Bilateral Economies of Scope*

Yao Amber Li[†] HKUST

Sichuang Xu[‡] CUHK(SZ)

Stephen R. Yeaple [§] PSU & NBER

Tengyu Zhao[¶] HKUST

This version: June 2023

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 costs of entering a specific export market can be used toward costs of acquiring imports 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 that suggest such market-specific bilateral economies of scope. Using a structural model, we estimate that the simultaneous export and import in a given country reduces export and import fixed costs by over 41 and 37 percent, respectively.

*We are grateful to Jonathan Eaton, James Tybout, Felix Tintelnot, Kim Ruhl, Wolfgang Keller, Peter Schott, Xiaodong Zhu, Chang Sun, Heiwai Tang, Hongsong Zhang, Haishi Li, conference participants at the Midwest International Trade Conference, the 2023 Asia Global Institute & Institute of China Economy Trade Conference, and seminar participants at Penn State University Brownbag Seminars for helpful comments. All errors are our own.

[†]The Hong Kong University of Science and Technology, email: yaoli@ust.hk

[‡]The Chinese University of Hong Kong, Shenzhen, email: xusichuang@cuhk.edu.cn

[§]Penn State University, NBER and CESifo, email: sry3@psu.edu

[¶]The Hong Kong University of Science and Technology, email: tzhaoah@connect.ust.hk

1 Introduction

International transactions are costly, requiring participating firms to make large investments in logistics, contracting, and foreign institutional knowledge. Since the publication of the seminal paper by Melitz (2003), the literature has developed an appreciation of the size and nature of these costs. The fact that only the most productive firms export and import suggests substantial fixed costs to both activities. The size and nature of these fixed costs have implications for almost every dimension of international economics including the welfare effects of trade policy (e.g. Costinot, Rodríguez-Clare, and Werning, 2020), the effect of trade liberalization on aggregate productivity (e.g. Pavcnik, 2002), and exchange rate pass-through (e.g. Amiti, Itskhoki, and Konings, 2014).

The goal of this paper is to present stylized facts on and to estimate the size of *market-specific bilateral economies of scope* in international trade, which arises when resources used to pay the fixed cost of entering a specific export (import) market can be simultaneously used toward paying the fixed cost of establishing an import (export) relationship in the same market. For example, firms may use the same translation service for both export and import purpose, or hire lawyers to meet the market-specific regulations on both sides.

We provide three sets of facts that corroborate the above narrative based on the universe of Chinese firm-country-level transaction data from 2000 to 2015. Our first observation is that, given a specific foreign market, the share of exporters conditional on being importers from that market is around an order of magnitude larger than that for the non-importers. Symmetric patterns are observed if we look at the conditional share of importers. To substantiate the relationships between firm's export and import within the same country, we conduct firm-country-level regression analysis following Chaney (2014) and Morales, Sheu, and Zahler (2019), and show firm's import (export) experience in a given country significantly increases the likelihood of exporting to (importing from) that market. Several additional robustness tests further confirm this finding, where we use Arellano-Bond dynamic panel regressions, isolate (non)foreign-related firms and perform sub-sample analysis across different periods. At the aggregate level, such market-specific export-import interdependence manifests itself as a pronounced positive correlation between the rankings of the destinations in number of Chinese exporters and the rankings of the origins in number of Chinese importers. Despite the fact that competing drivers (such as the correlations of country-level characteristics) might account for the documented findings in isolation, these facts as a whole suggest the presence of the market-specific bilateral economies of scope.

To estimate the size of our mechanism when various competing forces are present, we extend the quantitative framework of Antràs, Fort, and Tintelnot (2017) (AFT) to an environment where firms simultaneously source inputs from a set of origins and sell differentiated final products to these markets. Firms that engage in only export face a distribution of export fixed costs by market while firms that engage in only import face a different distribution of fixed costs by market. To incorporate economies of scope in bilateral trading relations, we allow these distributions to shift downward when exports and imports are simultaneously arranged for a given market. We show that the model inherits the tractability of AFT in that it allows for separate identification of the parameters associated to country-level characteristics (e.g., sourcing and sales potential) and the parameters governing firm pricing and trade profile (e.g., the elasticity of substitution across exported goods and across imported goods).

The separation of identification allows us to estimate the model in a less numerically cumbersome way, where we extend the algorithm of Jia (2008) and Arkolakis, Eckert, and Shi (2022) to a setting when firm's export and import choices across countries are jointly determined. Disciplined by the aforementioned stylized facts and estimated via the simulated method of moments routine, the model identifies large market-specific bilateral economies of scope: simultaneous export and import in a given market reduces, on average, export fixed cost by 41 percent and import fixed cost by 37 percent.

We show the estimated model aligns with the empirical regularities regarding the trade decisions of exporter and importer, their relative size to domestic firms, and the correlations between firm's export and import profiles. Based on the model, we assess its ability in replicating the documented correlations between the ranking of sourcing and exporting destinations by confronting the performance of the baseline against that of a series of restricted models, where we selectively mute the bilateral economies of scope mechanisms. The exercise separates our mechanism with the competing ones and thus enables transparent comparison on the quantitative performance of different channels. We show that roughly all of the rank-rank correlations are explained by the baseline model, 61% are explained when there is unilateral cost reduction and 38% when there is no fixed cost reduction at all. The practice underscores the role of two-sided cost reduction in understanding the Chinese firms' bilateral partnerships.

The estimated model provides a flexible quantitative device to study the aggregate impact as well as firm's response to various types of trade shocks. We are interested in how our mechanism adds to the understanding on the impact of trade liberalization on Chinese firms' global market participation. An important feature of China's accession to the WTO is that there are two-sided trade cost reductions. 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 allows for the dissection of Chinese firm's global market accession into the contributions from different sides of trade liberalization. By sequentially feeding the models with the estimated trade shocks, we find that the aggregate impact of import (export) liberalization on export (import) entry are three times larger for the baseline specification compared to the restricted one. Such difference at the aggregate level originates from firm-level amplification where the import (export) liberalization induces much larger response to firm's export (import) participation when the bilateral cost reduction mechanisms are present.

We contribute to several strands of literature. First, our paper is related to the recent study of complementarity between firm's export and import activity. Exporters and importers are more productive, with the most productive ones being both and accounting for substantial share of international trade flow (Bernard et al., 2009; Muûls and Pisu, 2009). The relationships between firm's export and import activities play an important role in shaping several margins of international trade (Bernard et al., 2018) and firm's strategic behavior in trade, such as exchange rate pass-through (Amiti, Itskhoki, and Konings, 2014). Empirical works also document causal linkage through which firm's importing activity promotes export performance (Feng, Li, and Swenson, 2016; Pierola, Fernandes, and Farole, 2018). Our paper provides a unified account on the relationships between firm's export and import decisions across countries, by documenting new stylized facts and gauging the quantitative magnitude through the lens of an estimated structural model.

We also add to the theoretical and quantitative work on firm's optimal trade decisions. While the existing papers examine the determinants of firm's 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. Our study is similar to Antràs et al. (2022) in studying the joint production and sourcing decisions for firms. We differ from their work in two critical aspects. First, Antràs et al. (2022) emphasize the bilateral economies of scope induced by FDI. In contrast, we focus on a bilateral cost reduction mechanism leading to within-firm export-import complementarity, which applies to a wider scope of firms. Second, we highlight the market-specific nature of the bilateral economies of scope. This has important policy implications because it suggests 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, this paper is complementary to a large strand of literature on trade policy and firm performance, particularly to 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 import liberalization are present. In addition, the findings that the effect of export (import) liberalization gets amplified through import (export) entry suggest potential under-estimation on the impact of trade policy shock when the bilateral economies of scope is 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 discuss how to connect the model to data. Section 5 presents the estimation results and Section 6 shows counter-factual experiments. Finally, Section 7 concludes.

2 Motivations

In this section, we first illustrate the idea of market-specific bilateral economies of scope with a fixed costs structure. Then, we present several stylized facts suggesting the existence of such bilateral economies of scope using dis-aggregated transaction level data for Chinese firms. Finally, we provide further robustness checks.

2.1 Conceptual Motivation

In this paper, we explore the market-specific bilateral economies of scope as one key determinant of firm's export and import decisions across countries. It is based on the idea that to some extent, fixed investments of exporting to one country can be simultaneously used to covering the fixed investments of importing from the same country, and vice versa. As a result, when firm trades with a country in both directions, it saves part of export fixed cost and also part of import fixed cost.[1]

Table 1 enumerates firm's market-specific fixed cost bundles conditional on different export and import decisions. If a firm only exports to or only imports from the foreign country, its fixed costs payment is given by f^X and f^M, respectively. The bilateral economies of scope arises when firm engages in both export and import activities within the foreign country. In this case, firm's export fixed cost is reduced by α_0 fraction while its import fixed cost is reduced by α_1 fraction. Therefore, it is cost-effective to export to and import from a foreign country simultaneously. The total cost saving is given by the sum of $\alpha_0 f^X$ and $\alpha_1 f^M$. Moreover, we assume that firm's trade decisions in a country do not affect fixed costs in trading with other countries due to the legal, cultural and geographic gap across borders. In other words, such bilateral economies of scope is market-specific.

Table 1: Market-Specific Economies of Scope and Fixed Investments in Exporting and Importing

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 firm needs to pay when deciding whether to export to and/or import from a foreign country. Export/Import dummy takes value one if firm exports to/imports from foreign.

In reality, the cost saving from concurrent export and import in a foreign country can

[1] This echos the finding of Grieco, Li, and Zhang (2022) that importing (exporting) experience significantly reduces export (import) fixed cost for Chinese firms, though they do not consider this mechanism as market-specific.

emerge from a business travel that helps 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 coming along with potentially asymmetric benefits on export and import fixed costs. Another example is that firm contracting with transportation company for both selling to and sourcing from a foreign country saves on receiving favorable contractual terms simply due to larger scope in two-way transactions compared to the case with only export or only import. Then the saved costs could be in terms of fixed investment in trade.

An immediate implication from the fixed costs structure is, exporters in a foreign country are more likely to import from the same country compared to non-exporters because of lower import fixed costs they need to pay. Symmetrically, importers in a foreign country are more likely to export to the same country compared to non-importers. Therefore, the fixed costs structure generates firm's export-import complementarity in the same foreign country.

2.2 Empirical Motivations

In this section, we describe the data and present empirical evidence consistent with the conceptual discussion above.

Data Description Our main data source, Chinese Customs Trade Statistics (henceforth CCTS) maintained by General Administration of Customs of China (2000-2015), covers the universe of Chinese export and import transactions. We restrict attention to ordinary trade records only and exclude processing trade records from our sample.[2] This is to focus on firm's trade decisions that reflect their active and strategic investment in finding foreign costumers and suppliers.[3] Furthermore, we keep only manufacturing firms and drop trade intermediaries from our sample (Ahn, Khandelwal, and Wei, 2011). The basic units of our analysis are firm-country-year triplets indicating firm's trade decisions across foreign countries in each year from 2000 to 2015. In the baseline sample, we limit our attention to firm's import of intermediate goods and export of final goods identified by Broad Economic

[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.2 for more details. Furthermore, in Section 2.3.1, 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]Under processing trade, it is mandatory for Chinese firms to export assembled goods back to foreign supplier (pure assembly, PA) or to any foreign country (import and assembly, IA). This generates a mechanical correlation between firm's export and import decisions which reflects only supply contract firm signed with foreign company but not firm's own trade strategy. For this reason, we drop processing trade records from the sample. However, the issue still remains if firms have under-reported processing trade in customs. Nevertheless, given that tariff duty can be exempted if transaction is reported as processing trade, one should anticipate firms in general would over-report their processing trade status. See Chen et al. (2021) for details on the R&D expenditure over-reporting induced by R&D subsidy in China. Hence, dropping the observed processing trade records is sufficient to remove most supply chain or offshoring relationship of Chinese firms. In Appendix A.2, we conduct several additional tests suggesting that the unobserved processing trade is not a major driver for our empirical findings.

Categories Revision 4 (BEC4). This is to bring our empirical analysis closer to quantitative framework where firms are assumed to import intermediate inputs and export final products. Our empirical results remain stable to including all types of goods in the sample. Finally, we focus only on the top 30 export destinations and top 30 import sourcing origins for China in terms of trade value that account for, on average, over 93% of China's annual export value and 96% of annual import value.[4] As our study focuses on firm's trade decisions at the extensive margin, this restriction helps to eliminate firm's ad-hoc trading activity in small countries and also makes both empirical and quantitative analysis computationally feasible. Appendix A.1 lists detailed data cleaning process for CCTS. Finally, in 2007, the customs sample contains over 68,000 unique Chinese exporters and the mean and median number of export destination per exporter is 5.77 and 2, respectively. On the import side, there are about 82,000 unique importers in 2007. The mean and median number of import sourcing origins per importer is 3.01 and 2, respectively.

In addition, we obtain firm's accounting information, such as total sales revenue and total input purchase from the Annual Survey of Industrial Enterprise (henceforth ASIE) from National Bureau of Statistics of China (1998-2009). We follow the standard approach in cleaning ASIE, e.g. dropping observations with missing or wrong sales revenue, output, establishment date, and employment.[5] Merging ASIE and CCTS gives us a full picture of Chinese firms' sales and sourcing activity in both domestic and foreign countries. In the merged sample, there are around 300,000 firms in 2007, and the share of exporters and importers is 8.73% and 10.78%, respectively. Lastly, the gravity variables including population weighted geographic distances, indicator for common language are from the CEPII.

With the above data, we test the presence of market-specific bilateral economies of scope. Fact 1 shows our first piece of evidence from testing the key implication of the fixed costs structure in Table 1.

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

Table 2 shows the conditional shares of exporters (column (1)-(2)) and the conditional shares of importers (column (4)-(5)) for different groups of firms in China. Column (1) presents the share of exporters in a foreign country among firms who also import from the same country and column (2) calculates the share of exporters among those who do not import from that country. Then in column (3), we present the ratio between these two conditional shares, indicating importers' advantage in export participation relative to non-importers. Symmetrically, we calculate the share of importers in a foreign country

[4]In 2007, the top 30 export destinations and top 30 import sourcing origins include 36 unique foreign countries.

[5]See, for example, Brandt, Van Biesebroeck, and Zhang (2012).

for exporters in the same country (column (4)) and for non-exporters (column (5)). The ratio in column (6) stands for exporters' advantage in import participation relative to non-exporters. In the first two rows, we define exporter and importer for each foreign country separately[6], calculate the conditional shares, and then take the mean level (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 non-importer. Similarly, on the import side, firm exporting to one country is 9.05 times more likely to import from the same country relative to a non-exporter. The above findings echo our conceptual discussion in the previous section, suggesting the presence of market-specific bilateral economies of scope.

We also conduct the same calculation for the global market as a whole (the last row) and show that the ratios in this case are significantly lower than that for the average foreign country.[7] Specifically, the importers' (exporters') advantage in export (import) participation is, on average, 46.47% (59.33%) higher for average country (the mean level in the first row) than for global market.[8] It suggests that a large fraction of the ratios in the first two rows should be attributed to market-specific factors.

We further validate the idea of market-specific bilateral economies of scope with an empirical model. The aim is to show whether firm's import (export) decision in a country plays a significant role in its export (import) decision for the same country, after taking into account several well-documented determinants of firm's trade decisions. Throughout the reduced-form exercises, we use the customs sample from 2000 to 2015 to fully utilize the data. We keep only firms who at least export to a foreign market and import from a foreign origin in each year, i.e. two-way traders. This is to ensure all firms in our sample are able to export and import at the same time.[9] The finding is summarized in Fact 2.

Fact 2. *Firm's past importing (exporting) experience in one country significantly increases the likelihood of being an exporter (importer) in the same country in the current year.*

Following Chaney (2014) and Morales, Sheu, and Zahler (2019), we specify the following

[6]For instance, if a firm only exports to US, then it is considered as exporter only when we do the calculation for US. When we calculate conditional shares for the other countries like Japan, the firms is considered as a non-exporter.

[7]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.

[8]The pattern remains stable to alternative calculation methods and to different years. For instance, we may first calculate ratios for each foreign country and then take mean level of ratios across countries. In this case, the mean ratio across countries is 10.19 and 9.10 on export and import side, respectively. A simple t-test rejects the null hypothesis that the mean ratio across countries is lower than or equal to that for global market with p-value 0.00 on both export and import side.

[9]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.

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 share 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.

regression equations:[10]

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

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 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 firm's trade decisions and work independently from our mechanism. As a result, the identification of market-specific bilateral economies of scope comes from variation of 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's trade probability as in Chaney (2014). Compared to the previous reduced-form exercise which studies either firm's export decisions or import decisions separately, the new feature of our empirical model is to include firm's past import decision, $\mathbb{I}\left\{\text{Imp.}_{fct-1} > 0\right\}$ as a key explanatory variable when estimating its export prob-

[10]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 firm's current trade decision or focusing on the contemporaneous effect only.

ability, and to include its past export decision, $\mathbb{I}\left\{\text{Exp.}_{fct-1} > 0\right\}$ when estimating import probability. Note that we also incorporate the standard gravity variables and the extended gravity variables following the practice of Chaney (2014); Morales, Sheu, and Zahler (2019). Appendix A.4 presents detailed construction of extended gravity variables. This is to capture the fact that firm is more likely to trade with countries that are geographically close to its established export and import network or share other characteristics with the countries that it exported to and imported from, such as language and income level.

Table 3 shows the regression result, where the dependent variable is an indicator for firm's current export decision in a foreign country. Column (1) reports the two coefficients of our interest, one showing the effect of 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 the firm-level controls including the number of export destinations, the number of import sourcing origins, and firm' s export and import values; column (3) incorporates the country fixed effects, and column (4) instead uses the country-year fixed effects. The results from column (1) to (4) show that firm's past import experience in a foreign country has a significant and positive effect in facilitating export decision to the same country. In addition, there is strong persistence in firm's export presence, which is a standard result in the exporter dynamics literature (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 remains stable.[11] 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%. Overall, the results suggest, at firm level, market-specific import experience is an important determinant of current export decision. In Table 4, we show firm's past export decision affects its current import decision in a symmetric way. In column (7), the estimated coefficient on past export decision is 0.286 and the marginal effect is 0.017, while the estimated coefficient measuring firm's import persistence is 1.474 and its marginal effect is 0.088. In a nutshell, these results suggest that firm's bilateral trade decisions in a foreign country are inter-dependent.

[11] We cannot control for all firm-level characteristics using fixed effects due to 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 add firm fixed effects in Probit model, and our qualitative results remain stable. In Appendix A.3, 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 qualitative results similar to the Probit model.

Table 3: The Effect of Import Choice on Export Decision: Probit

	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)
Constant	-0.652***	-0.788***	-2.337***	-2.529***	-5.775***	-9.662***	-11.69***
	(0.0203)	(0.0233)	(0.0155)	(0.0361)	(0.0322)	(0.176)	(0.608)
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
Observations	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

Note: This table presents the estimation results from specification (1) using Probit model. The dependent variable is firm f's export decision in country c in year t. Firm-level controls include the number of export destinations, the number of import sourcing origins, and firm' s export and import values. Extended gravity for distance$_{fct-1}$ is constructed following Chaney (2014) while the other extended gravity variables are constructed after Morales, Sheu, and Zahler (2019). 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 asterisk indicates significance at 1%(***), 5%(**) and 10%(*) level.

Table 4: The Effect of Export Choice on Import Decision: Probit

	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)
Constant	2.301***	2.632***	-2.254***	-2.353***	-1.469***	-0.759***	-0.877***
	(0.0234)	(0.0257)	(0.0140)	(0.0353)	(0.0406)	(0.0243)	(0.0404)
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 Probit model. The dependent variable is firm f's import decision in country c in year t. Firm-level controls include the number of export destinations, the number of import sourcing origins, and firm' s export and import values. Extended gravity for distance$_{fct-1}$ is constructed following Chaney (2014) while the other extended gravity variables are constructed after Morales, Sheu, and Zahler (2019). 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 asterisk indicates significance at 1%(***), 5%(**) and 10%(*) level.

Finally, at the aggregate level, a natural prediction based on previous findings is: 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 importers separately. Figure 1 scatters country's export rank and its import rank from China's perspective. The correlation between two ranks is positive and large (0.75), suggesting that country with a larger number of exporters from China also has a larger number of Chinese importers. Fact 3 summarises the finding.

Fact 3. *Country with more Chinese exporters also has more Chinese importers.*

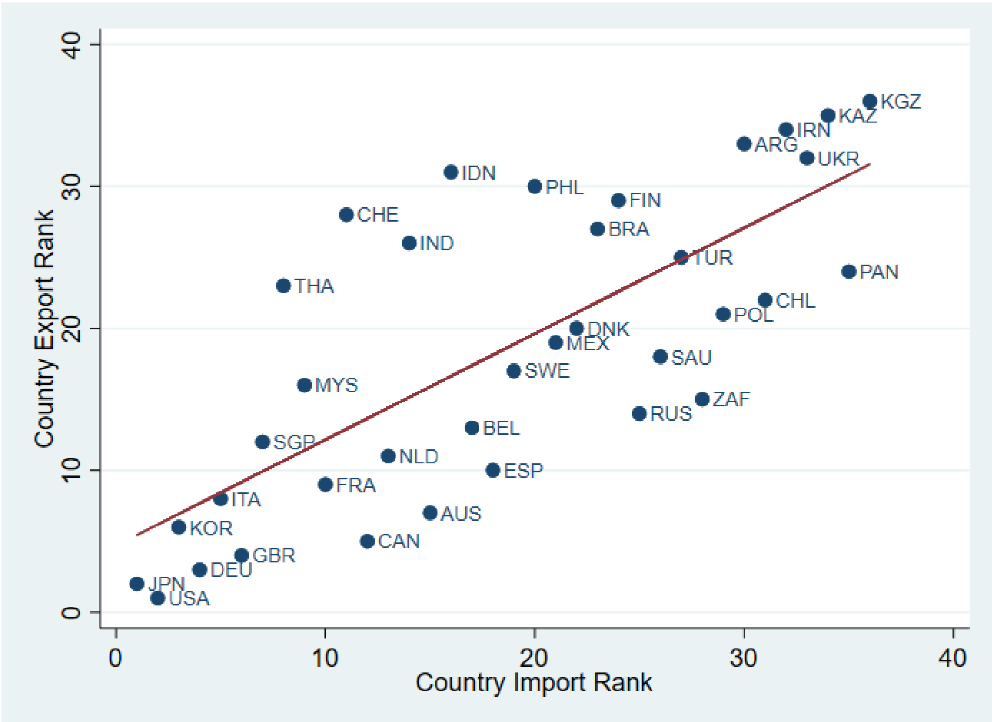


Figure 1: Country Rank Correlation by Number of Firms

Note: The export and import ranking across countries are based on number of Chinese exporters and importers, respectively. The rank-rank correlation in the figure is 0.75 with p-value 0.00. This exercise uses the customs sample only which includes top 30 export destinations and top 30 sourcing origins for China in year 2007, amounting to 36 foreign countries.

Admittedly, the above rank-rank correlation could be explained by multiple competing mechanisms that work independently from our market-specific 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. Dissecting the effect of our channel and the alternative ones is itself an interesting question, which we intend to answer in our quantitative exercise.

2.3 Further Discussions

We conclude the motivation section by presenting further tests addressing the issues related to dynamic panel specification and showing that our results are robust to taking into account foreign-related firms, additional extended gravity variables and different sample periods.

2.3.1 Dynamic Panel Regressions

To address the endogeneity issue from the dynamic panel regression, we follow the solution suggested by Wooldridge (1997, 2010) and employ dynamic Probit model with random effects.[12] The results are shown in column (1) and (2) of Table 5 where the dependent variable is firm's export dummy and of Table 6 where the dependent variable is firm's import dummy. Since it is computationally demanding to estimate dynamic Probit model, we restrict sample size in two different ways and cross-check the results. In column (1) of Table 5 and 6, we estimate the model with sample from 2008 to 2015 which constitutes around 75% observations of the full sample while in column (2) of Table 5 and 6, we randomly select half of firms and estimate the model with this random sample. Our parameters of interest (the first row of column (1) and (2)) remain significant and positive, suggesting that our finding of market-specific bilateral economies of scope is robust to accounting for unobserved heterogeneity and serial correlation. Besides, the estimated coefficients in column (1) and (2) are quite close to each other.

In addition, we employ the standard system GMM model with instrument variables (IVs). Following Feng, Li, and Swenson (2016), we use two IVs. The first one is firm-country-specific exposure to import (export) tariff, and the second one is an indicator for firm as processing importer (exporter) in a foreign country. Appendix A.5 presents how to construct the IVs and details about system GMM. The result is given in column (3) of Table 5 and 6.[13] Our qualitative result is robust to using system GMM with these two instrument variables.

2.3.2 Foreign-Related Firms

Several recent papers, notably Antràs et al. (2022), show that ownership linkage across countries (mostly through FDI) is one key determinant for bilateral trade relationships. Firms that are owned by foreign entities tend to trade more with their headquarters. To show the robustness of our channel to this potential force, we repeat the reduced-form exercises by adding an interaction term between our variable of interest and dummy for foreign-related firm. Here we identify foreign-related firms as those marked as "Owned by foreign entity"(外商独资企业), "Jointly owned by domestic and foreign entity"(中外合资企业), and "Jointly maintained by domestic and foreign entity"(中外合作企业) in CCTS. Column (4) and (7) of Table 5 and 6 show the results. After controlling foreign ownership, there is a significant and positive correlation between firm's current export (import) decision

[12] Morales, Sheu, and Zahler (2019) use a mixed Logit model with random effects which is computationally infeasible in our case due to a much larger sample size in our study.

[13] Here we use sample from 2001 to 2007 since after 2007 variation in export and import tariffs is quite limited. The sample size shrinks a lot as we focus on a balanced panel when constructing the firm-country-specific tariffs.

and its past import (export) decision in the same country. The magnitude of estimated coefficient barely changes. Furthermore, the estimated coefficient of the interaction term is also significant and positive, confirming the findings of Antràs et al. (2022) that foreign-related firms do have additional incentive to export to and import from the same market compared to the others.

2.3.3 Cross-Market Bilateral Economies of Scope

In reality, it is possible that exporting to one country encourages firm to import from the country that shares similar geographic or economic characteristics with its export destination. In this subsection, we check if such cross-market bilateral economies of scope exists and whether it affects our baseline result or not. For this purpose, we do the regressions including both export-side and import-side extended gravity variables.[14] Column (5) and (8) of Table 5 and 6 show the results. Several takeaways are worth mentioning. First, incorporating extended gravity variables on the other side does not alter the sign or change the significance of our key coefficients. Second, there seems to be no cross-market bilateral economies of scope, as the estimated coefficients on the additional variables (import-side extended gravity variable in Table 5 and export-side extended gravity variable in Table 6) are in general not significant.

2.3.4 Different Sample Period

Our baseline empirical exercise covers the period from 2000 to 2015. A potential concern here is that the post-WTO period (i.e., 2000-2007) are special as it is characterized by large declines in trade costs, fast growth in the export and the productivity of Chinese firms. Thus, firms trade strategy might be different in this episode compared to normal times. To address this concern, we repeat the same regression in column (6) and (9) of Table 5 and 6 by using data from 2008 to 2015. The results remain stable.

[14] See Appendix A.4 for detailed construction of the extended gravity variables.

Table 5: The Effect of Import Choice on Export Decision: Robustness

	Dependent Var.: $\mathbb{I}\{\text{Exp.}_{fct} > 0\}$								
	Dyn. Probit RE		System GMM	Probit			LPM		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
$\mathbb{I}\{\text{Imp.}_{fct-1} > 0\}$	0.733***	0.735***	0.052***	0.242***	0.248***	0.293***	0.013***	0.017***	0.013***
	(0.004)	(0.003)	(0.007)	(0.004)	(0.003)	(0.003)	(0.002)	(0.002)	(0.001)
.× Foreign Ownership Indicator$_{ft-1}$				0.093***			0.008***		
				(0.002)			(0.00549)		
$\mathbb{I}\{\text{Exp.}_{fct-1} > 0\}$	1.372***	1.459***	0.290***	1.276***	1.279***	1.290***	0.060***	0.060***	0.008***
	(0.004)	(0.003)	(0.010)	(0.004)	(0.004)	(0.004)	(0.003)	(0.003)	(0.002)
Exp. Ext. Distance$_{fct-1}$	-0.122***	-0.102***	-0.066***	-0.220***	-0.208***	-0.218***	-0.002	-0.002	0.000
	(0.002)	(0.002)	(0.008)	(0.002)	(0.002)	(0.002)	(0.002)	(0.02)	(0.002)
Exp. Ext. Contiguity$_{fct-1}$	0.212***	0.221***	0.017**	0.206***	0.210***	0.213***	0.019***	0.019***	0.015***
	(0.003)	(0.002)	(0.010)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.002)
Exp. Ext. Continent$_{fct-1}$	0.216***	0.236***	-0.059***	0.210***	0.214***	0.216***	-0.003***	-0.003***	-0.003***
	(0.003)	(0.002)	(0.009)	(0.004)	(0.004)	(0.004)	(0.001)	(0.001)	(0.001)
Exp. Ext. Com. Lang.$_{fct-1}$	0.269***	0.274***	0.023**	0.267***	0.260***	0.268***	0.003	0.003	0.002
	(0.002)	(0.002)	(0.011)	(0.003)	(0.003)	(0.003)	(0.002)	(0.002)	(0.002)
Exp. Ext. Income Group$_{fct-1}$	0.500***	0.483***	0.015	0.312***	0.313***	0.321***	-0.007***	-0.007***	-0.005**
	(0.003)	(0.003)	(0.010)	(0.004)	(0.004)	(0.004)	(0.002)	(0.002)	(0.002)
Imp. Ext. Distance$_{fct-1}$					-0.052***			0.001	
					(0.001)			(0.002)	
Imp. Ext. Contiguity$_{fct-1}$					-0.044***			0.003**	
					(0.001)			(0.003)	
Imp. Ext. Continent$_{fct-1}$					-0.037***			0.003***	
					(0.001)			(0.003)	
Imp. Ext. Com. Lang.$_{fct-1}$					0.067***			0.002*	
					(0.001)			(0.003)	
Imp. Ext. Income Group$_{fct-1}$					0.000			-0.002***	
					(0.003)			(0.001)	
Constant	-1.793***	-2.015***	-1.414***	-0.899***	-0.561***	-0.805***	0.122***	0.112***	0.111***
	(0.018)	(0.014)	(0.124)	(0.041)	(0.044)	(0.033)	(0.018)	(0.021)	(0.013)
Gravity Variables	YES	YES	YES	YES	YES	YES	YES	YES	YES
Firm-level Controls	YES	YES	YES	YES	YES	YES	NO	NO	NO
Firm-Year FE	-	-	NO	NO	NO	NO	YES	YES	YES
Country-Year FE	-	-	NO	YES	YES	YES	YES	YES	YES
Firm-Country FE	-	-	NO	NO	NO	NO	YES	YES	YES
Obs.	6,609,062	9,752,700	78,494	13,244,910	13,087,380	10,435,448	11,650,553	11,507,360	9,064,524
Adj. R^2	-	-	-	-	-	-	0.574	0.575	0.585
Pseudo R^2	-	-	-	0.469	0.470	0.465	-	-	-

Note: This table presents additional results across different models. Column (1) and (2) present the results from dynamic Probit model with random effects. In column (1), we use the customs sample from 2008 to 2015 while in column (2), we randomly select half of firms from the full sample. Column (3) shows the results from system GMM with instrument variables using the customs sample from 2001 to 2007. Year dummies are included in system GMM. Column (4) to (6) present results from Probit model, and column (7) to (9) list results from linear probability model (LPM). In column (4) and (7), we take into account foreign-related firms. In column (5) and (8), we add more extended gravity variables. In column (6) and (9), we use only the data from 2008 to 2015 to mitigate WTO entry effect. The extended gravity variables with prefix Exp. are constructed using only firm's past export decisions while the others with prefix Imp. are based on firm's past import decisions. Standard errors are in the parentheses and clustered at firm and country level. The number of asterisk indicates significance at 1%(***), 5%(**) and 10%(*) level.

Table 6: The Effect of Export Choice on Import Decision: Robustness

	Dependent Var.: $\mathbb{I}\{\text{Imp.}_{fct} > 0\}$								
	Dyn. Probit RE		System GMM	Probit			LPM		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
$\mathbb{I}\{\text{Exp.}_{fct-1} > 0\}$	0.645***	0.596***	0.020***	1.473***	1.481***	1.509***	0.0554***	0.0551***	0.000733
	(0.004)	(0.003)	(0.005)	(0.00392)	(0.00397)	(0.00416)	(0.00414)	(0.00415)	(0.00318)
.× Foreign Ownership Indicator$_{ft-1}$				0.0608***			0.00425***		
				(0.00431)			(0.000981)		
$\mathbb{I}\{\text{Imp.}_{fct-1} > 0\}$	1.784***	1.955***	0.234***	0.257***	0.241***	0.286***	0.00696***	0.00881***	0.00578***
	(0.006)	(0.004)	(0.009)	(0.00375)	(0.00329)	(0.00337)	(0.00123)	(0.00124)	(0.000925)
Imp. Ext. Distance$_{fct-1}$	-0.174***	-0.163***	-0.031***	-0.186***	-0.171***	-0.185***	0.00561***	0.00562***	0.00330***
	(0.002)	(0.002)	(0.005)	(0.00221)	(0.00227)	(0.00246)	(0.00109)	(0.00109)	(0.000858)
Imp. Ext. Contiguity$_{fct-1}$	0.213***	0.203***	0.032***	0.194***	0.199***	0.206***	0.0171***	0.0171***	0.0127***
	(0.004)	(0.003)	(0.008)	(0.00355)	(0.00359)	(0.00390)	(0.00309)	(0.00309)	(0.00239)
Imp. Ext. Continent$_{fct-1}$	0.103***	0.126***	-0.058***	0.0597***	0.0607***	0.0696***	-0.000346	-0.000365	-0.000899
	(0.004)	(0.003)	(0.007)	(0.00426)	(0.00434)	(0.00472)	(0.00108)	(0.00110)	(0.000806)
Imp. Ext. Com. Lang.$_{fct-1}$	0.147***	0.129***	0.017**	0.174***	0.167***	0.173***	0.00306	0.00309	0.00204
	(0.003)	(0.002)	(0.007)	(0.00355)	(0.00361)	(0.00394)	(0.00214)	(0.00214)	(0.00167)
Imp. Ext. Income Group$_{fct-1}$	0.346***	0.276***	0.039***	0.140***	0.144***	0.136***	-0.00493***	-0.00480***	-0.00275**
	(0.004)	(0.003)	(0.006)	(0.00445)	(0.00451)	(0.00486)	(0.00155)	(0.00152)	(0.00117)
Exp. Ext. Distance$_{fct-1}$					-0.0574***			-0.000312	
					(0.00206)			(0.000602)	
Exp. Ext. Contiguity$_{fct-1}$					-0.0384***			0.00125*	
					(0.00333)			(0.000657)	
Exp. Ext. Continent$_{fct-1}$					-0.00397			0.000110	
					(0.00356)			(0.000575)	
Exp. Ext. Com. Lang.$_{fct-1}$					0.0638***			-0.000850	
					(0.00320)			(0.000589)	
Exp. Ext. Income Group$_{fct-1}$					-0.00872**			-0.00174**	
					(0.00363)			(0.000675)	
Constant	-1.212***	-1.288***	-0.904***	-0.873***	-0.546***	-0.620***	0.0163	0.0198	0.0409***
	(0.019)	(0.014)	(0.082)	(0.0404)	(0.0439)	(0.0321)	(0.0102)	(0.0137)	(0.00811)
Gravity Variables	YES	YES	YES	YES	YES	YES	YES	YES	YES
Firm-level Controls	YES	YES	YES	YES	YES	YES	NO	NO	NO
Firm-Year FE	-	-	NO	NO	NO	NO	YES	YES	YES
Country-Year FE	-	-	NO	YES	YES	YES	YES	YES	YES
Firm-Country FE	-	-	NO	NO	NO	NO	YES	YES	YES
Obs.	5,967,909	8,789,230	126,044	11,764,732	11,557,192	9,383,745	10,515,452	10,357,332	8,249,557
Adj. R^2	-	-	-	-	-	-	0.609	0.609	0.628
Pseudo R^2	-	-	-	0.546	0.546	0.547	-	-	-

Note: This table presents additional results across different models. Column (1) and (2) present the results from dynamic Probit model with random effects. In column (1), we use the customs sample from 2008 to 2015 while in column (2), we randomly select half of firms from the full sample. Column (3) shows the results from system GMM with instrument variables using the customs sample from 2001 to 2007. Year dummies are included in system GMM. Column (4) to (6) present results from Probit model, and column (7) to (9) list results from linear probability model (LPM). In column (4) and (7), we take into account foreign-related firms. In column (5) and (8), we add more extended gravity variables. In column (6) and (9), we use only the data from 2008 to 2015 to mitigate WTO entry effect. The extended gravity variables with prefix Exp. are constructed using only firm's past export decisions while the others with prefix Imp. are based on firm's past import decisions. Standard errors are in the parentheses and clustered at firm and country level. The number of asterisk indicates significance at 1%(***), 5%(**) and 10%(*) level.

3 Theory

Motivated by the above empirical regularities, we provide a structural model of firm heterogeneity, market-specific trade decisions and market-specific 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 that comprises 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 goods. Production of final goods requires assembling a unit measure of differentiated intermediate inputs. 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 towards. In each origin country $j \in \mathbb{J}$, there exists a unit measure of intermediate-goods suppliers. Each supplier produces a distinct 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 upon Eaton and Kortum (2002) where 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 $k \in \mathbb{J}$ derive utility from consumption of final goods available there.

3.2 Preference

The representative consumer in market k maximizes its utility by consuming a non-manufacturing goods 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 written as

$$U_k = U_{Mk}^{\mu} U_{Nk}^{1-\mu}, \tag{2}$$

where

$$U_{Mk} = \left(\int_{\omega \in \Omega_k} q_k(\omega)^{\frac{\sigma-1}{\sigma}} d\omega \right)^{\frac{\sigma}{\sigma-1}}; \tag{3}$$

σ is the elasticity of substitution among differentiated final goods and Ω_k represents the set of differentiated final goods available in market k. The preference is common worldwide and gives rise to the following demand for any final goods ω available in market k:

$$q_k(\omega) = p_k(\omega)^{-\sigma} E_k P_k^{\sigma-1}, \tag{4}$$

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 which commands a wage w_k in 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

We first describe firm's sourcing decision. Firm characterized by its core productivity φ decides the set of origins $\mathsf{M}(\varphi) \subseteq \mathbb{J}$ to source intermediate inputs from, and for each intermediate input, it chooses the available supplier 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

$$z_i(\nu, \varphi; \mathsf{M}(\varphi)) = \min_{j \in \mathsf{M}(\varphi)} \left\{ \tau_{ij}^M a_j(\nu) w_j \right\}, \tag{5}$$

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. Besides, sourcing from any origin requires 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 firm φ as

$$c_i(\varphi; \mathsf{M}(\varphi)) = \frac{1}{\varphi} \left(\int_0^1 z_i(\nu, \varphi; \mathsf{M}(\varphi))^{1-\rho} d\nu \right)^{\frac{1}{1-\rho}}, \tag{6}$$

where ρ is the elasticity of substitution among intermediate inputs and the measure of inputs used in production is one.

Turning to the input suppliers in origin j. Following Eaton and Kortum (2002), we assume that their production efficiency $\frac{1}{a_j(\nu)}$ is drawn from a Fréchet distribution

$$\Pr(a_j(\nu) \geqslant a) = e^{-T_j a^{\theta}},$$

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 from Eaton and Kortum

(2002) indicates that firm φ's share of intermediate inputs sourced from origin j is given by

$$\chi_{ij}(\varphi; \mathsf{M}(\varphi)) = \frac{\xi_{ij}^M}{\Theta_i^M(\varphi)}, \tag{7}$$

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

$$\xi_{ij}^M \equiv T_j \left(\tau_{ij}^M w_j\right)^{-\theta} \tag{8}$$

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

$$\Theta_i^M(\varphi; \mathsf{M}(\varphi)) \equiv \sum_{j \in \mathsf{J}(\varphi)} \xi_{ij}^M \tag{9}$$

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

$$c_i(\varphi; \mathsf{M}(\varphi)) = \frac{1}{\varphi} \left(\gamma \Theta_i^M(\varphi; \mathsf{M}(\varphi))\right)^{-\frac{1}{\theta}}, \tag{10}$$

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) resembles bilateral trade shares formula in Eaton and Kortum (2002). In our model, it suggests that firm sources more inputs from origin with higher sourcing potential than the others conditional on paying sourcing fixed costs. Meanwhile, equation (10) is isomorphic to ideal price index from Eaton and Kortum (2002). Now it denotes firm's marginal cost of production which is decreasing in the sourcing capacity of strategy $\mathsf{M}(\varphi)$. Firm who sources from better (in terms of sourcing potential) and/or more origins is able to produces at a lower marginal cost than the others. Note that from equation (10) firm's sourcing decisions across different origins are inter-connected: sourcing from one origin may affect firm sourcing decision from the others due to its effect on marginal cost of production and the presence of sourcing fixed cost. As we show below, whether firm's sourcing decisions across origins are complements or substitutes to each other depends on parameter values.

Next, we formulate firm's sales decision. Firm φ decides whether to sell 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 a iceberg transportation cost, τ_{ki}^X (e.g., foreign import tariff), and a sales fixed cost, f_{ki}^X. Firm can sell final product to market k only after paying the sales fixed cost.

Taking as given sourcing strategy $\mathsf{M}(\varphi)$, the firm's sales revenue from serving market k is

$$r_{ki}(\varphi) = \sigma \varphi^{\sigma-1} \left(\gamma \Theta_i^M(\varphi)\right)^{\frac{\sigma-1}{\theta}} \left(\tau_{ki}^X\right)^{1-\sigma} B_k, \tag{11}$$

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 constant share of firm's sales revenue: $\frac{r_{ki}(\varphi)}{\sigma}$. Firm's total revenue is simply the sum of revenue from selected markets, and its sales share in market k is given by

$$\chi_{ki}^{X}(\varphi) = \frac{\xi_{ki}^{X}}{\Theta_i^X(\varphi)}, \tag{12}$$

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

$$\xi_{ki}^{X} \equiv \left(\tau_{ki}^{X}\right)^{1-\sigma} B_k \tag{13}$$

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

$$\Theta_i^X(\varphi) \equiv \sum_{k \in \mathsf{X}(\varphi)} \xi_{ki}^{X} \tag{14}$$

denotes the *sales capacity* corresponding to the sales strategy $\mathsf{X}(\varphi)$. Firm sells more to market with higher sales potential relative to the others after paying sales fixed cost.

To sum up, 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

$$\begin{aligned}\pi_i(\varphi) &= \varphi^{\sigma-1} \underbrace{\left(\gamma \Theta_i^M(\varphi)\right)^{\frac{\sigma-1}{\theta}} \Theta_i^X(\varphi)}_{\text{Non-market-specific bilateral economies of scope}} - w_i \sum_{k \in \mathsf{X}(\varphi)} f_{ki}^X - w_i \sum_{j \in \mathsf{M}(\varphi)} f_{ij}^M \\ &\quad + w_i \underbrace{\sum_{h \in \mathsf{X}(\varphi) \cap \mathsf{M}(\varphi)} \left(\alpha_0 f_{hi}^X + \alpha_1 f_{ih}^M\right)}_{\text{Market-specific bilateral economies of scope}} \quad , \end{aligned} \tag{15}$$

where the first term is firm's total variable profits, the second and third term captures the total sales and sourcing fixed costs. The last term is crucial to the mechanism of market-specific bilateral economies of scope, where 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 fixed costs structure in Table 1 where we use parameters α_0 and α_1 to determine the magnitude of market-specific bilateral economies of scope. α_0 measures to what extent, firm's sourcing decision in a country may benefit its sales choice to the same country through a reduction in sales fixed costs, f_{hi}^X. Similarly, α_1 measures to what extent, firm's sales entry may benefit its sourcing choice from the same country through a reduction in sourcing fixed costs, f_{ih}^M.

The profit function in equation (15) highlights two types of bilateral economies of scope incorporated in our model. The first one is non-market-specific bilateral economies of scope. It suggests that 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 the similar vein, sourcing from an additional origin makes the firm to be more likely to sell to all markets, as it reduces firm's marginal cost of production, i.e. higher $\Theta_i^M(\varphi)$.

In contrast, the market-specific bilateral economies of scope shown in the last term indicate that if firm sells to an additional country, it is more likely to source from the same country due to saving in part of sourcing fixed costs. This sales decision creates no incentive for firm to trade with the other countries in either direction, since it only affects sourcing fixed costs in this specific country and has no effect on fixed costs in the other countries. The same logic applies to firm's sourcing decision in any country. Therefore, the market-specific force explicitly leads to the complementarity between firm's sales and sourcing decision within a specific country.

Conditional on its productivity level, firm optimally chooses sourcing strategy $\mathsf{M}(\varphi)$ and exporting strategy $\mathsf{X}(\varphi)$ to maximize the profit function given in equation (15). Formally, the firm's profit maximization problem is written as follows.

$$\begin{aligned} \max_{\substack{\mathbb{I}_{ij}^M \in \{0,1\}_{j=1}^J \\ \mathbb{I}_{ki}^X \in \{0,1\}_{k=1}^J}} \pi_i(\varphi, \mathsf{X}, \mathsf{M}) &= \varphi^{\sigma-1} \left(\gamma \sum_{j=1}^J \mathbb{I}_{ij}^M T_j \left(\tau_{ij} w_j\right)^{-\theta} \right)^{\frac{\sigma-1}{\theta}} \sum_{k=1}^J \mathbb{I}_{ki}^X \left(\tau_{ki}^X\right)^{1-\sigma} B_k \\ &- w_i \sum_{k=1}^J \mathbb{I}_{ki}^J \left(1 - \alpha_0 \mathbb{I}_{ik}^M\right) f_{ki}^X - w_i \sum_{j=1}^J \mathbb{I}_{ij}^M \left(1 - \alpha_1 \mathbb{I}_{ji}^X\right) f_{ij}^M, \end{aligned} \tag{16}$$

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

Note that the two key parameters in our model are α_0 and α_1, which govern the magnitude of the bilateral economies of scope: larger α_0 implies sourcing from a country reduces firm's fixed cost of exporting to the same country by more and larger α_1 implies exporting to a country decreases sourcing fixed cost in the same country by more. With $0 \leq \alpha_0, \alpha_1 \leq 1$, firm's decision to export to a specific country complements its decision to source from the same country, and vice versa. This is the reason why our model can generate market-specific independence between firm's sourcing and sales decisions.

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}. Free entry condition implies firm will enter the market until the expected profit reaches zero:

$$\int_{\tilde{\varphi}_i}^{\infty} [\pi_i(\varphi)]\, dG_i(\varphi) = w_i f_{ei}, \tag{17}$$

where $\pi_i(\varphi)$ is defined in equation (15), 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,

$$N_i = \frac{\eta L_i}{\sigma f_i} \tag{18}$$

where

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

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

We conclude this section by defining the general equilibrium of our model:

Definition 1. *Given the wage level w_i, labor endowment L_i, and the other exogenous parameters, the general equilibrium consists of firm's 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 firm's profit maximization problem* (16)*, (ii) firms enter the market until the free entry condition* (17) *holds, and (iii) labor market clearing condition* (18) *holds.*

4 Connecting Model to Data

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

4.1 Specification of the Fixed Costs

Following Eaton, Kortum, and Kramarz (2011) and Antràs, Fort, and Tintelnot (2017), we assume firms face heterogeneous fixed costs in trade. The specification of firm f's fixed costs of sourcing and exports with country j is as follows.

$$\log\left(f_{fij}^M\right) = \beta_C^M + \beta_d^M \log \text{Distance}_{ij} + \beta_{disp}^M \varepsilon_{fij}^M, \tag{19}$$

$$\log\left(f_{fji}^X\right) = \beta_C^X + \beta_d^X \log \text{Distance}_{ji} + \beta_{disp}^X \varepsilon_{fji}^X. \tag{20}$$

The constant term β_C^M, β_C^X in scale parameter measures the magnitude of the obstacles in international trade and the term $\beta_d^M \log \text{Distance}_{ij}, \beta_d^X \log \text{Distance}_{ji}$ captures the country-specific barriers in importing from and exporting to country j using geographic distance. In addition, the firm-country-specific error terms $\varepsilon_{fij}^M, \varepsilon_{fij}^X$ are drawn from bivariate standard normal distribution with correlation ρ. In the end, we set fixed cost of selling to and sourcing from the domestic market (i.e., China) to zero. The above specification enables the model to generate small-size exporters and importers. Furthermore, it also helps to generate all four types of firms observed in the data. In the data, for any foreign country, we observe four sets of Chinese firms: pure exporters, pure importers, two-way traders and domestic firms. Without firm-country-specific fixed costs, strict hierarchical ranking in exporting and importing implies only three types of firms can co-exist. If exporting is easier than sourcing, then the model would fail to generate pure importers, because firms overcoming the barriers to import will also export (i.e., 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-markets complementarity and adopt a "sandwich" algorithm, which sequentially squeezes the upper and lower bounds of the choice space.[15] 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.

Proposition 1. *Under $\frac{\sigma-1}{\theta} \geqslant 1$ and $0 < \alpha_0, \alpha_1 < 1$, firm's profit maximization problem in equation (16) with heterogeneous fixed costs exhibits increasing difference in $(\mathbb{I}_{ki}^X, \mathbb{I}_{ji}^X)$, $(\mathbb{I}_{ki}^X, \mathbb{I}_{ij}^M)$, and $(\mathbb{I}_{ik}^M, \mathbb{I}_{ij}^M)$ for any $k, i, j \in \mathbb{J}$.*

Note in the above proposition, $\frac{\sigma-1}{\theta} \geqslant 1$ ensures the property of increasing difference in the profit function and therefore makes firm's export and import choices complementary to each other. We show the complementarity property is an empirically plausible one in our later analysis. As export and import decisions are complements, a direct corollary of Proposition 1 is that there is increasing difference property in $(\mathbb{I}_{ki}^M, \mathbb{I}_{ij}^M)$ and $(\mathbb{I}_{ki}^X, \mathbb{I}_{ij}^X)$. By the analysis in Antràs, Fort, and Tintelnot (2017); Arkolakis, Eckert, and Shi (2022), the "sandwich" algorithm applies in our environment, which bypasses the method of scanning

[15] 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.1 for detailed description of the algorithm.

the whole 2^{2J} combinations. Furthermore, Proposition 1 shows that α's, i.e. $0 < \alpha_0, \alpha_1 < 1$ is sufficient to ensure that the complementarity between $\mathbb{I}^X_{ki}$ and $\mathbb{I}^M_{ij}$ continues to hold.

Another challenge relates to the model estimation when firms' foreign market accessions are inter-dependent on the country-level aggregates. For our exercise in particular, the market-level sourcing and sales potentials affect firms' optimal strategies which, in turn, affect foreign markets' attractiveness through aggregation. This coupled general equilibrium feedback necessitates an estimation algorithm where a large set of country-specific variables are loaded into the simulation routine. To address this issue, we follow the practice of Antràs, Fort, and Tintelnot (2017) by assuming that representative consumer in each country has constant expenditure shares of manufacturing goods across markets.[16] Given that 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 country's sourcing and sales potentials. It allows for separate identification on the country's sourcing and sales potentials from other parameters governing firm-level decisions, which greatly alleviates the computational burden on our later quantitative analysis.

4.3 Final-Goods Producers

In this section, we discuss two issues concerning the final-goods producers in the model and the data. The first one is the interpretation of the fixed cost paid by final goods producers. Note that in the model, final goods producers pay the fixed costs of both sourcing and exporting. The assumption is plausible considering that Chinese firms typically have low bargaining power in the global market. In a more general sense, how trade costs are shared between the related parties could be an endogenous outcome of a bargaining process (Eaton et al., 2021). However, it requires detailed firm-to-firm transaction level data which is not available in China's case. That said, our estimated fixed costs should be interpreted as the part borne by Chinese firms.

The second issue relates to distinguishing final-goods producers and input suppliers. The model draws the distinction between inputs suppliers and final goods producers by assuming a production process involving only two stages. In the data, however, the distinction becomes less clear-cut as firms are typically connected by rich input-output linkages spanning potentially multiple industries. Following Antràs, Fort, and Tintelnot (2017), our model inherently lacks the flexibility in providing a framework that allows for the exact mapping from final-goods producers in the data to that in the model. Our quantitative exercise uses the full manufacturing sample in measuring or constructing statistics that are related to the

[16] 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.

final goods firms, and we also conduct robustness exercise by dropping firms operating in the upstream industries.

4.4 Gravity

We now derive the model-implied gravity equations for both intermediate and final goods, and discuss the implication of our mechanism on bilateral trade flows.

Conditional on firm's optimal trading strategy $\mathsf{X}^*(\varphi)$ and $\mathsf{M}^*(\varphi)$, its input purchase from origin j is $(\sigma-1)\chi_{ij}(\varphi)$ fraction of firm's profit,

$$M_{ij}(\varphi) = (\sigma-1)\varphi^{\sigma-1}\gamma^{\frac{\sigma-1}{\theta}}\left(\Theta_i^M(\varphi)\right)^{\frac{\sigma-1}{\theta}-1}\Theta_i^X(\varphi)\times T_j(\tau_{ij}^M w_j)^{-\theta}, \tag{21}$$

for $j \in \mathsf{M}^*(\varphi)$ and zero otherwise. And its sales revenue in market k is given by

$$X_{ki}(\varphi) = \sigma\varphi^{\sigma-1}\left(\gamma\Theta_i(\varphi)^M\right)^{\frac{\sigma-1}{\theta}}\times\left(\tau_{ki}^X\right)^{1-\sigma}B_k, \tag{22}$$

for $k \in \mathsf{X}^*(\varphi)$ and zero otherwise.

Summing equation (21) over all firms gives the aggregate import of intermediate goods from any origin j as follows:

$$M_{ij} = N_i\int_{\underline{\varphi}_i}^{\infty} M_{ij}(\varphi)dG_i(\varphi) = (\sigma-1)\gamma^{\frac{\sigma-1}{\theta}}N_i T_j(\tau_{ij}^M w_j)^{-\theta}\Lambda_{ij}^M, \tag{23}$$

where

$$\Lambda_{ij}^M \equiv \int_{\underline{\varphi}_i}^{\infty}\mathbb{I}_{ij}^M(\varphi)\varphi^{\sigma-1}\left(\Theta_i^M(\varphi)\right)^{\frac{\sigma-1}{\theta}-1}\Theta_i^X(\varphi)dG_i(\varphi) \tag{24}$$

is increasing in the number of firms in country i importing from origin j. By equation (23), we may derive the following gravity equation for trade in intermediate goods (see Appendix B.3 for the detailed derivations).

$$M_{ij} = \frac{E_i}{\bar{P}_i^{1-\sigma}/N_i}\times\frac{Q_j}{\sum_{h=1}^J\frac{E_h}{\bar{P}_h^{1-\sigma}/N_h}\left(\tau_{hj}^M\right)^{-\theta}\Lambda_{hj}}\times\left(\tau_{ij}^M\right)^{-\theta}\times\Lambda_{ij}^M, \tag{25}$$

where

$$\bar{P}_i^{1-\sigma}/N_i \equiv \sum_{k=1}^J b_k P_{ki}^{1-\sigma}/N_i \tag{26}$$

is the weighted average of country's mean export price index across all countries and $b_k = \frac{B_k}{\sum_{i=1}^J B_i}$ is the demand share of country k in the world. $P_{ki}^{1-\sigma} = N_i\int_{\underline{\varphi}_i}^{\infty}p_{ki}(\varphi)^{1-\sigma}dG_i(\varphi)$ is the export price index for firms in country i selling to market k. $Q_j = \sum_{h=1}^J M_{hj}$ is the total intermediate input produced by origin j.

Turning to the bilateral trade of final goods, the aggregate export from country i to market k is

$$X_{ki} = N_i \int_{\underline{\varphi}_i}^{\infty} X_{ki}(\varphi) dG_i(\varphi) = \sigma N_i \gamma^{\frac{\sigma-1}{\theta}} B_k \left(\tau_{ki}^X\right)^{1-\sigma} \Lambda_{ki}^X, \tag{27}$$

where

$$\Lambda_{ki}^X \equiv \int_{\underline{\varphi}_i}^{\infty} \mathbb{I}_{ki}^X(\varphi) \varphi^{\sigma-1} \left(\Theta_i^M(\varphi)\right)^{\frac{\sigma-1}{\theta}} dG_i(\varphi) \tag{28}$$

is increasing in the number of firms in country i exporting to market k. Similarly, we derive the following gravity equation for trade in final goods:

$$X_{ki} = \frac{E_i}{\bar{P}_i^{1-\sigma}/N_i} \times \frac{S_k}{\sum_{h=1}^{J} \frac{E_h}{\bar{P}_h^{1-\sigma}/N_h} \left(\tau_{kh}^X\right)^{1-\sigma} \Lambda_{kh}^X} \times \left(\tau_{ki}^X\right)^{1-\sigma} \times \Lambda_{ki}^X, \tag{29}$$

where $S_k = \sum_{h=1}^{J} X_{kh}$ denotes the total absorption of final goods for market k.

From equations (23) and (27), it is clear that the existence of bilateral economies of scope increases aggregate trade flows by facilitating firms' foreign market accession through reduction in fixed costs of export and import.

5 Quantitative Implementation

In this section, we present the quantitative implications of the model through estimation and counterfactual analysis. The questions that we intend to answer includes 1) how large is of the bilateral economies of scope mechanisms; and 2) to what extent this new mechanism accounts for the stylized facts documented in the empirical section. In the counterfactual analysis, we also show market-specific bilateral economies of scope affects the aggregate effects of the trade liberalization on firm's export and import decisions.

The quantitative analysis afterwards consistently uses the merged sample of Annual Survey of Industrial Enterprise and Chinese customs sample for the year 2007.[17] The set of countries in our sample is the union of the top 30 export destinations and top 30 import sourcing origins in terms of export and import value in 2007 respectively. A large fraction of the countries overlaps and the total number of countries amounts to 36 (except for China itself). Looking at the trade volume, the selected sample accounts for over 94% of total export value and 95% of total import value for China. 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 illustrate the result of the counterfactual analysis.

[17]We choose 2007 as the base year to study firm's trade decisions to avoid confounding impacts from China's WTO entry and 2008 financial crisis.

5.1 Model Parameterization

This section specifies model parameterization. From now on, we assume firm's productivity is drawn from Pareto distribution with 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). The second group of parameters include country's sourcing and sales potentials (ξs in equation (8) and (13)), the demand elasticity (σ), and the sourcing elasticity (θ). Following the discussion in Section 4.3, these parameters can be estimated independently from reduced-form regressions. The third group consists of 10 internally estimated parameters, which are chosen to match the observed trade pattern of Chinese firms. We estimate this set of parameters using the simulated method of moments (SMM) method.

Parameters Estimated from Reduced-Form Regressions We start with the estimation of country's sales and sourcing potentials from the perspective of Chinese firms, which can be separately identified taking the observed firms' export and import decisions as their optimal solution. The estimation uses the idea that country's sales and sourcing potential should be reflected by firm's sales and sourcing share across countries as in equation (7) and (12). We normalize equation (7) and (12) by firm's sales and sourcing share in domestic country respectively, take logs on both sides, and transform it into an empirical specification by adding residual term[18] as follows:

$$\log\left(\chi^M_{fij}\right) - \log\left(\chi^M_{fii}\right) = \log\left(\xi^M_{ij}\right) + \epsilon^M_{fij} \tag{30}$$

and

$$\log\left(\chi^X_{fki}\right) - \log\left(\chi^X_{fii}\right) = \log\left(\xi^X_{ki}\right) + \epsilon^X_{fki}, \tag{31}$$

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

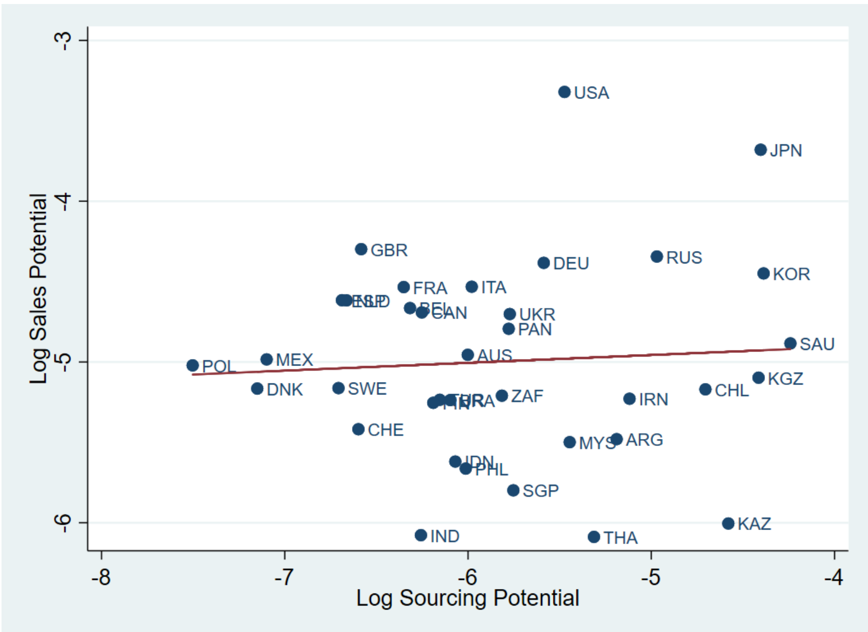
Firm's domestic intermediate input value is obtained from subtracting imported intermediate input from its total operating input. We then calculate the domestic sales revenue for each firm by subtracting export revenue from its total sales income. Based on this, we get firm's sourcing and sales shares across China and foreign countries. 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 equation (30) and (31) using ordinary

[18] One structural interpretation of the residual is firms face idiosyncratic preference shocks. The shock is i.i.d. across firms and markets, and is realized after the entry decisions are made. In this way, firms' entry decisions remains unaffected as long as the ex-post preference shock averages out in the (expected) profit function. Also note that the preference shock, once realized, introduces additional dispersion to firm sales.

least squares (OLS). The estimates of sourcing and sales potential, $\log\left(\xi_{ij}^{M}\right)$ and $\log\left(\xi_{ki}^{X}\right)$ are recovered from country fixed-effects of equation (30) and (31) separately. The estimation procedure is valid as long as ϵ_{fij}^{M} and ϵ_{fij}^{X} are realized after firm optimally chooses its trade strategy, and ϵ_{fij}^{M} and ϵ_{fij}^{X} are assumed to be measurement errors.

Figure 2 scatters the result of the estimated sourcing and sales potential, which shows a very weak positive relationship (with a slope of 0.05 and p-value of 0.809). Countries such as the U.S have the largest sales potential in our sample, whereas the sourcing potential is below Korean and Japan. The weak and insignificant relationship helps to alleviate the concern that that our documented stylized facts (e.g., the rank-rank correlation) in the empirical section are driven by the correlations between trade potentials instead of the bilateral scope mechanism.

Figure 2: Estimated Sales Potential and Sourcing Potentials

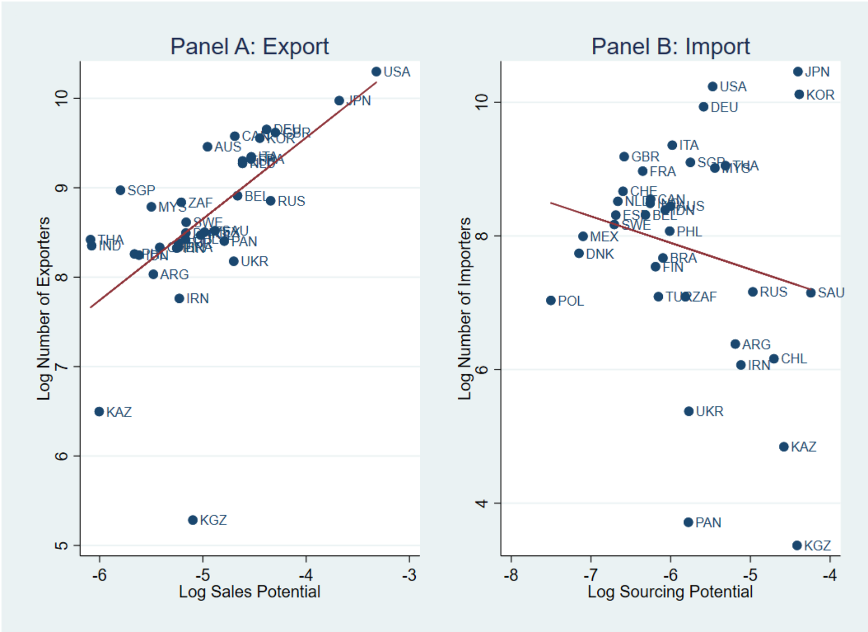


Note: This figure shows the estimated sales potential and sourcing potential for each foreign country. The slope of fitted line is 0.05 with p-value of 0.70. The estimation is based on China's top 30 sourcing origins and top 30 export destinations in year 2007, amounting to 36 foreign countries. Both sales and sourcing potentials are normalized by China's sales and sourcing potentials respectively.

Figure 3 examines the relationship between a country's sales (in Panel A) and sourcing (in Panel B) potential with the number of Chinese exporters and importers, respectively. In Panel A, there is a strong positive correlation between a country's sales potential and the number of Chinese exporters (the slope is 0.91 and the p-value of 0.00). However, we do not observe such positive relationship for the sourcing side. In panel B, the slope is -0.40 and the p-value 0.25. The reason is that sourcing and sales potentials do not capture trade barriers such as fixed costs, which could play an important determinants of importer entry.

Overall, Figure 3 shows that the Chinese firm's export decisions are mainly driven by benefit of selling to foreign markets while the sourcing decisions could be due to other factors in getting access to foreign input suppliers, which is estimated in the later section.

Figure 3: Sales/Sourcing Potentials and the Number of Exporters/Importers



Note: This figure shows the correlation between country's (log) sales potential and the (log) number of Chinese exporters (Panel A) and the correlation between country's (log) sourcing potential and the (log) number of Chinese importers (Panel B). In Panel A, the slope of fitted line is 0.91 with p-value 0.00. In Panel B, the slope of fitted line is -0.40 with p-value 0.25. The estimation is based on China's top 30 sourcing origins and top 30 export destinations in year 2007, amounting to 36 foreign countries. Both sales and sourcing potentials are normalized by China's sales and sourcing potentials respectively.

Estimation of Demand Elasticity σ The presence of the CES preference and monopolistic competition structure among final-goods producers indicate that firm 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's markup 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 firms' markups at the bottom 3% and the top 3%. The the mean of our estimated markups is 1.31, and the median level is 1.28. The implied σ is 4.23 for 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 of U.S. firms). The result reflects a lower markup charged by firms in China than those of the U.S. Note that $1-\sigma$ is the trade elasticity for final goods.[19]

Estimation of Sourcing Elasticity θ We now estimate the trade elasticity for intermediate goods θ. To do so, we use the definition for sourcing potential from equation (8):

$$\xi_{ij}^{M} \;=\; T_j\left(\tau_{ij}^{M}w_j\right)^{-\theta}. \tag{32}$$

Taking log on both sides and adding residual term yields an empirical specification:

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

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 $\log T_j$. $\log(w_j)$ 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 tariff imposed by China on imported intermediate inputs from country j. In running the regressions, we add a battery of gravity variables to control for the non-tariff trade barriers.

Table 7 provides the estimation result. In column (1) and (2), we use the estimated sourcing potential as the dependent variable. The regression results suggest an input trade elasticity of 1.072 in column (2), where we instrument $\log\tau_{ij}^{M}w_j$ by population size to deal with potential correlation of wages across countries and measurement error following Antràs, Fort, and Tintelnot (2017). Our estimated θ here is slightly lower than the one obtained in their paper (1.789). In line with the AFT results, the estimated trade elasticity using firm-level data is lower than that obtained from using aggregate trade flow[20], suggesting a more dispersed productivity distribution among input suppliers.

Alternatively, one may estimate input trade elasticity by gravity equation (23), and the result is reported in column (3) and (4). We use the observed log total import value across sourcing origins as dependent variable, and we control for $(\sigma-1)\gamma^{\frac{\sigma-1}{\theta}}N_i\Lambda_{ij}^{M}$ with log total domestic input purchase of all Chinese firms importing from origin j.[21] We then get an estimated trade elasticity of intermediate goods as 1.273 in column (4) when using same

[19] We conduct sensitivity check to higher value of $\sigma=5.76$ (i.e. lower markup charged by Chinese firms, $\mu=1.21$), close to the upper bound value in the literature (e.g., $\sigma=6.2$ in Feenstra and Romalis (2014)). The parameters of interests, α_0 and α_1, become slightly smaller than baseline, and our model still fits the rank-rank correlation quite well. See Appendix C.7 for more details.

[20] For instance, Eaton and Kortum (2002) obtain an estimated trade elasticity 3.60 using data on wages only.

[21] Note that we normalize domestic sourcing potential to be one. The domestic input purchase for firms importing from origin j is

$$N_i\int_{\underline{\varphi_i}}^{\infty}\mathbb{I}_{ij}^{M}(\varphi)(\sigma-1)\gamma^{\frac{\sigma-1}{\theta}}\varphi^{\sigma-1}\left(\Theta_i(\varphi)\right)^{\frac{\sigma-1}{\theta}-1}\Theta_i^{X}(\varphi)\times\xi_{ii}^{M}dG_i(\varphi)=(\sigma-1)\gamma^{\frac{\sigma-1}{\theta}}N_i\Lambda_{ij}^{M},$$

where $\xi_{ii}^{M}=1$.

Table 7: Estimating Sourcing Elasticity

	$\log\xi_j^M$		log aggregate import_j	
	OLS	IV	OLS	IV
	(1)	(2)	(3)	(4)
$\log\tau_{ij}^M w_j$	-1.094**	-1.072**	-1.762***	-1.273**
	(0.416)	(0.508)	(0.557)	(0.639)
log distance_{ij}	-0.540*	-0.537**	-0.455	-0.387
	(0.276)	(0.242)	(0.383)	(0.341)
Contiguity_{ij}	-0.987*	-0.981**	-1.009	-0.895*
	(0.560)	(0.490)	(0.660)	(0.530)
log GDP per capita_j	0.408	0.384	1.169	0.631
	(0.642)	(0.690)	(0.779)	(0.903)
Income group_{ij}	-1.372***	-1.367***	-1.410*	-1.283*
	(0.397)	(0.368)	(0.807)	(0.696)
RTA_{ij}	-0.109	-0.110	-0.0531	-0.0727
	(0.445)	(0.376)	(0.965)	(0.829)
log $\text{R\&D}_j$	-0.0499	-0.0512	-0.0806	-0.110
	(0.127)	(0.104)	(0.234)	(0.202)
log capital per worker_j	0.254	0.263	-0.0148	0.188
	(0.430)	(0.402)	(0.551)	(0.556)
log number of firms_j	0.121	0.121	0.304	0.303*
	(0.177)	(0.150)	(0.199)	(0.168)
log domestic input_j			0.984***	0.985***
			(0.228)	(0.189)
Constant	-8.817***	-8.757***	-10.18**	-8.848**
	(1.730)	(1.817)	(4.746)	(4.210)
F-Statistic	-	15.637	-	18.834
Obs.	36	36	36	36
R^2	0.526	0.526	0.860	0.856

Note: This table shows the estimation results for sourcing elasticity. The sample includes top 30 export destinations and top 30 sourcing origins for China in year 2007, amounting to 36 foreign countries. Following Antràs, Fort, and Tintelnot (2017), we use log population size as instrument for $\log\tau_{ij}^M w_j$ in columns (2) and (4). Robust standard errors are in the parentheses. The number of asterisk indicates significance at 1%(***), 5%(**) and 10%(*) level.

instrument as in column (2). Meanwhile, the estimated coefficient on log domestic input purchase (0.984 in column (3) and 0.985 in column (4)) is close to one, consistent with theoretical prediction in equation (23). We choose 1.072 in column (2) as our baseline value for θ in our quantitative analysis. Note that our estimation suggests $\sigma - 1 > \theta$. According to Proposition 1, firm's trade decisions across sourcing origins and export destinations are complementary to each other, implying the algorithm in Jia (2008) can be applied in our context.

Simulated Method of Moments and Model Solution The last set of parameters include 10 internally estimated parameters: the domestic demand scale ($\tilde{B}_i$),[22] the cost reduction parameters that govern the extent of bilateral economies of scope (α_0 and α_1), the correlation of fixed cost draws (ρ) and the parameters associated to the distribution of fixed costs draws for sourcing and exporting ($\beta^M_{disp}, \beta^M_C, \beta^M_d, \beta^X_{disp}, \beta^X_C, \beta^X_d$), including the mean and standard deviations of the market-specific sourcing and exporting fixed cost draws.

We choose the above 10 parameters to target the following three sets of moments. The first set includes the ratios between conditional shares for average foreign country from the first row of column (3) and (6) in Table 2, which we call importer's advantage in export participation and exporter's advantage in import participation respectively. These two moments play important roles in identifying α_0 and α_1, as we will momentarily show in the later section. In addition, we calculate the within-firm correlation between export and import profiles and take the average correlation across firms as another targeted moment for α_0 and α_1. The second set of targeted moments are relatively standard in the international trade literature. It contains 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. This set of moments are informative about the level and the dispersion of export and import fixed costs. In the end, we estimate the domestic demand scale ($\tilde{B}_i$) using the median domestic input purchase in RMB from data.[23] This moment helps to pin down levels of sales revenue, input purchases and fixed costs payment. Appendix C.2 show how we construct the moments in both data and simulation.

Finally, we solve the following program:

$$\hat{\Theta} = \arg\min_{\Theta} \left[\mathbf{M}(\Theta) - \mathbf{M}^d\right]' \hat{\mathbf{W}} \left[\mathbf{M}(\Theta) - \mathbf{M}^d\right], \tag{33}$$

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 moments. Following Adda and Cooper (2003), the elements in the weighting matrix, $\hat{\mathbf{W}}$, are computed from the inverse of the variance-covariance matrix of data moments based on 100 bootstrapped samples from the data.

For a more transparent illustration of the model's identification, we chart in Figure 4 the Jacobian matrix associated to the SMM estimation[24]. It shows how parameter changes lead to changes in the targeted moments. From this figure, we note parameters affecting the level of fixed costs (i.e., $\beta^M_C, \beta^M_d, \beta^X_C, \beta^X_d$) also affect the share of importers and exporters. In addition, increasing the standard deviation of fixed costs (i.e., $\beta^M_{disp}, \beta^X_{disp}$) increases the

[22]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 $\tilde{B}_i \equiv \left(\xi^M_{ii}\right)^{\frac{\sigma-1}{\theta}} \times \xi^X_{ii}$ where host country i refers to China.

[23]From the profit function (15), it is clear that change in $\tilde{B}_i$ leads to change in sales, input purchase and fixed costs payment since all firms at least source from and sell towards domestic market.

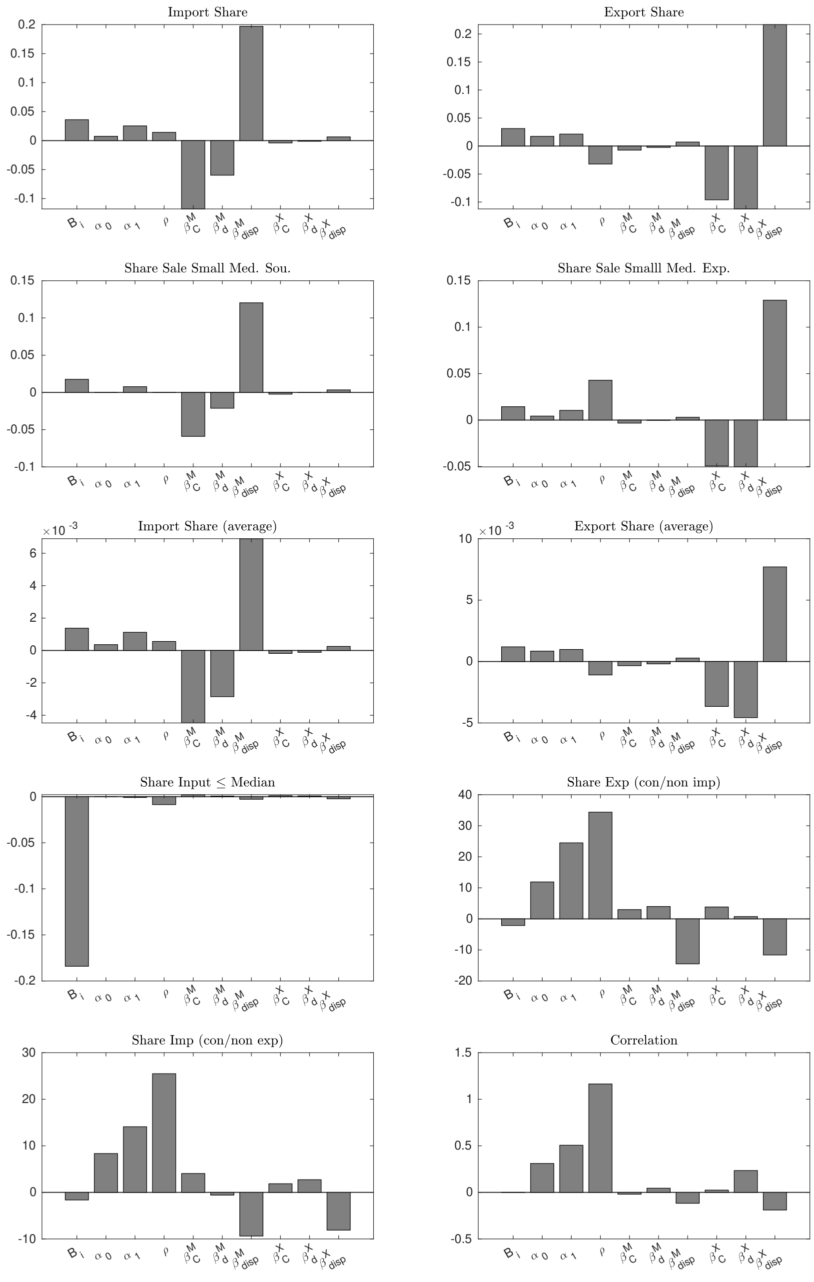
[24]Specifically, we compute the Jacobian matrix following Garcia-Macia, Hsieh, and Klenow (2019) by computing the percentage change in each moment with respect to a 0.1 level increase in each parameter.

fraction of exporter and importers. This is because larger dispersion implies more firms getting lower fixed cost draws. The two parameters governing the bilateral economies of scope mechanism play an important role in affecting the relative advantage of importers to become exporters, and conversely, the advantage of exporters to become importers. Finally, increasing in the parameter ρ, i.e. the correlation coefficient between the fixed cost draws, can also lead to increases in these advantages.

Panel C of Table 8 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, 2.48 million RMB or around 360,000 USD (or 10% the average exporter sales), and that of the sourcing fixed cost is 1.29 million RMB or over 187,000 USD (or 31% of the average firm's sourcing volume).[25] According to our estimates, it is relatively more difficult for Chinese firms to export to foreign market than to source from foreign origins. The presence of large fixed costs also implies that the impact of (partially) reducing them could have substantial impact on firm's global activities. Our estimation suggests that sourcing from a foreign country can, on average, reduces the fixed cost of exporting to the same country by about 40% (or equivalently, save 1 million RMB when firms decides to export), and this cost reduction effect is similar when we look at the other way around (about 37% in percentage or equivalently, 0.5 million RMB of import fixed cost saved if firms decides to exports to its sourcing origin). The result also suggests there is slightly positive ($\rho = 0.07$) correlations between the fixed cost shocks. Finally, there is 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 fixed costs for the Chinese exporters and importers.

[25] Das, Roberts, and Tybout (2007) show the estimated export fixed cost for Colombia firms is around 400,000 USD. Antràs, Fort, and Tintelnot (2017) present the estimated import fixed cost for US firms is about 50,000 USD

Figure 4: Jacobian Matrix



Note: This figure reports the model identification result by showing the Jacobian matrix. The horizontal axis represents the parameters and the vertical axis represents the local derivative of the moment (shown as the title of each panel) with respect to the corresponding parameters.

Table 8: 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	$\tilde{B}_i$	3.44 (0.150)	Estimation
Cost reduction (import-induced export)	α_0	0.41 (0.045)	Estimation
Cost reduction (export-induced import)	α_1	0.37 (0.025)	Estimation
Correlation of fixed costs	ρ	0.07 (0.004)	Estimation
Import: constant term	β_C^M	1.24 (0.050)	Estimation
Import: distance parameter	β_d^M	1.86 (0.003)	Estimation
Import: standard deviation	β_{disp}^M	1.85 (0.013)	Estimation
Export: constant term	β_C^X	2.48 (0.055)	Estimation
Export: distance parameter	β_d^X	1.40 (0.014)	Estimation
Export: standard deviation	β_{disp}^X	2.66 (0.020)	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) method. The weighting matrix is obtained by bootstrapping the data and the standard errors are reported in the parenthesis.

5.2 Fit of the Baseline and Alternative Models

Table 9 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 an unconditional 12% exporters and importers. These numbers are broadly consistent with the data, where the fraction of importer is 11% and the fraction of exporter is only 9%. In the data, the size distribution of exporters and importers are highly skewed. Following AFT, we use the fraction of firms whose sales are below median to discipline parameters associated to the mean level of fixed costs, and use the fraction of importers and exporters among firms below median sales to identify the dispersion parameter of fixed cost distributions. The model captures this large dispersion in sales i.e. 4.7% in model versus 6.1% in data for import sourcing and 5.3% in model versus 7.3% for exporting. Finally, the model captures the firm-level correlation between export and import profiles (0.48 v.s. 0.40) and the exporter's (importer's) advantage in import (export) participation. In the data we documented in Table 2, having export/import experience in a country is associated to around 9 times higher probability to become an importer/exporter in the same country. The model aligns well in terms of the exporters' advantage (9.07 v.s. 9.32) and predicts a slight overshoot for the importers' advantage (12.8 v.s. 9.05).

Besides the targeted moments, the estimated model also capture the salient features

Table 9: Model Fit

Parameters	Model	Data
Panel A: Targeted moments		
Share of importers	0.12	0.11
Share of exporters	0.12	0.09
Share of importers (below median sales)	0.047	0.061
Share of exporters (below median sales)	0.053	0.073
Share of firms with actual median domestic input purchase	0.52	0.50
Within-firm export-import correlation	0.48	0.40
Ratio b/w share of exporters among importers and non-importers	12.8	9.05
Ratio b/w share of importers among exporters and non-exporters	9.07	9.32
Panel B: Non-targeted moments		
Share of two-way traders	0.04	0.04
Share of two-way traders among exporters	0.35	0.44
Share of two-way traders among importers	0.34	0.36
Number of export destinations, two-way trader over pure exporters	1.46	1.50
Number of sourcing origins, two-way trader over pure importers	1.49	1.50

Note: This table shows model fit on targeted and non-targeted moments. See Appendix C.2 for details on the construction of moments.

associated to two-way traders. Specifically, the model generated a 4.2% (unconditional) share of two-way trader and in data, the share is around 4.0%. Similar performance is observed if we look at conditional moments: in data, the share of two-way trader is 44% conditional on being exporters and that is 35% on being importers, and the model prediction is 36% and 34%, respectively. In both the model and the data, two-way traders on average export towards more markets (1.46 in the model and 1.50 in the data), and at the same time source from more origins (1.49 in the model and 1.50 in the data). In Appendix Table A5, we also check the hierarchy patterns in sourcing and exporting for Chinese firms. Our model does a reasonably good job in matching the observed hierarchy patterns on both sides.

Restricted Models In this section, we consider three alternative models where we separately let $\alpha_0 = 0$, $\alpha_1 = 0$ and both set to be zero. Specifically, for each version of the restricted models, we re-estimate the models using the same set of moments as the baseline model. When re-estimating the first two 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. For the last model where the feedback mechanism is muted from both sides, we also drop the firm-level correlation moment. 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, we follow an alternative estimation procedure when all the four types of models are estimated by targeting the same set of moment as in the baseline model, and we show that the associated quantitative implications are similar.

Table 10: Parameter Assignments and Moments

Parameters/Moments	Baseline	$\alpha_1 = 0$	$\alpha_0 = 0$	Restricted	Source/Data
Panel A: Assigned					
Pareto shape	4.25	4.25	4.25	4.25	Literature
Panel B: Reduced-form regression					
Demand elasticity	4.23	4.23	4.23	4.23	Estimation
Sourcing elasticity	1.07	1.07	1.07	1.07	Estimation
Panel C: SMM					
Demand scale	3.44	3.27	3.44	3.67	Estimation
	(0.150)	(0.050)	(0.021)	(0.047)	Estimation
Cost reduction (import-induced export)	0.41	0.29	0.00	0.00	Estimation
	(0.045)	(0.038)	(–)	(–)	Estimation
Cost reduction (export-induced import)	0.37	0.00	0.38	0.00	Estimation
	(0.025)	(–)	(0.014)	(–)	Estimation
Correlation of fixed costs	0.07	0.11	0.13	0.13	Estimation
	(0.004)	(0.005)	(0.007)	(0.011)	Estimation
Import: constant term	1.24	1.63	1.84	1.94	Estimation
	(0.050)	(0.012)	(0.018)	(0.018)	Estimation
Import: distance parameter	1.86	1.33	1.05	1.06	Estimation
	(0.008)	(0.003)	(0.003)	(0.004)	Estimation
Import: standard deviation	1.85	1.98	1.95	1.90	Estimation
	(0.013)	(0.008)	(0.009)	(0.010)	Estimation
Export: constant term	2.48	2.62	2.63	2.25	Estimation
	(0.055)	(0.026)	(0.022)	(0.024)	Estimation
Export: distance parameter	1.40	0.92	0.73	0.74	Estimation
	(0.014)	(0.010)	(0.007)	(0.007)	Estimation
Export: standard deviation	2.66	2.63	2.50	2.32	Estimation
	(0.020)	(0.012)	(0.010)	(0.011)	Estimation
Panel D: Targeted moments					
Share of importers	0.12	0.14	0.14	0.12	0.11
Share of exporters	0.12	0.16	0.16	0.16	0.09
Share of importers (below median sales)	0.047	0.053	0.051	0.042	0.061
Share of exporters (below median sales)	0.053	0.074	0.071	0.067	0.073
Share of firms with actual median domestic input purchase	0.52	0.55	0.52	0.47	0.50
Within-firm export-import correlation	0.48	0.22	0.28	0.18	0.40
Ratio b/w share of exporters among importers and non-importers	12.8	6.09	11.0	6.30	9.05
Ratio b/w share of importers among exporters and non-exporters	9.07	4.90	7.59	5.32	9.32

Note: This table shows parameterization for the baseline and the three restricted model. The second column shows the results for baseline. The third column lists the calibration for the model where we set $\alpha_1 = 0$. In the estimation, we drop the moment on the share of exporters (conditional on importer vs. non-importer, i.e., the moment with an asterisk superscript); The forth column considers a symmetric case where we set $\alpha_0 = 0$. The fifth column sets $\alpha_1 = 0$ and $\alpha_0 = 0$. The standard errors are reported in parentheses.

In Table 10, we report the parameter estimations and model fit of both baseline model and restricted models. It is clear that the restricted models, free from the moments associated with market-specific bilateral economies of scope, are also able to replicate other moments such as the exporter and importer shares. The performance is anticipated, given that all these models are built on the AFT framework and thus inherit the quantitative properties from it. For example, the non-market-specific force in AFT implies all the restricted models are important in capturing the relative number and size of two-way traders (14% in model and 11% in data). By estimating these restricted versions of models, we can isolate our model mechanism from the standard AFT framework through sequentially muting the market-specific bilateral economies of scope.

5.3 Rank-Rank Correlation

In this section, we assess model's ability to replicate the documented correlation in the rank of export destinations and sourcing origins. To answer that, we use the model-generated data to compute the number of exporters and importers in each foreign country. For all four types of models, we scatter-plot the export and import rankings of each foreign country. The result is presented in Figure 5 and we look at the conditional sample of two-way traders (i.e., firms sell to at least one foreign market and at the same time source from at least one foreign origin) for both the data and the models.

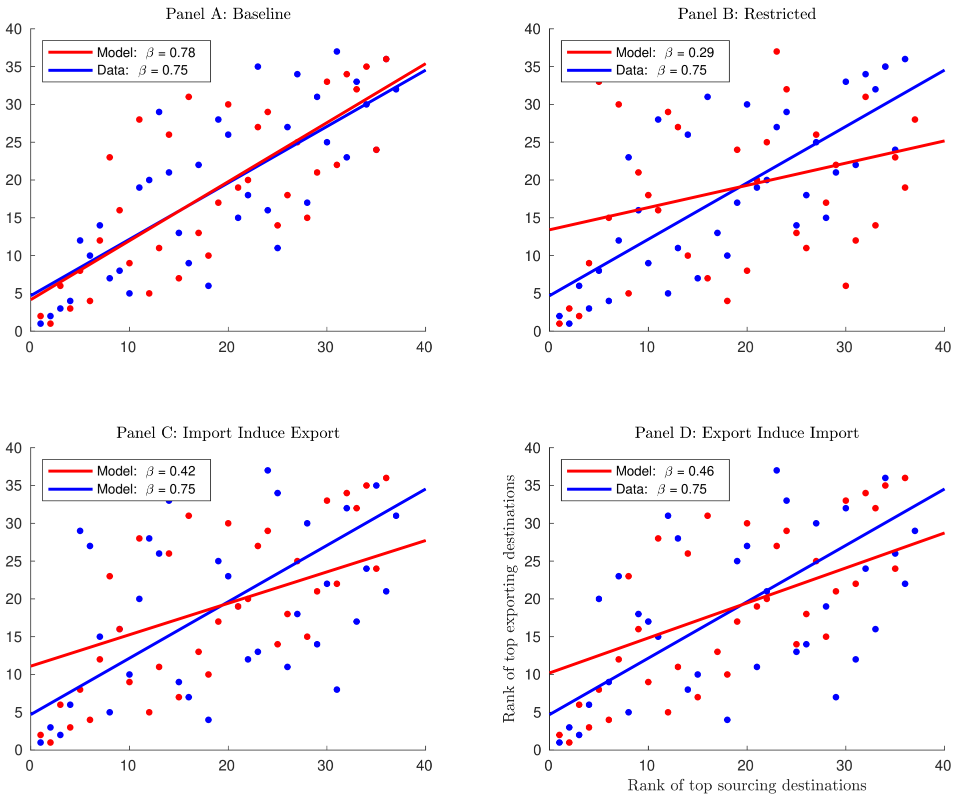
In the data that contains top trading partners with China, when rank of sourcing destination moves up by one, the rank of this country on the exporting destination list will on average increases by 0.75. The baseline model (in Panel A) closely traces this positive relationship, with a slight overshoot (0.78 for the model).[26]

The positive rank-rank relationship arising from the baseline model could be attributed by other channels that work independently from the market-specific economies of scope. For example, the correlation between a country's sourcing potential and sales potential in Figure 3 can lead to similar observations. To isolate this possibility from ours, 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 effect are muted. Because the only difference across these four models is whether there are bilateral, unilateral, or non-market specific economies of scope, the exercise thus helps to isolate our channels apart.

Panel B shows that without any fixed cost reduction mechanism, the restricted model explains around 40% (0.29/0.75) of the slopes in the data, which in turn implies that the bilateral cost reduction mechanism accounts for about the remaining 60%. Panel C and D alternately introduce unilateral economies of scope mechanism. The results suggest that one-sided cost reduction strengthens the positive relationship (0.46 for the import induced export and 0.42 for the other way around), but is insufficient to get the magnitude of the data.

[26] In Appendix C.4.1, 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).

Figure 5: 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 rankings 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.

In addition, these rank-rank relationships could also be a result of positive correlation between the market-specific fixed cost draws. Our estimation from Table 8 suggests a small ($\rho = 0.07$) correlation. That naturally leads to the issue regarding the potential downward bias of the fixed costs correlation parameter. In Appendix C.4.2, we conduct 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. Panel A of the table shows the rank-rank relationship (conditional on all exporters and importers) for all four types of models. We experiment the following correlation levels: $\rho \in \{0.0, 0.2, 0.4, 0.6, 0.8\}$, and all the rest values of the model are taken from our estimation. There are two points to note. First and perhaps not surprisingly, increasing the correlation parameter does make the model to better capture the rank-rank relationship, and this pattern largely holds for all four types of models. For example, for the second type of model (import to export), the rank-rank correlation increases from 0.2 to 0.4 when ρ increase from

0 to 0.40. But for it to deliver data-consistent rank-rank correlations, the cost draw needs to be very high. Panel B looks at the overall sample, where we find similar patterns exists. The results thus suggest that our proposed mechanism is quantitatively robust in terms of explaining the rank-rank fact 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 the 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 contributed 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, firm's trade decisions after 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 for answering this question. Our model provides an quantitative device as it incorporates firms' export and import participation with bilateral interdependence. We start the exercise by estimating the changes in trade costs.

Estimation of Trade Cost Changes 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 exporting) from 2001 to 2007 to represent the changes in τ_{ij}^M and τ_{jk}^X, respectively.[27] By this construction, the export tariff reduction is 15% and sourcing tariff reduction is 64%. There is no direct proxy for reductions in fixed cost. We thus infer the changes by looking at the foreign market participation rate by the Chinese firms. Specifically, we set the decrease in export fixed costs so that the model generates a change in 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 increases from 6.74% to 11.10%, and the share of exporters increases from 5.71% to 9.04%. The estimation shows that there is a 55% reduction for export fixed cost and 67% for import fixed cost.

Decomposition With the estimated reduction in tariffs and fixed costs, we conduct the following model-based decomposition. We first back out the *level* of country's sourcing and sales potentials as well as firm's fixed costs for 2001 by using the estimations of 2007 and the

[27] For import tariff, we take unweighted average MFN tariffs across HS-6 products in each year as average MFN tariff imposed by China. For export tariff, we unweighted average MFN tariffs across HS-6 products and across countries other than China in each year as average MFN tariff imposed by foreign country on China.

constructed trade cost changes.[28] We then feed the model with this pre-shock environment and solve the model, while keeping other model parameters constant. By this construction, country's sourcing and sales potentials and fixed costs are the only changing piece of the model that lead firms to shift their sourcing and exporting strategy.

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 in 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 the export-side shocks.

Table 11: Extensive Margin of Trade Liberalization

	Import liberalization	Export liberalization
Panel A: Baseline		
Number of exporters	0.043	0.957
Number of importers	0.959	0.041
Panel B: Restricted		
Number of exporters	0.015	0.985
Number of importers	0.987	0.013

Note: This table decomposes the extensive margin of trade into liberalization on sourcing and exporting side. The first column shows the contribution (in percent) of sourcing to exporter and importer entry.

Table 11 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 contribution of import liberalization in column (1). We also conduct similar exercise for the restricted model where $\alpha_0 = \alpha_1 = 0$, i.e., the bilateral economies of scope are muted.[29] The result is shown in Panel A. In the baseline model, sourcing liberalization has substantially larger impact on the exporter entry than the restricted model (4.3% v.s. 1.6%). Symmetrically, the baseline model also suggests larger contributions of export liberalization on the number of importers (4.1% v.s. 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, market-

[28] Recall that country's sourcing potential and sales potential are function of import and export tariffs, respectively.

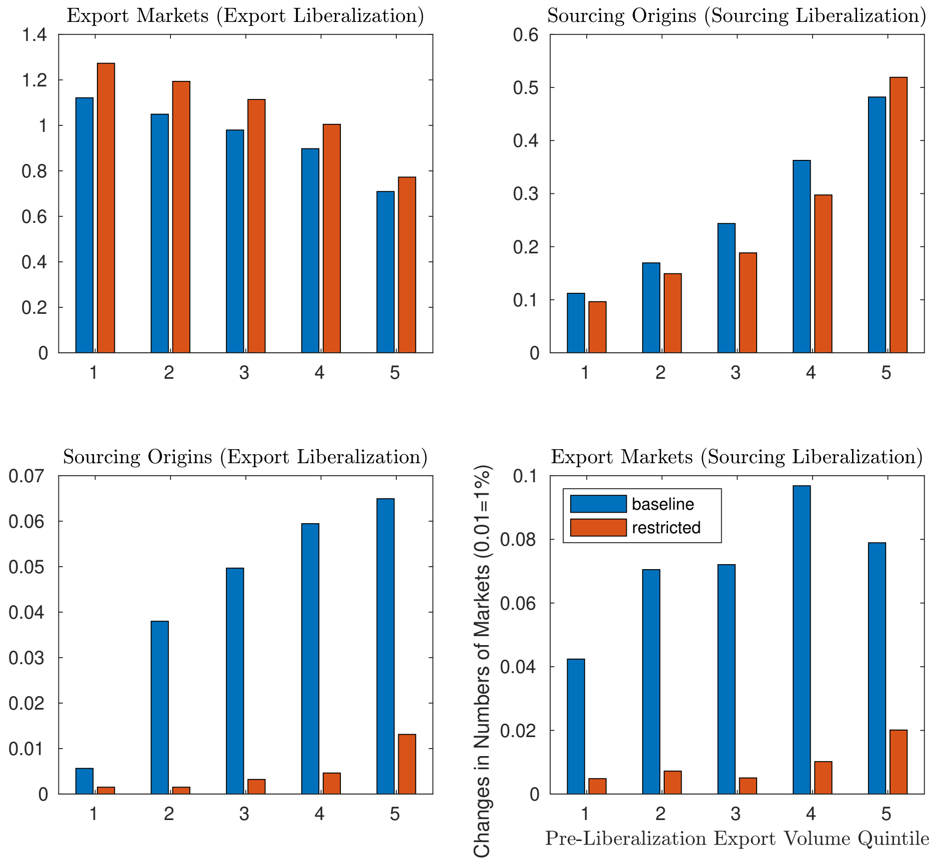
[29] In Appendix C.6, we report the decomposition result for the other two models with unilateral trade cost reduction, i.e. either $\alpha_1 = 0$ or $\alpha_0 = 0$.

specific 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.

The Mechanism To further understand the mechanisms behind the decomposition result, we separately shock the baseline and the restricted model by trade costs reductions (in both tariff and fixed costs) for sourcing and exporting, and we are interested in the effect of Chinese firms' foreign market participation (i.e., the number of sourcing origins and selling destinations). The first row of Figure 6 shows the direct effect of trade liberalization, where we chart the change in the number of sourcing origin after import liberalization and the change in the number of markets after export liberalization. Firms are categorized in 5 classes sorted by their pre-liberalization total sales (with 1 being the lowest and 5 being the highest). The associated response is contrasted for both the baseline and the restricted model. Note that the magnitude in the changes in foreign market participation is similar across the two types of the models.

This is anticipated, as firms in both models respond directly to the trade costs reductions. The result for the indirect effect, which is shown in the second row of Figure 6, is very different. Taking the export liberalization (the third panel by horizontal order) for example, export liberalization brings on average 4% increase in the number sourcing destination whereas the response of the restricted model is largely muted (around 0.5% on average). Symmetrically, import liberalization also induces around 6.5% more export destinations for the baseline and 1% for the restricted. The observed difference across the two types of models is largely derived from the bilateral cost reduction mechanism, in that trade liberalization from one side incentives market participation from the other side by lowering its fixed cost barriers.

Figure 6: Firm's Response to Trade Liberalization



Note: This figure plots the response of trading volume (export and sourcing), market accession (number of destinations and origins) for five groups of firms sorted by trading volume (with five being the highest). The blue-colored bars are for the baseline model and the yellow-colored bars are for the restricted model. The y-axises are in log deviations. All four panels share the same axis labels.

7 Conclusion

Our study highlights the linkage between firm's export and import activities, a force we call market-specific 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 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 market-specific bilateral economies. Second, the result that unilateral trade liberalization having a two-sided consequence implies our model can be extended to study the optimal trade policy issues. For example, cost reduction from a certain side of trade (either export or import) could be constrained or deemed too costly. Under these circumstances, policymaker's toolbox can be expanded by resorting to the corresponding policies from the other side of trade. Third, 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 on the questions such as the aggregate effects of a regional/preferential trade agreement.

References

Adda, J. and Cooper, R. (2003). *Dynamic Economics: Quantitative Methods and Applications*. The MIT Press.

Ahn, J., Khandelwal, A. K., and Wei, S.-J. (2011). The role of intermediaries in facilitating trade. *Journal of International Economics*, 84(1):73–85.

Albornoz, F., Pardo, H. F. C., Corcos, G., and Ornelas, E. (2012). Sequential exporting. *Journal of International Economics*, 88(1):17–31.

Amiti, M., Itskhoki, O., and Konings, J. (2014). Importers, exporters, and exchange rate disconnect. *American Economic Review*, 104(7):1942–78.

Amiti, M. and Konings, J. (2007). Trade liberalization, intermediate inputs, and productivity: Evidence from indonesia. *American Economic Review*, 97(5):1611–1638.

Antràs, P., Fadeev, E., Fort, T. C., and Tintelnot, F. (2022). Global sourcing and multinational activity: A unified approach. *NBER Working Paper Series*.

Antràs, P., Fort, T. C., and Tintelnot, F. (2017). The margins of global sourcing: Theory and evidence from us firms. *American Economic Review*, 107(9):2514–64.

Arkolakis, C., Eckert, F., and Shi, R. (2022). Combinatorial discrete choice: Multinational companies, plant fixed costs, and markups. *SSRN Working Paper Series*.

Bernard, A. B., Jensen, J. B., Redding, S. J., and Schott, P. K. (2009). The margins of us trade. *American Economic Review*, 99(2):487–93.

Bernard, A. B., Jensen, J. B., Redding, S. J., and Schott, P. K. (2018). Global firms. *Journal of Economic Literature*, 56(2):565–619.

Bils, M. and Klenow, P. J. (2000). Does schooling cause growth? *American economic review*, 90(5):1160–1183.

Brandt, L., Van Biesebroeck, J., Wang, L., and Zhang, Y. (2017). Wto accession and performance of chinese manufacturing firms. *American Economic Review*, 107(9):2784–2820.

Brandt, L., Van Biesebroeck, J., and Zhang, Y. (2012). Creative accounting or creative destruction? firm-level productivity growth in chinese manufacturing. *Journal of Development Economics*, 97(2):339–351.

Castellani, D. and Fassio, C. (2019). From new imported inputs to new exported products. firm-level evidence from sweden. *Research Policy*, 48(1):322–338.

Chaney, T. (2008). Distorted gravity: the intensive and extensive margins of international trade. *American Economic Review*, 98(4):1707–21.

Chaney, T. (2014). The network structure of international trade. *American Economic Review*, 104(11):3600–3634.

Chen, Z., Liu, Z., Suárez Serrato, J. C., and Xu, D. Y. (2021). Notching R&D investment with corporate income tax cuts in china. *American Economic Review*, 111(7):2065–2100.

Correia, S. (2015). Singletons, cluster-robust standard errors and fixed effects: A bad mix. *Duke University Working Paper*.

Costinot, A., Rodríguez-Clare, A., and Werning, I. (2020). Micro to macro: Optimal trade policy with firm heterogeneity. *Econometrica*, 88(6):2739–2776.

Das, S., Roberts, M. J., and Tybout, J. R. (2007). Market entry costs, producer heterogeneity, and export dynamics. *Econometrica*, 75(3):837–873.

De Loecker, J. and Warzynski, F. (2012). Markups and firm-level export status. *American Economic Review*, 102(6):2437–71.

Eaton, J., Eslava, M., Jinkins, D., Krizan, C. J., and Tybout, J. R. (2021). A search and learning model of export dynamics.

Eaton, J. and Kortum, S. (2002). Technology, geography, and trade. *Econometrica*, 70(5):1741–1779.

Eaton, J., Kortum, S., and Kramarz, F. (2011). An anatomy of international trade: Evidence from french firms. *Econometrica*, 79(5):1453–1498.

Fan, H., Li, Y. A., and Yeaple, S. R. (2015). Trade liberalization, quality, and export prices. *Review of Economics and Statistics*, 97(5):1033–1051.

Feenstra, R. C. and Romalis, J. (2014). International prices and endogenous quality. *Quarterly Journal of Economics*, 129(2):477–527.

Feng, L., Li, Z., and Swenson, D. L. (2016). The connection between imported intermediate inputs and exports: Evidence from chinese firms. *Journal of International Economics*, 101:86–101.

Garcia-Macia, D., Hsieh, C.-T., and Klenow, P. J. (2019). How destructive is innovation? *Econometrica*, 87(5):1507–1541.

Grieco, P. L., Li, S., and Zhang, H. (2022). Input prices, productivity, and trade dynamics: long-run effects of liberalization on chinese paint manufacturers. *The RAND Journal of Economics*, 53(3):516–560.

Jaffe, A. B. (1986). Technological opportunity and spillovers of R&D: evidence from firms' patents, profits and market value.

Jia, P. (2008). What Happens When Wal-Mart Comes to Town: An Empirical Analysis of the Discount Retailing Industry. *Econometrica*, 76(6).

Kasahara, H. and Rodrigue, J. (2008). Does the use of imported intermediates increase productivity? plant-level evidence. *Journal of Development Economics*, 87(1):106–118.

Liu, Q. and Qiu, L. D. (2016). Intermediate input imports and innovations: Evidence from chinese firms' patent filings. *Journal of International Economics*, 103:166–183.

Melitz, M. J. (2003). The impact of trade on intra-industry reallocations and aggregate industry productivity. *econometrica*, 71(6):1695–1725.

Morales, E., Sheu, G., and Zahler, A. (2019). Extended gravity. *The Review of Economic Studies*, 86(6):2668–2712.

Muûls, M. and Pisu, M. (2009). Imports and exports at the level of the firm: Evidence from belgium. *World Economy*, 32(5):692–734.

Pavcnik, N. (2002). Trade liberalization, exit, and productivity improvements: Evidence from chilean plants. *Review of Economic Studies*, 69(1):245–276.

Pierola, M. D., Fernandes, A. M., and Farole, T. (2018). The role of imports for exporter performance in peru. *World Economy*, 41(2):550–572.

Tintelnot, F. (2017). Global production with export platforms. *The Quarterly Journal of Economics*, 132(1):157–209.

Wooldridge, J. M. (1997). Multiplicative panel data models without the strict exogeneity assumption. *Econometric Theory*, 13(5):667–678.

Wooldridge, J. M. (2010). *Econometric analysis of cross section and panel data.* MIT press.

Yu, M. (2015). Processing trade, tariff reductions and firm productivity: Evidence from chinese firms. *Economic Journal*, 125(585):943–988.

Appendices

A Data Appendix

A.1 Data Description

We clean and construct the customs sample from the Chinese Customs Trade Statistics (2000-2015) as follows.

1. First, we restrict attention to records of ordinary trade only, and drop the two categories of processing trade: pure assembly (PA) and import and assembly (IA).

2. Second, the products in Chinese customs database are classified using Harmonized System (HS) code at the 8-digit level across years using different vintages (1996, 2002, 2007 or 2012). We aggregate the sample to firm-country-HS6 (6-digit) level within each year and then convert HS6 codes from different vintages to the 1996 vintage using publicly available correspondences tables from the UN Statistical Division.

3. Both the empirical and the model section focus on the sourcing of intermediates and the export of final goods. Therefore, for export, we only keep the consumption goods at HS6 level identified by Broad Economic Categories Rev. 4 (BEC4), and for import, we focus on the non-consumption goods imported by Chinese firms.

4. Following the method in Ahn, Khandelwal, and Wei (2011), we identify trade intermediaries based on their company names in customs sample and exclude such firms from our analysis.

5. Finally, we restrict our attention to a set of major trading partners with China. For each year from 2000 to 2015, we choose the top 30 export destinations in terms of export value and top 30 import sourcing origins in terms of import value for China. This leads to 59 unique foreign countries which, on average, cover over 93% of the annual export volume and over 96% of the annual import volume. When we conduct reduced-form regressions using the panel data in Fact 2, we choose to keep all 59 foreign countries. When we focus on cross-sectional data of 2007 in Fact 1, Fact 3 and quantitative analysis, we keep only top 30 export destinations and top 30 import sourcing origins, amounting to 36 foreign countries.

A.2 Unobserved Processing Trade

One potential concern about our study is that the correlation between firm's export and import decision in a foreign country may reflect the supply chain or offshoring contract which Chinese firms sign with foreign partner. Throughout the paper, we drop the observed processing trade records from the customs sample. Note that reporting transactions as processing trade exempts firms from tariff duty. Therefore, firm has incentive to over-report processing trade and dropping the observed processing trade records should be sufficient to exclude such mechanical linkages. To further address the issue of unobserved processing trade, we provide additional evidence as follows.

First, developed countries are more likely to sign supply contract with Chinese firms and we check whether the results are driven by those countries. Here we consider G7 as the major foreign partners of processing trade for China, and we repeat the baseline regressions by adding an interaction term between our variable of interest and dummy for G7. Columns (1)-(2) and (5)-(6) of Table A1 present the results and show that our variables of interest remain stable to taking into account primary supply contractors of China. Second, in the customs sample, some firms engage in both ordinary trade and processing trade. As we only exclude processing trade records from those firms, the resulting sample thus contains two types of firms: those who only do ordinary trade and the hybrid ones who do both. We additionally check whether the hybrid firms drive our empirical findings. We repeat the regression by adding an interaction term between our variable of interest and a dummy for processing trader (equals one if firm has any processing trade records on either export or import side). Columns (3)-(4) and (7)-(8) of Table A1 show that our variables of interest remain largely unchanged. Finally, if a majority of the trade linkages are unobserved processing subcontract, we should expect firms with more trade linkages (such as two-way traders) have lower mark-up compared to those with less trade linkages (such as pure exporter/importers). For example, Yu (2015) shows that Chinese firms with larger processing trade share experienced lower productivity growth after tariff reduction. In the merged sample, we estimate firm-level markup using the De Loecker and Warzynski (2012) method and find that the mean markup of two-way traders and pure exporters is 1.31 and 1.27 respectively, and the difference is statistically significant, suggesting the subcontract issue is not prevalent.

Table A1: Processing Trade and Bilateral Economies of Scope

Dependent Var.:	$\mathbb{I}\{\text{Exp.}_{fct} > 0\}$				$\mathbb{I}\{\text{Im.}_{fct} > 0\}$			
	LPM	Probit	LPM	Probit	LPM	Probit	LPM	Probit
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$\mathbb{I}\{\text{Imp.}_{fct-1} > 0\}$	0.013***	0.265***	0.018***	0.184***	0.055***	1.473***	0.055***	1.474***
	(0.002)	(0.004)	(0.002)	(0.006)	(0.004)	(0.004)	(0.004)	(0.004)
.× G7 Indicator$_c$	0.010***	0.045***						
	(0.002)	(0.005)						
.× Processing Trader$_{ft}$			-0.002	0.133**				
			(0.002)	(0.007)				
$\mathbb{I}\{\text{Exp.}_{fct-1} > 0\}$	0.060***	1.276***	0.060***	1.276***	0.005***	0.255***	0.004***	0.222***
	(0.003)	(0.004)	(0.003)	(0.004)	(0.001)	(0.004)	(0.001)	(0.006)
.× G7 Indicator$_c$					0.015***	0.067***		
					(0.003)	(0.005)		
.× Processing Trader$_{ft}$							0.006***	0.082***
							(0.001)	(0.006)
Constant	0.122***	-0.897***	0.122***	-0.890***	0.016	-0.875***	0.016	-0.874***
	(0.018)	(0.041)	(0.018)	(0.041)	(0.010)	(0.040)	(0.010)	(0.040)
Export Extended Gravity	YES	YES	YES	YES	NO	NO	NO	NO
Import Extended Gravity	NO	NO	NO	NO	YES	YES	YES	YES
Gravity Variables	YES	YES	YES	YES	YES	YES	YES	YES
Firm-level Controls	NO	YES	NO	YES	NO	YES	NO	YES
Firm-Year FE	YES	NO	YES	NO	YES	NO	YES	NO
Country-Year FE	YES	YES	YES	YES	YES	YES	YES	YES
Firm-Country FE	YES	NO	YES	NO	YES	NO	YES	NO
Obs.	11,650,553	13,244,910	11,650,553	13,244,910	10,515,452	11,764,732	10,515,452	11,764,732
Adj. R^2	0.574	-	0.574	-	0.609	-	0.609	-
Pseudo R^2	-	0.468	-	0.469	-	0.546	-	0.546

Note: This table presents additional tests on the unobserved processing trade. G7 indicator denotes whether country c is a G7 country. Processing trader dummy equals one if firm f engages in processing trade on either export or import side in year t. Extended gravity for distance$_{fct-1}$ is constructed following Chaney (2014) while the other variables of extended gravity are constructed after Morales, Sheu, and Zahler (2019). Export extended gravity variables are constructed using only firm's past export decisions while import extended gravity variables are constructed using only firm's past import decisions. 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 asterisk indicates significance at 1%(***), 5%(**) and 10%(*) level.

A.3 Linear Probability Model

We present the estimation results using linear probability model in Table A2 and A3. The advantage of using linear probability model is that we can add firm-year and firm-country fixed effects and use the code *reghdfe* developed by Correia (2015) in Stata to estimate the model efficiently.

Table A2: The Effect of Import Choice on Export Decision: LPM

	Dependent Var.: $\mathbb{I}\left\{\text{Exp.}_{fct} > 0\right\}$							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$\mathbb{I}\left\{\text{Imp.}_{fct-1} > 0\right\}$	0.117***	0.0722***	0.0722***	0.0169***	0.102***	0.0677***	0.0677***	0.0168***
	(0.0185)	(0.0130)	(0.0128)	(0.00152)	(0.0123)	(0.0108)	(0.0107)	(0.00151)
$\mathbb{I}\left\{\text{Exp.}_{fct-1} > 0\right\}$	0.542***	0.501***	0.501***	0.0600***	0.513***	0.481***	0.481***	0.0597***
	(0.0184)	(0.0136)	(0.0134)	(0.00253)	(0.0135)	(0.0106)	(0.0106)	(0.00280)
Exp. Ext. Distance_{fct-1}					-0.0218**	-0.0260**	-0.0254**	-0.00158
					(0.0102)	(0.0105)	(0.0104)	(0.00194)
Exp. Ext. $\text{Contiguity}_{fct-1}$					0.0382***	0.0386***	0.0389***	0.0189***
					(0.0118)	(0.00932)	(0.00921)	(0.00287)
Exp. Ext. Continent_{fct-1}					-0.00198	-0.00425	-0.00393	-0.00328***
					(0.00738)	(0.00732)	(0.00719)	(0.00115)
Exp. Ext. Com. Lang._{fct-1}					0.0172*	0.0138*	0.0129*	0.00317
					(0.00936)	(0.00707)	(0.00702)	(0.00243)
Exp. Ext. Income Group_{fct-1}					0.00832	-0.0114**	-0.0141**	-0.00681***
					(0.00566)	(0.00495)	(0.00537)	(0.00208)
Constant	0.210*	0.0489***	0.0502***	0.106***	-0.367**	0.280***	0.276***	0.122***
	(0.122)	(0.00363)	(0.00208)	(0.000318)	(0.174)	(0.0954)	(0.0944)	(0.0176)
Gravity Variables	YES	YES	YES	YES	YES	YES	YES	YES
Firm-Year FE	YES	YES	YES	YES	YES	YES	YES	YES
Country FE		YES				YES		
Country-Year FE			YES	YES			YES	YES
Firm-Country FE				YES				YES
Obs.	13,026,937	13,026,937	13,244,910	11,650,553	12,840,780	13,026,937	13,244,910	11,650,553
Adj. R^2	0.459	0.473	0.473	0.574	0.467	0.477	0.477	0.574

Note: This table presents the estimation results from specification (1) using linear probability model (LPM). The dependent variable is firm f's export dummy in country c at year t. Extended gravity for distance_{fct-1} is constructed following Chaney (2014) while the other extended gravity variables are constructed after Morales, Sheu, and Zahler (2019). 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 asterisk indicates significance at 1%(***), 5%(**) and 10%(*) level.

Table A3: The Effect of Export Choice on Import Decision: LPM

	Dependent Var.: $\mathbb{I}\left\{\text{Imp.}_{fct} > 0\right\}$							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$\mathbb{I}\left\{\text{Exp.}_{fct-1} > 0\right\}$	0.0640***	0.0382***	0.0381***	0.00909***	0.0572***	0.0366***	0.0365***	0.00899***
	(0.0130)	(0.00899)	(0.00880)	(0.00123)	(0.0102)	(0.00830)	(0.00816)	(0.00122)
$\mathbb{I}\left\{\text{Imp.}_{fct-1} > 0\right\}$	0.605***	0.560***	0.559***	0.0515***	0.588***	0.547***	0.547***	0.0554***
	(0.0174)	(0.0131)	(0.0129)	(0.00403)	(0.0149)	(0.0115)	(0.0114)	(0.00414)
Imp. Ext. Distance_{fct-1}					-0.00588	-0.00959	-0.00903	0.00561***
					(0.00645)	(0.00623)	(0.00614)	(0.00109)
Imp. Ext. $\text{Contiguity}_{fct-1}$					0.0404***	0.0425***	0.0428***	0.0171***
					(0.00963)	(0.00865)	(0.00863)	(0.00309)
Imp. Ext. Continent_{fct-1}					-0.00141	-0.00386	-0.00358	-0.000345
					(0.00498)	(0.00482)	(0.00473)	(0.00108)
Imp. Ext. Com. Lang._{fct-1}					0.00885	0.0132**	0.0131**	0.00306
					(0.00877)	(0.00657)	(0.00653)	(0.00214)
Imp. Ext. Income Group_{fct-1}					0.00175	-0.0130***	-0.0163***	-0.00493***
					(0.00355)	(0.00361)	(0.00411)	(0.00155)
Constant	0.433***	0.0314***	0.0251***	0.0646***	0.0828	0.120**	0.110*	0.0163
	(0.123)	(0.00318)	(0.00165)	(0.000272)	(0.171)	(0.0577)	(0.0569)	(0.0102)
Gravity Variables	YES	YES	YES	YES	YES	YES	YES	YES
Firm-Year FE	YES	YES	YES	YES	YES	YES	YES	YES
Country FE		YES				YES		
Country-Year FE			YES	YES			YES	YES
Firm-Country FE				YES				YES
Obs.	11,712,877	11,712,877	11,905,433	10,515,452	11,543,364	11,712,877	11,905,433	10,515,452
Adj. R^2	0.484	0.498	0.499	0.608	0.488	0.501	0.502	0.609

Note: This table presents the estimation results from specification (1) using linear probability model (LPM). The dependent variable is firm f's import dummy in country c at year t. Extended gravity for distance_{fct-1} is constructed following Chaney (2014) while the other extended gravity variables are constructed after Morales, Sheu, and Zahler (2019). 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 asterisk indicates significance at 1%(***), 5%(**) and 10%(*) level.

A.4 Construction of Extended Gravity Variables

This section constructs the extended gravity variables (recall that in the third and forth line of baseline specification (1), we include firm-country-specific gravity variables constructed from firm's past export or import network which are often referred to as "extended gravity" after Morales, Sheu, and Zahler (2019)). We focus on the construction of export-side extended gravity variables based on firm's past export network and the import-side ones are constructed in a similar way.

Following Chaney (2014), we first include the extended gravity variable of distance, Exp. Ext. Distance_{fct-1} which measures the average geographic distance between country c and firm's past export network. This is defined as

$$\text{Exp. Ext. Distance}_{fct-1} \equiv \frac{\sum_{c' \in \Omega} \mathbb{I}\left\{\text{Exp.}_{fc't-1} > 0\right\} \times \ln\left(\text{Distance}_{cc't-1}\right)}{\sum_{c' \in \Omega} \mathbb{I}\left\{\text{Exp.}_{fc't-1} > 0\right\}},$$

where $\text{Exp.}_{fc't-1}$ denotes firm f's export value to country c' in year $t-1$, Ω is the set of countries in our sample and $\ln\left(\text{Distance}_{cc't-1}\right)$ is log (population weighted) distance between country c and country c' that firm f exported to in year $t-1$. The indicator function $\mathbb{I}\left\{\text{Exp.}_{fc't-1} > 0\right\}$ equals to one if firm f exported to country c' at year $t-1$ and zero otherwise. As in Chaney (2014), we add another control for geographic remoteness of country c which is defined as

$$\text{Remoteness}_{ct-1} \equiv \frac{\sum_{c' \neq \text{CHN}} \ln\left(\text{Distance}_{cc't-1}\right)}{N_{c' \neq \text{CHN}}},$$

where CHN refers to China and $N_{c' \neq \text{CHN}}$ is the number of foreign countries in our sample. Remoteness_{ct-1} measures the average distance from country c to the countries other than China. This variable is absorbed in country-year fixed effects.

Following Morales, Sheu, and Zahler (2019), we include other extended gravity variables measuring geographic, cultural and economic similarity between country c and firm's past export network. These extended gravity variables are all dummy variables constructed from whether firm exported to any country that is adjacent to country c (Exp. Ext. $\text{Contiguity}_{fct-1}$), locates in the same continent as country c (Exp. Ext. Continent_{fct-1}), shares common official language with country c (Exp. Ext. Com. Lang._{fct-1}) or fall into same income group as country c (Exp. Ext. Income Group_{fct-1}). For instance, the extended gravity variable for contiguity, Exp. Ext. $\text{Contiguity}_{fct-1}$, equals to one if firm f exported to any country in year $t-1$ that is adjacent to country c and zero otherwise. The extended gravity variable for common language, Exp. Ext. Language_{fct-1}, equals to one if firm f exported to any country in year $t-1$ that shares a common official language with country c and zero otherwise.

A.5 Construction of Instrument Variables for System GMM

We show the construction of instrument variables used in system GMM estimation in this section. We follow Feng, Li, and Swenson (2016) and use two instrument variables: i) firm-country-specific import and export tariff exposure, and ii) firm-country-specific dummy for processing importer and processing exporters. When we study firm's export probability, the instrument variables used are firm-country-specific import tariff exposure and firm-country-specific dummy for processing importer. In the case when we study firm's import probability, the instrument variables used are firm-country-specific export tariff exposure and firm-country-specific dummy for processing exporter.

First, the firm-country-specific import tariff exposure is defined for some baseline year as follows.

$$\text{Import Tariff}_{fjt} = \sum_{h=1}^{H^M_{fj,t_b}} \left(\frac{\text{Imp.}_{fjh,t_b}}{\sum_{h=1}^{H^M_{fj,t_b}} \text{Imp.}_{fjh,t_b}} \text{Import Tariff}_{jht} \right),$$

where H^M_{fc,t_b} denotes the set of products firm f imports from foreign origin j in the base year t_b, $\text{Imp.}_{fjh,t_b}$ is the associated import value and $\text{Import Tariff}_{jht}$ is applied MFN tariffs on product h from origin j imposed by Chinese government. Similarly, firm-country-specific export tariff exposure is defined as

$$\text{Export Tariff}_{fkt} = \sum_{h=1}^{H^X_{fk,t_b}} \left(\frac{\text{Exp.}_{fkh,t_b}}{\sum_{h=1}^{H^X_{fk,t_b}} \text{Exp.}_{fkh,t_b}} \text{Export Tariff}_{kht} \right),$$

where H^X_{fc,t_b} denotes the set of products firm f exports towards foreign market k in the base year t_b, $\text{Exp.}_{fjh,t_b}$ is the associated import value and $\text{Export Tariff}_{jht}$ is applied MFN tariffs on product h from China imposed by foreign market k. Both tariffs are from the WTO Tariff Database. We choose $t_b = 2001$ as the base year.

Second, the firm-country-specific dummy for processing importer is defined as

$$\text{Processing Importer}_{fct-1} = \mathbb{I}\left\{\text{Value of processing import}_{fct-1} > 0\right\}.$$

The firm-country-specific dummy for processing exporter is defined in a symmetric way:

$$\text{Processing Exporter}_{fct-1} = \mathbb{I}\left\{\text{Value of processing export}_{fct-1} > 0\right\}.$$

The rationale for the two instrument variables are as follows. First, import tariff (export tariff) only directly affects firm's import decision (export decision). If market-specific bilateral economies of scope is present, then changes in either export or import tariff would affect firm's trade decision on the other side as well. Second, as in Feng, Li, and Swenson (2016), firm's processing import would arguably encourage only its ordinary import but do not directly affect its ordinary export. Through our channel, firm who engages in processing trade on import side in a foreign country is more likely to not only do ordinary import from the same country but also do ordinary export towards the same country. Similar assumption applies for processing exporter dummy.

In the baseline estimation of system GMM, we take firm's past trade decisions and all extended gravity variables as GMM-style instrument with maximum lag of 5, and consider standard gravity variables and the aforementioned IVs as IV-style instrument. Our key result of market-specific bilateral economies of scope remains stable to alternative specifications.

B Model Appendix

B.1 Solving the Free Entry Conditions

In this section, we show that J free entry conditions (17) deliver J unique aggregate demands across countries. Our strategy is to prove that taking as given the foreign demands $\{B_k\}_{k\neq i}$, the left-hand side of equation (17) is continuously non-decreasing in B_i. Then its valuation at constant $w_i f_{ei}$ gives us a unique equilibrium B_i. As a result, solving the system of J free entry conditions gives J unique B_i's.

The first step is to show the derivative of the left-hand side of equation (17) respect to B_i is positive. Note that we assume there is no iceberg trade cost or fixed cost of serving the domestic market, i.e. $\tau_{ii}^X = 1$ and f_{ii}^X=0, and the fixed cost for selling in any foreign market is sufficiently large even with import activity. Then all active firms including the least productive one in country i at least serve the domestic market. Combined with the condition that the least productive firm earns zero profit, the derivative of left-hand side of equation (17) with respect to B_i is

$$\int_{\tilde{\varphi}_i}^{\infty} \frac{\partial \left[\begin{array}{c} \varphi^{\sigma-1} \left(\gamma \Theta_i^M(\varphi)\right)^{\frac{\sigma-1}{\theta}} \Theta_i^X(\varphi) - w_i \sum_{k\in \mathsf{X}(\varphi)} f_{ki}^X - w_i \sum_{j\in \mathsf{M}(\varphi)} f_{ij}^M \\ +w_i \sum_{h\in \mathsf{X}(\varphi)\cap \mathsf{M}(\varphi)} \left(\alpha_0 f_{hi}^X + \alpha_1 f_{ih}^M\right) \end{array} \right]}{\partial B_i} dG_i(\varphi) > 0. \quad \text{(B.1)}$$

Note that the derivative is positive since raising B_i increases the profit of all firms. First of all, conditional on firms' export and import strategies, a higher domestic demand B_i directly raises total variable profit for all firms through the increases in sales potential $\Theta_i^X(\varphi)$. Secondly, for any levels of increase sales potential, firms' endogenous shift in trade strategies should brings additional gains in profit compared to the case when the trade strategies do not change. Also note that when $B_i \to 0$, firm cannot export to or source from any country and earn zero profit, and when $B_i \to \infty$, all firms include all countries into both export and import profile and earn infinite profit. Next we show the continuity of equation (B.1) by parts and conclude our proof. First, the variable profit is continuously differentiable for B_i. Its derivative with respect to B_i is

$$\int_{\tilde{\varphi}_i}^{\infty} \frac{\partial \left[\varphi^{\sigma-1} \left(\gamma\Theta_i^M(\varphi)\right)^{\frac{\sigma-1}{\theta}} \Theta_i^X(\varphi)\right]}{\partial B_i} dG_i(\varphi) =$$

$$\int_{\tilde{\varphi}_i}^{\infty} \frac{\partial \left[\varphi^{\sigma-1} \left(\gamma\Theta_i^M(\varphi)\right)^{\frac{\sigma-1}{\theta}} B_i + \varphi^{\sigma-1} \left(\gamma\Theta_i^M(\varphi)\right)^{\frac{\sigma-1}{\theta}} \left[\sum_{k\neq i} \left(\tau_{ki}^X\right)^{1-\sigma} B_k\right]\right]}{\partial B_i} dG_i(\varphi).$$

Note that change in B_i might affect firm profit discontinuously as it changes firm's export and import strategy. Following Antràs, Fort, and Tintelnot (2017), it can be shown that both $\Theta_i^M(\varphi)$ and $\Theta_i^X(\varphi)$ are non-decreasing in φ as firm's profit maximization problem (16) features increasing difference in $\left(\mathbb{I}_{ki}^X, \varphi\right)$ and in $\left(\mathbb{I}_{ij}^M, \varphi\right)$ for any k, j. As a result, there is strict hierarchy in firm's export and import decisions: for any $\varphi_1 \leq \varphi_2$, we have $\mathsf{M}(\varphi_1) \subseteq \mathsf{M}(\varphi_2)$ and $\mathsf{X}(\varphi_1) \subseteq \mathsf{X}(\varphi_2)$. Therefore, we must also have $\Theta_i^M(\varphi_1) \leq \Theta_i^M(\varphi_2)$ and $\Theta_i^X(\varphi_1) \leq \Theta_i^X(\varphi_2)$. We can further show that both $\Theta_i^M(\varphi)$ and $\Theta_i^X(\varphi)$ are also non-decreasing in domestic demand B_i. In other words, the variable profit $\varphi^{\sigma-1} \left(\gamma\Theta_i^M(\varphi)\right)^{\frac{\sigma-1}{\theta}} \Theta_i^X(\varphi)$ is a non-decreasing step function in φ and shows jump at different levels of $\varphi^{\sigma-1}B_i$. We focus the exhaustive case where there are $2J-1$ jumps in the profit function. Then firm's variable profit can be written as

$$\varphi^{\sigma-1} \left(\gamma\Theta_i^M(\varphi)\right)^{\frac{\sigma-1}{\theta}} \Theta_i^X(\varphi) = \begin{cases} \theta_1\varphi^{\sigma-1}B_i + \theta_1\varphi^{\sigma-1}B_i\left[\omega_1 - B_i\right] & \text{if } \varphi < b_1/B_i^{1/(\sigma-1)} \\ \theta_2\varphi^{\sigma-1}B_i + \theta_2\varphi^{\sigma-1}B_i\left[\omega_2 - B_i\right] & \text{if } b_1/B_i^{1/(\sigma-1)} \leqslant \varphi < b_2/B_i^{1/(\sigma-1)} \\ \ldots & \\ \theta_{2J}\varphi^{\sigma-1}B_i + \theta_{2J}\varphi^{\sigma-1}B_i\left[\omega_{2J} - B_i\right] & \text{if } b_{2J-1}/B_i^{1/(\sigma-1)} \leqslant \varphi \end{cases},$$

where θ_x denotes firm's sourcing capacity at interval x and ω_x denotes firm's sales capacity at interval x for $x = 1, 2, ..., 2J$.

Intuitively, as we move from less productive firms to more productive ones, previous analysis suggest that firm discontinuously add country to its export or import profile. Hence we can define the expected profit prior to entry as the sum of $2J$ continuous functions. In each one of them, firms with heterogeneous productivities have the same export and import profile. Then it is clear that the sum of those continuous functions which are differentiable with respect to B_i is also continuous in B_i.

As for the total fixed costs paid by firm, it is also continuously differentiable in B_i. Note that its derivative with respect to B_i is

$$\int_{\tilde{\varphi}_i}^{\infty} \frac{\partial \left[w_i \sum_{k\in\mathsf{X}(\varphi)} f_{ki}^X - w_i \sum_{j\in\mathsf{M}(\varphi)} f_{ij}^M + w_i \sum_{h\in\mathsf{X}(\varphi)\cap\mathsf{M}(\varphi)} \left(\alpha_0 f_{hi}^X + \alpha_1 f_{ih}^M\right)\right]}{\partial B_i} dG_i(\varphi). \tag{B.2}$$

An increase in B_i cannot possibly reduce the total fixed costs paid the firm as higher domestic profit induces firm to either export to or import from new country, which comes with additional fixed cost. Using the same logic as before, such derivative can be expressed as the sum of $2J$ functions continuous in B_i and shows jump at various levels. The derivative on fixed cost is therefore a continuous function on B_i. This concludes the proof that the domestic free entry condition delivers a unique B_i given the foreign aggregate demands.

B.2 Proof of Proposition 1

The following steps show the increasing difference property of firm's profit maximization problem (16) in $\left(\mathbb{I}_{ki}^X, \mathbb{I}_{ji}^X\right)$, $\left(\mathbb{I}_{ki}^X, \mathbb{I}_{ij}^M\right)$, and $\left(\mathbb{I}_{ik}^M, \mathbb{I}_{ij}^M\right)$ respectively, under the parameter constraint. In our context, the increasing difference property corresponds to the single crossing differences in choices (SCD-C) from below introduced by Arkolakis, Eckert, and Shi (2022), which is a pre-requisite to apply the "sandwitch" algorithm in Jia (2008).

Step 1. We show the profit function in (16) features increasing difference in $\left(\mathbb{I}_{ki}^X, \mathbb{I}_{ji}^X\right)$. Ceteris paribus, the marginal benefit of exporting to a market k is an increasing function of firm's decision of exporting to another market j. That is,

$$\pi_i\left(\mathbb{I}_{ki}^X=1, \mathbb{I}_{ji}^X=1\right)-\pi_i\left(\mathbb{I}_{ki}^X=0, \mathbb{I}_{ji}^X=1\right) \geqslant \pi_i\left(\mathbb{I}_{ki}^X=1, \mathbb{I}_{ji}^X=0\right)-\pi_i\left(\mathbb{I}_{ki}^X=0, \mathbb{I}_{ji}^X=0\right).$$

Plugging in the formulas for profits gives

$$\begin{aligned}
&\varphi^{\sigma-1}\left(\gamma \sum_{j=1}^{J} \mathbb{I}_{ij}^M T_j\left(\tau_{ij} w_j\right)^{-\theta}\right)^{\frac{\sigma-1}{\theta}}\left(\sum_{j'\neq j, j'\neq k} \mathbb{I}_{j'i}^X\left(\tau_{j'i}^X\right)^{1-\sigma} B_{j'}+\mathbb{I}_{ji}^X\left(\tau_{ji}^X\right)^{1-\sigma} B_j+\mathbb{I}_{ki}^X\left(\tau_{ki}^X\right)^{1-\sigma} B_k\right) \\
&-w_i\left(1-\alpha_0 \mathbb{I}_{ik}^M\right) f_{ki}^X(\omega)+w_i \alpha_1 \mathbb{I}_{ik}^M f_{ik}^M(\omega) \\
&-w_i\left(1-\alpha_0 \mathbb{I}_{ij}^M\right) f_{ji}^X(\omega)+w_i \alpha_1 \mathbb{I}_{ij}^M f_{ij}^M(\omega) \\
&-\left[\begin{array}{c}
\varphi^{\sigma-1}\left(\gamma \sum_{j=1}^J \mathbb{I}_{ij}^M T_j\left(\tau_{ij} w_j\right)^{-\theta}\right)^{\frac{\sigma-1}{\theta}}\left(\sum_{j'\neq j, j'\neq k} \mathbb{I}_{j'i}^X\left(\tau_{j'i}^X\right)^{1-\sigma} B_{j'}+\mathbb{I}_{ji}^X\left(\tau_{ji}^X\right)^{1-\sigma} B_j\right) \\
-w_i\left(1-\alpha_0 \mathbb{I}_{ij}^M\right) f_{ji}^X(\omega)+w_i \alpha_1 \mathbb{I}_{ij}^M f_{ij}^M(\omega)
\end{array}\right] \\
\geq &\varphi^{\sigma-1}\left(\gamma \sum_{j=1}^{J} \mathbb{I}_{ij}^M T_j\left(\tau_{ij} w_j\right)^{-\theta}\right)^{\frac{\sigma-1}{\theta}}\left(\sum_{j'\neq j, j'\neq k} \mathbb{I}_{j'i}^X\left(\tau_{j'i}^X\right)^{1-\sigma} B_{j'}+\mathbb{I}_{ki}^X\left(\tau_{ki}^X\right)^{1-\sigma} B_k\right) \\
&-w_i\left(1-\alpha_0 \mathbb{I}_{ik}^M\right) f_{ki}^X(\omega)+w_i \alpha_1 \mathbb{I}_{ik}^M f_{ik}^M(\omega) \\
&-\left[\varphi^{\sigma-1}\left(\gamma \sum_{j=1}^{J} \mathbb{I}_{ij}^M T_j\left(\tau_{ij} w_j\right)^{-\theta}\right)^{\frac{\sigma-1}{\theta}}\left(\sum_{j'\neq j, j'\neq k} \mathbb{I}_{j'i}^X\left(\tau_{j'i}^X\right)^{1-\sigma} B_{j'}\right)\right].
\end{aligned}$$

By cancelling common terms on both sides, it can be shown that the inequality hold. Also note that the above proof allows fixed costs of import and export to vary across firms and markets, which is captured by the $f_{ik}^M(\omega)$ and $f_{ji}^X(\omega)$ terms.

Step 2. We show if $0 < \alpha_0, \alpha_1 < 1$, the profit function also exhibits increasing difference in $\left(\mathbb{I}_{ki}^X, \mathbb{I}_{ij}^M\right)$ for any j and k. That is,

$$\pi_i\left(\mathbb{I}_{ki}^X = 1, \mathbb{I}_{ij}^M = 1\right) - \pi_i\left(\mathbb{I}_{ki}^X = 0, \mathbb{I}_{ij}^M = 1\right) \geqslant \pi_i\left(\mathbb{I}_{ki}^X = 1, \mathbb{I}_{ij}^M = 0\right) - \pi_i\left(\mathbb{I}_{ki}^X = 0, \mathbb{I}_{ij}^M = 0\right),$$

other things equal. It is equivalent to show that

$$\begin{aligned}
&\varphi^{\sigma-1}\left(\gamma\left(\sum_{j'\neq j}\mathbb{I}_{ij'}^M T_{j'}\left(\tau_{ij'}w_{j'}\right)^{-\theta} + T_j\left(\tau_{ij}w_j\right)^{-\theta}\right)\right)^{\frac{\sigma-1}{\theta}}\left(\sum_{k'\neq k}\mathbb{I}_{k'i}^X\left(\tau_{k'i}\right)^{1-\sigma}B_{k'} + \left(\tau_{ki}\right)^{1-\sigma}B_k\right)\\
&\quad - w_i\left(1-\alpha_0\mathbb{I}_{ik}^M\right)f_{ki}^X(\omega) + w_i\alpha_1\mathbb{I}_{ik}^M f_{ik}^M(\omega)\\
&\quad - w_i\left(1-\alpha_1\mathbb{I}_{ji}^X\right)f_{ij}^M(\omega) + w_i\alpha_0\mathbb{I}_{ji}^X f_{ji}^X(\omega) - \mathbb{I}\{k=j\}w_i\left(\alpha_0 f_{ki}^X(\omega) + \alpha_1 f_{ij}^M(\omega)\right)\\
&\quad - \left[\begin{array}{c}\varphi^{\sigma-1}\left(\gamma\left(\sum_{j'\neq j}\mathbb{I}_{ij'}^M T_{j'}\left(\tau_{ij'}w_{j'}\right)^{-\theta} + T_j\left(\tau_{ij}w_j\right)^{-\theta}\right)\right)^{\frac{\sigma-1}{\theta}}\left(\sum_{k'\neq k}\mathbb{I}_{k'i}^X\left(\tau_{k'i}\right)^{1-\sigma}B_{k'}\right)\\ -w_i\left(1-\alpha_1\mathbb{I}_{ji}^X\right)f_{ij}^M(\omega) + w_i\alpha_0\mathbb{I}_{ji}^X f_{ji}^X(\omega) - \mathbb{I}\{k=j\}w_i\left(\alpha_0 f_{ki}^X(\omega)\right)\end{array}\right]\\
\geqslant&\varphi^{\sigma-1}\left(\gamma\left(\sum_{j'\neq j}\mathbb{I}_{ij'}^M T_{j'}\left(\tau_{ij'}w_{j'}\right)^{-\theta}\right)\right)^{\frac{\sigma-1}{\theta}}\left(\sum_{k'\neq k}\mathbb{I}_{k'i}^X\left(\tau_{k'i}\right)^{1-\sigma}B_{k'} + \left(\tau_{ki}\right)^{1-\sigma}B_k\right)\\
&\quad - w_i\left(1-\alpha_0\mathbb{I}_{ik}^M\right)f_{ki}^X(\omega) + w_i\alpha_1\mathbb{I}_{ik}^M f_{ik}^M(\omega) - \mathbb{I}\{k=j\}w_i\left(\alpha_1 f_{ij}^M(\omega)\right)\\
&\quad - \left[\varphi^{\sigma-1}\left(\gamma\left(\sum_{j'\neq j}\mathbb{I}_{ij'}^M T_{j'}\left(\tau_{ij'}w_{j'}\right)^{-\theta}\right)\right)^{\frac{\sigma-1}{\theta}}\left(\sum_{k'\neq k}\mathbb{I}_{k'i}^X\left(\tau_{k'i}\right)^{1-\sigma}B_{k'}\right)\right].
\end{aligned}$$

Rearranging the inequality, we have, for $k \neq j$,

$$\begin{aligned}
&\varphi^{\sigma-1}\left(\gamma\left(\sum_{j'\neq j}\mathbb{I}_{ij'}^M T_{j'}\left(\tau_{ij'}w_{j'}\right)^{-\theta} + T_j\left(\tau_{ij}w_j\right)^{-\theta}\right)\right)^{\frac{\sigma-1}{\theta}}\left(\left(\tau_{ki}\right)^{1-\sigma}B_k\right)\\
\geqslant&\varphi^{\sigma-1}\left(\gamma\left(\sum_{j'\neq j}\mathbb{I}_{ij'}^M T_{j'}\left(\tau_{ij'}w_{j'}\right)^{-\theta}\right)\right)^{\frac{\sigma-1}{\theta}}\left(\left(\tau_{ki}\right)^{1-\sigma}B_k\right).
\end{aligned}$$

The above formula holds since $\sigma - 1 > 0$, which insures complementarity among firm's export and import decisions if export destination and import origin are not the same country. If $k = j$, we have

$$\begin{aligned}
&\varphi^{\sigma-1}\left(\gamma\left(\sum_{j'\neq j}\mathbb{I}_{ij'}^M T_{j'}\left(\tau_{ij'}w_{j'}\right)^{-\theta} + T_j\left(\tau_{ij}w_j\right)^{-\theta}\right)\right)^{\frac{\sigma-1}{\theta}}\left(\left(\tau_{ki}\right)^{1-\sigma}B_k\right) + \left(\alpha_0 f_{ki}^X(\omega) + \alpha_1 f_{ij}^M(\omega)\right)\\
\geqslant&\varphi^{\sigma-1}\left(\gamma\left(\sum_{j'\neq j}\mathbb{I}_{ij'}^M T_{j'}\left(\tau_{ij'}w_{j'}\right)^{-\theta}\right)\right)^{\frac{\sigma-1}{\theta}}\left(\left(\tau_{ki}\right)^{1-\sigma}B_k\right).
\end{aligned}$$

Therefore, if $0 < \alpha_0, \alpha_1 < 1$, the inequality holds. The existence of α_0, α_1 affects only the complementarity between export and import decision for the same country.

Step 3. Finally, we show the profit function also exhibits increasing difference in $\left(\mathbb{I}_{ij}^M, \mathbb{I}_{ik}^M\right)$ for any j and k. That is,

$$\pi_i\left(\mathbb{I}_{ik}^M = 1, \mathbb{I}_{ij}^M = 1\right) - \pi_i\left(\mathbb{I}_{ik}^M = 0, \mathbb{I}_{ij}^M = 1\right) \geqslant \pi_i\left(\mathbb{I}_{ik}^M = 1, \mathbb{I}_{ij}^M = 0\right) - \pi_i\left(\mathbb{I}_{ik}^M = 0, \mathbb{I}_{ij}^M = 0\right),$$

other things equal. It is equivalent to show that

$$\begin{aligned}
&\varphi^{\sigma-1}\left(\gamma\left(\sum_{j'\neq j, j'\neq k} \mathbb{I}_{ij'}^M T_{j'}\left(\tau_{ij'}w_{j'}\right)^{-\theta} + T_j\left(\tau_{ij}w_j\right)^{-\theta} + T_k\left(\tau_{ik}w_k\right)^{-\theta}\right)\right)^{\frac{\sigma-1}{\theta}}\left(\sum_{k=1}^{J}\mathbb{I}_{k'i}^X\left(\tau_{k'i}\right)^{1-\sigma}B_{k'}\right)\\
&-w_i\left(1-\alpha_0\mathbb{I}_{ik}^M\right)f_{ki}^X(\omega) + w_i\alpha_1\mathbb{I}_{ik}^M f_{ik}^M(\omega)\\
&-w_i\left(1-\alpha_1\mathbb{I}_{ji}^X\right)f_{ij}^M(\omega) + w_i\alpha_0\mathbb{I}_{ji}^X f_{ji}^X(\omega)\\
&-\left[\begin{array}{c}\varphi^{\sigma-1}\left(\gamma\left(\sum_{j'\neq j, j'\neq k}\mathbb{I}_{ij'}^M T_{j'}\left(\tau_{ij'}w_{j'}\right)^{-\theta} + T_j\left(\tau_{ij}w_j\right)^{-\theta}\right)\right)^{\frac{\sigma-1}{\theta}}\left(\sum_{k=1}^{J}\mathbb{I}_{k'i}^X\left(\tau_{k'i}\right)^{1-\sigma}B_{k'}\right)\\ -w_i\left(1-\alpha_1\mathbb{I}_{ji}^X\right)f_{ij}^M(\omega) + w_i\alpha_0\mathbb{I}_{ji}^X f_{ji}^X(\omega)\end{array}\right]\\
\geq&\varphi^{\sigma-1}\left(\gamma\left(\sum_{j'\neq j, j'\neq k}\mathbb{I}_{ij'}^M T_{j'}\left(\tau_{ij'}w_{j'}\right)^{-\theta} + T_k\left(\tau_{ik}w_k\right)^{-\theta}\right)\right)^{\frac{\sigma-1}{\theta}}\left(\sum_{k=1}^{J}\mathbb{I}_{k'i}^X\left(\tau_{k'i}\right)^{1-\sigma}B_{k'}\right)\\
&-w_i\left(1-\alpha_1\mathbb{I}_{ji}^X\right)f_{ij}^M(\omega) + w_i\alpha_0\mathbb{I}_{ji}^X f_{ji}^X(\omega)\\
&-\left[\varphi^{\sigma-1}\left(\gamma\left(\sum_{j'\neq j, j'\neq k}\mathbb{I}_{ij'}^M T_{j'}\left(\tau_{ij'}w_{j'}\right)^{-\theta}\right)\right)^{\frac{\sigma-1}{\theta}}\left(\sum_{k=1}^{J}\mathbb{I}_{k'i}^X\left(\tau_{k'i}\right)^{1-\sigma}B_{k'}\right)\right].
\end{aligned}$$

Similarly, it can be shown this is indeed the case if $\frac{\sigma-1}{\theta} \geq 1$.

B.3 Derivation of Gravity Equations

In this section, we focus on the derivation of the gravity equation for intermediate goods (25), and the one for final goods (29) can be derived in a similar way. Note rearranging equation (23) gives

$$M_{ij} = N_i \times (\sigma-1)\gamma^{\frac{\sigma-1}{\theta}}T_j(w_j)^{-\theta} \times \left(\tau_{ij}^M\right)^{-\theta} \times \Lambda_{ij}^M. \tag{B.3}$$

Define origin j's total production of intermediate goods as

$$Q_j \equiv \sum_k M_{kj} = (\sigma-1)\gamma^{\frac{\sigma-1}{\theta}}T_j(w_j)^{-\theta} \times \sum_k N_k\left(\tau_{kj}^M\right)^{-\theta}\Lambda_{kj}^M. \tag{B.4}$$

Hence, we have

$$(\sigma-1)\gamma^{\frac{\sigma-1}{\theta}}T_j(w_j)^{-\theta} = \frac{Q_j}{\sum_k N_k\left(\tau_{kj}^M\right)^{-\theta}\Lambda_{kj}^M}. \tag{B.5}$$

From the free-entry condition (17) and labor market clearing condition (18), we get the equilibrium number of entrants as

$$N_i = \frac{\eta w_i L_i}{\sigma \left(\int_{\underline{\varphi}_i}^{\infty} \varphi^{\sigma-1} \left(\gamma \Theta_i^M(\varphi) \right)^{\frac{\sigma-1}{\theta}} \Theta_i^X(\varphi) dG_i(\varphi) \right)}. \tag{B.6}$$

Country i's total expenditure on manufacturing sector is given by

$$E_i = \eta w_i L_i. \tag{B.7}$$

Rearranging the denominator of equation (B.6) gives

$$\begin{aligned}
&\sigma \left(\int_{\underline{\varphi}_i}^{\infty} \varphi^{\sigma-1} \left(\gamma \Theta_i^M(\varphi) \right)^{\frac{\sigma-1}{\theta}} \Theta_i^X(\varphi) dG_i(\varphi) \right) \\
= &\sum_{k=1}^{J} B_k \left(\int_{\underline{\varphi}_i}^{\infty} \mathbb{I}_{ki}^X(\varphi) \, \sigma \varphi^{\sigma-1} \left(\gamma \Theta_i^M(\varphi) \right)^{\frac{\sigma-1}{\theta}} \left(\tau_{ki}^X \right)^{1-\sigma} dG_i(\varphi) \right) \\
= &\sum_{k=1}^{J} B_k \times \frac{\sigma^{\sigma}}{(\sigma-1)^{\sigma-1}} P_{ki}^{1-\sigma} / N_i,
\end{aligned}$$

where the ideal export price index of goods exporting from country i to market k is defined as

$$\begin{aligned}
P_{ki}^{1-\sigma} &= N_i \int_{\underline{\varphi}_i}^{\infty} \mathbb{I}_{ki}^X(\varphi) \, p_{ki}^{1-\sigma}(\varphi) \, dG_i(\varphi) \\
&= N_i \int_{\underline{\varphi}_i}^{\infty} \mathbb{I}_{ki}^X(\varphi) \left(\frac{\sigma}{\sigma-1} \right)^{1-\sigma} \varphi^{\sigma-1} \left(\gamma \Theta_i^M(\varphi) \right)^{\frac{\sigma-1}{\theta}} \left(\tau_{ki}^X \right)^{1-\sigma} dG_i(\varphi).
\end{aligned}$$

Therefore

$$\begin{aligned}
N_i &= \frac{E_i}{\sum_{k=1}^{J} B_k \times \frac{\sigma^{\sigma}}{(\sigma-1)^{\sigma-1}} P_{ki}^{1-\sigma} / N_i} \\
&= \frac{E_i}{\frac{\sigma^{\sigma}}{(\sigma-1)^{\sigma-1}} \sum_k B_k \times \sum_{k=1}^{J} b_k \, P_{ki}^{1-\sigma} / N_i} \\
&\equiv \frac{E_i}{\frac{\sigma^{\sigma}}{(\sigma-1)^{\sigma-1}} \sum_k B_k \times \bar{P}_i^{1-\sigma} / N_i},
\end{aligned} \tag{B.8}$$

where $b_k \equiv \frac{B_k}{\sum_{i=1}^{J} B_i}$ and $\bar{P}_i^{1-\sigma} \equiv \sum_{k=1}^{J} b_k \, P_{ki}^{1-\sigma}$.

Finally, plugging $(\sigma-1)\gamma^{\frac{\sigma-1}{\theta}} T_j(w_j)^{-\theta}$ from equation (B.5) and N_i from equation (B.8) back into equation (B.3) yields the gravity equation (25) of intermediate goods.

C Estimation Appendix

C.1 Solution Algorithm

In this section, we list the steps in jointly solving a firm's export and import decisions. The algorithm is based on Proposition 1. The algorithm iterates an indicator vector, which contains all dummy variables that indicate a firm's exporting and sourcing status. Specifically, for firms indexed by φ_i and destination-specific exporting and sourcing cost draw $\varepsilon_i^s, \varepsilon_i^i$, we implement the following search algorithm:

1. we initialize two indication vectors: both of size $1 \times 2N$ (with the first $1 \sim N$ elements representing sourcing status and the remaining $N+1 \sim 2N$ elements representing the exporting status). The first vector $\mathcal{J}_l$ contains only zeros indicating firms neither export nor import; The second vector $\mathcal{J}_h$ contains only ones so that firms import from and export to all destinations.

2. starting from $\mathcal{J}_l$, we sequentially *add* sourcing and exporting destinations, depending on whether this action brings profit. We repeat this step until no room for improvement and label this final vector as $\mathcal{J}_l'$.

3. starting from $\mathcal{J}_h$, we sequentially *drop* sourcing and exporting destinations depending on whether this action brings profit. We iterate until no room for improvement and label this final vector as $\mathcal{J}_h'$.

4. if $\mathcal{J}_l = \mathcal{J}_h$, then the optimal decision is obtained, otherwise move to the next step

5. re-initialize $\mathcal{J} = \mathcal{J}_l' \cap \mathcal{J}_h'$, and scan through all the remaining combinations of exporting and sourcing decisions.

C.2 Moment Construction

Using the merged sample between Annual Survey of Industrial Enterprise and Chinese customs sample for the year 2007, we construct the moments as follows. First, it is straightforward to calculate the share of exporters and the share of importers in the sample. The share of exporters and the share of importers for those whose sales income are below median level can be calculated in a similar vein. We also calculate the share of Chinese firms exporting to and importing from each foreign country. The median level of domestic input purchase is directly observed in the data. By definition, the share of firms with domestic input purchase below this level is 0.5. Next, for each two-way trader, we observe its export and import strategies represented by two J-by-one vectors with each element indicating whether the firm exports to or imports from a foreign country. We calculate within-firm export-import correlation using Jaffe (1986)'s "closeness" measure for the two vectors. Then we take a simple average of this correlation across two-way traders as a targeted moment for α_0 and α_1. For the last two targeted moments: ratio between share of exporters among importers and non-importers, and ratio between share of importers among exporters and non-exporters. We use the same calculation as in Table 2. For each foreign country, we calculate the share of Chinese firms exporting to that country among those who import from the same country and among the others who do not. This leads to two conditional shares of exporters. Then we take simple average across foreign countries and calculate the ratio between these two cross-country mean-level conditional shares, i.e. ratio between share of exporters among importers and non-importers. The ratio between share of importers among exporters and non-exporters is calculated in a similar manner.

C.3 SMM Routine

Let $\Theta = \{\theta_1, \ldots, \theta_m\}$ represent parameters, and let $\mathbf{M} = \{\mathbf{m}_1, \ldots, \mathbf{m}_k\}$ represent moments. We numerically compute the following matrix containing derivatives of moments with respect to changes in parameters,

$$\frac{\Delta \mathbf{M}}{\Delta \Theta} = \begin{pmatrix} \frac{\Delta \mathbf{m}_1}{\Delta \theta_1} & \frac{\partial \mathbf{m}_1}{\partial \theta_m} \\ \cdots & \cdots \\ \cdots & \cdots \\ \frac{\partial \theta_k}{\partial \mathbf{m}_1} & \frac{\partial \mathbf{m}_k}{\partial \theta_m}. \end{pmatrix} \tag{C.1}$$

Then the standard error vector is given by

$$\sqrt{\mathrm{Diag}\left[\left(\frac{\Delta \mathbf{M}}{\Delta \Theta}\right)' \hat{\mathbf{W}}_{k\times k} \left(\frac{\Delta \mathbf{M}}{\Delta \Theta}\right)\right]}, \tag{C.2}$$

where

$$\hat{\mathbf{W}} = \begin{pmatrix} \frac{1}{\hat{\sigma}_1^2} & & & \\ & \ddots & & \\ & & \ddots & \\ & & & \frac{1}{\hat{\sigma}_k^2}. \end{pmatrix} \tag{C.3}$$

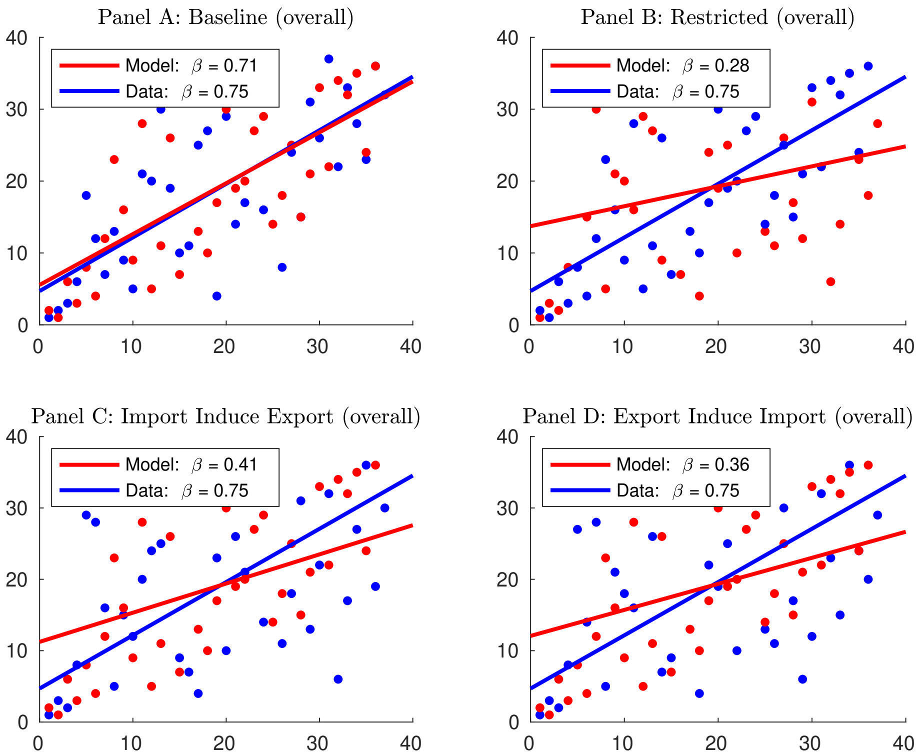
represents the weighting matrix for data. $\hat{\sigma}_k$ is the bootstrapped standard error for data moments.

C.4 Robustness of of the Estimation

C.4.1 Rank-Rank for Overall Firms

Figure A1 checks the robustness of the rank-rank correlation. In the text, the ranking of sourcing partners and exporting destinations is by the number of importers and exporters, respectively, and is for two-way traders only. In the following figure, we instead use the full sample including pure exporters and pure importers. We observe similar pattern.

Figure A1: Rank-Rank for Overall Firms



Note: This figure plots the rank-rank result. The ranking of sourcing partners and exporting destinations are by the number of importers and exporters, respectively, using overall sample.

C.4.2 Correlation Of Fixed Cost Draws

This section performs a comparative static analysis where we vary the positive correlations between the firm-level fixed cost draws. Table A4 reports the rank-rank correlation for different levels of correlation between the fixed cost draws.

Table A4: Rank-Rank Correlations for Correlated Fixed-Cost Shock Draws

Parameters	Baseline	$\alpha_1 = 0$	$\alpha_0 = 0$	Restricted	Data
Panel A: Number of exporters/importers; Overall sample					
$\rho = 0.00$	0.73	0.40	0.33	0.30	0.75
$\rho = 0.20$	0.74	0.40	0.38	0.29	0.75
$\rho = 0.40$	0.77	0.41	0.40	0.30	0.75
$\rho = 0.60$	0.83	0.45	0.47	0.31	0.75
$\rho = 0.80$	0.87	0.47	0.57	0.32	0.75
Panel B: Number of exporters/importers; Two-way traders only					
$\rho = 0.00$	0.76	0.42	0.42	0.31	0.75
$\rho = 0.20$	0.80	0.49	0.48	0.28	0.75
$\rho = 0.40$	0.85	0.53	0.56	0.36	0.75
$\rho = 0.60$	0.90	0.65	0.70	0.44	0.75
$\rho = 0.80$	0.93	0.74	0.79	0.54	0.75

Note: This table shows the rank-rank correlation when firms fixed cost draw on sourcing and exporting destinations are correlated.

C.4.3 Hierarchy Entry Pattern

Table A5 shows the hierarchical entry structure for both exporting and sourcing in model and in data.

C.5 Matching Identical Moments Across All Models

Table A6 lists the parameter assignments and estimations when all the four types of models are estimated by targeting the same set of moment (identical to the baseline model). In Figure A2, we plot the rank-rank relationship for the four models using the parameters in table A6.

Table A5: Hierarchy Structure in Importing and Exporting

	Baseline	$\alpha_1 = 0$	$\alpha_0 = 0$	Restricted	Data
Panel A: Importing					
1	100	100	100	100	100
1-2	4.32	2.55	2.22	2.01	2.92
1-2-3	0.29	0.19	0.17	0.17	0.57
1-2-3-4	0.048	0.028	0.030	0.028	0.52
1-2-3-4-5	0.012	0.006	0.005	0.006	0.64
Panel B: Exporting					
1	100	100	100	100	100
1-2	1.54	0.76	0.52	0.71	2.27
1-2-3	0.044	0.036	0.027	0.034	0.57
1-2-3-4	0.003	0.002	0.003	0.003	0.52
1-2-3-4-5	0.000	0.000	0.000	0.000	0.64

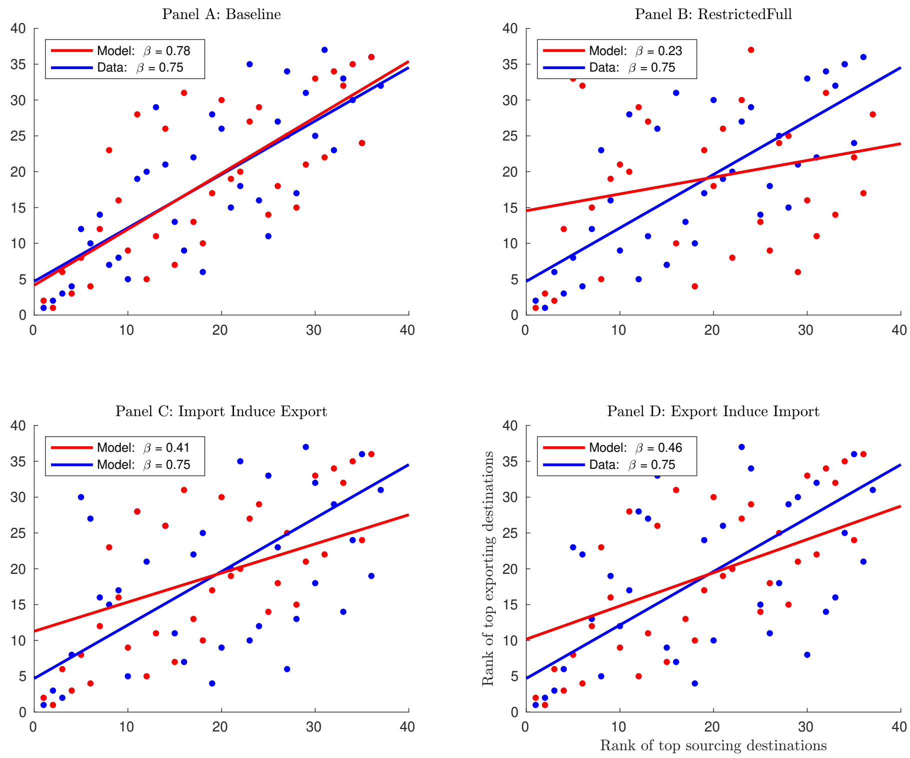
Note: This table shows the Chinese firms sourcing and exporting pattern from top origins and destinations. Panel A shows sourcing and Panel B shows exporting. The string 1 means importing to/exporting from top one countries but no other, and the string 1-2 means from/to top one and top two but no other; and so forth. All numbers are normalized by the first row.

Table A6: Parameter Assignments (Identical Moments)

Parameters/Moments	Baseline	$\alpha_1 = 0$	$\alpha_0 = 0$	Restricted	Source/Data
Panel A: Assigned					
Pareto shape	4.25	4.25	4.25	4.25	Literature
Panel B: Reduced-form regression					
Demand elasticity	4.23	4.23	4.23	4.23	Estimation
Sourcing elasticity	1.07	1.07	1.07	1.07	Estimation
Panel C: SMM					
Demand scale	3.44	2.46	2.59	2.76	Estimation
Cost reduction (import-induced export)	0.41	0.24	0.00	0.00	Estimation
Cost reduction (export-induced import)	0.37	0.00	0.29	0.00	Estimation
Correlation of fixed costs	0.07	0.13	0.14	0.12	Estimation
Import: constant term	1.24	2.03	2.30	2.41	Estimation
Import: distance parameter	1.86	1.66	1.30	1.33	Estimation
Import: standard deviation	1.85	1.49	1.47	1.44	Estimation
Export: constant term	2.48	3.20	2.85	1.81	Estimation
Export: distance parameter	1.40	0.73	0.84	0.56	Estimation
Export: standard deviation	2.66	2.71	2.60	1.99	Estimation
Panel D: Targeted moments					
Share of importers	0.12	0.02	0.02	0.01	0.11
Share of exporters	0.12	0.11	0.11	0.11	0.09
Share of importers (below median sales)	0.047	0.002	0.001	0.001	0.061
Share of exporters (below median sales)	0.053	0.047	0.045	0.032	0.073
Share of firms with actual median domestic input purchase	0.52	0.69	0.67	0.64	0.50
Within-firm export-import correlation	0.48	0.22	0.32	0.20	0.40
Ratio b/w share of exporters among importers and non-importers	12.8	20.9	28.5	25.1	9.05
Ratio b/w share of importers among exporters and non-exporters	9.07	12.5	20.7	19.1	9.32

Note: This table shows parameterization for the baseline and the three restricted model. The second column shows the results for baseline. The third column lists the calibration for the model where we set $\alpha_1 = 0$. In the estimation, we drop the moment on the share of exporters (conditional on importer vs. non-importer, i.e. the moment with an asterisk superscript); The forth column considers a symmetric case where we set $\alpha_0 = 0$. The fifth column sets $\alpha_1 = 0$ and $\alpha_0 = 0$. The standard errors are reported in parentheses.

Figure A2: Rank-Rank for Two-way Traders (Identical Moments)



Note: This figure plots the rank-rank result. The ranking of sourcing partners and exporting destinations is by the number of overall firms. All four panels share the same axis labels.

C.6 Decomposition of Models with Unilateral Economies of Scope

Table A7 shows the decomposition results from the two restricted models of unilateral economies of scope.

C.7 Sensitivity to Higher Demand Elasticity

Table A8 shows the parameter assignment for a larger value of σ. We re-estimate the model and obtain new parameter values. With this parameter assignment, Figure A3 presents the rank-rank correlation for the baseline model and restricted models.

Table A7: Extensive Margin of Trade Liberalization (Unilateral Scope)

	Import liberalization	Export liberalization
Panel A: $\alpha_1 = 0$		
Number of exporters	0.019	0.981
Number of importers	0.988	0.012
Panel B: $\alpha_0 = 0$		
Number of exporters	0.030	0.970
Number of importers	0.963	0.037

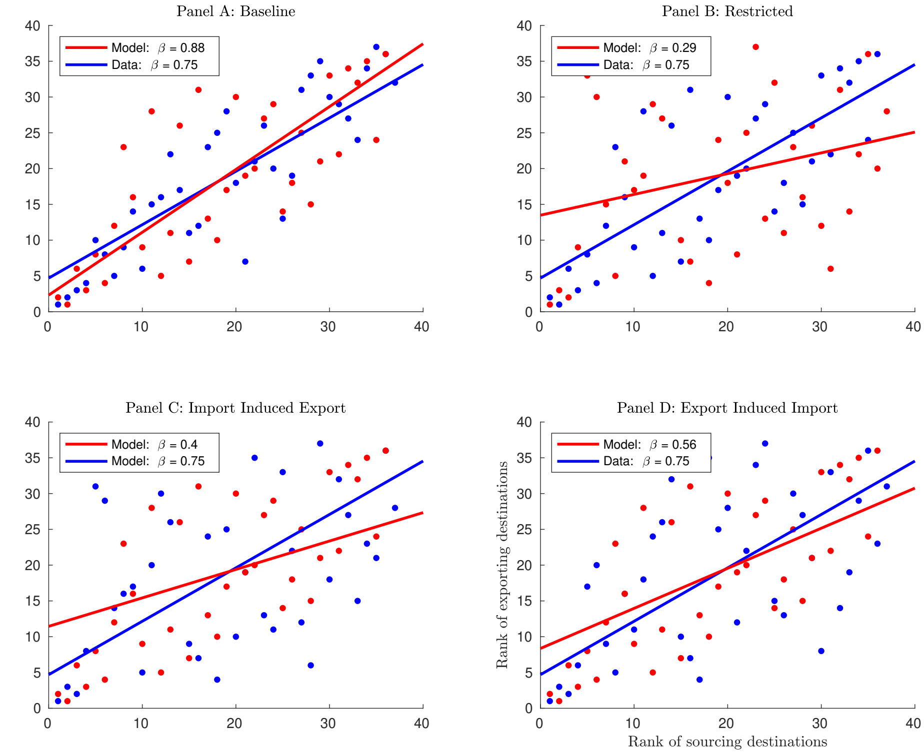
Note: This table decompose the extensive margin of trade into liberalization on sourcing and exporting side. The first column shows the contribution (in percent) of sourcing to exporter and importer entry; The second column is the contribution of export liberalization. The third and forth column are shows the associated numbers for the restricted model.

Table A8: Parameter Assignment: Alternative

Parameters	Symbols	Baseline	Source
Panel A: Assigned			
Pareto shape.	κ	4.25	Literature
Panel B: Reduced-form regressions			
Demand elasticity	σ	5.76	Estimation
Sourcing elasticity	θ	1.07	Estimation
Panel C: SMM			
Demand scale	$\tilde{B}_i$	2.59 (0.12)	Estimation
Cost reduction (import-induced export)	α_0	0.32 (0.12)	Estimation
Cost reduction (export-induced import)	α_1	0.28 (.059)	Estimation
Correlation of fixed costs	ρ	.063 (.013)	Estimation
Sourcing: constant term	β_C^M	1.55 (.053)	Estimation
Sourcing: coefficient of distance	β_d^M	2.33 (5e-3)	Estimation
Sourcing: standard deviation	β_{disp}^M	1.39 (.021)	Estimation
Export: constant term	β_C^X	3.09 (.098)	Estimation
Export: coefficient of distance	β_d^X	1.75 (.020)	Estimation
Export: standard deviation	β_{disp}^X	2.60 (.038)	Estimation

Note: This table shows the estimation of model parameters given a higher value of demand elasticity: 5.76 in this case versus 4.23 in the baseline.

Figure A3: Rank-Rank for Two-way Traders: Alternative



Note: This figure plots the rank-rank result given a higher value of demand elasticity: 5.76 in this case versus 4.23 in the baseline. The ranking of sourcing partners and exporting destinations is by the number of overall firms. All four panels share the same axis labels.