Does Yuan Appreciation Weaken the Increase in Exporters due to Trade Liberalization? Evidence from Chinese Firm-Product Data*

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Abstract

The Melitz (2003) model with exchange rates and sticky wages predicts that the extensive margin of exports can respond to both trade liberalization and nominal exchange rates, which might not, however, be supported by data according to the well-known argument about temporary vs. permanent shocks. Using Chinese firm-product data from 2000 to 2006, this paper empirically tests this theoretical prediction. Based on regressions, we have four main findings. First, reductions in tariffs, charged by China's trade partners, increased China's exporter numbers and export value/quantity per exporter at the product level, whereas the appreciation of China's yuan caused a decrease; in fact, the response to exchange rates is larger than that to tariffs in all cases. Second, using export variety as an alternative measurement of the extensive margin of exports provides similar results. Third, reductions in tariffs, charged by trade partners, increased not only entry but also exit of China's exporters, and yuan appreciation decreased them. Fourth, the implied elasticities of exporter numbers and export variety with respect to tariffs are, respectively, 0.0487 and 0.0116 while those with respect to nominal exchange rates are 0.11 and 0.0202.

JEL classification: F12, F14, F31

Keywords: Melitz model, exchange rates, tariffs, extensive margin of exports, trade elasticity, China

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1 Introduction

More and more Chinese firms have been entering foreign markets. In addition, as Figure 1 shows, recently China has faced significant changes in both tariffs, charged by trade partners, and nominal exchange rates. These observations raise a question: Can the number of exporters—the extensive margin (EM) of exports—respond to both tariffs and nominal exchange rates? This question is important because, although it has been empirically documented that the EM increases after trade liberalization (e.g., Kehoe and Ruhl, 2013), the observed changes in EM after trade liberalization might have been results weakened or strengthened by changes in nominal exchange rates.

Theoretically, the answer to this question is yes. The introduction of nominal exchange rates and sticky wages into the Melitz (2003) model of heterogeneous firm trade predicts that the EM of exports can respond to not only trade liberalization but also nominal exchange rates (e.g., Rodríguez-López, 2011).[1] Empirically, however, the answer might be no, according to the well-known argument by Ruhl (2008) that firms do not change their exporting status in response to temporary shocks (exchange rates or productivity) while some firms do change it in response to permanent shocks (tariffs).

We empirically test the aforementioned prediction by the Melitz (2003) model.[2] We use Chinese data because China has recently been conducting the simultaneous trade liberalization and currency policies as indicated by Figure 1; thus, China is an interesting case to investigate the responses of the EM of exports to trade liberalization vs. exchange rates. Specifically, we use Chinese firm-product annual data from 2000 to 2006 with 170 trade partners to test whether the appreciation (depreciation) of China's yuan weakens (strengthens) the response of the EM of China's exports to trade liberalization.

The benchmark regression results suggest that reductions in tariffs charged by China's trade partners increased China's exporter numbers at the product level, whereas the appreciation (depreciation) of China's yuan decreased (increased) them. The results support the

[1] As will be mentioned later, by developing a sticky-wage model of heterogeneous firm trade with exchange rates and endogenous markups, Rodríguez-López (2011) extends the discussion of the Melitz model to analyze the response of the EM of trade to nominal exchange rates. Bergin and Lin (2008) also examine the response to exchange rates, in particular, exchange rate regimes.

[2] Notably, as mentioned by Baggs et al. (2009), most empirical studies that have examined tariff changes/trade liberalization include exchange rates as a control variable; however, the analysis is at the industry level, not at the firm level.

theoretical prediction. The regression results are similar for the export value and quantity per exporter—the intensive margin (IM) of exports—at the product level. We emphasize that, in all cases, the response to nominal exchange rates is larger than that to tariffs.

When we investigate the responses of the entry and exit of China's exporters, the regression results suggest that reductions in tariffs, charged by its trade partners, increased not only entry but also exit of exporters and that yuan appreciation (depreciation) decreased (increased) them. This is because reductions in tariffs could encourage additional Chinese firms to enter. It could increase the competition in foreign markets, forcing low productivity exporters to exit. Feng et al. (2017) also empirically document that the entry and exit of Chinese exporters increased following China's World Trade Organization (WTO) accession in 2002. We also investigate the responses of the EM and IM of exports to tariffs and nominal exchange rates on the basis of export variety, and the results are similar.

We also perform several robustness checks regarding trade modes (ordinary vs. processing trade), export destinations (OECD vs. non-OECD countries; main trade partners), real exchange rates, high frequency data (quarterly), and sectoral and product differences. We find that the responses to tariffs and exchange rates are significantly different between processing and ordinary trade firms and that the significance of the coefficients is greater if the export destinations are non-OECD countries. The benchmark results are robust to real exchange rates and quarterly data. The coefficients of the EM of exports on tariffs are significant in 5 sectors in China's top 10 export sectors at the HS2 level while the coefficients on exchange rates are significant in 9 sectors. Finally, we discuss both firm- and aggregate-level implications from our results. We particularly want to emphasize that the implied elasticities of exporter numbers and export variety with respect to tariffs are, respectively, 0.0487 and 0.0116 (much smaller than estimates in the literature) while those with respect to nominal exchange rates are 0.11 and 0.0202.

Our study makes the following contributions to the literature on the EM of trade. Melitz (2003) focuses on the response of the EM of trade to trade liberalization, and Rodríguez-López (2011) focuses on the response of the EM of trade to nominal exchange rates. We focus on the responses of the EM of trade to these two factors; in particular, we use Chinese firm-product data to empirically investigate whether the response of the EM of China's exports to trade liberalization is weakened (strengthened) by China's yuan appreciation (depreciation).

Of course, there are studies that have empirically investigated the responses of firms or exporters to trade liberalization vs. exchange rates (e.g., Baggs et al., 2009 ; Fitzgerald and Hallerz, 2017). They have, however, focused on real exchange rates while we shed light on the significance of nominal exchange rates. Feenstra (1989) theoretically argues that the responses of the import price to tariffs and exchange rates are symmetric, and empirically verifies this argument using U.S. import prices of Japanese cars, trucks, and motorcycles. Motivated by Feenstra (1989), Baggs et al. (2009) (BBF) empirically test, using Canadian industry-firm annual data, if real exchange rates affect Canadian firm survival/exit, and they find that the overall effect of the real exchange rate changes is comparable to that of the Canada-U.S. Free Trade Agreement tariff changes, although the coefficient on the real exchange rate changes is smaller. Moreover, Fitzgerald and Hallerz (2017) (FH) empirically test if Irish exporters respond symmetrically to tariffs and real exchange rates using Irish firm-product annual data. FH are similar to BBF, in that both empirically test the equivalence between tariffs and real exchange rates, particularly for developed countries. FH are also similar to our paper, in that both focus on the responses of exporters while BBF look at all Canadian firms. Thus, FH are somewhere in between BBF and our paper. The three studies present different results: the response to exchange rates is larger than that to tariffs in China (our paper), whereas it is smaller in Canada (BBF) and Ireland (FH). Therefore, these three papers are satisfactory complements. FH uses the forward-looking investment in customer base to explain Ireland's case while our paper uses fixed cost and sticky wages to explain China's case.

Our paper also makes contributions to the literature on trade elasticity, in particular, EM elasticity. Our results imply that the elasticity of exporter numbers with respect to tariffs is 0.0487; that with respect to nominal exchange rates 0.11; and that with respect to real exchange rates 0.193. On the other hand, the estimated elasticity of exporter numbers with respect to tariffs by Bas et al. (2017) is 3.83, which is much larger than ours. That with respect to real exchange rates by Tang and Zhang (2012) is 0.17, which is close to ours. Our results also imply that the elasticity of export variety with respect to tariffs is 0.0116; that with respect to nominal exchange rates 0.0202; and that with respect to real exchange rates 0.086. The estimated elasticity of export variety with respect to tariffs by Feenstra and Kee (2007) is about 2, which is much larger than ours. That with respect to real exchange rates

by Colacelli (2010) is 0.045, which is close to ours in that both are less than 0.1. To our knowledge, however, no past studies have estimated the elasticity of exporter numbers or export variety with respect to nominal exchange rates.

The rest of this paper is organized as follows. Section 2 provides theoretical motivation for our empirical question. Section 3 documents the regression specification and data. Section 4 reports the regression results and robustness checks. Section 5 discusses firm- and aggregate-level implications from our results. Section 6 concludes.

2 Theoretical Motivation

We introduce nominal exchange rates and sticky wages to the Melitz (2003) model of heterogeneous firm trade to guide our empirical analysis on the relationship between tariffs/nominal exchange rates and the EM of exports. Our model is a simplified version of the Rodríguez-López (2011) model.[3] There are two countries: Home and Foreign. There is a continuum of households in the interval $[0, 1]$, and each household provides labor to the production of differentiated goods in each country. There are firms heterogeneous in productivity, and each firm produces a single variety under monopolistic competition. Home and Foreign markets are segmented.

First, we set up the preferences and production and show the equilibrium exporting cutoff productivity level for Home firms. Then, we derive the proposition regarding the elasticity of the exporting cutoff/exporter numbers with respect to tariffs and that with respect to nominal exchange rates.

Preferences

The representative Home household has the CES preferences for a continuum of differentiated

[3]While Rodríguez-López (2011) analyzes the Melitz (2003) model with nominal exchange rates, sticky wages, and translog preferences (endogenous markup) in main text, he also analyzes the Melitz model with nominal exchange rates, sticky wages, and CES preferences (constant markup) in appendix and shows that the results are robust. We simplify the latter CES preference (constant markup) model to focus on analyzing the relationship between tariffs/nominal exchange rates and the EM of exports.

goods produced in Home and Foreign. The utility function is then given by

$$U = \left(\int_{i \in \Delta'} q_i^{\frac{\nu-1}{\nu}} \right)^{\frac{\nu}{\nu-1}},$$

where q_i is consumption of variety i, $\nu > 1$ is the elasticity of substitution between varieties, and $\Delta' = [0, N]$ is the set of available varieties at Home.

Solving the utility maximization problem gives the demand for variety i

$$q_i = \left(\frac{p_i}{P}\right)^{-\nu} Q,$$

where p_i is the price of variety i and $P = (\int_{i \in \Delta'} p_i^{1-\nu})^{\frac{1}{1-\nu}}$ is the price of the composite good Q. The total expenditure of this household is $I = PQ$. Since households are located in the unit interval, the market demand and the representative household's demand are equivalent.

Production

The production function of a Home firm with productivity ϕ is given by

$$y(\phi) = \phi L,$$

where $y(\phi)$ is the output of a Home firm with productivity ϕ and L is the only factor of production.[4] As in the Melitz model, producers are heterogeneous in productivity, and each producer knows its productivity, ϕ, only after entry. The productivity is Pareto distributed in the interval $[\phi_{min}, \infty)$, and thus the cumulative distribution function for productivity is $G(\phi) = 1 - (\phi_{min}/\phi)^{\kappa}$, where $\kappa > 1$ is a parameter of productivity dispersion (the higher κ, the lower heterogeneity).

As does Rodríguez-López (2011), we assume that nominal wages are fixed at W in the Home currency. Then the marginal cost of a Home firm with productivity ϕ is constant at W/ϕ. Foreign production can analogously be defined. The production function of a Foreign firm with productivity ϕ is just $y^*(\phi) = \phi L^*$, where y^* is the output of a Foreign firm with

[4] In Rodríguez-López (2011), the production function of a Home firm with productivity ϕ is given by $y(\phi) = Z\phi L$, where Z is an aggregate labor productivity factor. Because Z is not necessary for our purpose, we set $Z = 1$ for simplification.

productivity ϕ and L^* is the Foreign labor. With fixed wages W^* in the Foreign currency, its marginal cost is W^*/ϕ.

There is the fixed cost of entry in terms of labor: f_E and f_E^* for Home and Foreign firms, respectively. There is also the fixed cost from selling in each market.[5] The fixed cost from selling in the Home market is f_D for Home firms and f_X^* for Foreign firms; the fixed cost from selling in the Foreign market is f_X for Home firms and f_D^* for Foreign firms. Another exporting cost is an iceberg cost. τ denotes the iceberg cost for Home firms so that a Home exporter must ship $\tau > 1$ units of the good in order for one unit to reach the Foreign market. We interpret $\tau - 1$ as tariffs imposed by Foreign. Similarly, τ^* denotes the iceberg cost for Foreign firms, and we interpret $\tau^* - 1$ as tariffs imposed by Home.

The profit maximizing domestic price in the Home currency for a Home firm with productivity ϕ is given by

$$p_D(\phi) = (1+\mu)\frac{W}{\phi},$$

where μ is the constant markup over marginal cost and equals

$$\mu = \frac{1}{\nu - 1}.$$

As does Rodríguez-López (2011), let ϵ be the exogenous nominal exchange rates defined as the price of the Foreign currency in terms of the Home currency (e.g., China's yuan per U.S. dollar). Then the export price in the Foreign currency for a Home firm with productivity ϕ is given by

$$p_X(\phi) = \tau(1+\mu)\frac{W}{\epsilon\phi}. \tag{2.1}$$

Equilibrium Exporting Cutoff

Then, we can derive the equilibrium exporting cutoff level for Home firms:

$$\phi_X = \tau\left[(\frac{f_X}{f_D^*})^{\frac{1}{\nu}}\frac{W}{\epsilon W^*}\right]^{\frac{\nu}{\nu-1}}\phi_D^*, \tag{2.2}$$

where ϕ_D^* is the cutoff productivity level for Foreign firms selling in the Foreign market and

[5] Without fixed costs in this CES model, it is always optimal for firms to produce a positive output for each market.

equals

$$\phi_D^* = \frac{f_D^{*\frac{1}{\kappa}}}{\tau \mathscr{F}^{*\frac{1}{\kappa}}} \left[\frac{(\tau\tau^*)^\kappa F^{\frac{\kappa-(\nu-1)}{\nu-1}} - 1}{\tau^{*\kappa} F^{\frac{\kappa-(\nu-1)}{\nu-1}} - \frac{1}{(\rho\epsilon)^{\frac{\kappa\nu}{\nu-1}}} \left(\frac{f_X}{f_D^*}\right)^{\frac{\kappa-(\nu-1)}{\nu-1}}} \right]^{\frac{1}{\kappa}}, \tag{2.3}$$

where $F = (f_X f_X^*)/(f_D f_D^*)$, $\rho = (\mathscr{F}^*/\mathscr{F})^{\frac{\nu-1}{\kappa\nu}}(W^*/W)$, $\mathscr{F}^* = [\kappa-(\nu-1)]/(\kappa\phi_{min}^\kappa)(\delta f_E^* + f_D^* + f_X^*)$, $\mathscr{F} = [\kappa-(\nu-1)]/(\kappa\phi_{min}^\kappa)(\delta f_E + f_D + f_X)$ and δ is a proportion of existing firms in each country to exit.[6]

Elasticity of the Exporting Cutoff and Exporter Numbers

Then, we obtain the following proposition.[7]

Proposition:

(a) The elasticity of the exporting cutoff with respect to tariffs for Home firms is:

$$\frac{\partial \ln \phi_X}{\partial \ln \tau} = \zeta_{\phi_X,\tau} > 1,$$

and the elasticity of the Home exporter numbers with respect to tariffs is:

$$\frac{\partial \ln N_X}{\partial \ln \tau} = \zeta_{N_X,\tau} < -\kappa.$$

(b) The elasticity of the exporting cutoff with respect to nominal exchange rates for Home firms is:

$$\frac{\partial \ln \phi_X}{\partial \ln \epsilon} = \zeta_{\phi_X,\epsilon} < -(1+\mu),$$

and the elasticity of the Home exporter numbers with respect to nominal exchange rates is:

$$\frac{\partial \ln N_X}{\partial \ln \epsilon} = \zeta_{N_X,\epsilon} > \kappa(1+\mu).$$

Proof: See Appendix A.1.

Proposition (a) argues that a decrease in tariffs, charged by partners, causes a decrease in the exporting cutoff and an increase in exporter numbers (the EM of exports). In particular,

[6] The equilibrium cutoff productivity levels can be derived using the zero-cutoff-profit conditions and the free-entry conditions.

[7] While the exporting cutoff part of the proposition reproduces the results by Melitz (2003) and Rodríguez-López (2011), the exporter numbers part was not explicitly derived by them.

exporter numbers increase by more than κ percent after a 1 percent reduction in tariffs.

Proposition (b) argues that a decrease in nominal exchange rates—appreciation—causes an increase in the exporting cutoff and a decrease in exporter numbers (the EM of exports). In particular, exporter numbers decrease by more than $\kappa(1+\mu)$ percent after a 1 percent decrease in nominal exchange rates (a 1 percent Home-currency appreciation). With the appreciation of the Home currency and fixed wages, the relative cost of Home to Foreign labor—$W/\epsilon W^*$—increases and thus Home firms become less competitive in the Foreign market.

Note that the above inequalities imply that the elasticity of the exporting cutoff/exporter numbers with respect to nominal exchange rates can be larger than that with respect to tariffs. At first glance, it may seem odd since the effects of tariffs and nominal exchange rates on price are the same by equation (2.1). The intuition behind is that, with fixed wages, a change in tariffs (charged by partners) does not change the fixed cost in the Foreign currency while a change in nominal exchange rates does. Thus, when nominal exchange rates depreciate by the same percent as tariffs decrease, the profit increase is larger for the nominal exchange rate change.

Furthermore, as implied by Chaney's (2008) model, the above inequality also implies that, noting $\mu = 1/(\nu - 1)$, the elasticity of exporter numbers with respect to nominal exchange rates can be affected by the elasticity of substitution between varieties (ν). The intuition is that, for the same percent change in nominal exchange rates, if the elasticity of substitution (ν) is lower, that is, if the markup (μ) is higher, then a change in profits is larger. It leads to a larger change in the exporting cutoff and thus a larger change in exporter numbers. Thus, in the more differentiated sector, the elasticity of exporter numbers with respect to nominal exchange rates can be larger.

3 Regression Specification and Data

3.1 Regression Specification

3.1.1 Exporter Numbers and Export Value/Quantity per Exporter

Guided by the Melitz model with the exchange rates presented in the previous section, we empirically investigate the responses of exporter numbers to tariffs and nominal exchange

rates at the product level. The benchmark regression is as follows:

$$\ln(E_{ijt}) = \alpha_0 + \alpha_1 \ln(1 + Tariff_{ijt}) + \alpha_2 \ln(NER_{jt}) + Other\ Controls + \epsilon_{ijt} \tag{3.1}$$

Here, E_{ijt} is the number of exporters of product i from China to country j at time t. Tariff_{ijt} is the tariff of product i charged by country j at time t. NER_{jt} is the nominal exchange rate, which is defined as China's yuan per currency of country j at time t; thus, when NER increases, China's yuan depreciates. The trade mode may affect exporters' behaviors; thus, we control the processing trade dummy.[8] When the product is exported under the processing trade mode, the dummy is 1; otherwise, it is 0.

We also control China's import tariffs within the same industry (HS 2-digit level) because the reduction of China's import tariffs could decrease the costs of China's firms, thus helping more non-exporting firms enter foreign markets.[9] Finally, we control the product-time fixed effect to capture the unobserved product-time demand shocks and the country fixed effect to capture the unobserved destination specific characteristics.

If α_1 is negative and α_2 is positive, then the implication from the Melitz model with exchange rates is supported. When tariff decreases, the EM of exports increases. When China's yuan appreciates (depreciates), the EM of exports decreases (increases), that is, the increase in EM of exports caused by tariff reductions is weakened or strengthened by currency appreciation or depreciation, respectively.

We also empirically investigate the responses of export value/quantity per exporter—the IM of exports—at the product level. In that case, E_{ijt} is the export value/quantity per exporter of product i from China to country j at time t.

3.1.2 Entry and Exit of Exporters

A change in exporter numbers could be caused by entry or/and exit of exporters. Thus, we also investigate the responses of the entry and exit of exporters to tariffs and nominal exchange rates, respectively. If the export value of a firm is 0 at year $t-1$ but positive at

[8] Processing trade refers to importing all or part of the raw and auxiliary materials and re-exporting the finished products after processing.

[9] The input-output table is based on the industry level, while our regressions are at the firm-product level. Thus, we do not use the input-output table to obtain the import tariffs.

year t, then we consider this firm as a new exporter at year t.[10] If the export value of a firm is positive at year $t-1$ but 0 at year t, then we consider this firm as a exit exporter at year t. The benchmark regression is as follows:

$$\ln(EN_{ijt}) = \beta_0 + \beta_1 \ln(1 + Tariff_{ijt}) + \beta_2 \ln(NER_{jt}) + Other\ Controls + \eta_{ijt} \tag{3.2}$$

Here, EN_{ijt} is the number of new (exit) exporters of product i from China to country j at time t.[11] We also control China's import tariffs within the same industry (HS 2-digit level), the processing trade dummy, and the product-time and country fixed effects. When EN is the number of new exporters, if β_1 is negative and β_2 is positive, then a decrease in tariffs causes additional Chinese firms to enter foreign markets, whereas China's yuan appreciation (depreciation) causes less (more) Chinese firms to enter. When EN is the number of exit exporters, if β_1 is positive and β_2 is negative, then a decrease in tariffs causes less Chinese firms to quit foreign markets, whereas the appreciation (depreciation) of China's yuan causes more (less) Chinese firms to quit.

3.1.3 Export Variety

In this section, we construct another measurement of the EM (IM) of exports that is based on export variety. Applying the methodology in Hummels and Klenow (2005), we define the country-product specific export variety at the HS4 level, which is the number of HS6 product varieties within each HS4 category.[12]

The EM index of exports for HS4 category i from China to country j at year t is defined as follows:

$$EEV_{ijt} = \frac{\sum_{h \in I_{ijt}} x_{hwt}}{\sum_{h \in I_{it}} x_{hwt}},$$

where I_{it} is the set of all HS6 product varieties within HS4 category i that China exports to

[10] We also use another definition of new exporters as robustness checks. If a firm never exported in previous years and year t is the first year in which this firm exports, then we consider this firm as a new exporter at year t. The results are robust.

[11] We also normalize the number of new (exit) exporters of product i from China to country j by the total number of exporters of product i from China to country j as robustness checks. Overall, the results remain robust.

[12] We do not use the number of HS8 product varieties within each HS6 category for two reasons. First, the code of HS8 is not stable, which changes year by year. Second, the number of HS8 product varieties within each HS6 category is small.

the world at year t; I_{ijt} is the set of HS6 product varieties within HS4 category i in which China has positive exports to country j at year t; and x_{hwt} is the export value of HS6 product variety h from China to the world at year t.[13] Thus, EEV_{ijt} can be thought of as a weighted count of varieties that China exports to country j at year t, relative to all varieties that China exports to the world. If $EEV_{ijt} = 1$, it means that China exports the whole set of product varieties within HS4 category i to country j. If $EEV_{ijt} = 0$, it means that China does not export any product variety within HS4 category i to country j. When EEV_{ijt} increases, the range of export varieties within HS4 category i from China to country j expands. Thus, EEV_{ijt} can be considered as a measurement of the EM of exports of HS4 category i from China to country j.

The IM index of exports for HS4 category i from China to country j at year t is defined as follows:

$$IEV_{ijt} = \frac{\sum_{h \in I_{ijt}} x_{hjt}}{\sum_{h \in I_{ijt}} x_{hwt}},$$

where x_{hjt} is the export value of HS6 product variety h from China to country j at year t. Thus, IEV_{ijt} equals China's exports to country j relative to China's exports to the world at year t, within HS4 category i. If $IEV_{ijt} = 1$, it means that country j is the only destination for HS4 category i from China. When IEV_{ijt} increases, the average export value of HS4 category i from China to country j increases. Thus, IEV_{ijt} can be considered as a measurement of the IM of exports of HS4 category i from China to country j.

Finally, multiplying IEV_{ijt} by EEV_{ijt} produces the ratio of China's exports of HS4 category i to country j to China's exports of the HS4 category i to the world.

We investigate the responses of the new measurements of the EM and IM of exports to tariffs and nominal exchange rates, respectively. The benchmark regression is as follows:

$$\ln(EV_{ijt}) = \gamma_0 + \gamma_1 \ln(1 + Tariff_{ijt}) + \gamma_2 \ln(NER_{jt}) + Other\ Controls + \rho_{ijt} \tag{3.3}$$

Here, EV_{ijt} is either EEV_{ijt}, the new EM index of exports, or IEV_{ijt}, the new IM index of exports. The controls are the same as those for regressions with exporter numbers. When EV is EEV, if γ_1 is negative and γ_2 is positive, then a decrease in tariffs increases export

[13] While Hummels and Klenow (2005) set the world's exports to country j as the base, we set China's exports to the world as the base.

variety from China, whereas China's yuan appreciation (depreciation) decreases (increases) it. When EV is IEV, if γ_1 is negative and γ_2 is positive, then a decrease in tariffs increases the export value per export variety from China, whereas China's yuan appreciation (depreciation) decreases (increases) it.

3.2 Data

The exchange rate and Consumer Price Index (CPI) data are from the International Monetary Fund (IMF) at the annual level.[14] The tariff [15] data is from the United Nations Conference on Trade and Development (UNCTAD)—Trade Analysis Information System (TRAINS). The tariffs of each HS 6-digit level product charged by each country are at the annual level. China's export data is from their customs agency at the transaction level. We aggregate these transactions to the firm-product-year level. Thus, we have the number of exporters and export value/quantity per exporter for each HS 6-digit product. The sample period is from 2000 to 2006.

The data summary is presented in Table 1 and Figure 1. The first part of Table 1 demonstrates that the exporter and destination numbers increase over time. From 2000 to 2006, the exporter numbers increase by 174.5 percent and destination numbers increase by 43 percent. The product numbers are almost constant. The second part of Table 1 and Figure 1 demonstrate that the tariffs, charged by partners, decrease over time. In 2000, the simple average tariffs are 9.6 percent, and in 2006 the tariffs are 8.1 percent. In addition, the simple average tariffs of the OECD countries remain robust, and that of the non-OECD countries decrease by almost 30 percent from 2000 to 2006. The third part of Table 1 shows that China's import tariffs also decrease from 2000 to 2006. Especially, when China became a WTO member in 2002, China's average import tariffs decrease by about 27 percent in that year.

The fourth part of Table 1 and Figure 1 demonstrate the time trend of China's nominal effective exchange rates (NEERs). After entering the WTO in 2002, the NEERs decrease until 2005—depreciation. On July 21, 2005, the People's Bank of China announced a revaluation of the yuan and a reform of the exchange rate regime. After 2005, the NEERs began to

[14] We also present the results with the quarterly data in the robustness checks.

[15] The tariff is the effectively applied tariff (AHS) which is defined as the lowest available tariff.

increase—appreciation—and do so until 2015.[16]

The last part of Table 1 demonstrates the trends of the EM and IM indexes of exports based on export variety. From 2000 to 2006, the average EM index of exports increases by 4 percent for ordinary trade and by only 1 percent for processing trade. During the same period, the average IM index of exports decreases by 42.9 percent for ordinary trade and by 35.6 percent for processing trade. These two patterns mean that Chinese exporters break into more foreign markets over time, especially for ordinary trade firms.

3.2.1 Tariffs and Exchange Rates for Top 10 Trade Partners

In this section, we present more detailed data for tariffs and nominal exchange rates: the time trends of tariffs and nominal exchange rates for China's top 10 trade partners from 2000 to 2006 (Figures 2 and 3). The top 10 partners are the euro area, the United States, Hong Kong, Japan, South Korea, the United Kingdom, Singapore, Taiwan, Canada, and India. Here, the tariff data is at the annual level, and the exchange rate data is at the monthly level.

The figures imply that tariffs and nominal exchange rates might be crucial factors that contribute to changes in the EM of China's exports. They also imply that the increase in EM because of tariff reductions might be weakened by currency appreciation or strengthened by currency depreciation. In the case of the euro area, for example, tariffs, charged by the euro area, decreased and the yuan depreciated from 2002 to 2004, implying that the yuan's depreciation might have strengthened the increase in China's EM because of tariff reductions. In the case of Japan, the tariffs charged by Japan decreased and the yuan first appreciated and then depreciated during the period 2001 to 2005, implying that the yuan's appreciation and depreciation, respectively, might have weakened and strengthened the increase in China's EM because of tariff reductions.

[16] Here, an increase (decrease) in the NEERs means China's yuan appreciation (depreciation), whereas an increase (decrease) in the independent variable NER—defined as China's yuan per a foreign currency—means China's yuan depreciation (appreciation).

4 Regression Results

4.1 Exporter Numbers and Export Value/Quantity per Exporter

The first part of Table 2 presents the EM's responses to tariffs and the nominal exchange rates. According to the Melitz model with exchange rates, a reduction in tariffs charged by trade partners would increase the number of China's exporters while the appreciation (depreciation) of China's yuan would decrease (increase) it. Our results verify this hypothesis. If the tariffs decrease by 1 percent, the exporter numbers would increase by 0.05 percent. If China's yuan appreciates by 1 percent, the exporter numbers would decrease by 0.09 percent. The elasticity of the nominal exchange rates is almost twice as that of the tariffs.[17] Thus, the EM of exports is more responsive to changes in the nominal exchange rates than that in tariffs.

The second and third parts of Table 2 demonstrate that the reductions in tariffs, charged by trade partners, stimulate the IM of exports from China and the appreciation (depreciation) of China's yuan would weaken (strengthen) this response. If the tariffs decrease by 1 percent, the export value per exporter would increase by 0.04 percent. If China's yuan appreciates by 1 percent, the export value per exporter would decrease by 0.08 percent. The elasticities are similar for export quantity per exporter. If the tariffs decrease by 1 percent, the export quantity per exporter would increase by 0.05 percent. If China's yuan appreciates by 1 percent, the export quantity per exporter would decrease by 0.07 percent. Again, the IM of exports is more responsive to changes in the nominal exchange rates than that in tariffs.

In addition, Table 2 demonstrates that the number of exporters is smaller, but the export value/quantity per exporter is larger in the processing trade mode. In column 2, we additionally control the import tariffs charged by China. The responses to tariff reductions and exchange rate fluctuations remain robust. We also observe that the import tariff reductions stimulate exports from China, at both the IM and EM. It is because that the reductions of import tariffs could decrease the input costs of China's firms, which improves their competitiveness in foreign markets. In column 3, we use the product-time fixed effect to capture the unobserved product-time demand shocks. The results remain robust.

[17] Although their primary interest is in estimating the response of export values to imported inputs, Feng et al. (2016) also observe a similar pattern using China's data. They control real exchange rates and tariffs and observe that the response of export values to the former is larger than that to the latter.

One concern is that the elasticities of tariffs and nominal exchange rates cannot directly be interpreted as the relative importance of these two factors. Thus, we additionally interpret the responses in terms of standard deviation. If the ln(1+Tariff) decreases by 1 standard deviation, the ln(Exporter Numbers) would increase by 0.04 standard deviation. If ln(NER) appreciates by 1 standard deviation, the ln(Exporter Numbers) would decrease by 0.25 standard deviation. Thus, the response of EM to nominal exchange rates is even much larger than that to tariffs in terms of standard deviation. For IM of exports, we have the similar results.

Then we compare the overall effects of tariffs and nominal exchange rates from 2000 to 2006. As shown in Table 1, from 2000 to 2002, tariffs (charged by partners) increased and China's yuan appreciated, both hurting the exports from China. The average tariffs increased by 3.7 percent and China's NEERs appreciated by 5.1 percent. Thus, the overall effect of China's yuan appreciation on EM (5.1×0.123) is about 3.5 times of that of tariffs increments (3.7×0.0483). From 2002 to 2005, tariffs decreased due to China's entry into WTO and China's yuan depreciated, both boosting the exports from China. The average tariffs decreased by 18.7 percent and China's NEERs depreciated by 10.6 percent. Thus, the overall effect of China's yuan depreciation on EM is about 1.4 times of that of tariffs reductions. Still, the nominal exchange rates have a higher overall effect on EM than that of tariffs. From 2005 to 2006, the average tariffs are almost constant, while China's NEERs appreciated by 2.3 percent. Thus, the overall effects on EM of exports are mainly driven by changes in nominal exchange rates. Again, for IM of exports, we obtain the similar results.

4.2 Entry and Exit of Exporters

In this section, we investigate the exporter dynamics in greater details. Exporter numbers depend on the entry and exit of exporters. Exporters' entry and exit decisions might have heterogeneous responses to the tariffs and nominal exchange rates. Thus, we separately examine the responses. Column 1 of Table 3 shows that the reductions in tariffs, charged by trade partners, increase not only entry but also exit of exporters. If the tariffs decrease by 1 percent, the new exporter numbers would increase by 0.028 percent and exit exporter numbers would increase by 0.022 percent. The response of entry is larger than that of exit. Thus, the net response to the tariff reduction is an increase in the exporter numbers. At first sight, the

results for exit might appear odd. As Feng et al. (2017) argue, however, it is possible that a tariff reduction increases both the entry and exit of exporters. This is because an increase in exporters due to the tariff reduction could increase the competition in foreign markets, forcing low productivity exporters to exit. Feng et al. (2017) also empirically document that the entry and exit of China's exporters increased following China's WTO accession in 2002.

The responses to exchange rate fluctuation are similar but larger. If China's yuan depreciates by 1 percent, new exporter numbers would increase by 0.060 percent and exit exporter numbers also would increase by 0.081 percent. In column 2, we additionally control China's import tariffs, and in column 3, we control the product-time fixed effect. The aforementioned pattern remains robust.

4.3 Export Variety

In this section, we investigate the responses to tariffs and exchange rates from the perspective of export variety. Column 1 of Table 4 shows that the reductions in tariffs, charged by trade partners, increase not only the EM index but also the IM index of exports. However, the coefficient of the IM index is much more significant. If the tariffs decrease by 1 percent, the EM index would increase by 0.015 percent and the IM index would increase by 0.094 percent. The exchange rate fluctuation only affects the IM index of exports. If China's yuan depreciates by 1 percent, the IM index would increase by 0.271 percent. In column 2, we additionally control China's import tariffs, and in column 3, we control the product-time fixed effect. The aforementioned pattern remains robust except that the exchange rate fluctuation also affects the EM index of exports.

To sum up the regression results in Sections 4.1-4.3, we have the three patterns:

First, reductions in tariffs, charged by China's trade partners, increased China's exporter numbers and export value/quantity per exporter at the product level, whereas the appreciation (depreciation) of China's yuan caused a decrease (increase)—the response to exchange rates is almost twice as that to tariffs.

Second, reductions in tariffs, charged by trade partners, increased not only entry but also exit of China's exporters, and yuan appreciation (depreciation) decreased (increased) them.

Third, reductions in tariffs, charged by trade partners, increased both China's export

variety and export value per export variety, and yuan appreciation (depreciation) decreased (increased) them.

4.4 Robustness Checks

In this section, we examine whether trade modes and destinations, real exchange rates, balanced data and data frequency, and sectoral and product heterogeneity would affect the benchmark results.

4.4.1 Trade Modes and Destinations

Trade Modes

Processing trade refers to the activity of importing all or part of the raw and auxiliary materials from abroad and re-exporting the finished products after processing or assembly by firms within the mainland. It is possible that the effect of an exchange rate appreciation on the export price of assembled products is canceled by the effect on the import price of the materials for assembly. Thus, the response to exchange rate fluctuations on processing trade is likely to be different from that on ordinary trade.[18] We thus divide firms into two groups: ordinary and processing trade firms. The columns 4 and 5 of Table 2 show that the responses of exporter numbers to tariffs and nominal exchange rates are similar for both trade modes. But the responses of export value/quantity per exporter are larger for processing trade firms. Thus, in terms of the IM, firms doing the processing trades are more responsive to the tariff and nominal exchange rate shocks. In addition, the columns 4 and 5 of Table 3 show that the responses of entry and exit are larger for ordinary trade firms. Thus, in terms of the EM, firms doing ordinary trade are more vulnerable to the shocks. The columns 4 and 5 of Table 4 show that the responses of the EM and IM indexes based on export variety are larger for processing trade.

Export Destinations

After China became a WTO member in 2002, the tariffs charged by trade partners, especially developing countries, decreased considerably; for example, the comparison among India and

[18] Marquez and Schindler (2007) argue that estimating the response to exchange rates should differentiate the ordinary and processing trade products.

developed countries (Figures 2 and 3). Thus, we divide the export destinations into two groups: OECD and non-OECD countries. Last two columns in Tables 2, 3 and 4 demonstrate that the coefficients are more significant for non-OECD countries.

Main Trade Partners

Our data covers about 170 destinations and many of them are small economies. The trade with these small economies might be significantly affected by unobservable factors other than tariffs and nominal exchange rates, such as political relationship. Thus, we restrict our sample to the top 50 partners for robustness checks. The export value with these partners is about 97.5 percent of China's total export value. The results in Table 5 show that our main findings are still robust.

4.4.2 Real Exchange Rates

The nominal and real exchange rates present very different movements in the United States from 2000-2006 (Figure A1 in Appendix A.2). Motivated by this observation, we perform robustness checks with the real exchange rates. Tables 6, 7 and 8 present the results with the real exchange rates. Notably, the results remain robust.

4.4.3 Balanced Data and Data Frequency

Balanced Data

Our data is a unbalanced data at the product-destination level. As Table 1 has shown, the product number is stable from 2000 to 2006, but the destination number expands quickly during the same period. Thus, the new export destinations might bias our results. In order to exclude this concern, we restrict our sample to the product-destination pairs that appear in the whole period (2000-2006). The export value in the balanced data is about 87 percent of that of the full sample. Table 9 shows that the coefficient on nominal exchange rates is more significant while that on tariffs is not significant.

Quarterly Data

The fluctuations of the annual exchange rate data might be small. Naknoi (2015) investigates the EM of exports using the quarterly U.S. bilateral trade data. Thus, we perform robustness

checks with the quarterly nominal exchange rate data. Tables 10, 11 and 12 demonstrate that the results remain robust. Notably, however, the responses to the quarterly data are smaller than those to the annual data. This is probably because firms take time to react to the tariff and exchange rate changes.

4.4.4 Sectoral and Product Heterogeneity

Sectoral Differences

The responses of the EM of exports to tariffs and exchange rates might be different across sectors. In this section, we additionally examine the responses by China's top 10 export sectors at the HS2 level. These sectors account for 66 percent of China's exports. These sectors are Electrical equipment (21.9 percent), Mechanical appliances (18.1 percent), Apparel, not knitted or crocheted (5.4 percent), Apparel, knitted or crocheted (4.5 percent), Optical instruments (3.1 percent), Furniture (3 percent), Toys and sports requisites (2.8 percent), Mineral products (2.5 percent), Footwear (2.5 percent), and Iron or steel (2.4 percent).[19] Table 13 shows that the coefficient on tariffs is significant in 5 sectors while that on exchange rates is significant in 9 sectors. Thus, Chinese firms respond more against exchange rates than against tariff changes.

Differentiated Goods

As implied by Chaney's (2008) model and our model, the response of the EM of exports to nominal exchange rates might also be different across products.[20] Here, following the classification from Rauch (1999), we divide products into two groups: homogeneous and differentiated goods. Table 14 presents the results. Diff Dummy is 1 if the product is a differentiated good; otherwise, it is 0. We find that the coefficient on nominal exchange rates is more significant for differentiated goods. We also find the similar result for tariffs.[21]

[19] The numbers in the brackets are ratios of exports in each sector relative to all exports from China. The number of HS2 codes in each sector are Electrical equipment (85), Mechanical appliances (84), Apparel, not knitted or crocheted (62), Apparel, knitted or crocheted (61), Optical instruments (90), Furniture (94), Toys and sports requisites (95), Mineral products (27), Footwear (64), and Iron or steel (73).

[20] As noted by Yi and Biesebroeck (2012), Chaney (2008) defines the EM of exports as how much new exporters export while almost all the empirical studies testing Chaney (2008) define it as the number of firms/products in exports.

[21] While the EM of exports with respect to tariffs is not affected by the elasticity of substitution (ν) in our model, Besedeš and Cole (2017) show that it is affected if tariffs are *ad valorem* tariffs.

These results are in line with some other empirical findings. Yi and Biesebroeck (2012) showed, using data for China's imports from 129 countries during the period 2001–2006, that differentiated goods have the higher elasticity of EM of exports to China with respect to China's tariffs than homogeneous goods. Colacelli (2010) found, using 136 countries' bilateral export data during the period 1981–1997, that differentiated goods have the higher elasticity of EM of exports with respect to exchange rates, though real.

5 Discussion

5.1 Firm-level Implications: Temporary vs. Permanent Shocks

Our firm-product level results have shown that the entry and exit of China's exporters responded significantly to not only reductions in tariffs but also changes in exchange rates. At first sight, this result seems to be inconsistent with the well-known argument by Ruhl (2008) that firms do not change their exporting status in response to temporary shocks while some firms do change it in response to permanent shocks. This is because if the changes in exchange rates are considered as temporary shocks, then the coefficients on exchange rates of the entry and exit of exporters would be insignificant.

However, it should be noted that, besides trade liberalization policy, China was conducting significant currency policy during the period to be studied in our paper: undervalued currency policy until 2005 and appreciation policy since 2005. This means that, in China from 2000 to 2006, it might be appropriate to consider changes in both tariffs and exchange rates as non-temporary shocks. Then it is not odd that our results have shown significant coefficients on both tariffs and exchange rates of the entry and exit of China's exporters. In this sense, our results can be consistent with Ruhl's (2008) argument.

However, it still remains a question why the response to exchange rates is larger than that to tariffs. A possible answer is provided by the theory presented in Section 2. Recall that the proposition implies that the elasticity of exporter numbers with respect to nominal exchange rates can be larger than that with respect to tariffs. The intuition behind is that, with fixed wages, a change in tariffs does not change the fixed cost in the Foreign currency while a change in nominal exchange rates does. Hence, when nominal exchange rates depreciate by the same percent as tariffs decrease, the profit increase is larger for the nominal exchange

rate change.

5.2 Aggregate-level Implications: The Trade Elasticity and the EM Elasticity

In Section 4, we have demonstrated that China's exports significantly respond to both tariffs and exchange rates. This is essentially a problem of the so-called elasticity of trade. Thus, it is important to know whether the micro results in our paper are consistent with the response of aggregate exports to these shocks in the existing studies.

We obtain the implied aggregate elasticity of exports by summing the coefficient of exporter numbers and that of export value per exporter, which is averaged over HS6 products. According to the results in column 3 of Table 2, the aggregate elasticity of exports with respect to tariffs is 0.09 and that with respect to nominal exchange rates is 0.23. According to the results in column 3 of Table 6, the aggregate elasticity of exports with respect to real exchange rates is 0.34. According to Ruhl (2008), on the other hand, the estimated (Armington) elasticities are 0.2-3.5 in the international real business cycle models and 4-15 in the applied general equilibrium models. Thus, all of our implied aggregate elasticities are more close to the former estimates.

It should be, however, noted that our main interest has been particularly in the response of the EM of exports, not the response of exports overall. Thus, it is more important to know whether our results are consistent with the response of the EM of exports to tariffs and exchange rates in the literature, although there are not many studies that estimated the elasticity of the EM of exports with respect to tariffs and exchange rates. We summarize the elasticities in our paper and other studies in Table 15.[22]

We obtain the elasticity of the EM of exports by looking at the coefficient of exporter numbers or export variety. First, let us focus on exporter numbers as a measurement of the EM of exports. According to the results in column 3 of Table 2, the elasticity of exporter numbers with respect to tariffs is 0.048, and that with respect to nominal exchange rates is 0.123. According to the results in column 3 of Table 6, the elasticity of exporter numbers

[22]The data frequency is a bit different between our papers and other studies. Our paper is at the product-destination-year level; Bas et al. (2017) is at the product-destination-year level; Tang and Zhang (2012) is at the product-destination-month level; Feenstra and Kee (2007) is at the industry-year level; Colacelli (2010) is at the country-year level.

with respect to real exchange rates is 0.191. On the other hand, the estimated elasticity of exporter numbers with respect to tariffs by Bas et al. (2017) is 3.83, which is much larger than ours. That with respect to real exchange rates by Tang and Zhang (2012) is 0.17, which is close to ours. To our knowledge, however, no past studies have estimated the elasticity of exporter numbers with respect to nominal exchange rates.

Next, let us consider export variety as a measurement of the EM of exports. According to the results in column 3 of Table 4, the elasticity of export variety with respect to tariffs is 0.014 and that with respect to nominal exchange rates is 0.028. According to the results in column 3 of Table 8, that with respect to real exchange rates is 0.088. According to the literature, on the other hand, the estimated elasticity of export variety with respect to tariffs by Feenstra and Kee (2007) is about 2, which is much larger than ours. That with respect to real exchange rates by Colacelli (2010) is 0.045, which is smaller than ours but close to ours in that both are less than 0.1. Note again that, to our knowledge, no past studies have estimated the elasticity of export variety with respect to nominal exchange rates.

6 Conclusion

We have empirically tested the implications from the Melitz model with the exchange rates. Specifically, using China's firm-product data from 2000 to 2006 with 170 trade partners, we tested whether the response of the EM of China's exports to trade liberalization is weakened (strengthened) by China's yuan appreciation (depreciation). Based on regressions, we have four main empirical findings. First, reductions in tariffs, charged by China's trade partners, increased China's exporter numbers and export value/quantity per exporter at the product level, whereas the appreciation (depreciation) of China's yuan decreased (increased) them—the latter response is larger than the former in all cases. Second, using export variety as an alternative measurement of the EM of exports provides similar results. Third, reductions in tariffs, charged by trade partners, increased not only entry but also exit of China's exporters, and the yuan's appreciation (depreciation) decreased (increased) them. Fourth, the implied elasticities of exporter numbers and export variety with respect to tariffs are, respectively, 0.0487 and 0.0116 (much smaller than estimates in the literature) while those with respect to nominal exchange rates are 0.11 and 0.0202.

The results presented in this paper are valuable, particularly for empirical studies on trade liberalization and the EM of trade. This is because the results indicate that the observed increases in EM after trade liberalization could be the results weakened by currency appreciation or strengthened by currency depreciation. Thus, future studies, in particular, on China's EM need to place more importance on exchange rates when investigating the changes in EM using firm data.

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Table 1: Data Summary

	Year						
Variables	2000	2001	2002	2003	2004	2005	2006
Exporter, Product, and Destination							
Exporter Numbers	59,709	65,505	74,882	90,705	114,768	138,881	163,923
Product Numbers	4,789	4,809	4,778	4,816	4,853	4,879	4,894
Destination Numbers	104	134	141	124	125	135	149
Tariffs Charged by Partners							
—All Countries							
(mean)	9.60	9.54	9.97	8.86	7.89	8.11	8.10
(sd)	16.14	14.87	35.45	15.37	18.86	11.90	12.35
—OECD Countries							
(mean)	4.91	5.01	5.12	4.98	3.93	4.63	4.75
(sd)	15.58	15.52	14.29	15.56	13.36	12.37	13.34
—Non-OECD Countries							
(mean)	14.86	13.74	14.45	12.43	11.30	10.72	10.42
(sd)	15.12	12.90	46.76	14.28	21.99	10.83	11.04
China's Import Tariffs							
(mean)	19.16	18.19	13.20	12.01	11.45	9.56	10.02
(sd)	16.52	17.11	9.34	8.16	9.15	5.54	7.29
China's Nominal Effective Exchange Rate	93.51	98.69	98.26	92.21	88.01	87.85	89.87
Export Variety							
—EM Index							
Processing Trade	0.754	0.751	0.752	0.758	0.765	0.764	0.762
Ordinary Trade	0.798	0.791	0.798	0.812	0.822	0.826	0.831
—IM Index							
Processing Trade	0.059	0.054	0.052	0.052	0.046	0.042	0.038
Ordinary Trade	0.028	0.024	0.022	0.022	0.020	0.018	0.016

Source: Chinese Customs Export and Import Database, IMF and TRAINS.

Table 2: Nominal Exchange Rates, Tariffs, and Exports (Annual)

	Full Sample			Ordinary	Processing	OECD	Non-OECD
	ln(Exporter Numbers)						
ln(1+Tariff)	-0.0482***	-0.0481***	-0.0483***	-0.0470***	-0.0514**	0.00963	-0.0454***
	(0.0167)	(0.0167)	(0.0174)	(0.0168)	(0.0251)	(0.0341)	(0.0169)
ln(NER)	0.0900***	0.0911***	0.123***	0.166***	0.163***	-0.00662	0.163***
	(0.0305)	(0.0304)	(0.0304)	(0.0398)	(0.0290)	(0.0954)	(0.0402)
Processing Trade	-1.184***	-1.184***	-1.202***			-1.262***	-1.212***
	(0.0324)	(0.0324)	(0.0331)			(0.0432)	(0.0522)
ln(1+China's Import Tariff)		-0.0671***					
		(0.00796)					
Observations	1,373,421	1,373,421	1,371,801	994,032	374,095	683,246	685,373
R-squared	0.570	0.570	0.593	0.658	0.628	0.689	0.554
	ln(Export Value per Exporter)						
ln(1+Tariff)	-0.0398***	-0.0397***	-0.0382**	-0.0181	-0.0846***	-0.0320	-0.0136
	(0.0144)	(0.0144)	(0.0148)	(0.0126)	(0.0271)	(0.0306)	(0.0180)
ln(NER)	0.0807*	0.0821*	0.108***	0.0774*	0.304***	-0.00301	0.126**
	(0.0425)	(0.0424)	(0.0398)	(0.0427)	(0.0579)	(0.0682)	(0.0564)
Processing Trade	0.613***	0.613***	0.601***			0.658***	0.436***
	(0.0601)	(0.0601)	(0.0606)			(0.0874)	(0.0674)
ln(1+China's Import Tariff)		-0.0810***					
		(0.0130)					
Observations	1,373,421	1,373,421	1,371,801	994,032	374,095	683,246	685,373
R-squared	0.352	0.352	0.378	0.393	0.449	0.409	0.391
	ln(Export Quantity per Exporter)						
ln(1+Tariff)	-0.0491***	-0.0491***	-0.0481***	-0.0235*	-0.103***	-0.0437	-0.0168
	(0.0160)	(0.0160)	(0.0164)	(0.0137)	(0.0279)	(0.0328)	(0.0180)
ln(NER)	0.0712*	0.0718*	0.0996***	0.0809**	0.316***	-0.00233	0.0981*
	(0.0395)	(0.0395)	(0.0379)	(0.0396)	(0.0613)	(0.0767)	(0.0548)
Processing Trade	0.455***	0.455***	0.441***			0.525***	0.243***
	(0.0544)	(0.0544)	(0.0546)			(0.0728)	(0.0568)
ln(1+China's Import Tariff)		-0.0405***					
		(0.0144)					
Observations	1,373,421	1,373,421	1,371,801	994,032	374,095	683,246	685,373
R-squared	0.606	0.606	0.623	0.672	0.614	0.625	0.665
Product FE	Yes	Yes					
Time FE	Yes	Yes					
Country FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Product-Time FE			Yes	Yes	Yes	Yes	Yes
Cluster by Country	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Note: (1) Since the tariffs charged by Hong Kong are zero, we exclude Hong Kong from the sample. (2) *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Source: Chinese Customs Export and Import Database, IMF and TRAINS.

Table 3: Nominal Exchange Rates, Tariffs, and Exporter Dynamics (Annual)

	Full Sample			Ordinary	Processing	OECD	Non-OECD
	ln(New Exporter Numbers)						
ln(1+Tariff)	-0.0280**	-0.0280**	-0.0278**	-0.0349***	-0.0187	0.0173	-0.0264**
	(0.0125)	(0.0125)	(0.0130)	(0.0128)	(0.0194)	(0.0268)	(0.0128)
ln(NER)	0.0596**	0.0599**	0.0861***	0.130***	0.0860***	0.0175	0.104***
	(0.0240)	(0.0240)	(0.0263)	(0.0370)	(0.0242)	(0.121)	(0.0325)
Processing Trade	-1.150***	-1.150***	-1.163***			-1.255***	-1.114***
	(0.0353)	(0.0353)	(0.0359)			(0.0482)	(0.0513)
ln(1+China's Import Tariff)		-0.0266***					
		(0.00590)					
Observations	1,228,924	1,228,924	1,227,627	893,127	331,404	600,487	624,485
R-squared	0.560	0.560	0.581	0.644	0.520	0.678	0.537
	ln(Exit Exporter Numbers)						
ln(1+Tariff)	-0.0221	-0.0221	-0.0230	-0.0293**	-0.0136	0.0240	-0.0262*
	(0.0141)	(0.0141)	(0.0147)	(0.0141)	(0.0226)	(0.0296)	(0.0139)
ln(NER)	0.0805**	0.0812**	0.102***	0.149***	0.0916***	0.00572	0.118***
	(0.0312)	(0.0311)	(0.0298)	(0.0360)	(0.0256)	(0.0720)	(0.0381)
Processing Trade	-1.078***	-1.078***	-1.091***			-1.155***	-1.056***
	(0.0353)	(0.0353)	(0.0360)			(0.0481)	(0.0531)
ln(1+China's Import Tariff)		-0.0375***					
		(0.00705)					
Observations	1,026,099	1,026,099	1,024,579	729,218	292,143	547,468	474,302
R-squared	0.552	0.552	0.575	0.633	0.521	0.662	0.531
Product FE	Yes	Yes					
Time FE	Yes	Yes					
Country FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Product-Time FE			Yes	Yes	Yes	Yes	Yes
Cluster by Country	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Note: (1) Since the tariffs charged by Hong Kong are zero, we exclude Hong Kong from the sample. (2) *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Source: Chinese Customs Export and Import Database, IMF and TRAINS.

Table 4: Nominal Exchange Rates, Tariffs, and Export Variety (Annual)

	Full Sample			Ordinary	Processing	OECD	Non-OECD
	ln(EM Index)						
ln(1+Tariff)	-0.0146***	-0.0145***	-0.0139***	-0.00843	-0.0246***	-0.00925	-0.0171**
	(0.00525)	(0.00525)	(0.00530)	(0.00565)	(0.00855)	(0.00768)	(0.00711)
ln(NER)	0.0177	0.0181	0.0282*	0.0299*	0.0338**	0.0683	0.0522**
	(0.0161)	(0.0159)	(0.0149)	(0.0166)	(0.0169)	(0.0474)	(0.0201)
Processing Trade	-0.256***	-0.256***	-0.261***			-0.222***	-0.317***
	(0.00982)	(0.00981)	(0.0102)			(0.0137)	(0.0102)
ln(1+China's Import Tariff)		-0.0474***					
		(0.00632)					
Observations	561,938	561,938	561,760	389,646	171,402	247,501	313,835
R-squared	0.255	0.255	0.280	0.334	0.345	0.318	0.295
	ln(IM Index)						
ln(1+Tariff)	-0.0937***	-0.0937***	-0.0947***	-0.0779***	-0.168***	-0.0365	-0.0687**
	(0.0259)	(0.0259)	(0.0264)	(0.0255)	(0.0351)	(0.0547)	(0.0290)
ln(NER)	0.271***	0.272***	0.273***	0.217***	0.439***	0.00486	0.224**
	(0.0664)	(0.0664)	(0.0665)	(0.0746)	(0.0751)	(0.147)	(0.0898)
Processing Trade	-0.373***	-0.373***	-0.378***			-0.230**	-0.637***
	(0.0664)	(0.0664)	(0.0675)			(0.101)	(0.0691)
ln(1+China's Import Tariff)		-0.0469**					
		(0.0192)					
Observations	561,938	561,938	561,760	389,646	171,402	247,501	313,835
R-squared	0.483	0.483	0.493	0.507	0.567	0.504	0.476
Product FE	Yes	Yes					
Time FE	Yes	Yes					
Country FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Product-Time FE			Yes	Yes	Yes	Yes	Yes
Cluster by Country	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Note: (1) Since the tariffs charged by Hong Kong are zero, we exclude Hong Kong from the sample. (2) *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Source: Chinese Customs Export and Import Database, IMF and TRAINS.

Table 5: Nominal Exchange Rates, Tariffs, and Exports for Main Trade Partners (Annual)

	Full Sample			Ordinary	Processing	OECD	Non-OECD
	ln(Exporter Numbers)						
ln(1+Tariff)	-0.0459*	-0.0457*	-0.0459*	-0.0427	-0.0477	0.00895	-0.0680*
	(0.0248)	(0.0248)	(0.0261)	(0.0263)	(0.0322)	(0.0355)	(0.0344)
ln(NER)	0.0671	0.0685	0.0840*	0.108**	0.168***	-0.0141	0.234***
	(0.0428)	(0.0425)	(0.0441)	(0.0532)	(0.0388)	(0.0951)	(0.0425)
Processing Trade	-1.283***	-1.283***	-1.303***			-1.283***	-1.432***
	(0.0324)	(0.0324)	(0.0333)			(0.0424)	(0.0566)
ln(1+China's Import Tariff)		-0.0879***					
		(0.00881)					
Observations	1,030,841	1,030,841	1,029,180	709,612	315,877	654,067	371,808
R-squared	0.599	0.599	0.624	0.698	0.665	0.694	0.599
	ln(Export Value per Exporter)						
ln(1+Tariff)	-0.0515**	-0.0513**	-0.0495**	-0.0276	-0.0860**	-0.0410	-0.0323
	(0.0205)	(0.0205)	(0.0211)	(0.0185)	(0.0345)	(0.0318)	(0.0326)
ln(NER)	0.0720	0.0737	0.117***	0.0789	0.308***	-0.0186	0.249***
	(0.0506)	(0.0504)	(0.0427)	(0.0503)	(0.0467)	(0.0630)	(0.0500)
Processing Trade	0.670***	0.670***	0.658***			0.672***	0.532***
	(0.0666)	(0.0666)	(0.0674)			(0.0893)	(0.0910)
ln(1+China's Import Tariff)		-0.104***					
		(0.0148)					
Observations	1,030,841	1,030,841	1,029,180	709,612	315,877	654,067	371,808
R-squared	0.334	0.334	0.366	0.392	0.447	0.409	0.399
	ln(Export Quantity per Exporter)						
ln(1+Tariff)	-0.0648***	-0.0647***	-0.0634***	-0.0368*	-0.105***	-0.0518	-0.0391
	(0.0228)	(0.0228)	(0.0235)	(0.0206)	(0.0358)	(0.0349)	(0.0306)
ln(NER)	0.0737	0.0752	0.116***	0.0861*	0.331***	-0.0117	0.216***
	(0.0462)	(0.0461)	(0.0411)	(0.0474)	(0.0542)	(0.0740)	(0.0552)
Processing Trade	0.497***	0.497***	0.484***			0.536***	0.277***
	(0.0607)	(0.0607)	(0.0613)			(0.0744)	(0.0829)
ln(1+China's Import Tariff)		-0.0895***					
		(0.0152)					
Observations	1,030,841	1,030,841	1,029,180	709,612	315,877	654,067	371,808
R-squared	0.608	0.608	0.628	0.687	0.621	0.628	0.694
Product FE	Yes	Yes					
Time FE	Yes	Yes					
Country FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Product-Time FE			Yes	Yes	Yes	Yes	Yes
Cluster by Country	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Note: (1) Since the tariffs charged by Hong Kong are zero, we exclude Hong Kong from the sample. (2) The export value of the top 50 partners is about 97.5 percent of China's total export value. (3) *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Source: Chinese Customs Export and Import Database, IMF and TRAINS.

Table 6: Real Exchange Rates, Tariffs, and Exports (Annual)

	Full Sample			Ordinary	Processing	OECD	Non-OECD
	ln(Exporter Numbers)						
ln(1+Tariff)	-0.0483***	-0.0481***	-0.0480***	-0.0453***	-0.0527**	0.0116	-0.0440**
	(0.0170)	(0.0170)	(0.0178)	(0.0172)	(0.0255)	(0.0347)	(0.0174)
ln(RER)	0.186***	0.186***	0.191***	0.186**	0.240***	0.189	0.187**
	(0.0603)	(0.0603)	(0.0601)	(0.0778)	(0.0454)	(0.117)	(0.0848)
Processing Trade	-1.180***	-1.180***	-1.198***			-1.256***	-1.213***
	(0.0330)	(0.0330)	(0.0337)			(0.0442)	(0.0531)
ln(1+China's Import Tariff)		-0.0640***					
		(0.00825)					
Observations	1,320,835	1,320,835	1,319,203	953,664	361,856	665,130	650,867
R-squared	0.571	0.571	0.593	0.658	0.629	0.691	0.553
	ln(Export Value per Exporter)						
ln(1+Tariff)	-0.0385***	-0.0383***	-0.0362**	-0.0154	-0.0817***	-0.0208	-0.0134
	(0.0147)	(0.0147)	(0.0151)	(0.0128)	(0.0277)	(0.0290)	(0.0186)
ln(RER)	0.120*	0.120*	0.150**	0.113	0.364***	0.108	0.155**
	(0.0626)	(0.0628)	(0.0600)	(0.0689)	(0.0723)	(0.0715)	(0.0777)
Processing Trade	0.628***	0.628***	0.616***			0.674***	0.444***
	(0.0604)	(0.0604)	(0.0609)			(0.0866)	(0.0696)
ln(1+China's Import Tariff)		-0.0786***					
		(0.0134)					
Observations	1,320,835	1,320,835	1,319,203	953,664	361,856	665,130	650,867
R-squared	0.350	0.350	0.376	0.390	0.449	0.411	0.388
	ln(Export Quantity per Exporter)						
ln(1+Tariff)	-0.0491***	-0.0490***	-0.0477***	-0.0229	-0.0984***	-0.0309	-0.0198
	(0.0161)	(0.0161)	(0.0166)	(0.0140)	(0.0283)	(0.0306)	(0.0182)
ln(RER)	0.132**	0.132**	0.159***	0.121*	0.383***	0.101	0.152**
	(0.0590)	(0.0590)	(0.0573)	(0.0663)	(0.0774)	(0.112)	(0.0664)
Processing Trade	0.471***	0.471***	0.457***			0.542***	0.252***
	(0.0544)	(0.0544)	(0.0546)			(0.0712)	(0.0586)
ln(1+China's Import Tariff)		-0.0399***					
		(0.0150)					
Observations	1,320,835	1,320,835	1,319,203	953,664	361,856	665,130	650,867
R-squared	0.605	0.605	0.622	0.671	0.615	0.626	0.666
Product FE	Yes	Yes					
Time FE	Yes	Yes					
Country FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Product-Time FE			Yes	Yes	Yes	Yes	Yes
Cluster by Country	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Note: (1) Since the tariffs charged by Hong Kong are zero, we exclude Hong Kong from the sample. (2) *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Source: Chinese Customs Export and Import Database, IMF and TRAINS.

Table 7: Real Exchange Rates, Tariffs, and Exporter Dynamics (Annual)

	Full Sample			Ordinary	Processing	OECD	Non-OECD
	ln(New Exporter Numbers)						
ln(1+Tariff)	-0.0283**	-0.0283**	-0.0279**	-0.0339**	-0.0212	0.0181	-0.0251*
	(0.0126)	(0.0126)	(0.0132)	(0.0131)	(0.0195)	(0.0272)	(0.0130)
ln(RER)	0.141**	0.140**	0.142***	0.141**	0.150***	0.201	0.105*
	(0.0545)	(0.0544)	(0.0533)	(0.0675)	(0.0386)	(0.120)	(0.0619)
Processing Trade	-1.149***	-1.149***	-1.162***			-1.253***	-1.114***
	(0.0361)	(0.0361)	(0.0367)			(0.0495)	(0.0523)
ln(1+China's Import Tariff)		-0.0241***					
		(0.00612)					
Observations	1,180,934	1,180,934	1,179,627	856,238	320,285	584,489	592,462
R-squared	0.561	0.561	0.582	0.644	0.524	0.680	0.537
	ln(Exit Exporter Numbers)						
ln(1+Tariff)	-0.0215	-0.0214	-0.0224	-0.0274*	-0.0153	0.0260	-0.0254*
	(0.0142)	(0.0142)	(0.0148)	(0.0143)	(0.0226)	(0.0296)	(0.0144)
ln(RER)	0.0802*	0.0803*	0.0783*	0.0825	0.0823**	0.0367	0.0825
	(0.0438)	(0.0438)	(0.0434)	(0.0583)	(0.0363)	(0.0882)	(0.0519)
Processing Trade	-1.077***	-1.077***	-1.090***			-1.152***	-1.058***
	(0.0362)	(0.0362)	(0.0370)			(0.0495)	(0.0544)
ln(1+China's Import Tariff)		-0.0359***					
		(0.00730)					
Observations	991,865	991,865	990,334	703,408	283,708	533,285	454,222
R-squared	0.553	0.553	0.575	0.633	0.525	0.664	0.531
Product FE	Yes	Yes					
Time FE	Yes	Yes					
Country FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Product-Time FE			Yes	Yes	Yes	Yes	Yes
Cluster by Country	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Note: (1) Since the tariffs charged by Hong Kong are zero, we exclude Hong Kong from the sample. (2) *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Source: Chinese Customs Export and Import Database, IMF and TRAINS.

Table 8: Real Exchange Rates, Tariffs, and Export Variety (Annual)

	Full Sample			Ordinary	Processing	OECD	Non-OECD
	ln(EM Index)						
ln(1+Tariff)	-0.0144***	-0.0143***	-0.0136**	-0.00808	-0.0242***	-0.00771	-0.0171**
	(0.00540)	(0.00540)	(0.00547)	(0.00587)	(0.00872)	(0.00784)	(0.00742)
ln(RER)	0.0854***	0.0848***	0.0878***	0.0889***	0.0932***	0.159***	0.0960***
	(0.0206)	(0.0204)	(0.0201)	(0.0229)	(0.0210)	(0.0381)	(0.0281)
Processing Trade	-0.255***	-0.255***	-0.260***			-0.219***	-0.319***
	(0.0101)	(0.0101)	(0.0104)			(0.0136)	(0.0108)
ln(1+China's Import Tariff)		-0.0471***					
		(0.00650)					
Observations	538,083	538,083	537,904	371,948	165,242	240,648	296,832
R-squared	0.253	0.253	0.279	0.333	0.346	0.318	0.294
	ln(IM Index)						
ln(1+Tariff)	-0.0921***	-0.0920***	-0.0931***	-0.0752***	-0.167***	-0.0256	-0.0698**
	(0.0266)	(0.0266)	(0.0271)	(0.0262)	(0.0363)	(0.0540)	(0.0300)
ln(RER)	0.341***	0.340***	0.335***	0.280**	0.540***	0.276*	0.244
	(0.126)	(0.126)	(0.126)	(0.137)	(0.124)	(0.162)	(0.162)
Processing Trade	-0.356***	-0.356***	-0.361***			-0.205**	-0.637***
	(0.0671)	(0.0671)	(0.0683)			(0.0983)	(0.0722)
ln(1+China's Import Tariff)		-0.0441**					
		(0.0198)					
Observations	538,083	538,083	537,904	371,948	165,242	240,648	296,832
R-squared	0.480	0.480	0.490	0.502	0.566	0.509	0.472
Product FE	Yes	Yes					
Time FE	Yes	Yes					
Country FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Product-Time FE			Yes	Yes	Yes	Yes	Yes
Cluster by Country	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Note: (1) Since the tariffs charged by Hong Kong are zero, we exclude Hong Kong from the sample. (2) *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Source: Chinese Customs Export and Import Database, IMF and TRAINS.

Table 9: Nominal Exchange Rates, Tariffs, and Exports for Balanced Panel (Annual)

	Full Sample			Ordinary	Processing	OECD	Non-OECD
	ln(Exporter Numbers)						
ln(1+Tariff)	-0.0186	-0.0184	-0.0177	-0.0203	-0.0176	0.0408	-0.0320
	(0.0272)	(0.0272)	(0.0285)	(0.0243)	(0.0457)	(0.0432)	(0.0255)
ln(NER)	0.195***	0.197***	0.207***	0.247***	0.270***	0.230	0.293***
	(0.0582)	(0.0582)	(0.0566)	(0.0512)	(0.0774)	(0.171)	(0.0727)
Processing Trade	-1.274***	-1.274***	-1.274***			-1.290***	-1.364***
	(0.0366)	(0.0366)	(0.0373)			(0.0448)	(0.0770)
ln(1+China's Import Tariff)		-0.0644***					
		(0.0111)					
Observations	568,062	568,062	565,466	410,700	151,112	374,696	186,816
R-squared	0.608	0.609	0.640	0.708	0.700	0.702	0.621
	ln(Export Value per Exporter)						
ln(1+Tariff)	-0.0290	-0.0287	-0.0265	-0.00410	-0.0592	-0.0243	0.0246
	(0.0183)	(0.0183)	(0.0188)	(0.0153)	(0.0369)	(0.0312)	(0.0248)
ln(NER)	0.152***	0.155***	0.221***	0.188***	0.332***	0.160*	0.246***
	(0.0516)	(0.0516)	(0.0399)	(0.0409)	(0.0654)	(0.0917)	(0.0555)
Processing Trade	0.938***	0.938***	0.938***			0.926***	0.864***
	(0.0790)	(0.0790)	(0.0805)			(0.103)	(0.109)
ln(1+China's Import Tariff)		-0.105***					
		(0.0117)					
Observations	568,062	568,062	565,466	410,700	151,112	374,696	186,816
R-squared	0.465	0.465	0.489	0.504	0.537	0.511	0.513
	ln(Export Quantity per Exporter)						
ln(1+Tariff)	-0.0430**	-0.0427*	-0.0407*	-0.0130	-0.0821**	-0.0338	0.0139
	(0.0215)	(0.0215)	(0.0221)	(0.0187)	(0.0379)	(0.0355)	(0.0239)
ln(NER)	0.0991*	0.101*	0.162***	0.141***	0.304***	0.160	0.207***
	(0.0574)	(0.0573)	(0.0492)	(0.0471)	(0.0792)	(0.147)	(0.0596)
Processing Trade	0.791***	0.791***	0.791***			0.809***	0.639***
	(0.0694)	(0.0694)	(0.0707)			(0.0850)	(0.103)
ln(1+China's Import Tariff)		-0.0922***					
		(0.0110)					
Observations	568,062	568,062	565,466	410,700	151,112	374,696	186,816
R-squared	0.663	0.663	0.678	0.732	0.659	0.678	0.742
Product FE	Yes	Yes					
Time FE	Yes	Yes					
Country FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Product-Time FE			Yes	Yes	Yes	Yes	Yes
Cluster by Country	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Note: (1) Since the tariffs charged by Hong Kong are zero, we exclude Hong Kong from the sample. (2) The export value of the balanced data is about 87 percent of that of the full sample. (3) *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Source: Chinese Customs Export and Import Database, IMF and TRAINS.

Table 10: Nominal Exchange Rates, Tariffs, and Exports (Quarterly)

	Full Sample			Ordinary	Processing	OECD	Non-OECD
	ln(Exporter Numbers)						
ln(1+Tariff)	-0.0360**	-0.0359**	-0.0368**	-0.0364**	-0.0382	0.0181	-0.0341**
	(0.0163)	(0.0163)	(0.0173)	(0.0163)	(0.0282)	(0.0340)	(0.0156)
ln(NER)	0.0815***	0.0824***	0.110***	0.153***	0.138***	-0.0417	0.136***
	(0.0242)	(0.0241)	(0.0261)	(0.0376)	(0.0217)	(0.0637)	(0.0369)
Processing Trade	-0.822***	-0.822***	-0.839***			-0.906***	-0.829***
	(0.0276)	(0.0276)	(0.0285)			(0.0384)	(0.0462)
ln(1+China's Import Tariff)		-0.0503***					
		(0.00754)					
Observations	3,885,617	3,885,617	3,876,329	2,835,619	1,024,425	2,052,652	1,808,819
R-squared	0.513	0.513	0.539	0.600	0.592	0.630	0.488
	ln(Export Value per Exporter)						
ln(1+Tariff)	-0.0296**	-0.0295**	-0.0286**	-0.0123	-0.0675**	-0.0276	-0.00122
	(0.0137)	(0.0137)	(0.0142)	(0.0114)	(0.0267)	(0.0280)	(0.0175)
ln(NER)	0.0503	0.0512	0.0789**	0.0640*	0.229***	-0.0365	0.119**
	(0.0361)	(0.0361)	(0.0340)	(0.0372)	(0.0427)	(0.0469)	(0.0476)
Processing Trade	0.582***	0.582***	0.572***			0.596***	0.446***
	(0.0596)	(0.0596)	(0.0603)			(0.0835)	(0.0690)
ln(1+China's Import Tariff)		-0.0525***					
		(0.0120)					
Observations	3,885,617	3,885,617	3,876,329	2,835,619	1,024,425	2,052,652	1,808,819
R-squared	0.328	0.328	0.361	0.374	0.442	0.389	0.381
	ln(Export Quantity per Exporter)						
ln(1+Tariff)	-0.0386**	-0.0386**	-0.0380**	-0.0162	-0.0878***	-0.0367	-0.00404
	(0.0155)	(0.0155)	(0.0160)	(0.0131)	(0.0273)	(0.0311)	(0.0173)
ln(NER)	0.0318	0.0320	0.0622*	0.0606	0.233***	-0.0565	0.0881*
	(0.0349)	(0.0348)	(0.0342)	(0.0372)	(0.0504)	(0.0662)	(0.0511)
Processing Trade	0.445***	0.445***	0.434***			0.486***	0.265***
	(0.0524)	(0.0524)	(0.0529)			(0.0668)	(0.0575)
ln(1+China's Import Tariff)		-0.00670					
		(0.0131)					
Observations	3,885,617	3,885,617	3,876,329	2,835,619	1,024,425	2,052,652	1,808,819
R-squared	0.593	0.593	0.614	0.658	0.614	0.615	0.659
Product FE	Yes	Yes					
Time FE	Yes	Yes					
Country FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Product-Time FE			Yes	Yes	Yes	Yes	Yes
Cluster by Country	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Note: (1) Since the tariffs charged by Hong Kong are zero, we exclude Hong Kong from the sample. (2) *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Source: Chinese Customs Export and Import Database, IMF and TRAINS.

Table 11: Nominal Exchange Rates, Tariffs, and Exporter Dynamics (Quarterly)

	Full Sample			Ordinary	Processing	OECD	Non-OECD
	ln(New Exporter Numbers)						
ln(1+Tariff)	-0.0158	-0.0157	-0.0170	-0.0249**	-0.00372	0.0239	-0.0198*
	(0.0112)	(0.0112)	(0.0120)	(0.0112)	(0.0211)	(0.0249)	(0.0106)
ln(NER)	0.0654***	0.0656***	0.0864***	0.132***	0.0714***	-0.0356	0.0969***
	(0.0180)	(0.0180)	(0.0212)	(0.0320)	(0.0135)	(0.0494)	(0.0258)
Processing Trade	-0.791***	-0.791***	-0.806***			-0.886***	-0.743***
	(0.0310)	(0.0310)	(0.0319)			(0.0433)	(0.0423)
ln(1+China's Import Tariff)		-0.0117**					
		(0.00489)					
Observations	3,885,617	3,885,617	3,876,329	2,835,619	1,024,425	2,052,652	1,808,819
R-squared	0.478	0.478	0.510	0.565	0.453	0.602	0.462
	ln(Exit Exporter Numbers)						
ln(1+Tariff)	-0.0124	-0.0124	-0.0138	-0.0218*	0.000444	0.0313	-0.0214*
	(0.0134)	(0.0134)	(0.0142)	(0.0126)	(0.0249)	(0.0285)	(0.0118)
ln(NER)	0.0632***	0.0635***	0.0775***	0.112***	0.0600***	-0.0400	0.118***
	(0.0183)	(0.0183)	(0.0197)	(0.0244)	(0.0189)	(0.0437)	(0.0262)
Processing Trade	-0.776***	-0.776***	-0.788***			-0.857***	-0.727***
	(0.0324)	(0.0324)	(0.0333)			(0.0444)	(0.0450)
ln(1+China's Import Tariff)		-0.0246***					
		(0.00461)					
Observations	2,943,893	2,943,893	2,935,599	2,114,866	806,452	1,648,924	1,273,650
R-squared	0.466	0.466	0.494	0.544	0.442	0.581	0.445
Product FE	Yes	Yes					
Time FE	Yes	Yes					
Country FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Product-Time FE			Yes	Yes	Yes	Yes	Yes
Cluster by Country	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Note: (1) Since the tariffs charged by Hong Kong are zero, we exclude Hong Kong from the sample. (2) *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Source: Chinese Customs Export and Import Database, IMF and TRAINS.

Table 12: Nominal Exchange Rates, Tariffs, and Export Variety (Quarterly)

	Full Sample			Ordinary	Processing	OECD	Non-OECD
	ln(EM Index)						
ln(1+Tariff)	-0.0154***	-0.0153**	-0.0155**	-0.00976	-0.0317***	-0.0123	-0.0167**
	(0.00589)	(0.00589)	(0.00599)	(0.00640)	(0.00867)	(0.00882)	(0.00833)
ln(NER)	0.00211	0.00264	0.0131	0.0135	0.0421**	0.0358	0.0462**
	(0.0157)	(0.0155)	(0.0143)	(0.0144)	(0.0164)	(0.0472)	(0.0192)
Processing Trade	-0.208***	-0.208***	-0.214***			-0.201***	-0.252***
	(0.00881)	(0.00881)	(0.00914)			(0.0130)	(0.0107)
ln(1+China's Import Tariff)		-0.0455***					
		(0.00555)					
Observations	1,714,729	1,714,729	1,713,543	1,211,122	499,177	806,037	905,270
R-squared	0.254	0.254	0.285	0.335	0.340	0.321	0.300
	ln(IM Index)						
ln(1+Tariff)	-0.0729***	-0.0728***	-0.0740***	-0.0622***	-0.142***	-0.0194	-0.0515*
	(0.0239)	(0.0239)	(0.0245)	(0.0234)	(0.0358)	(0.0501)	(0.0264)
ln(NER)	0.252***	0.252***	0.254***	0.223***	0.349***	-0.0720	0.214***
	(0.0555)	(0.0555)	(0.0563)	(0.0632)	(0.0536)	(0.0930)	(0.0785)
Processing Trade	-0.137**	-0.137**	-0.141**			-0.0595	-0.357***
	(0.0655)	(0.0655)	(0.0670)			(0.0984)	(0.0715)
ln(1+China's Import Tariff)		-0.0224					
		(0.0153)					
Observations	1,714,729	1,714,729	1,713,543	1,211,122	499,177	806,037	905,270
R-squared	0.461	0.461	0.473	0.479	0.561	0.483	0.457
Product FE	Yes	Yes					
Time FE	Yes	Yes					
Country FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Product-Time FE			Yes	Yes	Yes	Yes	Yes
Cluster by Country	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Note: (1) Since the tariffs charged by Hong Kong are zero, we exclude Hong Kong from the sample. (2) *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Source: Chinese Customs Export and Import Database, IMF and TRAINS.

Table 13: Exchange Rates, Tariffs, and Exports by Sectors (Annual)

		Nominal Exchange Rate			Real Exchange Rate		
		Numbers	Value	Quantity	Numbers	Value	Quantity
Electrical equipment	Tariff	-0.0686***	-0.0624**	-0.0727**	-0.0632***	-0.0556*	-0.0664*
		(0.0145)	(0.0287)	(0.0344)	(0.0144)	(0.0289)	(0.0348)
	Exchange Rate	0.186***	0.228***	0.205***	0.217***	0.320***	0.329***
		(0.0442)	(0.0659)	(0.0723)	(0.0549)	(0.0841)	(0.0838)
Mechanical appliances	Tariff	-0.0534***	-0.0216*	-0.0143	-0.0511***	-0.0211	-0.0136
		(0.0133)	(0.0130)	(0.0177)	(0.0136)	(0.0131)	(0.0180)
	Exchange Rate	0.154***	0.126*	0.210***	0.205**	0.167	0.305***
		(0.0443)	(0.0647)	(0.0707)	(0.0869)	(0.126)	(0.0998)
Apparel, not knitted or crocheted	Tariff	0.0777*	0.0305	0.0576*	0.0792*	0.0290	0.0554*
		(0.0416)	(0.0361)	(0.0320)	(0.0428)	(0.0357)	(0.0317)
	Exchange Rate	0.547***	0.327**	0.385**	0.605***	0.352	0.428*
		(0.125)	(0.163)	(0.159)	(0.207)	(0.234)	(0.242)
Apparel, knitted or crocheted	Tariff	-0.0340	0.0324	0.0467	-0.0306	0.0322	0.0452
		(0.0425)	(0.0506)	(0.0420)	(0.0428)	(0.0506)	(0.0426)
	Exchange Rate	0.382**	0.109	0.150	0.365	0.164	0.119
		(0.170)	(0.137)	(0.138)	(0.271)	(0.188)	(0.216)
Optical instruments	Tariff	-0.00855	0.0385*	0.0173	-0.0100	0.0400*	0.0206
		(0.0125)	(0.0206)	(0.0240)	(0.0126)	(0.0208)	(0.0240)
	Exchange Rate	0.0688*	0.129	0.192*	0.162***	0.204**	0.368***
		(0.0357)	(0.0962)	(0.0990)	(0.0571)	(0.0971)	(0.120)
Furniture	Tariff	0.0137	-0.0508*	-0.0861***	0.0197	-0.0421	-0.0833***
		(0.0200)	(0.0276)	(0.0282)	(0.0202)	(0.0264)	(0.0294)
	Exchange Rate	0.406***	0.310***	0.223***	0.759***	0.631***	0.573***
		(0.0803)	(0.0731)	(0.0734)	(0.111)	(0.108)	(0.120)
Toys and sports requisites	Tariff	0.0263	-0.00809	0.0225	0.0241	-0.0116	0.0172
		(0.0270)	(0.0301)	(0.0287)	(0.0268)	(0.0301)	(0.0288)
	Exchange Rate	0.347***	0.228***	0.141*	0.513***	0.307***	0.245**
		(0.0412)	(0.0751)	(0.0740)	(0.0576)	(0.104)	(0.0956)
Mineral products	Tariff	0.0786***	0.0727**	0.0600	0.0832***	0.0767**	0.0621
		(0.0283)	(0.0320)	(0.0403)	(0.0287)	(0.0335)	(0.0423)
	Exchange Rate	0.159**	0.0964	-0.00988	0.274***	0.144	0.00338
		(0.0689)	(0.0732)	(0.0703)	(0.0993)	(0.129)	(0.129)
Footwear	Tariff	-0.00365	0.0552**	0.0619**	-0.00744	0.0510*	0.0545*
		(0.0181)	(0.0264)	(0.0297)	(0.0180)	(0.0274)	(0.0302)
	Exchange Rate	0.202***	0.258***	0.205***	0.329***	0.251**	0.238**
		(0.0487)	(0.0577)	(0.0598)	(0.0708)	(0.100)	(0.100)
Iron or steel	Tariff	-0.186***	-0.491*	-0.557*	-0.186***	-0.478*	-0.545*
		(0.0644)	(0.260)	(0.290)	(0.0656)	(0.265)	(0.296)
	Exchange Rate	-0.115	0.128	0.00306	0.0172	0.365	0.235
		(0.142)	(0.704)	(0.800)	(0.244)	(0.663)	(0.806)

Note: (1) Since the tariffs charged by Hong Kong are zero, we exclude Hong Kong from the sample. (2) *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Source: Chinese Customs Export and Import Database, IMF and TRAINS.

Table 14: Exchange Rates, Tariffs, and Differentiated Products (Annual)

	Nominal Exchange Rate		Real Exchange Rate	
	ln(Exporter Numbers)			
ln(1+Tariff)	-0.0480***	0.0211	-0.0476***	0.0231
	(0.0176)	(0.0279)	(0.0180)	(0.0281)
ln(1+Tariff) × Diff Dummy		-0.0782***		-0.0797***
		(0.0212)		(0.0214)
ln(Exchange Rate)	0.122***	0.0848***	0.189***	0.148**
	(0.0304)	(0.0318)	(0.0602)	(0.0620)
ln(Exchange Rate) × Diff Dummy		0.0433***		0.0463***
		(0.0102)		(0.0107)
Processing Trade	-1.197***	-1.199***	-1.193***	-1.196***
	(0.0330)	(0.0332)	(0.0336)	(0.0338)
Observations	1,332,448	1,332,448	1,281,307	1,281,307
R-squared	0.592	0.594	0.592	0.594
	ln(Export Value per Exporter)			
ln(1+Tariff)	-0.0384**	0.0181	-0.0364**	0.0218
	(0.0149)	(0.0264)	(0.0152)	(0.0269)
ln(1+Tariff) × Diff Dummy		-0.0644**		-0.0661**
		(0.0292)		(0.0298)
ln(Exchange Rate)	0.105***	0.0807*	0.150**	0.122**
	(0.0400)	(0.0420)	(0.0598)	(0.0610)
ln(Exchange Rate) × Diff Dummy		0.0290**		0.0314***
		(0.0115)		(0.0118)
Processing Trade	0.601***	0.599***	0.616***	0.614***
	(0.0598)	(0.0596)	(0.0601)	(0.0599)
Observations	1,332,448	1,332,448	1,281,307	1,281,307
R-squared	0.377	0.378	0.376	0.377
	ln(Export Quantity per Exporter)			
ln(1+Tariff)	-0.0489***	0.00160	-0.0484***	0.00559
	(0.0165)	(0.0298)	(0.0167)	(0.0303)
ln(1+Tariff) × Diff Dummy		-0.0560*		-0.0595*
		(0.0330)		(0.0334)
ln(Exchange Rate)	0.0987**	0.0594	0.159***	0.116*
	(0.0382)	(0.0405)	(0.0574)	(0.0594)
ln(Exchange Rate) × Diff Dummy		0.0458***		0.0494***
		(0.0139)		(0.0140)
Processing Trade	0.445***	0.442***	0.461***	0.459***
	(0.0543)	(0.0540)	(0.0543)	(0.0540)
Observations	1,332,448	1,332,448	1,281,307	1,281,307
R-squared	0.626	0.626	0.626	0.626
Country FE	Yes	Yes	Yes	Yes
Product-Time FE	Yes	Yes	Yes	Yes
Cluster by Country	Yes	Yes	Yes	Yes

Note: (1) Since the tariffs charged by Hong Kong are zero, we exclude Hong Kong from the sample. (2) Diff Dummy is 1 if the product is a differentiated good according to the classification from Rauch (1999); otherwise, it is 0. (3) *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

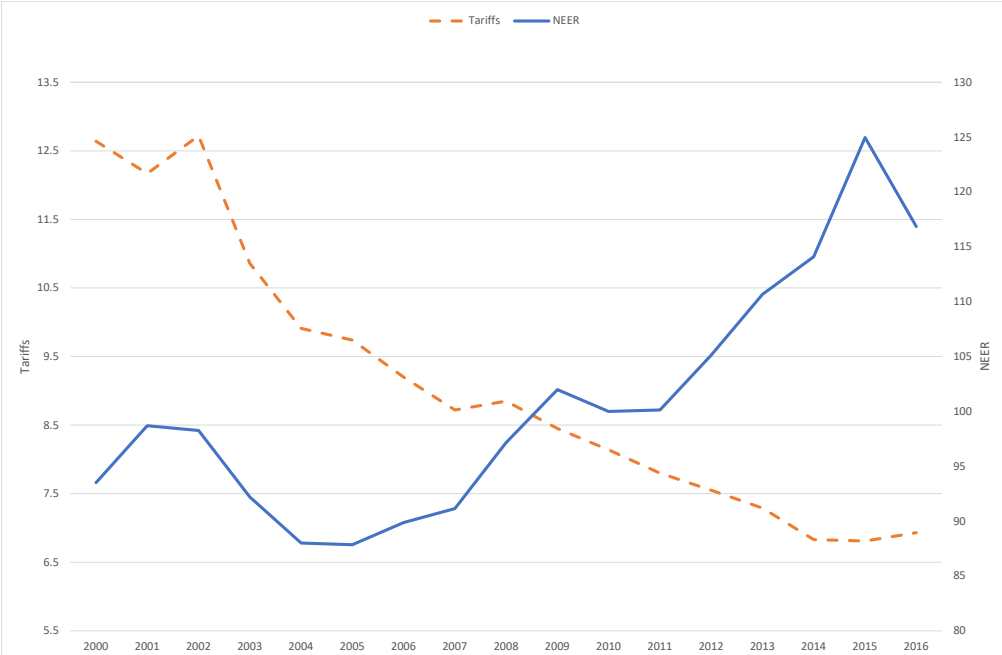
Source: Chinese Customs Export and Import Database, IMF and TRAINS.

Table 15: Elasticities in Selected Studies

Paper	Country	Tariff elasticity	Exchange rate elasticity	
			NER	RER
Exporter numbers				
Ours	China	0.048	0.123	0.191
Bas et al. (2017)	China & France	3.83		
Tang and Zhang (2012)	China			0.17
Export variety				
Ours	China	0.014	0.028	0.088
Feenstra and Kee (2007)	Mexico	2.049		
Colacelli (2010)	136 countries			0.045

Note: (1) Our paper is at the product-destination-year level. (2) Bas et al. (2017) is at the product-destination-year level. (3) Tang and Zhang (2012) is at the product-destination-month level. (4) Feenstra and Kee (2007) is at the industry-year level. (5) Colacelli (2010) is at the country-year level.

Figure 1: Average Tariffs Charged by Trade Partners and China's Nominal Effective Exchange Rates



Note: An increase (decrease) in nominal effective exchange rates means China's yuan appreciation (depreciation).

Source: IMF and TRAINS.

Figure 2: Tariffs and Nominal Exchange Rates

Note: A decrease (increase) in nominal exchange rates means China's yuan appreciation (depreciation).
Source: IMF and TRAINS.

Figure 3: Tariffs and Nominal Exchange Rates (Continued)

Note: A decrease (increase) in nominal exchange rates means China's yuan appreciation (depreciation).
Source: IMF and TRAINS.

A Appendix

A.1 Proof for Proposition

(a) $\zeta_{\phi_X,\tau} > 1$**:**

We obtain the elasticity of the exporting cutoff with respect to tariffs τ by taking log of (2.2) and differentiating it with respect to τ:

$$\zeta_{\phi_X,\tau} = 1 + \zeta_{\phi_D^*,\tau},$$

where $\zeta_{\phi_D^*,\tau}$ is the elasticity of the domestic cutoff level (ϕ_D^*) with respect to τ for Foreign firms.

We next show that $\zeta_{\phi_D^*,\tau} > 0$. By taking log of (2.3) and differentiating it with respect to τ, we obtain

$$\zeta_{\phi_{D,\tau}^*} = -1 + \frac{1}{1 - \frac{1}{\tau\tau^{*\kappa} F^{\frac{\kappa-(\nu-1)}{\nu-1}}}} > 0,$$

where the last inequality is because the second term is greater than 1.

Thus, $\zeta_{\phi_X,\tau} = 1 + \zeta_{\phi_D^*,\tau} > 1$.

$\zeta_{N_X,\tau} < -\kappa$**:**

Given the number of Home firms at Foreign $N_X = (\phi_{min}/\phi_X)^\kappa N_P$ where N_P is the pool of Home firms, we have

$$\zeta_{N_X,\tau} = -\kappa\zeta_{\phi_X,\tau} + \zeta_{N_p,\tau}.$$

Since

$$N_P = \frac{\kappa - (\nu-1)}{\kappa} \frac{1}{\nu W \phi_{min}^\kappa} \left[\frac{(\tau\tau^*)^\kappa F^{\frac{\kappa-(\nu-1)}{\nu-1}} \frac{\phi_D^\kappa I}{f_D} - \frac{\phi_X^\kappa \epsilon I^*}{f_X}}{(\tau\tau^*)^\kappa F^{\frac{\kappa-(\nu-1)}{\nu-1}} - 1} \right],$$

we have

$$\zeta_{N_p,\tau} = \frac{1}{(\tau\tau^*)^\kappa F^{\frac{\kappa-(\nu-1)}{\nu-1}} \frac{\phi_D^\kappa I}{f_D} - \frac{\phi_X^\kappa \epsilon I^*}{f_X}} \left[(\tau\tau^*)^\kappa F^{\frac{\kappa-(\nu-1)}{\nu-1}} \frac{\phi_D^\kappa I}{f_D} \kappa(1 + \zeta_{\phi_D,\tau}) - \frac{\phi_X^\kappa \epsilon I^*}{f_X} \kappa \zeta_{\phi_X,\tau} \right]$$
$$- \frac{\kappa(\tau\tau^*)^\kappa F^{\frac{\kappa-(\nu-1)}{\nu-1}}}{(\tau\tau^*)^\kappa F^{\frac{\kappa-(\nu-1)}{\nu-1}} - 1}.$$

Since

$$\zeta_{\phi_D,\tau} = \zeta_{\phi_X,\tau} - \frac{\tau^\kappa F^{\frac{\kappa-(\nu-1)}{\nu-1}}}{\tau^\kappa F^{\frac{\kappa-(\nu-1)}{\nu-1}} - (\rho\epsilon)^{\frac{\kappa\nu}{\nu-1}}\left(\frac{f_X^*}{f_D}\right)^{\frac{\kappa-(\nu-1)}{\nu-1}}},$$

we have

$$\begin{aligned}\zeta_{\phi_D,\tau} + 1 &= \zeta_{\phi_X,\tau} - \frac{\tau^\kappa F^{\frac{\kappa-(\nu-1)}{\nu-1}}}{\tau^\kappa F^{\frac{\kappa-(\nu-1)}{\nu-1}} - (\rho\epsilon)^{\frac{\kappa\nu}{\nu-1}}\left(\frac{f_X^*}{f_D}\right)^{\frac{\kappa-(\nu-1)}{\nu-1}}} + 1 \\ &< \zeta_{\phi_X,\tau}.\end{aligned}$$

Thus,

$$(\tau\tau^*)^\kappa F^{\frac{\kappa-(\nu-1)}{\nu-1}} \frac{\phi_D^\kappa I}{f_D}\kappa(1+\zeta_{\phi_D,\tau}) - \frac{\phi_X^\kappa \epsilon I^*}{f_X}\kappa\zeta_{\phi_X,\tau} < \left[(\tau\tau^*)^\kappa F^{\frac{\kappa-(\nu-1)}{\nu-1}} \frac{\phi_D^\kappa I}{f_D} - \frac{\phi_X^\kappa \epsilon I^*}{f_X}\right]\kappa\zeta_{\phi_X,\tau}$$

and

$$\zeta_{N_p,\tau} < \kappa\zeta_{\phi_X,\tau} - \kappa < \kappa(\zeta_{\phi_X,\tau} - 1).$$

Thus,

$$\begin{aligned}\zeta_{N_X,\tau} &= -\kappa\zeta_{\phi_X,\tau} + \zeta_{N_p,\tau} \\ &< -\kappa.\end{aligned}$$

(b) $\zeta_{\phi_X,\epsilon} < -(1+\mu)$**:**

We obtain the elasticity of the exporting cutoff with respect to nominal exchange rates ϵ by taking log (2.2) and differentiating it with respect to ϵ:

$$\zeta_{\phi_X,\epsilon} = \zeta_{\phi_{D,\epsilon}^*} - \frac{\nu}{\nu-1},$$

where $\zeta_{\phi_{D,\epsilon}^*}$ is the elasticity of the domestic cutoff level (ϕ_D^*) with respect to ϵ for Foreign firms.

We have $\nu/(\nu-1) = 1+\mu$, and it can be shown that $\zeta_{\phi_{D,\epsilon}^*} < 0$.

Thus, $\zeta_{\phi_X,\epsilon} = \zeta_{\phi_{D,\epsilon}^*} - \frac{\nu}{\nu-1} < -(1+\mu)$.

$\zeta_{N_X,\epsilon} > \kappa(1+\mu)$**:**

We have

$$\zeta_{N_X,\epsilon} = -\kappa\zeta_{\phi_X,\epsilon} + \zeta_{N_p,\epsilon}.$$

Since $\zeta_{\phi_X,\epsilon} < -(1+\mu)$, we have $-\kappa\zeta_{\phi_X,\epsilon} > \kappa(1+\mu)$.

Since

$$\zeta_{N_p,\epsilon} = \frac{1}{(\tau\tau^*)^\kappa F^{\frac{\kappa-(\nu-1)}{\nu-1}} \frac{\phi_D^\kappa I}{f_D} - \frac{\phi_X^\kappa \epsilon I^*}{f_X}} \left[(\tau\tau^*)^\kappa F^{\frac{\kappa-(\nu-1)}{\nu-1}} \frac{\phi_D^\kappa I}{f_D} \kappa\zeta_{\phi_D,\epsilon} - \frac{\phi_X^\kappa \epsilon I^*}{f_X}(\kappa\zeta_{\phi_X,\epsilon}+1) \right],$$

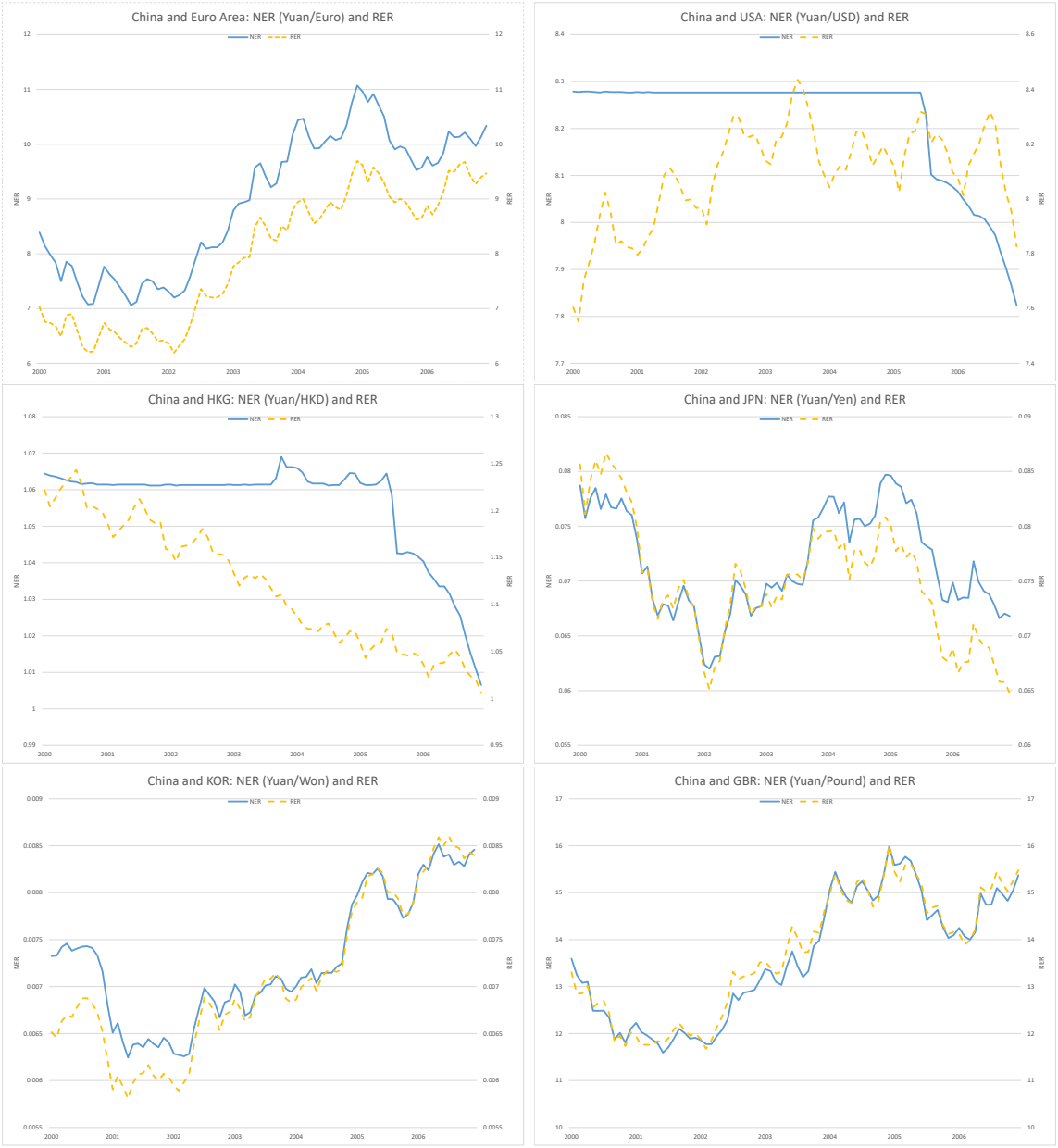
$\zeta_{\phi_D,\epsilon} > 0$ and $\zeta_{\phi_X,\epsilon} < -(1+\mu)$, we have $\zeta_{N_p,\epsilon} > 0$.

Thus, $\zeta_{N_X,\epsilon} > \kappa(1+\mu)$.

A.2 Nominal and Real Exchange Rates

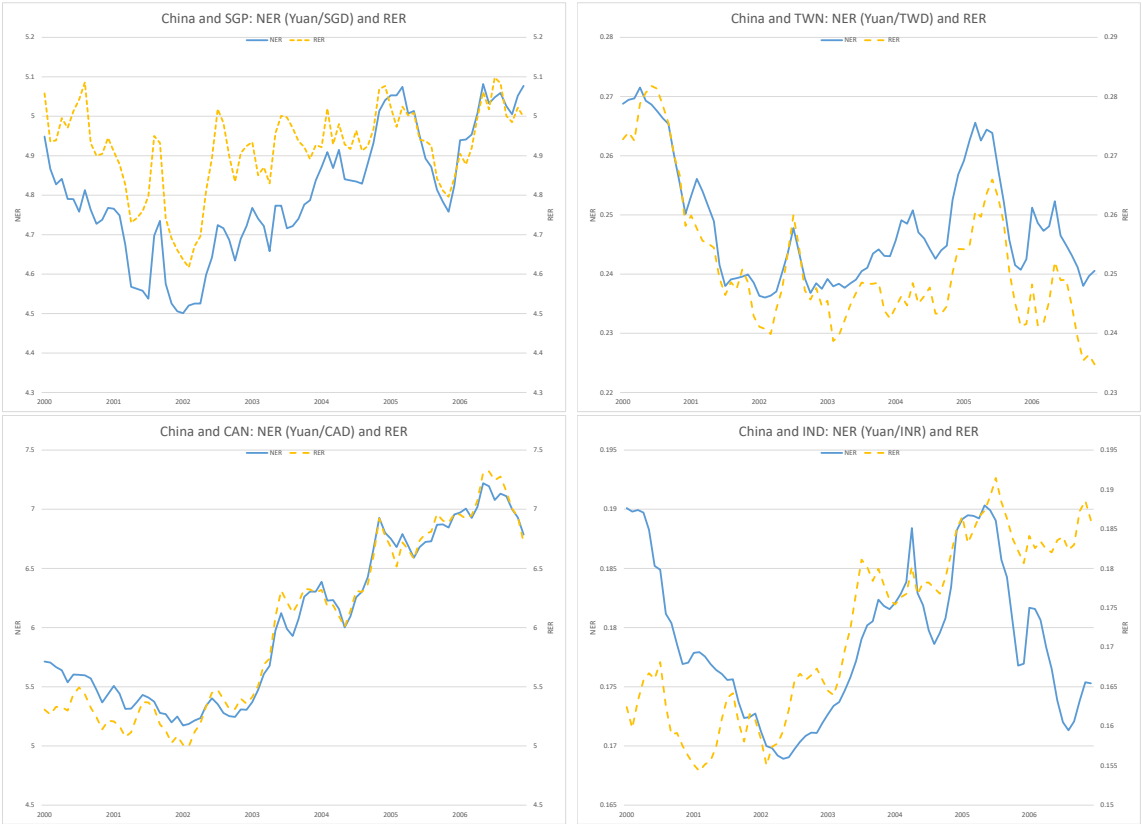
Figures A1-A2 demonstrate the relationship between nominal and real exchange rates for China's top 10 trade partners from 2000/01 to 2006/12. Notably, due to data constraints, to calculate the real exchange rates for the euro area we use producer prices for the euro area's CPI.

Figure A1: Nominal and Real Exchange Rates



Note: A decrease (increase) in nominal/real exchange rates means China's appreciation (depreciation). Source: IMF.

Figure A2: Nominal and Real Exchange Rates (Continued)



Note: A decrease (increase) in nominal/real exchange rates means China's appreciation (depreciation). Source: IMF.