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Imports and RMB Exchange Rate Pass-Through: Marginal Cost versus Quality Change

Yaqi Wang Miaojie Yu

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JEL: F1, F3, F4

Key words: Exchange rate pass-through; Chinese product quality; Importing intermediate inputs

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1 Introduction

The effect of exchange rate movements on the prices of internationally traded goods is one of the most important topics in international macroeconomics. The early literature finds that large movements in exchange rates only have small effects on the prices of internationally traded goods. One of the possible explanations for the incomplete exchange rate pass-through is that exporters adopt pricing-to-market strategies. Investigation on this topic was originally conducted on aggregate data. With the recent availability of disaggregated information, an increasing literature indicates that the

*Yaqi Wang, School of Finance, Central Univerisity of Finance and Economics, Beijing, 100871,China.Tel.: 86-10-131-2042-0600,email: yakisunny@126.com Miaojie Yu, China Center for Economic Research(CCER),National School of Development, Peking University, Beijing,100871,China. Tel:86-10-6275-3109,email:mjyu@nsd.pku.edu.cn.

exchange rate pass-through is incomplete.[1] Amiti *et al.* (2014) analyze firm-product-level data for Belgium and confirm the existence of incomplete exchange rate pass-through.[2] They find that import intensity and market share are the prime determinants of pass-through in a cross-section of firms, with roughly equal importance. Product-level evidence from China shows that exchange rate pass-through is nearly complete. For example, Li *et al.* (2015) find that the average exchange rate pass-through for Chinese exporters is around 95 percent.[3]But they remain silent on explanations for the low sensitivity of Chinese export prices to RMB exchange rate movements.

Different from findings on incomplete exchange rate pass-through, the present article shows that there is nearly complete exchange rate pass-through among Chinese exporters. Consistent with other literature that estimates exchange rate pass-through using Chinese customs transaction-level data, we find that the exchange rate pass-through for average Chinese exporters is nearly complete, that is, about 93 percent. Based on firm-product-level data, we also provide a possible explanation for China's complete exchange rate pass-through, from the interaction of imports, product quality, and export prices. We find that product heterogeneity plays an important role in explaining exchange rate pass-through differences. Our empirical results provide evidence of a "marginal cost channel," which is consistent with the literature. A novel finding of our study is that we find that the marginal cost channel is much weaker for products with higher quality upgrading. This finding helps us understand why we observe weaker impacts of the marginal cost channel for differentiated goods than homogeneous goods. In addition, we find evidence that exchange rate movements can alter product quality via imports of intermediate inputs.

The current article contributes to the literature in at least three important ways. First, it provides an explanation for the nearly complete exchange rate pass-through in China. RMB exchange rate movements and their impact on global trade have been under heated discussion for a long time. It is widely believed that China, as the largest exporter in the world, has been using its currency policy as the main driver for the surge in exports. This debate contributes to the importance of a precise estimate for exchange rate pass-through in Chinese exports. However, the few existing studies using aggregate data present mixed results[4]. Exchange rate movements can generate changes in the extensive and intensive margins of trade[5]. We focus on the intensive margin and

[1]Pricing-to-market theory is one of the early explanations for incomplete exchange rate pass-through. With the availability of transaction-level data, an emerging literature has begun to explain incomplete exchange rate price pass-through using micro factors, including exporters' productivity (Berman *et al.* , 2012) , export product quality (Auer *et al.* , 2018; Chen & Juvenal, 2016) , import intensity (Amiti *et al.* , 2014) , and so forth.

[2]Amiti *et al.* (2014) show the average exchange rate pass-through for their sample is 80 percent, with great heterogeneity across exporters. An exporter with a small market share and no imported inputs has a nearly complete pass-through, while a large exporter at the 95th percentile of the import intensity and market share distributions has a pass-through of just above 50 percent.

[3]Berman *et al.* (2012) also find very high exchange rate pass-through using French firm-level data.

[4]Bussiere *et al.* (2014) report full pass-through for Chinese exports, while Cui & Chang (2009) find it is less than 50 percent.

[5]Rodriguez-Lopez (2011) shows the low levels of exchange rate pass-through to aggregate-level import prices can be generated by changes in the composition of trade flows or the endogenous adjustment of exporters' markups. Using disaggregated Chinese customs trade data, Tang & Zhang (2012a) confirm that exchange movement has a significant impact on the extensive margin of China's trade.

try to identify the magnitudes of exporters' price adjustments for a given product. Therefore, we use highly disaggregated, transaction-level data instead of aggregate data to estimate the exchange rate pass-through. Using the same data set as ours, Li *et al.* (2015) find a nearly complete exchange rate pass-through for Chinese exports. But they do not explain the high exchange rate pass-through in China[6].

Previous literature has veiled the separate roles of import intensity (Amiti *et al.* , 2014) and export product quality (Chen & Juvenal, 2016) in determining exchange rate pass-through. Instead, we find that neither import intensity nor export product quality alone can provide a convincing explanation for the high exchange rate pass-through in China. First, according to the existing literature (e.g., Auer *et al.* (2018); Chen & Juvenal (2016)), exporters adjust their export prices less to exchange rate movements for low-quality products. Based on this explanation, Chinese exporters' product quality should remain low during the sample period to explain China's high exchange rate pass-through. However, widely documented evidence in the literature shows that there is prominent quality upgrading in China's export sector[7]. Based on our sample, we also confirm the role of export quality upgrading. Further, controlling for product quality in our specification, we still find high exchange rate pass-through and significant exchange rate pass-through heterogeneity at the product level.

Second, according to Amiti *et al.* (2014) exporters with higher import intensity tend to adjust their export prices more to exchange rate movement. Founded on this explanation, Chinese exporters' import intensity should remain low during the sample period to explain the high exchange rate pass-through. However, our data show high import intensity for Chinese exporters, especially for the sample period after China's accession to the World Trade Organization (WTO) in 2001. Specifically, in our sample, we find that around 54 percent of exports are accompanied by intermediate imports from the same country in terms of export value. Based on the argument in Amiti *et al.* (2014) , with such high import intensity, China's exchange rate pass-through should be incomplete. This study aims to fill the gap in the explanation for China's high exchange rate pass-through by using a joint explanation from quality upgrading and high import intensity among Chinese exporters.

Quality upgrading and the overlapping patterns between imports and exports are two important stylized facts in many countries, especially developing countries. We confirm the strong existence of these two patterns in our data. This article enriches understanding of export price movements combined with these two prominent patterns. There is also some evidence from developed coun-

[6]Li *et al.* (2015) attempt to use exporters' productivity as an explanation for the high exchange rate pass-through (ERPT) in China. However, they find that, even for an exporter with high productivity, the ERPT is still very high (93 percent). They also explore other potential reasons, including high imported input intensity and large distribution costs, and find a very high ERPT accounting for these factors.

[7]Fan *et al.* (2015) show there is product quality upgrading in Chinese exports due to the large input tariff cut during 2000–06. Wei *et al.* (2017) present evidence for Chinese product quality upgrading during 1995–2014 with Chinese patent data. They also point out that Chinese exporters are more innovative than non-exporters. Based on the methodology of Olley & Pakes (1996), Brandt *et al.* (2012) estimate that Chinese manufactuers' average annual productivity growth rate exceeds 15 percent.

tries[8].Our study also confirms the overlap between exporters and importers. We use China's customs transaction-level data for 2000–11 and find that over 70 percent of export transactions, in terms of export value, involve imports of intermediate inputs from the same trade partner.

Based on the overlapping patterns of firms' export and import activities, a recent and growing literature studies the impacts of import behavior on export performance. Based on China's customs data for 2002–06, Feng *et al.* (2016) find that intermediate input imports can contribute to the improvement of export performance. Exporters with higher intermediate input imports increase their export value and scope more than other exporters. Amiti *et al.* (2014) study the impact of import behavior on export price. They find that exchange rate pass-through to import prices is lower for exporters with higher import intensity. This corresponds to the marginal cost channel in our study. A novel finding in our research is that we also observe a "quality change channel," which we believe is a key explanation for the nearly complete exchange rate pass-through observed in our sample.

Although there are some studies on the role of quality upgrading in export prices, the interaction between quality upgrading and exchange rate pass-through has rarely been explored. Based on the quality measure in Khandelwal *et al.* (2013), Fan *et al.* (2015) find that a reduction in the input tariff induces exporters to increase the quality of their exports and raise export prices in industries where the scope for quality differentiation is large[9]. Bernini & Tomasi (2015) find that the marginal cost channel has a weaker negative impact on the exchange rate pass-through to prices of higher-quality export varieties. Our work is closely related to Bernini & Tomasi (2015), in that we also study the variation in the impact of the marginal cost channel across heterogeneous products. While they focus on the role of product quality, we emphasize the role of quality change of exported varieties. Our approach enables us to estimate directly the importance of the marginal cost channel for variation in exchange rate pass-through arising from the use of imported intermediate inputs.

We find that a reduction in the cost of intermediate imports caused by external exchange rate shocks would contribute to export product upgrading and an increase in export prices, which we call the quality change channel. And due to the existence of this quality change channel, the marginal cost channel is much weakener for products with plenty of quality upgrading space. We are inspired by the evidence in the literature showing that imports of intermediate inputs contribute to manufacturers' performance (Kugler & Verhoogen, 2009; Halpern *et al.* , 2015; Chen *et al.* , 2017)[10]. Some other research focuses on the impacts of input trade liberalization on firm performance (Amiti & Konings, 2007; Topalova & Khandelwal, 2011; Yu, 2015; Fan *et al.* , 2015). Based on China's customs data, using the same data set as ours, Fan *et al.* (2015) find that input tariff reductions

[8]Bernard *et al.* (2007) show there is a close link between exports and imports in the U.S. trade sector. They find that 26 percent of exporters also engage in import activities. Based on firm-level data for Belgium, Amiti *et al.* (2014) find that around 78 percent of exporters are also importing.

[9]The positive correlation between export quality and export price for Chinese exports is also found by Ge *et al.* (2015). They find that foreign firms charge higher export prices with higher capability of producing higher-quality goods.

[10]For example, based on customs data for Argentina, Gopinath & Neiman (2014) find that the increase in intermediate import costs caused by a large devaluation of the Argentine peso was the major explanation for the large decrease in productivity in Argentina's manufacturing sector.

lead exporters to raise their export product quality and export prices. Our findings here are quite similar. Appreciation of the RMB causes exporters to upgrade their export products due to cheaper intermediate input imports and higher export prices. Different from Fan *et al.* (2015), we focus on exchange rate movement, not tariff cuts. And since we observe a lot of overlap between export and import activities, exchange rate movement is more relevant in our case.

Third, the article enriches the understanding of the impacts of RMB exchange rate movements on Chinese exports. Since 2005, the RMB exchange rate system has been improving, and the RMB exchange rate has been appreciating. The cumulative appreciation of the RMB's bilateral nominal exchange rate against the U.S. dollar reached 22 percent by the end of 2011[11]. According to the traditional international balance of payments view, as long as the exchange rate pass-through to import prices is complete and fast, then an appreciation of the domestic currency will induce a reduction in exports and an increase in imports (Goldberg & Knetter, 1997). Due to the differences in export quality upgrading spaces, we find significant heterogeneity in exchange rate pass-through. We also find different export quantity responses to exchange rate movements. When facing RMB appreciation, firms with products with higher quality upgrading decrease export quantity less.

We show that the combination of Chinese exporters' high import intensity and significant quality upgrading during the sample period contributes to the observed complete exchange rate pass-through. With exchange rate movement, importing intermediate inputs can influence Chinese export prices from two opposite directions, as shown in Figure 1.

[Insert Figure 1 Here]

On the one hand, exchange rate movement alters the cost of production for exporters with intermediate input imports from the same trade partner. We call this the marginal cost channel. For instance, when the RMB appreciates, exporters' cost of intermediate input imports decreases, causing downward pressure on export prices, which reduces the exchange rate pass-through to import prices. This channel was first introduced in Amiti *et al.* (2014), and it is verified in our research. On the other hand, with a lower cost of importing intermediate inputs, exporters now have more access to more intermediate inputs of better quality. Exporters can produce higher-quality products with a more favorable intermediate input supply, which will push up export prices. We call this the quality change channel. Thus, we expect weakened impacts of the marginal cost channel for products with significant quality upgrading. With the observation of prominent export product quality upgrading in our sample, we derive a possible explanation for the insensitivity of Chinese export prices to RMB exchange rate movements.

We start our empirical analysis by documenting some stylized facts related to the overlapping patterns of exports and imports and significant quality upgrading in Chinese exports. We also show that importing exporters have better export performance than non-importing exporters, with larger scale of exports and wider export scope. These stylized facts lend support to the quality change channel. Our main empirical specification relates exchange rate pass-through to imports, capturing

[11]The RMB exchange rate fluctuated bilaterally in mid-2012 and early 2014.

the marginal cost channel and the quality change channel. The results provide strong support for the existence of the two channels. We find that the average exchange rate pass-through for importing exporters is significantly lower than for non-importing exporters, confirming the existence of the marginal cost channel. Further, we show that the marginal cost channel is weaker for products with higher product quality upgrading, confirming the existence of the quality change channel. Quantitatively, these results are large. For an exporter with a high propensity to import intermediate inputs, the exchange rate pass-through is 83 percent (96 percent) at the 5th (95th) percentile of the distribution of quality change. These results have important implications for understanding the aggregate pass-through, since large exporters with high pass-through account for a large share of exports. Finally, as RMB appreciation is a major concern for causing competitive pressure on Chinese exports, we provide analysis on the impacts of RMB exchange rate movements on Chinese export quantity and value. In brief, we find that export quantity and value decrease by greater magnitudes for products with low quality upgrading than products with high quality upgrading.

The remaining parts of the article are organized as follows. Section 2 introduces the data sources and summary. Section 3 presents our empirical specification and baseline results. Section 4 describes a series of robustness checks, and section 5 provides further discussion. Section 6 concludes.

2 Data and Stylized Facts

This section describes the data sets that we use for our empirical analysis and stylized facts on exporters and importers.

2.1 Data Description and Variables Construction

Our main data source is China's General Administration of Customs. The trade data are compiled at the Harmonized System (HS) 8-digit product level and include information on each product's quantity, value (in U.S. dollars), type of trade (i.e., processing or non-processing), and export destinations (or import sources). Our sample period spans from 2000 to 2011. The raw data on transactions are recorded at monthly frequency before 2007 and yearly frequency since 2007. We collapse the data set at the yearly frequency level for the analysis. We use the concordance table from the United Nations (UN) Statistics Division to unify the commodity classification system[12]. Specifically, we use the HS 2002 classification code for defining products. We define products at the HS 6-digit level.

The main macro-level data, including the exchange rate and consumer price index, come from the International Financial Statistics. Other macro variables, such as real gross domestic product (GDP) and real GDP per capita, come from the Penn World Table 8.0. The bilateral real exchange

[12]The commodity classification system changes every five years. Before 2002, China's Customs used HS 1996 to define products. From 2002 to 2006, it used HS 2002, and from 2007 to 2011, HS 2007 to define products. The concordance table we use in this paper is from the UN Statistics Division: https://unstats.un.org/unsd/cr/registry/regdnld.asp?Lg=1.

rate is constructed as follows:

$$rer_{ct} = \frac{NR_{ct} * P_{ct}}{P_{CH,t}} \tag{1}$$

NR_{ct} is the bilateral nominal exchange rate of the RMB over country c's currency, in direct quote. P_{ct} is export destination c's consumer price index, and $P_{CH,t}$ is China's consumer price index. The exchange rate here is an index with base period as 2000 ($rer_{c,2000} = 1$). An increase in rer_{ct} denotes a real depreciation of the RMB against country c's currency.

Table 1 reports a simple statistical summary of Chinese product-level trade data by year. A salient pattern in the data set is that most exporters also import intermediate inputs from the same export destination. Overall, when focusing on the highly disaggregated HS 6-digit level, approximately 20 percent of the 64,752,272 transaction-level observations are importing intermediate inputs from the same export destination, and 80 percent refers to export transactions without importing intermediate inputs from the same export destination. We also notice that the number of exporters expanded quickly during the sample period. The export transactions that took place during 2006–11 in total account for 71 percent of the total observations.

[Insert Table 1 Here]

Table 2 reveals the high correlation between exports and imports. We report the percentage of export transactions involved in intermediate input imports from the same export destination in terms of frequency and transaction value. The left panel in Table 2 shows that around 20 percent of export transactions involve intermediate imports from the same export destination in terms of frequency. Around 54 percent of export transactions involve intermediate imports from the same export destination in terms of value. In the right panel in Table 2, we redefine export transactions involving intermediate input imports from the same export destination.

The movement of the exchange rate in an import source country can still have an effect on the export price, as long as it exhibits strong co-movement with exchange rate movements in export destinations. However, it is difficult to measure the exact exchange rate co-movement between two currencies. To take care of this issue, we divide all the sample countries into three subgroups depending on their currency area: euro zone, pegging-dollar zone, and the rest of the world. When exporters in the euro zone or pegging-dollar zone import intermediate inputs from the same currency area, we classify this export transaction as involving imports of intermediate inputs from the same currency area. Based on this redefinition, around 35 percent of the export transactions involve an intermediate input import transaction from the same currency area in terms of frequency. Over 70 percent of the export transactions involve intermediate input import transactions from the same currency area in terms of value.

[Insert Table 2 Here]

From Table 2, we find that a substantial share of the export transactions involves intermediate inputs from the same currency area, and the transaction amounts are relatively high. In Table 3,

we highlight a new stylized fact, that is, the large differences within exporters between importing exporters and non-importing exporters. The table shows that these two groups of exporting firms differ in fundamental ways. The upper panel in the table reports various firm-level characteristics, including total export value, number of export destinations, and export scope, for importing exporters and non-importing exporters. We see that importing exporters export on a larger scale and to more export destinations with wider export scope.

[Insert Table 3 Here]

The lower panel in Table 3 examines changes in (log) export prices by the incumbent exporting/importing firms in 2000 and 2011. The firms are divided into two groups, namely, importing exporters and non-importing exporters, according to whether the exporters import intermediate inputs from the same export destination. We compute the median (log) export price per product per firm in 2000 and 2011 as well as the percentage change in parentheses. Table 3 shows that, on average, within each group of firms (i.e., importing or non-importing exporters), the price levels in 2011 are always higher than the price levels in 2000. This suggests that from 2000 to 2011, exporters all raised unit value export prices. In the same year, the price levels of importing exporters are always higher than those of non-importing exporters. Further, we divide the products into homogeneous and heterogeneous products, according to Rauch (1999). Again, we find an increase in export prices among all exporters and the increase is higher for importing exporters.

A novel observation is that the price increase in heterogeneous products is lower than in homogeneous products. This finding is consistent with our findings on the price index at the aggregate level. In Figure 2, we plot trends in the RMB real exchange rate and price indexes for homogeneous and heterogeneous products. We construct the price index for both types of products using the Tornqvist index (Feenstra & Weinstein, 2017), as follows:

$$Tindex_{ct} = \prod_{c,t} \left(\frac{uv_{c,k,t}}{uv_{c,k,t-1}}\right)^{w_{k,t}} \tag{2}$$

$w_{k,t}$ denotes the import share of product k in country c's total imports.$w_{k,t}$ is a simple average value of the import share at times t and t-1[13]. $uv_{c,k,t}$ denotes the unit export price of China's product k to its trade partner c. The data we use in Figure 2 are from the BACI database and International Financial Statistics.[14]. We set the base period for all three indexes at 2000 (all indexes = 1 in 2000).

[Insert Figure 2 Here]

In Figure 2, we observe that the RMB has experienced a continuous and quick appreciation since 2006. The RMB real effective exchange rate index, weighted by export share, climbed from 1.03 in 2005 to 0.58 in 2011, an appreciation of 44 percent. We also notice that the export price

[13]Here we use the simple average share at times t and t–1, to smooth the effects of outliers.

[14]The BACI database is provided by CEPII, covering all bilateral trade data for more than 200 countries since 1995. The classification code using in this database is HS 2002. Products are defined at the HS 6-digit level.

indexes of homogeneous products and heterogeneous products exhibit significant differences. The homogeneous price index exhibits faster and larger scale price increases than the heterogeneous goods index. This finding is consistent with Gopinath *et al.* (2012), who find that the price index of heterogeneous products was more stable than that of homogeneous products during the trade crisis in 2008–09.

[Insert Figure 3 Here]

In Figure 3, we plot the trends of the bilateral real exchange rate indexes for China's five major trade partners, the United States, Japan, South Korea, Germany, and the United Kingdom[15]. Overall, the RMB real exchange rate indexes have continued to appreciate since 2006 for all five countries, with significant variation in magnitudes. The RMB real exchange rate appreciated substantially more against the Deutsche mark, UK pound, and South Korean won than against the U.S. dollar and Japanese yen.

3 Empirical Analysis

This section presents our main empirical results. We start by introducing and estimating our main empirical specification. We then provide empirical evidence and explore the forces behind the empirical results. Specifically, we first investigate whether import intensity is a determinant of Chinese exporters' exchange rate pass-through, that is, the marginal cost channel, by replicating the analysis in Amiti *et al.* (2014). Second, we discuss the quality change channel and its weakening effect on the marginal cost channel.

3.1 Empirical Specification

Before introducing the role of export quality into our discussion, we first determine the average exchange rate pass-through across Chinese exporters and whether the "marginal cost channel" discovered by Amiti *et al.* (2014) is as important for Chinese exporters as it is for Belgian exporters. We estimate the following specification:

$$\begin{aligned} \Delta \ln Exportprice_{fpct} &= \alpha + \beta_1 * \Delta \ln RER_{ct} + \beta_2 * (IM_{fct} * \Delta \ln RER_{ct}) \\ &\quad + \beta_3 * IM_{fct} + \gamma * Z_{ct} + v_{fpc} + \lambda_t + \varepsilon_{fpct} \end{aligned} \tag{3}$$

where f denotes exporter, p denotes product defined at the HS 6-digit level, c denotes export destination, and t denotes time.$\Delta \ln Exportprice_{fpct}$ denotes the first difference value of export

[15]In our data, excluding exports to Hong Kong, Macao, and Taiwan, five countries are China's top trade partners: the United States (ranking first for exports, third for imports), Japan (second for exports, first for imports), South Korea (third for exports, second for imports), Germany (fourth for exports, fourth for imports), and the United Kingdom (sixth for exports, 22nd for imports).

price.[16] $\Delta \ln RER_{ct}$ denotes the bilateral real exchange rate between China and export destination c. IM_{fct} denotes the import status of exporter f sourcing intermediate inputs from export destination c. If exporter f imports intermediate inputs from export destination c, $IM_{fct} = 1$. Otherwise, $IM_{fct} = 0$.Z_{ct} is a series of country characteristics variables. We have controlled the real GDP and real GDP per capita of the export destinations in the specification. v_{fpc} is firm-product-destination fixed effect. We control this fixed effect to exclude the effects of time-unvarying factors' on firm pricing behavior, including country distance, culture, and consumer preferences. λ_t is time fixed effect, which denotes common shocks to all firm-country-product pairs, including the domestic country's price level and economic trend. ε_{fpct} is the error term.

3.2 Main Empirical Findings

Table 4 reports the results from the regression model above. Columns 1 and 2 report that at the annual horizon, the average exchange rate pass-through elasticity to export prices in our sample is 0.07, or, equivalently, 0.93 to import prices. We refer to this as 93 percent pass-through. In column 2, we control country-product fixed effects and year fixed effects in the regression. The estimated exchange rate pass-through elasticity is quite similar to the estimation in column 1. We find that the exchange rate pass-through estimated for the Chinese sample is significantly higher than estimates for other countries. For instance, based on the sample of Belgian firms, Amiti *et al.* (2014) estimate an exchange rate pass-through of around 80 percent. Berman *et al.* (2012) estimate an exchange rate pass-through of 87 percent using a sample of French firms.

Next, we explore whether there exists a difference in exchange rate pass-through for importing exporters and non-importing exporters, in columns 3 to 6. In columns 3 and 4, we estimate the exchange rate pass-through for importing exporters and non-importing exporters. The exchange rate pass-through for importing exporters is significantly lower than that for non-importing exporters. On average, the estimated exchange rate pass-through for importing exporters is 90 percent, and that for non-importing exporters is 95 percent. In columns 5 and 6, we include an interaction between exchange rates and a firm's import status. In column 5, the estimated coefficient on the interaction term between exchange rates and a firm's import dummy is quite consistent with the estimated results in columns 3 and 4. In column 6, we use an interaction term between exchange rates and import value instead in the regression. Interpreting our results quantitatively, we find that a firm with import value at the 5th percentile of the distribution has a pass-through of 95 percent (=1-0.054); for a firm with import value at the 95th percentile of the distribution, the pass-through is 86 percent (=1-0.054-0.005*16.7).[17] Amiti *et al.* (2014) conduct a similar analysis. Their numerical results show that the exchange rate pass-through decreases from 87 to 64 percent when import intensity increases by the same percentage.

[16] The unit price is calculated as export value divided by export quantity for each transaction. There were a few inconsistencies in the units of transactions for each firm-product-country pair. We deleted those observations to exclude their impacts on the measure of unit price.

[17] We also used a lagged term for import value in the regression and obtained very similar results. To save space, we do not report the results here.

[Insert Table 4 Here]

Comparing the results in Amiti *et al.* (2014), we find the impacts of import status variation in exchange rate pass-through, that is the "marginal cost channel", is much weaker in our sample. We propose that the quality change has a weakening impact on the "marginal cost channel". If a product has a large space for quality improvement, then the "marginal cost channel" will be much weaker for this product. We separately estimate the above specification for homogeneous products and heterogeneous products. The quality change space for heterogeneous products is larger than homogeneous goods (Fan *et al.* , 2015). The product differentiation degree is constructed according to Rauch (1999).

We report and compare the exchange rate pass-through for products with different levels of differentiation. We use Rauch (1999) classification to create two subgroups of products, homogeneous products (Diff=0) and heterogeneous products (Diff=1). According to the estimation results in column 2 in Table 5, we find that there is a significant difference between the impacts of the marginal cost channel in the two subgroups. For homogeneous products, the exchange rate pass-through for importing exporters is 24 percentage points lower than that for non-importing exporters. For heterogeneous products, the exchange rate pass-through for importing exporters is only 5.6 percentage points lower than that for non-importing exporters. We also report the estimation results in column 1 in Table 5, with the import measure replaced by import value. Quantitatively, when import value increases from the 5th to the 95th percentile of the distribution, the exchange rate pass-through for homogeneous products decreases from 96 percent (=1-0.044) to 71 percent (1-0.015*16.7-0.044); the exchange rate pass-through for heterogeneous products decreases from 96 to 87 percent (1-0.005*16.7-0.044). In columns 3 to 6, following Kugler & Verhoogen (2012), we replace the product quality differentiation measure by research and development (R&D) intensity and the Gollop-Monahan (GM) index.[18] According to Kugler & Verhoogen (2012), a higher R&D intensity and GM index denotes higher product quality differentiation. Based on these two alternative measures of product quality differentiation, we find consistent evidence for columns 3 to 6 in columns 1 and 2: facing exchange rate shock, the price movement of heterogeneous products is milder in homogeneous products. This finding is consistent with the evidence documented in Gopinath et al. (2012).

[Insert Table 5 Here]

[18]R&D intensity is defined as (r&d expenditure + advertisement cost)/sales. The GM index is constructed as: $GM_k = \sum_{j,k,t} w_{j,t}(\sum_i \frac{|s_{i,j,k,t} - s_{i,\bar{k},t}|}{2})^{1/2}$,where i,j,k and t denotes intermediate input, firm, industry and year,respectively. $s_{i,j,k,t}$ denotes the cost share of firm j for intermediate input i. $s_{i,\bar{k},t}$ denotes the average share of firm j of intermediate input i. $w_{j,t}$ is firm j's market share in industry k. This measure is contructed according to Bernard *et al.* (2007). The raw data are at the ISIC second version's 4-digit level. We use the concordance table from UN COMTRADE to match the data to the HS 2002 6-digit level.

3.3 Quality Change Channel

Based on the previous discussion, we propose that the weakening impact of the quality change channel on the marginal cost channel leads to the difference in the exchange rate pass-through of products with different quality differentiation.[19] To test the existence of the quality change channel, we introduce an interaction term of the real exchange rate, import change, and quality change in the baseline regression. We use the following specification:

$$\begin{aligned}\Delta \ln Exportprice_{fpct} &= \alpha + \beta_1 * \Delta \ln RER_{ct} + \beta_2 * (IM_{fct} * \Delta \ln RER_{ct}) + \beta_3 * (\widetilde{Q}_{fpc} * \Delta \ln RER_{ct}) \\ &+ \beta_4 * (\widetilde{Q}_{fpc} * \Delta \ln RER_{ct}) + \beta_5 * (IM_{fct} * \Delta \ln RER_{ct} * \widetilde{Q}_{fpc}) + \beta_6 * IM_{fct} \\ &+ \gamma * Z_{ct} + v_{fpc} + \lambda_t + \varepsilon_{fpct} \end{aligned} \tag{4}$$

The quality change is constructed as follows:

$$\widetilde{Q}_{fpc} = \frac{1}{(T_{fpc} - 1)} \sum_{t=1}^{T_{fpc}} \Delta \ln Q_{fpct} \tag{5}$$

where Q_{fpct} is firm f's export product p to destination c. T_{fpc} is the duration of exporter f's product p in destination c. We construct the Q_{fpct} according to the literature (Khandelwal *et al.* (2013); Fan *et al.* (2015)).[20] The economic intuition behind this measure is to use the unit price and export quantity to infer product quality. Conditional on the product price, if a product's export volume is higher than that of another product within the same product category, it is considered to be of higher quality. The estimation is conducted as follows:

$$\ln x_{fpct} = \sigma * \ln(p_{fpct}) + \varphi_p + \varphi_{ct} + \varepsilon_{fpct} \tag{6}$$

where x_{fpct} and p_{fpct} are product quantity and price, respectively. φ_p and φ_{ct} denote the product and country-time fixed effects, respectively.σ is elasticity of substitution across different products. We use the mean and median value estimates of σ from Broda & Weinstein (2006). We conduct ordinary least squares regression based on the specification above and take the residual term, $\widetilde{\varepsilon}_{fpct}$.$\widetilde{\varepsilon}_{fpct}$ is a measure of product quality.

[Insert Table 6 Here]

Table 6 presents a summary of the quality and import trends for our sample. We use $\Delta \ln Q_{fpct}$

[19] Bernini & Tomasi (2015) try a similar specification using export product quality instead of export product quality upgrading in the triple interaction. Based on the previous argument and the Chinese reality, we believe it is rapid quality upgrading instead of high export product quality during the sample period that explains the high exchange rate pass-through for Chinese exports. In addition, we included the quality and all its interactions in the regression for a robustness check, and found that our baseline results remain robust.

[20] These papers assume a CES utility function incoporating product quality. Under this assumption, the individual demand function can be written as: $x_{fpct} = q_{fpct}^{\sigma-1} p_{fpct}^{-\sigma} P_{ct}^{\sigma-1} Y_{ct}$.where x_{fpct}, q_{fpct} ,p_{fpct} are export quantity, quality, price, respectively. P_{ct} and Y_{ct} are country c's price level and income level.

and $\Delta \ln IM_{ft}$ to capture the changes in quality and intermediate import value change, respectively. As shown in the table, the quality and imports of intermediate inputs grow rapidly in the sample, with annual growth rates of 2.1 and 5.67 percent, respectively. Export product quality increased rapidly during 2000–07, with an annual growth rate of 12 percent. With the outbreak of the global financial crisis in 2008, export product quality began to deteriorate. A possible explanation is the large decline in production capacity of the intermediate input imports providers. We find similar evidence from the data on imports of intermediate inputs by Chinese exporters. During 2008–09, there was a plummet in intermediate input imports by Chinese exporters, with an accumulated percentage decline of over 20 percent. To exclude the impacts of the global financial crisis, we recalculated the annual growth rates of export product quality and intermediate input imports with a sample without observations during the global financial crisis. We find the annual growth rates (annual growth rate of 2 percent) of the reduced sample are significantly higher than those of the whole sample for export product quality and intermediate input imports. The recalculated annual growth rates of export product quality and intermediate input imports are 7.8 and 9.9 percent, respectively.

[Insert Table 7 Here]

We also provide information on annual growth rates for the subsamples in Table 7. The upper panel in the table provides separate estimates of annual growth rates for large and small exporters. Large exporters are those with total export value greater than the 75th percentile of the distribution. Small exporters are those with total export value less than the 25th percentile of the distribution. The total exports of these two groups (large and small) compose 75 and 2 percent of total exports, respectively. Based on the information provided in Table 7, it is clear that larger exporters are associated with significantly higher total intermediate input imports.

The lower panel in Table 7 reports separate estimates of annual growth rates for subsamples with developed country and developing country export destinations. We classify countries as developed if real GDP per capita is greater than $10,000 (in 2011 US$), and as developing if real GDP per capita is less than $4,000.[21] According to this classification, nearly 90 percent of China's exports go to developed countries. And products exported to developed countries have much higher annual growth rates than products exported to developing countries. This is consistent with the findings in Hallak & Schott (2011) and Feenstra & Romalis (2014). Both of them confirm that there exists a positive relationship between import quality and importing country's income level. In addition, we find that firms with developed countries export destinations import intermediate inputs much more than firms with developing country export destinations.

We face an identification challenge in specification (4). The import indicator, IM_{fct}, is an endogeneous variable. The literature finds that an exporter's import decision is endogeneous and might be influenced by its export behavior. For instance, Bastos *et al.* (2018) finds that exporters charge

[21] We also tried specifications taking the 50th and 75th percentiles as the threshold to classify countries as developed. We obtained estimates for annual growth rates with similar patterns as the estimates provided in Table 7.

higher export prices toward destinations with higher income levels, which are more inclined to pay higher prices for intermediate inputs. Kugler & Verhoogen (2009) find that importers are prone to pay higher prices for imported intermediate inputs than domestic intermediate inputs. Based on this evidence, it is natural to assume that Chinese exporters with higher export product quality, thus charging higher export prices for their products, are more likely to import intermediate inputs. If so, an exporter's import behavior is endogenous. That is, the random coefficients $\beta_2, \beta_4, \beta_5$, and β_6 are correlated with the endogenous intermediate input import behavior. So, it is a correlated random coefficients model (Wooldridge, 2008).

Following Heckman & Vytlacil (1998), we replace the endogenous variable import indicator with its predicted value.[22]. In the next section, we will estimate the import indicator with a Heckman procedure using some exogenous variables $Z_{fct.}$ We adopt the following specification:

$$IM_{fct}{=}E(IM_{fct}|Z_{fct}) + \epsilon_{fct} \tag{7}$$

where $E(\varepsilon_{fct}|Z_{fct}) = 0.Z_{fct}$ is a series of exogeneous variables in the Heckman selection equation. Specifically, Z_{fct} includes the firm-level input tariff, real GDP per capita, and real GDP in the importing country. We construct the firm-level input tariff as: $FIT_{fct} = \sum_{p=1}^{N} w_{fpc} * \tau_{pt.}\tau_{pt}$is China's import tariff rate for product p, which is at the HS 6-digit level. The tariff rate data are from WTO.[23] w_{fpc} is product p's import share in firm f's total imports from country c. However, we cannot use the current import share to construct the firm-level input tariff rates due to the endogeneity of the import share. A firm will lower its import share of the product with an increase in import tariff rates. If we use the current import share, , to construct the import tariff, we may underestimate the actual import tariff facing importers. Following Topalova & Khandelwal (2011) and Yu (2015), we attempt to use time-unvarying weights for constructing the input tariff rates. We use the initial value of the import share to construct the input tariffs. To alleviate endogeneity, we use a one-period lagged term for the tariff rates for the regression.

The bivariate sample Heckman selection estimation requires an excluded variable that affects the firm's import decision but does not appear in the extent of imports. We include importer's importing age and exporting cost in the selection equation as the excluded variables. Importer's importing age $(tenure_{fct})$ is defined as the current year minus the importer's initial year of importing for a given sourcing country. We use as a measure of the importer's experience. Previous literature points out that export probability is higher for more experienced firms (Amiti & Davis, 2012). Exporting cost $(Cost_{ct})$ is measured as the average customs-clearing cost faced by exporters in country c.[24] Exporting cost is classified as a fixed cost; thus, we believe it only affects the decision whether to import or not, but does not affect the value of imports.

[22]Feenstra & Romalis (2014) and Yu (2015) also apply this method in their related research.

[23]China's import tariff data are from WTO webpage http://tariffdata.wto.org/ReportersAndProducts.aspx.

[24]Average customs clearing costs for exporters are from the World Bank's Investment Climate Report, http://data.worldbank.org/indicator/IC.EXP.CSDC.CD?.

[Insert Table 8 Here]

We present the estimation results for the Heckman selection equation in Table 8. In columns 2 and 4, we find that importers are less likely to import intermediate inputs with a higher firm-level input tariff. In addition, we find that export cost would dampen the firm's intention to import intermediate inputs. Further, export cost and importer's age have weak explanatory power for importer's import value. When we include export cost and importer's age in the second-step Heckman estimate, we find that the joint contribution of the two variables in explaining import value variation is less than 1 percent. Hence, we validate the appropriateness of our choice of excluded variables.

By substituting the predicted import indicator from the Heckman selection equation into equation (4), we obtain:

$$\begin{aligned}\Delta \ln Exportprice_{fpct} &= \alpha + \beta_1 * \Delta \ln RER_{ct} + \beta_2 * E(IM_{fct}|Z_{fct}) * \Delta \ln RER_{ct} + \beta_3(\widetilde{Q}_{fpc} * \Delta \ln RER_{ct}) \\ &+ \beta_4 * E(IM_{fct}|Z_{fct}) * \Delta \ln RER_{ct} + \beta_5 * E(IM_{fct}|Z_{fct}) * \Delta \ln RER_{ct} * \widetilde{Q}_{fpc} \\ &+ \beta_6 * E(IM_{fct}|Z_{fct}) + \gamma Z_{ct} + \upsilon_{fpc} + \lambda_t + \delta_{fpct} \qquad (8)\end{aligned}$$

where $\delta_{fpct} = (\beta_2 * \Delta \ln RER_{ct} + \beta_5 * \Delta \ln RER_{ct} * \widetilde{Q}_{fpc} + \beta_6) * \epsilon_{fct} + \varepsilon_{fpct}$. All the terms in this error term have zero expected value conditional on Z_{fct}, so that δ_{fpct} is conditionally uncorrelated with these exogeneous variables and they can be used for estimation.

Based on the discussion of the quality change channel, we should expect the coefficient term on the triple interaction term, β_5, , to be negative: for products with greater quality differentiation, such as differentiated goods, the marginal cost channel of intermediate input imports should be weaker. Table 9 reports the estimation results based on specification (8). We find the estimation results are highly consistent with our conjecture. Quantitatively, we find that for exporters with low import intensity (at the 5th percentile of the import distribution) and low quality upgrading (at the 5th percentile of the quality change distribution), the exchange rate pass-through is 99 percent (=1-0.024-0.133*0.17*2.1+0.044*2.1-0.182*0.17). This value is close to complete exchange rate pass-through. For the import propensity for exporters hypothetically increased to the 95th percentile of the import distribution, we find the exchange rate pass-through decreases by 16 percent (=0.133*2.1*0.34+0.182*0.34), to 83 percent. Remaining at this import propensity, when the quality upgrading hypothetically increases to the 95th percentile of the quality change distribution, we find the average exchange rate pass-through increases by 10 percent (=0.133*4.2*0.51-0.044*4.2), to 93 percent.

[Insert Table 9 Here]

We also experimented with input tariff rates constructed with the mean value of trade weights for predicting importing behavior. We report the estimation results with import value replaced by prediction value based on alternative tariff measures. The estimation results, reported in Table 10, are quite similar to the results in Table 9.

[Insert Table 10 Here]

3.4 Robustness Checks

This section uses different specifications and indicators to test the robustness of our baseline results. By and large, the estimation results in the robustness checks support our previous conclusions.

3.4.1 Subsamples and Alternative Measures

We try different subsamples and alternative measures for the robustness checks. We summarize our results in Table 11. In columns 1 to 4, we use different subsamples. In the baseline, the sample includes many multi-product firms. When faced with "tougher" destination markets caused by foreign currency appreciation, a multi-product firm will have a tendency to reduce the product scope exported to this market and concentrate more on its core products (Bernard *et al.* , 2011; Mayer *et al.* , 2014). Those effects could interfere with the identification of our prediction. To exclude the impact of the product mix on heterogeneous exchange rate pass-through, we only keep single-product exporters in column 1. In addition, based on similar arguments, we only keep the observations for core product exports in column 2. A core product is defined as the firm's export product with the highest export value. In columns 1 and 2, we find that our baseline results still hold.

Considering the difference in pricing behavior between trade intermediaries and exporters, in column 3, we delete all samples of trade intermediaries and use the reduced sample for the regression.[25] We note that the role of quality change in affecting exchange rate pass-through is stronger for the sample excluding trade intermediaries.

In column 4, we delete all observations during the period of the global financial crisis (2008–09), to exclude its abnormal impact. The literature indicates that a large decrease in trade finance during the global financial crisis caused a plummet in global intermediate input trade and export quality downgrading. Meanwhile, the RMB exchange rate appreciation can also be seen as an outcome of the global financial crisis. The results in column 4 support our previous analysis. The impact of exchange rate movement on export price is strengthened for this reduced sample.

We conduct two different kinds of robustness checks in columns 5 to 8. First, we control for marginal cost in the baseline regression in column 5. We construct the measure for marginal cost according to Amiti *et al.* (2014).[26] Exchange rate movement would cause opposite impacts on export prices through intermediate input imports via the marginal cost channel and the quality change

[25]We follow the criteria in Tang & Zhang (2012b) for identifying the trade intermediaries. Specifically, we search for the key words "waimao","maoyi","waijing","jinchukou","jingmao","gongmao","
kemao" and etc among Chinese firm names. Once the firm name includes such key words, we identify this firm as trade intermediary.

[26]Marginal cost is constructed as: $\Delta mc^*_{ft} = \sum_{c\in C_{ft}} \sum_{p\in M_{ft}} w_{fpct} \Delta \log U_{fpct}$,where U_{fpct} is the unit price for firm f's intermediate input imports p from country c (denominated in RMB). w_{fpct} is the mean share of intermediate inputs in total cost between t and t-1. C_{ft} and M_{ft} denote the set of importing countries and intermediate inputs for firm f.

channel. So, when we control the marginal cost channel, the quality change channel will have a greater impact over export prices. We present the estimation results in column 5, and they confirm our analysis.

Second, we use alternative measures for intermediate input imports and quality change for the regressions in columns 6 to 8. In column 6, we use the share of intermediate input imports in total intermediate inputs for measuring import propensity. Since we need to use the Annual Survey of Industrial Firms (ASIF) for data on the total intermediate input cost, we merged the ASIF data with the customs data. We follow Yu (2015) criteria for merging two data sets. The number of observations in the merged sample is greatly reduced. We still find our baseline results hold for this reduced sample, with a decreased level of significance. We replace the quality change measures in columns 7 to 9. In column 7, we use the range of quality for exporters' export products to a given destination during the sample period to measure change in quality. In column 8, we use the percentage change in exporters' product quality compared with the previous period for measuring the quality change. In column 9, we use the moving average value (for four lagged terms)[27] of the percentage change in exporters' product quality compared with the previous period for measuring change in quality. We find our baseline results hold for these three measures.

[Insert Table 11 Here]

3.4.2 Currency Area

This subsection considers the impacts of the existence of a currency area on the interpretation of our baseline results. As discussed in the previous part, when there is a strong correlation in exchange rate movements between importing countries and exporting countries, the exchange rate movement in exporting countries would still have impacts on the importing behavior of firms from a different country. Thus, we redefine the export transactions with intermediate import inputs as export transactions involving intermediate inputs sourcing from the same currency area. We report the estimation results in Table 12 based on the redefinition and find that our previous results still hold for the redefined specification.

[Insert Table 12 Here]

3.4.3 Alternative Explanations

This subsection considers two explanations, alternative to our mechanism, which can explain the heterogeneous response to exchange rate movements.

(i) Market competition. According to the model of Berman *et al.* (2012), the exchange rate pass-through depends on the elasticity of substitution between goods, which is closely related to the degree of competition in the sector. One of the focuses in our analysis is on estimating the effect of

[27] We also tried using moving average terms for two and three lagged terms. To save space, we do not report the results here, but they are available upon request.

the quality change channel on exchange rate pass-through. Hence, our estimates might be biased if high-competition industries were systematically associated with low quality upgrading. To ensure this does not drive our results, we provide two robustness checks in columns 1 to 4 in Table 13. In columns 1 and 2, we control the industry competition effect by including the Herfindahl index (Fan et al., 2015). In columns 3 and 4, we include industry dummies interacted with the real exchange rate variable. The results are robust after controlling the market competition effects.

(ii) Quality differentiation. As shown in Bernini & Tomasi (2015), the imports of intermediate inputs and the quality of the exported output increase with exporters' ability to reduce exchange rate pass-through. The intermediate imports channel has a weaker negative impact on the exchange rate pass-through to the prices of higher-quality exported varieties. If the high product quality is correlated with high quality product upgrading, then our estimates might be biased. To exclude the impacts of export product quality, we control the export product quality and all its interaction terms with the real exchange rate and import indicator (including the triple interaction term). We find that our core results still hold, with the magnitudes nearly unaffected.

[Insert Table 13 Here]

3.5 Further Discussions

3.5.1 Exporter Size and Destination Heterogeneity

We report the estimation results for different subsamples in Table 14. In columns 1 to 4, we conduct separate regressions for subsamples of large exporters and small exporters. We classify an exporter as a large (small) exporter if its total exports are above (below) the 75th (25th) percentile of the export distribution. We find that the average exchange rate pass-through for large exporters (92 percent) is slightly lower than that of the subgroup of small exporters (96 percent). And we find that the quality change channel plays an important role in determining exchange rate pass-through for both subgroups. In columns 5 to 8, we split the sample into subsamples of firms exporting to developed and developing countries. We find that the average exchange rate pass-through (92 percent) of the subsample with developed country export destinations is significantly lower than that of the subsample with developing country export destinations (98 percent). A possible explanation for this might be the faster quality grading of export products exported to developed countries than products exported to developing countries. The quality change channel is insignificant for the subsample with developing country export destinations. A possible explanation for this might be that export product quality upgrading and export price adjustment for these countries are unresponsive to exchange rate movements, due to the limited consumption capacity of the local consumers.

[Insert Table 14 Here]

3.5.2 Impacts on Intermediate Input Imports

The quality change channel is based on the argument that exchange rate movement will affect exporters' intermediate input import behavior. We examine this impact in Table 15. We explore the impact of exchange rate movement on intermediate input import scope and unit price. We expect this impact will be stronger for products with higher quality upgrading. We regress import scope and import unit price on exchange rate movement and its interaction term with export product quality change. Noting that the import scope is in integers, we use a negative binominal specification for the regression in columns 1 to 3. Based on the estimation results, we find that when the RMB appreciates against other currencies, exporters will expand their import scope for intermediate inputs, and this holds for exporters with higher quality upgrading. Further, we split the sample into subgroups consisting of developed or developing importing countries. We find that exchange rate movement has a stronger impact over the subsample of exporters with importing countries as developed countries.

In columns 4 to 6, we examine the impact of exchange rate movement on import unit price. We find that the import price exhibits lower elasticity to exchange rate movement for exporters with higher product quality upgrading. A natural interpretation of this is that exporters also upgrade their intermediate input imports when they upgrade export product quality. When we split the sample into subgroups consisting of importing countries as developed countries or developing countries, we also find that the previous result holds for the subgroup with importing countries as developed countries. The possible intermediate input imports upgrading phenomenon is not obvious for the subsample with importing countries as developing countries.

[Insert Table 15 Here]

3.5.3 Heterogeneous Effects on Exports

As our previous estimates show, the exchange rate pass-through for Chinese exporters is nearly complete. In other words, local consumers would almost completely absorb the exchange rate movement. In this case, it is possible that appreciation of the RMB would cause significant negative impacts on external demand for Chinese exporters. Further, consumers of higher-quality products have lower demand price elasticity than consumers of lower-quality products. Thus, we expect this impact would differ across heterogeneous exporters with different degrees of export product quality upgrading. In Table 16, we report the elasticity of export quantity and value in columns 1 and 2 and columns 3 and 4, respectively. We use the median and mean value of demand elasticity to construct the quality change for columns 1 and 3 and columns 2 and 4, respectively. Based on the estimates in columns 1 and 3, we find that on average the elasticities of export quantity and export value with respect to the RMB exchange rate movement are 0.34 and 0.41, respectively. The estimates are consistent with the existing literature (Tang & Zhang, 2012a; Li *et al.* , 2015). In addition, we find great heterogeneity in exchange rate pass-through for products with different quality upgrading performance. When the RMB appreciates by 10 percent, export quantity and value for products

with high quality upgrading (at the 95th percentile of the quality change distribution) decrease by 1.4 and 3.2 percent, respectively, for exporters with average import level. We find that products with low quality upgrading (at the 5th percentile of the quality change distribution) decrease by greater magnitudes, 5.3 percent for export quantity and 5.1 percent for export value.

[Insert Table 16 Here]

4 Conclusion

Based on highly disaggregated customs transaction data over 2000–11, we estimate the exchange rate pass-through for Chinese exporters. The article shows that the exchange rate pass-through for Chinese exporters is nearly complete, around 93 percent. In other words, we find that Chinese export price, denominated in RMB, has a very low elasticity with respect to exchange rate movement. And we find this exchange rate pass-through is apparently different from the incomplete exchange rate pass-through widely documented in the literature. We propose a possible explanation for this based on the salient characteristics in the Chinese customs data.

Consistent with the literature, we confirm the existence of the marginal cost channel. For exporters with higher propensity to import intermediate inputs, the exchange rate pass-through into import prices is lower. With further study, we also reveal the existence of another channel, the quality change channel, which weakens the marginal cost channel. We note that large exporters dominate the market in our sample and are associated with high propensity to import intermediate inputs and quality upgrading. Establishing this, we propose that the offsetting impacts of the two channels explain the high exchange rate pass-through for Chinese exporters. In addition, we find that when the RMB appreciates, exporters with high quality upgrading will expand their import scope and upgrade intermediate input imports more than exporters with low quality upgrading products. This effect is more evident for exporters sourcing intermediate inputs from developed countries.

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Table 1: Chinese Transaction-level Trade Data by Year and Import-Status

			Importing Exporters		Non Importing Exporters	
Year	Freq.	Percent	Freq.	Percent	Freq.	Percent
2000	1,752,138	2.71	694,206	0.40	1,057,932	0.60
2001	1,974,590	3.05	738,904	0.37	1,235,686	0.63
2002	2,488,521	3.84	886,437	0.36	1,602,084	0.64
2003	3,102,250	4.79	989,125	0.32	2,113,125	0.68
2004	3,854,724	5.95	1,075,380	0.28	2,779,344	0.72
2005	4,872,929	7.53	1,179,781	0.24	3,693,148	0.76
2006	5,919,581	9.14	1,237,241	0.21	4,682,340	0.79
2007	6,970,694	10.77	1,191,700	0.17	5,778,994	0.83
2008	7,422,004	11.46	1,170,648	0.16	6,251,356	0.84
2009	7,659,821	11.83	1,147,096	0.15	6,512,725	0.85
2010	9,247,242	14.28	1,288,968	0.14	7,958,274	0.86
2011	9,487,778	14.65	1,224,464	0.13	8,263,314	0.87
2000-2011	64,752,272		12,823,950	0.20		0.80

Notes: Each observation is at firm-product-destination-year level. Product is defined at HS 6-digit level.

Table 2: Exporter and Importer Incidence

	Total Import		Intermediate Import		Intermediate Import	
	Frequency	Value	Frequency	Value	Frequency	Value
Importing Exporters	22.02%	57.72%	19.80%	54.44%	34.81%	70.47%
Non-importing Exporters	77.98%	42.28%	80.20%	45.56%	65.19%	29.53%

Notes: Each observation is at firm-product-destination-year level. We report the percentage of export transaction involving intermediate import inputs from the same export destination or not in the left panel of Table 2. We report the percentage of export transaction involving intermediate import inputs from the same currency area or not in the right panel of Table 2.

Table 3: Importing Export V.S. Non-importing Export

	Non-importing Export		Importing Export	
Total Export	1,977,618		8,038,492	
# of Export Destinations	7		10	
Export Scope	27		35	
Export Price	Year 2000	Year 2011	Year 2000	Year 2011
Per Firm-Product,median	1.55	2.68	2.13	5.4
Per Firm-Product-Country,median	1.58	3.45	2.33	7.55
Homogeneous				
Per Firm-Product,median	1.48	4.83	2.2	7.99
Per Firm-Product-Country,median	1.53	6.51	2.28	9.11
Differentiated				
Per Firm-Product,median	1.73	2.91	2.34	6
Per Firm-Product-Country,median	1.95	3.8	2.44	8.25

Notes: Each observation is at firm-product-destination-year level. Importing export is defined as export transaction involving intermediate import inputs from the same export destination. Total export, number of export destination and export scope are reported in median value. Product differentiation is classified according to Rauch (1999).

Figure 1: Marginal Cost Channel and Quality Change Channel

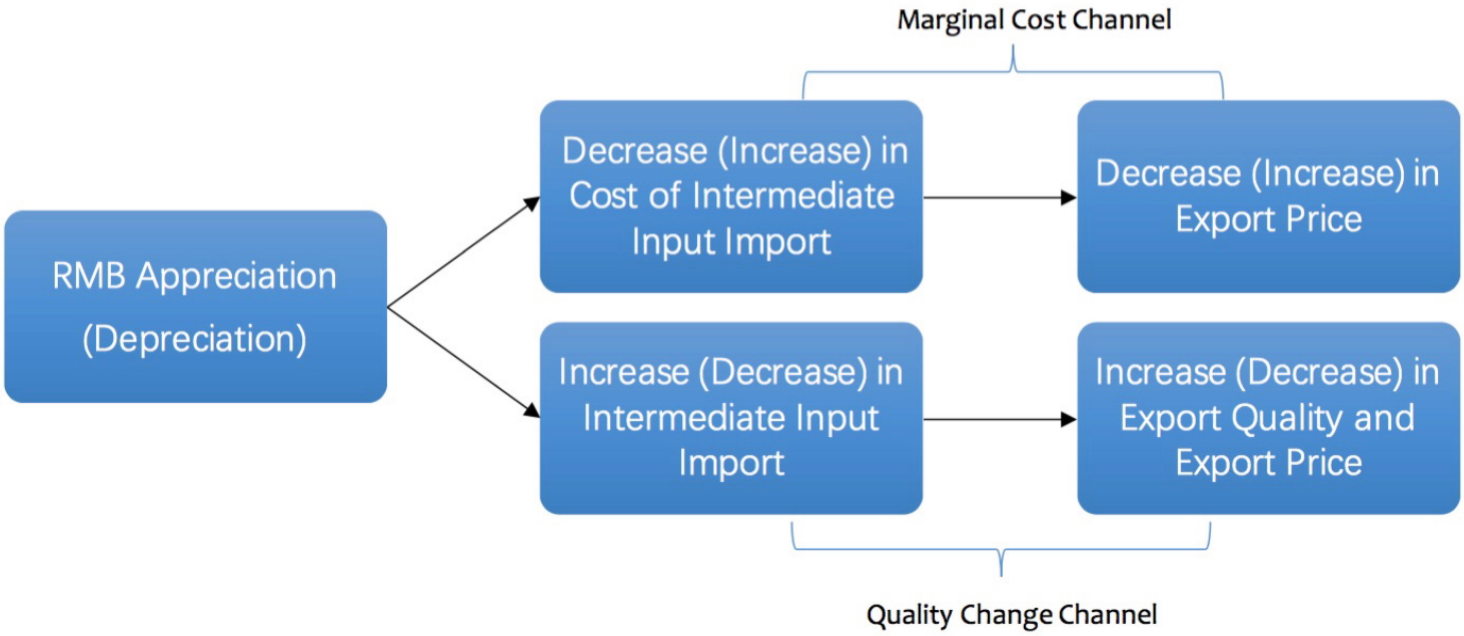
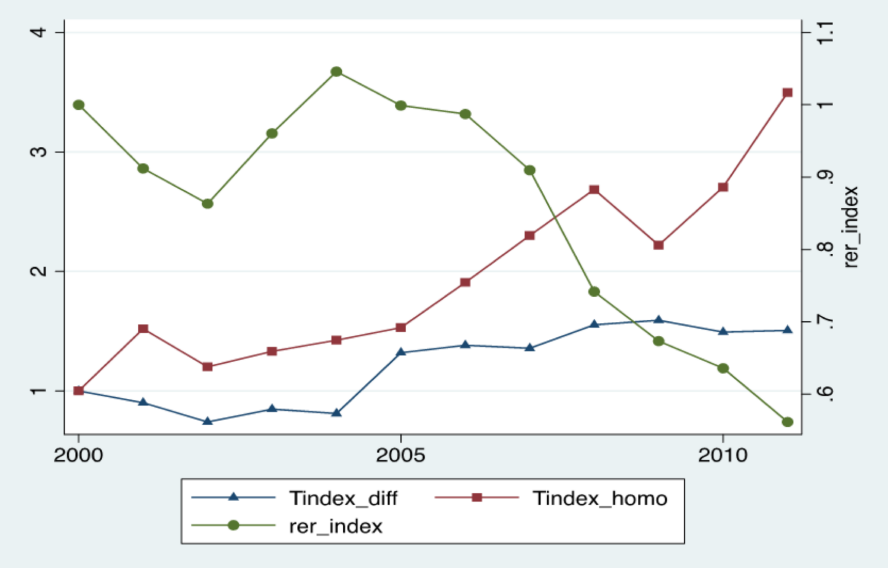
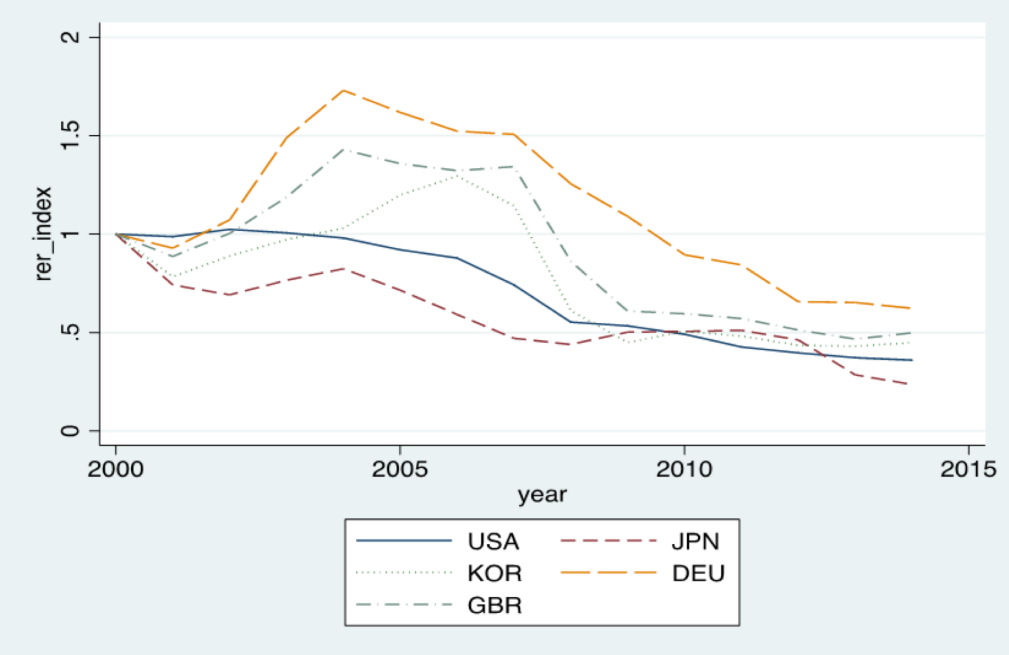


Figure 2: Homogeneous/Heterogeneous Product Price Index and RMB Real Effective Exchange Rate



Notes: Tindex_diff and Tindex_homo denote the price indexes of heterogeneous goods and homogeneous goods, respectively. The price indexes are constructed according to Tornqvist index. Export price is denominated in RMB. Product differentiation is classified according to Rauch (1999). rer_index denotes the RMB real effective exchange rate. An increase in rer_index denotes a real depreciation of RMB. We set the base period of all three indexes as 2000(index=1 in 2000).

Figure 3: RMB Bilateral Real Effective Exchange Rate Against Major Trade Partners



Notes: rer_index denotes the RMB real effective exchange rate. An increase in rer_index denotes a real depreciation of RMB. We set the base period of all indexes as 2000(index=1 in 2000).

Table 4: Import and Exchange Rate Pass-Through

	(1) Whole	(2) Whole	(3) Non-importing	(4) Importing	(5)	(6)
RER	0.070***	0.061***	0.046***	0.103***	0.055***	0.052***
	(17.71)	(26.81)	(9.62)	(11.62)	(18.39)	(17.46)
RER*Import					0.052***	0.005***
					(10.33)	(12.8)
Import					0.001	0.000***
					(1.61)	(4.12)
GDPPC	0.017	0.005	0.046***	0.053	0.044***	0.043***
	(1.47)	(0.99)	(2.72)	(1.24)	(3.93)	(3.89)
GDP	-0.013	-0.010**	-0.038**	-0.071*	-0.039***	-0.039***
	(-1.33)	(-2.54)	(-2.41)	(-1.88)	(-3.89)	(-3.87)
Fixed Effects						
fpc	Y		Y	Y	Y	Y
pc		Y				
t	Y	Y	Y	Y	Y	Y
Obs	15,503,857	15,503,857	11,030,248	4,473,609	15,503,857	15,503,857
R2	0.477	0.019	0.536	0.476	0.477	0.477

Notes: ***, **, and * indicate significance at the 1%, 5%, and 10% level. Robust standard errors corrected for clustering at the firm level. The t statistics are reported in parentheses. All regressions include a constant term and country-level control. We use the whole sample for regression in Columns 1,2,5 and 6. We use export transactions with and without intermediate input imports from the same export destination in Columns 3 and 4. The import status we use except for Column 6 is a dummy variable. We use the actual intermediate input import value from the same export destination in Column 6.

Table 5: Product Differentiation and Exchange Rate Pass-Through

	(1)	(2)	(3)	(4)	(5)	(6)
			RD Intensity		GM Index	
	Value	Dummy	Value	Dummy	Value	Dummy
RER	0.044***	0.048***	0.053***	0.052***	0.053***	0.052***
	(6.10)	(7.05)	(11.05)	(10.44)	(11.04)	(10.43)
RER*Import	0.015***	0.239***	0.101***	0.009***	0.088***	0.007***
	(2.62)	(2.95)	(5.14)	(5.78)	(5.26)	(5.72)
RER*Import*Diff	-0.010*	-0.183**	-1.098*	-0.115**	-0.032	-0.003
	(-1.76)	(-2.26)	(-1.70)	(-2.39)	(-0.99)	(-1.43)
Import	0.000***	0.001	0.001	0.000**	0.001	0.000**
	(2.69)	(0.71)	(1.1)	(2.4)	(1.12)	(2.42)
Fixed Effects						
fpc	Y	Y	Y	Y	Y	Y
t	Y	Y	Y	Y	Y	Y
Obs	7,325,338	7,325,338	12,952,200	12,952,200	12,952,200	12,952,200
R2	0.449	0.449	0.475	0.475	0.475	0.475

Notes: ***, **, and * indicate significance at the 1%, 5%, and 10% level. Robust standard errors corrected for clustering at the firm level. The t statistics are reported in parentheses. All regressions include a constant term and country-level control. The import status we use in Columns 1, 3, and 5 is a dummy variable. We use the actual intermediate input import value from the same export destination in Columns 2, 4, and 6.

Table 6: Annual Growth Rates of Export Quality and Import Intermediate Inputs

Year	Quality	Intermediate Input Imports
2001	16.70%	-3.85%
2002	13.12%	5.75%
2003	24.27%	16.09%
2004	4.35%	21.41%
2005	9.97%	9.52%
2006	-0.25%	7.31%
2007	16.56%	6.08%
2008	-16.23%	-5.27%
2009	-23.88%	-17.01%
2010	-10.41%	22.49%
2011	0.20%	6.62%
Annual Growth rate 1	2.07%	5.67%
Annual Growth rate 2	7.79%	9.87%

Notes: All numbers are calculated by authors based on Chinese Custom Data. Annual Growth Rates 1 are the geometric average value of annual growth rates during 2000-2011. Annual Growth Rates 2 are the geometric average value of annual growth rates for the whole sample excluding 2008 and 2009.

Table 7: Quality Change and Intermediate Import Inputs for Subsamples

	Quality Change (in %)	Intermediate Input Imports	% of Total Exports
Large Exporters	13.42%	13.96	75%
Small Exporters	-38.21%	7.27	2%
To Developed Countries	2.30%	10.21	90%
To Developing Countries	0.29%	9.20	4.7%

Notes: All numbers are calculated by authors based on Chinese Custom Data. Large exporters are referred as exporters with total export value above the 75% percentile of distribution. Small exporters are referred as exporters with total export value below the 25% percentile of distribution. We classify country as developed country if its real GDP per capita is higher above $10,000 (in 2011 US dollar). If a country's real GDP per capita is below $4,000, it is classified as developing country. Intermediate input imports value are in logs.

Table 8: The Heckman Two-Step Estimates of Import Selection

	(1)	(2)	(3)	(4)
	Import Indicator		Import Value	
Input Tariff	-0.127***	(-339.18)	-0.029***	(-345.43)
Export Cost			-0.054***	(-12.76)
Importer Age			-0.097***	(-517.41)
Inverse Mills Ratio			1.166***	(116.17)
Fixed Effects				
fpc	Y		Y	
t	Y		Y	
Obs	9,632,516		9,632,516	

Notes: ***, **, and * indicate significance at the 1%, 5%, and 10% level. Robust standard errors corrected for clustering at the firm level. The t statistics are reported in parentheses. All regressions include a constant term and country-level control. We use one period lagged term for export cost and importer's age in the regression. We use the initial value of import share to construct inputs tariffs.

Table 9: Import, Quality Change and Exchange Rate Pass-Through

	(1)	(2)	(3)	(4)	(5)	(6)
	Import Indicator			Import Value		
	Quality1	Quality2	Differentiation	Quality1	Quality2	Differentiation
RER	0.024***	0.029***	0.006	-0.270***	-0.255***	-0.315***
	(3.18)	(3.98)	(0.74)	(-7.62)	(-7.17)	(-8.02)
RER*Import*Quality	-0.133***	-0.079***		-0.011***	-0.018***	
	(-5.63)	(-4.21)		(-5.50)	(-10.01)	
RER*Import*Diff			-0.527***			-0.009***
			(-7.87)			(-5.95)
RER*Quality	0.044***	0.026***		0.173***	0.279***	
	(5.58)	(4.17)		(5.53)	(10.01)	
RER*Import	0.182***	0.176***	0.750***	0.023***	0.022***	0.035***
	(8.79)	(8.47)	(10.76)	(10.00)	(9.64)	(12.34)
Import*Quality	0.031***	0.063***		0.006***	0.006***	
	(22.29)	(58.57)		(42.40)	(53.47)	
Import	-0.012***	-0.009***	-0.010***	0.002***	0.002***	0.001***
	(-6.89)	(-5.21)	(-4.94)	(6.82)	(6.48)	(2.83)
Quality	0.079***	0.046***		-0.002	-0.031***	
	(159.68)	(124.25)		(-1.13)	(-16.78)	
Fixed Effects						
pc	Y	Y	Y	Y	Y	Y
t	Y	Y	Y	Y	Y	Y
Obs	5,958,996	5,958,996	5,413,483	5,958,996	5,958,996	5,413,483
R2	0.105	0.109	0.019	0.105	0.108	0.019

Notes: ***, **, and * indicate significance at the 1%, 5%, and 10% level. Robust standard errors corrected for clustering at the firm level. The t statistics are reported in parentheses. All regressions include a constant term and country-level control. We use the import indicator predicted from Heckman selection 1st-step estimates in Columns 1-3, and the import value predicted from Heckman selection 2nd-step estimates in Columns 4-6. We use the median and mean values of demand elasticities to construct quality change measures 1 and 2, respectively. Product's quality differentiation is classified according to Rauch (1999).

Table 10: Using Alternative Tariff Measures

	(1)	(2)	(3)	(4)	(5)	(6)
	Import Indicator			Import Value		
	Quality1	Quality2	Differentiation	Quality1	Quality2	Differentiation
RER	0.046***	0.049***	0.021**	-0.454***	-0.465***	-0.538***
	(5.59)	(6.06)	(2.30)	(-7.29)	(-7.47)	(-7.55)
RER*Import	-0.170***	-0.139***		-0.018***	-0.021***	
*Quality	(-8.16)	(-8.74)		(-5.24)	(-6.61)	
RER*Import			-0.539***			-0.013***
*Diff			(-7.87)			(-5.47)
RER*Quality	0.057***	0.050***		0.284***	0.331***	
	(7.66)	(8.87)		(5.11)	(6.43)	
RER*Import	0.120***	0.121***	0.723***	0.034***	0.035***	0.053***
	(5.11)	(5.17)	(10.02)	(8.68)	(8.95)	(10.43)
Import*Quality	0.011***	0.031***		0.001***	0	
	(7.56)	(28.50)		(4.51)	(1.05)	
Import	-0.027***	-0.023***	-0.019***	0	0.001	-0.001
	(-12.63)	(-10.65)	(-8.00)	(0.50)	(1.64)	(-0.90)
Quality	0.085***	0.056***		0.069***	0.062***	
	(163.19)	(143.56)		(14.85)	(12.38)	
Fixed Effects						
pc	Y	Y	Y	Y	Y	Y
t	Y	Y	Y	Y	Y	Y
Obs	5,959,138	5,959,138	5,413,567	5,959,138	5,959,138	5,413,567
R2	0.105	0.108	0.019	0.105	0.108	0.019

Notes: ***, **, and * indicate significance at the 1%, 5%, and 10% level. Robust standard errors corrected for clustering at the firm level. The t statistics are reported in parentheses. All regressions include a constant term and country-level control. We use the import indicator predicted from Heckman selection 1st-step estimates in Columns 1-3, and the import value predicted from Heckman selection 2nd-step estimates in Columns 4-6. We use the median and mean values of demand elasticities to construct quality change measures 1 and 2, respectively. Product's quality differentiation is classified according to Rauch (1999).

Table 11: Subsamples and Alternative Measures

	(1) Single	(2) Core	(3) W/ Intermediaries	(4) W/ 2008-09	(5) MC	(6) Intensity	(7) Range	(8) Current	(9) MA
RER	0.041*	0.095***	0.044**	0.001	0.032***	0.079***	0.030**	-0.047***	-0.011
	(1.68)	(12.85)	(2.22)	(0.05)	(2.80)	(3.17)	(2.07)	(-4.21)	(-0.58)
RER*Import*Quality	-0.135**	-0.081***	-0.195***	-0.244***	-0.169***	-0.063	-0.004*	-0.160***	-0.062*
	(-2.26)	(-3.52)	(-8.09)	(-8.16)	(-6.70)	(-1.41)	(-1.70)	(-8.89)	(-1.93)
RER*Quality	0.045**	0.027***	0.066***	0.088***	0.060***	0.016	0	0.059***	0.020*
	(2.00)	(4.03)	(7.16)	(7.55)	(6.30)	(0.77)	(-0.19)	(8.32)	(1.95)
RER*Import	0.101	0.001	0.196***	0.219***	0.141***	-0.035	0.216***	0.343***	0.405***
	(1.55)	(0.08)	(3.51)	(5.79)	(4.13)	(-0.76)	(5.24)	(10.45)	(6.15)
Import*Quality	0.018***	0.006***	0.001	0.006*	0.006**	0.011***	0.001***	-0.020***	0.003
	(3.88)	(5.20)	(0.80)	(1.96)	(2.08)	(3.86)	(2.81)	(-6.02)	(1.23)
Import	-0.056***	-0.058***	-0.028***	-0.035***	-0.028***	0.008***	-0.026***	-0.124***	0.014*
	(-9.19)	(-14.81)	(-6.90)	(-7.69)	(-7.14)	(2.79)	(-6.57)	(-27.13)	(1.83)
Quality	0.072***	0.069***	0.086***	0.089***	0.055***	0.076***	0	0.107***	0.007***
	(40.40)	(111.57)	(146.27)	(66.96)	(26.62)	(58.01)	(-1.20)	(82.49)	(7.85)
MC					0.089***				
					(70.67)				
Fixed Effects									
pc	Y	Y	Y	Y	Y	Y	Y	Y	Y
t	Y	Y	Y	Y	Y	Y	Y	Y	Y
Obs	5,958,996	5,958,996	5,413,483	4,682,388	5,937,629	391,739	6,789,062	5,901,004	2,027,031
R2	0.105	0.108	0.019	0.113	0.105	0.145	0.021	0.348	0.035

Notes: ***, **, and * indicate significance at the 1%, 5%, and 10% level. Robust standard errors corrected for clustering at the firm level. The t statistics are reported in parentheses. All regressions include a constant term and country-level control. We use the import indicator predicted from Heckman selection 2nd-step estimates for all columns except for Column 6. Product's quality differentiation is classified according to Rauch (1999).

Table 12: Considering Currency Areas

	(1) Quality1	(2) Quality2	(3) Differentiation
RER	0.124***	0.121***	0.113***
	(14.05)	(13.52)	(11.73)
RER*Import*Quality	-0.036***	-0.058***	
	(-2.73)	(-5.43)	
RER*Import*Diff			-0.418***
			(-5.63)
RER*Quality	0.015**	0.031***	
	(2.28)	(5.88)	
RER*Import	-0.096***	-0.079***	0.342***
	(-5.67)	(-4.67)	(4.48)
Import*Quality	-0.001	0.003***	
	(-0.56)	-2.86	
Import	-0.029***	-0.025***	-0.022***
	(-9.03)	(-8.47)	(-5.69)
Quality	0.090***	0.066***	
	(116.33)	(81.7)	
Fixed Effects			
pc	Y	Y	Y
t	Y	Y	Y
Obs	5,623,027	5,623,027	5,106,036
R2	0.106	0.109	0.02

Notes: ***, **, and * indicate significance at the 1%, 5%, and 10% level. Robust standard errors corrected for clustering at the firm level. The t statistics are reported in parentheses. All regressions include a constant term and country-level control. We use the import indicator predicted from Heckman selection 1st-step estimates for all columns. We use the median and mean values of demand elasticities to construct quality change measures 1 and 2, respectively. Product's quality differentiation is classified according to Rauch (1999).

Table 13: Alternative Explanations

	(1)	(2)	(3)	(4)	(5)	(6)
		Market Competition			Quality	Quality
RER	0.027**	0.015	0.055***	0.024	-0.394***	-0.435***
	(2.28)	(1.21)	(3.45)	(1.57)	(-6.77)	(-7.20)
RER*Import*Quality		-0.153***		-0.153***	-0.018***	-0.018***
		(-6.54)		(-6.57)	(-6.23)	(-5.87)
RER*Quality		0.054***		0.054***	0.292***	0.276***
		(6.00)		(6.01)	(6.24)	(5.81)
RER*Import	0.189***	0.230***	0.187***	0.209***	0.031***	0.033***
	(5.36)	(6.35)	(5.31)	(6.32)	(8.29)	(8.56)
Import*Quality		0.010***		0.010***	0.001***	0.001***
		(4.03)		(4.03)	(2.89)	(3.85)
Import	-0.021***	-0.001*	-0.021***	-0.001*	0.000	0.001
	(-5.14)	(-1.68)	(-5.15)	(-1.69)	(0.12)	(1.07)
Quality		0.086***		0.086***	0.076***	0.073***
		(74.68)		(75.01)	(18.83)	(18.06)
Fixed Effects						
pc	Y	Y	Y	Y	Y	Y
Sector Dummies*RER			Y	Y		
t	Y	Y	Y	Y	Y	Y
Obs	6,829,558	6,829,558	6,805,519	6,805,519	6,789,062	6,789,062
R2	0.021	0.104	0.019	0.102	0.109	0.109

Notes: ***, **, and * indicate significance at the 1%, 5%, and 10% level. Robust standard errors corrected for clustering at the firm level. The t statistics are reported in parentheses. All regressions include a constant term and country-level control. We use the import indicator predicted from Heckman selection 1st-step estimates for all columns. For Columns 1-2, we include HHI 's interaction with RER and the triple interaction term for HHI, RER and import indicator. For Columns 3-4, we include sector dummies*RER and the triple interaction term for sector dummies, RER and import indicator. For Columns 5-6, we include the quality and all its interaction terms with RER and import indicator (including the triple interaction term). To save space, we do not report the coeffiecients for these terms.

Table 14: Exporter Size and Destination Heterogeneity

	(1) Large	(2) Large	(3) Small	(4) Small	(5) Developed	(6) Developed	(7) Developing	(8) Developing
RER	0.081***	0.037**	0.062***	0.049***	0.076***	0.064***	0.052***	-0.075
	(9.72)	(2.20)	(12.91)	(3.60)	(16.92)	(5.54)	(2.74)	(-0.88)
RER*Import*Quality		-0.076**		-0.203***		-0.161***		0.149
		(-1.97)		(-6.88)		(-6.46)		(0.72)
RER*Quality		0.035**		0.067***		0.057***		-0.072
		(2.57)		(5.90)		(5.86)		(-1.17)
RER*Import		0.145***		0.108***		0.082**		0.335
		(2.70)		(2.90)		(2.50)		(1.17)
Import*Quality		-0.001		0.013***		0.013***		0.017
		(-0.37)		(5.38)		(4.98)		(1.22)
Import		-0.035***		-0.023***		-0.029***		-0.005
		(-5.47)		(-6.82)		(-8.37)		(-0.22)
Quality		0.088***		0.088***		0.085***		0.092***
		(50.90)		(89.99)		(70.83)		(22.90)
Fixed Effects								
pc	Y	Y	Y	Y	Y	Y	Y	Y
t	Y	Y	Y	Y	Y	Y	Y	Y
Obs	5,359,163	3,439,279	10,144,694	3,390,279	13,195,887	6,362,411	840,397	171,473
R2	0.466	0.099	0.544	0.128	0.470	0.101	0.571	0.190

Notes: ***, **, and * indicate significance at the 1%, 5%, and 10% level. Robust standard errors corrected for clustering at the firm level. The t statistics are reported in parentheses. All regressions include a constant term and country-level control. We use the import indicator predicted from Heckman selection 1st-step estimates for all columns. We use the median and mean values of demand elasticities to construct quality change measure 1 and 2, respectively. Product's quality differentiation is classified according to Rauch (1999).Large exporters are referred as exporters with total export value above the 75% percentile of distribution. Small exporters are referred as exporters with total export value below the 25% percentile of distribution. We classify country as developed country if its real GDP per capita is higher above $10,000 (in 2011 US dollar). If a country's real GDP per capita is below $4,000, it is classified as developing country.

Table 15: Exchange Rate Movement on Intermediate Input Imports

	(1)	(2)	(3)	(4)	(5)	(6)
		Import Scope			Unit Price	
		Developed	Developing		Developed	Developing
RER	-0.183***	-0.205***	-0.133***	0.392***	0.405***	0.392
	(-30.97)	(-33.11)	(-3.84)	(14.89)	(14.04)	(1.55)
RER*Quality	-0.014***	-0.014***	-0.002	-0.041***	-0.041***	-0.005
	(-3.28)	(-3.13)	(-0.06)	(-5.16)	(-5.20)	(-0.04)
Quality	0.001	0.002	-0.005			
	(0.94)	(1.57)	(-0.73)			
Random Effects	Y	Y	Y			
Fixed Effects						
fpc				Y	Y	Y
t				Y	Y	Y
Obs	1,221,844	1,148,258	73,586	1,189,744	1,161,104	28,640
R2				0.01	0.011	0.011

Notes: ***, **, and * indicate significance at the 1%, 5%, and 10% level. Robust standard errors corrected for clustering at the firm level. The t statistics are reported in parentheses. All regressions include a constant term and country-level control. We use the import indicator predicted from Heckman selection 1st-step estimates for all columns. Product's quality differentiation is classified according to Rauch (1999). We classify countries as developed country if its real GDP per capita is greater than $10,000 (in 2011 US dollars). If a country's real GDP per capita is less than $4,000, it is a developing country.

Table 16: Heterogeneous Impacts on Export

	(1)	(2)	(3)	(4)
	Quantity	Quantity	Value	Value
RER	0.415***	0.441***	0.424***	0.401***
	(5.77)	(6.02)	(5.75)	(5.52)
RER*Quality	-0.094***	-0.111***	-0.045***	-0.036**
	(-4.12)	(-4.45)	(-2.60)	(-2.40)
RER*Import	-0.235	0.018	0.037	-0.228
	(-1.06)	(0.08)	(0.16)	(-1.02)
Import*Quality	0.061***	0.070***	0.154***	0.131***
	(2.95)	(3.15)	(8.54)	(8.12)
Import	0.283***	0.277***	0.295***	0.299***
	(7.66)	(7.55)	(7.94)	(7.91)
Quality	0.244***	0.309***	0.122***	0.080***
	(31.93)	(37.19)	(19.29)	(14.41)
Fixed Effects				
pc	Y	Y	Y	Y
t	Y	Y	Y	Y
Obs	3,344,021	3,344,021	3,344,021	3,344,021
R2	0.055	0.073	0.04	0.054

Notes: ***, **, and * indicate significance at the 1%, 5%, and 10% level. Robust standard errors corrected for clustering at the firm level. The t statistics are reported in parentheses. All regressions include a constant term and country-level control. We use the import indicator predicted from Heckman selection 1st-step estimates for all columns.