Bilateral Economies of Scope[*]

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Abstract

International transactions are costly because they require investments in logistics, contracts, and the acquisition of local institutional knowledge. We posit that a portion of the fixed cost of entering a specific export market can be used toward covering the cost of acquiring imported inputs from that same market, and vice versa. Using dis-aggregated transactions data for Chinese firms from 2000 to 2015, we document firm-level trading patterns suggesting such bilateral economies of scope. Through a structural model, we estimate that the simultaneous export and import in a given country reduce export and import fixed costs by around 42 and 35 percent, respectively.

JEL Codes: F12 F13 F14 F17

[*]We are grateful to Jonathan Eaton, Lorenzo Caliendo, James Tybout, Felix Tintelnot, Kim Ruhl, Shang-Jin Wei, Michael Zheng Song, Daniel Yi Xu, Wolfgang Keller, Peter Schott, Matilde Bombardini, Andrei Levchenko, Mark Roberts, Xiaodong Zhu, Jingting Fan, Miaojie Yu, Jiandong Ju, Hong Ma, Zhiyuan Li, Qing Liu, Ran Jing, Bing Li, Chang Sun, Heiwai Tang, Hongsong Zhang, Haishi Li, conference participants at the 2023 SED Meeting, the 2023 JPGI PhD Alumni Conference at the UW-Madison, the Midwest International Trade Conference, the 2023 AMES at Beijing and Singapore, the 2023 CTRG Annual Meeting, the 2023 HKUST Conference on International Economics, the 2023 Firm and Industrial Dynamics Workshop at HKU, the Global Value Chain Training and Research Workshop at UIBE, the Shanghai Macro Workshop at SUFE, the 2023 Asia Global Institute & Institute of China Economy Trade Conference at HKU, and participants in various seminars for helpful comments. We also thank the editor and four anonymous referees for their constructive insights. Yao Amber Li gratefully acknowledges financial support from the Research Grants Council of Hong Kong, China (General Research Funds Project 16506823). Authors are listed in alphabetical order. All errors are our own.

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1 Introduction

International transactions are costly, requiring participating firms to make large investments in logistics, contracting, and acquisition of foreign institutional knowledge (Melitz, 2003). The fact that only the most productive firms export and import suggests large fixed costs to tap the global markets, and the understanding of these costs has important implications in the study of international economics (e.g., Costinot, Rodríguez-Clare, and Werning, 2020, Pavcnik, 2002 and Amiti, Itskhoki, and Konings, 2014). However, most of the literature focuses on the impact of fixed costs on firms' export and import decisions in isolation.

In reality, the fixed costs of exporting and importing are likely to overlap, making the bilateral trade decisions of a firm interdependent. For example, when a Chinese firm hires a legal compliance team to export to Indonesia, the same team, thanks to the understanding of local regulations, could partially help its sourcing from Indonesia as well. Conversely, when a firm overcomes the barrier to source from Japan, its understanding of Japanese language and culture may have already removed the bulk of specific costs to penetrate the Japanese market. In this paper, we present stylized facts on and quantify the magnitudes of the interrelated reductions in trade barriers, which we call *bilateral economies of scope.*

We begin this paper by providing three sets of facts that corroborate the above narrative based on the universe of Chinese firm-country-level transaction data from 2000 to 2015. First, given a specific foreign market, the share of exporters conditional on being importers from that market is an order of magnitude larger than that among non-importers, and the same patterns are observed for the conditional share of importers. Second, we demonstrate using regression analysis inspired by Chaney (2014) and Morales, Sheu, and Zahler (2019) that a firm's import experience in a given country significantly increases the likelihood of exporting to that market, and vice versa. This result is highly robust to many alternative specifications including Arellano-Bond dynamic panel regressions and to extensive sub-sample analysis. Finally, at the aggregate level, bilateral economies of scope manifest themselves as a large positive correlation between the ranks of the export destinations in the numbers of Chinese exporters and the ranks of the import sourcing origins in the numbers of Chinese importers. While competing drivers (such as correlations of country-level characteristics) might account for each of our documented findings individually, the facts as a whole suggest bilateral economies of scope.

To estimate the size of our mechanism when various alternative forces are present, we extend the quantitative framework of Antràs, Fort, and Tintelnot (2017) (henceforth AFT) to an environment in which firms simultaneously source inputs from a set of import sourcing origins and sell differentiated final products to a set of export destinations. Firms that only export face a market-specific distribution of export fixed costs, while firms that only import face another fixed cost distribution. To incorporate bilateral economies of scope in firm trade decisions, we allow these distributions to shift downward when a firm exports to and imports from the same market. In addition, we allow for the shifts in the export fixed cost to be different from that in import fixed cost with each shift governed by a distinct parameter. This setting allows for potentially different mechanisms in which a firm's trade decision on one side may marginally benefit the other side. We show that the model inherits the tractability of AFT in that it allows for the parameters associated with country-level characteristics (e.g., sourcing and sales potentials) and the parameters governing firms' pricing and trade profiles (e.g., the trade elasticities and the distributions of fixed costs) to be identified in separate stages.

The separation of identification enables us to extend the algorithm of Jia (2008) and Arkolakis, Eckert, and Shi (2022) to allow firms to jointly determine their export and import decisions across different markets. We estimate the model via simulated method of moments where the key moments are the stylized facts from our descriptive analysis. The estimated parameters imply large bilateral economies of scope: by simultaneously exporting and importing from a given market a firm reduces, on average, export fixed cost by 42 percent and import fixed cost by 35 percent.

We show the estimated model aligns with the empirical regularities regarding the trade decisions of exporters and importers, their relative size to domestic firms, and the cross-markets entry patterns. We assess the role of bilateral economies of scope in creating the documented correlations between the ranks of sourcing origins and export destinations by comparing the performance of the baseline model to a series of restricted models in which the bilateral economies of scope mechanisms are selectively shut down. We show that roughly 69% of the rank-rank correlations are explained by the baseline model, 48% are explained when there is unilateral cost reduction and only 29% when there is no fixed cost reduction at all. The exercise underscores the importance of bilateral economies of scope in Chinese firms' bilateral partnerships with foreign markets.

The estimated model provides a flexible quantitative device for studying the firms' response to and the aggregate impact of various types of trade shocks. We show that our mechanism is crucial for understanding how trade liberalization affects Chinese firms' global market participation. An important feature of China's accession to the WTO is that trade cost reductions during the episode were bilateral. While canonical trade models study the impact of export and import liberalization in isolation, our model allows for simultaneous trade cost reductions from both sides and is able to dissect Chinese firms' global market accession into the contributions from different sides of liberalization. By feeding the same estimated trade shocks into the baseline and restricted models, we find that the aggregate impact of import (export) liberalization on export (import) entry is almost doubled for the baseline specification compared to the restricted one. This difference at the aggregate level is due to amplifications at the firm-level as the import (export) liberalization induces a larger response to a firm's export (import) participation when the bilateral cost reduction mechanism is present. We conclude by showing that bilateral economies of scope have the implication that import protection has the effect of discouraging firms from exporting.

We contribute to several strands of literature. First, our paper is related to the recent study of complementarity between a firm's export and import activities. Exporters and importers are more productive, with the most efficient ones being both and accounting for a substantial share of international trade flow (Bernard et al., 2009; Muûls and Pisu, 2009). The relationships between within-firm export and import activities play an important role in shaping several margins of international trade (Bernard et al., 2018) and firms' strategic behavior in trade (such as exchange rate pass-through Amiti, Itskhoki, and Konings, 2014). Empirical works also document causal links through which a firm's import activity promotes its export performance (Feng, Li, and Swenson, 2016; Pierola, Fernandes, and Farole, 2018). Our study is similar to Kasahara and Lapham (2013) and Grieco, Li, and Zhang (2022) in documenting and quantifying the within-firm bilateral complementarity through a fixed cost story. Our exercise, however, differs from theirs by emphasizing that such complementarity is market-specific.[1] In addition, we provide a unified account of the relationships between firms' export and import decisions across countries.

We also add to the theoretical and quantitative work on firms' optimal trade decisions. While the existing papers examine the determinants of firm export decisions (e.g., Chaney, 2008; Eaton, Kortum, and Kramarz, 2011; Tintelnot, 2017) or import decisions (e.g., Antràs, Fort, and Tintelnot, 2017) in isolation, our model allows for a more flexible and potentially inter-dependent bilateral trade linkages. In this sense, our study resembles Antràs et al. (2022) in studying the joint production and sourcing decisions for firms. We diverge from their work in two critical aspects. First, while Antràs et al. (2022) emphasizes the effect of FDI, we focus on a bilateral cost reduction mechanism that leads to the complementarity of export-import relationships at the firm level. Second, we highlight the market-specific nature of such bilateral economies of scope. This has important policy implications, suggesting that a change in trade policies, e.g., regional trade agreement (RTA) and preferential trade agreement (PTA), affects bilateral trade relationships with targeted countries disproportionately more than the others.

Finally, our paper complements a large strand of literature on trade policy and firm performance, particularly those studying the relationship between trade liberalization and global market participation (Amiti and Konings, 2007; Kasahara and Rodrigue, 2008; Brandt et al., 2017). Our estimated model provides a quantitative device to analyze and decompose the impact of trade cost reductions, especially when both export and

[1] Albornoz and Garcìa-Lembergman (2023) shows that exporting to a new destination increases the probability of Argentine firms to import from the same place through a reduction in import fixed costs. However, they do not establish a similar relationship in the other direction.

import liberalization are present. In addition, the findings that the effect of export (import) liberalization gets amplified through import (export) entry indicate potential under-estimation on the impact of trade policy shock when the bilateral economies of scope are neglected.

The remainder of this paper is structured as follows. Section 2 provides conceptual and empirical motivations for our study. Section 3 presents a quantitative trade model that reconciles the empirical regularities. Section 4 provides several remarks regarding the quantitative model and discusses how to connect the model to the data. Section 5 presents the estimation results, and Section 6 shows counterfactual experiments. Finally, Section 7 concludes.

2 Motivations

In this section, we first conceptualize the idea of bilateral economies of scope, where fixed costs paid to facilitate one direction of trade to a specific market can be simultaneously used in helping the firm to engage in trade from the other direction in that market. We then present several stylized facts that corroborate this idea using the data on Chinese firms. Finally, we provide robustness checks.

2.1 Conceptual Motivation

Table 1 enumerates a firm's market-specific fixed cost bundles conditional on different export and import decisions. If the firm only exports to or only imports from this foreign country, its fixed cost payment is given by f^X and f^M, respectively. The bilateral economies of scope arise when the firm engages in both export and import activities within the foreign country. In this case, the export fixed cost faced by the firm is reduced by a fraction of α_0, while its import fixed cost is reduced by a fraction of α_1. Therefore, it is cost-effective to bundle trade decisions in the same place. The total cost saved is given by the sum of $\alpha_0 f^X$ and $\alpha_1 f^M$. What is important here is that the cost reduction mechanism works only if the firm's bilateral trade decisions are for the same country because fixed costs (e.g., legal, cultural, or geographical barriers) are market-specific.

In reality, the cost saving from concurrent export and import in a foreign country can emerge from a business travel that helps the firm to get familiar with not only local customers but also suppliers, or from hiring a lawyer or translator facilitating trade in both directions—both cases coming along with potentially asymmetric benefits on export and import sides.

An immediate implication from the structure of fixed costs is that importers in a foreign country are more likely to export to the same country compared to non-importers due to a lower export fixed cost that they need to pay. It is the parameter α_0 that governs the extent of the importers' advantage in export participation relative to non-importers. Larger α_0 is associated to a lower export fixed cost faced by importers. Conversely, exporters in a foreign country are more likely to import from the same country compared to non-exporters, where the parameter α_1 plays a critical role in driving the exporters' advantage in import participation relative to non-exporters.

2.2 Empirical Motivations

This section presents empirical evidence for the mechanism described above. We provide a brief description of the dataset here and relegate more detailed discussions to Appendix A.2.

Our main data source is the Chinese Customs Trade Statistics (henceforth CCTS), which covers the universe of Chinese firms' export and import transactions (2000-2015). We focus on ordinary trade records only and drop transactions of processing trade from our sample.[2] This is to focus on the firms' trade decisions that reflect their active and strategic investment in finding foreign costumers and suppliers.[3] In addition, we limit

[2]In the customs sample, firms may engage in both ordinary trade and processing trade. We only drop their trade records classified as processing trade. As a result, there are two types of firms in our sample: firms who only do ordinary trade and hybrid firms who do both. The empirical results are robust to taking into account the second type of firms. See Appendix A.5 for more details. Furthermore, in Section A.4.1, the presence of hybrid firms allow us to use firm's processing trade experience as an instrument in system GMM estimation following Feng, Li, and Swenson (2016)'s estimation strategy.

[3]Processing trade generates a mechanical correlation between firm's export and import decisions and reflects only the supply contract the firm signed with foreign company but not the firm's own trade strategy. For this reason, we drop processing trade records from the sample. In Appendix A.5, we conduct several additional tests suggesting that the unobserved processing trade does not drive our

our attention to firms' import of intermediate goods and export of final goods identified by Broad Economic Categories Revision 4 (BEC4) and focus only on the top 30 export destinations and top 30 import sourcing origins (in terms of trade flow) for China.[4] The trade flows for these countries account for over 93% of China's annual export value and 96% of annual import value.

We then merge the customs dataset to the Annual Survey of Industrial Enterprise (henceforth ASIE) from National Bureau of Statistics of China (1998-2009) following the standard procedure. The latter contains accounting information of above-size (5 million RMB in total revenue) Chinese manufacturers such as revenue and input purchase. The merged sample contains around 300,000 firms (for the year 2007), where 9.05% of them are exporters and 11.10% are importers. Lastly, the gravity variables such as population weighted geographic distances and indicator for common language are from the CEPII dataset. With the above data, we provide evidence in support of bilateral economies of scope for Chinese firms. Fact 1 summarizes the first empirical pattern.

Fact 1. *For a specific country, the share of Chinese exporters (importers) conditional on being importers (exporters) is significantly higher than that conditional on being non-importers (non-exporters).*

Table 2 shows the shares of exporters and the shares of importers for different groups of firms in China. Column (1) is the share of exporters in a foreign country among firms that also import from the same country, (2) lists the share of exporters among those who do not import from that country, and (3) presents the ratio between these two conditional shares. Columns (4) to (6) show the corresponding statistics for the conditional shares of importers.

In the first two rows, we define each firm as exporter and importer in each foreign

empirical findings.

[4]For all analyses except the reduced-form exercises in Fact 2, we only use cross-sectional data in year 2007. Then in that year, we rank foreign countries according to China's total export value and total import value respectively, and pick the top 30 export destinations and top 30 import sourcing origins. There is significant overlap between the two sets of countries, resulting in a total of 36 trading partners for China. When we use the panel data from 2000 to 2015 in Fact 2, we do the same rankings separately for each year and then pool them together, leading to a total of 59 trading partners. Our regression results are barely affected the choice of country set.

country separately[5], calculate the conditional shares, and then take the simple average (the first row) and the median level (the second row) across countries. Hence, the results represent an average foreign country. According to the first row, on the export side, the probability of an importer in a foreign country becoming an exporter in the same country is 9.33 times that of a local non-importer. This ratio is informative about the magnitude of α_0, as it measures the importers' advantage in export participation relative to non-importers *within* a foreign country. Similarly, on the import side, a firm exporting to one country is 9.05 times more likely to import from the same country relative to a local non-exporter, which helps us to infer the value of α_1 later on.[6]

The last row of Table 2 shows the conditional ratios for the global market as a whole, which is smaller than that of the market-specific counterparts. The importers' (exporters') advantage in export (import) participation is 46% (59%) higher for average country (the mean level in the first row) than for global market. This discrepancy highlights the importance of market-specific factors in driving the large conditional ratios for a specific foreign country.

To further validate our finding and test whether a firm's import (export) decision in a country plays a significant role in its export (import) decision for the same country, we control for several well-documented determinants of firm trade decisions. In this exercise, we use the whole span of the customs sample (i.e., from 2000 to 2015). We keep firms who export to at least one foreign market and import from at least one foreign origin in each year, i.e., two-way traders, to ensure all firms in our sample are able to export and import at the same time.[7] The following Fact 2 previews our finding here.

Fact 2. *A firm's past import (export) experience in one foreign country significantly*

[5]For instance, if a firm only exports to US, then it is considered an exporter only when we do the calculation for US. When we calculate conditional shares for the other countries like Japan, the firms is considered a non-exporter. In the case of the global market, exporters are defined as firms that export to any foreign country and importers are defined as those who import from any foreign country in the sample.

[6]We show in Appendix Figure A1 the full spectrum of conditional ratios across countries. In Appendix Table A7, we test the correlation between conditional ratios and several gravity variables. The results indicate that conditional ratios are significantly higher for countries sharing no common language with China. This fact lends support to our narrative about sharing translation service within the same country.

[7]Including one-way traders generates downward bias in our estimates as they only trade with foreign countries in one direction. The empirical results are robust to including all firms, to using merged sample as in Fact 1, and to restricting the number of foreign countries.

increases the likelihood of being an exporter (importer) in the same country.

Following Chaney (2014) and Morales, Sheu, and Zahler (2019), we specify the following regression equations:[8]

$$\begin{aligned}
\Pr\left(\text{Trade}_{fct} > 0 | \text{Observables}\right) &= \Phi\left(\beta_1 \mathbb{I}\left\{\text{Imp.}_{fct-1} > 0\right\} + \beta_2 \mathbb{I}\left\{\text{Exp.}_{fct-1} > 0\right\}\right. \\
&+ \delta \text{Standard Gravity}_{\text{CHN},ct} \\
&+ \gamma_1 \text{Extended Gravity: Distance}_{fct-1} + \gamma_2 \text{Remoteness}_{ct-1} \\
&+ \gamma_3 \text{Other Extended Gravity}_{fct-1} \\
&+ \left. \omega \text{Controls}_{ft-1}\right), \qquad (1)
\end{aligned}$$

where $\text{Trade}_{fct} \in \left\{\text{Exp.}_{fct}, \text{Imp.}_{fct}\right\}$ denotes firm f's export or import value in country c in year t. The corresponding dummy for firm trade decision is denoted by $\mathbb{I}\left\{\text{Trade}_{fct} > 0\right\}$ which takes the value one if firm f exports to or imports from country c in year t. We control for firm-level and country-level factors such firm size, productivity and country size using firm-year fixed effect and country-year fixed effects whenever possible. These forces might affect the firm's trade decisions and work independently from our mechanism. As a result, the identification of bilateral economies of scope comes from variation of the firm's trade decisions across countries that are not driven by firm-level and country-level characteristics. $\Phi(\cdot)$ is the cumulative density function of the standard normal distribution, leading to a Probit model of firm trade probability as in Chaney (2014).

Compared to the previous reduced-form exercises which study either a firm's export decisions or its import decisions separately, the new feature of our empirical model is to include the firm's past import decision, $\mathbb{I}\left\{\text{Imp.}_{fct-1} > 0\right\}$, as a key explanatory variable when estimating its export probability, and to include its past export decision, $\mathbb{I}\left\{\text{Exp.}_{fct-1} > 0\right\}$, when examining import probability. Note that we also incorporate the standard gravity variables and the extended gravity variables following the practice

[8] The reason why we estimate the lagged effect here is to be consistent with previous studies of firm trade decisions. Our results are robust to including a firm's current trade decision or focusing on the contemporaneous effect only. Besides, in Appendix A.9, we incorporate an interaction term $\mathbb{I}\left\{\text{Imp.}_{fct-1} > 0\right\} \times \mathbb{I}\left\{\text{Exp.}_{fct-1} > 0\right\}$ and show the robustness of our results to this alternative specification.

of Chaney (2014); Morales, Sheu, and Zahler (2019). This is to capture the fact that a firm is more likely to trade with countries that are geographically close to its established trade networks or share other characteristics with the countries that it already exported to and imported from, such as language and income level.[9]

Table 3 shows the results. In Panel A, the dependent variable is an indicator for the firm's current export decision in a foreign country. Column (1) reports the two coefficients of interest, one showing the effect of the firm's past import experience from a foreign country on its current export decision to the same country and the other measuring country-specific export persistence. Column (2) adds several firm-level controls.[10] Column (3) incorporates country fixed effects, and column (4) instead uses country-year fixed effects. The results from column (1) to (4) show that the firm's past import experience in a foreign country has a significant and positive effect in facilitating its export to the same country. In addition, there is strong persistence in firm export presence within a country, which is a standard result in the literature of export dynamics (e.g., Albornoz et al., 2012; Chaney, 2014; Morales, Sheu, and Zahler, 2019).

Columns (5) to (7) include the extended gravity variables, and the results remain stable. Taking column (7) as the baseline result, the coefficient on the past import decision is 0.287 and the corresponding marginal effect is 0.028, suggesting that importing from a country increases the probability of firm exporting to the same country by 2.8%. The coefficient measuring export persistence is 1.277 and its marginal effect is 0.126 which indicates that past export experience increases the probability of firm continuing to export by 12.6%. The results indicate that market-specific import experience is an important determinant of the firm's current export decision. In Panel B, we show a firm's past export decision affects its current import decision in a similar yet quantitatively distinct way. In column (7), the estimated coefficient on past export decision is 0.286 and the marginal

[9]Appendix A.10 presents detailed information regarding the construction of the extended gravity variables.

[10]We cannot control for all firm-level characteristics using fixed effects due to a large number of firms in our sample. In a robustness check, we pick a single industry with limited number of firms in which we are able to include firm fixed effects in the Probit model, and our results remain stable. In Appendix A.6, we instead use a linear probability model. This allows us to control for firm-level time-varying factors that may affect our results with firm-year and firm-country fixed effects. We obtain results qualitatively consistent with the Probit model.

effect is 0.017, while the estimated coefficient measuring a firm's import persistence is 1.474 and its marginal effect is 0.088. Overall, these findings suggest that the firm's export and import decisions in a foreign country are complementary to each other.[11]

Finally, at the aggregate level, a natural prediction based on previous findings is that a foreign country with more Chinese exporters should have more Chinese importers as well. To show whether this is the case, we rank foreign countries by the number of Chinese exporters and the number of Chinese importers separately. Figure 1 scatters country-level export ranks and corresponding import ranks. The correlation between the two ranks is positive and large (0.75 in Panel A), suggesting that the most popular export destinations for Chinese exporters are often the places that attract a larger number of Chinese importers. In Panel B, we regress log number of Chinese exporters and importers on several gravity variables, and calculate a country's export rank and its import rank using the regression residuals. The correlation becomes 0.71, slightly lower than in Panel A. Both exercises are consistent with our predictions based on micro-level evidence of bilateral economies of scope. Fact 3 summarizes the finding.

Fact 3. *A foreign country with more Chinese exporters also has more Chinese importers.*

The above rank-rank correlation could be explained by multiple competing mechanisms that work independently from the bilateral economies of scope. For example, markets attracting more Chinese firms to export could be larger in scale or have lower trade costs which, in turn, induces more Chinese firms to import from. We dissect the effect of our channel and the alternatives in our quantitative exercises.

In Appendix A.4, we present further tests addressing the issues related to dynamic panel specifications and show that our results are robust to taking into account foreign-related firms, stagnant firms, additional extended gravity variables and alternative sample periods.

[11] Appendix A.8 examines potential sources of bilateral complementarity by introducing an interaction term between a firm's past trade decision and some gravity variables. We find that such complementarity is stronger for countries that are more distant from China and share no official language with China, consistent with our narrative about sharing translation team on both sides of trade to save costs.

3 Theory

Motivated by the above empirical regularities, we provide a structural model of firm heterogeneity and bilateral trade decisions with bilateral economies of scope. We build our model on the framework of Antràs, Fort, and Tintelnot (2017) and allow firms to trade in both final and intermediate goods.

3.1 Environment

Consider a world consisting of J countries, which are indexed by i (host country), j (sourcing origin), and k (sales market). The set of countries is denoted by $\mathbb{J} = \{1, 2, ..., J\}$. Within each host country $i \in \mathbb{J}$, there exists a measure N_i^A of domestic final goods producers. Each firm is characterized by its core productivity φ and produces a differentiated final good. The production of final goods requires the assembly of a unit measure of differentiated intermediate inputs. The firm's objective is to maximize its total profits by selecting the optimal set of origins to source intermediate inputs from and the optimal set of destinations to sell its final goods to. In each origin country $j \in \mathbb{J}$, there exists a unit measure of intermediate goods suppliers. Each supplier produces different intermediate goods $\nu \in [0, 1]$ for final goods producers and is characterized by its unit labor requirement $a_j(\nu)$. This environment for intermediate goods suppliers is built on Eaton and Kortum (2002) where the input suppliers engage in perfect competition and labor is the only input used in the production of intermediate inputs. Finally, the representative consumer in each sales market $k \in \mathbb{J}$ derives utility from the consumption of final goods available there.

3.2 Preference

The representative consumer in the market k maximizes its utility by consuming a non-manufacturing good and a continuum of manufacturing final goods. The measure of manufacturing final goods available to the consumer is endogenously determined by free entry and international trade. The consumer's utility function is $U_k = U_{Mk}^{\mu} U_{Nk}^{1-\mu}$ and

$$U_{Mk} = \left(\int_{\omega \in \Omega_k} q_k(\omega)^{\frac{\sigma-1}{\sigma}} d\omega \right)^{\frac{\sigma}{\sigma-1}}; \tag{2}$$

σ is the elasticity of substitution between differentiated final goods and Ω_k represents the set of differentiated final goods available in market k. The preference is the same across all countries and leads to the following demand for any final good ω available in market k: $q_k(\omega) = p_k(\omega)^{-\sigma} E_k P_k^{\sigma-1}$ where E_k is country k's total expenditure on manufacturing goods and P_k is the ideal price index of manufacturing sector. Labor is the only factor of production that commands a wage w_k in the market k. The non-manufacturing sector captures a constant share of the economy's spending $1 - \mu$, competes for labor with manufacturing sector, and is assumed to be large enough to pin down wages in terms of non-manufacturing output.

3.3 Technology and Market Structure

Firms characterized by their core productivity φ decide the set of origins $\mathsf{M}(\varphi) \subseteq \mathbb{J}$ to source intermediate inputs from, and for each intermediate input, they choose the available suppliers that offers the lowest price. The efficiency of input suppliers across countries is commonly known. Given any sourcing strategy $\mathsf{M}(\varphi)$, the price firm φ pays for intermediate input z is $z_i(\nu, \varphi; \mathsf{M}(\varphi)) = \min_{j \in \mathsf{M}(\varphi)} \left\{ \tau_{ij}^M a_j(\nu) w_j \right\}$, where sourcing from input suppliers located in origin j incurs iceberg cost denoted by τ_{ij}^M that can be interpreted as geographical (such as transportation) or man-made (such as tariff) barriers. In addition, sourcing from any origin j requires the firm to pay a fixed entry cost denoted by f_{ij}^M, which is country-specific but common to all firms from host i. We can express the marginal cost of production for the firm φ as

$$c_i(\varphi; \mathsf{M}(\varphi)) = \frac{1}{\varphi} \left(\int_0^1 z_i(\nu, \varphi; \mathsf{M}(\varphi))^{1-\rho} d\nu \right)^{\frac{1}{1-\rho}}, \tag{3}$$

where ρ is the elasticity of substitution among intermediate inputs.

Turning to the input suppliers of origin j, we follow Eaton and Kortum (2002) and assume that their production efficiency $\frac{1}{a_j(\nu)}$ is drawn from a Fréchet distribution: $\Pr\left(a_j(\nu) \geqslant a\right) = e^{-T_j a^{\theta}}$ where T_j represents the mean of productivity of input suppliers and measures the absolute advantage of origin j in producing intermediate inputs. θ measures the dispersion of productivity of input suppliers and thus the comparative advantage of input production across origins. A lower θ implies larger dispersion of productivity.

Given any sourcing strategy $\mathsf{M}(\varphi)$, the standard argument of Eaton and Kortum (2002) indicates that firm φ's share of intermediate inputs sourced from origin j is given by

$$\chi_{ij}(\varphi; \mathsf{M}(\varphi)) = \frac{\xi_{ij}^M}{\Theta_i^M(\varphi)}, \tag{4}$$

if $j \in \mathsf{M}(\varphi)$ and zero otherwise, where

$$\xi_{ij}^M \equiv T_j \left(\tau_{ij}^M w_j\right)^{-\theta} \tag{5}$$

measures origin j's appeal as an input supplier or *sourcing potential* of origin j to host country i, and

$$\Theta_i^M(\varphi; \mathsf{M}(\varphi)) \equiv \sum_{j \in \mathsf{J}(\varphi)} \xi_{ij}^M \tag{6}$$

represents the *sourcing capacity* corresponding to the sourcing strategy $\mathsf{M}(\varphi)$. Finally, the firm's marginal cost of production depends on its sourcing strategy $\mathsf{M}(\varphi)$ and is derived as

$$c_i(\varphi; \mathsf{M}(\varphi)) = \frac{1}{\varphi}\left(\gamma \Theta_i^M(\varphi; \mathsf{M}(\varphi))\right)^{-\frac{1}{\theta}}, \tag{7}$$

where $\gamma \equiv \left[\Gamma\left(\frac{\theta+1-\rho}{\theta}\right)\right]^{\frac{\theta}{1-\rho}}$ with Γ being the gamma function.

Equation (7) is isomorphic to the ideal price index of Eaton and Kortum (2002). In our setting, it denotes the marginal cost of production of the firm, which is decreasing in the sourcing capacity of sourcing strategy $\mathsf{M}(\varphi)$. The firm that sources from better (in terms of sourcing potential) and/or more origins is able to produce at a lower marginal cost than the others.

Next, we describe the firm's sales decisions. A firm with productivity φ decides whether to sell the final goods to each market. Its sales strategy is the set of selected markets denoted by $\mathsf{X}(\varphi) \subseteq \mathbb{J}$. Selling to market k entails an iceberg transportation cost, τ_{ki}^{X} (e.g., foreign import tariff), and a sales fixed cost, f_{ki}^{X}. The firm can sell final product to market k only after paying the fixed cost.

Taking as given the sourcing strategy $\mathsf{M}(\varphi)$, the firm's sales revenue from serving market k is $r_{ki}(\varphi) = \sigma\varphi^{\sigma-1}\left(\gamma\Theta_i^M(\varphi)\right)^{\frac{\sigma-1}{\theta}}\left(\tau_{ki}^X\right)^{1-\sigma} B_k$, where $B_k \equiv \frac{1}{\sigma}\left(\frac{\sigma}{\sigma-1}\right)^{1-\sigma} P_k^{\sigma-1}E_k$ denotes the aggregate demand in market k. The corresponding profit is a constant share of the firm's sales revenue: $\frac{r_{ki}(\varphi)}{\sigma}$. A firm's total revenue is simply the sum of revenues from selected markets, and its sales share in market k is given by

$$\chi_{ki}^{X}(\varphi) = \frac{\xi_{ki}^{X}}{\Theta_i^{X}(\varphi)}, \tag{8}$$

if $k \in \mathsf{X}(\varphi)$ and zero otherwise, where

$$\xi_{ki}^{X} \equiv \left(\tau_{ki}^{X}\right)^{1-\sigma} B_k \tag{9}$$

is market k's appeal as a consumer or *sales potential* of market k to firms located in host country i, and

$$\Theta_i^{X}(\varphi) \equiv \sum_{k\in\mathsf{X}(\varphi)} \xi_{ki}^{X} \tag{10}$$

denotes the *sales capacity* corresponding to the sales strategy $\mathsf{X}(\varphi)$. Firms sell more to markets with higher sales potential relative to the others after paying the fixed cost, and those with higher sales capacity receive larger total revenue from the globe.

To sum up, the total profit for firm φ in host i with sales strategy $\mathsf{X}(\varphi) \subseteq \mathbb{J}$ and sourcing strategy $\mathsf{M}(\varphi) \subseteq \mathbb{J}$ is therefore

$$\begin{aligned}\pi_i(\varphi) \quad = \quad & \varphi^{\sigma-1} \underbrace{\left(\gamma \Theta_i^M(\varphi)\right)^{\frac{\sigma-1}{\theta}} \Theta_i^X(\varphi)}_{\text{Export-import complementarity}} - w_i \sum_{k \in \mathsf{X}(\varphi)} f_{ki}^X - w_i \sum_{j \in \mathsf{M}(\varphi)} f_{ij}^M \\ & \underbrace{+ w_i \sum_{h \in \mathsf{X}(\varphi) \cap \mathsf{M}(\varphi)} \left(\alpha_0 f_{hi}^X + \alpha_1 f_{ih}^M\right)}_{\text{Bilateral economies of scope}}, \end{aligned} \tag{11}$$

where the first term is the firm's total variable profits, the second and third term captures the total sales and sourcing fixed costs. Here we allow firms to save part of sales fixed cost and part of sourcing fixed cost from including any country h in both sourcing and sales strategy. This is built upon the fixed cost structure in Table 1 where we use parameters α_0 and α_1 to determine the magnitude of bilateral economies of scope where we assume that $0 < \alpha_0, \alpha_1 < 1$.

The profit function in equation (11) highlights two distinct sources of complementarity incorporated in our model. The first one is conventional export-import complementarity, which suggests selling to an additional market increases the marginal benefit of sourcing from *all* origins due to an increase in market size (i.e., higher $\Theta_i^X(\varphi)$) and leads to a greater likelihood for the firm to source from all origins. In a similar vein, sourcing from an additional origin makes the firm to be more likely to sell to all markets, as it reduces the firm's marginal cost of production (i.e., higher $\Theta_i^M(\varphi)$).

In contrast, the bilateral economies of scope shown in the last term indicates that if the firm sells to an additional country, it is more likely to source from the same country due to saving part of sourcing fixed costs. This sales decision creates no incentive for the firm to trade with other countries, since the cost reduction is market-specific. The same logic applies to a firm's sourcing decisions.

Conditional on its productivity level, a firm optimally chooses sourcing strategy $\mathsf{M}(\varphi)$ and exporting strategy $\mathsf{X}(\varphi)$ to maximize the profit function given in equation (11). Formally, the firm's profit maximization problem is written as follows.

$$\max_{\substack{\mathbb{I}_{ij}^M \in \{0,1\}_{j=1}^J \\ \mathbb{I}_{ki}^X \in \{0,1\}_{k=1}^J}} \pi_i(\varphi, \mathsf{X}, \mathsf{M}) = \varphi^{\sigma-1} \left(\gamma \sum_{j=1}^{J} \mathbb{I}_{ij}^M T_j \left(\tau_{ij} w_j\right)^{-\theta} \right)^{\frac{\sigma-1}{\theta}} \sum_{k=1}^{J} \mathbb{I}_{ki}^X \left(\tau_{ki}^X\right)^{1-\sigma} B_k$$

$$- \; w_i \sum_{k=1}^{J} \mathbb{I}_{ki}^X \left(1 - \alpha_0 \mathbb{I}_{ik}^M\right) f_{ki}^X - w_i \sum_{j=1}^{J} \mathbb{I}_{ij}^M \left(1 - \alpha_1 \mathbb{I}_{ji}^X\right) f_{ij}^M, \quad (12)$$

where $\mathbb{I}_{ij}^M$ denotes the firm's sourcing decision in origin j which equals to one if it sources from origin j and zero otherwise, and $\mathbb{I}_{ki}^X$ denotes the firm's sales decision in market k which equals one if the firm sells to market k and zero otherwise.

3.4 Equilibrium

We now define the general equilibrium. The assumption in Section 3.2 implies that the wage level is pinned down in terms of non-manufacturing goods which we take as numeraire. As in Melitz (2003), we assume free entry for final-goods producers, and the productivity of entrant is revealed only after it pays for sunk cost of entry f_{ei}. The free entry condition implies firms will enter the market until the expected profit reaches zero:

$$\int_{\tilde{\varphi}_i}^{\infty} \left[\pi_i\left(\varphi\right)\right] dG_i(\varphi) = w_i f_{ei}, \quad (13)$$

where $\pi_i\left(\varphi\right)$ is defined in equation (11), and $\tilde{\varphi}_i$ is the cutoff productivity for survival which determines the measure of producing firms after entry. J free entry conditions uniquely pin down J unknowns of aggregate demand B_i in equilibrium (see Appendix B.1 for proof).

The labor market clearing condition delivers the equilibrium measure entrants,

$$N_i = \frac{\eta L_i}{\sigma f_i}, \quad (14)$$

where $f_i \equiv \int_{\tilde{\varphi}_i}^{\infty} \left[\sum_{k \in \mathsf{X}(\varphi)} f_{ki}^X + \sum_{j \in \mathsf{M}(\varphi)} f_{ij}^M - \sum_{h \in \mathsf{X}(\varphi) \cap \mathsf{M}(\varphi)} \left(\alpha_0 f_{hi}^X + \alpha_1 f_{ih}^M \right) \right] dG_i(\varphi) + f_{ei}$

is the total fixed costs payment in country i. The measure of active firms in country i is given by $N_i^A = N_i [1 - G_i(\tilde{\varphi}_i)]$. The equilibrium of the model is defined as follows.

Definition 1. *Given the wage level w_i, labor endowment L_i, and the other exogenous parameters, the general equilibrium consists of firms' optimal choices of sales strategy and sourcing strategy, $\mathsf{X}(\varphi)$ and $\mathsf{M}(\varphi)$, the cutoff productivity of survival $\tilde{\varphi}_i$, aggregate demand B_i, and measure of potential entrants N_i such that (i) $\mathsf{X}(\varphi)$ and $\mathsf{M}(\varphi)$ solve each firm's profit maximization problem* (12)*, (ii) firms enter the market until the free entry condition* (13) *holds, and (iii) labor market clearing condition* (14) *holds.*

4 Connecting Model to Data

In this section, we discuss how to connect the model to the data and describe the related assumptions that help to conduct a quantitative analysis.

4.1 Specifications of the Fixed Costs

Following Eaton, Kortum, and Kramarz (2011) and Antràs, Fort, and Tintelnot (2017), we assume that firms face heterogeneous fixed costs in trade. The specifications of firm f's fixed costs of sourcing from and exporting to the country j are as follows:

$$\log\left(f_{fij}^M\right) = \beta_C^M + \beta_d^M \log \text{Distance}_{ij} + \beta_{disp}^M \varepsilon_{fij}^M, \tag{15}$$

$$\log\left(f_{fji}^X\right) = \beta_C^X + \beta_d^X \log \text{Distance}_{ji} + \beta_{disp}^X \varepsilon_{fji}^X. \tag{16}$$

The constant terms, β_C^M and β_C^X, measure the magnitude of the generic obstacles in international trade common to all countries, and the terms, $\beta_d^M \log \text{Distance}_{ij}$ and $\beta_d^X \log \text{Distance}_{ji}$, capture the country-specific barriers when trading with country j measured by geographic distance. In addition, the firm-country-specific cost draws, ε_{fij}^M and ε_{fij}^X, are from a joint standard normal distribution. These cost draws have unit variance and, in a similar spirit to Morales, Sheu, and Zahler (2019), are correlated across markets. Specifically, for any firm f and country i, j, k, $\text{Corr}\left(\varepsilon_{fij}^M, \varepsilon_{fik}^M\right) = \text{Corr}\left(\varepsilon_{fij}^X, \varepsilon_{fik}^X\right) = \text{Corr}\left(\varepsilon_{fij}^M, \varepsilon_{fik}^X\right) = \rho$.

We use parameter ρ to capture the potential cross-market complementarity inspired by Morales, Sheu, and Zahler (2019).[12]

Dispersion of fixed costs at the firm level enables the model to account for small-size exporters and importers observed in the data. Furthermore, it also helps to generate four types of trading firms as in the data: pure exporters, pure importers, two-way traders, and non-trading firms. Note that in our model, if the firm-level fixed cost dispersion is absent, only three types of firms would exist. To see this, suppose exporting is easier than importing for some foreign market, then any firm overcoming the barriers of importing must also export, and automatically becomes a two-way trader.

4.2 Challenges in Model Solution and Estimation

One well-known challenge in the literature lies in solving the discrete choice problem for agents with heterogeneous characteristics, as the "brute force" approach implies exponentially exploding choice sets. One solution inspired by Jia (2008) is to exploit cross-market complementarity and adopt a "sandwich" algorithm, which sequentially squeezes the upper and lower bounds of the choice space.[13] Arkolakis, Eckert, and Shi (2022) shows that a similar squeezing algorithm works for the case when discrete choices are substitutes to each other. Trade economists have widely used such algorithm, but the focus is typically either on export decisions (Tintelnot, 2017) or import decisions (Antràs, Fort, and Tintelnot, 2017), separately. The fact that our model has trade decisions on both sides poses another challenge regarding whether this algorithm can be applied in this more general environment. Proposition 1 shows it still works under some parameter constraints.

Proposition 1. *Under $\frac{\sigma-1}{\theta} \geqslant 1$ and $0 < \alpha_0, \alpha_1 < 1$, a firm's profit maximization problem in equation (12) with heterogeneous fixed costs exhibits increasing difference in $\left(\mathbb{I}^X_{ki}, \mathbb{I}^X_{ji}\right)$, $\left(\mathbb{I}^X_{ki}, \mathbb{I}^M_{ij}\right)$, and $\left(\mathbb{I}^M_{ik}, \mathbb{I}^M_{ij}\right)$ for any $k, i, j \in \mathbb{J}$.*

[12] We set fixed costs of selling to and sourcing from the domestic market (i.e., China) to zero. Appendix C.3.3 provides detailed discussions on the simulation practice.

[13] The idea is to squeeze the choice set by keeping the must-included items from below and dropping the must-excluded items from above. Then we end up with a computationally manageable choice set that contains the optimal solution. See Appendix C.3.4 for detailed description of the algorithm.

Note that in the above proposition, $\frac{\sigma-1}{\theta} \geqslant 1$ ensures the property of increasing difference in the profit function and therefore makes a firm's export and import choices complementary to each other. We show that the complementarity property is empirically plausible in our later analysis. As cross-market export and import decisions are complements, a direct corollary of Proposition 1 is that there is an increasing difference property in $\left(\mathbb{I}_{ki}^{M}, \mathbb{I}_{ij}^{M}\right)$ and $\left(\mathbb{I}_{ki}^{X}, \mathbb{I}_{ij}^{X}\right)$. By the analysis in Antràs, Fort, and Tintelnot (2017); Arkolakis, Eckert, and Shi (2022), the "sandwich" algorithm can be used in our environment, bypassing the method of scanning the entire 2^{2J} combination. Furthermore, Proposition 1 shows that the constraint on α's, i.e., $0 < \alpha_0, \alpha_1 < 1$, is sufficient to ensure that the complementarity between $\mathbb{I}_{ki}^{X}$ and $\mathbb{I}_{ij}^{M}$ continues to hold.

Another challenge relates to the model estimation arises when firms' foreign market accessions depend on the country-level aggregates. For our exercise in particular, the country-level sourcing and sales potentials affect firms' optimal trade strategies which, in turn, affect foreign markets' attractiveness through aggregation. This, coupled with general equilibrium feedback, necessitates an estimation algorithm in which a large set of country-specific variables is loaded into the simulation routine. To address this issue, we follow the practice of Antràs, Fort, and Tintelnot (2017) and assume that the representative consumer in each country has constant expenditure shares of manufacturing goods across markets.[14] Given that the wage is pinned down by non-manufacturing production in each country and labor is in-elastically supplied, the direct implication of a constant expenditure share is that the Chinese firms' overall profit is a constant. By the free entry condition, the firm mass is thus fixed for each country. As a result, trade strategies do not affect country-level aggregates, particularly sourcing and sales potentials. It allows for separate identification on the country-level sourcing and sales potentials from other parameters governing firm-level trade decisions, which greatly alleviates the computational burden on our quantitative analysis.

In Appendix C.1, we discuss the issues related to the final-goods producers in the

[14]Another necessary condition for us to separately identify parameters is that the cost reduction mechanism only works through fixed cost. To the extent that we focus on the extensive margins of trade, as Antràs, Fort, and Tintelnot (2017) do, the fixed cost mechanism should play the primary role.

model and in the data. Appendix C.2 presents the derivation of gravity equations.

5 Quantitative Implementation

In this section, we present the quantitative implications of the model through estimation and counterfactual analysis. Consistent with the empirical analysis, the quantitative exercise uses the merged sample of Annual Survey of Industrial Enterprise and the Chinese customs sample for the year 2007. The questions that we intend to answer include 1) how large are the bilateral economies of scope; and 2) to what extent does this new mechanism account for the stylized facts documented in the empirical section. In the counterfactual analysis, we show that bilateral economies of scope have the aggregate consequences during trade liberalization.

In what follows, we first present the model parameterization and identification. We then show the model fits a set of targeted and non-targeted moments. We finally show the results of counterfactuals.

5.1 Model Parameterization

This section specifies the parameterization of the model. From now on, we assume that the productivity of a firm is drawn from a Pareto distribution with a shape parameter κ. We group the structural parameters for the baseline model into three subcategories. The first group contains only the Pareto shape parameter $\kappa = 4.25$, which is assigned externally following Antràs, Fort, and Tintelnot (2017).[15] The second group of parameters includes the country-level sourcing potentials and sales potentials (ξ's in equation (5) and (9)), the demand elasticity (σ), and the sourcing elasticity (θ). Following the discussion in Section C.1, these parameters can be directly estimated from reduced-form regressions. The third group consists of 10 internally estimated parameters, which are chosen to match

[15] According to the model, firm sales should follow a Pareto distribution with shape parameter $\kappa/(\sigma - 1)$. We can estimate this Pareto shape parameter using the total sales income by the top 1 percent of Chinese firms in 2007 (3,014 observations). Our estimation yields $\kappa/(\sigma - 1) = 1.17$ with p-value 0.00. Given our preferred $\sigma = 4.23$, the implied Pareto parameter for productivity distribution stands at $\kappa = 3.78$, slightly lower than the baseline value (4.25) employed in our paper. Sensitivity check is presented in Appendix C.4.3.

the observed trade patterns of Chinese firms. We estimate this set of parameters using the Simulated Method of Moments (SMM) approach.

Estimation of Sales Potentials and Sourcing Potentials We start with the estimation of country-level sales and sourcing potentials from the perspective of Chinese firms, which can be separately identified from firms' observed optimal export and import decisions. We use the idea that a country's sales and sourcing potential should be reflected by a firm's sales and sourcing share across countries as shown in equations (4) and (8). We normalize equations (4) and (8) by the firm's sales and sourcing share in domestic country, respectively, take logs on both sides, and transform them into empirical specifications by adding residual terms as follows:

$$\log\left(\chi_{fij}^{M}\right) - \log\left(\chi_{fii}^{M}\right) = \log\left(\xi_{ij}^{M}\right) + \epsilon_{fij}^{M} \tag{17}$$

and

$$\log\left(\chi_{fki}^{X}\right) - \log\left(\chi_{fii}^{X}\right) = \log\left(\xi_{ki}^{X}\right) + \epsilon_{fki}^{X}, \tag{18}$$

where χ_{fij}^{M} denotes firm f's sourcing share in origin j, χ_{fki}^{X} is firm f's sales share in market k, and the host country i refers to China. Here we normalize China's sourcing potential and sales potential to be one.

The domestic intermediate input value of a firm is obtained by subtracting the imported intermediate input from its total operating input expenditure. Similarly, we calculate the domestic sales revenue for each firm by subtracting export revenue from its total sales income. Based on which, we obtain sourcing and sales shares in China and across foreign countries for each firm. Each observation in the sample corresponds to firm f's sourcing (sales) share from foreign origin j (towards foreign market k) normalized by its domestic sourcing (sales) share, given positive sourcing (sales) value in that foreign country. We estimate equations (17) and (18) using ordinary least squares (OLS). Estimates of sales potential and sourcing, $\log\left(\xi_{ij}^{M}\right)$ and $\log\left(\xi_{ki}^{X}\right)$, are recovered from country-level fixed effects separately. The estimation procedure is valid as long as ϵ_{fij}^{M} and ϵ_{fij}^{X} are realized after a firm optimally chooses its trade strategies. In Appendix C.4.3, we show that our estimates of sales potentials and sourcing potentials are robust to alternative specifications.

Estimation of Demand Elasticity σ The presence of the CES preference and monopolistic competition structure among final-goods producers indicate that firms charge a constant markup over marginal cost, i.e., $\mu = \sigma/(\sigma-1)$. This implies that we can use the estimated markups to infer the demand elasticity parameter. Using the firm-level data, we estimate firm-level markups by the standard De Loecker and Warzynski (2012) method, separately for each four-digit industry level. To alleviate the effect of extreme values, we trim estimated markups at the bottom 3% and the top 3%. The mean of our estimated markups is 1.31, and the median level is 1.28. The implied σ is 4.23 for the mean level of firm markups, a number that is slightly higher than the estimation in Antràs, Fort, and Tintelnot (2017) (3.85 by using data from US firms). The result reflects a lower markup charged by firms in China than those of the U.S.

Estimation of Sourcing Elasticity θ We now estimate the trade elasticity for intermediate goods θ. To do so, we use the definition on sourcing potential from equation (5):

$$\xi_{ij}^{M} \quad = \quad T_j \left(\tau_{ij}^{M} w_j\right)^{-\theta}. \tag{19}$$

Based on the previous equation, we estimate the following empirical specification:

$$\begin{aligned}\log\left(\hat{\xi_{ij}^{M}}\right) =& \beta_0 + \beta_1 \log \mathrm{R\&D}_j + \beta_2 \log \text{capital per worker}_j + \beta_3 \log \text{number of firms}_j \\ & - \theta\left[\log\left(\tau_{ij}^{M} w_j\right)\right] + \beta_g \times \text{Gravity}_{ij} + \epsilon_{ij},\end{aligned}$$

where we include origin j's the R&D stock, capital per worker and number of firms to proxy country j's efficiency in input production $\log T_j$. $\log\left(w_j\right)$ is the human-capital adjusted wage taken from Bils and Klenow (2000). $\log\left(\hat{\xi_{ij}^{M}}\right)$ is the estimated sourcing potential from the previous section. τ_{ij}^{M} is proxied by the unweighted MFN tariffs imposed by China on imported intermediate inputs from the country j. In running the regressions, we add a battery of gravity variables to control for the non-tariff trade barriers. Appendix Table A12 provides the estimation results using various approaches. We choose 1.072 in column (2) as our baseline value for θ.

Simulated Method of Moments (SMM) The last set of parameters includes 10 internally estimated parameters by a SMM approach. We choose the above 10 parameters to target the following three sets of moments. While all parameters are jointly estimated, some moments are more informative for a group of parameters. In what follows, we provide a brief description of identification. In Appendix C.3.1, we provide details on the moments constructions for both model and data, and also report auxiliary information on the estimation (including the Jacobian matrix and a Monte Carlo analysis).

1. The domestic demand scale ($\tilde{B}_i$). We estimate the domestic demand scale ($\tilde{B}_i$) using the median domestic input purchase (in RMB) from data.[16] From the profit function (11), it is clear that a change in $\tilde{B}_i$ leads to a change in firm sales revenue, input purchase and fixed costs payment since all firms at least source from and sell towards domestic market. This moment helps to pin down levels of sales revenue, input purchases and fixed costs payment.

2. The correlation of fixed cost draws (ρ). Recall that by equation (15) and (16), the fixed costs are assumed to be correlated across markets. Thus, we can use information of firms' unilateral, cross-market correlations of trade decisions to identify ρ. If ρ is high, then a firm's sourcing profile should have a stronger cross-market correlation (and so does the export profile). The cross-market entry correlations allow for separating ρ from the two α's, because the latter mostly affects the within-market bilateral entry correlation.

[16] Note that the estimated sourcing and sales potentials are normalized by China's sourcing and sales potential, respectively. Here the domestic demand scale is defined as $\tilde{B}_i \equiv \left(\xi_{ii}^{M}\right)^{\frac{\sigma-1}{\theta}} \times \xi_{ii}^{X}$ where host country i refers to China.

3. The two parameters for bilateral economies of scope (α_0 and α_1). Given that ρ is identified, we use the two conditional ratios (given in column (3) and (6) of Table 2) to jointly identify the two α's. To show identification, we follow the Monte Carlo thought experiment. Suppose the true α_0 is much larger than α_1 (e.g., $\alpha_0 = 0.99$ and $\alpha_1 = 0.01$). In this case, importing from one country removes a large bulk of the barriers of exporting to that country, while exporting adds little to importing. Then one should expect that almost all importers from this destination will also export to it, whereas the converse is not true. This asymmetric effect suggests a large gap between conditional share on the export v.s. the import side. When this gap is small, one should not observe α_0 and α_1 to be significantly differ. In this sense, the gap between the conditional ratios should be able to tell the two α's apart. To further enhance the identification, we have included another moment that measures the correlation between a country's geographic distance and the fraction of two-way traders among Chinese firms trading with this country (either through export or import). This correlation measures how the share of Chinese two-way traders in a foreign country changes with its distance to China.[17]

4. Other parameters associated with the distribution of fixed cost draws for import and export ($\beta^M_{disp}, \beta^M_C, \beta^M_d, \beta^X_{disp}, \beta^X_C, \beta^X_d$), including the mean and standard deviations of the market-specific fixed cost draws on both sides of trade. This set of parameters are relatively standard in the literature. We follow Antràs, Fort, and Tintelnot (2017) and choose the following targeted moments: i) share of exporters and importers among the overall Chinese firms and among the firms whose sales are below median level; ii) share of exporters and importers in each foreign country.

[17] Note that depending on the relative magnitude of fixed costs elasticities to distance (i.e., β^X_d and β^M_d), our fixed costs specifications (i.e., equation (15) and (16)) suggest α_0 and α_1 should have differential effect on this correlation. Specifically, if $\beta^X_d > \beta^M_d$, it implies that a firm's export fixed cost increases with geographic distance more drastically relative to its import fixed cost. In this case, due to the multiplicative nature of our cost reduction mechanism, α_0 (import-induced export) should have larger impact on the likelihood of a firm being a two-way trader in a market compared to α_1, especially for more distant ones. An increase in α_0 would lead to a larger share of two-way traders in more distant markets compared to an increase in α_1, thereby increasing the cross-country correlation between distance and the share of two-way traders. When $\beta^X_d < \beta^M_d$, it is α_1 that plays a more significant role in governing this correlation.

These moments are informative about the level and the dispersion of firm export and import fixed costs in various markets.

Finally, we solve the following program:

$$\hat{\Theta} = \arg\min_{\Theta} \left[\mathbf{M}(\Theta) - \mathbf{M}^d\right]' \hat{\mathbf{W}} \left[\mathbf{M}(\Theta) - \mathbf{M}^d\right], \tag{20}$$

where $\mathbf{M}(\Theta)$ is the vertically-stacked moment vector generated after the model is solved, and $\mathbf{M}^d$ is the counterpart in the data. The diagonal matrix $\hat{\mathbf{W}}$ weights each moment. Following Adda and Cooper (2003), the elements in the weighting matrix are computed from the inverse of the variance-covariance matrix of the data moments based on 100 bootstrapped samples from the data.

Panel C of Table 4 shows the results for the estimated parameters. The result confirms the existence of large fixed costs in exporting and importing. The magnitude of the fixed cost of exporting is, on average, 2.6 million RMB or around 376,000 USD (or 9% the average exporter sales), and that of the sourcing fixed cost is 1.4 million RMB or 203,000 USD (or 27% of the average firm sourcing volume).According to our estimates, it is relatively more difficult for Chinese firms to export to foreign markets than to source from foreign origins. The presence of large fixed costs also implies that the impact of (partially) reducing them could have a substantial impact on firms' global activities. Our estimation suggests that sourcing from a foreign country can, on average, reduce the fixed cost of exporting to the same country by about 42% (or equivalently, save 1 million RMB when firms decide to export), and this cost reduction effect is similar when we look at the other way around (about 35% in percentage or equivalently, 0.5 million RMB of import fixed cost saved if firms decide to export to its sourcing origin). The results also suggest there is a slightly positive ($\rho = 0.05$) correlation between the fixed cost draws. Finally, there is a large dispersion of fixed costs on both the export and import side across firms, which is necessary to match the substantial heterogeneity in terms of export and import decisions for Chinese firms.

5.2 Fit of the Baseline and Alternative Models

Table 5 shows the model fit for both targeted and non-targeted moments. The first set of moments is the share of importers and the share of exporters among all Chinese manufacturing firms. The model predicts around 11% exporters and 13% importers unconditionally. These numbers are broadly consistent with the data, where the fraction of importer is 11% and the fraction of exporter is about 9%. In the data, the size distribution of exporters and importers is highly dispersed. The model accounts for this large dispersion in sales, i.e., 4.3% in model versus 6.1% in data for import sourcing and 5.8% in model versus 7.3% for exporting. In addition, the model matches the share of firms with domestic input purchase below than the median level from the data—around 45% of firms are below this median. Finally, the model captures the cross-market correlation within a firm's trade profiles (0.14 v.s. 0.15) and the exporter's (importer's) advantage in import (export) participation. In the data, we document that having export (import) experience in a country is associated to around 9 times higher probability to become an importer (exporter) in the same country as shown in Table 2. The model aligns well in terms of the exporters' advantage (8.2 v.s. 9.3) and predicts a slight overshoot for the importers' advantage (11.1 v.s. 9.1).

In addition to the targeted moments, the estimated model also captures the salient features associated to two-way traders. Specifically, the model generated a 3.7% (unconditional) share of two-way traders and in the data, the share is around 4.0%. Similar performance is observed if we look at conditional moments: in the data, the share of two-way trader is 44% conditional on being exporters, and 36% on being importers. The model prediction is 29% and 35%, respectively. In both the model and the data, two-way traders on average export towards more markets (1.66 in the model and 1.50 in the data), and at the same time source from more origins (1.53 in the model and 1.50 in the data).

Restricted Models In this section, we consider three alternative models where we selectively set α_0, α_1 to be zero. For each version of the restricted models, we re-estimate the models using the same set of moments as the baseline model. The only difference is that when re-estimating restricted models, we drop the two ratios of conditional shares moments, i.e., exporter's advantage in import participation and importer's advantage in export participation.[18]

An important dimension on which the restricted models perform poorly relative to the baseline model is in replicating Fact 3, the rank-rank correlation. We use model-generated data to compute the number of exporters and importers in each foreign country. Figure 2 shows the results for the sample of two-way traders for the top trading partners of China in both the data and the four models. In the data, when the rank of a sourcing origin increases by one, its rank as an export destination would on average increase by 0.75. The baseline model (in Panel A) closely traces this positive relationship (0.52 for the model, or 69% of observed rank-rank correlation).[19]

The positive rank-rank relationship arising from the baseline model could be attributed to channels other than bilateral economies of scope. For example, the correlation between a country's sourcing potential and sales potential shown in Figure A5 can lead to similar observations. To isolate this possibility, we scatter the rank-rank relationship for the three restricted versions of models: only import-induced export (i.e., only $\alpha_1 = 0$), only export-induced import (i.e. only $\alpha_0 = 0$) and the one where both effects are muted. Because the only difference across these four models is whether there are bilateral, unilateral, or no economies of scope, the exercises isolate the alternative channels.

Panel B shows that without any fixed cost reduction mechanism, the restricted model explains around 29% (0.22/0.75) of the slopes in the data, which in turn implies that the bilateral cost reduction mechanism accounts for about the remaining 40%. Panels C and D alternately introduce an unilateral economies of scope mechanism. The results

[18]We do so because the restricted models are not designed to reproduce these facts. By dropping these moments, the estimation avoids stacking the deck against the baseline model. In Appendix C.5.2, we force the three restricted models to target the exact same moment as in the baseline model. We show that the quantitative implications are stable.

[19]In Appendix C.4.4, we check the robustness of our result by ranking the sourcing origins and exporting destinations on all firms, i.e., including pure exporters, pure importers and two-way traders. For that sample, the model delivers a slightly lower (0.71) correlations than the data (0.75). Moreover, Appendix C.4.1 shows that our baseline model is also able to match the residual plot of rank-rank correlation as shown in Panel B of Figure 1.

suggest that one-sided cost reduction strengthens the positive relationship (0.33 for the import induced export and 0.36 for the other way around), but is insufficient to get the magnitude of the data.

Another possibility is that these rank-rank relationships are the result of a positive correlation between fixed cost draws. To assess this alternative explanation, in Appendix C.4.4, we perform a sensitivity analysis where we change the correlation of the cost draw parameter from 0.0 to 0.80, from a regime where the fixed cost draws are independent to the one when 80% of the draws overlap. The result shows that our mechanism is quantitatively robust in terms of explaining the rank-rank correlation documented in the empirical section.

6 Dissecting the Extensive Margin of Trade Liberalization

In this section, we use the model to dissect the impact of trade liberalization on Chinese firms' international market accession since the WTO entry. The aim is to decompose the observed changes in aggregate firm entry from 2001 to 2007 into the part contributed by import liberalization and the part by export liberalization. In China's case, there was a significant reduction in both import tariffs imposed by China and also a reduction in export tariffs imposed by foreign countries on Chinese exports after WTO entry. Hence, a firm's trade decisions after trade liberalization should be affected by changes in trade barriers from both sides. However, quantitative trade models focusing on one-sided trade activities are inherently biased to answer this question. Our model provides a quantitative device as it incorporates both firms' export and import participation with bilateral interdependence. We start the exercise by estimating the changes in trade costs.

Estimation of Changes in Trade Costs After 2001, there were reductions in both the tariffs and fixed costs for Chinese firms for both export and import side. Tariff changes are directly observable, and we use the average changes in China's MFN tariffs (for sourcing) and average changes in foreign MFN tariffs (for export) from 2001 to 2007 to represent the changes in τ_{ij}^{M} and τ_{jk}^{X}, respectively. By this construction, the reduction in export tariff is 15% and the reduction in source tariff is 64%. We then back out the *level* of country's sourcing and sales potentials for 2001 using the estimates of 2007 adjusted for the observed change in tariffs. There is no direct proxy for reductions in fixed costs. We therefore infer the changes by looking at the changes in foreign market participation rate by Chinese firms. Specifically, we set the decrease in export and import fixed costs so that the model generates a change in the share of exporters and importers that matches that of the data in the observed period. From 2001 to 2007, the share of importers in our sample increased from 6.74% to 11.10%, and the share of exporters increased from 5.71% to 9.04%. The estimation shows that there is a 56% reduction for the fixed cost of exports and 67% for the fixed cost of imports.

Decomposition With the estimated changes in potentials and fixed costs, we perform the following model-based decomposition. By this construction, country-level sourcing and sales potentials and firm-level fixed costs are the only changing piece of the model that lead firms to shift their sourcing and exporting strategy.

We first feed the model with this pre-shock environment (i.e., year 2001) and solve the model, while keeping other model parameters constant. To decompose Chinese firms' foreign market accession into import and export liberalization, we denote the change in variable x as $\Delta_{\text{both}}x$ if we feed both import and export trade cost reductions to the model in year 2001, and as $\Delta_{\text{import}}x$ if we feed only an import cost reduction. Then the contribution of import liberalization to the change in x is $\Delta_{\text{import}}x/\Delta_{\text{both}}x$. Then the difference between $\Delta_{\text{both}}x$ and $\Delta_{\text{import}}x$ is attributed to export-side shocks.

Table 6 shows the decomposition result for changes in the number of Chinese exporters and importers. Column (1) shows the contribution of import liberalization (containing both tariff and fixed cost reductions) on change in the number of exporters and importers; column (2) reports the contribution of export liberalization, which is simply one minus the contribution of import liberalization in column (1). We also conduct a similar exercise for the restricted model where $\alpha_0 = \alpha_1 = 0$, i.e., bilateral economies of scope are muted.[20] The result is shown in Panel A. In the baseline model, sourcing liberalization has a substantially larger impact on exporter entry than the restricted model (3.1% vs. 1.6%). Symmetrically, the baseline model also suggests greater contributions of export liberalization to the number of importers (3.0% vs 1.6%).

The positive effect of unilateral import liberalization on firms' exporting behavior is well documented. Increased accessibility to foreign sourcing origins enables firms to export more through technology and quality upgrading (Fan, Li, and Yeaple, 2015; Feng, Li, and Swenson, 2016), and promoted innovation activity (Liu and Qiu, 2016; Castellani and Fassio, 2019). Consistent with the empirical literature, we show that through a fixed costs story, bilateral economies of scope plays an important role in accounting for the effect of import liberalization on export activity in China. Neglecting this channel underestimates the effect of import liberalization by almost one half. In Appendix C.4.4, we further explain the mechanism behind the results here.

Implications for Trade Protectionism Barriers to imports have risen dramatically in recent years (Caliendo and Parro, 2022). In this section, we show that the tight connection between firm import and export decisions in our model suggests that such regulations may backfire and instead may cause fewer firms to export.

In Figure 3, we present the response on the number of exporters as China increases the fixed cost of sourcing. We contrast the baseline model with the restricted one. The comparison suggests that the drop in the number of exporters is over two times larger if the bilateral economies of scope mechanism is present. The results thus underscore the significant costs of trade protectionism in preventing firms from tapping the international market.

[20] In Appendix C.5.4, we report the decomposition result for the other two models with unilateral trade cost reduction, i.e., either $\alpha_1 = 0$ or $\alpha_0 = 0$.

7 Conclusion

Our study highlights the close linkage between a firm's export and import activities, a force we call bilateral economies of scope. We model such economies of scope through saving in fixed investment due to simultaneous export and import in the same country. Our calibration shows the cost saving mechanism is quantitatively large. A counterfactual study demonstrates that such force is relevant in understanding the observed bilateral trade relationship as well as in understanding the implications of trade liberalization effect.

These findings present potential avenues for future research. First, for transparent illustration, the model is kept intentionally parsimonious by assuming direct reductions in bilateral fixed costs associated with a firm's export and import decisions. Extending the model to a richer setting with a more micro-founded mechanism (e.g., information asymmetry or two-sided searching process) should offer more structural interpretation of the bilateral economies.

Second, our exercise focuses on the extensive margin of trade and restricts attention to the complementarity between fixed costs. It could also be interesting to extend the model to allow complementarity along the intensive margin, and thus offering a unified quantitative framework to understand bilateral trade relationships.

Third, the existence of bilateral economies of scope has implications for optimal trade policy. For example, cost reduction from a certain side of trade (either export or import) could be constrained or deemed too costly. Under these circumstances, policy maker's toolbox can be expanded by resorting to the corresponding policies from the other side of trade, which might have welfare implications. However, answering these questions requires overcoming potential data restrictions and computational challenges in estimating the general equilibrium version of the AFT framework.

Finally, the current model does not allow for spillovers in cost reduction. In practice, however, firms' trade decisions in one country could affect the fixed costs of exporting to or sourcing from other countries that are geographically proximate, linguistically close or culturally similar. Allowing for such a mechanism may lead to new policy implications for the aggregate effects of a regional/preferential trade agreement.

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Tables and Figures

Table 1: Bilateral Economies of Scope and Fixed Investments in Export and Import

Export Dummy \ Import Dummy	0	1
0	$[0, 0]$	$[0, f^M]$
1	$[f^X, 0]$	$\left[(1-\alpha_0) f^X, (1-\alpha_1) f^M\right]$

Note: This table shows the different bundles of fixed investments a firm needs to pay when deciding whether to export to and import from a foreign country. Export (Import) dummy takes value one if the firm exports to (imports from) the foreign country. Here we assume that $0 < \alpha_0, \alpha_1 < 1$.

Table 2: Conditional Share of Exporters and Importers

	Share of Exporters			Share of Importers		
	Importers	Non-Importers	Ratio	Exporters	Non-Exporters	Ratio
	(1)	(2)	(3)	(4)	(5)	(6)
Avg. Cty. (Mean)	9.68%	1.04%	9.33	7.34%	0.81%	9.05
Avg. Cty. (Median)	7.43%	0.73%	10.18	4.72%	0.52%	9.08
Global Market	35.23%	5.53%	6.37	43.47%	7.65%	5.68

Note: This table shows the conditional shares of exporters (column (1)-(2)) and importers (column (4)-(5)). Column (1) presents the share of exporters in a foreign country among importers in the same country and column (2) presents the share of exporters in a foreign country among those who do not import from that country. Column (3) calculates the ratio between figures shown in column (1) and (3). Symmetrically, column (4)-(6) show the share of importers in a foreign country among exporters in the same country, the share of importers among non-exporters, and the ratio between these two conditional shares. This exercise uses the merged sample of ASIE and CCTS which includes top 30 export destinations and top 30 sourcing origins for China in year 2007, amounting to 36 foreign countries. The patterns are robust if we look across different years.

Table 3: Bilateral Economies of Scope

Panel A: The Effect of Import Choice on Firm Export Decisions							
	Dependent Var.: $\mathbb{I}\{\text{Exp.}_{fct} > 0\}$						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
$\mathbb{I}\{\text{Imp.}_{fct-1} > 0\}$	0.483***	0.590***	0.327***	0.328***	0.487***	0.286***	0.287***
	(0.00356)	(0.00309)	(0.00335)	(0.00337)	(0.00282)	(0.00307)	(0.00309)
$\mathbb{I}\{\text{Exp.}_{fct-1} > 0\}$	2.087***	1.792***	1.555***	1.551***	1.488***	1.281***	1.277***
	(0.00410)	(0.00343)	(0.00381)	(0.00383)	(0.00324)	(0.00351)	(0.00352)
Exp. Ext. Distance$_{fct-1}$					-0.176***	-0.220***	-0.220***
					(0.00201)	(0.00220)	(0.00221)
Exp. Ext. Contiguity$_{fct-1}$					0.217***	0.206***	0.205***
					(0.00207)	(0.00270)	(0.00271)
Exp. Ext. Continent$_{fct-1}$					0.195***	0.208***	0.209***
					(0.00326)	(0.00371)	(0.00371)
Exp. Ext. Com. Lang.$_{fct-1}$					0.191***	0.268***	0.268***
					(0.00195)	(0.00280)	(0.00282)
Exp. Ext. Income Group$_{fct-1}$					0.403***	0.309***	0.311***
					(0.00324)	(0.00387)	(0.00399)
Gravity Variables	YES	YES	YES	YES	YES	YES	YES
Firm-level Controls	NO	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES	YES
Country FE			YES			YES	
Country-Year FE				YES			YES
Obs.	13,026,937	13,026,937	13,026,937	13,244,910	12,840,780	12,840,780	13,020,420
Pseudo R^2	0.384	0.412	0.447	0.449	0.438	0.466	0.468
Panel B: The Effect of Export Choice on Firm Import Decisions							
	Dependent Var.: $\mathbb{I}\{\text{Imp.}_{fct} > 0\}$						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
$\mathbb{I}\{\text{Exp.}_{fct-1} > 0\}$	0.433***	0.563***	0.318***	0.320***	0.489***	0.285***	0.286***
	(0.00381)	(0.00301)	(0.00323)	(0.00323)	(0.00291)	(0.00309)	(0.00310)
$\mathbb{I}\{\text{Imp.}_{fct-1} > 0\}$	2.282***	2.032***	1.702***	1.696***	1.812***	1.478***	1.474***
	(0.00439)	(0.00349)	(0.00383)	(0.00384)	(0.00369)	(0.00391)	(0.00392)
Imp. Ext. Distance$_{fct-1}$					-0.0971***	-0.186***	-0.186***
					(0.00196)	(0.00219)	(0.00221)
Imp. Ext. Contiguity$_{fct-1}$					0.279***	0.195***	0.194***
					(0.00284)	(0.00355)	(0.00355)
Imp. Ext. Continent$_{fct-1}$					0.128***	0.0601***	0.0600***
					(0.00348)	(0.00424)	(0.00426)
Imp. Ext. Com. Lang.$_{fct-1}$					0.120***	0.176***	0.175***
					(0.00251)	(0.00355)	(0.00356)
Imp. Ext. Income Group$_{fct-1}$					0.253***	0.147***	0.141***
					(0.00335)	(0.00425)	(0.00445)
Gravity Variables	YES	YES	YES	YES	YES	YES	YES
Firm-level Controls	NO	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES	YES
Country FE			YES			YES	
Country-Year FE				YES			YES
Obs.	11,712,877	11,712,820	11,712,820	11,764,732	11,543,307	11,712,820	11,764,732
Pseudo R^2	0.468	0.492	0.536	0.537	0.504	0.544	0.546

Note: This table presents the estimation results from specification (1) using the Probit model. Firm-level controls include the number of export destinations, the number of import sourcing origins, and firm-level export and import values. Appendix A.10 shows how to construct extended gravity variables. Standard gravity variables include distance, indicator for contiguity, common continent, common language, common income group and RTA between China and foreign country, and foreign GDP per capita. Standard errors are in the parentheses and clustered at firm and country level. The number of asterisks indicates significance at 1%(***), 5%(**) and 10%(*) level.

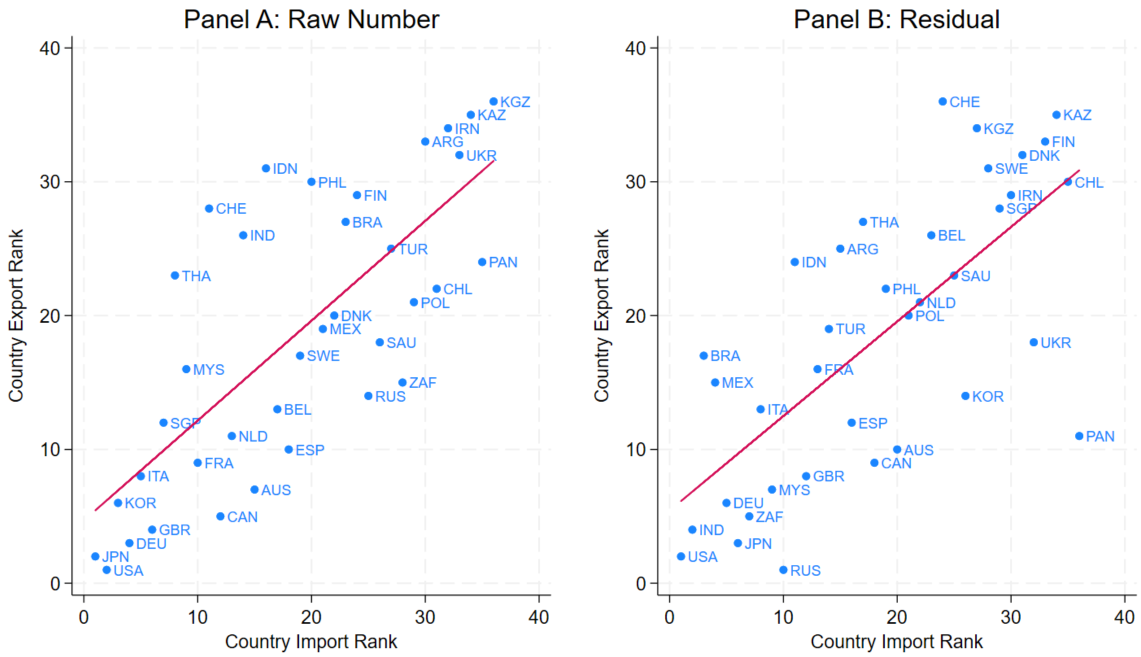


Figure 1: Country Rank Correlation by Number of Firms

Note: This exercise uses the merged sample of ASIE and CCTS, which includes top 30 export destinations and top 30 sourcing origins for China in year 2007 (in total 36 foreign countries). In Panel A, a country's export rank and its import rank is based on the raw number of Chinese exporters and importers, while in Panel B, we calculate a country's ranks based on the regression residuals where we regress the raw number of exporters and importers on a set of gravity variables (including distance, indicator for contiguity, common continent, common language, common income group and RTA between China and foreign country, and foreign GDP per capita).

Table 4: Parameter Assignments: Baseline

Parameters	Symbols	Baseline	Source
Panel A: Assigned			
Pareto shape	κ	4.25	Literature
Panel B: Reduced-form regressions			
Demand elasticity	σ	4.23	Estimation
Sourcing elasticity	θ	1.07	Estimation
Panel C: SMM			
Demand scale	$\tilde{B}_i$	3.81 (0.140)	Estimation
Cost reduction (import-induced export)	α_0	0.42 (0.034)	Estimation
Cost reduction (export-induced import)	α_1	0.35 (0.024)	Estimation
Correlation of fixed costs	ρ	0.05 (0.004)	Estimation
Sourcing: constant term	β_C^M	2.72 (0.094)	Estimation
Sourcing: coefficient of distance	β_d^M	1.34 (0.014)	Estimation
Sourcing: standard deviation	β_{disp}^M	2.30 (0.033)	Estimation
Export: constant term	β_C^X	3.39 (0.095)	Estimation
Export: coefficient of distance	β_d^X	0.77 (0.039)	Estimation
Export: standard deviation	β_{disp}^X	2.71 (0.026)	Estimation

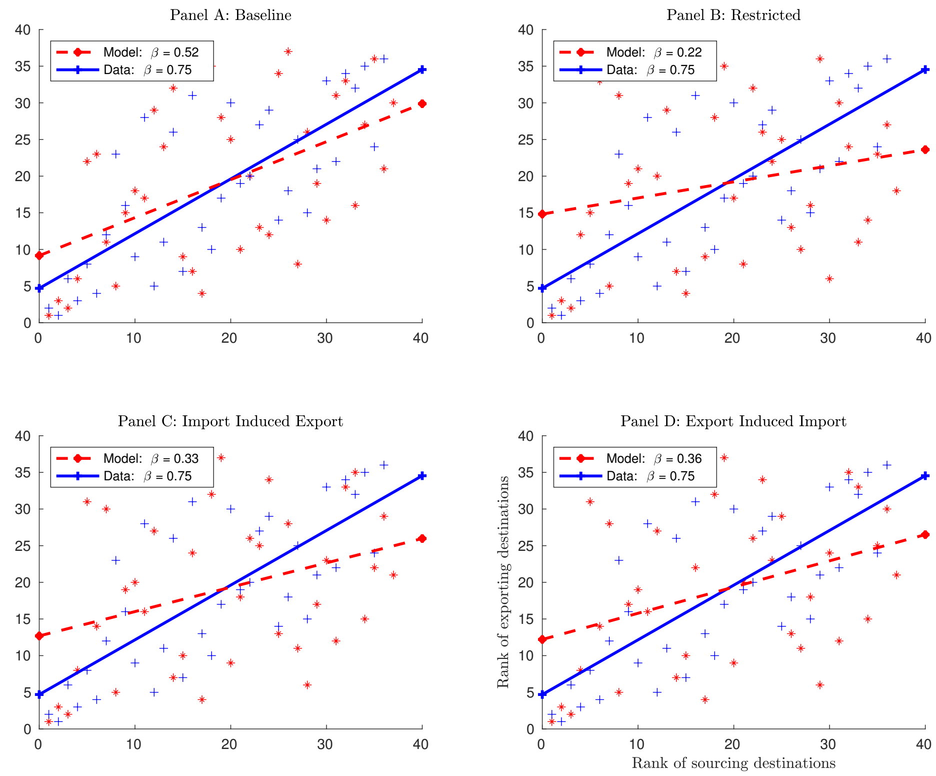
Note: This table lists the parameter values for the assigned and the ones from either reduced-form regression or from the simulated method of moments (SMM) approach. The weighting matrix is obtained by bootstrapping the data and the standard errors are reported in parentheses.

Table 5: Model Fit

Parameters	Model	Data
Panel A: Targeted moments		
Share of importers	0.11	0.11
Share of exporters	0.13	0.09
Share of importers (below median sales)	0.043	0.061
Share of exporters (below median sales)	0.058	0.073
Share of firms with median (in data) domestic input purchase	0.45	0.50
Ratio b/w share of exporters among importers and non-importers	11.1	9.05
Ratio b/w share of importers among exporters and non-exporters	8.21	9.32
Two-way distance correlation	-0.7	-0.4
Entry order correlation	0.14	0.15
Panel B: Non-targeted moments		
Share of two-way traders	0.037	0.040
Share of two-way traders among exporters	0.29	0.44
Share of two-way traders among importers	0.35	0.36
Number of export destinations (two-way trader over pure exporter)	1.66	1.50
Number of sourcing origins (two-way trader over pure importer)	1.53	1.50

Note: This table shows model fit on targeted and non-targeted moments. See Appendix C.3.1 for details on the construction of moments.

Figure 2: Rank-Rank Correlation



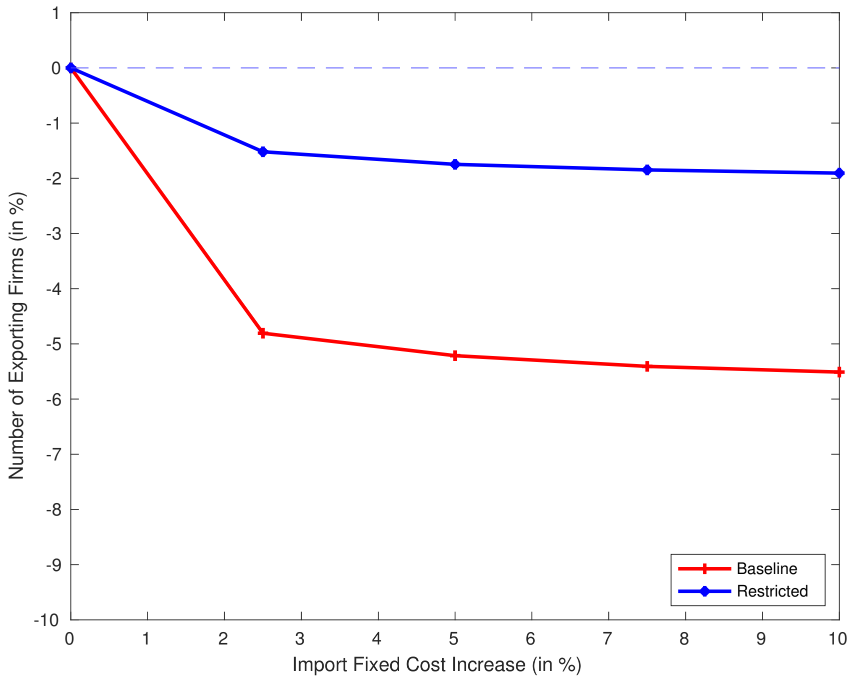
Note: This figure plots the rank-rank result for the selected top 30 sourcing origins and top 30 export markets countries in 2007. The ranks of sourcing origins and exporting destinations are by the number of Chinese importers and exporters, respectively, for two-way traders only. All four panels share the same axis labels.

Table 6: Extensive Margin of Trade Liberalization

	Import liberalization	Export liberalization
Panel A: Baseline		
Number of exporters	0.0311	0.969
Number of importers	0.970	0.0297
Panel B: Restricted		
Number of exporters	0.0162	0.984
Number of importers	0.984	0.0155

Note: This table decomposes the extensive margin of trade into liberalization on import and export side. Column (1) shows the contribution (in percent) of import liberalization alone to exporter and importer entry, while column (2) presents the contribution of export liberalization alone. The numbers in each row do not sum to 1 due to rounding errors.

Figure 3: Effects of Sourcing Fixed Cost Increase



Note: This figure plots the impact of an increase in import fixed cost on firms' export participation. Each scatter shows the drop of exporter numbers (average across all destinations and in percentage) if the fixed import costs are increased for all foreign countries, which is normalized by the baseline value of fixed costs estimates.