Two-Way Traders and Dollar Shocks: Absorbers or Amplifiers?

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Abstract

We examine how dollar exchange rate fluctuations affect exports through firms that both import and export. Using transaction-level Chinese customs data, we show that dollar exchange rate fluctuations have much larger effects on export prices and quantities than bilateral exchange rates. These effects are strongly amplified by two-way traders, who cut export prices more and expand quantities more following an RMB appreciation against the dollar. We attribute this amplification to lower input costs and expanded input varieties. A quantitative heterogeneous-firm model with dominant currency pricing confirms that supply-chain channels—cheaper inputs and expanded sourcing varieties—account for the majority of the amplification, and identifies a general equilibrium spillover through which two-way traders' import substitution lowers domestic factor prices for all firms. Consistent with this mechanism, we find empirically that pure exporters in product markets with greater two-way trader presence exhibit stronger export responses, especially in labor-intensive industries.

Keywords: dollar exchange rate, two-way trader, pure exporter, export prices, export quantity

JEL classification: F14, F31, F44

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1 Introduction

Exchange rate fluctuations have long been central to international economics due to their far-reaching effects on trade patterns, firm behavior, and macroeconomic adjustment. Early studies focused primarily on bilateral or trade-weighted exchange rate movements, documenting their influence on various economic outcomes (e.g., Campa and Goldberg, 2005; Gopinath et al., 2010; Berman et al., 2012; Li et al., 2015). More recently, attention has shifted toward the dominant role of the US dollar in international trade and finance (e.g., Gopinath et al., 2020; Boz et al., 2022). A growing body of research shows that fluctuations in the dollar's exchange rate generate sizable global spillovers, influencing trade flows and financial conditions well beyond bilateral trading relationships (e.g., Goldberg and Tille, 2009; Gopinath, 2015; Georgiadis and Schumann, 2021; Gopinath and Stein, 2021; De Gregorio et al., 2024; McLeay and Tenreyro, 2025). This dominant-currency paradigm underscores the dollar as a key channel through which global shocks are transmitted across countries.

Despite this progress, existing research has largely examined the effects of exchange rate movements on exporting and importing activities separately (e.g., Berman et al., 2012; Gopinath and Neiman, 2014; Chen and Juvenal, 2016; Amiti et al., 2019). This leaves open a central question: how do firms that simultaneously import and export—two-way traders—respond to exchange rate fluctuations, particularly movements in the dollar? This question is of first-order importance in an era of rapidly expanding global value chains, where two-way traders account for a large and growing share of trade (Bernard et al., 2009; Feng et al., 2016). Exposed to exchange rate movements on both input and output margins, two-way traders may respond to dollar fluctuations differently from pure exporters. A common intuition suggests that such firms are partially hedged, since import-side and export-side effects may offset one another. In this paper, we show that the opposite is true: two-way traders amplify dollar shocks rather than absorb them.

Using transaction-level Chinese Customs data from 2006 to 2015, we examine how two-way traders' exports respond to fluctuations in the RMB–USD exchange rate. China provides a particularly suitable setting for this analysis. Since its WTO accession in 2001, China has become deeply integrated into international production networks, with its share of global goods exports rising from 1.78% in 2000 to 13.75% in 2022. Two-way traders account for roughly 60% of China's total export value, making their exchange rate responses of first-order importance for understanding trade dynamics. Moreover, the majority of China's exports are invoiced in US dollars, rendering firms particularly exposed to dollar exchange rate movements. This exposure became especially salient following China's exchange rate regime reform in July 2005, when the renminbi shifted from a fixed peg to a managed float against the dollar. Taken together, China's deep integration into global value chains, the prominence of two-way traders, and the widespread use of dollar invoicing make it an ideal laboratory for studying how dollar fluctuations affect export behavior.

To better assess the importance of dollar exchange rate fluctuations for trade, we restrict our sample to China's trade with non-dollar economies—excluding partners that adopt the US dollar or maintain a fixed peg against it—and focus on the post-2005 period, when China moved from a dollar-pegged exchange rate regime to a managed floating exchange rate regime. We first show that movements in the RMB–USD exchange rate have substantially stronger effects on China's export volumes and prices than bilateral exchange rate fluctuations with destination currencies. Whereas an appreciation of the RMB relative to a destination currency has limited effects on export prices and quantities, an appreciation of the RMB against the dollar significantly lowers RMB-denominated export prices and is associated with substantial increases in export quantities. This evidence is consistent with the view that dollar-denominated pricing plays a significant role in China's trade.

Building on these observations, we examine the role of two-way traders in shaping the trade effects of dollar exchange rate movements. We classify firms that engaged in both exporting and importing in the previous year as two-way traders and compare their responses to those of pure exporters. We find that two-way traders amplify the effects of dollar movements. Following an appreciation of the RMB against the dollar, two-way traders reduce their RMB-denominated export prices by significantly more than pure exporters, implying lower pass-through to dollar prices. Along the quantity margin, two-way traders also expand export volumes by substantially more than pure exporters. Because two-way traders experience larger marginal cost reductions through cheaper imported inputs, they can lower export prices more aggressively, which in turn generates larger demand-driven quantity expansions. These amplification effects are robust to alternative definitions of two-way trading and to specifications that control for market share, firm size, financial constraints, strategic complementarity in invoicing, and ownership type. We further address concerns about endogenous selection into two-way trading using stable-status restrictions and propensity score matching, both of which confirm the baseline findings.

Our finding that two-way traders amplify the trade effects of dollar exchange rate movements challenges the intuition that firms engaged in both importing and exporting are naturally hedged. To shed light on this amplification, we propose two underlying mechanisms.

The first is the **input cost channel**. Under dollar invoicing, an appreciation of the RMB against the dollar reduces the cost of imported inputs, allowing two-way traders to lower export prices more aggressively and expand export volumes by more than pure exporters. We provide supporting evidence from both import and export data. On the import side, RMB appreciations significantly reduce RMB-denominated import prices, with larger effects for sticky-price inputs and inputs sourced from high-dollar-invoicing countries. On the export side, the amplification is stronger for two-way traders with higher imported input intensity, greater reliance on sticky-price inputs, and sourcing from high-dollar-invoicing origins.

The second is the **input variety channel**. Under dollar invoicing, RMB appreciation expands firms' extensive margins of input sourcing by increasing the set of imported varieties that

can be sourced profitably, generating potential productivity gains (Gopinath and Neiman, 2014; Blaum, 2024; Devereux et al., 2025). We show that RMB appreciations increase imported input varieties—both the number of varieties per sourcing country and the number of sourcing countries—and that two-way traders with greater input variety exhibit stronger amplification in export prices and quantities.

In addition, we explore potential **spillover effects** from two-way traders to pure exporters operating in the same product markets. When RMB appreciation encourages two-way traders to expand their use of imported inputs, this can influence local labor market conditions. If imported inputs and labor are highly substitutable, this adjustment dampens labor demand and wages, reducing production costs for pure exporters in labor-intensive industries. Consistent with this mechanism, we find that pure exporters in product categories with a higher presence of two-way traders display stronger export responses to dollar movements, with effects concentrated in labor-intensive industries. Although the spillover is smaller than the direct amplification for two-way traders, it suggests that the trade effects of dollar fluctuations extend beyond two-way traders through their market presence.

To interpret these facts, we develop a quantitative model with heterogeneous firms. Two-way traders source both domestic and foreign inputs and export their output, while pure exporters rely only on domestic inputs. In the model, a dollar appreciation lowers the domestic-currency cost of imported inputs and reduces the effective cost of expanding the sourcing network. These mechanisms lower marginal costs more strongly for two-way traders than for pure exporters, generating larger price responses and larger quantity responses. The model also allows for general-equilibrium spillovers through local factor markets, so that the expansion of two-way traders can affect firms that do not import directly.

The quantitative model serves two purposes. First, it provides a disciplined framework for interpreting the reduced-form evidence. Second, it allows us to quantify the contribution of different channels to the observed amplification effect. In particular, we decompose the response into a direct export-price channel, an imported input cost channel, an imported input variety channel, and a spillover channel. The quantitative results show that the direct export-price response matters in the short run, but the imported input cost and variety channels account for a substantial share of the amplification for two-way traders. The spillover channel is present but quantitatively smaller than the direct mechanisms. This decomposition clarifies why two-way traders are not simple natural hedges: their import-side exposure creates a powerful cost-reduction margin that can reinforce, rather than offset, the export-side response to dollar shocks.

We also find evidence of spillovers to pure exporters in markets with a high concentration of two-way traders. Pure exporters in these markets respond more strongly to dollar shocks, particularly in labor-intensive industries, consistent with a general-equilibrium mechanism operating through local factor markets. Although the spillover effect is smaller than the direct amplification observed for two-way traders, it suggests that the influence of two-way traders extends

beyond their own export behavior and affects other firms in the same market.

We contribute to three strands of the literature. First, our study relates to the literature on the trade effects of exchange rate fluctuations (e.g., Campa and Goldberg, 2005; Berman et al., 2012; Amiti et al., 2019). We depart from this work by highlighting the central role of dollar exchange rate movements and documenting the distinct responses of two-way traders to dollar fluctuations. Our finding that two-way traders amplify the effects of dollar shocks challenges the conventional view that import-intensive exporters are naturally hedged and therefore less exposed to exchange rate movements.

Second, our work adds to the growing literature on dominant currency pricing (Goldberg and Tille, 2009; Gopinath et al., 2020; Amiti et al., 2022; De Gregorio et al., 2024; McLeay and Tenreyro, 2025). We provide evidence of the dollar's outsized role in shaping international trade, particularly in China's trade.[1] Moreover, we show that dollar dominance in the global trading system is central to trade dynamics within expanding global value chains and constitutes an important channel through which external shocks translate into sizable domestic real effects.

Third, our study complements the literature on international propagation of shocks through global value chains. While existing work has focused primarily on macroeconomic outcomes (Cook and Patel, 2023) or transmission through inter-firm supply chain linkages (Acemoglu et al., 2012; Ozdagli and Weber, 2017; Boehm et al., 2019), we advance this literature by emphasizing on the role of two-way traders. By documenting how two-way-traders amplify dollar exchange rate shocks and generate spillovers to pure exporters, we provide new insights into how firm-level trade structures shape the international diffusion of shocks along global value chains.

Our findings also carry important policy implications, particularly for developing economies. As countries become more integrated into global trade and value chains, policymakers should be attentive to vulnerabilities arising from dollar-denominated pricing and deeper global value chain participation. Policies that promote invoicing currency diversification, support access to more diversified export markets, and strengthen firms' financial resilience may help mitigate exposure to dollar exchange rate shocks and enhance economic stability in an increasingly interconnected global economy.

The remainder of the paper is organized as follows. Section 2 describes the data and documents the trade effects of dollar exchange rate fluctuations. Section 3 examines the role of two-way traders in shaping these effects. Section 4 develops a quantitative model to rationalize the empirical findings, and Section 5 concludes.

[1] Our finding that Chinese exports respond strongly to dollar exchange rate fluctuations, but weakly to movements in the RMB's bilateral exchange rates with trading partners, also helps explain the muted trade effects of bilateral exchange rate movements widely documented in the literature on the Chinese economy (e.g., Li et al., 2015).

2 Data and Dollar Exchange Rate Effects

2.1 Data

Our primary data source is transactions-level customs data for Chinese firms from 2006 to 2015, collected by the General Administration of Customs of China (GACC).[2] This dataset covers the universe of China's import and export transactions and contains detailed information for each transaction, including the Harmonized System (HS) product code, trade value and quantity, Chinese firm name, trading-partner country, unit of measure, and trade mode. In this study, we exclude all processing-trade transactions and focus on ordinary trade only. Following the convention in the literature (e.g., Li et al., 2015; Feng et al., 2016; Fan et al., 2018), we aggregate products to the HS-6 digit level and compute unit values as measures of prices.[3]

To study meaningful variation in dollar exchange rate exposure and avoiding mechanical links arising from dollar pegs, we restrict the sample to China's trade with non-dollar economies—excluding trading partners that either adopt the US dollar as legal tender or maintain a fixed exchange rate against the dollar.[4] This segment accounts for a substantial share of China's trade: during 2006–2015, exports to non-dollar countries represent, on average, 78.1% of China's total exports. Because our analysis focuses on production firms' responses to exchange rate movements, we exclude trade intermediaries.[5] Following Gopinath et al. (2020), we also drop transactions involving commodities.[6]

We identify two-way traders by matching firms' import and export records based on firm names and classify a firm as a two-way trader if it engages in both importing and exporting in the previous year.[7] Over the 2006–2015 period, two-way traders account for a disproportionately

[2]Prior to July 21, 2005, China maintained a fixed exchange rate regime that pegged the RMB to the US dollar, resulting in limited variation in the nominal RMB–USD exchange rate. Following the 2005 exchange rate reform, China moved toward a managed floating regime, allowing for greater flexibility in the RMB–USD rate. Accordingly, our analysis focuses on the post-2005 period, during which dollar exchange rate fluctuations are more pronounced and therefore more relevant for assessing their effects on China's trade. Our main results on the amplification effects of two-way traders remain robust when the estimation sample is extended back to 2000.

[3]Export (import) unit value is computed as the ratio of export (import) values to export (import) quantities. To mitigate the influence of outliers and the potential unit value bias documented in Silver (2007), we winsorize unit value growth at the 5th and 95th percentiles.

[4]Excluded countries include: Aruba, United Arab Emirates, Antigua and Barbuda, Bahrain, Bahamas, Belize, Bermuda, Barbados, Cayman Islands, Djibouti, Dominica, Ecuador, Federated States of Micronesia, Grenada, Jordan, Saint Kitts and Nevis, Lebanon, Saint Lucia, Montserrat, Oman, Panama, Palau, Qatar, Saudi Arabia, El Salvador, Timor-Leste, United States of America, Saint Vincent and the Grenadines (Venezuela is also excluded due to its extreme exchange rate volatility following Gopinath et al. (2020)).

[5]We follow the method in Ahn et al. (2011) to identify trade intermediaries based on certain key words in firm names. See Ahn et al. (2011) for details.

[6]Following the broad definition in Gopinath et al. (2020), commodities are defined as products classified under HS chapters 1–27 and 72–83, including animal, vegetable, food, mineral, and metal products.

[7]Following the Broad Economic Classification (BEC), products are grouped into three categories: capital goods (categories 41 and 521), intermediate goods (111, 121, 21, 22, 31, 322, 42, and 53), and final consumption goods (112, 122, 522, and 61–63). In defining two-way traders, we exclude firms' imports of final consumption goods in order to focus on input-related channels. Our main results remain unchanged when two-way traders are defined to include imports of final consumption goods.

large share of China's trade. On the export side, they account for only about 27% of exporting firms yet generate more than 58% of total export value, indicating a strong concentration of export activity among two-way traders. On the import side, two-way traders represent nearly 57% of importing firms and account for over 60% of total import value, underscoring their central importance in China's import activity as well. We later also verify that our main results are robust to alternative definitions of two-way traders.

In Table 1, we compare the export performance between two-way traders and pure exporters between 2006 and 2015 across several dimensions, including average export values, quantities, prices; growth rates of export value, quantity and price; market share at the firm-product-destination level; and the number of destination countries served at the firm-product level. The summary statistics reveal that the two groups are broadly comparable across most dimensions. Average export values and quantities are similar. While two-way traders exhibit slightly higher export prices, the difference is modest. Growth rates of export value, quantity, and price are also closely aligned. Likewise, market shares and destination coverage differ only moderately. Overall, these comparisons suggest that two-way traders and pure exporters are similar in terms of scale, growth, and market presence, mitigating concerns that systematic differences in observable characteristics drive the differential responses documented in our analysis.

Another key variable in our analysis is the exchange rate. Country-level data on bilateral nominal exchange rates and consumer price indices (CPI) are obtained from the International Financial Statistics (IFS). We construct real exchange rates by deflating nominal exchange rates using the CPI. Specifically, we define exchange rate ($E_{ij,t}$) as the number of units of currency i required to purchase one unit of currency j in year t; under this definition, an increase in $E_{ij,t}$ corresponds to an appreciation of currency j relative to currency i.

We also include a set of macroeconomic control variables in our empirical analysis. Country-level real GDP growth is obtained from the IFS, China's producer price index (PPI) inflation from the CEIC database, and the WTI oil price and VIX index from the St. Louis Fed's FRED database, with annual values constructed as averages of daily observations. Data on the global GDP deflator are drawn from the World Development Indicators. Detailed summary statistics of key variables used in our empirical analyses are provided in the Appendix Table A1.

2.2 Dollar Exchange Rate Effects

Prior to our investigation on the role of two-way traders in the trade effects of dollar exchange rate fluctuations, we first present evidence for the central role of the dollar in China's trade. Following standard practice in the dollar invoicing literature (e.g., Gopinath et al., 2020; Boz et al., 2022), we estimate the following firm-product-destination panel specification to assess the importance of dollar exchange rate fluctuations to the Chinese exports:

$$\Delta y_{f,h,i,t} = \beta_0 + \beta_1 \Delta e_{iRMB,t} + \gamma_1 \Delta e_{\$RMB,t} + \theta X_{f,i,t} + \eta_{f,h,i} + \varepsilon_{f,h,i,t} \tag{1}$$

where f denotes firm, h denotes the product at the HS 6-digit level, i denotes destination country, and t denotes year. $\Delta y_{f,h,i,t}$ represents the growth rate of export quantity or RMB price. $\Delta e_{iRMB,t}$ is the growth rate of bilateral real exchange rate between RMB and destination country i's currency, and $\Delta e_{\$RMB,t}$ represents the growth rate of the RMB–USD real exchange rate. Positive values of $\Delta e_{iRMB,t}$ or $\Delta e_{\$RMB,t}$ represent a real appreciation of RMB relative to country i's currency or the US dollar in year t.

$X_{f,i,t}$ is a vector of control variables at various levels. We include country-level characteristics, such as real GDP growth and inflation rate in China and in its trading-partner countries. To account for global economic and financial conditions, we control for the growth rate of the WTI oil price, the log VIX index, and the growth rate of the adjusted broad dollar index.[8] We also include firm-specific time trends to capture firms' time-varying characteristics. $\eta_{f,h,i}$ represents firm-product-destination fixed effects, which absorb time-invariant unobserved heterogeneity at the firm, product, destination, and their interaction levels.

We are particularly interested in the coefficient on the RMB–USD exchange rate, γ_1, which captures the effects of dollar exchange rate movements on export prices and quantities. In a conventional framework with producer-currency pricing (PCP) or local-currency pricing (LCP), dollar exchange rate fluctuations should have no impacts on exports conditional on bilateral exchange rates between non-dollar trading partners, implying $\gamma_1 = 0$. By contrast, under dollar pricing with sticky dollar prices, an appreciation of the RMB against the US dollar lowers export prices in RMB and, holding the RMB-destination bilateral exchange rate fixed, reduces destination-currency prices as well, thereby boosting foreign demand. Accordingly, we expect γ_1 to be significantly negative in export price regressions and significantly positive in export quantity regressions.

Table 2 presents the estimation results for Equation (1). Columns (1) and (2) examine export quantities, while columns (3) and (4) focus on export prices denominated in RMB. When only the bilateral exchange rate between the RMB and the destination currency is included (columns (1) and (3)), its effect on export prices is statistically insignificant, and its effect on export quantities is significantly negative but modest in magnitude. A 1% real appreciation of RMB against the destination currency has essentially no impact on export prices and reduces export quantities by about 0.128%. These findings are consistent with the existing literature documenting weak export responses to bilateral exchange rate movements in China (e.g., Marquez and Schindler, 2007; Li et al., 2015).

Columns (2) and (4) add the RMB–USD exchange rate. The estimated effects of the bilateral exchange rate remain largely unchanged, while the dollar exchange rate exhibits statistically significant and economically sizable effects on both export prices and quantities. Specifically, a 1% appreciation of the RMB against the US dollar lowers export prices in RMB by 0.594%

[8]The adjusted broad dollar index is constructed following Collins et al. (2019). It is computed as a weighted average of bilateral exchange rates against the US dollar at the country pair level, which excludes the paired trading-partner countries from the weighting scheme.

and increases export quantities by 0.735%. These dollar effects are broadly in line with recent evidence from the dollar invoicing literature and point to a substantial role for dollar pricing in Chinese exports.[9] They also offer a natural explanation for the weak response of Chinese exports to bilateral exchange rate movements documented in earlier studies: when export prices are predominantly set in dollars, changes in bilateral exchange rates between non-dollar currencies have limited pass-through to export prices and quantities.

In the Appendix Table A2, we also conduct a series of robustness checks on the effects of dollar exchange rate fluctuations. First, we replace the real bilateral and dollar exchange rates with their nominal counterparts to assess whether the dollar effects persist when nominal rates are used. Second, we augment the baseline specification with additional controls, including lagged exchange rate growth and exchange rate volatility. Third, we re-estimate Equation (1) using weighted OLS with trade share as weights to account for heterogeneity in trade volumes. Fourth, we examine the dollar effects separately across different product categories, including intermediate goods, final goods, differentiated goods, and non- petrochemical-and-metal products. Across all specifications, we consistently find a significantly negative effect of dollar exchange rate movements on export prices and a significantly positive effect on export quantities, confirming the robustness of the dollar effects in Chinese exports.

3 The Role of Two-way Traders

3.1 Basic Results

Having established the fact that dollar exchange rate movements have significant impacts on Chinese exports, we proceed to explore the role of two-way traders in shaping the dollar effect. To that end, we interact changes in the dollar exchange rate and the bilateral exchange rate, respectively, with a two-way trader indicator and include these two interaction terms, along with the two-way trader indicator itself, into our baseline specification:

$$\begin{aligned}\Delta y_{f,h,i,t} = \beta_0 + \gamma_1 e_{\$RMB,t} + \gamma_2(\Delta e_{\$RMB,t} \times TW_{f,t-1}) + \beta_1 \Delta e_{iRMB,t} \\ + \beta_2(\Delta e_{iRMB,t} \times TW_{f,t-1}) + \lambda TW_{f,t-1} + \theta X_{f,i,t} + \eta_{f,h,i} + \varepsilon_{f,h,i,t}\end{aligned} \tag{2}$$

where $TW_{f,t-1}$ is a binary indicator for two-way traders that takes on the value of one if firm f participates in both importing and exporting activities in year $t-1$, and zero otherwise. The key coefficient of interest is γ_2, which captures the differential responses of export prices or quantities to dollar exchange rate fluctuations between two-way traders and pure exporters.

Table 3 reports the estimation results of Equation (2). As shown in columns (1) and (3), the

[9] Using firm-level customs data from Colombian, Gopinath et al. (2020) show that a 1% appreciation of peso against the US dollar reduces export prices in peso by 0.633% and increases export quantities by 1.007%, whereas the appreciation of peso against destination country's currency has negligible effects on export prices and quantities.

interaction between the dollar exchange rate and the two-way trader indicator is significantly positive in the export quantity regression and significantly negative in the export price regression. These results indicate that two-way traders tend to amplify the impacts of an RMB appreciation against the US dollar by expanding export quantities more and reducing export prices more aggressively than pure exporters. Specifically, following a 1% appreciation of the RMB relative to the US dollar, pure exporters lower export prices (in RMB) by 0.508% and increase export quantities by 0.601%, whereas two-way traders reduce export prices by 0.704% and expand export quantities by 0.904%. Thus, two-way traders exhibit approximately 38.6% greater price adjustment and 50.4% stronger quantity responses than pure exporters.

In columns (2) and (4), we further include year fixed effects to control for time-varying aggregate shocks common to all exporters. With year fixed effects included, the level effect of the change in dollar exchange rate is absorbed, leaving identification to rely on differential responses across firms. The results show that the amplification effects associated with two-way traders remain both qualitatively and quantitatively similar.

In contrast, two-way traders respond much less to bilateral exchange rate movements than pure exporters. When the RMB appreciates against a destination country's currency, two-way traders adjust their RMB export prices only weakly, often keeping prices stable or even raising them slightly, and experience a substantially larger contraction in export quantities. This muted response to bilateral exchange rate fluctuations stands in sharp contrast to the pronounced amplification observed for dollar exchange rate movements.

3.2 Robustness Checks

In this subsection, we assess the robustness of our results by incorporating additional interaction terms between exchange rate changes and firm characteristics, as well as by adopting alternative definitions of two-way traders.

Additional Interaction Terms. A potential concern is that two-way trader status may proxy for other firm attributes, such as market share, size, financial conditions, currency invoicing choices or ownership structures, so that the amplification of dollar shocks attributed to two-way traders might merely reflect confounding firm characteristics. To address this concern, we interact exchange rate changes with a set of firm-level or industry-level attributes and include these additional interaction terms in Equation (2). Estimation results from these robustness checks are reported in Table 4.

We first consider firm market share. As documented in the literature (e.g., Amiti et al., 2014; Goldberg and Tille, 2016), firms with greater market power tend to rely more heavily on imported inputs, have more scope to adjust markups in response to exchange rate movements, and are more likely to use vehicle-currency pricing such as dollar invoicing. To ensure that the two-way trader indicator is not simply capturing market power, we proxy for export market

power using the firm's lagged export market share at the product-destination level and include its interaction with exchange rate changes as an additional control.[10]

As shown in columns (1) and (2), including this interaction leaves our main results essentially unchanged: the estimated coefficients on the interaction between the dollar exchange rate and the two-way trader indicator remain very similar, both qualitatively and quantitatively, to the baseline estimates in Table 3. Regarding the market share interaction term itself, we find that, holding other factors constant, firms with larger export market shares tend to reduce their RMB export prices less but expand export quantities more following an appreciation of the RMB against the US dollar.[11]

The second confounding factor we examine is firm size. As pointed out in a recent study by Amiti et al. (2022), firm size plays an important role in shaping exporters' adjustment in price and quantity as well as their choices of invoicing currency. To ensure that our findings are not driven by differential responses to exchange rate fluctuations across firms with different sizes, we include firm size, proxied by a firm's total export value from the previous year, and its interaction with exchange rate changes as additional controls in columns (3) and (4). Again, including the firm size interaction does not affect our main findings, as we continue to find a similar amplifying role of two-way traders in the trade effects of dollar exchange rate movements as observed in the baseline regressions. With respect to the firm size interaction *per se*, as the RMB appreciates relative to the US dollar, large exporters tend to lower their export prices by less than small exporters but not adjust their export quantities in a significantly different way from small exporters.

Third, we examine whether firm financial constraints confound our results. Prior studies show that financially constrained firms respond differently to exchange rate movements and volatility (Strasser, 2013; Lin et al., 2018), and that dollar funding conditions play an important role in shaping export behavior (Gopinath and Stein, 2021; Bruno and Shin, 2023). If two-way trader status is correlated with firms' financial constraints, the observed amplification effect could reflect differences in financing conditions rather than trading patterns *per se*.

To address this concern, we interact a widely adopted industry-level measure of external finance dependence with changes in dollar and bilateral exchange rates separately and include

[10]The export market share variable is defined at the firm-product-country level. Specifically, The market share of firm f for product h in the country i in year t is constructed as: $MS_{f,h,i,t} = \frac{EXP_{f,h,i,t}}{\sum_{f \in CN} EXP_{f,h,i,t}} \times s_{CN,h,i,t}$, where $EXP_{f,h,i,t}$ is the value of product h exported by firm f to country i in year t and $s_{CN,h,i,t}$ is the share of country i's imports of product h sourced from China, calculated based on the trade flow data from the UN Comtrade database. The marker share variable itself is also included in the regressions.

[11]The estimated coefficients on the interaction between market share and bilateral exchange rate changes are significantly negative in the export-price regression and significantly positive in the export-quantity regression. This implies that, holding other factors constant, firms with larger export market shares lower their RMB export prices more and experience smaller declines in export quantities when the RMB appreciates against a destination-country currency. The relatively lower pass-through of bilateral exchange rate movements to destination-currency prices for high-market-share Chinese exporters is consistent with the evidence for Belgian firms documented in Amiti et al. (2014).

these interaction terms as additional controls in columns (5) and (6).[12] Incorporating these financial-constraint interactions does not alter our main findings regarding the amplification role of two-way traders. Turning to the newly included interaction between external finance dependence and changes in dollar exchange rate, we find that firms with greater reliance on external finance (i.e., financially more constrained firms) adjust their RMB-denominated export prices less and experience smaller increases in export quantities following an appreciation of the RMB relative to the US dollar.[13]

Fourth, we address the potential confounding role of strategic complementarity in pricing-currency choice. Previous studies document that strategic complementarity is a key determinant of firms' invoicing decisions: firms are more likely to price in US dollars when their competitors do so (Goldberg and Tille, 2008; Mukhin, 2022; Benguria and Wagner, 2024). If two-way traders systematically differ in their exposure to such strategic complementarity, our results could reflect heterogeneous responses to exchange rate movements driven by invoicing incentives rather than trading status.

To address this concern, we follow the literature (e.g., Gopinath et al., 2010) and construct a measure of strategic complementarity at the destination-product level by computing the share of destination country i's imports of product h sourced from countries that predominantly use dollar invoicing in exports.[14] We then interact this measure with exchange rate changes and include the interaction terms along with the strategic complementarity measure itself in the regressions. As shown in columns (7) and (8), our findings regarding the amplification effects of two-way traders remain robust to the inclusion of these strategic-complementarity interactions. Conditional on firms' exposure to strategic complementarity in dollar pricing, two-way traders continue to exhibit stronger price and quantity responses to dollar exchange rate movements. Meanwhile, we also notice that when the RMB appreciates against the US dollar, firms facing greater strategic complementarity in dollar pricing tend to reduce their RMB export prices more and experience larger expansions in export quantities.

Finally, to address the concern that our findings for two-way traders may simply reflect heterogeneous responses to exchange rate fluctuations across firms with different ownership structures, we control for interactions between exchange rate changes and firms' ownership types in the regressions. The corresponding estimates are reported in columns (9) and (10). Our main

[12] Following Rajan and Zingales (1996), we compute the industry median of the share of capital expenditures that are not financed by internal cash flows from operations based on the Compustat data on US-listed firms from 1990 to 2005, and use it as a measure of external finance dependence for each industry. Since the external finance dependence variable is time invariant at the industry level, its level effect is absorbed by firm-country-product fixed effects.

[13] As for the interaction between external finance dependence and bilateral exchange rate movements, we find that, conditional on the impacts of dollar exchange rate movements, financially more constrained firms exhibit slightly larger, albeit statistically insignificant, pass-through of bilateral exchange rate changes to destination-currency prices and experience smaller declines in export quantities.

[14] Countries predominantly use dollar invoicing in exports include dollarized countries, countries with fixed exchange rate against the US dollar, and non-dollar countries with dollar invoicing share in exports exceeding 50%.

results for two-way traders remain robust to the inclusion of these ownership interactions. In addition, the estimates indicate that, following an appreciation of the RMB against the U.S. dollar, foreign-invested firms reduce RMB-denominated export prices more and expand export quantities more than domestically owned private firms, whereas state-owned firms lower export prices by considerably less and exhibit no significant increase in export quantities.

Alternative Measures of Two-way Traders. We further assess the robustness of our findings using alternative measures of two-way trading and report results in Appendix Table A3. First, in columns (1) and (2), we redefine two-way traders as firms that engaged in both exporting and importing in at least one of the previous two years. Second, we replace the binary two-way trader indicator with continuous measures of two-way trading intensity. Specifically, columns (3) and (4) use the lagged import-to-export ratio, while columns (5) and (6) use the average import-to-export ratio over the previous two years. Across all specifications, we consistently find that two-way traders significantly amplify the effects of dollar exchange rate fluctuations on export prices and quantities.

3.3 Dealing with Endogeneity

A potential challenge in identifying the causal role of two-way traders in the trade effects of dollar exchange rate movements is that firms' participation in two-way trading may be endogenous and correlated with underlying firm characteristics. To address this self-selection concern, we adopt two approaches. First, we restrict the analysis to a subset of firms that maintain stable trading patterns, either as two-way traders or as pure exporters, throughout the sample period, and re-estimate Equation (2) in Table 5. Columns (1) and (2) focus on firms that were two-way traders (or pure exporters) at the beginning of the sample period and remained so for the entire sample period, while columns (3) and (4) include firms that preserve their initial trading status but allows for firm exit. Across both samples, we continue to find a significantly negative coefficient on the interaction between dollar exchange rate changes and the two-way trader indicator in the export price regressions, and a significantly positive coefficient in the export quantity regressions.

Second, we employ propensity score matching (PSM) to construct matched samples of two-way traders and pure exporters with similar characteristics. Specifically, in each year, we match two-way traders to pure exporters based on a set of firm attributes, including ownership type, export inception year, lagged export value, lagged number of varieties exported, lagged number of destination markets, lagged share of exports to high dollar-invoicing countries, and lagged export share of differentiated goods. To ensure robustness, we implement three matching methods, including four-nearest-neighbor matching (with replacement), radius matching, and kernel matching. We then re-estimate our baseline specification using each matched sample.

Table 6 summarizes the estimation results from these matched samples. Across all matching

methods, the estimated coefficients on the interaction between the two-way trader indicator and dollar exchange rate changes remain statistically significant, with a negative sign in the export price regressions and a positive sign in the export quantity regressions, and are quantitatively stable.

Overall, these results above provide strong evidence that two-way traders amplify the trade effects of dollar exchange rate movements, reinforcing our confidence that the main findings are unlikely to be driven by self-selection bias.

3.4 Underlying Mechanisms

Having established that two-way traders amplify the trade effects of dollar exchange rate fluctuations, in this subsection, we further explore the underlying mechanisms through which this amplification operates. Specifically, we consider two channels: the input cost channel and the input variety channel.

3.4.1 Input Cost Channel

When imports are predominantly invoiced in dollar, an appreciation of the RMB against the dollar lowers the RMB-denominated cost of imported inputs. For Chinese firms that rely on imported inputs, this exchange rate movement reduces unit production costs. Because two-way traders both import inputs and export outputs, they benefit more directly from this cost reduction than pure exporters, which do not import. As a result, following an RMB appreciation against the dollar, two-way traders are able to reduce their RMB-denominated export prices more aggressively and expand export quantities by more than pure exporters.

A direct test of this input cost channel would require detailed, product-level information on firms' cost structures and the currency in which their imported inputs are invoiced. However, such granular data are not available. We therefore rely on indirect tests and present evidence from both import and export data that is consistent with the operation of this channel.

Evidence from import prices. In Table 7, we focus on imports of non-final goods and examine the pass-through of dollar exchange rate movements to RMB import prices. If imports are predominantly invoiced in dollars and dollar prices are sticky, we should observe a strong response of RMB import prices to dollar exchange rate changes, with larger pass-through for goods with stickier prices or those sourced from countries with a high tendency to invoice in dollars.

To that end, we first re-estimate Equation (1) using the change in the log RMB import price as the dependent variable. As shown in column (1), dollar exchange rate movements have a substantial impact on import prices: a 1% appreciation of the RMB against the US dollar leads

to a 0.633% decrease in RMB-denominated import prices.[15]

In column (2), we classify a product as a sticky-price good if its price adjustment frequency is below the median and interact this indicator with exchange rate changes.[16] The coefficient on this interaction term is negative and statistically significant at the 1% level, indicating a substantially larger dollar exchange rate passthrough to the RMB prices for imports with greater price stickiness.

In column (3), we classify a sourcing country as a high-dollar-invoicing country if more than 50% of its exports are invoiced in dollars on average and interact this indicator with exchange rate changes.[17] The estimated coefficient on this interaction is again significantly negative, suggesting that dollar exchange rate pass-through to RMB import prices is considerably larger when imports originate from countries with a high propensity to invoice in dollars.

Taken together, these results consistently point to the prevalence of dollar invoicing and sticky dollar price in China's imports. Moreover, in column (4), we include the interaction between exchange rate changes and the two-way trader indicator in the import price regression. The results show that, relative to pure importers, two-way traders experience a sharper decline in RMB import prices following a RMB appreciation against the dollar.[18] Overall, the import price evidence suggests that two-way traders enjoy larger cost savings from RMB appreciation against the US dollar than pure exporters who do not import.

Evidence from export responses. We next turn to the export data to assess whether export responses to dollar exchange rate movements are consistent with the input cost channel. If China's imports are largely invoiced in dollar and their dollar prices are sticky, the amplification of dollar exchange rate shocks should be stronger for two-way traders that (1) rely more heavily on imported inputs, (2) import a larger share of sticky-price inputs, or (3) source inputs from countries with a high dollar invoicing tendency. We examine these heterogeneities in Table 8.

First, we test whether the amplification effect associated with two-way traders varies with their imported input intensity. We construct an HS 2-digit industry-level measure of imported input intensity using China's 2005 Annual Survey of Industrial Enterprises and Customs data, and classify industries as high import intensity if their imported input intensity measures ex-

[15] While not reported for brevity, we also include changes in the bilateral exchange rate in the regression. Compared to fluctuations in the dollar exchange rate, bilateral exchange rate movements have a much smaller effect on import price: a 1% appreciation of the RMB against the sourcing country currency is associated with only a 0.29% decline in RMB-denominated import prices.

[16] The data on the frequency of price adjustments are originally constructed by Nakamura and Steinsson (2008) at the BLS Entry Level Item (ELI) level and subsequently aggregated to the 4-digit NAICS level by Fajgelbaum et al. (2020). We further map these price adjustment frequencies to the HS 6-digit level using the HS6-NAICS concordance available at the following website: `https://rdrr.io/github/insongkim/concordance/man/hs6_naics.html`.

[17] We obtain country-level data on the currency composition of export invoicing from Boz et al. (2025).

[18] This result also implies that, following an appreciation of the RMB against the U.S. dollar, two-way traders benefit more from reductions in imported input costs than pure exporters, even when the latter rely on imported inputs indirectly through purchases from pure importers.

ceed the median.[19] We then include a triple interaction term among the high-import-intensity indicator, exchange rate changes, and the two-way-trader indicator in Equation (2). As shown in columns (1) and (4), two-way traders operating in import-intensive industries exhibit significantly stronger amplification effects on both export quantities and export prices.

Second, we examine whether amplification depends on the share of imported inputs with sticky prices. After classifying imported goods by price stickiness, we compute each firm's share of sticky-price imports and interact this measure with exchange rate changes and the two-way-trade indicator. Columns (2) and (5) show that the resulting triple interaction terms are statistically significant in both export price and quantity regressions, with a negative coefficient for export prices and a positive coefficient for export quantities.[20] These results indicate that two-way traders importing a larger share of sticky-price inputs reduce export prices more and expand export quantities more following an RMB appreciation against the US dollar.

Finally, we distinguish two-way traders by their share of imports from high-dollar-invoicing countries (high versus low) and interact exchange rate changes separately for each group. Columns (3) and (6) reveal that while both types of two-way traders amplify the effects of dollar exchange rate movements, the amplification is significantly stronger for those sourcing inputs from high-dollar-invoicing countries.

Overall, the combined evidence from import prices and export responses provides strong support for the input cost channel as one of the key mechanisms through which two-way traders amplify the trade effects of dollar exchange rate shocks.

3.4.2 Input Variety Channel

An alternative mechanism through which two-way traders amplify the effects of dollar exchange rate movements is the input variety channel. A growing literature (e.g., Gopinath and Neiman, 2014; Blaum, 2024; Devereux et al., 2025) shows that exchange rate shocks affect firms' access to imported input varieties and, in turn, their productivity. Under dominant dollar invoicing and in the presence of fixed costs associated with importing distinct input varieties, an appreciation of the RMB against the U.S. dollar reduces the effective cost of sourcing foreign inputs for Chinese firms. This cost reduction allows importers to expand the range of imported input varieties, thereby raising productivity through better input complementarities and quality upgrading. Because two-way traders are directly engaged in importing, they are particularly well

[19] We first compute each firm's import input share, defined as the share of imported non-final input costs in total production costs, using the 2005 Annual Survey of Industrial Enterprises. We then follow the literature (Bernard et al., 2010; Ma et al., 2014) to calculate, for each (HS2) industry, the weighted average of firms' import input shares, where the weights are based on firms' export share from the 2005 Customs data. This measure serves as our industry-level indicator of import intensity.

[20] To facilitate comparison between pure exporters and two-way traders with varying degrees of sticky-price imports, we set the sticky-price import share to zero for pure exporters. In the regressions, we include the sticky-price import share, its interaction with exchange rate changes, and its interaction with the two-way trader indicator. As a robustness check, we also restrict the sample to two-way traders only and find similar results.

positioned to benefit from such input variety expansion. Relative to pure exporters, which do not import directly, two-way traders can translate these productivity gains into larger reductions in RMB-denominated export prices and stronger expansion in export quantities following an RMB appreciation against the dollar, thereby amplifying the trade effects of dollar exchange rate fluctuations. In what follows, we provide supporting evidence for this channel from both the import and export sides.

Evidence from import varieties. We first examine whether an appreciation of the RMB relative to the dollar is associated with an expansion in firms' imported input varieties. To this end, we consider three dimensions of import variety at the firm level: (1) the number of input varieties imported per sourcing country, (2) the number of sourcing countries, and (3) the total number of imported input varieties.

Table 9 summarizes the effects of dollar exchange rate fluctuations on these three measures of import variety, using both the full sample of imported goods and the subsample of non-final goods. Across all variety measures and samples, we consistently find significantly positive coefficients on dollar exchange rate changes. These results indicate that RMB appreciation relative to the dollar not only leads firms to import more varieties from existing sourcing countries but also encourages them to expand the set of countries from which they source inputs. These patterns are consistent with the operation of the imported input variety channel.

Evidence from export responses. Having established that RMB appreciation against the dollar increases firms' import input varieties, we next examine whether two-way exporters with greater input varieties amplify the trade effects of dollar exchange rate fluctuations more strongly. Specifically, we replace the two-way trade indication in Equation (2) with firm-level measures of import variety, focusing on two dimensions: (a) the number of input varieties imported in the previous year and (b) the number of sourcing countries in the previous year.[21]

Table 10 reports the results from these regressions. Regardless of the import variety measure used, the interaction terms between exchange rate changes and import variety are significantly negative in the export price regressions and significantly positive in the export quantity regressions. These findings indicate that two-way traders importing a larger range of input varieties exhibit substantially stronger amplification effects on export prices and quantities in response to dollar exchange rate fluctuations.

Taken together, the evidence from both import variety expansion and heterogeneous export responses underscores the importance of the input variety channel in explaining why two-way traders amplify the trade effects of dollar exchange rate movements. By facilitating productivity gains through expanded access to imported inputs under dollar invoicing, this channel complements the input cost mechanism and reinforces the central role of two-way traders in amplifying

[21]We also classify two-way traders into single- and multiple-variety groups based on whether they import a single or multiple input varieties, or source inputs from a single country or multiple countries. We then interact the corresponding group indicators separately with exchange rate changes. As shown in Appendix Table A4, using these discrete measures of import variety yields qualitatively similar results.

the trade effects of dollar shocks.

3.5 Spillovers to Pure Exporters

So far, we have shown that an appreciation of the RMB against the U.S. dollar enables two-way traders to expand the range of imported input varieties. Such an expansion in the use of imported inputs can have important implications for local labor markets, depending on whether imported inputs and labor are substitutes or complements. When the degree of substitution between imported inputs and labor is high, increased reliance on imported inputs by two-way traders during episodes of RMB appreciation may reduce their labor demand, thereby exerting downward pressure on local wages. This wage adjustment can, in turn, benefit pure exporters—particularly those in labor-intensive industries—by lowering production costs and enabling them to reduce export prices and expand export volumes.

To test for such spillover effects on pure exporters, we focus on a subsample consisting exclusively of pure exporters and examine whether their export price and quantity responses to dollar exchange rate movements vary with the presence of two-way traders at the product level. Table 11 reports the results. In columns (1) and (2), we measure the presence of two-way traders at the HS 6-digit level using the lagged export share of two-way traders and include its interaction with exchange rate changes in the regressions. The estimated interaction coefficient is significantly negative in the export price regression and significantly positive in the export quantity regression. These results indicate that, following an appreciation of the RMB against the U.S. dollar, pure exporters in product categories with a greater presence of two-way traders reduce their RMB export prices more sharply and expand export quantities more substantially.

To gauge the economic magnitude of these effects, consider a 1% appreciation of the RMB against the U.S. dollar. Pure exporters in product categories with the average concentration of two-way traders (0.488) reduce export prices by 0.395% and increase export quantities by 0.54%. In contrast, pure exporters in product categories where the concentration of two-way traders is higher by one standard deviation (0.173) reduce export prices by 0.523% and increase export quantities by 0.839%, implying responses that are approximately 32.5% larger for prices and 55.5% larger for quantities.

We further assess the robustness of these spillover effects using alternative measures of two-way trader concentration at the HS 6-digit level. Specifically, we consider the average export share of two-way traders over the sample period and their initial export share in 2006. As shown in columns (3) through (6), our main findings remain unchanged: pure exporters exhibit stronger responses to dollar exchange rate movements in product categories with a higher concentration of two-way traders.[22]

[22]We also proxy the presence of two-way traders at the HS 2-digit industry level using their lagged export share, their average export share over the sample period, and their initial export share in 2006, respectively. Across all three measures, the results remain both qualitatively and quantitatively similar to those reported in Table A5.

Finally, to provide more direct evidence that the interaction effects documented above operate through labor market spillovers, we examine whether pure exporters in more labor-intensive industries benefit disproportionately from the presence of two-way traders.[23] We construct a measure of labor intensity at the HS 2-digit industry level using China's 2005 Annual Survey of Industrial Enterprises and Customs data and include a triple interaction among exchange rate changes, the lagged export share of two-way traders, and industry labor intensity in the regressions.[24] Columns (7) and (8) show that this triple interaction term is significantly negative in the export price regression and significantly positive in the export quantity regression. These results indicate that the spillover effects of two-way traders are indeed more pronounced for pure exporters operating in more labor-intensive industries, consistent with a labor-market channel.

In sum, the results in this subsection provide consistent evidence of spillover effects from two-way traders to pure exporters operating within the same product markets. Pure exporters in product categories with a higher concentration of two-way traders exhibit significantly stronger export price and quantity responses to dollar exchange rate movements, with these effects being particularly pronounced in more labor-intensive industries. These spillovers indicate that the trade effects of dollar exchange rate movements extend beyond two-way traders, propagating across firms and industries through their presence.

4 Quantitative Model

We develop a small open economy model with heterogeneous firms to rationalize the empirical findings and quantify the contribution of different channels. The model features three firm types: domestic firms (T1) that sell domestically and import intermediates, two-way traders (T2) that export while sourcing both domestic and foreign inputs, and pure exporters (T3) that export using only domestic inputs. The key mechanisms are: (i) dominant currency pricing generates expenditure-switching effects from dollar shocks; (ii) imported input cost reductions lower marginal costs for T2 firms; (iii) endogenous expansion of sourcing networks further reduces costs through love-of-variety; and (iv) general equilibrium factor price adjustments transmit these effects to T3 firms.

[23] This test also helps rule out the possibility that our finding, namely, that a higher concentration of two-way traders within a product category is associated with stronger responses of pure exporters to dollar exchange rate movements, is driven solely by competitive interactions between two-way traders and pure exporters.

[24] We compute each firm's labor cost per unit of capital stock and then construct an HS 2-digit industry-level measure of labor intensity as the export-share-weighted average of this ratio across firms. Labor costs include wages, labor insurance, and welfare benefits, while real capital stock is constructed using the perpetual inventory method following Brandt et al. (2012). We also consider alternative industry-level measures of labor intensity, including the wage-to-capital stock ratio and the employment-to-capital stock ratio. Our results are robust to these alternative measures.

4.1 Environment

The economy is populated by a representative household and a continuum of differentiated firms with total measure normalized to unity. Firms are exogenously divided into domestic firms (measure ν_1), two-way traders (measure $(1-\nu_1)\nu_2$), and pure exporters (measure $(1-\nu_1)(1-\nu_2)$). The representative household has standard CRRA preferences over domestic goods and separable labor disutility, with details provided in Appendix B.1.[25]

4.2 Firms and Production

Each firm produces according to a Cobb-Douglas technology combining labor and materials:

$$y_i = \phi_i l_i^{1-\gamma} x_i^{\gamma}, \tag{3}$$

where ϕ_i is time-invariant idiosyncratic productivity and $\gamma \in (0,1)$ is the materials share. The material bundle aggregates domestic inputs (q_{iD}) and imported inputs (x_{iM}) via a CES aggregator:

$$x_i = \left[(1-\alpha_s)^{\frac{1}{\varepsilon}} (q_{iD})^{\frac{\varepsilon-1}{\varepsilon}} + \alpha_s^{\frac{1}{\varepsilon}} (x_{iM})^{\frac{\varepsilon-1}{\varepsilon}} \right]^{\frac{\varepsilon}{\varepsilon-1}}, \tag{4}$$

where α_s parameterizes openness to imports and $\varepsilon > 1$ is the elasticity of substitution between domestic and foreign inputs. For pure exporters, $\alpha_3 = 0$, so they rely exclusively on domestic inputs. The foreign input bundle is a CES aggregate over sourcing countries: $x_{iM} = \left(\int_{\Sigma_i} q_{ij}^{(\kappa-1)/\kappa} dj \right)^{\kappa/(\kappa-1)}$, where Σ_i is the firm's endogenous sourcing network.

Import Price Index and Marginal Cost. Assuming exogenous foreign input prices constant across countries in USD, the import price index evaluates to:

$$P_I(n_{iM}) = \frac{p^{\$} \cdot n_{iM}^{\frac{1}{1-\kappa}}}{e^{\$}}, \tag{5}$$

where $n_{iM} = |\Sigma_i|$ is the number of sourcing countries and $e^{\$}$ is the nominal exchange rate (USD per domestic currency). This expression captures two core mechanisms: an appreciation directly lowers the import price index, while an expansion in n_{iM} further reduces it via love-of-variety. The marginal cost for firm i of type s is:

$$MC_i = \frac{1}{\phi_i} \left(\frac{W}{1-\gamma} \right)^{1-\gamma} \left(\frac{Q_s(n_{iM})}{\gamma} \right)^{\gamma}, \tag{6}$$

[25] The household maximizes $U_0 = E_0 \sum_{t=0}^{\infty} \beta^t \left[\log(C_t) - \eta \frac{L_t^{1+\psi}}{1+\psi} \right]$ subject to a standard budget constraint with portfolio adjustment costs.

where $Q_s(n_{iM}) = \left[(1-\alpha_s)P_D^{1-\varepsilon} + \alpha_s P_I(n_{iM})^{1-\varepsilon}\right]^{1/(1-\varepsilon)}$ is the composite input price index.

Endogenous Sourcing Strategy. Importing entails a type-specific fixed cost f_s^M per sourcing country, denominated in USD. Firms choose the size of their sourcing network to minimize total production costs. The optimal network size satisfies:

$$\frac{\gamma\alpha_s}{\kappa-1}\left(\frac{P_I(n_{iM})}{Q_s(n_{iM})}\right)^{1-\varepsilon} MC_i(n_{iM})y_i = n_{iM}\frac{f_s^M}{e^{\$}}. \tag{7}$$

Under the restrictions $\gamma(\sigma-1) < \kappa-1$ and $\varepsilon \leq \kappa$, a unique interior solution $n_{iM}^* \in (0,\infty)$ exists, and an appreciation of the domestic currency strictly increases the equilibrium number of sourcing countries (proof in Appendix C).

Export Pricing. Exporters sell to foreign markets subject to iceberg trade costs τ, facing local-currency demand $y_{i,j,t} = (p_{i,j,t}^{LC}/P_{j,t})^{-\sigma} d_{j,t}$. Export prices are subject to Calvo rigidity with non-resetting probability θ_X. Crucially, an exogenous fraction ω of exporters adopt Dominant Currency Pricing (DCP, pricing in USD), while the remaining $1-\omega$ adopt Producer Currency Pricing (PCP). The aggregate export price index facing destination j in local currency is:

$$P_{j,t}^{1-\sigma} = \omega\left(\frac{P_{j,t}^{\$}}{e_{j,t}/e_t^{\$}}\right)^{1-\sigma} + (1-\omega)\left(P_{j,t}^{H}e_{j,t}\right)^{1-\sigma}, \tag{8}$$

where $P_{j,t}^{\$}$ and $P_{j,t}^{H}$ are the Calvo-aggregated price indices of DCP and PCP firms. Domestic firms (T1) sell exclusively in the domestic market under analogous Calvo pricing with parameter θ_D.

Equilibrium. The labor market clears when aggregate labor supply equals the sum of firm-level labor demands. Domestic firms' output satisfies household consumption and intermediate input demands, while exporters' output meets foreign demand. The monetary authority sets the nominal interest rate via a Taylor rule: $i_t = \bar{i} + \phi_\pi \pi_{D,t} + \mu_t$. The complete set of equilibrium conditions is provided in Appendix B.3.

4.3 Decomposition of Export Responses

To isolate the economic mechanisms driving the export response to dollar shocks, we log-linearize the model and construct a sequence of counterfactual scenarios that progressively activate different margins of exchange rate exposure.

Type-2 Decomposition. We define four counterfactual scenarios for two-way traders:

- **CF1:** Type-2 firms use only domestic inputs ($\alpha_2 = 0$, $n^2_{iM,t} = \bar{n}_{iM}$) and direct export price valuation effects are shut down.
- **CF2:** Imported inputs remain restricted, but direct export price valuation and expenditure-switching effects are reactivated.
- **CF3:** The intensive margin of imported inputs is restored ($\alpha_2 > 0$), while the sourcing network remains fixed at $\bar{n}_{iM}$.
- **Baseline:** The endogenous extensive margin of importing is fully activated.

The marginal contribution of each channel is identified by differencing across scenarios:

$$\mathcal{E}^{T2}_{\text{price},t} = \frac{d\widehat{EX}_t^{T2,cf2}}{d\hat{e}_t^{\$}} - \frac{d\widehat{EX}_t^{T2,cf1}}{d\hat{e}_t^{\$}}, \tag{9}$$

$$\mathcal{E}^{T2}_{\text{cost},t} = \frac{d\widehat{EX}_t^{T2,cf3}}{d\hat{e}_t^{\$}} - \frac{d\widehat{EX}_t^{T2,cf2}}{d\hat{e}_t^{\$}}, \tag{10}$$

$$\mathcal{E}^{T2}_{\text{variety},t} = \frac{d\widehat{EX}_t^{T2}}{d\hat{e}_t^{\$}} - \frac{d\widehat{EX}_t^{T2,cf3}}{d\hat{e}_t^{\$}}, \tag{11}$$

$$\mathcal{E}^{T2}_{\text{residual},t} = \frac{d\widehat{EX}_t^{T2,cf1}}{d\hat{e}_t^{\$}}. \tag{12}$$

Type-3 Decomposition. For pure exporters, we use two additional scenarios:

- **CF4:** Type-2 firms are restricted from importing, and direct export price effects for T3 are shut down.
- **CF5:** Type-2 restrictions remain, but T3 export price effects are reactivated.

The three additive channels are:

$$\mathcal{E}^{T3}_{\text{price},t} = \frac{d\widehat{EX}_t^{T3,cf5}}{d\hat{e}_t^{\$}} - \frac{d\widehat{EX}_t^{T3,cf4}}{d\hat{e}_t^{\$}}, \tag{13}$$

$$\mathcal{E}^{T2\to T3}_{\text{spillover},t} = \frac{d\widehat{EX}_t^{T3}}{d\hat{e}_t^{\$}} - \frac{d\widehat{EX}_t^{T3,cf5}}{d\hat{e}_t^{\$}}, \tag{14}$$

$$\mathcal{E}^{T3}_{\text{residual},t} = \frac{d\widehat{EX}_t^{T3,cf4}}{d\hat{e}_t^{\$}}. \tag{15}$$

Analytical Insights. Using a scalar approximation $\Theta \in (0,1)$ for the effective degree of price flexibility under Calvo pricing, the channels admit closed-form expressions (derived in

Appendix E):

$$\mathcal{E}^{T2}_{\text{price},t} \approx \omega(1-\sigma)(\Theta-1), \tag{16}$$

$$\mathcal{E}^{T2}_{\text{cost},t} \approx (1-\sigma)\Theta \times (-\gamma s_I^2), \tag{17}$$

$$\mathcal{E}^{T2}_{\text{variety},t} \approx (1-\sigma)\Theta \times \frac{\gamma s_I^2}{1-\kappa}\Psi_2, \tag{18}$$

where s_I^2 is the steady-state import expenditure share for T2 firms and $\Psi_2 > 0$ is the sourcing elasticity. The spillover channel for pure exporters is:

$$\mathcal{E}^{T2\to T3}_{\text{spillover},t} \approx (1-\sigma)\Theta \left[(1-\gamma)\left(\frac{d\hat{W}_t}{d\hat{e}_t^{\$}} - \frac{d\hat{W}_t}{d\hat{e}_t^{\$}}\Big|_{cf4}\right) + \gamma\left(\frac{d\hat{P}_{D,t}}{d\hat{e}_t^{\$}} - \frac{d\hat{P}_{D,t}}{d\hat{e}_t^{\$}}\Big|_{cf4}\right)\right]. \tag{19}$$

The difference between the baseline and CF4 wage elasticities is driven by the weighted import intensity of two-way traders, $(1-\nu_1)\nu_2 s_I^2$, analytically confirming that pure exporters derive a cost-reduction spillover from the global value chain integration of two-way traders.

Several key insights emerge. First, the DCP share ω amplifies the export price channel, interacting with nominal rigidities (Θ). Second, the import cost channel scales linearly with import intensity s_I^2. Third, the variety channel reveals a complementarity between the intensive and extensive margins: it is proportional to $s_I^2 \times \Psi_2$, so firms with higher import intensity enjoy disproportionately larger gains from expanding their sourcing networks.

Aggregation. The aggregate export elasticity decomposes into seven micro-level channels, weighted by steady-state revenue shares:

$$\frac{d\widehat{EX}_t}{d\hat{e}_t^{\$}} = s_{EX}^{T2}\left(\mathcal{E}^{T2}_{\text{price},t} + \mathcal{E}^{T2}_{\text{cost},t} + \mathcal{E}^{T2}_{\text{variety},t} + \mathcal{E}^{T2}_{\text{residual},t}\right) + s_{EX}^{T3}\left(\mathcal{E}^{T3}_{\text{price},t} + \mathcal{E}^{T2\to T3}_{\text{spillover},t} + \mathcal{E}^{T3}_{\text{residual},t}\right). \tag{20}$$

In the quantitative analysis, we compute impulse responses for the baseline and each counterfactual without relying on the constant-Θ approximation, capturing the full Calvo dynamics.

4.4 Calibration

We calibrate the model to match key moments of Chinese trading firms using the Chinese Customs Data (CCD), the Annual Survey of Industrial Firms (ASIF), and the 2007 China Input-Output Table. Table 12 summarizes the parameter values.

Externally calibrated parameters. We set the discount factor $\beta = 0.99$, inverse Frisch elasticity $\psi = 2$, and portfolio adjustment cost $\phi = 0.025$. Trade elasticities follow the literature: $\sigma = 2$ (Gopinath et al., 2020), $\varepsilon = 1.5$ (Feenstra et al., 2018), and $\kappa = 4$ (Broda and Weinstein, 2006). Calvo parameters are $\theta_D = \theta_X = 0.75$ (Gali and Monacelli, 2005). The DCP share

is $\omega = 0.80$, reflecting dollar dominance in Chinese export invoicing. The materials share $\gamma = 0.83$ is from the 2007 IO Table. Firm-type shares are $\nu_1 = 0.49$ (from matched CCD-ASIF data) and $\nu_2 = 0.41$ (from CCD 2006–2015).

Internally calibrated parameters. The Pareto shape parameters governing within-type productivity distributions are identified from the revenue share of the top 5% of firms: $k_{T1} = k_{T2} = 1.17$ and $k_{T3} = 1.30$. The CES import weights $\{\alpha_1, \alpha_2\}$ and per-country sourcing fixed costs $\{f_1, f_2\}$ are jointly calibrated to match observed import expenditure shares ($s_{M1} = 27.4\%$, $s_{M2} = 36.7\%$) and average numbers of sourcing countries ($N_1 = 3.19$, $N_2 = 4.15$). The calibration yields $\alpha_1 = 0.21$, $\alpha_2 = 0.28$, $f_1 = 0.13$, and $f_2 = 0.02$.

4.5 Quantitative Results

We consider a permanent, unanticipated one-percent depreciation of the US dollar against the domestic currency, decaying with quarterly persistence $\rho_e = 0.80$.

4.5.1 Two-Way Traders versus Pure Exporters

Figure 1 reports the impulse responses of export quantities and prices for two-way traders and pure exporters. On impact, two-way traders achieve a 0.76% reduction in domestic-currency export prices and a 1.53% expansion in export volume, compared with a 0.70% price decline and 1.40% quantity increase for pure exporters. The amplification operates through two channels: the import cost channel (the import price index for T2 falls by 1.68% on impact, directly reducing marginal costs by 0.49% versus 0.05% for T3) and the import variety channel (the number of sourcing countries rises by 2.05%, further depressing costs through love-of-variety).

The prevalence of DCP acts as a central amplifier. Under a high-DCP regime ($\omega = 0.90$), the first-year average quantity expansion is 1.19% for T2 and 0.99% for T3. When the DCP share falls to 0.10, these responses collapse to 0.44% and 0.25%, respectively—a nearly threefold difference that underscores the first-order importance of invoicing currency composition.

4.5.2 Channel Decomposition

Two-Way Traders. Figure 2 reports the decomposition. On impact, the export price channel dominates, driven by expenditure-switching under DCP. As nominal rigidities dissipate, the import cost and variety channels take precedence, both exhibiting persistent hump-shaped dynamics peaking around the fourth quarter. Over the full 30-quarter horizon, the import variety channel accounts for 42.2% of the cumulative export revenue expansion, the export price channel contributes 34.8%, the import cost channel adds 19.4%, and the GE residual accounts for 3.6%. The dominance of the two input-side channels (collectively over 60%) confirms that

the endogenous reorganization of sourcing networks sustains and amplifies the trade elasticity beyond what nominal rigidities alone can generate.

Pure Exporters. Figure 3 reports the decomposition for pure exporters. On impact, the export price channel dominates. Over the medium term, however, the spillover from two-way traders becomes the primary driver: as T2 firms substitute toward cheaper foreign intermediates, aggregate demand for domestic labor contracts, suppressing wages and reducing T3 marginal costs. Cumulatively, the export price channel accounts for 49.1% of the 30-quarter expansion, while the spillover channel contributes 44.4%. This near-parity implies that evaluating pure exporters in partial equilibrium severely underestimates their trade elasticity.

Aggregate Decomposition. While two-way traders account for only 41% of the exporting firm population, they drive 57.2% of the aggregate export expansion following a dollar depreciation, reflecting their direct access to import cost and variety channels. Pure exporters contribute the remaining 42.8%, relying primarily on the GE spillover. This highlights that the aggregate trade elasticity is fundamentally governed by the micro-structure of global value chain integration.

5 Conclusion

This paper studies how U.S. dollar exchange rate movements shape trade outcomes when firms participate simultaneously in importing and exporting. Using transaction-level Chinese trade data, we document three sets of findings.

First, dollar exchange rate movements play a substantially larger role than bilateral exchange rates in shaping China's export outcomes to non-dollar economies. An appreciation of the RMB against the dollar is associated with pronounced declines in RMB export prices and sizable increases in export quantities, consistent with the widespread use of dollar invoicing.

Second, two-way traders amplify these effects. Following an RMB appreciation against the dollar, two-way traders lower export prices more aggressively and expand export volumes by a larger margin than pure exporters. These amplification effects are robust to alternative definitions of two-way trading, extensive controls for firm heterogeneity, and strategies addressing selection into two-way trade.

Third, we identify two complementary mechanisms: (i) lower dollar-denominated input costs enable two-way traders to reduce marginal costs directly, and (ii) dollar appreciations expand firms' sourcing networks, generating productivity gains through input variety. These adjustments also spill over to pure exporters operating in the same product markets, particularly in labor-intensive industries.

To quantify the relative importance of these mechanisms, we develop a heterogeneous-firm model calibrated to Chinese micro data. The channel decomposition reveals that the import variety channel accounts for 42.2% of the cumulative export revenue response of two-way traders, the import cost channel contributes 19.4%, and the export price channel driven by dominant currency pricing accounts for 34.8%. Together, the two supply-chain channels explain over 60% of the long-run amplification. For pure exporters, the general equilibrium spillover from two-way traders' import adjustments accounts for 44.4% of their cumulative response—nearly as large as the direct price channel (49.1%). At the aggregate level, two-way traders drive 57.2% of the total export expansion despite constituting only 41% of exporting firms, underscoring their disproportionate role in transmitting dollar shocks.

These results challenge the view that firms engaged in both importing and exporting are naturally hedged against exchange rate fluctuations. Instead, two-way traders serve as key amplifiers of dollar shocks, operating through supply-chain mechanisms that persist well beyond the short-run effects of nominal rigidities. From a policy perspective, the dominance of supply-chain channels over the invoice-currency channel implies that diversifying invoicing practices alone would leave the deeper structural amplification largely intact, highlighting the importance of addressing firms' dependence on dollar-denominated input networks in an increasingly interconnected global trading system.

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Tables and Figures

Table 1: Two-way Traders vs. Pure Exporters

	Two-way Traders	Pure Exporters
Panel A. Firm-product-destination level		
log export value	12.281	12.481
log export quantity	7.746	8.586
log export price	4.531	3.894
Change in log export value	0.039	0.030
Change in log export quantity	0.016	0.010
Change in log export price	0.019	0.018
Market share	0.064	0.047
Panel B. Firm- product level		
# of destination countries	2.794	2.414

Notes: This table compares trading patterns between two-way and pure exporters using the data on ordinary export transactions between 2006 and 2015.

Table 2: Trade Effects of Bilateral vs. Dollar Exchange Rate

	Export Quantity		Export Price	
	(1)	(2)	(3)	(4)
$\Delta e_{iRMB,t}$	-0.128***	-0.133***	-0.001	0.002
	(0.006)	(0.006)	(0.003)	(0.002)
$\Delta e_{\$RMB,t}$		0.735***		-0.594***
		(0.061)		(0.025)
N	5,362,463	5,362,463	5,362,463	5,362,463
R^2	0.288	0.288	0.248	0.248
Baseline Controls	Y	Y	Y	Y
Firm×Ctry×Prod FE	Y	Y	Y	Y

Notes: This table estimates the effects of RMB exchange rates on the Chinese exports. The dependent variable is the log-difference of export quantity in columns (1)–(2) and the log-difference in export price in columns (3)–(4). $\Delta e_{iRMB,t}$ is the log-difference of RMB's real exchange rate with destination country i's currency. $\Delta e_{\$RMB,t}$ is the log-difference of RMB's real exchange rate with the dollar. All regressions include a constant term, baseline controls, and firm-product-country fixed effects. Baseline controls include firm-specific time trend, destination country's real GDP growth and CPI inflation, China's real GDP growth and PPI inflation, oil price growth, log VIX, and the growth rate of the adjusted broad dollar index. Standard errors are clustered at the firm level. *, **, and *** indicate the significance level of 10%, 5%, and 1%, respectively.

Table 3: The Role of Two-way Traders

	Export Quantity		Export Price	
	(1)	(2)	(3)	(4)
$\Delta e_{\$RMB,t}$	0.601***		-0.508***	
	(0.065)		(0.028)	
$\Delta e_{\$RMB,t} * TW$	0.303***	0.290***	-0.196***	-0.190***
	(0.059)	(0.059)	(0.026)	(0.025)
$\Delta e_{iRMB,t}$	-0.101***	-0.099***	-0.018***	-0.025***
	(0.008)	(0.008)	(0.003)	(0.004)
$\Delta e_{iRMB,t} * TW$	-0.070***	-0.069***	0.045***	0.044***
	(0.013)	(0.013)	(0.005)	(0.005)
N	5,362,463	5,362,463	5,362,463	5,362,463
R2	0.288	0.288	0.248	0.249
Baseline Controls	Y	Y	Y	Y
Firm×Ctry×Prod FE	Y	Y	Y	Y
Year FE	N	Y	N	Y

Notes: This table estimates the role of two-way traders in the trade effects of exchange rates. The dependent variable is the change in log export quantity in columns (1)–(2) and the change in log export price in columns (3)–(4). Columns (2) and (4) further include year fixed effects. $\Delta e_{\$RMB,t}$ is the log-difference of RMB's real exchange rate with the dollar. $\Delta e_{iRMB,t}$ is the log-difference of RMB's real exchange rate with destination country i's currency. TW is an indicator for two-way traders. All regressions include a constant term, baseline controls, and firm-product-country fixed effects. Baseline controls include firm-specific time trend, destination country's real GDP growth and CPI inflation, China's real GDP growth and PPI inflation, oil price growth, log VIX, and the growth rate of the adjusted broad dollar index. Standard errors are clustered at the firm level. *, **, and *** indicate the significance level of 10%, 5%, and 1%, respectively.

Table 4: Additional Interaction Controls

	Market Share		Firm Size		Financial Constraint		Strategic Complementarity		Ownership	
	Quantity	Price	Quantity	Price	Quantity	Price	Quantity	Price	Quantity	Price
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
$\Delta e_{\$RMB,t}$	0.551***	-0.549***	0.597***	-0.505***	0.777***	-0.575***	0.592***	-0.553***	0.537***	-0.426***
	(0.069)	(0.029)	(0.067)	(0.027)	(0.070)	(0.030)	(0.070)	(0.029)	(0.069)	(0.029)
$\Delta e_{\$RMB,t} * TW$	0.308***	-0.196***	0.314***	-0.200***	0.277***	-0.212***	0.272***	-0.189***	0.265***	-0.177***
	(0.062)	(0.026)	(0.060)	(0.026)	(0.063)	(0.026)	(0.063)	(0.026)	(0.063)	(0.027)
$\Delta e_{\$RMB,t} * X$	0.061**	0.112***	-0.036	0.026*	-0.127***	0.028**	0.125***	-0.025***		
	(0.027)	(0.008)	(0.082)	(0.015)	(0.027)	(0.012)	(0.024)	(0.009)		
$\Delta e_{\$RMB,t} * FIE$									0.202***	-0.256***
									(0.066)	(0.028)
$\Delta e_{\$RMB,t} * SOE$									0.069	0.127**
									(0.122)	(0.052)
N	4,798,378	4,798,378	5,362,463	5,362,463	4,702,177	4,702,177	4,798,378	4,798,378	5,362,463	5,362,463
R^2	0.304	0.256	0.288	0.248	0.291	0.249	0.297	0.256	0.288	0.248
Baseline Controls	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Firm×Ctry×Prod FE	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y

Notes: This table examines results with additional interaction controls. The dependent variable is the change in log export quantity in odd-numbered columns and the change in log export price in even-numbered columns. $\Delta e_{\$RMB,t}$ is the log-difference of RMB's real exchange rate with the dollar. *TW* is a binary indicator of two-way traders. *X* represents the firm's market share in columns (1)–(2), firm size in columns (3)–(4), industry's external finance dependence in columns (5)–(6), and the degree of strategic complementarity in dollar invoicing at the country-product level in columns (7)–(8). FIE and SOE represent the indicator variable for whether the firm is a foreign-invested enterprise or a state-owned enterprise. All continuous control variables are standardized to ease interpretation. All regressions include the log-difference of RMB's real exchange rate with the destination country's currency and its corresponding interactions, a constant term, baseline controls, and firm-product-country fixed effects. The baseline controls are firm-specific time trend, destination country's real GDP growth and CPI inflation, China's real GDP growth and PPI inflation, oil price growth, log VIX, and the growth rate of the adjusted broad dollar index. Standard errors are clustered at the firm level. *, **, and *** indicate the significance level of 10%, 5%, and 1%, respectively.

Table 5: Subsample Using Firms with Stable Trading Patterns

	No Entry or Exit		With Entry and Exit	
	Quantity	Price	Quantity	Price
	(1)	(2)	(3)	(4)
$\Delta e_{\$RMB,t}$	0.744***	-0.552***	0.297***	-0.366***
	(0.114)	(0.054)	(0.081)	(0.034)
$\Delta e_{\$RMB,t} * TW$	0.553***	-0.364***	0.539***	-0.321***
	(0.099)	(0.046)	(0.078)	(0.033)
$\Delta e_{iRMB,t}$	-0.076***	-0.038***	-0.086***	-0.021***
	(0.016)	(0.007)	(0.010)	(0.004)
$\Delta e_{iRMB,t} * TW$	-0.079***	0.061***	-0.090***	0.057***
	(0.022)	(0.009)	(0.016)	(0.006)
N	1,527,017	1,527,017	3,533,740	3,533,740
R2	0.223	0.197	0.300	0.258
Baseline Controls	Y	Y	Y	Y
Firm×Ctry×Prod FE	Y	Y	Y	Y
Year FE	N	Y	N	Y

Notes: his table checks the robustness of the results by restricting the sample to firms whose trading patterns remained unchanged throughout the sample period. In columns (1)–(2), the sample is restricted to continuous firms with no entry and exit during the sample period. In columns (3)–(4), the sample allows for firm entry and exit. The dependent variable is the change in log export quantity in columns (1) and (3), and the change in log export price in columns (2) and (4). $\Delta e_{\$RMB,t}$ is the log-difference of RMB's real exchange rate with the dollar. $\Delta e_{iRMB,t}$ is the log-difference of RMB's real exchange rate with destination country i's currency. TW is an indicator for two-way traders. All regressions include a constant term, baseline controls, and firm-product-country fixed effects. Baseline controls include firm-specific time trend, destination country's real GDP growth and CPI inflation, China's real GDP growth and PPI inflation, oil price growth, log VIX, and the growth rate of the adjusted broad dollar index. Standard errors are clustered at the firm level. *, **, and *** indicate the significance level of 10%, 5%, and 1%, respectively.

Table 6: Results from Matched Samples

	Export Quantity			Export Price		
	Nearest neighbor	Radius	Kernel	Nearest neighbor	Radius	Kernel
	(1)	(2)	(3)	(4)	(5)	(6)
$\Delta e_{\$RMB,t}$	0.669***	0.591***	0.585***	-0.552***	-0.495***	-0.498***
	(0.083)	(0.065)	(0.065)	(0.036)	(0.028)	(0.028)
$\Delta e_{\$RMB,t} * TW$	0.303***	0.306***	0.310***	-0.229***	-0.214***	-0.213***
	(0.069)	(0.059)	(0.059)	(0.036)	(0.028)	(0.028)
$\Delta e_{iRMB,t}$	-0.103***	-0.102***	-0.102***	-0.018***	-0.017***	-0.017***
	(0.011)	(0.008)	(0.008)	(0.005)	(0.003)	(0.003)
$\Delta e_{iRMB,t} * TW$	-0.055***	-0.076***	-0.073***	0.039***	0.046***	0.046***
	(0.016)	(0.013)	(0.013)	(0.006)	(0.005)	(0.005)
N	3,718,106	5,215,228	5,231,023	3,718,106	5,215,228	5,231,023
R^2	0.315	0.291	0.290	0.276	0.250	0.250
Baseline Controls	Y	Y	Y	Y	Y	Y
Firm×Ctry×Prod FE	Y	Y	Y	Y	Y	Y

Notes: This table estimates the role of two-way traders using matched samples. The dependent variable is the change in log export quantity in columns (1)–(3) and the change in log export price in columns (4)–(6). $\Delta e_{\$RMB,t}$ is the log-difference of RMB's real exchange rate with the dollar. $\Delta e_{iRMB,t}$ is the log-difference of RMB's real exchange rate with destination country *i*'s currency. In columns (1) and (4), the matched sample is constructed using the nearest neighbors matching method and the number of neighbors is four. In columns (2) and (5), the matched sample is constructed using the radius matching method. In columns (3) and (6), the matched sample is constructed using the kernel matching method. All regressions include a constant term, baseline controls, and firm-product-country fixed effects. The baseline controls include firm-specific time trend, destination country's real GDP growth and CPI inflation, China's real GDP growth and PPI inflation, oil price growth, log VIX, and the growth rate of the adjusted broad dollar index. Standard errors are clustered at the firm level. *, **, and *** indicate the significance level of 10%, 5%, and 1%, respectively.

Table 7: Effects on Import Price

	(1)	(2)	(3)	(4)
$\Delta e_{\$RMB,t}$	-0.634***	-0.581***	-0.156**	-0.544***
	(0.060)	(0.065)	(0.073)	(0.070)
$\Delta e_{\$RMB,t} * Sticky$		-0.160***		
		(0.045)		
$\Delta e_{\$RMB,t} * USD_H$			-0.292***	
			(0.055)	
$\Delta e_{\$RMB,t} * TW$				-0.129**
				(0.059)
N	1,541,397	1,371,249	1,394,632	1,541,397
R^2	0.249	0.250	0.249	0.249
Baseline Controls	Y	Y	Y	Y
Firm×Ctry×Prod FE	Y	Y	Y	Y

Notes: This table estimates the effects on import price. The dependent variable is the change in log import price in columns (1)–(3) and the change in log import quantity in columns (4)–(6). $\Delta e_{\$RMB,t}$ is the log-difference of RMB's real exchange rate with the dollar. $Sticky$ is a binary indicator of sticky-price goods. USD_H is a binary indicator identifying countries where the share of exports invoiced in US dollars exceeds 50%. TW is a binary indicator of two-way traders. All regressions include the log-difference of RMB's real exchange rate with the sourcing country's currency and its corresponding interactions, a constant term, baseline controls, and firm-product-country fixed effects. Baseline controls include firm-specific time trend, destination country's real GDP growth and CPI inflation, China's real GDP growth, oil price growth, log VIX, and the growth rate of the adjusted broad dollar index. Standard errors are clustered at the firm level. *, **, and *** indicate the significance level of 10%, 5%, and 1%, respectively.

Table 8: Evidence on the Input Cost Channel

	Export Quantity			Export Price		
	Imported Input Intensity	Sticky-Price Input Imports	USD Invoicing Intensity	Imported Input Intensity	Sticky-Price Input Imports	USD Invoicing Intensity
	(1)	(2)	(3)	(4)	(5)	(6)
$\Delta e_{\$RMB,t}$	0.576***	0.589***	0.581***	-0.401***	-0.499***	-0.501***
	(0.072)	(0.065)	(0.065)	(0.031)	(0.028)	(0.028)
$\Delta e_{\$RMB,t} * TW$	0.187**	0.218***		-0.116***	-0.150***	
	(0.080)	(0.064)		(0.035)	(0.027)	
$\Delta e_{\$RMB,t} * TW * IM_INT_H$	0.210**			-0.111**		
	(0.106)			(0.045)		
$\Delta e_{\$RMB,t} * TW * IM_sticky$		0.452***			-0.241***	
		(0.118)			(0.053)	
$\Delta e_{\$RMB,t} * TW_USD_L$			0.304***			-0.161***
			(0.075)			(0.034)
$\Delta e_{\$RMB,t} * TW_USD_H$			0.330***			-0.239***
			(0.078)			(0.032)
N	5,361,545	5,309,719	5,267,820	5,361,545	5,309,719	5,267,820
R^2	0.288	0.289	0.291	0.248	0.249	0.250
Baseline Controls	Y	Y	Y	Y	Y	Y
Firm×Ctry×Prod FE	Y	Y	Y	Y	Y	Y

Notes: This table presents evidence on the imported input cost channel. The dependent variable is the change in log export quantity in columns (1)–(3) and the change in log export price in columns (4)–(6). $\Delta e_{\$RMB,t}$ is the log-difference of RMB's real exchange rate with the dollar. TW is a binary indicator of two-way traders. IM_INT_H is a binary indicator of industries that have their imported input intensities above the sample median. IM_Sticky is the firm's standardized sticky-price import share. TW_USD_L and TW_USD_H are dummy variables indicating two-way firms with, respectively, low and high shares of inputs imported from highly dollar-exposed countries, based on the median split within the sample of two-way firms. All regressions include the log-difference of RMB's real exchange rate with the destination country's currency and its corresponding interactions, a constant term, baseline controls, and firm-product-country fixed effects. Baseline control variables include firm-specific time trend, destination country's real GDP growth and CPI inflation, China's real GDP growth and PPI inflation, oil price growth, log VIX, and the growth rate of the adjusted broad dollar index. Standard errors are clustered at the firm level. *, **, and *** indicate the significance level of 10%, 5%, and 1%, respectively.

Table 9: Effects on Import Variety

	Δ ln(# of Varieties per Sourcing Country)		Δ ln(# of Sourcing Countries)		Δ ln(Total # of Varieties)	
	All Goods	Non-final Inputs	All Goods	Non-final Inputs	All Goods	Non-final Inputs
	(1)	(2)	(3)	(4)	(5)	(6)
$\Delta e_{\$RMB,t}$	0.434***	0.417***	0.344***	0.332***	0.703***	0.669***
	(0.078)	(0.077)	(0.070)	(0.071)	(0.092)	(0.093)
N	1,004,025	929,451	518,235	489,491	518,235	489,491
R^2	0.242	0.237	0.342	0.339	0.377	0.373
Baseline Controls	Y	Y	Y	Y	Y	Y
Firm×Ctry FE	Y	Y	N	N	N	N
Firm FE	N	N	Y	Y	Y	Y

Notes: This table estimates the effects on import variety. The dependent variable is the change in log number of imported varieties per sourcing country in columns (1) and (2), the change in log number of sourcing countries in columns (3) and (4), and the change in log total number of varieties in columns (5) and (6). $\Delta e_{\$RMB,t}$ is the log-difference of RMB's real exchange rate with the dollar. Odd-numbered columns use the sample of all imported goods. Even-numbered columns use the sample of imported intermediate inputs only. Columns (1)–(2) control for the log-difference of RMB's real exchange rate with the sourcing country's currency, firm-sourcing-country fixed effects, and incorporate controls including firm-specific time trend, sourcing country's real GDP growth and CPI inflation, China's real GDP growth, oil price growth, log VIX, and the growth rate of the adjusted broad dollar index. Columns (3)–(6) control for firm fixed effects and controls including firm-specific time trend, China's real GDP growth, oil price growth, log VIX, and the growth rate of the adjusted broad dollar index. All regressions include a constant term. Standard errors are clustered at the firm level. *, **, and *** indicate the significance level of 10%, 5%, and 1%, respectively.

Table 10: Evidence on the Import Variety Channel

	Export Quantity		Export Price	
	# of Varieties	# of Sourcing Countries	# of Varieties	# of Sourcing Countries
	(1)	(2)	(3)	(4)
$\Delta e_{\$RMB,t}$	0.669***	0.674***	-0.543***	-0.539***
	(0.062)	(0.062)	(0.025)	(0.026)
$\Delta e_{\$RMB,t} * NUM$	0.011***	0.027***	-0.008***	-0.028***
	(0.003)	(0.008)	(0.001)	(0.003)
N	5,187,097	5,203,363	5,187,097	5,203,363
R^2	0.290	0.290	0.250	0.250
Baseline Controls	Y	Y	Y	Y
Firm×Ctry×Prod FE	Y	Y	Y	Y

Notes: This table presents the evidence on the input variety channel. The dependent variable is the change in log export quantity in columns (1) and (2), and the change in log export price in columns (3) and (4). $\Delta e_{\$RMB,t}$ is the log-difference of RMB's real exchange rate with the dollar. NUM is measured by the total number of imported varieties from the previous year in columns (1) and (3) and by the number of sourcing countries from the previous year in columns (2) and (4). In all specifications, the variable NUM is winsorized at the 5th and 95th percentiles. All regressions include the log-difference of RMB's real exchange rate with the destination country's currency and its corresponding interactions, a constant term, baseline control variables, and firm-product-country fixed effects. The baseline controls are firm-specific time trend, destination country's real GDP growth and CPI inflation, China's real GDP growth and PPI inflation, oil price growth, log VIX, and the growth rate of the adjusted broad dollar index. Standard errors are clustered at the firm level. *, **, and *** indicate the significance level of 10%, 5%, and 1%, respectively.

Table 11: Spillover Effects on Pure Exporters

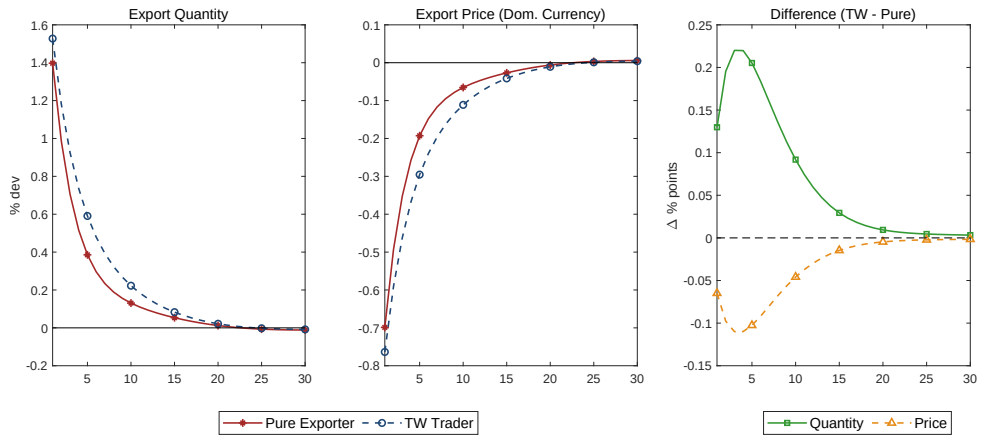
TW share measure	Previous Year		Sample Average		Initial Year		Previous Year	
	Quantity	Price	Quantity	Price	Quantity	Price	Quantity	Price
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$\Delta e_{\$RMB,t}$	0.540***	-0.395***	0.599***	-0.416***	0.600***	-0.418***	0.523***	-0.374***
	(0.076)	(0.033)	(0.076)	(0.033)	(0.076)	(0.033)	(0.076)	(0.033)
$\Delta e_{\$RMB,t} * TW_share$	1.731***	-0.742***	1.311***	-0.398***	1.225***	-0.542***	2.159***	-1.029***
	(0.211)	(0.088)	(0.222)	(0.093)	(0.224)	(0.096)	(0.218)	(0.092)
$\Delta e_{\$RMB,t} * TW_share * LI$							0.867***	-0.431***
							(0.226)	(0.091)
N	2,899,397	2,899,397	2,899,397	2,899,397	2,899,397	2,899,397	2,899,024	2,899,024
R^2	0.321	0.282	0.321	0.282	0.321	0.282	0.321	0.283
Baseline Controls	Y	Y	Y	Y	Y	Y	Y	Y
Firm×Ctry×Prod FE	Y	Y	Y	Y	Y	Y	Y	Y

Notes: This table examines the spillover effects on pure exporters. The dependent variable is the change in log export quantity in odd-numbered columns and the change in log export price in even-numbered columns. $\Delta e_{\$RMB,t}$ is the log-difference of RMB's real exchange rate with the dollar. In columns (1) and (2) and columns (7) and (8), *TW_share* is the value share of two-way exporters in the previous year; in columns (3) and (4), it is the average value share over the sample period; and in columns (5) and (6), it is the value share at the beginning of the sample period. *LI* is the standardized industry level labor intensity. All regressions include the log-difference of RMB's real exchange rate with the destination country's currency and its corresponding interactions, a constant term, baseline controls, and firm-product-country fixed effects. The baseline controls are firm-specific time trend, destination country's real GDP growth and CPI inflation, China's real GDP growth and PPI inflation, oil price growth, log VIX, and the growth rate of the adjusted broad dollar index. Standard errors are clustered at the firm level. *, **, and *** indicate the significance level of 10%, 5%, and 1%, respectively.

Table 12: Calibration

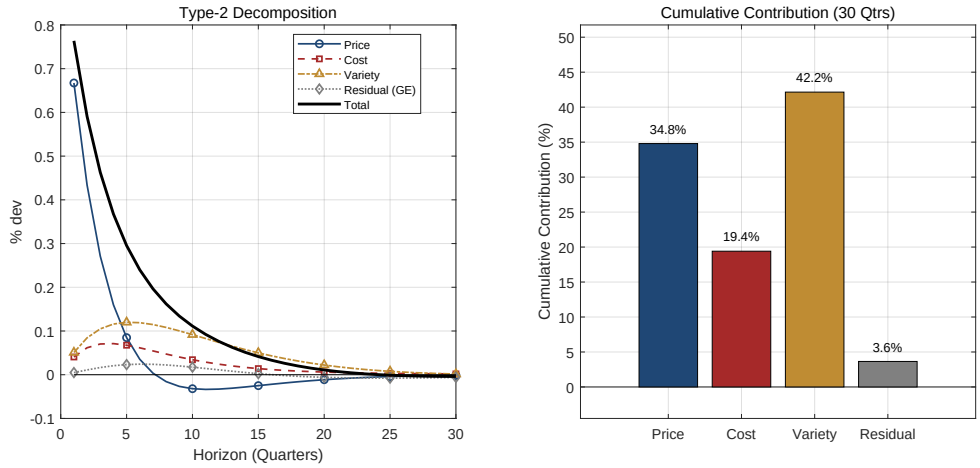
Parameter	Value	Source/Target	Description
Panel A: Externally calibrated			
β	0.99	Standard	Discount factor
ψ	2.00	Standard	Inverse Frisch elasticity
σ	2	Gopinath et al. (2020)	Elasticity across varieties
ε	1.5	Feenstra et al. (2018)	Elasticity dom. vs. imported inputs
κ	4	Broda and Weinstein (2006)	Elasticity across foreign varieties
γ	0.83	2007 China IO Table	Materials share
θ_D, θ_X	0.75	Gali and Monacelli (2005)	Calvo probability
ω	0.80	–	DCP export share
ν_1	0.49	Matched CCD-ASIF, 2006	Share of domestic firms
ν_2	0.41	CCD, 2006–2015	Two-way traders among exporters
Panel B: Internally calibrated			
k_{T1}, k_{T2}	1.17	Top 5% rev. share = 0.65	Pareto shape, Type 1 & 2
k_{T3}	1.30	Top 5% rev. share = 0.50	Pareto shape, Type 3
α_1	0.21	Import share $s_{M1} = 0.27$	CES weight on imports, Type 1
α_2	0.28	Import share $s_{M2} = 0.37$	CES weight on imports, Type 2
f_1	0.13	Avg. source countries $N_1 = 3.19$	Per-country fixed cost, Type 1
f_2	0.02	Avg. source countries $N_2 = 4.15$	Per-country fixed cost, Type 2

Figure 1: Two-Way Traders versus Pure Exporters: Export Responses



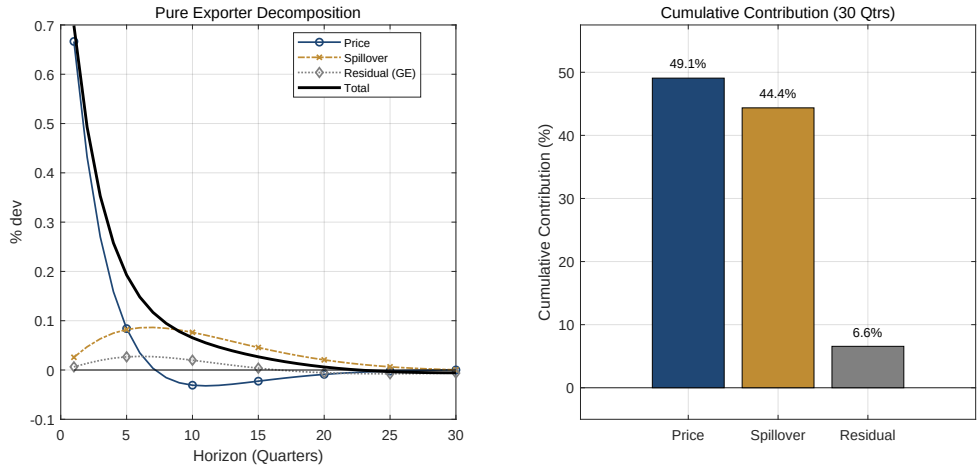
Notes: Impulse responses of export quantity and price for two-way traders (blue) and pure exporters (red) to a one-percent dollar depreciation. The right panel shows the difference between the two groups.

Figure 2: Channel Decomposition for Two-Way Traders



Notes: Left panel: time paths of the four channels for Type-2 export revenue elasticity. Right panel: cumulative contribution of each channel as a share of the total over 30 quarters.

Figure 3: Channel Decomposition for Pure Exporters



Notes: Left panel: time paths of the three channels for Type-3 export revenue elasticity. Right panel: cumulative contribution of each channel as a share of the total over 30 quarters.

A Appendix

Tables and Figures

Table A1: Summary Statistics of Key Variables

	No. of Obs.	Mean	Std. Dev.	Min.	Max.
Panel A. Regression on Exports					
Change in log export quantity	5,362,463	0.012	1.020	-2.749	2.723
Change in log export price	5,362,463	0.019	0.378	-0.831	0.921
$\Delta e_{\$RMB,t}$	5,362,463	0.034	0.031	-0.001	0.110
$\Delta e_{iRMB,t}$	5,362,463	0.047	0.116	-0.277	4.803
Two-way trader (TW)	5,362,463	0.434	0.496	0	1
Industry Import intensity	5,361,545	0.277	0.143	0.019	0.709
Share of imports from high USD exposed countries of TWs	2,250,245	0.686	0.387	0	1
Share of sticky-price imports of TWs	2,284,263	0.368	0.392	0	1
No. of imported varieties of TWs	2,164,872	13.288	18.239	1	85
No. of sourcing countries of TWs	2,179,360	4.979	4.998	1	23
Trade credit dependence	4,703,810	-0.038	1.271	-20.111	0.123
Labor intensity	5,361,328	-1.749	0.602	-3.892	-0.409
Market share	4,864,606	0	1	-0.244	21.193
Firm size	5,362,463	0	1	-0.116	48.923
External finance dependence	4,703,810	0	1	-1.833	6.426
Degree of strategic complementarity	4,864,606	0	1	-1.112	3.647
Destination's real GDP growth	5,362,463	0.025	0.033	-0.452	0.318
Destination's CPI inflation	5,362,463	0.036	0.040	-0.185	0.465
China's real GDP growth	5,362,463	0.065	0.022	0.033	0.103
China's PPI inflation	5,362,463	0.001	0.044	-0.054	0.069
Oil price growth	5,362,463	-0.058	0.254	-0.557	0.246
Log VIX	5,362,463	2.926	0.288	2.616	3.452
Adjusted broad dollar index growth	5,362,463	0.015	0.050	-0.051	0.118
Panel B. Regression on Imports					
Change in log import quantity	1,541,397	0.032	1.103	-2.860	2.876
Change in log import price	1,541,397	0.006	0.597	-1.303	1.398
Two-way trader	1,541,397	0.730	0.444	0	1
Sticky-price goods	1,372,578	0.499	0.500	0	1

Continued on next page

Table A1 - *Continued from previous page*

	No. of Obs.	Mean	Std. Dev.	Min.	Max.
High-dollar-invoicing country	1,394,632	0.532	0.499	0	1
Change in log number of varieties per sourcing country	929,451	0.014	0.667	-5.187	5.209
Change in log number of sourcing countries	489,491	0.018	0.548	-3.638	3.638
Change in log total number of varieties	489,491	0.011	0.729	-5.100	5.220

Notes: This table presents summary statistics of key variables. Panel A reports ordinary export transactions, and Panel B presents ordinary imports of non-final goods.

Table A2: Robustness Check on the Effect of Dollar Exchange Rate

	Use Nominal EXR	Add Lagged EXR	Add EXR Volatility	Trade Weighted	Intermediate Goods	Final Goods	Differentiated Goods	Exclude Petchems & Basic Metals
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Panel A. Export Quantity								
$\Delta e_{iRMB,t}$	-0.128***	-0.098***	-0.140***	-0.081**	-0.096***	-0.229***	-0.143***	-0.133***
	(0.006)	(0.006)	(0.007)	(0.035)	(0.009)	(0.014)	(0.007)	(0.006)
$\Delta e_{\$RMB,t}$	1.873***	1.731***	1.480***	1.049**	0.498***	1.434***	0.844***	0.735***
	(0.073)	(0.064)	(0.069)	(0.489)	(0.082)	(0.099)	(0.066)	(0.061)
N	5,362,463	5,354,121	5,061,534	5,362,463	2,539,811	1,963,667	4,690,051	5,361,808
R^2	0.289	0.289	0.291	0.421	0.302	0.296	0.290	0.288
Panel B. Export Price								
$\Delta e_{iRMB,t}$	-0.000	-0.017***	0.007***	-0.014	0.007**	-0.002	0.001	0.002
	(0.002)	(0.003)	(0.003)	(0.017)	(0.003)	(0.005)	(0.003)	(0.002)
$\Delta e_{\$RMB,t}$	-1.230***	-1.125***	-1.040***	-0.508*	-0.586***	-0.628***	-0.661***	-0.594***
	(0.031)	(0.027)	(0.029)	(0.276)	(0.033)	(0.042)	(0.028)	(0.025)
N	5,362,463	5,354,121	5,061,534	5,362,463	2,539,811	1,963,667	4,690,051	5,361,808
R^2	0.249	0.250	0.251	0.357	0.263	0.259	0.248	0.248

Notes: This table reports the results from robustness checks. The dependent variables in panels A and B are the change in log export quantity and the change in log export price, respectively. $\Delta e_{iRMB,t}$ is the log-difference of RMB's exchange rate with destination country i's currency. $\Delta e_{\$RMB,t}$ is the log-difference of RMB's exchange rate with the dollar. Column (1) replaces the real exchange rates with the nominal exchange rates. Column (2) adds lagged real exchange rates as additional controls. Column (3) adds log real exchange rate volatility as additional controls. Column (4) estimated a trade-weighted regression using the share of China's total exports in each year as the weights. Columns (5) and (6) re-estimate the regressions in the subsamples of intermediate and final goods, respectively. Column (7) uses the sample of differentiated goods only. Column (8) excludes petrochemicals and basic metal industries from the estimation sample. All regressions include a constant term, baseline controls, and firm-product-country fixed effects. The baseline controls are firm-specific time trend, destination country's real GDP growth and CPI inflation, China's real GDP growth and PPI inflation, oil price growth, log VIX, and the growth rate of the adjusted broad dollar index. Standard errors are clustered at the firm level. *, **, and *** indicate the significance level of 10%, 5%, and 1%, respectively.

Table A3: Alternative Measures of Two-way Traders

	TW1		TW2		TW3	
	Quantity	Price	Quantity	Price	Quantity	Price
	(1)	(2)	(3)	(4)	(5)	(6)
$\Delta e_{\$RMB,t}$	0.609***	-0.514***	0.697***	-0.539***	0.683***	-0.535***
	(0.066)	(0.028)	(0.064)	(0.027)	(0.063)	(0.027)
$\Delta e_{\$RMB,t} * TW$	0.249***	-0.165***	0.810***	-0.599***	0.591***	-0.515***
	(0.059)	(0.025)	(0.195)	(0.094)	(0.152)	(0.072)
$\Delta e_{iRMB,t}$	-0.096***	-0.020***	-0.131***	-0.001	-0.132***	-0.000
	(0.009)	(0.003)	(0.007)	(0.003)	(0.007)	(0.003)
$\Delta e_{iRMB,t} * TW$	-0.075***	0.045***	-0.036	0.073***	-0.015	0.053***
	(0.013)	(0.005)	(0.041)	(0.015)	(0.040)	(0.015)
N	5,362,463	5,362,463	5,154,028	5,154,028	5,166,549	5,166,549
R^2	0.288	0.248	0.289	0.249	0.288	0.248
Baseline Controls	Y	Y	Y	Y	Y	Y
Firm×Ctry×Prod FE	Y	Y	Y	Y	Y	Y

Notes: This table checks the robustness to alternative measures of two-way traders. The dependent variable is the change in log export quantity in columns (1) (3) and (5), and the change in log export price in columns (2) (4) and (6). $\Delta e_{\$RMB,t}$ is the log-difference of RMB's real exchange rate with the dollar. $\Delta e_{iRMB,t}$ is the log-difference of RMB's real exchange rate with destination country i's currency. In columns (1) and (2), TW is a binary indicator of two-way traders who engaged in both exporting and importing activities in the previous two years. In columns (3) and (4), TW is the ratio of imports to exports at the firm level in the previous year. In columns (5) and (6), TW is the average ratio of imports to exports at the firm level in the previous two years. All regressions include a constant term, baseline controls, and firm-product-country fixed effects. The baseline controls include firm-specific time trend, destination country's real GDP growth and CPI inflation, China's real GDP growth and PPI inflation, oil price growth, log VIX, and the growth rate of the adjusted broad dollar index. Standard errors are clustered at the firm level. *, **, and *** indicate the significance level of 10%, 5%, and 1%, respectively.

Table A4: Discrete Measure of Input Variety

	Export Quantity		Export Price	
	# of varieties	# of sourcing countries	# of varieties	# of sourcing countries
	(1)	(2)	(3)	(4)
$\Delta e_{\$RMB,t}$	0.598***	0.598***	-0.506***	-0.506***
	(0.065)	(0.065)	(0.028)	(0.028)
$\Delta e_{\$RMB,t} * TW_single$	0.188*	0.194**	-0.059	-0.108***
	(0.101)	(0.087)	(0.046)	(0.041)
$\Delta e_{\$RMB,t} * TW_multiple$	0.336***	0.350***	-0.233***	-0.233***
	(0.064)	(0.067)	(0.027)	(0.028)
N	5,362,463	5,362,463	5,362,463	5,362,463
R^2	0.288	0.288	0.248	0.248
Baseline Controls	Y	Y	Y	Y
Firm×Ctry×Prod FE	Y	Y	Y	Y

Notes: This table checks the robustness to an alternative measure of imported input diversification. The dependent variable is the change in log export quantity in columns (1) and (2), and the change in log export price in columns (3) and (4). $\Delta e_{\$RMB,t}$ is the log-difference of RMB's real exchange rate with the dollar. TW_single is a binary indicator of two-way traders with a single imported variety or a single sourcing country in the previous year. $TW_multiple$ is a binary indicator of two-way traders with multiple imported varieties or multiple sourcing countries in the previous year. All regressions include a constant term, baseline controls, and firm-product-country fixed effects. The baseline controls include firm-specific time trend, destination country's real GDP growth and CPI inflation, China's real GDP growth and PPI inflation, oil price growth, log VIX, and the growth rate of the adjusted broad dollar index. Standard errors are clustered at the firm level. *, **, and *** indicate the significance level of 10%, 5%, and 1%, respectively.

Table A5: Alternative Measure of Two-way share

TW share measure	Previous Year		Sample Average		Initial Year	
	Quantity	Price	Quantity	Price	Quantity	Price
	(1)	(2)	(3)	(4)	(5)	(6)
$\Delta e_{\$RMB,t}$	0.551***	-0.397***	0.594***	-0.414***	0.597***	-0.415***
	(0.076)	(0.033)	(0.076)	(0.033)	(0.076)	(0.033)
$\Delta e_{\$RMB,t} * TW_share$	1.884***	-0.738***	0.912***	-0.237***	1.457***	-0.464***
	(0.251)	(0.102)	(0.246)	(0.101)	(0.311)	(0.127)
N	2,899,397	2,899,397	2,899,397	2,899,397	2,899,397	2,899,397
R^2	0.321	0.282	0.321	0.282	0.321	0.282
Baseline Controls	Y	Y	Y	Y	Y	Y
Firm×Ctry×Prod FE	Y	Y	Y	Y	Y	Y

Notes: This table presents a robustness check using alternative measures of two-way exporter share at the HS 2-digit industry level. The dependent variable is the change in log export quantity in odd-numbered columns and the change in log export price in even-numbered columns. $\Delta e_{\$RMB,t}$ is the log-difference of RMB's real exchange rate with the dollar. In columns (1) and (2) and columns (7) and (8), *TW_share* is the value share of two-way exporters in the previous year; in columns (3) and (4), it is the average value share over the sample period; and in columns (5) and (6), it is the value share at the beginning of the sample period. *LI* is the standardized industry level labor intensity. All regressions include the log-difference of RMB's real exchange rate with the destination country's currency and its corresponding interactions, a constant term, baseline controls, and firm-product-country fixed effects. The baseline controls are firm-specific time trend, destination country's real GDP growth and CPI inflation, China's real GDP growth and PPI inflation, oil price growth, log VIX, and the growth rate of the adjusted broad dollar index. Standard errors are clustered at the firm level. *, **, and *** indicate the significance level of 10%, 5%, and 1%, respectively.

Table A6: Selected Impulse Responses to a Dollar Depreciation

	$h = 1$	$h = 4$	$h = 10$	$h = 20$	$h = 30$
Panel A. Export Quantities and Prices					
$\hat{y}_t^{T2}$ (% dev)	1.527	0.735	0.223	0.022	−0.008
$\hat{y}_t^{T3}$ (% dev)	1.398	0.515	0.131	0.012	−0.011
$\hat{p}_t^{T2}$ (% dev)	−0.764	−0.368	−0.111	−0.011	0.004
$\hat{p}_t^{T3}$ (% dev)	−0.699	−0.258	−0.065	−0.006	0.006
Panel B. Cost and Sourcing Variables					
$\widehat{MC}_t^{T2}$ (% dev)	−0.490	−0.337	−0.129	−0.009	0.005
$\widehat{MC}_t^{T3}$ (% dev)	−0.047	−0.145	−0.100	−0.008	0.006
$\hat{P}_{I,t}^{T2}$ (% dev)	−1.682	−0.861	−0.226	−0.024	−0.003
Panel C. Aggregate Variables					
$\hat{e}_t^{\$}$ (% dev)	1.000	0.512	0.134	0.014	0.002
$\widehat{EX}_t$ (% dev)	0.731	0.312	0.088	0.008	−0.005

Notes: Percentage deviations from steady state at selected horizons following a one-percent dollar depreciation.

Table A7: Channel Decomposition for Two-Way Traders (Type 2)

	Elasticity at horizon			Cumulative	Share
Channel	$h = 1$	$h = 4$	$h = 10$	(30 Qtrs)	(%)
Export Price	0.667	0.160	−0.032	1.305	34.8
Import Cost	0.041	0.071	0.034	0.728	19.4
Import Variety	0.051	0.116	0.092	1.581	42.2
Residual	0.005	0.021	0.017	0.137	3.6
Total	0.764	0.368	0.111	3.750	100.0

Notes: Decomposition of the Type-2 export revenue elasticity with respect to a dollar depreciation. The "Share" column reports each channel's contribution as a percentage of the sum of the absolute values of the cumulative channel responses.

Table A8: Channel Decomposition for Pure Exporters (Type 3)

	Elasticity at horizon			Cumulative	Share
Channel	$h = 1$	$h = 4$	$h = 10$	(30 Qtrs)	(%)
Export Price	0.667	0.159	−0.031	1.344	49.1
Residual	0.006	0.024	0.020	0.180	6.6
Spillover from TW	0.026	0.075	0.076	1.215	44.4
Total	0.699	0.258	0.065	2.738	100.0

Notes: Decomposition of the Type-3 export revenue elasticity with respect to a dollar depreciation.

B Full Model Setup and Equilibrium

This appendix provides the detailed optimization problems, Calvo pricing recursive formulations, and general equilibrium market clearing conditions omitted from Section 4.

B.1 Household Problem

The representative household maximizes expected lifetime utility subject to the period budget constraint. The optimal choices for consumption, labor, and bond holdings yield the following conditions:

$$\frac{1}{P_{D,t}C_t} = \lambda_t, \tag{21}$$

$$\eta L_t^{\psi} = \lambda_t W_t, \tag{22}$$

$$\lambda_t \left[1 + \phi P_{D,t}(B_t - \bar{B})\right] = \beta \mathbb{E}_t \left[\lambda_{t+1}(1 + i_t)\right], \tag{23}$$

where λ_t is the Lagrange multiplier for the budget constraint.

B.2 Firms' Pricing Problems

Domestic Firms (T1)

The profit maximization problem for a domestic firm resetting its price is:

$$\max_{\tilde{p}_{i,t}} \mathbb{E}_t \sum_{m=0}^{\infty} (\beta\theta_D)^m \frac{\lambda_{t+m}}{\lambda_t} \left[\tilde{p}_{i,t} - MC_{i,t+m}\right] \left(\frac{\tilde{p}_{i,t}}{P_{D,t+m}}\right)^{-\sigma} S_{t+m}, \tag{24}$$

where S_{t+m} denotes total real domestic demand. The optimal reset price is:

$$\tilde{p}_{i,t} = \frac{\sigma}{\sigma - 1} \frac{\mathbb{E}_t \sum_{m=0}^{\infty} (\beta\theta_D)^m \lambda_{t+m} MC_{i,t+m} P_{D,t+m}^{\sigma} S_{t+m}}{\mathbb{E}_t \sum_{m=0}^{\infty} (\beta\theta_D)^m \lambda_{t+m} P_{D,t+m}^{\sigma} S_{t+m}}. \tag{25}$$

The domestic aggregate price index evolves recursively:

$$P_{D,t}^{1-\sigma} = \theta_D P_{D,t-1}^{1-\sigma} + (1 - \theta_D)\tilde{P}_{D,t}^{1-\sigma}, \tag{26}$$

where $\tilde{P}_{D,t} = \left(\frac{1}{1-\theta_D} \int_{i \in \Theta_t} \tilde{p}_{i,t}^{1-\sigma} di\right)^{\frac{1}{1-\sigma}}$ is the average optimal reset price index, and Θ_t denotes the set of firms that reset their prices in period t.

Exporting Firms (T2 and T3)

Exporters face probability θ_X of keeping their prices fixed. The profit maximization problem for the exporting firm is:

$$\max_{\tilde{p}_{i,j,t}} \mathbb{E}_t \sum_{m=0}^{\infty} (\beta\theta_X)^m \frac{\lambda_{t+m}}{\lambda_t} \left[R_{i,j,t+m}(\tilde{p}_{i,j,t}) - (1+\tau) MC_{i,t+m} \right] y_{i,j,t+m}, \tag{27}$$

where $R_{i,j,t+m}(\tilde{p}_{i,j,t})$ denotes the per-unit revenue converted back into the home currency. For DCP exporters, $R_{i,j,t+m}(\tilde{p}_{i,j,t}) = \tilde{p}^{\$}_{i,j,t} / e^{\$}_{t+m}$; for PCP exporters, $R_{i,j,t+m}(\tilde{p}_{i,j,t}) = \tilde{p}^{H}_{i,j,t}$.

The optimal reset price in USD for a DCP firm i is:

$$\tilde{p}^{\$}_{i,j,t} = \frac{\sigma}{\sigma-1}(1+\tau) \frac{\mathbb{E}_t \sum_{m=0}^{\infty} (\beta\theta_X)^m \lambda_{t+m} MC_{i,t+m} \left(\frac{e_{j,t+m}}{e^{\$}_{t+m}} \right)^{-\sigma} P^{\sigma}_{j,t+m} d_{j,t+m}}{\mathbb{E}_t \sum_{m=0}^{\infty} (\beta\theta_X)^m \lambda_{t+m} \frac{1}{e^{\$}_{t+m}} \left(\frac{e_{j,t+m}}{e^{\$}_{t+m}} \right)^{-\sigma} P^{\sigma}_{j,t+m} d_{j,t+m}}, \tag{28}$$

where $e_{j,t}$ denotes the bilateral exchange rate expressed as the local currency of destination j per unit of the home currency.

For PCP firms pricing in the home currency, the optimal reset price is:

$$\tilde{p}^{H}_{i,j,t} = \frac{\sigma}{\sigma-1}(1+\tau) \frac{\mathbb{E}_t \sum_{m=0}^{\infty} (\beta\theta_X)^m \lambda_{t+m} MC_{i,t+m} (e_{j,t+m})^{-\sigma} P^{\sigma}_{j,t+m} d_{j,t+m}}{\mathbb{E}_t \sum_{m=0}^{\infty} (\beta\theta_X)^m \lambda_{t+m} (e_{j,t+m})^{-\sigma} P^{\sigma}_{j,t+m} d_{j,t+m}}. \tag{29}$$

The aggregate price indices for DCP firms and PCP firms evolve as:

$$(P^{\$}_{j,t})^{1-\sigma} = \theta_X (P^{\$}_{j,t-1})^{1-\sigma} + (1-\theta_X)(\tilde{P}^{\$}_{j,t})^{1-\sigma}, \tag{30}$$

$$(P^{H}_{j,t})^{1-\sigma} = \theta_X (P^{H}_{j,t-1})^{1-\sigma} + (1-\theta_X)(\tilde{P}^{H}_{j,t})^{1-\sigma}, \tag{31}$$

where $\tilde{P}^{\$}_{j,t} = \left(\frac{1}{1-\theta_X} \int_{i \in \Theta_{DCP,t}} (\tilde{p}^{\$}_{i,j,t})^{1-\sigma} di \right)^{\frac{1}{1-\sigma}}$ and $\tilde{P}^{H}_{j,t} = \left(\frac{1}{1-\theta_X} \int_{i \in \Theta_{PCP,t}} (\tilde{p}^{H}_{i,j,t})^{1-\sigma} di \right)^{\frac{1}{1-\sigma}}$, with $\Theta_{DCP,t}$ and $\Theta_{PCP,t}$ denoting the sets of DCP and PCP exporters, respectively, that reset their prices in period t.

B.3 Market Clearing and Aggregation

Equilibrium requires the labor market to clear:

$$L_t = \int_0^1 l_{i,t} \, di. \tag{32}$$

At the firm level, output for domestic firms clears consumption and intermediate demands:

$$y_{i,t} = c_{i,t} + \int_v h_{vi,t}\, dv, \tag{33}$$

where $h_{vi,t}$ denotes the demand for firm i's output as an intermediate input by firm v. For exporting firms, output satisfies foreign demands across all destinations:

$$y_{i,t} = \sum_j (1+\tau) y_{i,j,t}. \tag{34}$$

The total demand for domestic exports from country j is exogenously given by:

$$d_{j,t} = \bar{d}_j \left(\frac{e^{\$}_t}{\bar{e}^{\$}} \right)^{-\zeta}, \tag{35}$$

where $\zeta > 0$ is the elasticity of foreign aggregate demand with respect to the dollar exchange rate.

The external closure of the economy implies that aggregate export revenue equals aggregate import expenditure in the steady state:

$$EX_t = IM_t. \tag{36}$$

C Sourcing Strategy Proof

C.1 Derivation of the First-Order Condition

Firms in T1 and T2 choose the number of sourcing countries, n_{iM}, to minimize the total cost of production $TC(n_{iM}) = MC_i(n_{iM}) y_i + n_{iM} \frac{f_s^M}{e^{\$}}$. The first-order condition (FOC) with respect to n_{iM} is:

$$-\frac{\partial MC_i(n_{iM})}{\partial n_{iM}} y_i = \frac{f_s^M}{e^{\$}}. \tag{37}$$

To solve for $\frac{\partial MC_i}{\partial n_{iM}}$, we apply the chain rule:

$$\frac{\partial MC_i}{\partial n_{iM}} = \frac{\partial MC_i}{\partial Q_s} \frac{\partial Q_s}{\partial n_{iM}}. \tag{38}$$

Using the marginal cost definition from the main text, the first term is:

$$\frac{\partial MC_i}{\partial Q_s} = \gamma \frac{MC_i}{Q_s}. \tag{39}$$

The intermediate input price index $Q_s(n_{iM})$ dictates the extensive margin derivative:

$$\frac{\partial Q_s}{\partial n_{iM}} = -\frac{\alpha_s}{\kappa - 1}(Q_s)^{\varepsilon} P_I(n_{iM})^{1-\varepsilon} \frac{1}{n_{iM}}. \tag{40}$$

Combining these derivatives, we obtain:

$$\frac{\partial MC_i}{\partial n_{iM}} = -\frac{\gamma \alpha_s}{\kappa - 1} \left(\frac{P_I(n_{iM})}{Q_s(n_{iM})} \right)^{1-\varepsilon} \frac{MC_i(n_{iM})}{n_{iM}}. \tag{41}$$

Substituting this back into the FOC yields the condition presented in the main text:

$$\frac{\gamma \alpha_s}{\kappa - 1} \left(\frac{P_I(n_{iM})}{Q_s(n_{iM})} \right)^{1-\varepsilon} MC_i(n_{iM}) y_i = n_{iM} \frac{f_s^M}{e^{\$}}. \tag{42}$$

C.2 Conditions for a Unique Interior Solution

A sufficient condition to ensure the existence of a unique interior solution $n_{iM}^* \in (0, \infty)$ is that the marginal benefit of adding a sourcing country is strictly decreasing globally. Let $MB(n_{iM}) \equiv -\frac{\partial MC_i}{\partial n_{iM}} y_i$.

To evaluate the elasticity of $MB(n_{iM})$, we analyze the firm's optimal behavior in the flexible-price steady state. The optimal pricing rule implies that the firm's price is strictly proportional to its marginal cost ($p_i \propto MC_i$). Consequently, the firm's total output y_i is proportional to $MC_i^{-\sigma}$. Then we have:

$$MB(n_{iM}) \propto \left(\frac{P_I(n_{iM})}{Q_s(n_{iM})} \right)^{1-\varepsilon} MC_i(n_{iM})^{1-\sigma} \frac{1}{n_{iM}}. \tag{43}$$

Taking the logarithm of $MB(n_{iM})$ and using the relation $MC_i \propto (Q_s)^{\gamma}$, we have:

$$\ln MB = C + (1 - \varepsilon) \ln P_I + [\gamma(1 - \sigma) - (1 - \varepsilon)] \ln Q_s - \ln n_{iM}. \tag{44}$$

Define the share of imported inputs in total material expenditure as $s_I = \alpha_s (P_I / Q_s)^{1-\varepsilon} \in (0, 1)$. Combining this with the elasticity of the import price index $\frac{\partial \ln P_I}{\partial \ln n_{iM}} = -\frac{1}{\kappa - 1}$, we get:

$$\frac{\partial \ln Q_s}{\partial \ln n_{iM}} = s_I(n_{iM}) \left(-\frac{1}{\kappa - 1} \right). \tag{45}$$

Differentiating (44) with respect to $\ln n_{iM}$, we obtain:

$$\frac{\partial \ln MB}{\partial \ln n_{iM}} = \frac{\varepsilon - 1}{\kappa - 1}(1 - s_I) + \frac{\gamma(\sigma - 1)}{\kappa - 1} s_I - 1. \tag{46}$$

A sufficient condition for $\frac{\partial \ln MB}{\partial \ln n_{iM}} < 0$ for all $s_I \in (0,1)$ is:

$$\gamma(\sigma - 1) < \kappa - 1 \quad \text{and} \quad \varepsilon \leq \kappa. \tag{47}$$

Under these restrictions, $MB(n_{iM})$ is strictly decreasing in n_{iM}, while the marginal cost $f_s^M / e^{\$}$ is constant. This guarantees a unique crossing and hence a unique interior solution n_{iM}^*.

C.3 The Effect of Domestic Currency Appreciation

Assuming the uniqueness condition holds, we define the implicit function from the FOC as:

$$\Phi(n_{iM}, e^{\$}) \equiv MB(n_{iM}, e^{\$}) - \frac{f_s^M}{e^{\$}} = 0. \tag{48}$$

The response of the optimal number of sourcing countries to an exchange rate shock is:

$$\frac{\partial n_{iM}}{\partial e^{\$}} = -\frac{\partial \Phi / \partial e^{\$}}{\partial \Phi / \partial n_{iM}}. \tag{49}$$

We established in Section C that $MB(n_{iM})$ is strictly decreasing in n_{iM}, hence $\frac{\partial \Phi}{\partial n_{iM}} < 0$.

For the sign of the numerator $\frac{\partial \Phi}{\partial e^{\$}}$:

$$\frac{\partial \Phi}{\partial e^{\$}} = \frac{\partial MB}{\partial e^{\$}} + \frac{f_s^M}{(e^{\$})^2}. \tag{50}$$

An appreciation of the domestic currency (an increase in $e^{\$}$) directly lowers the import price index P_I. This has two expansionary effects on the marginal benefit:

1. **Substitution Effect:** A lower P_I reduces the ratio P_I / Q_s. Since imported and domestic inputs are substitutes ($\varepsilon > 1$), the term $(P_I / Q_s)^{1-\varepsilon}$ increases.
2. **Scale Effect:** A lower P_I reduces the firm's marginal cost MC_i. Operating through the optimal pricing channel, the lower cost expands demand. Since demand is elastic ($\sigma > 1$), the term $MC_i^{1-\sigma}$ increases.

Both effects strictly imply $\frac{\partial MB}{\partial e^{\$}} > 0$. Combined with the direct reduction in the fixed cost $f_s^M / e^{\$}$, we conclude $\frac{\partial \Phi}{\partial e^{\$}} > 0$. Therefore:

$$\frac{\partial n_{iM}}{\partial e^{\$}} = -\frac{(+)}{(-)} > 0. \tag{51}$$

Thus, an appreciation of the domestic currency strictly increases the optimal number of sourcing countries. ■

D Complete Log-Linearized System

This appendix reports the full set of log-linearized equilibrium conditions for the model. For any variable x_t with a strictly positive steady-state value $\bar{x} > 0$, we define $\hat{x}_t \equiv d \ln x_t = dx_t / \bar{x}$.

D.1 Households

The log-linearized first-order conditions of the representative household are:

$$-\hat{P}_{D,t} - \hat{C}_t = \hat{\lambda}_t, \tag{52}$$

$$\psi \hat{L}_t = \hat{\lambda}_t + \hat{W}_t, \tag{53}$$

$$\hat{\lambda}_t + \phi_Y \hat{B}_t = \mathbb{E}_t \hat{\lambda}_{t+1} + \frac{i}{1+i} \hat{i}_t, \tag{54}$$

where $\hat{B}_t \equiv dB_t / Y$ is the bond holding scaled by steady-state output, allowing us to evaluate the dynamics around a zero net foreign asset position ($\bar{B} = 0$). The parameter combination ϕ_Y captures the marginal cost of deviating from this steady state.

D.2 Firm Costs and Sourcing Strategy

For a firm of type $s \in \{1, 2, 3\}$, the log-linearized marginal cost is:

$$\widehat{MC}_t^s = (1 - \gamma) \hat{W}_t + \gamma \hat{Q}_t^s. \tag{55}$$

Materials Price Index. The materials price index for a type-s firm is given by:

$$Q_t^s = \left[(1 - \alpha_s) P_{D,t}^{1-\varepsilon} + \alpha_s P_{I,t}^{1-\varepsilon} n_{iM,t}^{\frac{1-\varepsilon}{1-\kappa}} \right]^{\frac{1}{1-\varepsilon}}. \tag{56}$$

Taking a first-order Taylor expansion and using the definition of the steady-state import share $s_I^s \equiv \alpha_s (P_I / Q_s)^{1-\varepsilon}$, we obtain:

$$\hat{Q}_t^s = s_I^s \hat{P}_{I,t} + (1 - s_I^s) \hat{P}_{D,t} + \frac{s_I^s}{1 - \kappa} \hat{n}_{iM,t}^s, \tag{57}$$

where the import price index satisfies $\hat{P}_{I,t} = -\hat{e}_t^{\$}$. For Type-3 firms, $\alpha_3 = 0$ and $s_I^3 = 0$, so $\hat{Q}_t^3 = \hat{P}_{D,t}$.

Sourcing Decision (Type 1 and 2). The extensive margin of importing for T1 and T2 firms is determined by log-linearizing the optimal sourcing first-order condition (42), which yields:

$$(1-\varepsilon)(\hat{P}_{I,t}-\hat{Q}_t^s)+\widehat{MC}_{i,t}+\hat{y}_{i,t}=\hat{n}_{iM,t}^s-\hat{e}_t^{\$}. \tag{58}$$

To isolate the sourcing elasticity Ψ_s, we apply the partial-equilibrium assumption ($\hat{P}_{D,t}=\hat{W}_t=0$). Under this condition, we have $\hat{P}_{I,t}=-\hat{e}_t^{\$}$, $\hat{Q}_t^s=-s_I^s\hat{e}_t^{\$}+\frac{s_I^s}{1-\kappa}\hat{n}_{iM,t}^s$, $\widehat{MC}_{i,t}=\gamma\hat{Q}_t^s$, and $\hat{y}_{i,t}=-\sigma\gamma\hat{Q}_t^s$ (assuming flexible prices). Substituting these expressions and collecting terms yields:

$$\left[(\varepsilon-1)(1-s_I^s)+\gamma s_I^s(\sigma-1)+1\right]\hat{e}_t^{\$}=\left[1-\frac{\varepsilon-1}{\kappa-1}(1-s_I^s)-\frac{\gamma(\sigma-1)}{\kappa-1}s_I^s\right]\hat{n}_{iM,t}^s. \tag{59}$$

This establishes the linear relationship $\hat{n}_{iM,t}^s=\Psi_s\hat{e}_t^{\$}$, where the sourcing elasticity is explicitly defined as:

$$\Psi_s\equiv\frac{(\varepsilon-1)(1-s_I^s)+\gamma s_I^s(\sigma-1)+1}{1-\frac{\varepsilon-1}{\kappa-1}(1-s_I^s)-\frac{\gamma(\sigma-1)}{\kappa-1}s_I^s}>0. \tag{60}$$

D.3 Pricing and Export Revenue

Optimal Reset Prices. The optimal reset price for domestic firms (T1) is:

$$\hat{\tilde{p}}_{D,t}=(1-\beta\theta_D)\mathbb{E}_t\sum_{m=0}^{\infty}(\beta\theta_D)^m\widehat{MC}_{t+m}^1. \tag{61}$$

For exporting firms (T2 and T3), the log-linearized optimal reset prices under Producer Currency Pricing (PCP) and Dominant Currency Pricing (DCP) are:

$$\hat{\tilde{p}}_t^H=(1-\beta\theta_X)\mathbb{E}_t\sum_{m=0}^{\infty}(\beta\theta_X)^m\widehat{MC}_{t+m}^s, \tag{62}$$

$$\hat{\tilde{p}}_t^{\$}=(1-\beta\theta_X)\mathbb{E}_t\sum_{m=0}^{\infty}(\beta\theta_X)^m\left(\widehat{MC}_{t+m}^s+\hat{e}_{t+m}^{\$}\right). \tag{63}$$

Aggregate Price Indices. The domestic aggregate price index evolves according to $\hat{P}_{D,t}=\theta_D\hat{P}_{D,t-1}+(1-\theta_D)\hat{\tilde{p}}_{D,t}$. For exporters, the aggregate price indices for PCP and DCP goods follow Calvo dynamics:

$$\hat{P}_t^H=\theta_X\hat{P}_{t-1}^H+(1-\theta_X)\hat{\tilde{p}}_t^H, \tag{64}$$

$$\hat{P}_t^{\$}=\theta_X\hat{P}_{t-1}^{\$}+(1-\theta_X)\hat{\tilde{p}}_t^{\$}. \tag{65}$$

Export Revenue. We consider a single representative foreign destination and set the bilateral exchange rate $e_{j,t}$ to be constant ($\hat{e}_{j,t} = 0$), isolating the dollar exchange rate as the sole source of variation. Under this assumption:

- For PCP firms (fraction $1-\omega$): the local-currency price is $p_{j,t}^{LC} = p_t^H e_{j,t}$. With $\hat{e}_{j,t} = 0$, we have $\hat{p}_t^{LC} = \hat{p}_t^H$. Domestic-currency revenue per unit is $\hat{R}_t = \hat{p}_t^H$.
- For DCP firms (fraction ω): the local-currency price is $p_{j,t}^{LC} = p_t^{\$}(e_{j,t}/e_t^{\$})$. With $\hat{e}_{j,t} = 0$, we obtain $\hat{p}_t^{LC} = \hat{p}_t^{\$} - \hat{e}_t^{\$}$. Domestic-currency revenue per unit is $\hat{R}_t = \hat{p}_t^{\$} - \hat{e}_t^{\$}$.

Substituting these into the revenue definition $\widehat{EX}_t^s = \hat{R}_t + \hat{y}_t^s$ and holding exogenous foreign demand and foreign prices constant, we obtain the simplified export revenue expression:

$$\widehat{EX}_t^s = \omega(1-\sigma)(\hat{p}_t^{\$} - \hat{e}_t^{\$}) + (1-\omega)(1-\sigma)\hat{p}_t^H + \omega\hat{p}_t^{\$} + (1-\omega)\hat{p}_t^H - \omega\hat{e}_t^{\$}. \tag{66}$$

Simplifying:

$$\widehat{EX}_t^s = \omega\left[(1-\sigma)(\hat{p}_t^{\$} - \hat{e}_t^{\$}) + \hat{p}_t^{\$} - \hat{e}_t^{\$}\right] + (1-\omega)\left[(1-\sigma)\hat{p}_t^H + \hat{p}_t^H\right], \tag{67}$$

which reduces to:

$$\widehat{EX}_t^s = \omega(2-\sigma)(\hat{p}_t^{\$} - \hat{e}_t^{\$}) + (1-\omega)(2-\sigma)\hat{p}_t^H. \tag{68}$$

D.4 Monetary Policy

The log-linearized Taylor rule is:

$$\hat{i}_t = \phi_\pi \hat{\pi}_{D,t} + \hat{\mu}_t, \tag{69}$$

where $\hat{\pi}_{D,t} = \hat{P}_{D,t} - \hat{P}_{D,t-1}$ is domestic CPI inflation and $\hat{\mu}_t$ is an exogenous monetary policy shock.

D.5 Exchange Rate Process

The dollar exchange rate follows an exogenous AR(1) process:

$$\hat{e}_t^{\$} = \rho_e \hat{e}_{t-1}^{\$} + \varepsilon_t^e, \tag{70}$$

where $\rho_e \in (0,1)$ is the persistence parameter and ε_t^e is an i.i.d. shock.

E Derivations for the Analytical Decomposition

E.1 Calvo Pricing and the Scalar Approximation

Under Calvo pricing, the log-linearized reset prices for exporters are given by:

$$\hat{\tilde{p}}_t^H = (1-\beta\theta_X)\mathbb{E}_t \sum_{m=0}^{\infty} (\beta\theta_X)^m \widehat{MC}_{t+m}, \tag{71}$$

$$\hat{\tilde{p}}_t^{\$} = (1-\beta\theta_X)\mathbb{E}_t \sum_{m=0}^{\infty} (\beta\theta_X)^m \left(\widehat{MC}_{t+m} + \hat{e}_{t+m}^{\$}\right). \tag{72}$$

When the marginal cost response to the exchange rate shock is sufficiently persistent—specifically, when $\frac{d\widehat{MC}_{t+m}}{d\hat{e}_t^{\$}} \approx \rho^m \frac{d\widehat{MC}_t}{d\hat{e}_t^{\$}}$ for some ρ close to the shock persistence ρ_e—the infinite sums collapse to a scalar approximation. Define:

$$\Theta \equiv \frac{(1-\beta\theta_X)(1-\theta_X)}{1-\beta\theta_X\rho_e} \in (0,1). \tag{73}$$

This scalar captures the effective degree of price flexibility: $\Theta \to 1$ as $\theta_X \to 0$ (fully flexible) and $\Theta \to 0$ as $\theta_X \to 1$ (fully rigid). With this approximation, the aggregate price responses simplify to:

$$\frac{d\hat{p}_t^H}{d\hat{e}_t^{\$}} = \Theta \frac{d\widehat{MC}_t}{d\hat{e}_t^{\$}}, \tag{74}$$

$$\frac{d\hat{p}_t^{\$}}{d\hat{e}_t^{\$}} = \Theta \left(\frac{d\widehat{MC}_t}{d\hat{e}_t^{\$}} + 1\right). \tag{75}$$

The $+1$ term in (75) reflects that DCP firms price in dollars: only the fraction that resets can adjust their dollar price in response to the exchange rate movement.

E.2 Marginal Cost Elasticities under the Counterfactuals

The analytical decomposition relies on the marginal cost elasticities implied by each counterfactual scenario. For transparency, we evaluate the partial-equilibrium channels by holding general equilibrium factor price responses constant across CF1–CF3.

Type-2 Firms. Taking derivatives of the marginal cost under each counterfactual:

$$\frac{d\widehat{MC}_t^{2,\text{cf1}}}{d\hat{e}_t^{\$}} = (1-\gamma)\frac{d\hat{W}_t}{d\hat{e}_t^{\$}} + \gamma\frac{d\hat{P}_{D,t}}{d\hat{e}_t^{\$}}, \tag{76}$$

$$\frac{d\widehat{MC}_t^{2,\text{cf2}}}{d\hat{e}_t^{\$}} = \frac{d\widehat{MC}_t^{2,\text{cf1}}}{d\hat{e}_t^{\$}}, \tag{77}$$

$$\frac{d\widehat{MC}_t^{2,\text{cf3}}}{d\hat{e}_t^{\$}} = \frac{d\widehat{MC}_t^{2,\text{cf2}}}{d\hat{e}_t^{\$}} - \gamma s_I^2, \tag{78}$$

$$\frac{d\widehat{MC}_t^{2}}{d\hat{e}_t^{\$}} = \frac{d\widehat{MC}_t^{2,\text{cf3}}}{d\hat{e}_t^{\$}} + \frac{\gamma s_I^2}{1-\kappa}\Psi_2. \tag{79}$$

The step from CF2 to CF3 activates the intensive margin of importing (direct cost reduction of γs_I^2). The step from CF3 to baseline activates the extensive margin (variety effect scaled by the sourcing elasticity Ψ_2).

Type-3 Firms. For pure exporters, the counterfactual CF4 suppresses Type-2 import spillovers:

$$\frac{d\widehat{MC}_t^{3,\text{cf4}}}{d\hat{e}_t^{\$}} = (1-\gamma)\frac{d\hat{W}_t}{d\hat{e}_t^{\$}}\bigg|_{\text{cf4}} + \gamma\frac{d\hat{P}_{D,t}}{d\hat{e}_t^{\$}}\bigg|_{\text{cf4}}, \tag{80}$$

$$\frac{d\widehat{MC}_t^{3,\text{cf5}}}{d\hat{e}_t^{\$}} = \frac{d\widehat{MC}_t^{3,\text{cf4}}}{d\hat{e}_t^{\$}}, \tag{81}$$

$$\frac{d\widehat{MC}_t^{3}}{d\hat{e}_t^{\$}} = (1-\gamma)\frac{d\hat{W}_t}{d\hat{e}_t^{\$}} + \gamma\frac{d\hat{P}_{D,t}}{d\hat{e}_t^{\$}}. \tag{82}$$

E.3 Substituting into the Channel Definitions

We substitute the price approximations (74)–(75) and the marginal cost elasticities into the channel definitions from Section 2.

Type-2 GE Residual. In CF1, the direct export price valuation is neutralized. Revenue responds only through endogenous factor price adjustments:

$$\mathcal{E}^{T2}_{\text{residual},t} = (1-\sigma)\Theta\left[(1-\gamma)\frac{d\hat{W}_t}{d\hat{e}_t^{\$}} + \gamma\frac{d\hat{P}_{D,t}}{d\hat{e}_t^{\$}}\right]. \tag{83}$$

Type-2 Export Price Channel. Comparing CF2 to CF1, the export price valuation effect is reactivated. The incremental contribution isolates the pure expenditure-switching demand ef-

fect:

$$\mathcal{E}^{T2}_{\text{price},t} = \omega(1-\sigma)(\Theta-1). \tag{84}$$

Type-2 Import Cost Channel. Taking the difference between CF3 and CF2:

$$\mathcal{E}^{T2}_{\text{cost},t} = (1-\sigma)\Theta \times (-\gamma s_I^2). \tag{85}$$

Type-2 Import Variety Channel. The difference between the baseline and CF3:

$$\mathcal{E}^{T2}_{\text{variety},t} = (1-\sigma)\Theta \times \frac{\gamma s_I^2}{1-\kappa}\Psi_2. \tag{86}$$

Type-3 Channels. The derivations mirror the Type-2 logic:

$$\mathcal{E}^{T3}_{\text{residual},t} = (1-\sigma)\Theta\left[(1-\gamma)\frac{d\hat{W}_t}{d\hat{e}^{\$}_t}\Big|_{\text{cf4}} + \gamma\frac{d\hat{P}_{D,t}}{d\hat{e}^{\$}_t}\Big|_{\text{cf4}}\right], \tag{87}$$

$$\mathcal{E}^{T3}_{\text{price},t} = \omega(1-\sigma)(\Theta-1), \tag{88}$$

$$\mathcal{E}^{T2\to T3}_{\text{spillover},t} = (1-\sigma)\Theta\left[(1-\gamma)\left(\frac{d\hat{W}_t}{d\hat{e}^{\$}_t} - \frac{d\hat{W}_t}{d\hat{e}^{\$}_t}\Big|_{\text{cf4}}\right) + \gamma\left(\frac{d\hat{P}_{D,t}}{d\hat{e}^{\$}_t} - \frac{d\hat{P}_{D,t}}{d\hat{e}^{\$}_t}\Big|_{\text{cf4}}\right)\right]. \tag{89}$$

E.4 General Equilibrium Factor Price Elasticities

The residual and spillover channels depend on the equilibrium responses of wages and domestic prices to the exchange rate shock. We derive closed-form expressions under flexible domestic prices ($\theta_D = 0$) and a constant real interest rate.

E.4.1 CF4 Economy

In CF4, Type-2 firms are restricted to domestic inputs ($\alpha_2 = 0$), while Type-1 firms retain their full import networks. The log-linearized marginal costs are:

$$\widehat{MC}^1_t = (1-\gamma)\hat{W}_t + \gamma\left[-s_I^1\left(1+\frac{\Psi_1}{\kappa-1}\right)\hat{e}^{\$}_t + (1-s_I^1)\hat{P}_{D,t}\right], \tag{90}$$

$$\widehat{MC}^2_t = (1-\gamma)\hat{W}_t + \gamma\hat{P}_{D,t}, \tag{91}$$

$$\widehat{MC}^3_t = (1-\gamma)\hat{W}_t + \gamma\hat{P}_{D,t}. \tag{92}$$

Flexible domestic prices imply $\hat{P}_{D,t} = \widehat{MC}_t^1$. Solving for $\hat{P}_{D,t}$:

$$\hat{P}_{D,t} = \frac{1-\gamma}{1-\gamma(1-s_I^1)}\hat{W}_t - \frac{\gamma s_I^1}{1-\gamma(1-s_I^1)}\left(1+\frac{\Psi_1}{\kappa-1}\right)\hat{e}_t^{\$}. \tag{93}$$

Aggregating factor demands across the three firm types and imposing labor market clearing yields:

$$\left.\frac{d\hat{W}_t}{d\hat{e}_t^{\$}}\right|_{\text{cf4}} = \frac{-\gamma}{1+\frac{\psi(1-\gamma)}{1+\psi}} \cdot \frac{1}{1+\frac{\gamma}{1-\gamma}\frac{1}{\sigma-1}\left[(1-\nu_1)+\nu_1 s_I^1\left(1+\frac{\Psi_1}{\kappa-1}\right)\right]}. \tag{94}$$

The domestic price elasticity follows from substituting (94) into (93):

$$\left.\frac{d\hat{P}_{D,t}}{d\hat{e}_t^{\$}}\right|_{\text{cf4}} = \frac{1-\gamma}{1-\gamma(1-s_I^1)}\left.\frac{d\hat{W}_t}{d\hat{e}_t^{\$}}\right|_{\text{cf4}} - \frac{\gamma s_I^1}{1-\gamma(1-s_I^1)}\left(1+\frac{\Psi_1}{\kappa-1}\right). \tag{95}$$

E.4.2 Baseline Economy

In the baseline, both Type-1 and Type-2 firms actively optimize their import networks. The additional import substitution by Type-2 firms amplifies the decline in domestic factor prices. Aggregating factor demands now yields:

$$\frac{d\hat{W}_t}{d\hat{e}_t^{\$}} = \frac{-\gamma}{1+\frac{\psi(1-\gamma)}{1+\psi}} \cdot \frac{1}{1+\frac{\gamma}{1-\gamma}\frac{1}{\sigma-1}\left[(1-\nu_1)+\nu_1 s_I^1\left(1+\frac{\Psi_1}{\kappa-1}\right)+(1-\nu_1)\nu_2 s_I^2\left(1+\frac{\Psi_2}{\kappa-1}\right)\right]}. \tag{96}$$

The domestic price elasticity retains the same functional form as in CF4:

$$\frac{d\hat{P}_{D,t}}{d\hat{e}_t^{\$}} = \frac{1-\gamma}{1-\gamma(1-s_I^1)}\frac{d\hat{W}_t}{d\hat{e}_t^{\$}} - \frac{\gamma s_I^1}{1-\gamma(1-s_I^1)}\left(1+\frac{\Psi_1}{\kappa-1}\right). \tag{97}$$

E.5 Key Analytical Insights

Comparing (96) with (94), the spillover channel is proportional to the additional term $(1-\nu_1)\nu_2 s_I^2\left(1+\frac{\Psi_2}{\kappa-1}\right)$ in the denominator. This term captures the weighted import intensity of two-way traders and analytically proves that:

1. The spillover from two-way traders to pure exporters scales with the measure of two-way traders ($(1-\nu_1)\nu_2$), their import intensity (s_I^2), and their sourcing elasticity (Ψ_2).

2. The import cost and variety channels interact multiplicatively: the variety channel $\mathcal{E}^{T2}_{\text{variety},t}$ in (86) is proportional to $s_I^2 \times \Psi_2$, implying that firms with higher import intensity benefit disproportionately from expanding their sourcing networks.

3. Under the calibrated parameters, the variety channel dominates the cost channel in the long run because $\Psi_2 > 1$, amplifying the base cost reduction by a factor of $\Psi_2/(\kappa - 1)$.