Foreign Ownership and Firm Response to Foreign Demand Shocks (Job Market Paper)

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Abstract

This paper studies firm response and welfare implication of foreign demand shocks in a developing country when foreign-owned firms repatriate their gains. Using an enterprise survey in Vietnam, I first show that trade activities in Vietnam are predominantly conducted by foreign-owned manufacturers rather than domestic ones, even conditional on firm size. Exploiting the US-China trade war episode in 2018-2019 as a positive foreign demand shock to all Vietnam-based manufacturers, I provide evidence that the positive responses in input sourcing, product export, and employment are mainly driven by foreign-owned manufacturers, especially Chinese manufacturers. Motivated by the findings, I develop and estimate a quantitative model of trade participation with foreign ownership, where domestic and foreign-owned firms differ in their productivity, fixed costs of sourcing and exporting, as well as whether they retain net profits in Vietnam. The welfare contribution of a simulated demand shock to Vietnam similar in magnitude to the trade war would be 15 percent higher if foreign-owned manufacturers were to retain all their profits locally.

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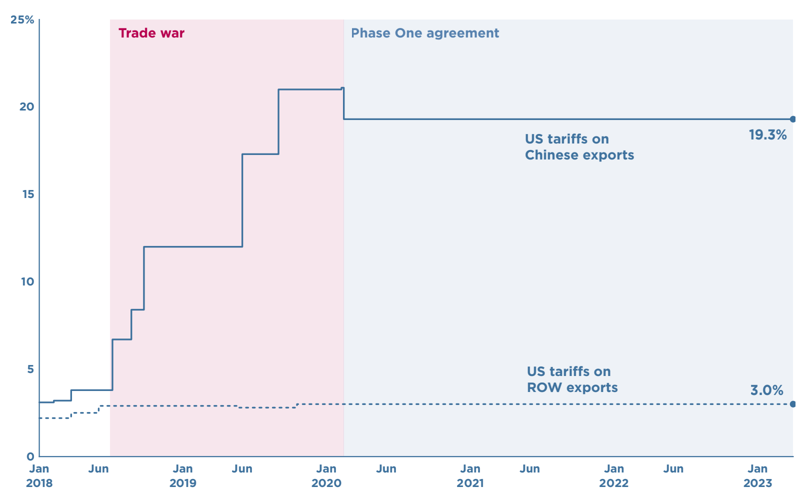
1 Introduction

The US-China trade war starting in 2018 completely changed the landscape of international trade. The Trump government imposed a series of tariffs on Chinese exports, raising the average import tariff from around 3 percent in early 2018 to over 20 percent by the end of 2019. During the same period, the average tariff level stayed pretty much constant for the rest of the world (see Figure 1). As a result, global trade and global value chains have been reallocating to some third countries producing close substitutes to Chinese exports according to recent research (Fajgelbaum et al., 2021; Alfaro and Chor, 2023). Theoretically, the trade war episode serving as a foreign demand shock to those third countries should reallocate resources to productive firms and raise their aggregate productivity and welfare (Melitz, 2003). It is thus intriguing to ask: What kind of firms are actually responding to the US-China trade war in bystander countries? How large are the welfare gains of the trade war in those bystander countries? My paper investigates the two questions focusing on a country that has been widely regarded as a major beneficiary of the trade war episode: Vietnam.

Figure 1: Average US Tariffs on Exports from China and Rest of the World, 2018-2022



NOTE: Constructed by Chad Bown with data from UN Comtrade, Trade Map, and Market Access Map. Link: https://www.piie.com/research/piie-charts/us-china-trade-war-tariffs-date-chart.

I provide novel evidence that the strong export response in Vietnam during the US-China trade war is mainly driven by foreign-owned manufacturers, especially Chinese manufacturers. The empirical analysis is conducted in two layers. At the product level, I use bilateral trade flows between Vietnam and the US/China/rest of the world (ROW) to show that (1)

Vietnamese exports to the US and ROW increased significantly in final goods subjected to the US import tariffs on Chinese exports, and (2) Vietnamese imports from China increased significantly in intermediates and capital goods subject to the same set of tariffs. The results are suggestive that some manufacturers in Vietnam adjusted their production in response to the trade war by importing cheap intermediates from China, assembling them in Vietnam, and selling the final products to the US and ROW. Then at the firm level, I utilize the Vietnam Enterprise Survey (VES) and construct a sectoral exposure measure to the US-China trade war to examine the production response of Vietnam-based manufacturers during the trade war period. On average, manufacturers in sectors more exposed to the trade war were found more likely to increase their employment and export sales. When breaking down the sample into domestic versus foreign-owned, it turns out that the positive response is mainly coming from foreign-owned manufacturers, with Chinese manufacturers exhibiting the strongest response.

The empirical findings raise a natural question: How much did Vietnam actually gain from the US-China trade war if most responses came from foreign-owned firms? Foreign-owned firms in general would not retain their profits locally besides paying taxes, and they could even shift their profits to affiliates in tax havens via accounting techniques such as transfer pricing to further reduce their tax burden in Vietnam. In fact, several large multinational enterprises (MNEs) have been subject to tax disputes with the Vietnamese government in recent years. A pronounced case is Coca-Cola, which was required by the General Department of Taxation to pay over 35 Million USD in fines and tax arrears in 2019.[1] This pressing issue to policymakers in Vietnam prompted their decision to join the OECD initiative of the global minimum tax (GMT) in 2021.[2] Set to start in 2024, Vietnam will follow other 142 countries in implementing a minimum income tax rate of 15 percent for all MNEs with more than 800 Million USD in annual revenues. Given the comprehensive practice of foreign profit shifting in Vietnam, conventional trade models that attribute all the profits made by foreign-owned firms to the host country could overpredict Vietnam's welfare gains.

To correctly quantify the welfare gains of the US-China trade war to Vietnam, I develop and estimate a quantitative model of trade participation with foreign ownership based on the global sourcing model by Antràs, Fort and Tintelnot (2017). There are several novel features of my model. First, I introduce the margin of exporting into the model. Final goods

[1]Coca-Cola has been operating in Vietnam since 1993 but only started reporting positive profits from 2013 onward. According to Vietnam's Ministry of Finance, 55 percent of foreign-owned businesses in Vietnam reported losses while having an average 13 percent increase in their revenues in 2020. See news report: https://vir.com.vn/coca-cola-continues-tax-haggle-with-gdt-82926.html.

[2]See news report: https://tinyurl.com/2hhbfb42.

producers choose whether to source their inputs and export their products abroad given their core productivity and fixed costs to participate in trade. The resulting profit function exhibits complementarity between the decision of sourcing and exporting, which echoes the empirical finding from the product-level analysis. Second, I introduce the distinction of domestic and foreign ownership. Final goods producers are either domestic or foreign-owned and draw their productivity and fixed costs from separate distributions, consistent with the findings from the firm-level analysis. Most importantly, the foreign-owned firms do not contribute their net profits to the aggregate income in the host country in the baseline model in contrast to the conventional quantitative models in trade, which typically do not allow for this distinction. The model parameters are then estimated via the simulated method of moments. The estimates confirm substantial differences in fixed costs by firm ownership, where the fixed costs to sourcing and exporting for foreign-owned manufacturers are only 19 percent and 7 percent of those for domestic manufacturers respectively.

With the parameter estimates, a counterfactual exercise is conducted to understand the welfare gains from the US-China trade war. I impose a positive foreign demand shock on my model, which induces an average export response that is similar in magnitude to what I estimated from the empirical analysis in 2017-2019. Lastly, I show that the real expenditure response to the foreign demand shock in Vietnam would have been 15 percent higher than the baseline if foreign-owned firms contributed all their profits to the aggregate income locally. I also found that differences in fixed costs between domestic and foreign-owned firms can explain about 40 percent of the differences in trade participation between the two groups of firms, much more than the 10 percent variation explained by productivity differences.

This paper makes contributions to at least three strands of literature. The first one is about the impact of the US-China trade war. Recent research highlights that the trade war led to complete tariff pass-through and substantial welfare losses for both the US and China (Amiti, Redding and Weinstein, 2019; Ma, Ning and Xu, 2021; Chang, Yao and Zheng, 2021; Fajgelbaum et al., 2020). Additionally, it had significant effects on third countries, with some engaging in "tariff hopping" and restructuring of the global value chains (Flaaen, Hortaçsu and Tintelnot, 2020; Fajgelbaum et al., 2021; Alfaro and Chor, 2023). Some recent studies zoom in on Vietnam and show that the trade war episode leads to export growth, increasing wages, improved labor conditions, as well as reallocation of workers into the formal manufacturing sector (Rotunno et al., 2023; Nguyen and Lim, 2023; Malesky and Mosley, 2021). To the best of my knowledge, this study is the first one to highlight that the positive trade and production response in Vietnam to the foreign demand shock induced by the trade war is mainly driven by foreign-owned firms and also the first one to provide a quantitative general equilibrium framework to study the welfare implication of the demand shock in an emerging economy with a large presence of foreign capital.

This paper also contributes to the extensive literature about trade liberalization and reallocation in developing countries (Atkin and Khandelwal, 2020; Atkin and Donaldson, 2022). In particular, McCaig and Pavcnik (2018) and McCaig, Pavcnik and Wong (2022) study the impact of the US-Vietnam Bilateral Trade Agreement (BTA) in 2001 on the Vietnamese economy and show that it expands the formal sector and encourages foreign firm entry due to improving exporting opportunities. My research echoes their empirical findings about the reallocation of resources toward foreign-owned firms in Vietnam and further digs into the welfare gains of a foreign demand shock with foreign profit shifting in a quantitative framework.

Lastly, the estimation results in my paper about the substantial differences in fixed costs by foreign ownership also add to recent work on the new sources of scale economies in trade (Morales, Sheu and Zahler, 2019; Antràs et al., 2022; Li et al., 2023). Although I did not explicitly study the underlying mechanisms for why foreign-owned firms have much lower fixed costs for sourcing and exporting activities, the results are consistent with the findings in those papers showing that MNEs are more likely to source from or export to regions whose characteristics are similar to their home countries or previous trading partners, where their affiliates are based, or where they had previous exporting experience.

The rest of the paper is organized as follows. Section 2 presents the data source and key descriptive facts. Section 3 exploits the US-China episode as a foreign demand shock to Vietnamese manufacturers and studies their trade and production response. Based on the empirical findings, Section 4 presents the theoretical framework. Section 5 describes the estimation details of model parameters. With the estimated model, Section 6 conducts the counterfactual exercise and welfare analysis. Section 7 concludes.

2 Data and Descriptive Facts

In this section, I introduce the main datasets that I use and provide three key descriptive facts about Vietnamese manufacturers. Some of these facts have been documented before by other papers, e.g. McCaig, Pavcnik and Wong (2022). Nonetheless, the objective is to highlight the distinction between domestic and foreign-owned firms in Vietnam and guide the intuition for the reduced-form analysis and theoretical framework in the following sections.

2.1 Data

For the majority of my empirical analysis, I use the Vietnam Enterprise Survey (VES) from 2010 to 2019. It includes all officially registered firms in Vietnam and provides data on firm ID, location, ISIC 4-digit industry classifications, and balanced sheets, offering a comprehensive view of the corporate landscape. Importantly, the survey asks about the main capital source country of the firms. I complement the VES with the Vietnam Technology and Competitiveness Survey (TCS) from 2009 to 2014, which covers a subset of firms from the VES and provides more trade-related information such as firms' sourcing and exporting activities. Additionally, I employ the CEPII BACI Database, which spans from 2010 to 2019, providing bilateral trade flow data by HS 6-digit product codes.

2.2 Descriptive Facts of Vietnamese Manufacturers

Fact 1. Foreign-owned manufacturers are larger than domestic ones.

In Table 1, I first examine the main outcomes for active manufacturers in Vietnam by ownership. Foreign-owned manufacturers are defined as the manufacturers in the VES data reporting 100 percent of their capital source from abroad, and domestic manufacturers are the non-foreign-owned manufacturers in the VES data.[3] On average, foreign-owned manufacturers in Vietnam are close to ten times larger than domestic manufacturers in employment, assets, and sales. In Panel (a) of Figure 2, I plot the employment distribution in 2017 and the shares of domestic and foreign-owned manufacturers in each percentile. Domestic manufacturers are mostly small in size, while foreign-owned manufacturers concentrate more on the top percentiles of the distributions.

[3]Most foreign direct investments in Vietnam are green fields. In Figure 8 of Appendix A, I show that foreign joint ventures in Vietnam account for a very small number in both firm counts and employment.

Fact 2. Foreign-owned manufacturers participate more in trade activities than domestic manufacturers conditional on firm size.

In Table 1, only about five percent of domestic manufacturers engage in import and export on average, while the numbers are over 60 percent for foreign-owned manufacturers. Furthermore, foreign-owned manufacturers are much more likely to participate in both import and export activities across all employment percentiles, as shown in Panel (b) of Figure 2.[4]

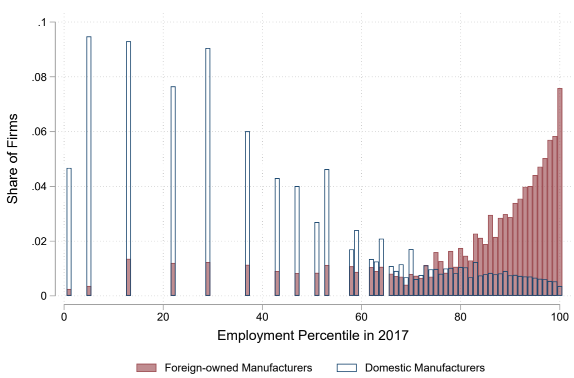
Table 1: Summary Statistics of Vietnamese Manufacturers in 2017

	Employment	Assets	Sales	1(Exporter)	1(Importer)
Domestic					
Mean	44	1442	1586	0.049	0.047
Median	7	122	75	0.000	0.000
SD	285	14400	20830	0.216	0.211
Observations	65628	65628	65628	65628	65628
Foreign-owned					
Mean	538	12578	18113	0.634	0.644
Median	106	1989	1861	1.000	1.000
SD	2121	138311	286455	0.482	0.479
Observations	6420	6420	6420	6420	6420

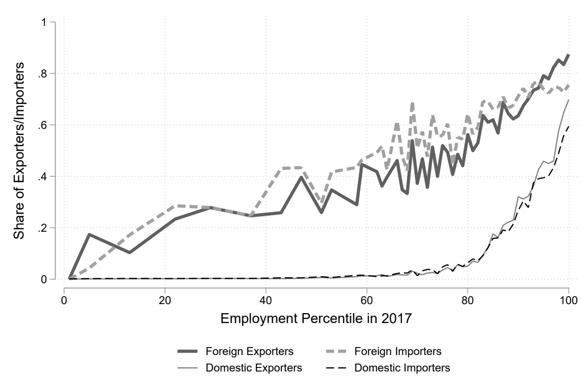
NOTE: Sample is Vietnamese manufacturers with positive employment, assets, and sales in the Vietnam Enterprise Survey. The unit of assets and sales is 1000 USD.

Figure 2: Employment Distribution and Trade Participation in 2017

(a) Employment Distribution



(b) Trade Participation



NOTE: Sample is Vietnamese manufacturers with positive employment, assets, and sales in the Vietnam Enterprise Survey.

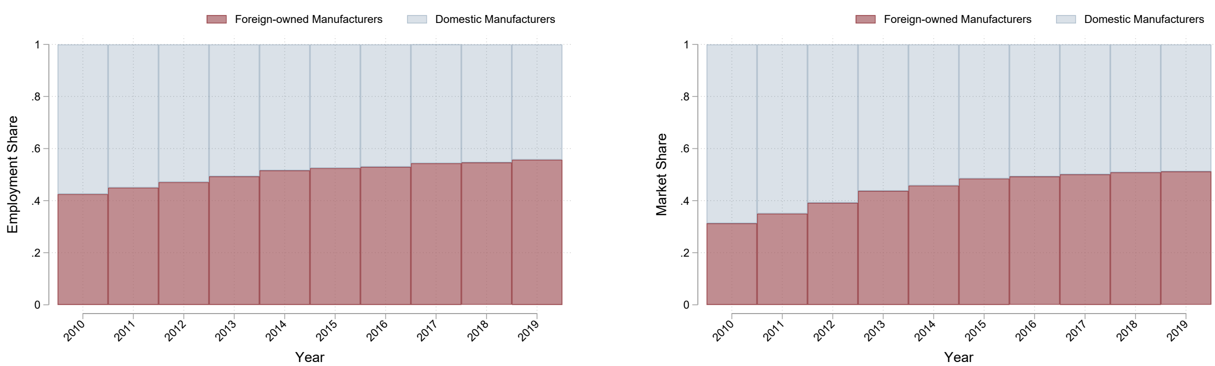
[4] In Figure 9 of Appendix A, I show that trade participation for foreign-owned firms is rising in 2017-2019.

Fact 3. Employment and market shares of foreign-owned manufacturers have been rising in the 2010s.

Figure 3 shows the employment and revenue share of domestic and foreign-owned manufacturers over time. Foreign shares have risen over time, accounting for over 50 percent of total manufacturing employment and sales in Vietnam by 2019, despite their firm count being much smaller.

Figure 3: Composition of Vietnamese Manufacturers By Ownership

(a) Employment **(b)** Sales



NOTE: Sample is Vietnamese manufacturers with positive employment, assets, and sales in the Vietnam Enterprise Survey from 2010-2019.

3 Reduced Form Analysis

In this section, I exploit the US-China trade war in 2018-2019 as a positive foreign demand shock to Vietnam and study the overall trade response at the product level as well as the production response from individual manufacturers in Vietnam. The product-level results highlight that the trade war triggers a rise in Vietnamese exports and imports. Moreover, the export response is stronger in final goods to the US, and the import response is stronger in intermediates from China. At the firm level, I also see that exposed foreign-owned manufacturers in Vietnam raise their employment and exports, with stronger responses from Chinese manufacturers.

3.1 Product-Level Trade Responses

Using the bilateral trade flow data from CEPII, I examine how the growth rate of Vietnamese trade with other countries responds to the US-China trade war at the product level. The following regression specification is adopted:

$$\begin{aligned}\frac{\Delta_{17,19} Y_p^{k,VN}}{\frac{1}{2}(Y_{p,17}^{k,VN} + Y_{p,19}^{k,VN})} =& \beta_0 + \beta_1 \, \Delta_{17,19} \log(1 + \tau_p^{US,CN}) \\ &+ \beta_2 \, \Delta_{17,19} \log(1 + \tau_p^{US,VN}) + \beta_3 \, \frac{\Delta_{13,15} Y_p^{k,VN}}{\frac{1}{2}(Y_{p,13}^{k,VN} + Y_{p,15}^{k,VN})} + \epsilon_p, \qquad (1)\end{aligned}$$

where $\Delta_{17,19} Y_p^{k,VN}$ is the difference in trade values of an HS 6-digit product p between Vietnam and the country k from 2017 to 2019, $\Delta_{17,19} \log(1+\tau_p^{US,CN})$ is the change of log US import tariff on export of product p from China, and $\Delta_{17,19} \log(1+\tau_p^{US,VN})$ is the change of log US import tariff on export of product p from Vietnam. To account for zero values for certain products in either 2017 or 2019, I use the Davis-Haltiwanger growth rate to measure the growth in trade values.[5] I further control for the growth rate from 2013 to 2015 to account for potential pre-existing trends before the trade war.

The corresponding estimates for β_0 and β_1 in Equation (20) are shown in Table 2. On the one hand, Vietnamese exports for a given product responded significantly to the rise in US import tariffs on the same product from China, especially for exports to the US and ROW. On the other hand, Vietnamese imports also rose in response to the US import tariffs, particularly imports from China. One standard deviation of the tariff change is about

[5] A difference-in-log measure which yields similar results. The tables are included in Appendix B.1.

7 percentage points, so a one-standard-deviation increase in the tariff contributes to export growth of 4.6 percent overall and 7.4 percent to the US on average as well as import growth of 1.7 percent overall and 3.5 percent from China on average. Using the business identifier code (BIC), I further separate the products into intermediates and final goods and run the same specification in Table 12 and Table 11 of Appendix B.1. It can be seen that the export response to the US is mostly driven by the final goods, while the import response from China is mainly driven by the surge in intermediate imports.

Table 2: Effect of the US Trade War Tariffs on Vietnamese Trade Value (All Products)

(a) Export Value

	(1)	(2)	(3)	(4)
	Total Export	Export to US	Export to CN	Export to ROW
$\Delta \log(1+\tau^{US,CN})$	0.649***	1.059***	0.561	0.516***
	(0.164)	(0.288)	(0.348)	(0.164)
Constant	0.083***	0.173***	0.115**	0.070***
	(0.025)	(0.038)	(0.050)	(0.025)
Observations	4217	1785	1664	4155
R^2	0.007	0.015	0.007	0.004

(b) Import Value

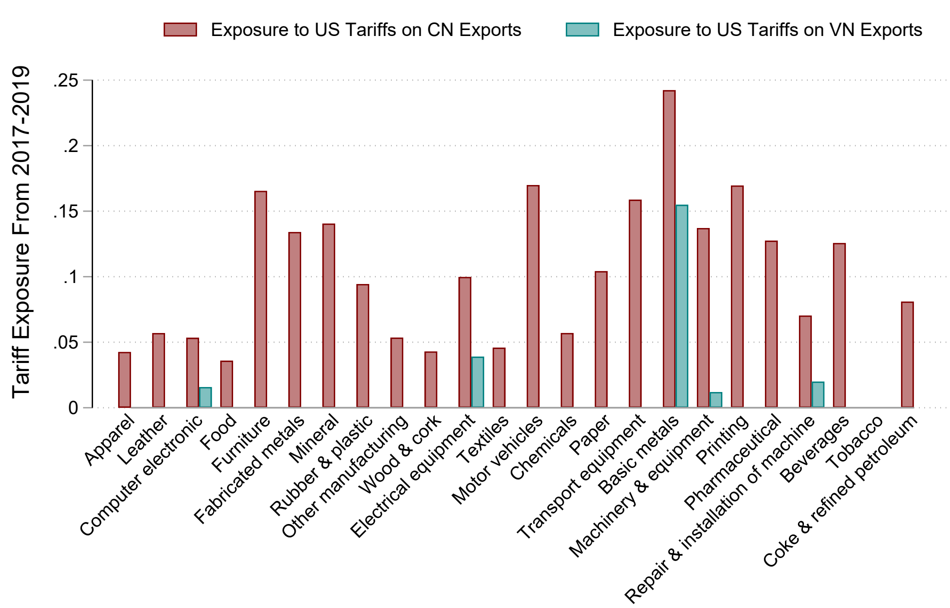
	(1)	(2)	(3)	(4)
	Total Import	Import from US	Import from CN	Import from ROW
$\Delta \log(1+\tau^{US,CN})$	0.241*	0.385	0.502***	-0.070
	(0.128)	(0.252)	(0.172)	(0.135)
Constant	0.076***	0.029	0.183***	0.019
	(0.022)	(0.041)	(0.028)	(0.023)
Observations	4871	2669	3976	4785
R^2	0.001	0.001	0.003	0.004

NOTE: Standard errors are clustered at the product level. CN stands for China, and ROW stands for rest of the world. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

3.2 Firm Level Responses

Because the VES data does not record the products that manufacturers produce, I have to define a measure that aggregates the product-level tariffs to the sector level. For each 4-digit ISIC manufacturing sector in Vietnam, I define its exposure to US import tariffs as a weighted average of product-level tariffs, with the weights given by the shares of Vietnamese export values to the US for every product within the given sector.[6] On average, manufacturers in our firm sample are exposed to an 8 percent and 0.3 percent increase in US import tariffs on Chinese and Vietnamese exports respectively in 2017-2019, as shown in Table 15 of Appendix B.2. The average tariff exposure for each 2-digit ISIC sector is illustrated in Figure 4. There are rich variations in the exposure to the US tariffs on Chinese exports, while the exposure to the tariffs on Vietnamese exports concentrates mostly on the sector of basic metals due to the steel and aluminum tariffs.

Figure 4: Sectoral Tariff Exposures By Manufacturing Sector in Vietnam



NOTE: Sectors are ordered by their total employment in Vietnam in 2017.

[6] Details of the measure are provided in Appendix B.2.

With the exposure measure, I study incumbent manufacturers' production and trade response with the following regression specification analogous to the trade-level analysis:

$$\begin{aligned}\frac{\Delta_{17,19} Y_{ijk}}{\frac{1}{2}(Y_{ijk,17}+Y_{ijk,19})} =& \beta_1\ \Delta_{17,19}\log(1+\tau_j^{US,CN}) + \beta_2\ \Delta_{17,19}\log(1+\tau_j^{US,VN}) \\ &+ \beta_3\ \frac{\Delta_{13,15} Y_{ijk}}{\frac{1}{2}(Y_{ijk,13}+Y_{ijk,15})} + X_{ik} + \epsilon_{ijk}, \end{aligned} \tag{2}$$

where i indexes a firm, j indexes an industry, and k indexes the location of the firm (provinces in this case). Similar to the trade-level analysis, I use the Davis-Haltiwanger growth rate for firm outcomes.[7] The outcomes of interests include employment, sales, export value, and import value. To avoid overrepresentation of extreme observations, all the outcomes are winsorized at their annual 1st and 99th percentiles. The control variables X_{ik} include the fixed effects of firm location, age, and size quintile in 2017. In addition, I also control for the outcome growth rate in 2013-2015 to address the concern of potential pre-trends.

In Table 3, the effects of tariff exposure on firm employment and sales are reported. Foreign-owned manufacturers were much more responsive to tariff exposure than domestic ones; on average, they increased their employment by 2.6 percent when their tariff exposure increased by one standard deviation. Manufacturers from China responded even more strongly, raising their employment by 6.5 percent and their sales by 7.6 percent.

In Table 4, the effects of tariff exposure on export and import growth are reported. Average manufacturers increased their exports by about 15 percent in response to a one-standard-deviation rise in tariff exposure. Exports by Chinese manufacturers rose by a staggering 40%. Surprisingly, average manufacturers' import values decreased. On the contrary, firms in the wholesale and retail sectors increased their imports significantly, suggesting that some manufacturers may have indirectly imported their inputs via the retailers.

[7] A difference-in-log measure yields similar results. The tables are included in Appendix B.2.

Table 3: Effect of the Trade War Tariffs on Employment and Sales Growth

(a) Employment Growth in 2017-2019

	(1) All	(2) Domestic	(3) Foreign	(4) CN	(5) Foreign\CN	(6) Wholesale
$\Delta \log(1+\tau^{US,CN})$	0.134	0.127*	0.375***	0.940*	0.286**	0.153
	(0.082)	(0.075)	(0.112)	(0.496)	(0.115)	(0.107)
Constant	-0.174***	-0.188***	-0.092***	-0.158***	-0.083***	-0.123***
	(0.008)	(0.008)	(0.012)	(0.058)	(0.013)	(0.007)
Province FE	Yes	Yes	Yes	Yes	Yes	Yes
Age FE	Yes	Yes	Yes	Yes	Yes	Yes
Size FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	30797	26947	3833	448	3370	56459
R^2	0.106	0.126	0.054	0.208	0.053	0.131

(b) Total Sales Growth in 2017-2019

	(1) All	(2) Domestic	(3) Foreign	(4) CN	(5) Foreign\CN	(6) Wholesale
$\Delta \log(1+\tau^{US,CN})$	-0.108	-0.126	0.137	1.087***	0.010	0.071
	(0.105)	(0.114)	(0.126)	(0.402)	(0.133)	(0.112)
Constant	-0.075***	-0.080***	-0.055***	-0.121**	-0.047***	-0.093***
	(0.012)	(0.013)	(0.014)	(0.049)	(0.014)	(0.006)
Province FE	Yes	Yes	Yes	Yes	Yes	Yes
Age FE	Yes	Yes	Yes	Yes	Yes	Yes
Size FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	30797	26947	3833	448	3370	56459
R^2	0.015	0.015	0.043	0.186	0.043	0.009

NOTE: Sample is Vietnamese manufacturers and wholesalers who were present in the Vietnam Enterprise Survey from 2013-2019 with positive employment, assets, and sales. Outcomes are winsorized at 1 and 99 percentile. Standard errors are clustered at the sector-region level. CN stands for China. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 4: Effect of the Trade War Tariffs on Export and Import Growth

(a) Export Growth in 2017-2019

	(1) All	(2) Domestic	(3) Foreign	(4) CN	(5) Foreign\CN	(6) Wholesale
$\Delta \log(1+\tau^{US,CN})$	2.072*	2.225*	1.929*	6.075***	1.551	-6.524***
	(1.177)	(1.225)	(1.119)	(1.639)	(1.178)	(1.716)
Constant	-0.595***	-0.766***	-0.457***	-0.815***	-0.421***	0.388***
	(0.128)	(0.125)	(0.145)	(0.141)	(0.153)	(0.138)
Province FE	Yes	Yes	Yes	Yes	Yes	Yes
Age FE	Yes	Yes	Yes	Yes	Yes	Yes
Size FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	5345	2359	2970	299	2663	942
R^2	0.071	0.100	0.071	0.197	0.073	0.130

(b) Import Growth in 2017-2019

	(1) All	(2) Domestic	(3) Foreign	(4) CN	(5) Foreign\CN	(6) Wholesale
$\Delta \log(1+\tau^{US,CN})$	-2.031*	-2.991**	-1.384	-4.307**	-0.912	3.072**
	(1.211)	(1.334)	(1.176)	(1.973)	(1.177)	(1.261)
Constant	0.310**	0.206	0.397***	0.559***	0.367**	-1.257***
	(0.153)	(0.177)	(0.147)	(0.198)	(0.151)	(0.039)
Province FE	Yes	Yes	Yes	Yes	Yes	Yes
Age FE	Yes	Yes	Yes	Yes	Yes	Yes
Size FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	5708	2564	3122	322	2788	2349
R^2	0.073	0.110	0.080	0.298	0.080	0.083

NOTE: Sample is Vietnamese manufacturers and wholesalers who were present in the Vietnam Enterprise Survey from 2013-2019 with positive employment, assets, and sales. Outcomes are winsorized at 1 and 99 percentile. Standard errors are clustered at the sector-region level. CN stands for China. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

3.3 Discussion of Empirical Findings

Overall, the reduced form analysis provides a complete picture of how Vietnam responded to the trade war in 2017-2019. The trade-level analysis indicates that Vietnam increased its imports from China, in particular in capital and intermediate goods, as well as its exports to the US and the rest of the world, in particular in final goods. This is supporting evidence of Vietnam-based firms reacting to the shock by sourcing cheaper inputs, assembling them locally, and exporting the final products to the world market. Furthermore, the firm-level analysis focusing on incumbent manufacturers shows a positive increase in employment, sales, and exports, mainly driven by foreign-owned manufacturers, with the Chinese firms exhibiting the strongest response. The strong employment rise rejects the claim that all these responses are merely repackaging and relabeling of products elsewhere. In fact, the employment and export responses are strongest in labor-intensive subsectors such as textile and apparel, shown in Table 18 of Appendix B.2. All these effects are estimated conditional on firm location, size, and age. This highlights the significant heterogeneity in the barrier to trade participation between domestic and foreign-owned firms.

One important caveat of the regression analysis is that it only captures the relative effects of tariff exposures, not the absolute effects. It is very likely that a foreign demand shock at the scale of the trade war could have a general equilibrium effect on products or sectors that are not directly exposed to the episode. To understand the overall welfare effect of a foreign demand shock, I develop a theoretical framework of firm participation with foreign ownership in the next section, taking into account the key empirical findings as well as the fact that foreign-owned firms do not contribute their net profits to local consumption.

4 Model of Trade Participation With Firm Ownership

The reduced-form analysis in the previous section confirms that firm response to foreign demand shocks can differ starkly by ownership in a developing country. To further understand the welfare implication of these responses, I develop a static framework of trade participation with foreign ownership based on the global sourcing model by Antràs, Fort and Tintelnot (2017). In the following, I will first describe the overall environment, then introduce the consumer demand and goods supply in detail, and lay out the general equilibrium conditions of the model.

4.1 Environment

There are two countries, home and abroad,[8] each with a representative consumer and a fixed mass of final good manufacturers. The consumer offers labor inelastically and consumes manufacturing varieties. Each final good manufacturer produces a single variety and engages in monopolistic competition. To produce a variety, the firm employs domestic workers to assemble a unit measure of inputs, which can be sourced either from home or abroad. After the products are produced, they can be sold either locally or overseas. Given the local and foreign demand, firms' variable profits are determined by their own core productivity, which is already known before they make any production decisions.

On top of the standard setting, each firm has an ownership status: domestic or foreign-owned. The ownership status matters in three key aspects. First, firms have to pay ownership-specific operation costs to become active in any production activities. They would rather stay inactive if they could not make positive profits net of the costs given their own productivity and consumer demand. The ownership-specific operation costs thus lead to self-selection into production by ownership and different productivity distributions for active domestic and foreign-owned firms. Second, a firm has to pay ownership-specific fixed costs of sourcing and exporting. This would generate self-selection into import and export activities. Lastly, domestic firms are owned by the representative household and hence their net profits will contribute wholly to domestic consumption; however, I assume that foreign-owned firms only contribute a constant share of their net profits to consumption in the home country. Later in Section 6, I vary the contributed share and examine the welfare implication to the home country.

[8] I do not call the other country "foreign" to avoid confusion with "foreign-owned" firms.

Before proceeding to the details of the model, the timing of firm decisions is summarized. First, all final good manufacturers draw their core productivity. Then they decide whether to pay the fixed operation costs and start producing their product. Once they become active in production, they choose whether to participate in trade activities, including sourcing some of their inputs and exporting their products abroad. Finally, firm profits are realized given their core productivity and trade participation decisions.

4.2 Consumer Demand

The representative consumer in country $k \in \{h, a\}$ has CES utility over differentiated manufacturing final goods:[9]

$$U_k = \left(\int_{\Omega} q_k(\omega)^{\frac{\sigma-1}{\sigma}} d\omega \right)^{\frac{\sigma}{\sigma-1}}, \tag{3}$$

where σ is the elasticity of substitution over varieties.

The representative consumer in each country maximizes their utility by choosing how much to consume for each variety given their budget constraint. This leads to the consumer demand for each variety ω:

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

where E_k is the total manufacturing expenditure, and P_k is the aggregate manufacturing price index. Following Cosar, Guner and Tybout (2016), I assume that home country is a small open economy and imports a fixed variety of final goods from abroad, N_a. As a result, the home-currency price index for imported final goods is $\tau^M \epsilon \, [\int_0^{N_a} p_a(\omega)^{1-\sigma} d\omega]^{\frac{1}{1-\sigma}}$, where ϵ is the exchange rate, and $p_a(\omega)$ is the free-on-board (FOB) price of imported variety $\omega \in [0, N_a]$. Analogously, the home-currency price index for local final goods is $[\int_{\Omega_h} p_h(\omega)^{1-\sigma} d\omega]^{\frac{1}{1-\sigma}}$, where Ω_h is endogenously determined by the measure of active manufacturers at home. Since the measure of foreign varieties and their FOB prices are exogenous to the model, $[\int_0^{N_a} p_a(\omega)^{1-\sigma} d\omega]^{\frac{1}{1-\sigma}}$ is normalized to one by choice of the foreign currency for simplicity.

[9] The main focus of this model is the home country, i.e. Vietnam. To avoid cumbersome notations, the country subscript below will be mostly omitted and only used when it is necessary. The setup for the other country in the model will be analogous.

Therefore, the aggregate price index at home is

$$P_h = \left[\int_{\Omega_h} p_h(\omega)^{1-\sigma} d\omega + (\tau^M \epsilon)^{1-\sigma} \right]^{\frac{1}{1-\sigma}}. \tag{5}$$

Following Antràs, Fort and Tintelnot (2017), a residual demand term is defined here which will be useful later:

$$B_k \equiv \frac{1}{\sigma} (\frac{\sigma}{\sigma - 1})^{1-\sigma} E_k P_k^{\sigma-1}. \tag{6}$$

4.3 Goods Supply

Each final good manufacturer at home makes a unique variety by hiring workers to assemble a continuum of intermediate inputs. They are indexed by their ownership status $i \in \{d, f\}$, i.e. domestic or foreign-owned. The marginal cost of a manufacturer of ownership status i with core productivity φ is thus given by:

$$c_i(\varphi) = \frac{1}{\varphi} w_h^{\gamma} \left(\int_0^1 z_i(\nu, \varphi)^{(1-\rho)} d\nu \right)^{\frac{1-\gamma}{1-\rho}}, \tag{7}$$

where γ is labor expenditure share and ρ is substitution elasticity between inputs. w_h is the wage rate of manufacturing workers at home, and $z_i(\nu, \varphi)$ is the price of a given input ν for a firm of ownership i and productivity φ.

Input producers are assumed to use only labor and engage in perfect competition. Therefore, the price of input ν that a manufacturer pays is:

$$z_i(\nu, \varphi) = \begin{cases} e_h(\nu) w_h & \text{if } J_i^M(\varphi) = 0 \\ \min\{e_h(\nu) w_h, \tau^M \epsilon e_a(\nu) w_a\} & \text{if } J_i^M(\varphi) = 1, \end{cases} \tag{8}$$

where τ^M is the iceberg trade cost of importing a unit of input ν from abroad, $\{e_h, e_a\}$ are the unit labor requirement of the input at home and abroad, and $J_i^M(\varphi)$ is an indicator of whether manufacturer with ownership i and productivity φ engage in import activities. Following Eaton and Kortum (2002), the unit labor requirements for each country are assumed to be drawn from the Fréchet distribution:

$$\Pr(e_k(\nu) \geq e) = \exp(-T_k e^{\theta}). \tag{9}$$

Then given its import status J_i^M, the import share of producer is:

$$\chi_i^M(\varphi) = \begin{cases} 0 & \text{if } J_i^M(\varphi) = 0 \\ \frac{(\tau^M \epsilon w_a)^{-\theta} T_a}{w_h^{-\theta} T_h + (\tau^M \epsilon w_a)^{-\theta} T_a} & \text{if } J_i^M(\varphi) = 1. \end{cases} \tag{10}$$

Taking the consumer demands at home and abroad as given, the final good manufacturer with ownership i and productivity φ engages in monopolistic competition with other firms. This leads to the constant markup pricing rule, i.e. $p(\varphi) = \frac{\sigma}{\sigma-1} c(\varphi)$. It is easy to show that the variable and net profit of the firm can be derived as follows:

$$\begin{aligned} \pi_v(\varphi, J_i^M, J_i^X) &= \left(\frac{\varphi}{w_h^\gamma \beta}\right)^{\sigma-1} \left(\underbrace{\frac{T_h}{w_h^\theta}}_{\Theta_h^M} + J_i^M \underbrace{\frac{T_a}{(\tau^M \epsilon w_a)^\theta}}_{\Theta_a^M} \right)^{\frac{(1-\gamma)(\sigma-1)}{\theta}} \left(\underbrace{B_h}_{\Theta_h^X} + J_i^X \underbrace{\frac{B_a}{(\tau^X)^{\sigma-1}}}_{\Theta_a^X} \right), \\ \pi_i(\varphi, J_i^M, J_i^X) &= \pi_v(\varphi, J_i^M, J_i^X) - w_h f_i^O - J_i^M w_h f_i^M - J_i^X w_h f_i^X \quad \forall i \in \{d, f\}, \end{aligned} \tag{11}$$

where β is some constant,[10] $J_i^X(\varphi)$ is an indicator of whether manufacturer with ownership i and productivity φ engage in export activities, $\{\Theta_h^M, \Theta_a^M\}$ are defined as the **sourcing potentials** at home and abroad, and $\{\Theta_h^X, \Theta_a^X\}$ are defined as the analogous **sales potentials**. Furthermore, manufacturers have to pay ownership-specific operation costs f_i^O to stay active in production. They also have to pay the sourcing and exporting fixed costs $\{f_i^M, f_i^X\}$ if they decide to participate in either of the activities, which are also different by ownership.

The following proposition shows that the trade participation decisions are complementary to each other and also to their own productivity. The proof is provided in Appendix C.

Proposition 1 *π_i has increasing differences in (φ, J_i^M), (φ, J_i^X), and (J_i^M, J_i^X). Therefore,*

1. *More productive manufacturers are more likely to participate in import and export.*
2. *Improvement in sales potential abroad weakly increases manufacturers' export and import participation.*

[10] $\beta \equiv \frac{1}{\gamma^\gamma (1-\gamma)^{1-\gamma}} \Gamma(\frac{\theta-\rho+1}{\theta})^{\frac{1-\gamma}{1-\rho}}$.

Lastly, the export share of firm (i, φ) can be derived as the following:

$$\chi_i^X(\varphi) = \begin{cases} 0 & \text{if } J_i^X(\varphi) = 0 \\ \frac{(\tau^X)^{1-\sigma} B_a}{B_h + (\tau^X)^{1-\sigma} B_a} & \text{if } J_i^X(\varphi) = 1. \end{cases} \tag{12}$$

4.4 Equilibrium

Fixed numbers of potential entrants $\{N_d, N_f\}$ are present at home with the knowledge of their own core productivity φ. A manufacturer will pay the associated operation costs f_i^O to stay active in production if their realized profit in equation (11) is weakly positive. Therefore, the domestic and foreign-owned manufacturers who earn zero profits will pin down the respective cutoff productivities $\{\underline{\varphi}_d^*, \underline{\varphi}_f^*\}$:

$$\pi_i(\underline{\varphi}_i^*, J_i^{M*}, J_i^{X*}) = 0 \quad \forall i \in \{\text{d}, \text{f}\}. \tag{13}$$

The trade balance condition requires the total amount of imports from abroad to equal the total amount of exports, which pins down the exchange rate ϵ^*.

$$\begin{aligned} &\sum_{i \in \{d,f\}} \underbrace{N_i \left[1 - G(\underline{\varphi}_i^*)\right]}_{\text{Number of active firms}} \int_{\underline{\varphi}_i^*}^{\infty} \underbrace{\chi_i^M(\varphi)(1-\gamma)\ (\sigma-1)\pi_v(\varphi, J_i^{M*}, J_i^{X*})}_{\text{Imported inputs}}\ dG(\varphi) + \underbrace{B_h^*(\tau^M \epsilon^*)^{1-\sigma}}_{\text{Imported final goods}} \\ &= \sum_{i \in \{d,f\}} N_i \left[1 - G(\underline{\varphi}_i^*)\right] \int_{\underline{\varphi}_i}^{\infty} \underbrace{\chi_i^X(\varphi)\sigma\pi_v(\varphi, J_i^{M*}, J_i^{X*})}_{\text{Exported final goods}}\ dG(\varphi). \end{aligned} \tag{14}$$

Because the trade balance condition holds, the aggregate expenditure at home equals the aggregate income at home, given by the sum of labor income and net profits from firms.

$$E_h^* = \underbrace{w_h L_h}_{\text{Labor income}} + \sum_{i \in \{d,f\}} N_i \left[1 - G(\underline{\varphi}_i^*)\right] \lambda_i \int_{\underline{\varphi}_i^*}^{\infty} \underbrace{\pi_i(\varphi, J_i^{M*}, J_i^{X*})}_{\text{Net profits}}\ dG(\varphi). \tag{15}$$

Note that λ_i is a number in $[0, 1]$, representing the share of profits that firms of ownership i contribute to expenditure in the home country. For the baseline specification, λ_d is set to one, and λ_f is set to zero. In Section 6, I will study the welfare implication of different λ_f.

The goods market clearing condition pins down the aggregate price index P_h^* and thus the residual demand at home B_h^* following equation (6).

$$
\begin{aligned}
E_h^* = \sum_{i\in\{d,f\}} N_i \left[1 - G(\underline{\varphi}_i^*)\right] \int_{\underline{\varphi}_i^*}^{\infty} \underbrace{(1-\chi_i^X(\varphi))\sigma\pi_v(\varphi, J_i^{M*}, J_i^{X*})}_{\text{Local final goods}} \, dG(\varphi) \\
+ \underbrace{B_h^*(\tau^M\epsilon^*)^{1-\sigma}}_{\text{Imported final goods}} .
\end{aligned}
\tag{16}
$$

Workers supply their labor inelastically given wages. The following labor market clearing must hold in equilibrium:

$$
\begin{aligned}
w_h L_h = \sum_{i\in\{d,f\}} \underbrace{N_i \left[1 - G(\underline{\varphi}_i^*)\right]}_{\text{Number of active firms}} \int_{\underline{\varphi}_i^*}^{\infty} \underbrace{w_h(f_i^O + J_i^{M*} f_i^M + J_i^{X*} f_i^X)}_{\text{Wages paid for fixed costs}} \\
+ \underbrace{\gamma(\sigma-1)\pi_v(\varphi, J_i^{M*}, J_i^{X*})}_{\text{Wages paid for final goods production}} + \underbrace{(1-\chi_i^M(\varphi))(1-\gamma)\,(\sigma-1)\pi_v(\varphi, J_i^{M*}, J_i^{X*})}_{\text{Wages paid for local input production}} \, dG(\varphi).
\end{aligned}
\tag{17}
$$

Wage is later normalized to unity, so labor serves as the numeraire of the model.

Lastly, the set of parameters in the model is defined as Λ, which includes the demand elasticity σ, the input trade elasticity θ, the labor expenditure share γ, the sourcing and sales potential abroad $\{\Theta_a^M, \Theta_a^X\}$, the fixed operation costs $\{f_d^O, f_f^O\}$, and the fixed sourcing and exporting costs $\{f_d^M, f_f^M, f_d^X, f_f^X\}$. This section concludes with the definition of the general equilibrium of this small open economy.

Definition 1 *Given the fixed number of entrants $\{N_d, N_f\}$ and the set of parameters Λ, the general equilibrium of the small open economy contains all manufacturers' optimal trade participation decisions $\{J_i^{M*}, J_i^{X*}\}$, the ownership-specific cutoff productivities $\{\underline{\varphi}_d^*, \underline{\varphi}_f^*\}$, the exchange rate ϵ^*, the aggregate expenditure at home E_h^*, and the aggregate price index at home P_h^* s.t.*

1. *$\{J_i^{M*}, J_i^{X*}\}$ maximize each manufacturer's profit in equation (11).*
2. *$\{\underline{\varphi}_d^*, \underline{\varphi}_f^*\}$ satisfy the zero profit conditions in equation (13).*
3. *ϵ^* ensures the trade balance condition in equation (14) is satisfied.*
4. *E_h^* satisfies the budget constraint in equation (15).*
5. *P_h^* ensures the goods market clearing condition in equation (16) is satisfied.*

5 Structural Estimation

In this section, I describe the estimation of the model parameters, which has two main parts. On the one hand, some parameters are estimated via country-level gravity regressions, including the sourcing and sales potentials abroad $\{\Theta_a^M, \Theta_a^X\}$, the demand elasticity σ, and input trade elasticity θ. On the other hand, the rest of the parameters are jointly estimated via the simulated method of moments (SMM). The first part of the estimation follows Antràs, Fort and Tintelnot (2017) very closely, so I relegate the details to Appendix D and focus on the second part of the estimation. I will first explain the parameterization of the productivity and fixed costs for domestic and foreign-owned manufacturers. The estimation procedure and results are then provided.

5.1 Parameterization

A manufacturer of ownership status $i \in \{d, f\}$ is assumed to draw their core productivity φ from a Pareto distribution with dispersion parameter κ. The manufacturer will not produce anything if the draw is below their ownership-specific productivity cutoff $\underline{\varphi}_i$ pinned down by the zero profit conditions in equation (13). In addition, firms also draw their sourcing and exporting fixed costs from two separate log-normal distributions. Specifically, the means of the log-normal distributions are parameterized as $\{\log \beta_{cons}^M + \log \beta_f^M \mathbb{1}(\text{Foreign-owned}), \log \beta_{cons}^X + \log \beta_f^X \mathbb{1}(\text{Foreign-owned})\}$. The additional coefficients for foreign-owned firms indicate their cost ratios relative to the domestic firms. Lastly, the variances of the log-normal distributions are denoted by $\{\beta_{disp}^M, \beta_{disp}^X\}$.

5.2 Simulation Procedure

Together with the labor expenditure share and manufacturing residual demand term, there are 11 remaining parameters to be estimated:
$\delta = [\underline{\varphi}_d, \underline{\varphi}_f, \kappa, \beta_{cons}^M, \beta_f^M, \beta_{disp}^M, \beta_{cons}^X, \beta_f^X, \beta_{disp}^X, \gamma, B_h]$. The parameters are estimated altogether by minimizing the following objective function:

$$\hat{\delta} = \arg\min_{\delta} \quad [m - \hat{m}(\delta)]^\top W [m - \hat{m}(\delta)], \tag{18}$$

where m is a vector of data moments, $\hat{m}$ is a vector of simulated moments, and W is the weighting matrix, which I opt for the identity matrix.

A total of 66,300 domestic firms and 6,400 foreign-owned firms are simulated, about the same as the number of active manufacturers in the 2017 VES data. Each firm draws its core productivity as well as sourcing and exporting fixed costs from the parameterized distributions.[11] Given the sourcing and sales potentials at home and abroad, they then decide whether to pay the associated costs and participate in import and export activities. With the simulated outcomes, I construct three sets of moments explained below.

5.3 Moments and Identification

The first set of moments concerns the estimation of productivity parameters $\{\underline{\varphi}_d, \underline{\varphi}_f, \kappa\}$. When productivity is distributed Pareto, the log share of firms with productivity larger than each productivity percentile will be proportional to the log percentile.[12] Since the firm productivity is unobserved from the data, I instead take advantage of the distribution of sales in the data and implement the following regression specification for each sales percentile by ownership:

$$\log \underbrace{Pr(\text{Sales} \geq x_i)}_{\text{Share of firms with sales more than percentile } x_i} = a_0 + a_1 \log x_i + \epsilon_i, \tag{19}$$

where x_i is a percentile of sales for firms of ownership i in the data. The estimates of a_0 and a_1 from the two regressions (in total four coefficients) are used as data moments. I conduct the same procedure with the simulated data and obtain the model moments.

The second set of moments deals with the fixed cost parameters $\{\beta^M_{cons}, \beta^M_f, \beta^M_{disp}, \beta^X_{cons}, \beta^X_f, \beta^X_{disp}\}$. To identify the average magnitude of sourcing and exporting fixed costs by firm ownership, I use the average shares of importers and exporters for domestic and foreign-owned firms in the 2017 VES data. Then to identify the dispersion of these fixed costs, I pick the shares of importers and exporters among domestic and foreign-owned firms with sales below the median in the 2017 VES data. The intuition for the latter moments is that an increase in dispersion will lead to more importers and exporters for firms below the median sales relative to those above the median when fixed cost draws are i.i.d. distributed. There are eight data moments used.

The last set of moments takes care of the labor expenditure share γ and manufacturing

[11] Note that the ownership-specific productivity cutoffs $\{\underline{\varphi}_d, \underline{\varphi}_f\}$ are also the scale parameters for the productivity distributions of active firms. Therefore, the estimation of productivity parameters $\{\underline{\varphi}_d, \underline{\varphi}_f, \kappa\}$ can be treated as estimating two different Pareto distributions with different scales and the same dispersion.

[12] If φ is distributed Pareto with scale $\underline{\varphi}_i$ and dispersion κ, then $\log Pr(\varphi \geq x) = \kappa \log \underline{\varphi}_i - \kappa \log x$.

residual demand at home B_h. Intuitively, I use the average wage bill over sales ratio from the 2017 VES data as the moment to identify the labor expenditure share in the model. For the latter parameter, I adopt the share of firms with annual domestic sales less than the median (79K USD) in the 2017 VES data. This moment from the data is simply 0.5 by construction, but in the model, the domestic demand term that governs the magnitude of domestic sales will have to adjust to make the simulated moment close to the data moment. In total, 14 moments are used in the SMM to estimate 11 parameters.

5.4 Estimation Results

The estimation results are summarized in Table 5. Regarding the productivity parameters, the productivity cutoff of foreign-owned firms is higher than the domestic firms, reflecting their higher productivity. Then note that the estimates of fixed cost parameters reveal substantial differences between domestic and foreign-owned firms. In particular, β_f^M and β_f^X indicate that the sourcing and exporting costs for foreign-owned firms are only about 19 percent and 7 percent of the domestic firms' costs respectively.[13]

The median sourcing and exporting fixed costs are shown in Table 6. Consistent with our parameter estimates, foreign-owned firms have significantly lower fixed costs, ranging from 35-83K USD, while the median costs for domestic firms range from 360-609K USD. In addition, the fixed operation costs can be inferred from the lowest simulated profits (gross of operation costs) by ownership based on the zero profit conditions in equation (13). The result in Table 7 confirms that foreign-owned firms in Vietnam face higher operation costs to stay active in production activities, which in turn leads to higher productivity than the domestic firms on average.

[13]Because the fixed costs are assumed to be drawn from a log-normal distribution, their means are $\exp(\log \beta_{cons} + \mathbb{1}(i = f) \log \beta_f + \frac{\beta_{disp}}{2})$.

Table 5: Summary of Model Parameters and Estimates

Parameter	Description	Estimate	Section
Estimation via linear regressions			
Θ_a^M/Θ_h^M	Relative sourcing potential abroad	1.611	D.1
Θ_a^X/Θ_h^X	Relative exporting potential abroad	1.526	D.1
σ	Demand elasticity	4.205	D.2
θ	Input trade elasticity	1.334	D.2
Estimation via simulated method of moments (SMM)			
κ	Productivity dispersion	4.390	5
β_{cons}^M	Constant of log sourcing fixed costs	0.349	5
β_f^M	Coefficient of foreign indicator in log sourcing fixed costs	0.193	5
β_{disp}^M	Dispersion of log sourcing fixed costs	0.972	5
β_{cons}^X	Constant of log exporting fixed costs	0.607	5
β_f^X	Coefficient of foreign indicator in log exporting fixed costs	0.069	5
β_{disp}^X	Dispersion of log exporting fixed costs	0.965	5
γ	Labor expenditure share	0.317	5

Table 6: Median Fixed Costs By Firm Ownership

	Median Value (Thousand USD)
f^M for domestic firms	360
f^M for foreign-owned firms	83
f^M for all firms	331
f^X for domestic firms	609
f^X for foreign-owned firms	35
f^X for all firms	539

Table 7: Operation Costs By Firm Ownership

	Value (USD)
f^O for domestic firms	1,487
f^O for foreign firms	4,256

5.5 Model Fit

The key moments of interest are the trade participation rate by ownership. In Figure 5, I show that the SMM does a decent job of matching the participation rate in 2017 VES data. The remaining moment fits are provided in Table 8.

Figure 5: Moment Fit: Trade Participation By Firm Ownership

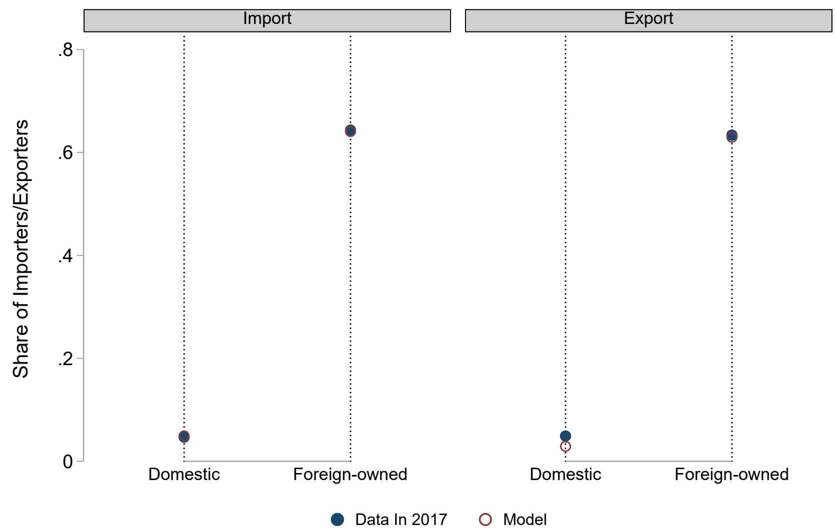


Table 8: Moment Fit: Other Moments

Moment in 2017	Data	Model
Moments for productivity		
Intercept for domestic firms	-1.580	-1.251
Coef for domestic firms	-0.357	-0.259
Intercept for foreign firms	-0.542	-0.534
Coef for foreign firms	-0.409	-0.298
Moments for fixed costs		
Share of domestic importers w/ less than median sales	0.002	0.000
Share of foreign importers w/ less than median sales	0.004	0.000
Share of domestic exporters w/ less than median sales	0.003	0.000
Share of foreign exporters w/ less than median sales	0.004	0.000
Moments for labor expenditure and manufacturing demand		
Share of firms w/ less than median domestic sales	0.500	0.606
Average wage bill over sales	0.339	0.257

6 Counterfactual Analysis of Foreign Demand Shocks

With the model parameters estimated from the previous section, I now conduct a counterfactual analysis of a foreign demand shock to the Vietnamese economy, generating trade responses from Vietnamese manufacturers of similar magnitudes to the actual data during the US-China trade war in 2017-2019. There are two main objectives of this exercise. The first one is to understand the extent to which differences in trade response between domestic and foreign-owned firms can be explained by their differences in productivity and fixed costs of sourcing and exporting. The second one is to understand the welfare implication of the shock when foreign-owned firms retain different levels of profits in Vietnam.

6.1 Baseline Predictions

The baseline estimates of my model in Section 5 reflect the underlying primitives in 2017. To simulate the response from Vietnamese manufacturers to the tariff shock of the US-China trade war in 2018-2019, my approach is to increase the sales potential abroad, i.e. Θ_a^X. Specifically, I raise the sales potential abroad by 25 percent and resolve the residual demand at home, aggregate price index, aggregate expenditure, aggregate wage index, and the number of active firms such that the zero profit conditions in equation (13) and the labor market clearing condition in equation (17) are satisfied under the new equilibrium.[14] The magnitude of the shock is set such that the average export growth generated from the model is about 15 percent, close to the estimated export growth in Table 4.

The model moments before and after imposing the shock are summarized in Table 9. In this new equilibrium, residual demand at home B_h and the aggregate price index P_h stay pretty much the same. The demand shock lifts up the labor demand and raises the real wage by 7 percent. In response to rising wages and lower prices at home, less productive firms could not earn positive profits and stay out of the market. As a result, the total number of active domestic and foreign-owned firms both decreases.

The changes in firm production outcomes over the initial distribution are demonstrated in Figure 6. Consistent with the changes in model moments after the shock, harsher competition and rising wages at home lead to negative growth in sales for most firms except the largest ones, who take advantage of the increasing demand abroad and gain in both local and export sales. Most firms also decrease their employment resulting in negative wage bill growth.

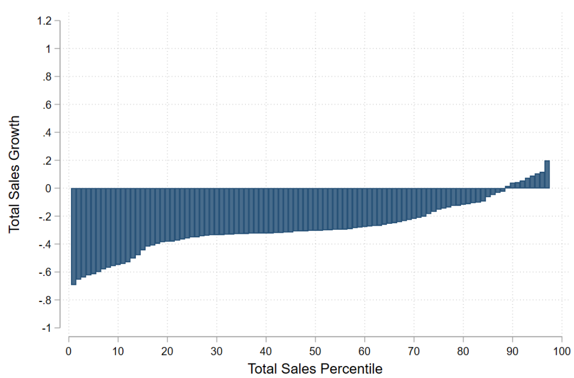
[14]The algorithm is provided in Appendix E.

Table 9: Moments Before and After the Foreign Demand Shock

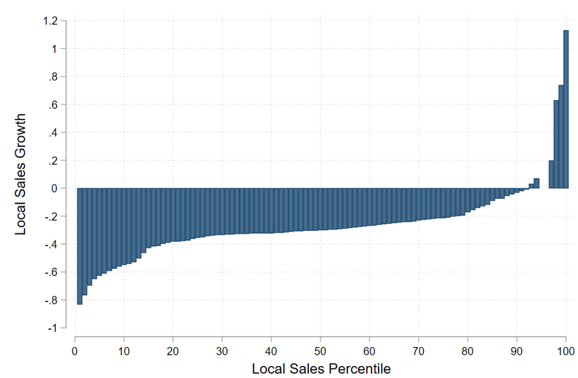
Model Moment	Before Shock	After Shock
Exporting potential abroad	0.012	0.015
Residual demand at home	0.008	0.008
Aggregate price index at home	0.047	0.047
Aggregate expenditure at home	39728	42516
Aggregate wage index at home	32939	35221
Number of active domestic firms	66300	58500
Number of active foreign firms	6400	5600
Number of active firms	72700	64100

Figure 6: Change in Sales and Wage Bill of Manufacturers

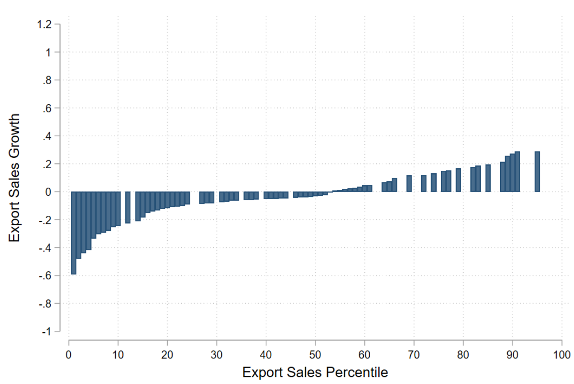
(a) Total Sales



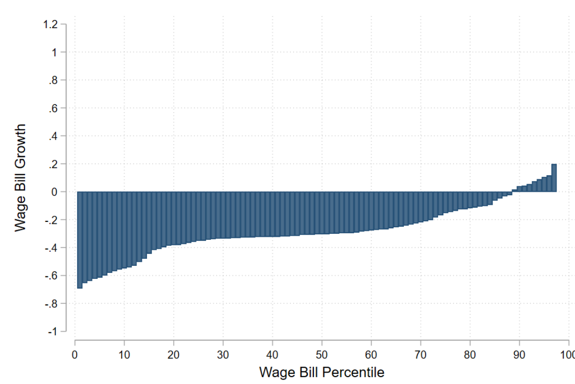
(b) Local Sales



(c) Export Sales



(d) Total Wage Bill

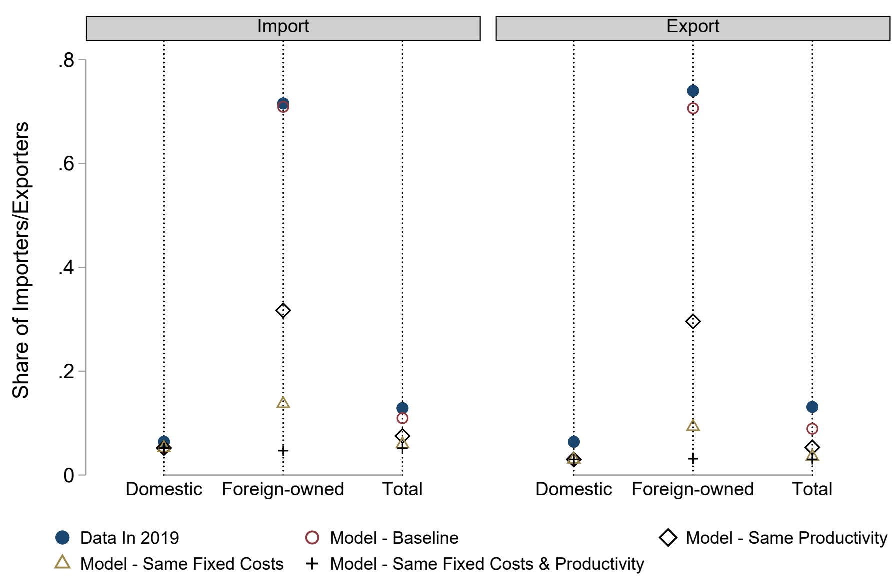


6.2 Decompose the Role of Productivity and Fixed Costs

The trade response of firms to the foreign demand shock is illustrated in Figure 7. The baseline prediction of the model (in red circle) does a decent job matching the trade participation rate in the 2019 data (in blue dot), despite the fact that I did not intentionally set the shock to match those moments. Both domestic and foreign-owned firms increase their average trade participation in response to the shock, but the discrepancy is still large.

To understand what drives the discrepancy in trade participation, I reduce the productivity cutoff of foreign-owned firms to the same level as the domestic firms while keeping all other parameters fixed. As shown in the squared points in Figure 7, the trade participation rates from the foreign-owned firms drop significantly when firms share the same productivity cutoff. The remaining discrepancy in trade participation is driven by heterogeneity in fixed costs, which explains about 40 percent of the difference in the import response and 39 percent in the export response. Then I do a similar exercise setting the fixed cost parameters of foreign-owned firms to be the same as the domestic firms' parameters, and plot the trade response in triangle points in the same figure. Somewhat surprisingly, heterogeneity in productivity actually explains only about 13 percent of differences in import response and 9 percent in export response. Overall, this exercise highlights the importance of heterogeneous fixed costs in explaining the different trade responses by firm ownership.

Figure 7: Trade Response to Foreign Demand Shocks



6.3 Contribution to Real Expenditure By Firm Ownership

My model baseline assumes that foreign-owned firms do not contribute their profits to local expenditure, i.e. $\lambda_f = 0$ in equation (15). Based on equation (15), I decompose the real expenditure, defined as the total expenditure over the aggregate price index, into labor income and net profit contributed by domestic and foreign-owned firms respectively, and calculate the growth of each component following the simulated foreign demand shock. The result is summarized in the first two columns of Table 10. When foreign-owned firms do not contribute their net profits to local consumption, their response to the shock accounts for about 2 percent of real expenditure growth in Vietnam, while domestic firms contribute about 6 percent in response to the shock. Note that most contributions in labor income and net profit are driven by the most productive firms who are able to exploit the rising demand at home and abroad and grow even larger.

To understand how foreign retained profits affect real expenditure, I rerun the same counterfactual analysis adjusting $\lambda_f = 1$ and show the result in the remaining columns in Table 10. This setting corresponds to the conventional quantitative models in trade. real expenditure before the shock is higher than the baseline. This gain in real expenditure sustains more marginal domestic firms, who rely more on the local market, and thus increases domestic firms' overall welfare contribution in response to the foreign demand shock. Foreign-owned firms also contribute more due to the gain in both domestic and foreign markets. With full retention of their net profits, foreign-owned firms account for about 3 percent of the real expenditure growth. Overall, the real expenditure gain from the foreign demand shock in absolute terms is 13 percent higher than the baseline with full repatriation of foreign profits.

Table 10: Decomposition of real expenditure Growth

	Baseline (λ_f=0)		Convention (λ_f=1)	
	Domestic	Foreign-owned	Domestic	Foreign-owned
Δ Labor income (%)	4.51	1.86	4.15	1.89
Δ Net profit (%)	1.41	0.70	1.30	0.74
Δ Real consumption (%)	7.78		8.09	

7 Conclusion

Many developing countries want to reap the benefits of trade liberalization and pursue export-led growth. Foreign-owned firms thus could be crucial because they are often the largest and most productive firms in developing countries. This paper takes the role of foreign ownership seriously and studies its implication for trade participation, production response, and real expenditure in the face of foreign demand shocks.

Focusing on Vietnam, I first show empirically that foreign-owned firms participate in trade much more than their domestic counterparts, and they have been gaining market share since 2010. Utilizing the US-China trade war episode as a foreign demand shock to Vietnam, I provide evidence that (1) the shock induces stronger import responses in intermediate goods from China and export responses in final goods to the US and the rest of the world, and (2) foreign-owned manufacturers in Vietnam, in particular those from China, are more likely to participate in trade activities and increase their employment as well as export sales in response to the shock.

Based on the empirical findings, I develop and estimate a quantitative model of trade participation with foreign ownership. Firms are distinguished by their ownership, which leads to different draws of productivity and fixed costs. Given their draws, firms decide whether to import inputs and export their products abroad. Importantly, foreign-owned firms do not retain their profits locally in the baseline model. In the counterfactual exercise, a foreign demand shock is fed into the model. The firm response from the model is consistent with what we see in the data during the trade war. Particularly, the feature of ownership-specific fixed costs is confirmed to be the major factor driving the differential response in trade participation. Furthermore, whether the net profits from the foreign-owned firms are retained locally matters for real expenditure in Vietnam.

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Appendices

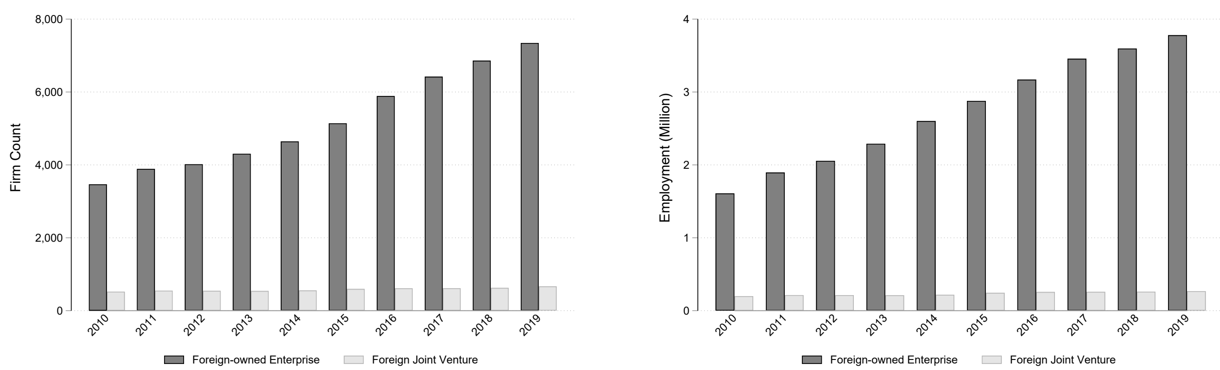
A Additional Descriptive Facts

Fact 4. Foreign-owned manufacturers in Vietnam are predominantly green fields.

In Figure 8, I show the firm count and employment for 100 percent foreign-owned manufacturers versus foreign joint ventures. It can be clearly seen that the foreign investments in Vietnam are predominantly greenfield FDI, and their count and employment are both increasing in the 2010s.

Figure 8: Vietnamese Manufacturers By Ownership Type in 2010-2019

(a) Firm Count **(b)** Employment



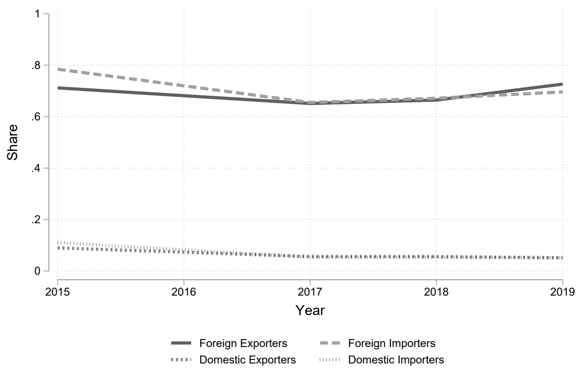
NOTE: Sample is Vietnamese manufacturers with positive employment, assets, and sales in the Vietnam Enterprise Survey from 2010-2019.

Fact 5. Trade participation by foreign-owned manufacturers increased over 2017-2019, while it stayed the same for domestic manufacturers.

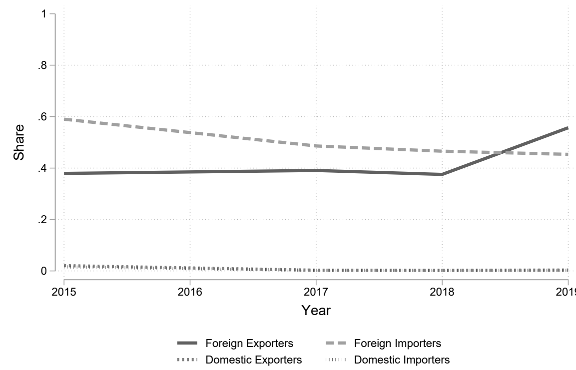
In Figure 9, I show the share of importers and exporters for domestic and foreign-owned manufacturers respectively from 2015-2019. Consistent with Table 1, the share of importers and exporters have been around 70 percent for foreign-owned manufacturers and 10 percent for domestic manufacturers. It is worth noting that export participation by foreign-owned manufacturers has increased during the trade war period (2018-2019), for samples of all, incumbent, and new manufacturers alike.

Figure 9: Trade Participation of Vietnamese Manufacturers By Ownership

(a) Incumbent Manufacturers



(b) New Manufacturers

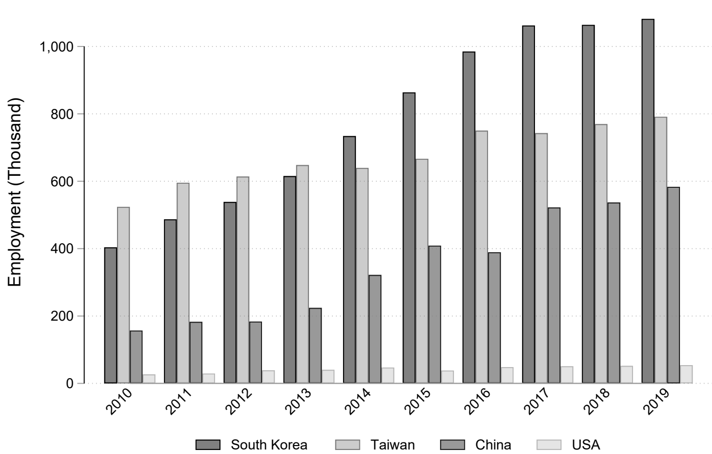


NOTE: Sample is Vietnamese manufacturers with positive employment, assets, and sales in the Vietnam Enterprise Survey from 2015-2019. Incumbent manufacturers are the ones that appear at least a year in the previous years of the survey, and the new manufacturers are the ones that appear for the first time in each year of the survey.

Fact 6. Foreign-owned manufacturers come from mostly nearby Asian countries.

Lastly, I show the employment of foreign-owned manufacturers by their origin in Figure 10. Foreign investments in Vietnam come mostly from nearby Asian countries. By the year 2019, the largest foreign investor in Vietnam is South Korea, followed by Taiwan and China. Notably, employment by Chinese manufacturers has been rising in the 2010s.

Figure 10: Employment of Foreign-owned Manufacturers By Origin (Top 3 + USA)



NOTE: Sample is Vietnamese manufacturers with positive employment, assets, and sales in the Vietnam Enterprise Survey from 2010-2019.

B Additional Results for the Reduced Form Analysis

B.1 Product-level Trade Responses

Trade response by product type. I run the same specification on final goods and intermediate goods separately based on the Broad Economic Categories (BEC) of the United Nations Statistical Commission. The estimates for final goods are in Table 11 and the estimates for intermediates are in Table 12. The growth of final goods exports from Vietnam to the US is particularly strong, as shown in column 2 of Table 11. On the other hand, the growth of intermediate imports from China to Vietnam is also large. Additionally, I also look at products that are traded between Vietnam, China, the US, and ROW (i.e. the "consistent" products) and include the results in Table 13. The results in the main text are robust to this restriction.

Table 11: Effect of the US Trade War Tariffs on Vietnamese Trade Value (Final Goods)

(a) Export Value

	(1) Total Export	(2) Export to US	(3) Export to CN	(4) Export to ROW
$\Delta \log(1+\tau^{US,CN})$	0.495	1.550***	0.536	0.152
	(0.320)	(0.466)	(0.628)	(0.317)
Constant	0.115***	0.093**	0.073	0.138***
	(0.034)	(0.046)	(0.061)	(0.034)
Observations	1355	853	643	1345
R^2	0.003	0.025	0.009	0.001

(b) Import Value

	(1) Total Import	(2) Import from US	(3) Import from CN	(4) Import from ROW
$\Delta \log(1+\tau^{US,CN})$	0.604*	-0.153	0.916**	0.051
	(0.313)	(0.550)	(0.391)	(0.329)
Constant	0.062*	-0.003	0.162***	0.019
	(0.034)	(0.061)	(0.043)	(0.035)
Observations	1400	668	977	1368
R^2	0.006	0.006	0.010	0.001

NOTE: Standard errors are clustered at the product level. CN stands for China, and ROW stands for rest of the world. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 12: Effect of the US Trade War Tariffs on Vietnamese Trade Value (Intermediates)

(a) Export Value

	(1) Total Export	(2) Export to US	(3) Export to CN	(4) Export to ROW
$\Delta \log(1+\tau^{US,CN})$	0.792***	-0.226	-0.018	0.842***
	(0.230)	(0.495)	(0.560)	(0.232)
Constant	0.053	0.415***	0.234**	0.004
	(0.040)	(0.082)	(0.094)	(0.040)
Observations	2862	932	1021	2810
R^2	0.008	0.012	0.005	0.007

(b) Import Value

	(1) Total Import	(2) Import from US	(3) Import from CN	(4) Import from ROW
$\Delta \log(1+\tau^{US,CN})$	0.107	0.241	0.469**	-0.152
	(0.158)	(0.325)	(0.217)	(0.170)
Constant	0.085***	0.077	0.186***	0.024
	(0.029)	(0.056)	(0.038)	(0.031)
Observations	3471	2001	2999	3417
R^2	0.001	0.000	0.002	0.007

NOTE: Standard errors are clustered at the product level. CN stands for China, and ROW stands for rest of the world. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 13: Effect of the US Trade War Tariffs on Vietnamese Trade Value (Consistent Products)

(a) Export Value

	(1) Total Export	(2) Export to US	(3) Export to CN	(4) Export to ROW
$\Delta \log(1+\tau^{US,CN})$	0.456*	0.793*	-0.367	0.547**
	(0.253)	(0.423)	(0.487)	(0.250)
Constant	0.149***	0.267***	0.277***	0.102**
	(0.044)	(0.063)	(0.075)	(0.042)
Observations	767	767	767	767
R^2	0.006	0.020	0.023	0.007

(b) Import Value

	(1) Total Import	(2) Import from US	(3) Import from CN	(4) Import from ROW
$\Delta \log(1+\tau^{US,CN})$	0.216	0.393	0.870***	0.167
	(0.232)	(0.506)	(0.322)	(0.239)
Constant	0.160***	0.102	0.229***	0.013
	(0.043)	(0.083)	(0.055)	(0.044)
Observations	767	767	767	767
R^2	0.002	0.006	0.014	0.011

NOTE: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Alternative specification of the product-level analysis. I employ the difference-in-log specification to the product-level export and import values:

$$\begin{aligned}\Delta_{17,19} \log Y_p^{k,VN} =& \beta_0 + \beta_1\, \Delta_{17,19} \log(1+\tau_p^{US,CN}) \\ &+ \beta_2\, \Delta_{17,19} \log(1+\tau_p^{US,VN}) + \beta_3\, \frac{\Delta_{13,15} Y_p^{k,VN}}{\frac{1}{2}(Y_{p,13}^{k,VN} + Y_{p,15}^{k,VN})} + \epsilon_p, \end{aligned} \tag{20}$$

where $\Delta_{17,19} \log Y_p^{k,VN}$ is the difference in log trade values of an HS 6-digit product p between Vietnam and the country k from 2017 to 2019, $\Delta_{17,19} \log(1+\tau_p^{US,CN})$ is the change of log US import tariff on export of product p from China, and $\Delta_{17,19} \log(1+\tau_p^{US,VN})$ is the change of log US import tariff on export of product p from Vietnam. The caveat is that products that have zero values in either 2017 or 2019 will be dropped under this specification. The results are shown in Table 14. The strong export and import responses documented in the main text are still robust under this alternative specification.

Table 14: Effect of the US Trade War Tariffs on Vietnamese Trade Value (Difference in Log)

(a) Export Value

	(1)	(2)	(3)	(4)
	Total Export	Export to US	Export to CN	Export to ROW
$\Delta \log(1+\tau^{US,CN})$	1.048***	1.716***	1.060*	0.879***
	(0.275)	(0.468)	(0.607)	(0.276)
Constant	0.085**	0.221***	0.142	0.065
	(0.042)	(0.061)	(0.089)	(0.042)
Observations	4217	1785	1664	4155
R^2	0.006	0.022	0.006	0.003

(b) Import Value

	(1)	(2)	(3)	(4)
	Total Import	Import from US	Import from CN	Import from ROW
$\Delta \log(1+\tau^{US,CN})$	0.314	0.675*	0.592**	0.059
	(0.209)	(0.394)	(0.257)	(0.224)
Constant	0.061*	0.023	0.206***	-0.010
	(0.036)	(0.064)	(0.042)	(0.038)
Observations	4871	2669	3976	4785
R^2	0.001	0.001	0.002	0.003

NOTE: Standard errors are clustered at the product level. CN stands for China, and ROW stands for rest of the world. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

B.2 Firm-level Responses

Construction of the sectoral exposure measure. The sectoral exposure measure to the US-China trade war is constructed as a weighted average of product-level tariffs, with weights given by the export shares of each product for a given sector. Specifically,

$$\Delta_{17,19}\log(1+\tau_j^{US,CN}) = \sum_{p\in\Omega_j} \frac{X_{p,17}^{US,VN}}{X_{j,17}^{US,VN}} \times \Delta_{17,19}\log(1+\tau_p^{US,CN}), \tag{21}$$

$$\Delta_{17,19}\log(1+\tau_j^{US,VN}) = \sum_{p\in\Omega_j} \frac{X_{p,17}^{US,VN}}{X_{j,17}^{US,VN}} \times \Delta_{17,19}\log(1+\tau_p^{US,VN}), \tag{22}$$

where j stands for a 4-digit ISIC sector, and p stands for a 6-digit HS product code. Ω_j is the set of products belonging to sector j.[15] The summary of the exposure measure is provided in Table 15.

Table 15: Summary of Sectoral Tariff Exposures in 2017-2019

	$\Delta_{17,19}\log(1+\tau_j^{US,CN})$	$\Delta_{17,19}\log(1+\tau_j^{US,VN})$
Mean	0.081	0.003
Median	0.064	0.000
SD	0.071	0.022

Alternative specification of the firm-level analysis. I implement the difference-in-log specification to the firm-level outcomes:

$$\begin{aligned}\Delta_{17,19}\log Y_{ijk} =& \beta_1\,\Delta_{17,19}\log(1+\tau_j^{US,CN}) + \beta_2\,\Delta_{17,19}\log(1+\tau_j^{US,VN}) \\ &+ \beta_3\,\frac{\Delta_{13,15}Y_{ijk}}{\frac{1}{2}(Y_{ijk,13}+Y_{ijk,15})} + X_{ik} + \epsilon_{ijk},\end{aligned} \tag{23}$$

where i indexes a firm, j indexes an industry, and k indexes the location of the firm (provinces in this case). Note that firms with zero value in either 2017 or 2019 will be dropped under this specification. The results for employment and sales growth are provided in Table 16 and the results for export and import growth are included in Table 17. The strong employment

[15] Ω_j is defined according to the HS6-ISIC4 correspondence constructed by Liao et al. (2021).

and export responses documented in the main text are still robust under this alternative specification.

Table 16: Effect of the Trade War Tariffs on Employment and Sales Growth (Difference in Log)

(a) Employment Growth in 2017-2019

	(1) All	(2) Domestic	(3) Foreign	(4) CN	(5) Foreign\CN	(6) Wholesale
$\Delta \log(1+\tau^{US,CN})$	0.187*	0.173*	0.531***	1.505**	0.362**	0.151
	(0.104)	(0.094)	(0.176)	(0.679)	(0.184)	(0.137)
Constant	-0.215***	-0.231***	-0.129***	-0.235***	-0.112***	-0.145***
	(0.010)	(0.010)	(0.019)	(0.080)	(0.020)	(0.008)
Province FE	Yes	Yes	Yes	Yes	Yes	Yes
Age FE	Yes	Yes	Yes	Yes	Yes	Yes
Size FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	30797	26947	3833	448	3370	56459
R^2	0.103	0.124	0.050	0.202	0.047	0.133

(b) Total Sales Growth in 2017-2019

	(1) All	(2) Domestic	(3) Foreign	(4) CN	(5) Foreign\CN	(6) Wholesale
$\Delta \log(1+\tau^{US,CN})$	-0.185	-0.203	0.092	1.479***	-0.103	0.070
	(0.149)	(0.162)	(0.183)	(0.552)	(0.191)	(0.163)
Constant	-0.093***	-0.100***	-0.063***	-0.191***	-0.045**	-0.115***
	(0.018)	(0.019)	(0.020)	(0.072)	(0.021)	(0.007)
Province FE	Yes	Yes	Yes	Yes	Yes	Yes
Age FE	Yes	Yes	Yes	Yes	Yes	Yes
Size FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	30797	26947	3833	448	3370	56459
R^2	0.014	0.015	0.040	0.164	0.041	0.009

NOTE: Sample is Vietnamese manufacturers and wholesalers who were present in the Vietnam Enterprise Survey from 2013-2019 with positive employment, assets, and sales. Outcomes are winsorized at 1 and 99 percentile. Standard errors are clustered at the sector-region level. CN stands for China. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 17: Effect of the Trade War Tariffs on Export and Import Growth (Difference in Log)

(a) Export Growth

	(1) All	(2) Domestic	(3) Foreign	(4) CN	(5) Foreign\CN	(6) Wholesale
$\Delta\log(1+\tau^{US,CN})$	1.720	1.019	1.831	10.865***	1.066	-2.475
	(1.620)	(2.203)	(1.410)	(3.510)	(1.562)	(6.539)
Constant	-0.752***	-0.761***	-0.727***	-1.789***	-0.619***	0.345
	(0.177)	(0.210)	(0.178)	(0.345)	(0.199)	(0.335)
Province FE	Yes	Yes	Yes	Yes	Yes	Yes
Age FE	Yes	Yes	Yes	Yes	Yes	Yes
Size FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	2575	772	1784	149	1620	147
R^2	0.078	0.161	0.079	0.245	0.086	0.243

(b) Import Growth

	(1) All	(2) Domestic	(3) Foreign	(4) CN	(5) Foreign\CN	(6) Wholesale
$\Delta\log(1+\tau^{US,CN})$	-1.446	-0.598	-1.683	-2.598	-1.557	5.798
	(1.553)	(1.976)	(1.609)	(5.683)	(1.579)	(4.633)
Constant	0.462***	0.086	0.588***	0.542	0.581***	-1.442***
	(0.173)	(0.220)	(0.191)	(0.683)	(0.178)	(0.212)
Province FE	Yes	Yes	Yes	Yes	Yes	Yes
Age FE	Yes	Yes	Yes	Yes	Yes	Yes
Size FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	2561	727	1813	130	1669	286
R^2	0.086	0.176	0.069	0.180	0.070	0.179

NOTE: Sample is Vietnamese manufacturers and wholesalers who were present in the Vietnam Enterprise Survey from 2013-2019 with positive employment, assets, and sales. Outcomes are winsorized at 1 and 99 percentile. Standard errors are clustered at the sector-region level. CN stands for China. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Sectoral heterogeneity. I break down the firm sample by their two-digit industry code and estimate the employment and export response by sector in Table 18. In general, the sectors with stronger responses are more labor intensive, e.g. manufacturing of textiles (also including apparels) and paper.

Table 18: Sectoral Heterogeneity of Employment and Export Growth

(a) Employment Growth By Sector

	(1) Food	(2) Textile	(3) Paper	(4) Chemical	(5) Pharmaceutical	(6) Mineral	(7) Electronic	(8) Transport	(9) Furniture	(10) Other
$\Delta \log(1+\tau^{US,CN})$	0.328	0.272	0.258*	0.087	0.075	0.269*	-0.328*	0.340	0.406*	0.470
	(0.210)	(0.270)	(0.132)	(0.187)	(0.290)	(0.153)	(0.184)	(0.350)	(0.211)	(0.314)
Constant	-0.149***	-0.188***	-0.161***	-0.154***	-0.169***	-0.213***	-0.161***	-0.167***	-0.238***	-0.190***
	(0.021)	(0.017)	(0.015)	(0.023)	(0.027)	(0.011)	(0.021)	(0.042)	(0.032)	(0.020)
Province FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Age FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Size FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	3587	3346	6565	1250	2413	7393	2078	714	1524	1777
R^2	0.105	0.118	0.134	0.145	0.138	0.134	0.141	0.152	0.168	0.164

(b) Export Growth By Sector

	(1) Food	(2) Textile	(3) Paper	(4) Chemical	(5) Pharmaceutical	(6) Mineral	(7) Electronic	(8) Transport	(9) Furniture	(10) Other
$\Delta \log(1+\tau^{US,CN})$	1.007	6.490***	1.929	-1.239	-0.034	0.187	-0.703	1.304	-3.764	-0.173
	(1.704)	(1.295)	(2.321)	(1.985)	(2.096)	(0.981)	(0.946)	(1.822)	(2.818)	(2.110)
Constant	-0.788***	-1.255***	-0.732***	0.495***	0.076	-0.151	0.041	-0.032	-0.295	-0.570***
	(0.122)	(0.128)	(0.193)	(0.127)	(0.210)	(0.134)	(0.113)	(0.246)	(0.456)	(0.185)
Province FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Age FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Size FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	569	1165	493	240	520	807	564	207	331	251
R^2	0.244	0.134	0.195	0.232	0.147	0.133	0.138	0.214	0.144	0.215

NOTE: Sample is Vietnamese manufacturers who were present in the Vietnam Enterprise Survey from 2013-2019 with positive employment, assets, and sales. Outcomes are winsorized at 1 and 99 percentile. Standard errors are clustered at the sector-region level. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

C Proof of Proposition 1

Proof of part 1:

Our goal is to show that $\pi(\varphi, J^M, J^X)$ has increasing differences in (φ, J^M) and (φ, J^X). Note that $\forall\ \varphi' > \varphi$,

$$
\begin{aligned}
&\pi(\varphi', 1, J^X) - \pi(\varphi, 1, J^X) \\
&= (\varphi'^{\sigma-1} - \varphi^{\sigma-1}) w_h^{-\gamma(\sigma-1)} \beta^{-(\sigma-1)} [\Theta_h^M + \Theta_f^M]^{\frac{(1-\gamma)(\sigma-1)}{\theta}} [B_h + J^X (\tau^X)^{-(\sigma-1)} B_f] \\
&(\varphi'^{\sigma-1} - \varphi^{\sigma-1}) w_h^{-\gamma(\sigma-1)} \beta^{-(\sigma-1)} [\Theta_h^M]^{\frac{(1-\gamma)(\sigma-1)}{\theta}} [B_h + J^X (\tau^X)^{-(\sigma-1)} B_f] \\
&= \pi(\varphi', 0, J^X) - \pi(\varphi, 0, J^X)
\end{aligned}
$$

The first equality holds by Equation (11). The inequality holds because the sourcing potentials are strictly positive and $\frac{(1-\gamma)(\sigma-1)}{\theta} \geq 0$. The last equality again follows Equation (11). Therefore, $\pi(\varphi, J^M, J^X)$ has increasing differences in (φ, J^M). Following the same exercise, it can be shown that $\pi(\varphi, J^M, J^X)$ also has increasing differences in (φ, J^X).

Proof of part 2:

Our goal is to show that $\pi(\varphi, J^M, J^X)$ has increasing differences in (J^M, J^X). Note that

$$
\begin{aligned}
&\pi(\varphi, 1, 1) - \pi(\varphi, 1, 0) \\
&= \varphi^{\sigma-1} w_h^{-\gamma(\sigma-1)} \beta^{-(\sigma-1)} [\Theta_h^M + \Theta_f^M]^{\frac{(1-\gamma)(\sigma-1)}{\theta}} [J^X (\tau^X)^{-(\sigma-1)} B_f] - J_i^X w_h f_i^X \\
&\geq \varphi^{\sigma-1} w_h^{-\gamma(\sigma-1)} \beta^{-(\sigma-1)} [\Theta_h^M]^{\frac{(1-\gamma)(\sigma-1)}{\theta}} [J^X (\tau^X)^{-(\sigma-1)} B_f] - J_i^X w_h f_i^X \\
&= \pi(\varphi, 0, 1) - \pi(\varphi, 0, 0)
\end{aligned}
$$

The first equality follows Equation (11). The inequality holds because the sourcing potentials are strictly positive and $\frac{(1-\gamma)(\sigma-1)}{\theta} \geq 0$. The last equality again follows Equation (11). Therefore, $\pi(\varphi, J^M, J^X)$ has increasing differences in (J^M, J^X).

D Additional Details of Structural Estimation

D.1 Estimation of Foreign Sourcing and Sales Potential

This section describes the estimation of relative sourcing and sales potential abroad, i.e. $\{\frac{\Theta_a^M}{\Theta_h^M}, \frac{\Theta_a^X}{\Theta_h^X}\}$. Following the same approach as Antràs, Fort and Tintelnot (2017), I first estimate each foreign country's sourcing and sales potential relative to Vietnam's and then average them by trade flows with Vietnam to obtain the "representative" sourcing and sales potential abroad. The Vietnam Technology and Competitiveness Survey (TCS) asks manufacturers where their top three sourcing and exporting countries are and the associated firm-level import and export shares, which I use for the following estimation.

Note that every firm's import and export shares for each country are analogous to equation (10) and (12):

$$\chi_{i,j}^M = \frac{(\tau_j^M w_j)^{-\theta} T_j}{\sum_l (\tau_l^M w_l)^{-\theta} T_l} = \frac{\Theta_j^M}{\sum_l \Theta_l^M}, \tag{24}$$

$$\chi_{i,k}^X = \frac{(\tau_k^X)^{1-\sigma} B_k}{\sum_l (\tau_l^X)^{1-\sigma} B_l} = \frac{\Theta_k^X}{\sum_l \Theta_l^X}, \tag{25}$$

where $\{\chi_{i,j}^M, \chi_{i,k}^X\}$ are firm i's import share from country j and export share to country k. Taking log of the shares and subtracting the log shares in Vietnam, one can obtain the following:

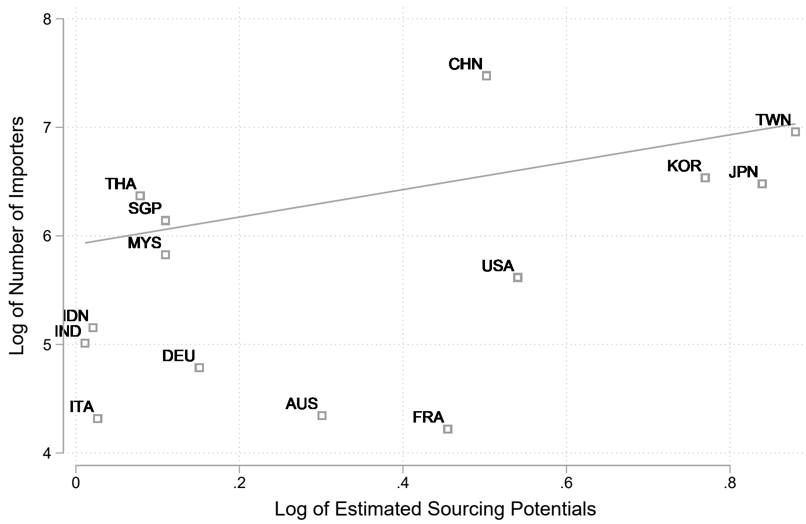
$$\log \chi_{i,j}^M - \log \chi_{i,h}^M = \log \underbrace{\Theta_j^M / \Theta_h^M}_{\text{Relative sourcing potential of country j}}, \tag{26}$$

$$\log \chi_{i,k}^X - \log \chi_{i,h}^X = \log \underbrace{\Theta_k^X / \Theta_h^X}_{\text{Relative sales potential of country k}}, \tag{27}$$

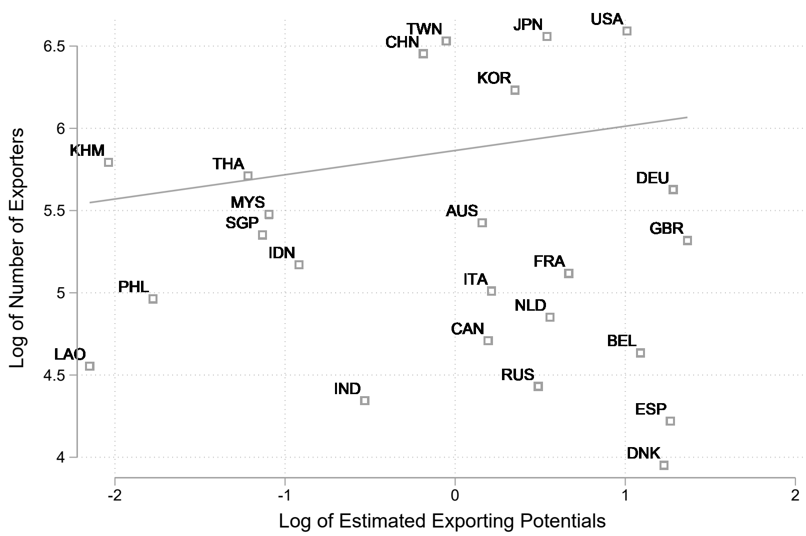
where $\{\chi_{i,h}^M, \chi_{i,h}^M\}$ are firm i's shares of domestic sourcing and sales. The relative sourcing and sales potentials can then be estimated by regressing the log differences in shares on the country dummies. Figure 11 illustrates the estimates and associated log number of importers and exporters in the TCS data. Intuitively, the estimated sourcing potentials are high for Vietnam's main sourcing countries such as China, and the estimated sales potentials are high for major exporting partners such as the US.

Figure 11: Estimates of Relative Sourcing and sales potentials By Country

(a) Sourcing Potential



(b) sales potential



NOTE: The sourcing and sales potentials are estimated using the Vietnam Technology and Competitiveness Survey (TCS) in years 2009-2014. The estimates are relative to the potential of local sourcing and sales in Vietnam.

D.2 Estimation of Demand and Input Trade Elasticities

To estimate the demand elasticity σ, note that the sales potential of country k is:

$$\Theta_k^X = (\tau_k^X)^{1-\sigma} B_k. \tag{28}$$

Then by taking log of the estimated sales potentials (with Vietnam's potential normalized to one), σ can be estimated with the following regression specification:

$$\begin{aligned}\log \widehat{\Theta_k^X} =& (1-\sigma)\log \tau_k^X + \alpha_d \log \text{distance}_{hk} + \alpha_c \text{ control of corruption}_k + \alpha_g \log \text{GDP}_k \\ &+ \alpha_0 + \epsilon_k, \end{aligned} \tag{29}$$

where variations in log average export tariffs to country k identify the demand elasticity. I further control for gravity variables such as bilateral distance, degree of corruption, and country GDP to account for potential omitted variable bias.[16] The estimation result is shown in Table 19. The estimates indicate an estimate of σ to be around 5.2, implying an average markup of 24 percent.[17]

The strategy of estimating the input trade elasticity θ is analogous. Note that the sourcing potential of country j is:

$$\Theta_j^M = (\tau_j^M w_j)^{-\theta} T_j. \tag{30}$$

Taking log of the estimated sourcing potentials, I estimate θ with the following specification:

$$\begin{aligned}\log \widehat{\Theta_j^M} =& -\theta \log(\tau_j^M w_j) + \beta_d \log \text{distance}_{hj} + \beta_c \text{ control of corruption}_j + \beta_g \log \text{GDP}_j \\ &+ \beta_r \log \text{R\&D}_j + \beta_k \log \text{capital}_j + \beta_e \log \# \text{ establishments}_j + \beta_0 + \epsilon_j, \end{aligned} \tag{31}$$

where variations in $\log(\tau_j^M w_j)$, the log multiple of average import tariffs and manufacturing monthly wage in country j,[18] identify the input trade elasticity. Besides standard gravity variables, I also control for R&D expenditure, capital-labor ratio, and number of establishments in each foreign country j to account for the technology level term T_j.

To further deal with unobserved variables that could correlate with both the manufac-

[16] Details of the estimation and data sources are provided in Appendix D.3.

[17] The estimate of σ in Antràs, Fort and Tintelnot (2017) with the US data is 3.85, implying an average markup of 35 percent.

[18] Wages are adjusted by the country-level human capitals using the years of schooling from the Barro-Lee Education Attainment Dataset and the returns to education from Psacharopoulos and Patrinos (2018).

turing wage and the error term, I follow the same approach as Antràs, Fort and Tintelnot (2017) using country population as an instrument. The results are shown in Table 20. The instrument seems to do a decent job of correcting the selection bias associated with sourcing activities at the country level. I end up using $\theta = 1.334$.[19]

Table 19: Estimation of Demand Elasticity

	Log Exporting Potential		
$\log \tau_k^X$	-4.223***	-4.324***	-4.205***
	(0.342)	(0.451)	(0.440)
log Distance		1.891	-2.978*
		(5.297)	(1.219)
Control of Corruption		0.300	0.163
		(0.271)	(0.175)
log GDP			0.805
			(0.402)
Constant	0.222***	-15.517	13.206
	(0.015)	(43.602)	(15.246)
Observations	142	142	142
R^2	0.919	0.920	0.921

Sample is at the country-year level.

Standard errors are clustered at the region level.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

[19]The estimate of θ in Antràs, Fort and Tintelnot (2017) with the US data is 1.789.

Table 20: Estimation of Input Trade Elasticity

	Log Sourcing Potential	
	OLS	IV
$\log \tau_j^M w_j$	0.012	-1.334***
	(0.056)	(0.363)
log Distance	0.085	0.111
	(0.056)	(0.110)
Control of Corruption	-0.249**	0.499**
	(0.044)	(0.227)
log GDP	-0.165	-0.809***
	(0.112)	(0.233)
log R&D	0.219***	0.637***
	(0.033)	(0.214)
log Capital/Worker	0.009	0.391**
	(0.135)	(0.154)
log # Establishment	-0.135	0.059
	(0.067)	(0.110)
Constant	1.418	7.289**
	(1.106)	(3.190)
Observations	59	59
R^2	0.241	.

Sample is at the country-year level.

Standard errors are clustered at the region level.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

D.3 Data Source for Estimation

Table 21: Data Source

Variable	Data Source
Bilateral trade flows	BACI, CEPII
Bilateral distance, language, contiguity	Gravity, CEPII
Control of corruption	WGI, World Bank
R&D expenditure	WDI, World Bank
Number of establishments	Industrial Statistics Database, UNIDO
Manufacturing wage	ILOSTAT, International Labour Organization
GDP	Penn World Table
Physical capital	Penn World Table
Years of schooling	Barro-Lee Educational Attainment Dataset
Mincer coefficients by country	Psacharopoulos and Patrinos (2018)

E Algorithm for Counterfactual Analysis

The parameters in the model include: demand elasticity σ, input trade elasticity θ, labor expenditure share γ, sourcing and sales potential abroad $\{\Theta_a^M, \Theta_a^X\}$, shape parameter of productivity κ, parameters of fixed costs $\{\beta_{cons}^M, \beta_f^M, \beta_{disp}^M, \beta_{cons}^X, \beta_f^X, \beta_{disp}^X\}$, fixed operation costs $\{f_d^O, f_f^O\}$, and number of potential entrants $\{N_d, N_f\}$.

The endogenous variables in the model include: trade participation decisions $\{J_i^M, J_i^X\}$, ownership-specific cutoff productivities $\{\underline{\varphi}_d, \underline{\varphi}_f\}$, exchange rate ϵ, aggregate expenditure at home E_h, and aggregate price index at home P_h.

The counterfactual analysis is conducted in the following steps.

1. Raise Θ_a^X to match the average export response identified from Section 3.
2. Given exchange rate ϵ and aggregate price index P_h,
   (a) Update $\{\underline{\varphi}_d, \underline{\varphi}_f\}$ from the zero profit conditions given productivity and fixed cost parameters.
   (b) Update number of active domestic and foreign-owned firms, i.e. $N_i(1 - G(\underline{\varphi}_i))$.
   (c) Draw productivities and fixed costs and then simulate firm response $\{J_i^M, J_i^X\}$ following equation (11).
   (d) Calculate import and export values at home following equation (14).
   (e) Update the exchange rate ϵ.
   (f) Repeat step (a)-(e) until equation (14) holds.
3. Given aggregate price index P_h, calculate aggregate expenditure (i.e. goods demand) and goods supply following equation (15) and equation (16).
4. Update the aggregate price index P_h and then B_h following equation (6).
5. Repeat step 2-4 until equation (16) holds.