Exchange Rate Risk and Trade Mode Choice in the Processing Trade: Evidence from Chinese Data

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Abstract

This study investigates the impact of exchange rate fluctuations on trade mode choices among assembly firms. Using the Chinese Customs data from 2000 to 2006, we show that exchange rate pass-through (ERPT) depends on which entity is responsible for importing inputs. Relative to passively receiving inputs under pure assembly (PA) mode, foreign invested assembly firms mainly source inputs by themselves through import and assembly (IA) mode and enjoy lower ERPT by doing so. We then relate exchange rate fluctuations to processing mode choices and find that the share of import through PA increases with exchange rate volatilities. This effect is more pronounced for firms in liquidity constrained industries and is mitigated by better local financial development.

JEL classification: F14, F23, F31

Keywords: exchange rate risk, trade mode choice, processing trade, financial constraint

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1 Introduction

With the integration of global economies, an increasing number of production activities have been transferred from developed to developing countries in pursuit of lower labor costs. By participating in the multinational production network, developing countries have become an important part of the global value chain. In 2017, processing trade in China accounts for about one-third of the total trade value and three-quarters of total trade surplus.[1] One feature of processing trade is that the majority of inputs are imported. Assembly firms could either source inputs and handle payments by themselves or receive inputs for free from foreign parties to whom assembled final products are exported. High reliance on imported inputs indicates that these assembly firms are easily exposed to exchange rate risks. Moreover, compared to firms in ordinary trade, assembly firms are less productive and more financially constrained (Manova and Yu, 2016) which lead to greater liquidity pressure due to exchange rate changes. In this study, we investigate how exchange rate fluctuations affect decisions of assembly firms to take charge of imported input sourcing.

Unlike ordinary trade where domestic importers always take charge of imported inputs purchasing, firms doing processing trade face two options. They could obtain inputs from foreign parties for free under *pure assembly* (PA) mode or purchase imported inputs and handle related payments by themselves under *import and assembly* (IA) mode. Import prices under PA mode reflect the actual transactions between input suppliers and foreign parties who outsourced assembly tasks.

Using monthly import data at the transaction level from 2000 to 2006, we document two stylized facts related to the assembly firms in China. First, comparisons between the two processing modes reveal that state-owned assembly firms are more likely to engage in PA mode while foreign invested assembly firms have larger import share through IA mode. Second, we examine the difference of exchange rate pass-through (ERPT) to import prices between the two processing modes under various ownership structures. We construct monthly import price changes for each firm-product-country combination and relate these to the real exchange rate movements between China and its import source countries. We find ERPT is

[1] According to the China General Administration of Customs report, in 2017, the value of processing trade was 1,190 billion U.S. dollars, which accounts for 29% of China's total trade value. The trade surplus of processing trade was 327 billion U.S. dollars, which accounts for 77% of China's total trade surplus.

different depending on who is in charge of imported inputs sourcing activities. In particular, input sourcing undertaken by state-owned assembly firms through IA experiences higher exchange rate pass-through compared to inputs sourced by foreign parties under PA. The difference is not statistically significant. On the contrary, among foreign invested firms, ERPT is significantly lower if assembly firms rather than foreign parties handle input sourcing. In other words, if we take receiving free inputs (i.e., PA) as a benchmark, foreign invested assembly firms enjoy lower ERPT while state-owned ones face higher ERPT when they source imported inputs by themselves.

The stylized facts suggest a correlation between firm ability to bear exchange rate risk and processing mode choice. For example, for foreign-invested assembly firms, the ERPT is lower when they use IA compared to PA mode. At the same time, we observe over 80% of processing imports of foreign invested firms came under IA mode. Motivated by the stylized facts, we further investigate whether and how exchange rate fluctuations affect the processing mode choices among assembly firms in China. We use the standard deviation of monthly exchange rate changes weighted by import values from each source country in the previous year as a proxy for exchange rate volatility faced by assembly firms. We find that higher exchange rate fluctuations lead to larger share of processing imports through PA mode. When the exchange rate fluctuation increase one standard deviation, the import share of PA mode would increase by 2%. Considering the average PA share is 24%, the effect of exchange rate risk on mode choice is economically significant. The assembly firms face no exchange rate risks when using PA mode since they passively receive imported inputs. Exchange rate volatilities only matter when they source inputs by themselves under IA. When exchange rate risk increases, assembly firms tend to import more using PA mode to avoid such risks. This effect is significant for private and foreign invested firms who are more likely to react to market conditions compared to state-owned assembly firms. Our results are robust when we rule out trade intermediaries and using alternative exchange risk measures.

In addition, we hypothesize that the exchange rate risk avoidance behavior through processing mode selection could be mitigated by better local financial development and is more severe for assembly firms in liquidity constrained industries. We use loans over GDP ratio to capture local financial development. The results show that assembly firms in regions with better financial development are less likely to adjust exchange rate risks through more PA

imports. They may have better alternatives to hedge risks and have access to lower borrowing costs. Next, inventory to sales ratio is used to capture short-term industry liquidity constraints. We find a stronger effect for assembly firms in industries facing higher liquidity constraints.

To the best of our knowledge, this study is the first of its kind to examine the impact of exchange rate fluctuation on import prices and processing mode choices among assembly firms in developing countries. It documents sorting of assembly firms into different processing mode based on firm ownership and explains how this relates to ERPT differences depending on input sourcing responsibilities. Previous research examining processing mode choices focus on property rights theory and financial constraints. This paper contributes to the literature by offering a third explanation, exchange rate risks, for trade mode choices of assembly firms.

The rest of the paper is organized as follows. Section 2 reviews related studies. Section 3 introduces the background of China's processing trade. Section 4 describes the data and Section 5 studies the ERPT in import prices. In Section 6, we investigate how exchange rate risk affect the choices of processing trade modes. Finally, section 7 concludes.

2 Literature Review

Three strands of literature are related to this study. The first strand addresses the choice of processing trade modes. Some studies analyze these choices from the perspective of foreign parties and use the property right theory of the firm (Feenstra and Hanson, 2005; Fernandes and Tang, 2012) to explain foreign parties' decisions on controlling imported inputs purchasing. These studies argue that foreign parties prefer internalization (PA mode) because ownership of inputs is a source of power when contracts are incomplete. Other studies use the financial constraint (Manova and Yu, 2016) to explain the choice of processing trade modes from the perspective of assembly firms. These works find that limited access to capital prevents assembly firms upgrading from PA mode to IA mode. In this study, we present a third possible mechanism to explain the sourcing decisions of firms from the perspective of exchange rate risks. In PA mode assembly firms are free of exchange rate risks, and thus they prefer PA mode if they face higher exchange rate fluctuations. We empirical results show that, relative to foreign parties, state-owned assembly firms bear similar exchange rate

risks while joint-owned or foreign-owned assembly firms bear less exchange rate risks. Thus, the exchange rate risk mechanism could explain that state-owned assembly firms have higher proportions in PA mode than joint-owned or foreign-owned assembly firms do.

The second strand of literature is related to the impact of exchange rate fluctuations on prices and margins of trade. Pioneer research investigate import price responses over time at the aggregate product-country level and provide evidence on partial ERPT (e.g., Campa and Goldberg (2005); Gopinath et al. (2010)). With the availability of firm level information, many studies focus on the firm responses of exchange rate fluctuations. For example, Amiti et al. (2014) demonstrate the ERPT of Belgian exporters is correlated with their import intensities. Most of these papers focus on the responses of exporters (e.g., Tang and Zhang (2012); Li et al. (2015a); Berman et al. (2012)). Li et al. (2015b) is an exception and their paper shows that the import response of Chinese firms to exchange rate fluctuations with OECD countries is incomplete and declining since 2001. Our paper differs from this literature by exploring heterogeneous ERPT due to firm characteristics. In particular, we examine assembly firms in processing trade and compare the pass-through between PA and IA modes motivated by their innate risk bearing capabilities.

The third strand of literature studies how financial conditions affect firms' responses to exchange rate fluctuations. Strasser (2013) finds that the ERPT of financially constrained firms is almost twice that of unconstrained firms. Héricourt and Poncet (2013) find that a firm's exported value decreases for destinations with higher exchange rate volatility and this effect is magnified for financially vulnerable firms. Thus, these studies argue that financially constraint firms are more likely to be affected by exchange rate fluctuations. As Manova and Yu (2016) show, assembly firms in China are more likely to be financially constrained. Thus, they have incentives to mitigate the impact of exchange rate fluctuations. Usually firms can employ three kinds of tools: operation hedging strategies, financial hedging strategies, and direct pass-through to customers. Bartram et al. (2010) find that pass-through and operational hedging both reduce exchange rate exposure by $10-15\%$ while financial hedging decreases exposure by about 40%. Döhring (2008) and Takatoshi et al. (2013) investigate the exchange rate risk management of European firms and Japanese firms respectively. In this study, we find another channel for assembly firms to avoid exchange rate risks: Engaging in PA mode. Firms' choices into PA mode is more pronounced in financially constraint

industries and less prevalent in regions with better financial development further supports our argument.

3 Background

In the processing trade, assembly firms in China obtain inputs from abroad, process them locally, and then export the value-added goods. Most assembly firms do not have their own brands or responsibility for marketing in foreign countries. Thus, these assembly firms are in charge of the production process only.

There are two processing trade modes in China: PA and IA. The distinction is that in PA mode, the assembly firm does not take ownership of either the imported inputs or the value-added goods, and hence, plays a fairly passive role. The value-added the firm creates is only the processing service fee. By comparison, in IA mode, the assembly firm plays a more active role, because it controls the imported inputs purchasing and owns the imported inputs and value-added goods.

Figure 1 shows the production chains for PA and IA modes. First, the assembly firm in China signs a production contract with a foreign party. Then, these firms decide which among them is in charge of the imported inputs. In PA mode, the foreign party purchases the inputs and then transfers them to the assembly firm in China for free. Although the inputs are free, the foreign party still needs to report the values of these inputs to Chinese Customs. This is the "import price" observed in the customs data. In IA mode, an assembly firm in China purchases inputs by itself. After processing these inputs, the assembly firm either returns or sells the value-added goods to the foreign party. This is the "export price" observed in the customs data. Thus, in PA mode, the foreign party outsources only the assembly process but controls the purchase of inputs. Meanwhile, in IA mode, the foreign party outsources both the assembly process and the purchase of inputs.

In Chinese Customs data, we can observe the prices between foreign parties and assembly firms in PA mode and the prices between imported inputs suppliers and assembly firms in IA mode. Unfortunately, we cannot directly observe the prices between imported inputs suppliers and foreign parties. However, it is reasonable to assume that foreign parties do not have incentive to misreport the costs of imported inputs to Chinese Customs. First, in PA

mode, the imported inputs belong to foreign parties. Hence, it is not necessary for them to hide the price information from assembly firms. In some legal disputes, the foreign parties might have incentive to inflate the prices to obtain more compensation. If the inflation is a fixed markup to the real price and not related to the exchange rate fluctuations, it will not affect ERPT since inflated margins canceled out when we take first differences. The price inflation could be related to the exchange rate fluctuations when foreign parties have higher incentives to misreport during Chinese yuan depreciations. In this case, the ERPT in PA mode is overestimated. Second, imports and exports are tariff-free for the processing trade in China. Foreign parties cannot obtain tariff benefits from misreporting to the Chinese Customs. Third, assembly firms charge only processing service fees in PA mode. Foreign parties cannot evade corporate tax by misreporting import or export prices. However, if the imported inputs supplier and foreign parties belong to the same multinational firm, then the foreign party has incentive to misreport the import or export prices for tax benefits. Owing to data limitations, we cannot discuss intra-firm trade concerns in this study. Hereafter, we assume that the price between imported inputs suppliers and foreign parties is the same as the transfer price between foreign parties and assembly firms in China. Thus, in both PA and IA modes, the import prices measure the costs of imported inputs. This enables us to investigate how assembly firms in China and foreign parties react to the exchange rate fluctuation, respectively.

Another concern is the misreport problem in IA mode. Since the imported inputs in the processing trade are tariff-free, assembly firms in China have incentive to sell imported inputs in domestic market instead of export. In the second half of 2005, the Chinese Customs conduct a campaign, which lasted half a year, to fight against smuggling via processing trade (GAC, 2006). The number of cases that are found to violate the law is $5,350$ and the value is 7.82 billion Chinese yuan, which accounts for 0.35% of total imports by processing trade in 2005.[2]

In PA mode, foreign parties own value-added goods. Thus, they do not care about the ERPT in export prices. However, since foreign parties need to import inputs from other suppliers, they indeed care about the ERPT in import prices. In IA mode, assembly firms in China import inputs and sell value-added goods back to foreign parties. Thus, assembly firms

[2]Due to data limitations, we are not able to discuss the smuggling concerns in this study.

care about the ERPT in both import and export prices. Usually the export price is decided when the contract is signed, after which the inputs are imported. Thus, when both foreign parties and assembly firms import inputs, they regard the export price as given. Thus, the ERPT in export prices would not affect the ERPT in import prices and both kinds of firms seek low ERPT in import prices.[3]

4 Data

4.1 Customs Data

This study uses the "Chinese Customs Export and Import Database" from 2000 to 2006, which is reported on a monthly basis and collected by Chinese Customs. This database includes transaction level information on export and import values, quantities, products classified at the eight-digit harmonized system (HS) level, export destination of import source country, firm ownership (state-owned, private-owned, joint-owned and foreign-owned),[4] and trade modes (ordinary, PA and IA). We first convert trade flows denominated in U.S. dollar into Chinese yuan by monthly exchange rate between U.S. dollar and Chinese yuan. Second, the HS code changed in 2002 at the HS6 level. In order to keep the product category consistent, we firstly aggregate the product to the HS6 level and then convert all products to HS1996 by using the concordance between HS2002 and HS1996. Third, this database does not directly provide any price information. We divide the value of the product by the quantity to obtain the unit value price at the HS6 level.

One data advantage of studying ERPT of assembly firms is that all the imported goods should be used as intermediate inputs for production in order to qualify for tariff exemption. In previous studies, however, some imported goods are sold in the domestic market and others are used as intermediate inputs. It is necessary to distinguish the usage of imported goods. In the Chinese processing trade, we do not mix the ERPT of these two kinds of imported goods.

The customs data include all transactions of China's processing imports from 2000 to

[3]We discuss the ERPT in export prices in Appendix A.1 and compare our results with existing studies.

[4]The joint-owned and foreign-owned firms include those with investors from Hong Kong, Taiwan, and Macao.

2006. There are more than 23 million observations, which cover 205 countries and regions and 4,732 products at the HS6 level. In 2000, there were 33,275 firms engaged in the processing trade and these firms imported goods worth 765 billion yuan. In 2006, the firm number increased to 48,492 and the value of imported goods increased to 2,542 billion yuan.

Table 1 shows the number of firms and import values by processing trade modes. About $15\% - 18\%$ of firms only participate in PA mode whereas more than 70% of firms choose purely IA mode with the rest 12% of firms participate in both. Over time, the number of firms in each trade mode category remains stable. In terms of import value, the contribution of pure IA importers rises over time. In 2000, about 60% of import values came from firms engaged in pure IA mode. This number increased to almost 70% in 2006. Meanwhile, the share of import values generated by firms doing both PA and IA decreased from 27% in 2000 to around 13% in 2006. This pattern suggests that firms participating in pure IA mode played an increasingly important role in processing imports compared to firms experimenting with both modes.

In Table 2, we divide firms into four ownership categories and present the import values (and share) of PA versus IA under each ownership structure. Among state-owned firms, those who participate in PA brought two to three times more imports compared to IA firms. In 2000, for example, about 77% of import values came from state-owned PA firms while the rest 23% belonged to state-owned IA firms. On the contrary, for joint-owned and foreign-owned firms, imports through IA mode accounted for the majority of trade values. Specifically, over 80% of processing imports by joint or foreign owned firms were carried out in IA mode and this share remained quite stable over our sample period. Private-owned firms seem to react abruptly to China's accession to the World Trade Organization (WTO)[5]. From 2000 to 2002, private-owned firms started doing processing trade by a tiny scale, i.e., 6.3 billion in total compared to over 200 billion yuan done by state-owned firms in 2002. And most processing imports of private firms came in IA mode during this period. After trade liberalization, the processing imports by private-owned firms boomed. Most of the processing imports done by private firms came from PA mode at first while gradually gravitated towards IA as firms gained more experience.

Next, we compare the two processing trade modes, PA versus IA, from three aspects:

[5]China became a member of WTO on 11 December 2001.

source of origin, firm location, and product variety. Panel A of Table 3 shows the top six origin countries and regions. Four of them are developed economies in East Asia. Mainland China also appears as one of the top origins since inputs purchased from *bonded areas* are counted as imports from China. The role of China resembles a processing platform which imports intermediate goods from nearby East Asian economies and assembles parts into final goods which are then being exported. In Panel B of Table 3, we find that more than 94% of assembly firms are located in the eight coastal provinces (out of 32 provinces in Mainland China). In particular, assembly firms in Guangdong account for almost half of the processing imports for both PA and IA mode. In Panel C of Table 3, we investigate the differences of product varieties between the two processing trade modes. The product varieties are classified into 97 HS2 categories. For both import processing modes, products of Chapter 85[6] are the primary imported inputs. They account for 32.36% of processing imports among all product varieties in the PA mode and 45.53% in the IA mode.[7]

Above all, there is no significant difference between PA and IA modes in terms of source of origin, firm location and product variety. Firm ownership, however, exhibits huge influence on processing imports between the two modes.

4.2 Exchange Rate and CPI Data

The nominal exchange rate data and consumer price index (CPI) are collected from the International Financial Statistics (IFS) on monthly basis.[8] The real exchange rate (RER_{jt}) between country j and China at time t is defined as the foreign currency price per Chinese yuan (NER_{jt}) times the ratio of Chinese CPI over foreign CPI, which is as follows:

$$RER_{jt} = NER_{jt} \times CPI_{China,t}/CPI_{jt} \tag{1}$$

An increase in the real exchange rate (RER_{jt}) implies an appreciation of the yuan.

Before July 2005, China peged its currency to U.S. dollar. Thus, the nominal exchange

[6]Chapter 85 is "electrical machinery and equipment and parts thereof; sound recorders and reproducers, television image and sound recorders and reproducers, and parts and accessories of such articles."

[7]We further look into the sub-categories within Chapter 85 which includes 290 products at the HS6 level. Figure 2 shows the distribution of product import shares under PA mode on the left and IA mode on the right. The two figures resembles each other with an import share correlation of 0.97.

[8]The CPI data of Australia and New Zealand are on quarterly basis. The CPI and nominal exchange rate data of Taiwan are collected from National Statistics, Taiwan.

rate between U.S. dollar and Chinese yuan is fixed. However, the nominal exchange rate between other currencies (e.g. Euro and Japanese yen) and Chinese yuan is flexible. In order to show the sources of real exchange movements, we present the time trend of exchange rate between China and its top 15 trade partners[9] from 1999 to 2007 in Figure 3. For most trade partners, the real and nominal exchange rates move simultaneously, which implies that the relative CPI change is stable. The United States, Hong Kong, and Malaysia experienced a fixed nominal exchange rate before 2005 which explains the diversion between nominal and real exchange rate changes.[10]

4.3 Financial Data

In this study, we use two financial measurements: local financial development and industrial liquidity constraint. In practice, it is difficult to measure local financial development given its complexity and multi-dimensionality. This study uses the ratio between loans and gross domestic product (GDP) to measure financial development at the prefecture level. Loans include both enterprise and resident loans. The financial data are collected from the "China City Statistical Yearbook" and include 287 prefectures covering the period 2003 to 2006.[11] The distribution of loans/GDP remains stable over time. Thus, we use the average loans/GDP from 2003 to 2006 to measure local financial development. A higher value of this ratio presents a higher level of local financial development. Panel A of Table 4 shows that the mean of loans/GDP is 0.88 and standard deviation is 0.44. The top five cities with the highest financial development level are Beijing, Xining, Wurumuqi, Yichuan and Haikou. All of these cities are provincial capitals. The bottom five cities are Daqing, Kelamayi, Chongzuo, Hezhou and Jieyang. These cities either possess abundant petroleum resources which lead to extremely high GDP or are less developed in all aspects.

In this study, we use the ratio of inventory to sales as a proxy for industrial liquidity constraint. A higher value of this ratio represents a higher level of external liquidity needs. Following Raddatz (2006), we extract the firm level information from the U.S. Compustat

[9] In terms of import values, the top 15 sources of origin are: the United States, Euro Area, Hong Kong, Japan, South Korea, the United Kingdom, Russia, Taiwan, India, Australia, Indonesia, Philippines, Singapore, Thailand and Malaysia.

[10] The inflation rates in India and Russia are much higher than that of China which lead to diversions in real and nominal exchange rate movements.

[11] These yearbooks do not report loan data at the prefecture level before 2003.

dataset over 2000 to 2006 period and calculate industry median of inventory to sales ratio at the 2-digit Standard Industrial Classification (SIC) level. We then map these SIC codes to HS product classifications for Chinese importers whose own industries are determined by their main exporting product. Panel B of Table 4 summarizes the distribution of liquidity constrains for 2-digit SIC manufacturing industries. Tobacco, leather and primary metal industries face the highest liquidity constraints compared to the least constrained industries such as printing, petroleum refining and chemicals.

Rajan and Zingales (1998) provides an alternative measure of dependence on external finance using the share of capital expenditures not financed by cash flows. As pointed out by Raddatz (2006), this measure is more of a long-term proxy compared to the inventory-sales ratio. It addresses the initial investment scale and duration of gestation period as causes of financial dependence of an industry. In this study, we examine the effect of exchange rate fluctuations on processing mode choices. We hypothesize that industries with higher liquidity constraints are more likely to be affected by exchange rate movements. Inventory-to-sales ratio is a better candidate to reflect industry sensitivity to short-run financial shocks.[12]

5 ERPT in Import Prices

In this section, we examine the ERPT in import prices. In PA mode assembly firms in China import inputs, while in IA mode, foreign parties import inputs. Thus, it is necessary to distinguish between the two modes and to examine the ERPT differences between them.

5.1 Benchmark Regression at the Firm-Product-Country Level

We examine the ERPT at the firm-product-country level for PA and IA modes respectively. First, we aggregate all import transactions to the firm-HS6-country-mode level for each month. Then we calculate the average price of each firm-HS6-country-mode unit for each month. We conduct monthly analysis using a stacked regression following previous studies such as Campa and Goldberg (2005); Li et al. (2015b). The benchmark regression is as

[12]Results using the Rajan and Zingales (1998) measure of external finance dependence can be provided upon request.

follows:

$$\begin{aligned}\Delta \ln(P_{ijk(t-1,t)}) = \ & \alpha_0 + \sum_{h=0}^{3} \alpha_{1h} \Delta \ln(RER_{j(t-h-1,t-h)}) \\ & + \sum_{h=0}^{3} \alpha_{2h} \Delta \ln(RER_{j(t-h-1,t-h)}) \times Mode_{ijkt} \\ & + \alpha_3 \ Mode_{ijkt} + \mu_{ij} + \eta_k + \lambda_t + \epsilon_{ijkt}\end{aligned} \tag{2}$$

Here, P_{ijkt} is the import price (yuan) of product i from country j for firm k at time t. RER_{jt} is the real exchange rate between country j and China at time t. $Mode_{ijkt}$ is a dummy for processing trade mode which equals 1 if the product is traded under IA mode and 0 otherwise. μ_{ij} measures the product-country fixed effect, η_k measures the firm fixed effect and λ_t measures the time fixed effect. We take both import prices and real exchange rate in the first difference of log forms. In Chinese Customs data, we observe only the arrival month of imported products at the ports. One concern is that there is a time lag between the signing of import contracts and the arrival of those products. If the time lag is greater than one month, then we should examine the effect of the exchange rate in the previous months instead of in the current month. To check this problem, we include both the contemporaneous exchange rate fluctuation and three lagged exchange rate fluctuations to examine the ERPT at the 3-month term. The real exchange rates are measured at the country-month level and we cluster the standard errors by country. [13]

The coefficient α_{10} measures the short-term ERPT for PA mode while $\sum_{h=0}^{3} \alpha_{1h}$ measures the long-term ERPT for PA mode. When the yuan appreciates, the import price (yuan) is supposed to decrease. Thus, α_{10} and $\sum_{h=0}^{3} \alpha_{1h}$ should be negative. The coefficient α_{20} measures the short-term ERPT differences between the two trade modes—PA and IA, while $\sum_{h=0}^{3} \alpha_{2h}$ measures the long-term ERPT differences. When α_{20} or $\sum_{h=0}^{3} \alpha_{2h}$ is negative, it means that the ERPT is larger in IA mode. When α_{20} or $\sum_{h=0}^{3} \alpha_{2h}$ is positive, it means that the ERPT is larger in PA mode. The coefficient α_3 measures the price change differences between the two trade modes.

The result is presented in Table 5. In the first two columns, we present the short-term

[13] We also cluster the standard errors by country-month as a robustness check and the results are robust, which are presented in Appendix A.2.

results, that is, the responses of price adjustment to the exchange rate change at the current month. In the last two columns, we present the long-term results, that is, the responses of price adjustment to the exchange rate change at the current and last three months. In the short-term, the price is sticky, which does not response to the exchange rate change. While in the long-term, the response of price change is significant. Column 3 shows that the ERPT is 0.2227. On average, when the yuan appreciates by 10%, the import price (yuan) decreases by 2.227%. This result is larger than that in Li et al. (2015b). They find that the ERPT in import prices from OECD countries is 0.052 in the processing trade and 0.127 in the ordinary trade. In column 4, we additionally control the interaction term between the real exchange rate and the trade mode. The result shows that the ERPT in PA mode is 0.2629. When the yuan appreciates by 10%, the import prices (yuan) decreases by 2.629%. In IA mode, the exchange rate pass through is lower, at 0.1948. When the yuan appreciates by 10%, the import price (yuan) decreases by 1.948%. In summary, the result in Table 5 shows that when assembly firms in China import inputs by themselves, they bear lower ERPT though the ERPT difference is insignificant.

Boz et al. (2017) emphasizes the role of dollar exchange rate rather than bilateral exchange rate in price pass-through. Most trade flow in China is invoiced in U.S. dollar.[14] However, the pricing decision is not necessary to be made in U.S. dollar. The imported goods could be priced in source country's currency and then the price is converted to U.S. dollar using spot exchange rate. In order to investigate which one is more important, bilateral exchange rate or exchange rate between U.S. dollar and Chinese yuan, we include both exchange rates in our estimation. When we control both exchange rates, only bilateral exchange rate is significant. Thus, we will focus on the bilateral exchange rate in this study. The detail is presented in Appendix A.3.

5.1.1 Ownership

Table 2 shows that most state-owned assembly firms are engaged in PA mode while joint-owned and foreign-owned assembly firms are engaged in IA mode. Thus, It is necessary to examine the ERPT by ownership. The results are shown in Table 6. In the short-term, the

[14]China did not officially report invoicing data in U.S. dollar. The People's Bank of China reported invoicing data in Chinese yuan since 2009. By Ito and Chinn (2013), the share of China's trade invoiced in Chinese yuan is negligible in 2009.

ERPT is still insignificant except for foreign-owned assembly firms. Hereafter, we will focus on the long-term ERPT. For state-owned and private-owned assembly firms, the long-term ERPT is higher in IA mode but insignificant. For joint-owned or foreign-owned assembly firms, the long-term ERPT are both lower in IA mode. The ERPT for joint-owned assembly firms (0.20) is only 38% of ERPT for foreign parties (0.52) while the ERPT for foreign-owned assembly firms (0.19) is only 59% of ERPT for foreign parties (0.32). In sum, relative to foreign parties, state-owned or private-owned assembly firms bear similar ERPT while joint-owned or foreign-owned assembly firms bear lower ERPT.

Several mechanisms may explain this result. First, state-owned assembly firms might have weak international market networks, thereby bearing more ERPT when they import materials by themselves. While joint-owned and foreign-owned assembly firms have more experiences in the international market, thereby bearing less ERPT. Second, state-owned assembly firm might have better access to bank credit than joint-owned or foreign owned ones, and thus are less responsive to market. Third, state-owned assembly firms are less likely to be financially constrained. Therefore, state-owned assembly firms are more able to bear higher import prices due to exchange rate movements when they take control of imported inputs purchasing (i.e., engage in IA). Fourth, the invoice of currency can affect the ERPT (Devereux et al., 2017). Suppose the import price is fixed and the transaction is invoiced in yuan; then, the ERPT should be close to 0. On the contrary, suppose the transaction is invoiced in foreign currency; then, the ERPT should be close to 1. If the invoices of currency are significantly different by ownership, the ERPT will be different. Owing to data limitations, we cannot discuss this issue in this study. Fifth, the differences in the types of the product could also explain these results. In Panel C of Table 3 and Figure 2, we show that there are no significant differences between imported goods under the two processing trade modes. Thus, we believe that financial condition, access to bank credit, and knowledge of the international market are the main reasons to rational the EPRT differences among ownership.

5.1.2 Excluding the U.S. Dollar Pegging Countries

From 2000 to 2005, the yuan was pegged to the U.S. dollar. Thus, the exchange rate between China and the United States was fixed. The real exchange rate fluctuation between

them reflected only the relative CPI fluctuation. Among the top 10 sources of origin, Hong Kong also pegged its currency to the U.S. dollar. Thus, we exclude the U.S. dollar pegging countries.[15] Panel A of Table 7 presents the results which are very similar to that in the full sample.

5.1.3 Intermediary Company

In the processing trade, some firms are pure import-export companies that do not produce any products. These firms provide only services to facilitate transactions between assembly firms and foreign parties. Thus, it is necessary to distinguish these firms from other ordinary assembly firms. Following Manova and Yu (2016), we use the keywords in firm names to identify import-export companies.[16] The summary of intermediary companies is presented in Appendix A.5. In Panle B of Table 7, we exclude all intermediary companies from our sample. For state-owned assembly firms, the ERPT is now lower in IA mode but insignificant. A large number of state-owned assembly firms engaged in PA mode import inputs through intermediary companies. After deleting intermediary companies, the observations of state-owned assembly firms decrease by 70%. Thus, the ERPT are different between state-owned import-export companies and state-owned ordinary assembly firms. For assembly firms that could directly sign contracts with foreign parities, their ERPT is lower. One possible explanation is that these assembly firms have more experiences in the international market, thereby bearing less ERPT.

5.1.4 Differentiated Goods

The ERPT might be different across products. Here, following the classification from Rauch (1999), we divide products into two groups: homogeneous and differentiated goods. We define two dummy variables. $Homogeneous$ is 1 if the product is a homogeneous good; otherwise, it is 0. $Differentiated$ is 1 if the product is a differentiated good; otherwise, it is 0. Table 8 presents the results. Our benchmark result remain robust when the imported inputs are differentiated goods. However, when assembly firms in China import homogeneous

[15]The U.S. dollar pegging countries (regions) during our sample period include Bahamas, El Salvador, Hong Kong, Jordan, Malaysia, Panama, Saudi Arabia and United States.

[16]The keywords that we use are "jingmao," "jinchukou," "maoyi," "kemao," "waimao," "jiagongzhuang-peifuwuggongsi," "waijingfazhan," and "duiwaijingjifazhan."

goods, there is no difference between two trade modes. By the classification in Rauch (1999), homogeneous goods are either traded on an organized exchange or reference priced. The import prices would be similar regardless of trade modes. Thus, the ERPT is indifferent between two trade modes.

Above all, we find that ERPT differs depending on whether the assembly firm or its foreign party takes the responsibility of input sourcing. In particular, we find strong evidence that foreign invested assembly firms bear lower ERPT when they source inputs by themselves under IA mode. This result is not driven by dollar pegging countries or intermediary companies. In addition, the ERPT is greater when assembly firms import differentiated materials.[17]

6 Exchange Rate Risk and Trade Mode Choice

When assembly firms are risk neutral, they would like input costs (yuan) to be fixed. This implies that assembly firms prefer the ERPT in import prices (yuan) to be zero when the exchange rate fluctuates. In this sense, the ERPT measures the exchange rate risks faced by assembly firms. The higher is the ERPT, the higher is the exchange rate risk. Most assembly firms in China are financially constrained (Manova and Yu, 2016), and so the fluctuation of input costs causes liquidity risks for them. Meanwhile assembly firms obtain more profits if they are engaged in IA mode (Manova and Yu, 2016). Thus, assembly firms face a trade-off. When assembly firms choose PA mode, they earn less profit. However, in this case, foreign parties bear exchange rate risks. When assembly firms choose IA mode, they can earn more profit. However, the disadvantage is that they take on exchange rate risks by themselves. Thus, the degree of ERPT or exchange rate risks may affect the choice of processing trade modes.

In previous sections, we show that state-owned assembly firms bear higher ERPT than foreign parties do but insignificant, while joint-owned and foreign-owned assembly firms bear significantly less ERPT when they take control of input sourcing. In addition, Table 2 shows that state-owned assembly firms are more engaged in PA mode while joint-owned and foreign-owned assembly firms prefer IA mode. Combining these two empirical findings, the

[17]We also find in Appendix A.6 that the ERPT is greater when assembly firms import inputs from developed countries

exchange rate risk might be a potential explanation for the trade mode choices of assembly firms in China. Thus, this study provides a potential explanation for the trade mode choices of assembly firms in China from the perspective of exchange rate risks.

To verify this mechanism, we investigate whether the exchange rate risks faced by assembly firms would affect their trade mode choice using the firm-year level data. The regression specification is as follows:

$$PR_{kt} = \beta_0 + \beta_1 ERR_{kt-1} + \rho_c + \phi_s + \lambda_t + \epsilon_{kt} \tag{3}$$

Here, PR_{kt} is the value share of PA mode, that is PA/(PA+IA), for firm k in year t. If PR_{kt} is 1, it implies that firm k is only engaged in PA mode. If PR_{kt} is 0, it implies that firm k is only engaged in IA mode. Higher is PR_{kt}, the value share in PA mode is higher. ERR_{kt-1} is the exchange rate risk faced by firm k in year $t-1$. We use lagged exchange rate fluctuations to avoid the simultaneous problem. ρ_c is the prefecture fixed effect, ϕ_s is the industry fixed effect and λ_t is the year fixed effect. The industry that an assembly firm belongs to is defined at the HS2 level. We use the export products to define assembly firms' industry instead of imported products. Since an assembly firm might export products at multiple HS2 categories, we use its main HS2 category, in which the export value share is larger than 50% of all export values. Some firms export products in multiple industries and do not have a HS2 code that comprises at least 50% of all export values. We regard these firms as ones with unidentified industry and drop them from our sample.[18]

The key explanatory variable in regression (3) is the firm level exchange rate risk ERR_{kt}. Following Chit et al. (2010), we first define a proxy for exchange rate volatility, V_{jt}, for country j in year t.

$$V_{jt} = \sqrt{\sum_{m=0}^{11} \frac{(\Delta \ln(RER_{jt,(-m-1,-m)}) - \overline{\Delta \ln(RER_{jt,(-m-1,-m)})})^2}{11}} \tag{4}$$

Here, $\Delta \ln(RER_{jt,(-m-1,-m)})$ is the first difference of the log monthly exchange rate in year t and m represents the month. Thus, in each year t, we have twelve $\Delta \ln(RER_{jt,(m-1,m)})$s.

[18]The export values of these firms account for about 20% of all export values. We also use HS2 code that comprises the highest export value to represent the industry for firms as a robustness check. The results are presented in Appendix A.7.

Then we use their standard deviation to proxy the exchange rate volatility in year t. The higher is V_{jt}, the exchange rate risk is higher when firms import inputs from country j in year t. Since firm k could import inputs from multiple countries, we use the ratio of import value from each country to total import value as the weight to construct the weighted exchange rate risk for each firm k. The definition of ERR_{kt-1} is

$$ERR_{kt-1} = \sum_{j \in J} W_{jkt-1} \times V_{jt-1} \tag{5}$$

In order to solve the endogeneity problem, we use the import weight from country j for firm k in year $t-1$, W_{jkt-1}, and exchange rate volatility between import source country j and China in year $t-1$, V_{jt-1}.[19] J is the set of source of countries. If our argument is correct, β_1 should be positive.

The benchmark result is shown in Panel A of Table 9. When assembly firms in China face higher exchange rate risks in previous year, the value share of PA mode is higher (column 1). Columns 2 to 4 show that this pattern remain robust across ownership. The exception is the state-owned assembly firms. Although the coefficient is positive but insignificant (column 2). State-owned assembly firms is less sensitive to exchange rate risk. We also present the beta coefficient of ERR_{-1}.[20] When ERR_{-1} increase one standard deviation, the share of PA mode will increase by 0.05 standard deviation. The standard deviation of PA ratio in full sample is 0.41. Thus, when exchange rate risk, ERR, increase one standard deviation, the PA ratio would increase by 2%. Considering the average PA ratio is 24%, the effect of exchange rate risk on mode choice is economically significant.

Intermediary companies provide only intermediary services between assembly firms and foreign parties. Thus, exchange rate risks may have different effects on the value share of PA mode for these companies. We remove all intermediary companies and present results in Panel B of Table 9. The coefficients are similar with benchmark results. Finally, we redefine ERR_{-1} using exchange rate fluctuation of last six months instead of last year. Panel C of Table 8 shows that our benchmark pattern remain robust with this alternative measurement.

[19] One shortage of this measurement is that some firms were inactive in importing inputs in previous year and thus we cannot construct ERR_{t-1} for these firms. All observations in 2000 (the first year in our data) and some observations in following years are dropped.

[20] The beta coefficient standardizes the OLS coefficient to capture the change in standard deviation units of the dependent variable in response to a one standard deviation increase in the independent variable.

In sum, empirical results verify our argument and show that assembly firms have a higher probability of choosing PA mode when exchange rate risks in the previous period are larger.

6.1 Local Financial Development

In this section, we examine how local financial development would affect the relationship between exchange rate risk and trade mode choice. When firms are located in financially developed prefectures, they receive two potential benefits. First, they can access more financial tools to hedge against exchange rate fluctuations. Financial hedging is a substitute strategy with direct ERPT (Bartram et al., 2010). Second, the developed financial sector is helpful for decreasing the borrowing costs of firms. Thus, these firms have less financial constraints. Unconstrained importing firms can bear higher exchange rate risks (Strasser, 2013). Based on these two channels, higher local financial development would weaken the impact of exchange rate risks on trade mode choice. We examine this argument in the following regression:

$$PR_{kt} = \gamma_0 + \gamma_1 ERR_{kt-1} \times FinD_c + \gamma_2 ERR_{kt-1} + Z_{ct} + \rho_c + \phi_s + \lambda_t + \epsilon_{kt} \tag{6}$$

Here, $FinD_c$ is loans/GDP at the prefecture level, which measures local financial development. All other variables are the same as that of regression (3). Note that the pure effect of local financial development on mode choice is absorbed by the prefecture fixed effect. In Z_{ct}, we control other characteristics at the prefecture level: GDP and GDP per capita. The coefficient we are interested in is γ_1, which should be negative.

The results are shown in Table 10. The Panel A shows that only for foreign-owned assembly firms, high local financial development could weaken the impact of exchange rate risks. For other types of assembly firms, located in financially developed prefectures is not helpful. In China, Beijing and Shanghai are two special cities. The four largest state-owned banks in China are located in Beijing while more than half foreign-owned banks in China are located in Shanghai. Thus, we remove Beijing and Shanghai and present results in Panel B. Column 1 shows high local financial development is helpful to weaken the impact of exchange rate risks for all firm. However, this result is mainly driven by joint-owned and foreign-owned assembly firms. Finally, as shown in Table 3, most assembly firms are located in coastal provinces. Thus, we present the result in this sub-sample (Panel C). The

coefficients remain robust. In sum, we find that the effect of exchange rate risks could be mitigated by better local financial development. But this pattern only holds for joint-owned and foreign-owned assembly firms.

6.2 Industrial Liquidity Constraint

We further investigate how liquidity constraint at the industry level could exaggerate exchange rate risks and affect import mode choices. We hypothesize that firms in industries of higher liquidity needs are more responsive to exchange rate fluctuations and thus more likely to engage in PA mode. We use the following empirical specification with an interaction between exchange rate fluctuation (ERR) and liquidity constraints (LQ),

$$PR_{kt} = \theta_0 + \theta_1 ERR_{kt-1} \times LQ_s + \theta_2 ERR_{kt-1} + Z_{ct} + \rho_c + \phi_s + \lambda_t + \epsilon_{kt} \tag{7}$$

Here, LQ_s captures the degree of liquidity constraint firms in industry s face. Note that the pure effect of liquidity constraint on mode choice is absorbed by the industry fixed effect. The regression results are shown in Table 11. For firms with average liquidity index of 0.13, the combined coefficient on ERR is positive, indicating that larger exchange rate fluctuations lead to higher probability of using PA mode.[21] The positive and significant interaction term suggests that this effect becomes more pronounced for firms in industries with higher liquidity constraints. This result is robust across different ownerships. Our results are consistent with findings in Manova and Yu (2016). They demonstrate that firms with better financial health are associated with higher IA share among processing trade. In other words, firms facing liquidity constrains will be more likely to engage in PA mode. We provide further evidence that financial conditions of assembly firms affects their mode choices depending on potential exchange rate risks they face.

7 Conclusion

In this study, we examine the impact of exchange rates movements on import prices and its relationship with trade mode choices of assembly firms in China. First, we find that ERPT

[21]The share of industries with negative overall sign on ERR responses accounts only 4.5%.

depends on the entity who takes the responsibility of input source. Relative to foreign parties, state-owned or private-owned assembly firms bear higher but insignificant ERPT while joint-owned and foreign-owned assembly firms bear less ERPT. Second, we find that the ERPT is greater when assembly firms import differentiated materials. Thus, when we estimate the aggregate impact of exchange rate shocks, we should take into account the heterogeneous effects across firm ownership, sources of origin and types of product.

Then, we argue that the differences in ERPT may reflect different risks. We used exchange risks to explain the fact that state-owned assembly firms are more engaged in PA mode while joint-owned and foreign-owned assembly firms prefer IA mode. When the exchange rate risks are higher, assembly firms have higher possibility to choose PA mode. In addition, we find that higher local financial development could weaken this effect while higher industrial liquidity constraint could strengthen it. This paper points out an important friction for Chinese assembly firms: Exchange rate risks. The ability to bear exchange risks depends on financial conditions and affects input sourcing initiatives. Since independence input sourcing usually leads to higher profitability, policies trying to facilitate assembly firms should aim to improve their financial conditions.

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Table 1: Firm Number and Import Value by Trade Modes

Year	Trade Mode	Firm Number	Share[1]	Import Value[2]	Share[3]
2000	Only PA	4,849	14.57%	96	12.55%
	Only IA	24,259	72.90%	457	59.74%
	Both PA and IA	4,167	12.53%	212	27.71%
	Either PA or IA	33,275	100%	765	100%
2001	Only PA	5,549	15.97%	102	12.11%
	Only IA	24,631	70.90%	506	60.10%
	Both PA and IA	4,560	13.13%	234	27.79%
	Either PA or IA	34,740	100%	842	100%
2002	Only PA	6,260	17.13%	90	9.43%
	Only IA	25,788	70.55%	609	63.84%
	Both PA and IA	4,502	12.32%	255	26.73%
	Either PA or IA	36,550	100%	954	100%
2003	Only PA	6,943	17.38%	175	13.06%
	Only IA	28,279	70.79%	926	69.10%
	Both PA and IA	4,728	11.83%	239	17.84%
	Either PA or IA	39,950	100%	1,340	100%
2004	Only PA	7,819	17.70%	238	13.05%
	Only IA	31,013	70.20%	1260	69.08%
	Both PA and IA	5,346	12.10%	326	17.87%
	Either PA or IA	44,178	100%	1,824	100%
2005	Only PA	8,683	18.27%	281	12.66%
	Only IA	33,359	70.19%	1,530	68.95%
	Both PA and IA	5,483	11.54%	408	18.39%
	Either PA or IA	47,525	100%	2,219	100%
2006	Only PA	8,916	18.39%	449	17.66%
	Only IA	34,219	70.56%	1,760	69.24%
	Both PA and IA	5,357	11.05%	333	13.10%
	Either PA or IA	48,492	100%	2,542	100%

Data Sources: The "Chinese Customs Export and Import Database".

Notes: This table shows the firm numbers and import values by the trade modes.
1. The share is measured by the firm number ratio between the sub-sample (only PA, only IA, both PA and IA, either PA or IA) and the full sample.
2. The import value is the total import value of firms in the sub-sample and the unit is in billion yuan.
3. The share is measured by the value ratio between the sub-sample (only PA, only IA, both PA and IA, either PA or IA) and the full sample.

Table 2: Ownership and Trade Mode

Year	Ownership	Value[1]	Share	Value[1]	Share
		PA		IA	
2000	State-owned	151	76.54%	46.4	23.46%
	Private-owned	0.24	27.50%	0.62	72.50%
	Joint-owned	40	16.02%	210	83.98%
	Foreign-owned	39.6	12.51%	277	87.49%
2001	State-owned	161	76.77%	48.6	23.23%
	Private-owned	0.68	30.19%	1.56	69.81%
	Joint-owned	42.9	16.88%	211	83.12%
	Foreign-owned	52.6	14.00%	323	86.00%
2002	State-owned	165	77.59%	47.6	22.41%
	Private-owned	2.34	36.61%	4.05	63.39%
	Joint-owned	35.8	13.99%	220	86.01%
	Foreign-owned	62.2	12.98%	417	87.02%
2003	State-owned	165	74.25%	57.3	25.75%
	Private-owned	21.4	68.88%	9.67	31.12%
	Joint-owned	38.4	11.79%	288	88.21%
	Foreign-owned	91.0	11.98%	668	88.02%
2004	State-owned	184	71.60%	73.0	28.40%
	Private-owned	35.6	67.15%	17.4	32.85%
	Joint-owned	47.8	11.51%	368	88.49%
	Foreign-owned	168	15.29%	929	84.71%
2005	State-owned	188	68.47%	86.6	31.53%
	Private-owned	43.1	61.24%	27.3	38.76%
	Joint-owned	49.9	10.86%	410	89.14%
	Foreign-owned	256	18.07%	1,160	81.93%
2006	State-owned	190	66.66%	95.2	33.34%
	Private-owned	48.4	57.34%	36.0	42.66%
	Joint-owned	56.0	11.37%	437	88.64%
	Foreign-owned	283	16.81%	1,400	83.19%

Data Sources: The "Chinese Customs Export and Import Database".

Notes: This table shows the values by ownership and trade modes.
1. The unit is in billion yuan.
2. The share is either PA/(PA+IA) or IA/(PA+IA) under each ownership structure.

Table 3: Source of Origin, Firm Location and Product by Trade Mode

PA		IA	
Panel A: Source of Origin Share			
Taiwan	21.83%	Japan	18.58%
Japan	17.01%	Taiwan	18.45%
South Korea	16.37%	South Korea	13.53%
Mainland China	11.26%	Mainland China	12.96%
Hong Kong	5.70%	United States	5.16%
United States	4.83%	Hong Kong	4.72%
Others	23.00%	Others	26.63%
Panel B: Firm Location Share[1]			
Guangdong	52.51%	Guangdong	44.94%
Jiangsu	22.00%	Jiangsu	16.64%
Shanghai	7.91%	Shanghai	13.31%
Shandong	6.55%	Tianjin	4.63%
Liaoning	2.80%	Shandong	4.54%
Zhejiang	2.14%	Fujian	3.83%
Fujian	2.02%	Liaoning	3.53%
Tianjin	1.44%	Zhejiang	3.00%
Others	2.63%	Others	5.58%
Panel C: Product Variety Share[2]			
Electrical machinery and equipment (chapter 85)	32.36%	Electrical machinery and equipment (chapter 85)	45.53%
Optical, photographic, cinematographic (chapter 90)	10.58%	Nuclear reactors, boilers, machinery and mechanical appliances (chapter 84)	9.73%
Plastics (chapter 39)	9.24%	Optical, photographic, cinematographic (chapter 90)	8.33%
Nuclear reactors, boilers, machinery and mechanical appliances (chapter 84)	3.83%	Plastics (chapter 39)	6.96%
Others	43.99%	Others	29.45%

Data Sources: The "Chinese Customs Export and Import Database".

Notes: This table shows the source of origin, firm locations and product categories by the trade modes.
1. The location is at the province level, which include 32 provinces in Mainland China.
2. The product is at the HS2 level, which include 97 kinds of product categories.
3. The share is measured by the value ratio between the sub-sample and the full sample.

Table 4: Summary of Financial Data

Panel A: Local Financial Development			
Mean	0.88	Std. Dev.	0.44
Top Cities		**Bottom Cities**	
Beijing	3.29	Daqing	0.18
Xining	3.02	Kelamayi	0.23
Wurumuqi	2.38	Chongzuo	0.33
Yinchuan	2.38	Hezhou	0.33
Haikou	2.25	Jieyang	0.36
Panel B: Industry Liquidity Constraint			
Mean	0.13	Std. Dev.	0.04
Top Industries		**Bottom Industries**	
Tobacco Products	0.24	Printing and Publishing	0.04
Leather and Leather Products	0.17	Petroleum Refining and Related Industries	0.05
Primary Metal Industries	0.17	Chemicals and Allied Products	0.09

Data Sources: The "China City Statistical Yearbook" and "U.S. Compustat".

Table 5: ERPT and Trade Mode

	Dependent Variable: $\Delta \ln$(Price)			
	(1)	(2)	(3)	(4)
	Short-term		**Long-term**	
$\Delta \ln$(RER)	-0.0145	-0.0302	-0.2227***	-0.2629***
	(-1.114)	(-1.218)	(8.92)	(6.87)
$\Delta \ln$(RER) $\times$ Trade Mode		0.0261		0.0681
		(0.923)		(1.62)
Trade Mode	0.00155	0.00153	0.00152	0.00147
	(1.631)	(1.562)	(1.579)	(1.392)
Observations	12,808,500	12,808,500	12,808,500	12,808,500
R-squared	0.005	0.005	0.005	0.005
Product-Country FE	✓	✓	✓	✓
Firm FE	✓	✓	✓	✓
Time FE	✓	✓	✓	✓
Cluster By Country	✓	✓	✓	✓

Data Sources: The "Chinese Customs Export and Import Database" and IFS.

Notes: This table shows the ERPT in import prices.
1. The product is at the HS6 level. The trade mode is a dummy. If the product is traded under PA mode, then it is 0, and otherwise 1.
2. The price is in the yuan and the exchange rate is the real exchange rate between the source of origin and China. An increase in the real exchange rate implies an appreciation of the yuan.
3. The short-term ERPT means the response to the current month; the long-term ERPT means the response to the current and last three months.
4. F-statistics in parentheses for $\Delta \ln$(RER) and $\Delta \ln$(RER)$\times$Trade Mode, and t-statistics in parentheses for other variables. *Significant at 10%; **significant at 5%; ***significant at 1%.

Table 6: ERPT and Trade Mode By Ownership

	Dependent Variable: $\Delta \ln$(Price)			
	(1)	(2)	(3)	(4)
	Short-term		**Long-term**	
Panel A: State-owned				
$\Delta \ln$(RER)	0.0121	0.0149	-0.1262	-0.0927
	(0.545)	(0.615)	(2.42)	(2.03)
$\Delta \ln$(RER) × Trade Mode		-0.0191		-0.2268
		(-0.283)		(1.76)
Trade Mode	0.00203	0.00205	0.00202	0.00216
	(1.084)	(1.106)	(1.077)	(1.270)
Observations	2,536,094	2,536,094	2,536,094	2,536,094
R-squared	0.007	0.007	0.007	0.007
Panel B: Private-owned				
$\Delta \ln$(RER)	-0.0713	-0.121	-0.3339***	-0.2907**
	(-1.076)	(-1.570)	(8.04)	(5.04)
$\Delta \ln$(RER) × Trade Mode		0.217**		-0.2072
		(2.158)		(0.62)
Trade Mode	-0.00686**	-0.00721**	-0.00683**	-0.00688**
	(-2.371)	(-2.622)	(-2.359)	(-2.159)
Observations	411,180	411,180	411,180	411,180
R-squared	0.023	0.023	0.023	0.023
Panel C: Joint-owned				
$\Delta \ln$(RER)	0.0198	-0.0361	-0.2978***	-0.5195***
	(0.896)	(-1.292)	(11.24)	(8.04)
$\Delta \ln$(RER) × Trade Mode		0.0792***		0.3159**
		(3.908)		(4.52)
Trade Mode	-0.000109	-0.000254	-0.000204	-0.000701
	(-0.0504)	(-0.115)	(-0.0926)	(-0.273)
Observations	3,015,715	3,015,715	3,015,715	3,015,715
R-squared	0.007	0.007	0.007	0.007
Panel D: Foreign-owned				
$\Delta \ln$(RER)	-0.0418**	-0.0803**	-0.2216***	-0.3165***
	(-2.300)	(-2.312)	(-9.52)	(6.89)
$\Delta \ln$(RER) × Trade Mode		0.0495		0.1258*
		(1.584)		(3.29)
Trade Mode	0.00294***	0.00293***	0.00292***	0.00294***
	(3.065)	(3.143)	(3.060)	(3.227)
Observations	6,835,528	6,835,528	6,835,528	6,835,528
R-squared	0.005	0.005	0.005	0.005
Product-Country FE	✓	✓	✓	✓
Firm FE	✓	✓	✓	✓
Time FE	✓	✓	✓	✓
Cluster By Country	✓	✓	✓	✓

Data Sources: The "Chinese Customs Export and Import Database" and IFS.

Notes: This table shows the ERPT in import prices by ownership.
1. The product is at the HS6 level. The trade mode is a dummy. If the product is traded under PA mode, then it is 0, and otherwise 1.
2. The price is in the yuan and the exchange rate is the real exchange rate between the source of origin and China. An increase in the real exchange rate implies an appreciation of the yuan.
3. The short-term ERPT means the response to the current month; the long-term ERPT means the response to the current and last three months.
4. F-statistics in parentheses for $\Delta \ln$(RER) and $\Delta \ln$(RER)×Trade Mode, and t-statistics in parentheses for other variables. *Significant at 10%; **significant at 5%; ***significant at 1%.

Table 7: ERPT and Trade Mode Exclude U.S. Dollar Pegging Countries or Intermediary

	Dependent Variable: $\Delta \ln$(Price)			
	(1)	(2)	(3)	(4)
	State-owned	**Private-owned**	**Joint-owned**	**Foreign-owned**
Panel A: Exclude U.S. Dollar Pegging Countries				
$\Delta \ln$(RER)	-0.0990	-0.3424**	-0.5056***	-0.3110***
	(2.39)	(4.11)	(9.69)	(7.04)
$\Delta \ln$(RER) × Trade Mode	-0.2773	-0.2800	0.3207**	0.1303*
	(2.44)	(1.30)	(5.07)	(3.71)
Trade Mode	0.00253	-0.00885	0.000895	0.00366***
	(1.123)	(-1.454)	(0.444)	(2.828)
Observations	1,779,978	318,469	2,345,108	5,493,238
R-squared	0.009	0.024	0.008	0.005
Panel B: Exclude Intermediary				
$\Delta \ln$(RER)	-0.1521	-0.3908***	-0.5248***	-0.3169**
	(1.08)	(7.66)	(8.03)	(6.84)
$\Delta \ln$(RER) × Trade Mode	0.1539	-0.1509	0.3203**	0.1260*
	(0.39)	(0.36)	(4.51)	(3.23)
Trade Mode	0.00416	-0.00847	-0.000714	0.00295**
	(1.115)	(-0.749)	(-0.404)	(2.506)
Observations	519,783	168,654	3,014,603	6,832,520
R-squared	0.018	0.034	0.007	0.005
Product-Country FE	✓	✓	✓	✓
Firm FE	✓	✓	✓	✓
Time FE	✓	✓	✓	✓
Cluster By Country	✓	✓	✓	✓

Data Sources: The "Chinese Customs Export and Import Database" and IFS.

Notes: This table shows the long-term ERPT in import prices excluding U.S. dollar pegging countries.
1. The product is at the HS6 level. The trade mode is a dummy. If the product is traded under PA mode, then it is 0, and otherwise 1.
2. The price is in the yuan and the exchange rate is the real exchange rate between the source of origin and China. An increase in the real exchange rate implies an appreciation of the yuan.
3. F-statistics in parentheses for $\Delta \ln$(RER) and $\Delta \ln$(RER)×Trade Mode, and t-statistics in parentheses for other variables. *Significant at 10%; **significant at 5%; ***significant at 1%.

Table 8: ERPT and Product Category

	Dependent Variable: $\Delta \ln$(Price)			
	(1)	(2)	(3)	(4)
	State-owned	**Private-owned**	**Joint-owned**	**Foreign-owned**
$\Delta \ln$(RER) × Homogeneous	-0.0281	0.0474	-0.2619**	-0.2290***
	(0.11)	(0.13)	(4.15)	(7.24)
$\Delta \ln$(RER) × Homogeneous	-0.0114	-0.0709	0.0242	0.0911
× Trade Mode	(0.01)	(0.11)	(0.03)	(1.50)
$\Delta \ln$(RER) × Differentiated	-0.1208*	-0.3240**	-0.5391**	-0.3318**
	(3.01)	(5.44)	(6.69)	(6.29)
$\Delta \ln$(RER) × Differentiated	-0.2581	-0.3388	0.3476**	0.1271*
× Trade Mode	(1.54)	(1.79)	(4.27)	(3.21)
Trade Mode	0.002292	-0.007633**	-0.00076	0.003248***
	(1.40)	(-2.35)	(-0.30)	(4.05)
Observations	2,461,373	398,176	2,925,637	6,623,303
R-squared	0.007	0.023	0.007	0.005
Product-Country FE	✓	✓	✓	✓
Firm FE	✓	✓	✓	✓
Time FE	✓	✓	✓	✓
Cluster By Country	✓	✓	✓	✓

Data Sources: The "Chinese Customs Export and Import Database" and IFS.

Notes: This table shows the long-term ERPT in import prices by product category.
1. The product is at the HS6 level.
2. The price is in the yuan and the exchange rate is the real exchange rate between the source of origin and China. An increase in the real exchange rate implies an appreciation of the yuan.
3 $Homogeneous$ is 1 if the product is a homogeneous good; otherwise, it is 0. $Differentiated$ is 1 if the product is a differentiated good; otherwise, it is 0.
4. T-statistics in parentheses for Trade Mode, and F-statistics in parentheses for other variables. *Significant at 10%; **significant at 5%; ***significant at 1%.

Table 9: Exchange Rate Risk and Mode Choice

	Dependent Variable: PA Ratio				
	(1)	(2)	(3)	(4)	(5)
	All	**State-owned**	**Private-owned**	**Joint-owned**	**Foreign-owned**
Panel A: Benchmark					
ERR_{-1}	2.823***	0.521	3.380***	3.766***	2.232***
	(0.216)	(0.369)	(0.789)	(0.297)	(0.284)
Beta	0.0467	0.00994	0.0442	0.0661	0.0351
Observations	163,506	15,231	8,250	49,996	89,917
R-squared	0.340	0.334	0.345	0.372	0.400
Panel B: Only Non-intermediary Companies					
ERR_{-1}	2.931***	0.661	3.247***	3.761***	2.203***
	(0.227)	(0.470)	(0.847)	(0.297)	(0.283)
Beta	0.0485	0.0128	0.0447	0.0660	0.0347
Observations	154,773	8,448	6,401	49,974	89,828
R-squared	0.354	0.361	0.392	0.372	0.400
Panel C: Only Non-intermediary Companies & Alternative ERR					
ERR_{-1}	2.414***	0.596	3.141***	2.630***	1.895***
	(0.143)	(0.536)	(0.872)	(0.219)	(0.198)
Beta	0.0408	0.0110	0.0441	0.0484	0.0302
Observations	154,648	8,404	6,320	49,972	89,827
R-squared	0.354	0.361	0.394	0.370	0.400
Prefecture FE	✓	✓	✓	✓	✓
Industry FE	✓	✓	✓	✓	✓
Time FE	✓	✓	✓	✓	✓

Data Sources: The "Chinese Customs Export and Import Database" and IFS.

Notes: This table shows the impact of exchange rate risk on mode choice.
1. Alternative *ERR* is defined as the exchange rate fluctuation of last six months.
2. Robust standard errors in parentheses. *Significant at 10%; **significant at 5%; ***significant at 1%.

Table 10: Exchange Rate Risk and Mode Choice: Local Financial Development

	Dependent Variable: PA Ratio				
	(1)	(2)	(3)	(4)	(5)
	All	**State-owned**	**Private-owned**	**Joint-owned**	**Foreign-owned**
Panel A: Benchmark					
ERR_{-1}	5.334***	1.072	3.570	6.535***	4.997***
	(0.794)	(2.058)	(2.529)	(1.272)	(0.875)
$ERR_{-1}\times$ Loans/GDP	-1.516**	1.272	-0.225	-1.129	-2.127***
	(0.705)	(1.838)	(2.358)	(0.921)	(0.703)
ln(GDP)	-0.00896	0.0266	-0.240***	-0.0140	-0.00444
	(0.00831)	(0.0913)	(0.0869)	(0.0160)	(0.00966)
ln(GDP per Capita)	0.00153	0.0144	0.00950	0.00764	-0.00132
	(0.00362)	(0.0142)	(0.0205)	(0.00571)	(0.00449)
Observations	107,963	4,851	5,701	31,213	66,126
R-squared	0.358	0.354	0.385	0.369	0.397
Panel B: Without Shanghai and Beijing					
ERR_{-1}	5.918***	-0.422	4.813	7.153***	5.823***
	(0.765)	(2.443)	(2.968)	(1.527)	(0.938)
$ERR_{-1}\times$ Loans/GDP	-2.461***	2.490	-1.836	-2.115*	-3.371***
	(0.672)	(2.442)	(2.995)	(1.262)	(0.862)
ln(GDP)	-0.0132	0.0139	-0.219**	-0.0136	-0.00643
	(0.00874)	(0.1000)	(0.0891)	(0.0166)	(0.0103)
ln(GDP per Capita)	-8.85e-05	0.0149	0.0298	0.00894	-0.00132
	(0.00407)	(0.0164)	(0.0232)	(0.00720)	(0.00517)
Observations	97,356	4,341	5,282	26,702	60,958
R-squared	0.374	0.361	0.386	0.389	0.417
Panel C: Only Coastal Provinces Exclude Shanghai					
ERR_{-1}	6.947***	1.015	6.641**	8.373***	5.964***
	(0.870)	(3.141)	(3.154)	(1.747)	(0.978)
$ERR_{-1}\times$ Loans/GDP	-3.165***	1.442	-3.303	-3.099**	-3.439***
	(0.744)	(3.189)	(3.150)	(1.409)	(0.895)
ln(GDP)	-0.0100	0.0807	-0.214**	-0.0132	-0.00570
	(0.00882)	(0.125)	(0.0942)	(0.0170)	(0.0103)
ln(GDP per Capita)	0.00207	0.0205	0.0341	0.0118	-0.00112
	(0.00427)	(0.0201)	(0.0245)	(0.00775)	(0.00526)
Observations	93,094	3,507	4,889	25,082	59,597
R-squared	0.377	0.350	0.382	0.386	0.416
Prefecture FE	✓	✓	✓	✓	✓
Industry FE	✓	✓	✓	✓	✓
Time FE	✓	✓	✓	✓	✓

Data Sources: The "Chinese Customs Export and Import Database", IFS and "China City Statistical Yearbook".

Notes: This table shows the impact of exchange rate risk on mode choice.
1. We exclude intermediary companies from the sample.
2. Robust standard errors in parentheses. *Significant at 10%; **significant at 5%; ***significant at 1%.

Table 11: Exchange Rate Risk and Mode Choice: Industry Liquidity

	Dependent Variable: PA Ratio				
	(1)	(2)	(3)	(4)	(5)
	All	**State-owned**	**Private-owned**	**Joint-owned**	**Foreign-owned**
ERR_{-1}	-9.338***	-3.065	-5.023	-10.02***	-9.948***
	(1.314)	(2.403)	(3.910)	(1.937)	(1.193)
$ERR_{-1} \times LQ$	86.80***	23.03	61.41**	98.24***	86.43***
	(9.718)	(15.96)	(27.63)	(13.38)	(8.399)
Observations	155,383	8,572	6,351	50,157	90,186
R-squared	0.328	0.285	0.333	0.343	0.383
Prefecture FE	✓	✓	✓	✓	✓
Industry FE	✓	✓	✓	✓	✓
Time FE	✓	✓	✓	✓	✓

Data Sources: The "Chinese Customs Export and Import Database", IFS and "U.S. Compustat".

Notes: This table shows the impact of exchange rate risk on mode choice.
1. We exclude intermediary companies from the sample.
2. Robust standard errors in parentheses. *Significant at 10%; **significant at 5%; ***significant at 1%.

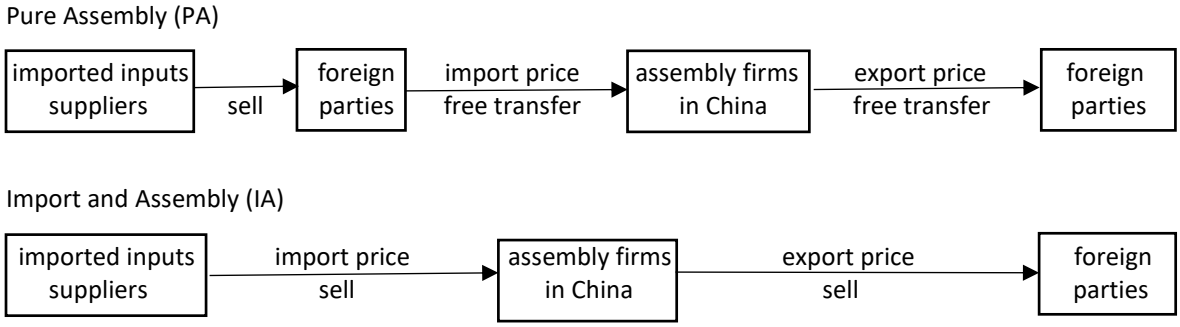

Figure 1: The Production Chains for the PA and IA trade modes

Notes: This figure shows the production chains for PA and IA modes, respectively. First, the assembly firm in China signs a production contract with a foreign party. Then, these firms decide which among them is in the charge of the imported inputs purchasing. In PA mode, the foreign party purchases the inputs and then transfers them to the assembly firm for free. Although the inputs are free, the foreign party still needs to report the values of these inputs to Chinese Customs. This is the "import price" observed in the customs data. In IA mode, an assembly firm in China purchases inputs by itself. After processing these inputs, the assembly firm either returns or sells the value-added good to the foreign party. This is the "export price" observed in the customs data.

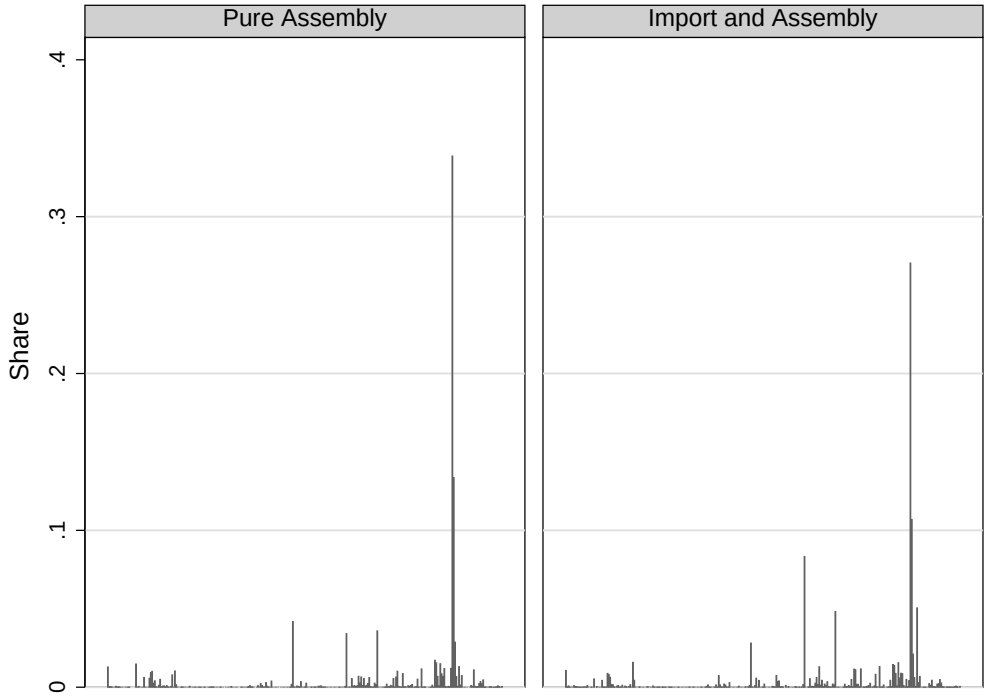

Figure 2: The Distribution Across Imported Product Varieties

Data Sources: The "Chinese Customs Export and Import Database".

Notes: This figure shows the distribution of imported product varieties within the "electrical machinery and equipment and parts thereof; sound recorders and reproducers, television image and sound recorders and reproducers, and parts and accessories of such articles" category (Chapter 85). Within this category, there are 290 kinds of products at the HS6 level. The x-axis is the product variety and the y-axis is the import value share of the product. The correlation of these shares between two trade modes is 0.97.

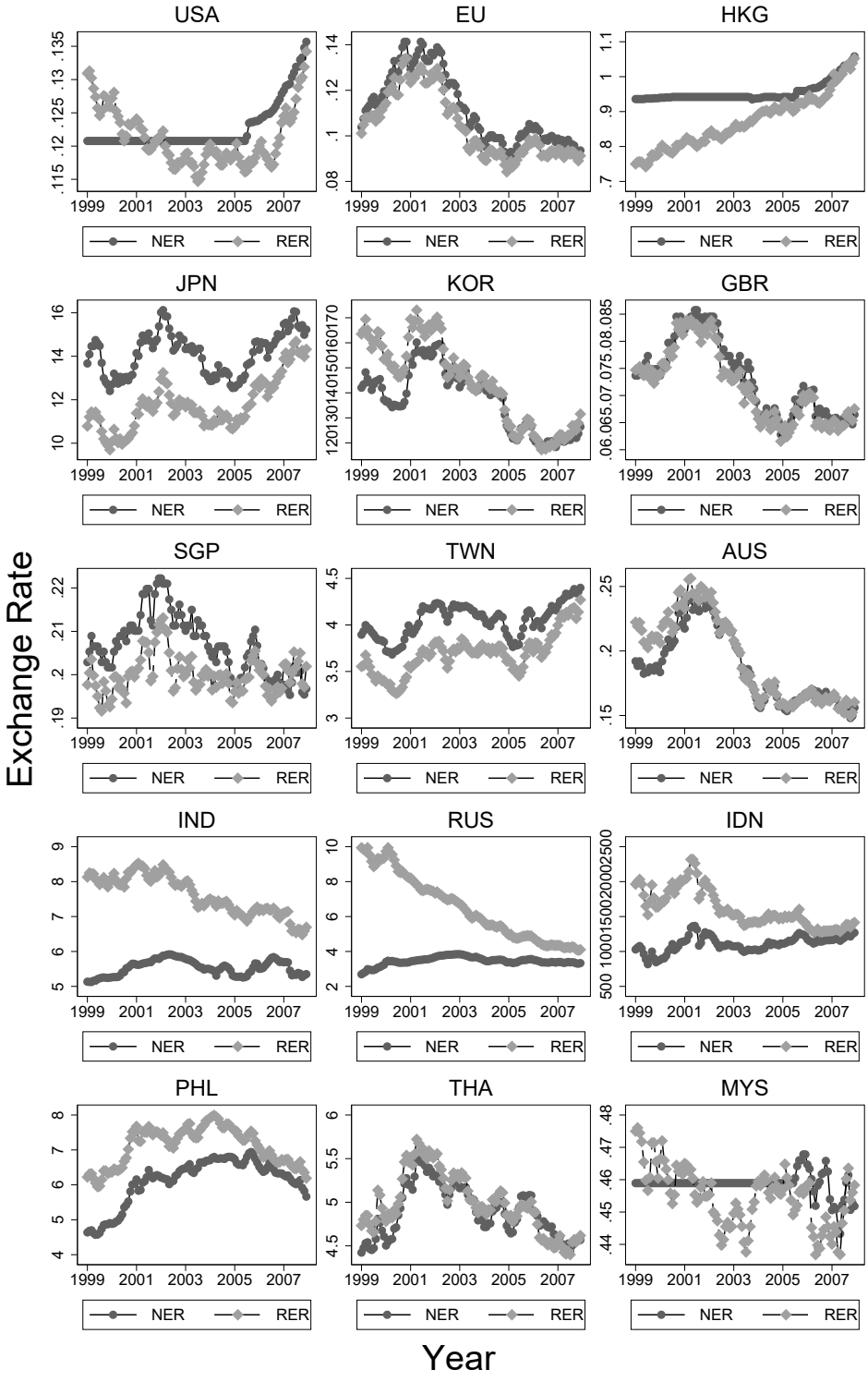

Figure 3: The Real and Nominal Exchange Rates with Main Trade Partners

Data Sources: The "IFS Database".
Notes: This figure shows the nominal and real exchange rates between China and its main trade partners.

A Appendix

A.1 ERPT in Export Prices

In this section, we investigate the ERPT in export prices. The regression specification is as follows:

$$\Delta \ln(P_{ijk(t-1,t)}) = \alpha_0 + \sum_{h=0}^{3} \alpha_{1h} \Delta \ln(RER_{j(t-h-1,t-h)}) + \alpha_2 \, Mode_{ijkt} + \mu_{ij} + \eta_k + \lambda_t + \epsilon_{ijkt} \quad \text{(A1)}$$

Here, P_{ijkt} is the export price (yuan) of product i to country j for firm k at time t. RER_{jt} is the real exchange rate between country j and China at time t. $Mode_{ijkt}$ is a dummy for the trade mode. If the product is traded under PA mode, then $Mode_{ijkt}$ is 0, and otherwise 1. μ_{ij} measures the product-country fixed effect, η_k measures the firm fixed effect and λ_t measures the time fixed effect. We take both export prices and real exchange rates in the first difference of log forms. $\sum_{h=0}^{3} \alpha_{1h}$ measures the long-term ERPT and is supposed to be negative. When Chinese yuan appreciates, the export price (yuan) should be decrease. In processing trade, the export price is decided when the contract is signed, after which the inputs are imported. Thus, we suspect that the ERPT in export prices would be lower than that in import prices. Table A1 presents the results. When Chinese yuan appreciates by 10%, the export price decreases by 0.9% (column 1). Compared with the ERPT in import prices (Table 5), this coefficient is smaller and insignificant. Li et al. (2015a) also investigate the ERPT in export prices using both ordinary and processing trade data. Their regression is at the firm-product-country-year level. They find that, with a 10% appreciation of Chinese yuan, export price drops by 0.35%. The coefficient in their paper is even smaller than ours. The difference might come from trade mode or time frequency.

A.2 ERPT in Import Prices, Cluster by Country-Month

The key explanatory variable of regression (2) is the real exchange rate, which is measured at the country-month level. In the main text, we cluster the standard errors by country. In this section, we re-run regression (2) for each ownership type and cluster the standard errors by country-month as a robustness check. The results in Table A2 are similar to that in Tables 5 and 6. Thus, our benchmark results are robust. That is, relative to foreign

Table A1: ERPT in Export Prices

	Dependent Variable: $\Delta \ln$(Price)				
	(1)	(2)	(3)	(4)	(5)
	All	**State-owned**	**Private-owned**	**Joint-owned**	**Foreign-owned**
$\Delta \ln$(RER)	-0.0914	-0.0663	-0.0512	-0.1568	-0.0800
	(1.99)	(1.96)	(0.39)	(2.13)	(1.7)
Trade Mode	-0.000256	-0.000710	-0.000138	0.00410**	-0.00125
	(-0.34)	(-0.71)	(-0.08)	(2.05)	(-0.92)
Observations	7,968,253	1,953,081	345,260	1,777,269	3,878,847
R-squared	0.009	0.010	0.029	0.017	0.011
Product-Country FE	✓	✓	✓	✓	✓
Firm FE	✓	✓	✓	✓	✓
Time FE	✓	✓	✓	✓	✓
Cluster By Country	✓	✓	✓	✓	✓

Data Sources: The "Chinese Customs Export and Import Database" and IFS.

Notes: This table shows the long-term ERPT in export prices.
1. The product is at the HS6 level. The trade mode is a dummy. If the product is traded under PA mode, then it is 0, and otherwise 1.
2. The price is in the yuan and the exchange rate is the real exchange rate between the export destination and China. An increase in the real exchange rate implies an appreciation of the yuan.
3. F-statistics in parentheses for $\Delta \ln$(RER), and t-statistics in parentheses for Trade Mode. *Significant at 10%; **significant at 5%; ***significant at 1%.

parties, state-owned and private-owned assembly firms bear higher ERPT but insignificant while joint-owned and foreign-owned assembly firms bear lower ERPT.

A.3 Bilateral Exchange Rate and Exchange Rate Between U.S. Dollar and Chinese Yuan

Boz et al. (2017) emphasizes the role of U.S. dollar exchange rate rather than bilateral exchange rate in price pass-through. Most trade flow in China is invoiced in U.S. dollar. In order to investigate which one is more important, bilateral exchange rate or exchange rate between U.S. dollar and Chinese yuan, we include both exchange rates in our estimation. The regression specification is as follows:

$$\begin{aligned}\Delta \ln(P_{ijk(t-1,t)}) = \ & \alpha_0 + \sum_{h=0}^{3} \alpha_{1h} \Delta \ln(RER_{j(t-h-1,t-h)}) + \sum_{h=0}^{3} \alpha_{2h} \Delta \ln(RER_{u(t-h-1,t-h)}) \\ & + \alpha_3 \, Mode_{ijkt} + \mu_{ij} + \eta_k + \lambda_t + \epsilon_{ijkt}\end{aligned} \tag{A2}$$

Table A2: ERPT in Import Prices, Cluster by Country-Month

	Dependent Variable: $\Delta \ln$(Price)			
	(1)	(2)	(3)	(4)
	Short-term		Long-term	
Panel A: Full Sample				
$\Delta \ln$(RER)	-0.0145	-0.0302	-0.2227***	-0.2629***
	(-0.639)	(-0.923)	(31.19)	(19.94)
$\Delta \ln$(RER) × Trade Mode		0.0261		0.0681
		(0.898)		(1.69)
Trade Mode	0.00155	0.00153	0.00152	0.00147
	(0.954)	(0.939)	(0.932)	(0.909)
Observations	12,808,500	12,808,500	12,808,500	12,808,500
R-squared	0.005	0.005	0.005	0.005
Panel B: State-owned				
$\Delta \ln$(RER)	0.0121	0.0149	-0.1262*	-0.0927
	(0.34)	(0.45)	(3.44)	(1.82)
$\Delta \ln$(RER) × Trade Mode		-0.0191		-0.2268
		(-0.16)		(1.17)
Trade Mode	0.00203	0.00205	0.00202	0.00216
	(0.51)	(0.52)	(0.51)	(0.55)
Observations	2,536,094	2,536,094	2,536,094	2,536,094
R-squared	0.007	0.007	0.007	0.007
Panel C: Private-owned				
$\Delta \ln$(RER)	-0.0713	-0.121	-0.3339*	-0.2907
	(-0.799)	(-1.285)	(3.25)	(2.16)
$\Delta \ln$(RER) × Trade Mode		0.217		-0.2072
		(1.297)		(0.43)
Trade Mode	-0.00686	-0.00721	-0.00683	-0.00688
	(-0.829)	(-0.875)	(-0.826)	(-0.837)
Observations	411,180	411,180	411,180	411,180
R-squared	0.023	0.023	0.023	0.023
Panel D: Joint-owned				
$\Delta \ln$(RER)	0.0198	-0.0361	-0.2978***	-0.5195***
	(0.564)	(-0.462)	(23.53)	(15.88)
$\Delta \ln$(RER) × Trade Mode		0.0792		0.3159**
		(1.003)		(5.30)
Trade Mode	-0.000109	-0.000254	-0.000204	-0.000701
	(-0.0346)	(-0.0795)	(-0.0645)	(-0.224)
Observations	3,015,715	3,015,715	3,015,715	3,015,715
R-squared	0.007	0.007	0.007	0.007
Panel E: Foreign-owned				
$\Delta \ln$(RER)	-0.0418	-0.0803	-0.2216***	-0.3165***
	(-1.610)	(-1.490)	(22.38)	(-11.82)
$\Delta \ln$(RER) × Trade Mode		0.0495		0.1258
		(0.954)		(1.89)
Trade Mode	0.00294	0.00293	0.00292	0.00294
	(1.190)	(1.187)	(1.178)	(1.190)
Observations	6,835,528	6,835,528	6,835,528	6,835,528
R-squared	0.005	0.005	0.005	0.005
Product-Country FE	✓	✓	✓	✓
Firm FE	✓	✓	✓	✓
Time FE	✓	✓	✓	✓
Cluster By Country-Month	✓	✓	✓	✓

Data Sources: The "Chinese Customs Export and Import Database" and IFS.

Notes:
1. The product is at the HS6 level. The trade mode is a dummy. If the product is traded under PA mode, then it is 0, and otherwise 1.
2. The price is in the yuan and the exchange rate is the real exchange rate between the source of origin and China. An increase in the real exchange rate implies an appreciation of the yuan.
3. The short-term ERPT means the response to the current month; the long-term ERPT means the response to the current and last three months.
4. Robust F-statistics in parentheses for $\Delta \ln$(RER) and $\Delta \ln$(RER)×Trade Mode, and t-statistics in parentheses for other variables. *Significant at 10%; **significant at 5%; ***significant at 1%.

Table A3: ERPT in Import Prices: Bilateral and US Exchange Rates

	Dependent Variable: $\Delta \ln$(Price)				
	(1)	(2)	(3)	(4)	(5)
	All	**State-owned**	**Private-owned**	**Joint-owned**	**Foreign-owned**
$\Delta \ln$(Bilateral RER)	-0.2908***	-0.2190***	-0.3729***	-0.3805***	-0.2698***
	(12.37)	(7.74)	(12.25)	(13.35)	(13.80)
$\Delta \ln$(US RER)	0.0193	0.0078	-0.5469*	0.0318	0.0404
	(0.03)	(0.00)	(3.50)	(0.01)	(0.20)
Observations	12,808,500	2,536,094	411,180	3,015,715	6,835,528
R-squared	0.005	0.007	0.023	0.007	0.005
Product-Country FE	✓	✓	✓	✓	✓
Firm FE	✓	✓	✓	✓	✓
Time FE	✓	✓	✓	✓	✓
Cluster By Country	✓	✓	✓	✓	✓

Data Sources: The "Chinese Customs Export and Import Database" and IFS.

Notes: This table shows the long-term ERPT in import prices.
1. The product is at the HS6 level.
2. The price is in the yuan and the exchange rate is the real exchange rate between the source of origin and China. An increase in the real exchange rate implies an appreciation of the yuan.
3. F-statistics in parentheses. *Significant at 10%; **significant at 5%; ***significant at 1%.

Here, P_{ijkt} is the import price (yuan) of product i from country j for firm k at time t. RER_{jt} is the real exchange rate between country j and China at time t. RER_{ut} is the real exchange rate between US and China at time t. $Mode_{ijkt}$ is a dummy for the trade mode. If the product is traded under PA mode, then $Mode_{ijkt}$ is 0, and otherwise 1. μ_{ij} measures the product-country fixed effect, η_k measures the firm fixed effect and λ_t measures the time fixed effect. Since RER_{ut} only has time variation, we control month fixed effect instead of year-month fixed effect. The result is presented in Table A3. When we include both bilateral and U.S. dollar exchange rates, only the former is significant. This finding based on firm information is different from what Boz et al. (2017) observe using country level aggregates. Our results suggest that the bilateral exchange rate plays a more important role on pass-through rather than the invoice currency in Chinese processing trade. Thus, we focus on the bilateral exchange rate in this study.

A.4 Real Exchange Rate Decomposition

The sources of real exchange rate movements can come from either nominal exchange rate fluctuations or relative CPI changes. Thus, we decompose the real exchange rate into two parts: the nominal exchange rate and the relative CPI, and investigate which plays a larger

Table A4: RER Decomposition: NER and Relative CPI

	Dependent Variable: $\Delta \ln$(Price)				
	(1)	(2)	(3)	(4)	(5)
	All	**State-owned**	**Private-owned**	**Joint-owned**	**Foreign-owned**
$\Delta \ln$(NER)	-0.2290***	-0.1313*	-0.2835**	-0.3060***	-0.2293***
	(9.83)	(2.93)	(5.16)	(12.26)	(10.48)
$\Delta \ln$(Relative CPI)	0.0911	-0.1003	0.8132*	0.1191	0.1128
	(0.62)	(0.34)	(3.07)	(0.39)	(1.09)
Observations	12,808,500	2,536,094	411,180	3,015,715	6,835,528
R-squared	0.005	0.007	0.023	0.007	0.005
Product-Country FE	✓	✓	✓	✓	✓
Firm FE	✓	✓	✓	✓	✓
Time FE	✓	✓	✓	✓	✓
Cluster By Country	✓	✓	✓	✓	✓

Data Sources: The "Chinese Customs Export and Import Database" and IFS.

Notes: This table shows the decomposition of ERPT in import prices.
1. The product is at the HS6 level.
2. The price is in the yuan and the exchange rate is the nominal exchange rate between the source of origin and China. An increase in the nominal exchange rate implies an appreciation of the yuan.
3. An increase in the relative CPI implies the inflation is higher in China.
4. F-statistics in parentheses. * Significant at 10%; **significant at 5%; ***significant at 1%.

role. The regression specification is as follows:

$$\begin{aligned}\Delta \ln(P_{ijk(t-1,t)}) = \ & \alpha_0 + \sum_{h=0}^{3} \alpha_{1h} \Delta \ln(NER_{j(t-h-1,t-h)}) + \sum_{h=0}^{3} \alpha_{2h} \Delta (CPI_{China}/CPI_j)_{t-1,t} \\ & + \alpha_3 \ Mode_{ijkt} + \mu_{ij} + \eta_k + \lambda_t + \epsilon_{ijkt}\end{aligned} \tag{A3}$$

Here, P_{ijkt} is the import price (yuan) of product i from country j for firm k at time t. NER_{jt} is the nominal exchange rate between country j and China at time t. $(CPI_{China}/CPI_j)_t$ is the relative CPI between China and country j at time t. $Mode_{ijkt}$ is a dummy for the trade mode. If the product is traded under PA mode, then $Mode_{ijt}$ is 0, and otherwise 1. The result is presented in Table A4. When nominal exchange rate appreciates, the price decreases. When the relative CPI in China is higher, the price increases but insignificant. Thus, price changes are mainly driven by nominal exchange rate changes compared to relative CPI change.[22]

[22]The coefficient of relative CPI changes is positive and significant only for private-owned assembly firms which may suggest that firms of different ownership have different source location preferences for their imported inputs.

A.5 Summary of Intermediary Companies

In this section, we present some facts about intermediary companies in processing trade. Panel A of Table A5 shows that the number of intermediary companies remains stable from 2000 to 2006. In 2000, the share of intermediary companies was 7.79%, and this decreased slightly to 7.27% in 2006. However, the total values imported by intermediary companies decreased significantly. In 2000, intermediary companies imported around 20% of total goods but in 2006, these firms imported only 8.4% of total goods. This finding implies that the role of intermediary companies is in decline. Some assembly firms no longer need intermediary services and can directly establish connections with foreign parties.

Panels B and C show that intermediary companies differ from non-intermediary companies in processing trade modes. Around 82% of non-intermediary companies were engaged in IA mode in 2006 and the import value was more than 77%. Only 73% of intermediary companies were engaged in IA mode and the total value was less than 25%. This finding implies that firms that cooperate with intermediary companies prefer to participate in PA mode. Some small firms cannot directly receive orders from foreign parties, and intermediary companies can supply such matching services. At the same time, these small firms do not have international market networks or cannot bear the exchange rate risks, and thus, they are engaged only in PA mode.

Table A6 shows the import value share of ownership for both non-intermediary and intermediary companies. Before 2003, state-owned intermediary companies import over 99% inputs in terms of values. In September 2003, China began to relax the regulation on direct trade rights and the capital requirement to become a intermediary company decreased from five million yuan to one million yuan. Thus, the value share by private-owned intermediary jumped in 2003. The value shares of joint-owned and foreign-owned intermediary are negligible.

A.6 Source of Origin

Existing studies (Manova and Zhang, 2012) argue that the quality of product is different across countries and the bargaining position of assembly firms also may vary across countries.

Table A5: Summary of Intermediary and Non-intermediary Companies

	Share of Firm Number		Value[1]	
Panel A: Full Sample				
Year	**Non-Intermediary**	**Intermediary**	**Non-Intermediary**	**Intermediary**
2000	92.21%	7.79%	611	154
2001	92.33%	7.67%	679	163
2002	92.88%	7.12%	788	166
2003	93.08%	6.92%	1,160	183
2004	93.01%	6.99%	1,610	210
2005	94.19%	5.81%	2,010	210
2006	92.73%	7.27%	2,330	214
Panel B: Non-Intermediary				
Year	**PA**	**IA**	**PA**	**IA**
2000	24.56%	85.80%	162	555
2001	26.75%	84.30%	181	618
2002	27.30%	83.04%	187	719
2003	27.12%	83.06%	240	1,060
2004	27.82%	82.71%	369	1,500
2005	28.33%	81.93%	494	1,860
2006	27.49%	82.24%	582	2,030
Panel C: Intermediary				
Year	**PA**	**IA**	**PA**	**IA**
2000	57.15%	81.06%	146	114
2001	57.38%	80.74%	155	122
2002	57.43%	80.71%	159	144
2003	57.32%	76.71%	173	103
2004	56.20%	76.92%	195	81.4
2005	55.13%	76.17%	196	77.3
2006	54.37%	73.42%	201	66.3

Data Sources: The "Chinese Customs Export and Import Database".

Notes: This table shows the summary of intermediary and non-intermediary companies.
1. The unit is in billion yuan.
2. Since a assembly firm in China can be engaged in both trade modes, the sum of shares of PA and IA modes is larger than 1.

Table A6: Intermediary Companies and Ownership

	Share of Value			
Year	**State-owned**	**Private-owned**	**Joint-owned**	**Foreign-owned**
Panel A: Non-Intermediary				
2000	7.23%	0.12%	40.79%	51.85%
2001	6.92%	0.30%	37.43%	55.35%
2002	6.02%	0.66%	32.51%	60.82%
2003	5.12%	1.01%	28.19%	65.67%
2004	4.91%	1.32%	25.75%	68.01%
2005	4.93%	1.81%	22.84%	70.42%
2006	4.90%	1.80%	21.14%	72.15%
Panel B: Intermediary				
2000	99.75%	0.06%	0.13%	0.06%
2001	99.66%	0.13%	0.14%	0.06%
2002	99.12%	0.74%	0.09%	0.06%
2003	89.29%	10.58%	0.04%	0.09%
2004	84.79%	15.1%	0.03%	0.08%
2005	83.67%	16.17%	0.02%	0.14%
2006	79.88%	19.86%	0.01%	0.25%

Data Sources: The "Chinese Customs Export and Import Database".

Notes: This table shows the import value share of ownership for both non-intermediary and intermediary companies.

Thus, we divide sources of origin into two groups: developed and developing countries.[23] Then, we investigate the ERPT for these two groups. Table A7 shows that the result is robust for developed countries and the coefficient of ERPT is insignificant for developing countries. This means that the exchange rate risk is almost zero for assembly firms in China and there is no significant difference between the two trade modes. One possibility is that assembly firms in China have a strong bargaining position when they import inputs from developing countries.

A.7 Alternative Industry Classification

In the main text, we use the HS2 code that comprises at least 50% of all export values to classify the industry that a firm belongs to. We drop those firms that do not have any HS2 code that is at least 50% of all export values. The export values of these dropped firms account for about 20% of all export values. In order to solve the sample selection concern,

[23]The developed countries (regions) include 34 OECD countries plus Hong Kong, and Taiwan.

Table A7: ERPT in Import Prices: Source of Origin

	Dependent Variable: $\Delta \ln$(Price)			
	(1)	(2)	(3)	(4)
	State-owned	**Private-owned**	**Joint-owned**	**Foreign-owned**
Panel A: Developed Countries				
ln(RER)	-0.1030	-0.1865	-0.5298***	-0.3562***
	(1.92)	(2.24)	(7.71)	(7.63)
ln(RER) × Trade Mode	-0.2240	-0.3023	0.2964*	0.1210*
	(1.93)	(1.36)	(3.62)	(2.90)
Trade Mode	0.00214	-0.00685*	-0.000459	0.00319***
	(1.24)	(-1.80)	(-0.17)	(3.70)
Observations	2,267,595	360,266	2,752,931	6,172,677
R-squared	0.007	0.024	0.007	0.005
Panel B: Developing Countries				
ln(RER)	-0.1259	-0.8178***	-0.5087	0.0470
	(0.64)	(15.57)	(1.05)	(0.05)
ln(RER) × Trade Mode	0.2415	0.6914	0.4237	-0.0730
	(0.64)	(2.54)	(0.87)	(0.14)
Trade Mode	-0.00958	-0.00730*	-0.00893**	0.00147
	(-0.89)	(-1.71)	(-2.55)	(0.40)
Observations	268,086	50,643	261,874	661,275
R-squared	0.012	0.024	0.014	0.009
Product-Country FE	✓	✓	✓	✓
Firm FE	✓	✓	✓	✓
Time FE	✓	✓	✓	✓
Cluster By Country	✓	✓	✓	✓

Data Sources: The "Chinese Customs Export and Import Database" and IFS.

Notes: This table shows the long-term ERPT in import prices by source of origin.
1. The product is at the HS6 level. The trade mode is a dummy. If the product is traded under PA mode, then it is 0, and otherwise 1.
2. The price is in the yuan and the exchange rate is the real exchange rate between the source of origin and China. An increase in the real exchange rate implies an appreciation of the yuan.
3. The developed countries (regions) include 34 OECD countries plus Hong Kong, and Taiwan.
4. F-statistics in parentheses for $\Delta \ln$(RER) and $\Delta \ln$(RER)×Trade Mode, and t-statistics in parentheses for other variables. *Significant at 10%; **significant at 5%; ***significant at 1%.

Table A8: Exchange Rate Risk and Mode Choice

	Dependent Variable: PA Ratio				
	(1)	(2)	(3)	(4)	(5)
	All	**State-owned**	**Private-owned**	**Joint-owned**	**Foreign-owned**
Panel A: Benchmark					
ERR_{-1}	2.759***	0.333	3.265***	3.740***	2.214***
	(0.211)	(0.354)	(0.786)	(0.292)	(0.279)
Beta	0.0452	0.00605	0.0422	0.0656	0.0348
Observations	169,752	17,611	8,544	50,891	92,596
R-squared	0.331	0.345	0.335	0.371	0.400
Panel B: Only Non-intermediary Companies					
ERR_{-1}	2.893***	0.524	3.244***	3.735***	2.185***
	(0.222)	(0.467)	(0.847)	(0.292)	(0.278)
Beta	0.0478	0.00987	0.0444	0.0655	0.0343
Observations	158,904	8,933	6,485	50,864	92,504
R-squared	0.351	0.361	0.380	0.371	0.400
Panel C: Only Non-intermediary Companies & Alternative ERR					
ERR_{-1}	2.376***	0.375	3.190***	2.589***	1.896***
	(0.142)	(0.532)	(0.871)	(0.217)	(0.195)
Beta	0.0400	0.00677	0.0445	0.0476	0.0302
Observations	158,768	8,884	6,399	50,862	92,503
R-squared	0.351	0.362	0.382	0.369	0.400
Prefecture FE	✓	✓	✓	✓	✓
Industry FE	✓	✓	✓	✓	✓
Time FE	✓	✓	✓	✓	✓

Data Sources: The "Chinese Customs Export and Import Database" and IFS.

Notes: This table shows the impact of exchange rate risk on mode choice.
1. Alternative *ERR* is defined as the exchange rate fluctuation of last six months.
2. Robust standard errors in parentheses. *Significant at 10%; **significant at 5%; ***significant at 1%.

in this section we use another way to classify the industry for firms as a robustness check. We use the HS2 code that comprises the highest export values to represent the industry for firms. The results are presented in Tables A8-A10.

Table A9: Exchange Rate Risk and Mode Choice: Local Financial Development

	Dependent Variable: PA Ratio				
	(1)	(2)	(3)	(4)	(5)
	All	**State-owned**	**Private-owned**	**Joint-owned**	**Foreign-owned**
Panel A: Benchmark					
ERR_{-1}	5.166***	0.768	3.558	6.426***	4.837***
	(0.778)	(2.053)	(2.530)	(1.249)	(0.859)
$ERR_{-1}\times$ Loans/GDP	-1.423**	1.324	-0.242	-1.071	-2.020***
	(0.696)	(1.831)	(2.361)	(0.909)	(0.702)
ln(GDP)	-0.00805	-0.0170	-0.218**	-0.0107	-0.00326
	(0.00823)	(0.0884)	(0.0921)	(0.0157)	(0.00947)
ln(GDP per Capita)	0.00102	0.0163	0.00731	0.00746	-0.00167
	(0.00358)	(0.0141)	(0.0204)	(0.00565)	(0.00443)
Observations	110,772	5,030	5,779	31,758	68,133
R-squared	0.355	0.358	0.372	0.368	0.396
Panel B: Without Shanghai and Beijing					
ERR_{-1}	5.865***	-0.416	4.934*	7.156***	5.758***
	(0.751)	(2.436)	(2.976)	(1.502)	(0.917)
$ERR_{-1}\times$ Loans/GDP	-2.503***	2.130	-2.023	-2.187*	-3.373***
	(0.663)	(2.431)	(3.009)	(1.246)	(0.846)
ln(GDP)	-0.0122	-0.0360	-0.195**	-0.0109	-0.00494
	(0.00867)	(0.0960)	(0.0946)	(0.0163)	(0.0101)
ln(GDP per Capita)	-0.000621	0.0172	0.0271	0.00798	-0.00149
	(0.00403)	(0.0164)	(0.0232)	(0.00713)	(0.00509)
Observations	99,962	4,503	5,357	27,183	62,846
R-squared	0.371	0.367	0.372	0.390	0.417
Panel C: Only Coastal Provinces Exclude Shanghai					
ERR_{-1}	6.884***	1.094	6.761**	8.401***	5.914***
	(0.852)	(3.135)	(3.157)	(1.718)	(0.955)
$ERR_{-1}\times$ Loans/GDP	-3.194***	0.932	-3.510	-3.187**	-3.451***
	(0.732)	(3.171)	(3.159)	(1.390)	(0.877)
ln(GDP)	-0.00951	0.00236	-0.189*	-0.0126	-0.00420
	(0.00874)	(0.117)	(0.101)	(0.0167)	(0.0101)
ln(GDP per Capita)	0.00169	0.0228	0.0307	0.0109	-0.00112
	(0.00422)	(0.0200)	(0.0245)	(0.00766)	(0.00517)
Observations	95,669	3,663	4,958	25,557	61,471
R-squared	0.374	0.354	0.368	0.386	0.415
Prefecture FE	✓	✓	✓	✓	✓
Industry FE	✓	✓	✓	✓	✓
Time FE	✓	✓	✓	✓	✓

Data Sources: The "Chinese Customs Export and Import Database", IFS and "China City Statistical Yearbook".

Notes: This table shows the impact of exchange rate risk on mode choice.
1. We exclude intermediary companies from the sample.
2. Robust standard errors in parentheses. *Significant at 10%; **significant at 5%; ***significant at 1%.

Table A10: Exchange Rate Risk and Mode Choice: Industry Liquidity

	Dependent Variable: PA Ratio				
	(1)	(2)	(3)	(4)	(5)
	All	**State-owned**	**Private-owned**	**Joint-owned**	**Foreign-owned**
ERR_{-1}	-9.254***	-3.098	-5.222	-9.894***	-9.801***
	(1.295)	(2.350)	(3.885)	(1.910)	(1.179)
$ERR_{-1} \times LQ$	85.91***	21.85	61.87**	97.29***	85.17***
	(9.574)	(15.16)	(27.52)	(13.21)	(8.290)
Observations	158,645	8,881	6,412	50,800	92,438
R-squared	0.325	0.291	0.324	0.342	0.383
Prefecture FE	✓	✓	✓	✓	✓
Industry FE	✓	✓	✓	✓	✓
Time FE	✓	✓	✓	✓	✓

Data Sources: The "Chinese Customs Export and Import Database", IFS and "U.S. Compustat".

Notes: This table shows the impact of exchange rate risk on mode choice.
1. We exclude intermediary companies from the sample.
2. Robust standard errors in parentheses. *Significant at 10%; **significant at 5%; ***significant at 1%.