135)	(0.153)
Observations	188465	188465	188465	112238	112238	112238	38950	38950	38950	37277	37277	37277
R-squared	0.323	0.401	0.414	0.485	0.464	0.424	0.464	0.463	0.423	0.504	0.483	0.443
	Panel B': Imports from US - Small Firms											
	(13)	(13')	(13")	(14)	(14')	(14")	(15)	(15')	(15")	(16)	(16')	(16")
$\Delta\ln(RER^{CPI})$	-0.030	-0.696***	-0.726***	-0.046	-0.854***	-0.900***	-0.018	-0.794***	-0.812***	-0.004	-0.316***	-0.320*
	(0.041)	(0.098)	(0.093)	(0.054)	(0.123)	(0.102)	(0.030)	(0.065)	(0.084)	(0.012)	(0.020)	(0.180)
Observations	898402	898402	898402	479553	479553	479553	226482	226482	226482	192367	192367	192367
R-squared	0.242	0.276	0.247	0.299	0.278	0.302	0.292	0.305	0.291	0.318	0.297	0.321

Notes: Dependent variables are the percentage changes of unit value, quantity, or total value of Chinese firm *f*'s exports of HS 6-digit product *p* to US or Chinese firm *f*'s imports of HS 6-digit product *p* from US over year *t-1* and *t* as indicated. OLS coefficients are reported with robust standard errors adjusted for clustering at the firm level. We also control for weighted exchange rate between RMB and the currencies of other major trading partners, US GDP, Chinese GDP, product fixed effects, firm fixed effects, and industry specific trend in all specifications. ***, **, and * indicate statistical significance at the 1%, 5%, and 10%, respectively.

Table 8: Exchange Rate Pass-Through and Trade Elasticities across Homogeneous Firms and Differentiated Firms

VARIABLES	All Firms			Ordinary Firms			Mixed Processing Firms			Pure Processing Firms		
	Δln(uv)	*Δln(q)*	*Δln(v)*	*Δln(uv)*	*Δln(q)*	*Δln(v)*	*Δln(uv)*	*Δln(q)*	*Δln(v)*	*Δln(uv)*	*Δln(q)*	*Δln(v)*
	Panel A: Exports to US - Differentiated Firms											
	(1)	(1')	(1")	(2)	(2')	(2")	(3)	(3')	(3")	(4)	(4')	(4")
$\Delta\ln(RER^{CPI})$	0.082***	0.971**	1.053***	0.093***	1.017***	1.110***	0.055***	0.836***	0.891***	0.005*	0.613	0.618
	(0.006)	(0.462)	(0.023)	(0.010)	(0.195)	(0.059)	(0.101)	(0.092)	(0.091)	(0.003)	(0.711)	(0.752)
Observations	1483167	1483167	1483167	1197669	1197669	1197669	165186	165186	165186	120312	120312	120312
R-squared	0.309	0.453	0.512	0.336	0.370	0.378	0.489	0.491	0.509	0.355	0.389	0.397
	Panel A': Exports to US - Homogeneous Firms											
	(5)	(5')	(5")	(6)	(6')	(6")	(7)	(7')	(7")	(8)	(8')	(8")
$\Delta\ln(RER^{CPI})$	0.033	1.563***	1.596***	0.037	1.700***	1.737***	0.020	1.332***	1.352***	0.004	0.683**	0.687*
	(0.134)	(0.112)	(0.032)	(0.093)	(0.125)	(0.120)	(0.101)	(0.341)	(0.087)	(0.052)	(0.325)	(0.386)
Observations	370792	370792	370792	299417	299417	299417	41297	41297	41297	30078	30078	30078
R-squared	0.286	0.264	0.269	0.223	0.216	0.212	0.282	0.275	0.298	0.242	0.235	0.231
	Panel B: Imports from US - Differentiated Firms											
	(9)	(9')	(9")	(10)	(10')	(10")	(11)	(11')	(11")	(12)	(12')	(12")
$\Delta\ln(RER^{CPI})$	-0.048***	-0.462***	-0.510***	-0.069***	-0.571***	-0.640***	-0.037***	-0.441***	-0.478***	-0.008*	-0.192	-0.200
	(0.006)	(0.015)	(0.043)	(0.010)	(0.029)	(0.050)	(0.004)	(0.028)	(0.062)	(0.004)	(0.515)	(0.205)
Observations	869494	869494	869494	473433	473433	473433	212346	212346	212346	183715	183715	183715
R-squared	0.329	0.277	0.241	0.362	0.392	0.398	0.357	0.391	0.365	0.327	0.361	0.369
	Panel B': Imports from US - Homogeneous Firms											
	(13)	(13')	(13")	(14)	(14')	(14")	(15)	(15')	(15")	(16)	(16')	(16")
$\Delta\ln(RER^{CPI})$	-0.019	-1.163***	-1.182***	-0.027	-1.330***	-1.357***	-0.013	-1.117***	-1.130***	-0.005	-0.786*	-0.791*
	(0.037)	(0.072)	(0.020)	(0.052)	(0.326)	(0.069)	(0.028)	(0.035)	(0.109)	(0.016)	(0.442)	(0.447)
Observations	217373	217373	217373	118358	118358	118358	53086	53086	53086	45929	45929	45929
R-squared	0.354	0.325	0.403	0.246	0.273	0.256	0.244	0.237	0.233	0.214	0.207	0.203

Notes: Dependent variables are the percentage changes of unit value, quantity, or total value of Chinese firm *f*'s exports of HS 6-digit product *p* to US or Chinese firm *f*'s imports of HS 6-digit product *p* from US over year *t-1* and *t* as indicated. OLS coefficients are reported with robust standard errors adjusted for clustering at the firm level. We also control for weighted exchange rate between RMB and the currencies of other major trading partners, US GDP, Chinese GDP, product fixed effects, firm fixed effects, and industry specific trend in all specifications. ***, **, and * indicate statistical significance at the 1%, 5%, and 10%, respectively.

Table 9: The CNY/USD Rate and Chinese Firm-Level Entry into China-US Export and Import Markets

VARIABLES	All Firms	Ordinary Firms	Mixed Processing Firms	Pure Processing Firms	All Firms
	Panel A: Entry into Export Market				
	(1)	(2)	(3)	(4)	(5)
$\Delta\ln(RER^{CPI})$	0.316***	0.355***	0.179***	0.059*	0.323***
	(0.058)	(0.020)	(0.012)	(0.032)	(0.063)
$\Delta\ln(RER^{CPI})\times$Share of Processing Trade					-0.012***
					(0.003)
Industry Specific Trend	yes	yes	yes	yes	yes
Observations	721801	600312	62580	58909	721801
Pseudo R-squared	0.327	0.392	0.317	0.361	0.390
Chi^2 Statistics			12.16***	14.29***	
	Panel B: Entry into Import Market				
	(1')	(2')	(3')	(4')	(5')
$\Delta\ln(RER^{CPI})$	-0.244***	-0.282***	-0.238***	-0.165*	-0.249***
	(0.079)	(0.014)	(0.020)	(0.097)	(0.018)
$\Delta\ln(RER^{CPI})\times$Share of Processing Trade					0.024***
					(0.007)
Industry Specific Trend	yes	yes	yes	yes	yes
Observations	386042	219164	67619	99259	386042
Pseudo R-squared	0.375	0.416	0.328	0.369	0.335
Chi^2 Statistics			11.31***	12.60***	

Notes: Dependent variable is an indicator of firm *f*'s entry into exporting from China to US during year *t-1* and *t* or entry into importing from US to China during year *t-1* and *t*. Marginal effects of probit regressions are reported with robust standard errors adjusted for clustering at the industry level. We also control for weighted exchange rate between RMB and the currencies of other major trading partners, US GDP, and Chinese GDP in the regressions. ***, **, and * indicate statistical significance at the 1%, 5%, and 10%, respectively. Chi^2 Statistics test the significant difference of elasticities between the specified firm group and the group of ordinary firms.

Table 10: The CNY/USD Rate and Firm-Level Exit from China-US Export and Import Markets

VARIABLES	All Firms	Ordinary Firms	Mixed Processing Firms	Pure Processing Firms	All Firms
	Panel A: Exit from Export Market				
	(1)	(2)	(3)	(4)	(5)
$\Delta\ln(RER^{CPI})$	-0.456***	-0.488***	-0.428***	-0.160	-0.463***
	(0.010)	(0.032)	(0.036)	(0.132)	(0.052)
$\Delta\ln(RER^{CPI})$×Share of Processing Trade					0.051***
					(0.008)
Industry Specific Trend	yes	yes	yes	yes	yes
Observations	657954	544802	61726	51426	657954
R-squared	0.317	0.289	0.452	0.433	0.380
Chi^2 Statistics			20.16***	15.09***	
	Panel B: Exit from Import Market				
	(1')	(2')	(3')	(4')	(5')
$\Delta\ln(RER^{CPI})$	0.297***	0.358***	0.320***	0.121	0.299***
	(0.020)	(0.018)	(0.027)	(0.230)	(0.011)
$\Delta\ln(RER^{CPI})$×Share of Processing Trade					-0.059***
					(0.009)
Industry Specific Trend	yes	yes	yes	yes	yes
Observations	317029	180721	65660	70648	317029
R-squared	0.402	0.418	0.377	0.328	0.456
Chi^2 Statistics			12.27***	16.10***	

Notes: Dependent variable is an indicator of firm *f*'s exit from exporting from China to US during year *t-1* and *t* or exit from importing from US to China during year *t-1* and *t*. Marginal effects of probit regressions are reported with robust standard errors adjusted for clustering at the industry level. We also control for weighted exchange rate between RMB and the currencies of other major trading partners, US GDP, and Chinese GDP in the regressions. ***, **, and * indicate statistical significance at the 1%, 5%, and 10%, respectively. Chi^2 Statistics test the significant difference of elasticities between the specified firm group and the group of ordinary firms.

Table 11: Back-of-the-Envelope Calculation on the Economic Magnitude of 10% RMB Appreciation

		Continuing Firms	Entry Firms	Exit Firms	Total Change
		Panel A: All Firms			
ΔExports	All Firms	-51.53	-3.37	3.04	-57.94
		88.94%	*5.82%*	*-5.24%*	*100.00%*
ΔImports	All Firms	10.34	1.03	-0.51	11.88
		87.02%	*8.66%*	*-4.33%*	*100.00%*
ΔTrade Balance	All Firms	-41.20	-2.34	2.52	-46.06
		89.43%	*5.08%*	*-5.48%*	*100.00%*
		Panel B: Ordinary, Mixed, and Pure Processing Firms			
ΔExports	Ordinary Firms	-43.74	-3.35	2.11	-49.20
		88.90%	*6.80%*	*-4.29%*	*100.00%*
	Mixed Firms	-4.61	-0.27	0.37	-5.26
		87.69%	*5.21%*	*-7.11%*	*100.00%*
	Processing Firms	0.00	-0.02	0.00	-0.02
		0.00%	*100.00%*	*0.00%*	*100.00%*
	All Firms	-48.35	-3.64	2.49	-54.48
		88.75%	*6.69%*	*-4.56%*	*100.00%*
ΔImports	Ordinary Firms	7.13	0.86	-0.55	8.55
		83.41%	*10.11%*	*-6.47%*	*100.00%*
	Mixed Firms	3.76	0.32	-0.11	4.19
		89.64%	*7.74%*	*-2.62%*	*100.00%*
	Processing Firms	0.00	0.05	0.00	0.05
		0.00%	*100.00%*	*0.00%*	*100.00%*
	All Firms	10.89	1.24	-0.66	12.79
		85.13%	*9.68%*	*-5.18%*	*100.00%*
ΔTrade Balance	Ordinary Firms	-36.61	-2.48	1.56	-40.65
		90.06%	*6.11%*	*-3.84%*	*100.00%*
	Mixed Firms	-0.85	0.05	0.26	-1.06
		80.00%	*-4.80%*	*-24.80%*	*100.00%*
	Processing Firms	0.00	0.02	0.00	0.02
		0.00%	*100.00%*	*0.00%*	*100.00%*
	All Firms	-37.46	-2.41	1.82	-41.69
		89.86%	*5.77%*	*-4.37%*	*100.00%*

Notes: Value is in billions of USD. Author's calculation based on the regression results and 2011 Customs data. Refer to Section 5 for more details.