Foreign Ownership and the Welfare Responses to the US–China Trade War: Evidence from Manufacturers in Vietnam

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Abstract

This paper studies the welfare implications of the US–China trade war in Vietnam. Utilizing an enterprise survey in Vietnam that covers the universe of registered firms with information on their capital ownership, I provide novel evidence that Vietnam's positive responses in employment and exports in 2017–2019 are driven mainly by foreign-owned manufacturers. To further understand the welfare gains of the trade war episode, I develop and estimate a quantitative model of trade participation with foreign ownership, where foreign-owned and domestic manufacturers differ in their distributions of productivity and fixed costs to participate in sourcing and exporting activities. A foreign demand shock to Vietnam of a magnitude similar to that of the trade war raises the real expenditure in the model by 5 percent, predominantly from an increase in labor income.

Keywords: International Investment; Quantitative Model of Trade; Trade Policy
JEL Codes: F21; F12; F13

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1 Introduction

The US–China trade war starting in 2018 completely changed the landscape of international trade. The Trump administration imposed a series of tariffs on Chinese exports, raising the average import tariff from approximately 3 percent in early 2018 to over 20 percent by the end of 2019. During the same period, the average tariff level remained mostly constant for the rest of the world. As a result, global trade and value chains have been reallocating to some third countries producing close substitutes to Chinese exports, according to recent research (Fajgelbaum et al., 2024; Alfaro and Chor, 2023). Theoretically, the trade war episode, acting as a foreign demand shock to those third countries, should have served to reallocate resources to productive firms and raise their aggregate productivity (Melitz, 2003). It is thus intriguing to ask: What kind of firms are actually responding to the US–China trade war in third countries? How large are the welfare gains from the trade war for those countries? My paper investigates the two questions, focusing on a country widely regarded as a major beneficiary of the trade war episode: Vietnam.

I provide novel evidence that the strong employment and export response in Vietnam during the US–China trade war is driven mainly by foreign-owned 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 subject 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 suggest 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, to examine the production response of Vietnam-based manufacturers during the trade war period, I utilize the Vietnam Enterprise Survey (VES) and construct a measure for sectoral exposure to the US–China trade war. On average, manufacturers in sectors more exposed to the trade war are more likely to have increased their export sales. When I break down the sample into domestic versus foreign-owned firms, I find that the positive responses in employment, assets, and exports occur predominantly from foreign-owned manufacturers.

The empirical findings highlight the importance of complementarity between input sourcing and output exporting, as well as foreign ownership, in measuring the welfare gains of the trade war episode in Vietnam. In particular, foreign-owned and domestic manufacturers in Vietnam differ not only in their size distribution but also in their tendency to participate in trade activities. The latter fact still holds even when conditional on firm employment, suggesting that domestic and foreign-owned firms face different fixed costs of trade participation. A quantitative trade model without foreign ownership would miss these margins and risk miscalculating the gains from foreign demand shocks.

To correctly quantify Vietnam's welfare gains from the US–China trade war, I develop and estimate a quantitative model of trade participation with foreign ownership based on the global sourcing model of Antràs et al. (2017). There are several novel features of my model. First, I introduce the margin of exporting into the model. Final goods producers choose whether to source their inputs and export their products to the world market given their core productivity and fixed costs of participating in trade. The resulting profit function exhibits complementarity between the sourcing and exporting decisions, which echoes the empirical finding from the product-level analysis. Second, I introduce the distinction between 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 sector-level analysis. Additionally, it is assumed that foreign-owned firms do not contribute their net profits to aggregate income in the host country in the baseline model, acknowledging the well-known issue of profit shifting in Vietnam.[1] 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 of sourcing and exporting for foreign-owned manufacturers are only 19 percent and 7 percent of those for domestic manufacturers, respectively.

With the parameter estimates, I conduct a counterfactual exercise to elucidate the welfare gains from the US–China trade war. Specifically, I impose a positive foreign demand shock on the estimated model, which induces an average export response of the same magnitude as the one by the US trade war tariffs estimated from the data. I show that the shock induces a five-percent increase in Vietnam's real expenditure, which is almost entirely driven by an increase in labor income, not net profits contributed by the firms. I also find that the differences in fixed costs between domestic and foreign-owned firms can explain approximately 40 percent of the differences in trade participation between the two groups of firms, much more than the 10 percent variation explained by their productivity differences.

This paper makes contributions to at least three strands of literature. The first is about

[1] Many MNEs have been subject to tax disputes with the Vietnamese government in recent years, e.g. Adidas, Suntory, Unilever, etc. A pronounced case is Coca-Cola, which has been operating in Vietnam since 1993 but only started reporting positive profits from 2013 onward. In 2019, the General Department of Taxation required the company to pay over 35 Million USD in fines and tax arrears: https://vir.com.vn/coca-cola-continues-tax-haggle-with-gdt-82926.html.

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 et al., 2019; Ma et al., 2021; Chang et al., 2021; Fajgelbaum et al., 2020a; Flaaen and Pierce, 2019; Fajgelbaum and Khandelwal, 2022). Additionally, it had significant effects on third countries, with some firms engaging in "tariff hopping," leading to restructuring of global value chains (Flaaen et al., 2020; Fajgelbaum et al., 2024; Alfaro and Chor, 2023; Iyoha et al., 2025). Some recent studies focus on Vietnam and show that the trade war episode led to export growth, increased wages, improved labor conditions, and reallocation of workers into the formal manufacturing sector (Rotunno et al., 2024; Nguyen and Lim, 2023; Malesky and Mosley, 2021). To the best of my knowledge, this study is the first to provide a quantitative general equilibrium framework to study the welfare implications of the US–China trade war in an emerging economy with a large presence of foreign capital.

This paper also contributes to the extensive literature on trade liberalization and reallocation in developing countries (Atkin and Khandelwal, 2020; Atkin and Donaldson, 2022). In particular, McCaig and Pavcnik (2018) and McCaig et al. (2022) study the impact of the 2001 US–Vietnam bilateral trade agreement (BTA) on the Vietnamese economy and show that it expanded the formal sector and encouraged foreign firm entry by 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 from a foreign demand shock in the presence of foreign profit shifting in a quantitative framework.

Last, 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 et al., 2019; Antràs et al., 2024; Li et al., 2024). Although I do not explicitly study the mechanisms underlying foreign-owned firms' much lower fixed costs of sourcing and exporting activities, my results are consistent with these papers' findings that MNEs are more likely to source from or export to regions with characteristics similar to those of their home countries or previous trading partners, regions where their affiliates are based, or regions with which they have previous export experience.

The rest of the paper is organized as follows. Section 2 presents the data sources and key descriptive facts of Vietnam-based manufacturers. Section 3 studies Vietnam's trade and production response to the US–China trade war episode. Based on the empirical findings, Section 4 presents the theoretical framework. Section 5 describes the details of the model parameter estimation. 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 et al. (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 2-digit industry classification, and balance sheet information, offering a comprehensive view of the corporate landscape. Importantly, the survey asks about the firms' main capital source country. I complement the VES with Vietnam Technology and Competitiveness Survey (TCS) data from 2009 to 2014, which covers a subset of firms from the VES and provides more trade-related information such as details on firms' sourcing and exporting activities. Additionally, I employ the CEPII BACI Database, which spans 2010 to 2019, providing bilateral trade flow data by HS 6-digit product code.

2.2 Descriptive Facts on Vietnamese Manufacturers

Fact 1. Foreign-owned manufacturers in Vietnam are larger than domestic ones. In Table 1, I first examine the main outcomes for active manufacturers in Vietnam by ownership category. Foreign-owned manufacturers are defined as manufacturers in the VES data reporting 100 percent of their capital to be sourced from abroad, and domestic manufacturers are the non-foreign-owned manufacturers in the VES data.[2] 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 1, I plot the employment distribution in 2017. Domestic manufacturers are mostly small in size, while foreign-owned manufacturers concentrate more in the top percentiles of the distributions.

[2]Most foreign direct investments in Vietnam are greenfield investments. In Figure 7 of Appendix A, I show that foreign joint ventures in Vietnam have a very small presence in terms of both firm count and employment.

Table 1: Summary Statistics of Vietnamese Manufacturers in 2017

	Employment	Assets	Sales	Share of Exporters	Share of Importers
Domestic					
Mean	44	1,442	1,586	0.049	0.047
Median	7	122	75	0.000	0.000
SD	285	14,400	20,830	0.216	0.211
Observations	65,628	65,628	65,628	65,628	65,628
Foreign-owned					
Mean	538	12,578	18,113	0.634	0.644
Median	106	1,989	1,861	1.000	1.000
SD	2,121	138,311	286,455	0.482	0.479
Observations	6,420	6,420	6,420	6,420	6,420

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

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

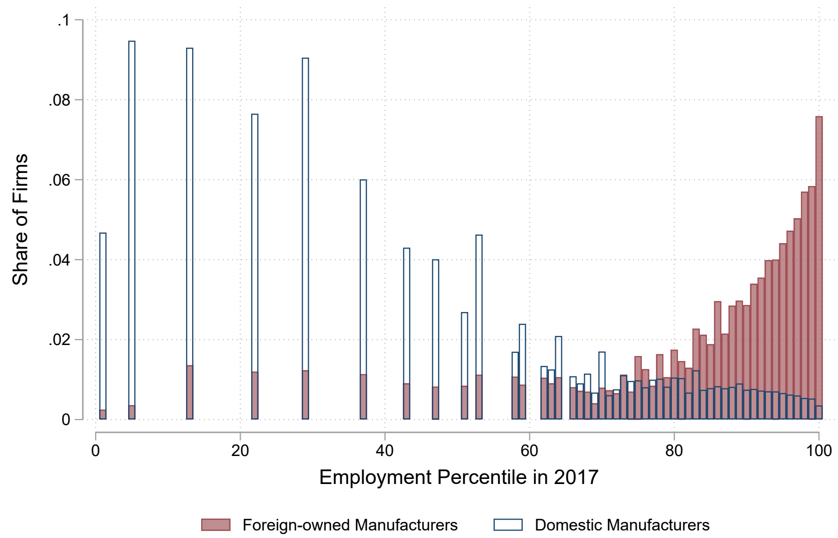
In Table 1, only approximately five percent of domestic manufacturers engage in import and export on average, while the numbers are over 60 percent for foreign-owned manufacturers. Furthermore, I plot the shares of domestic and foreign-owned manufacturers in each percentile in Panel (b) of Figure 1. Foreign-owned manufacturers are much more likely to participate in both import and export activities across all employment percentiles.

Fact 3. Trade participation by foreign-owned manufacturers increased over 2017–2019, while it stayed the same for domestic manufacturers.

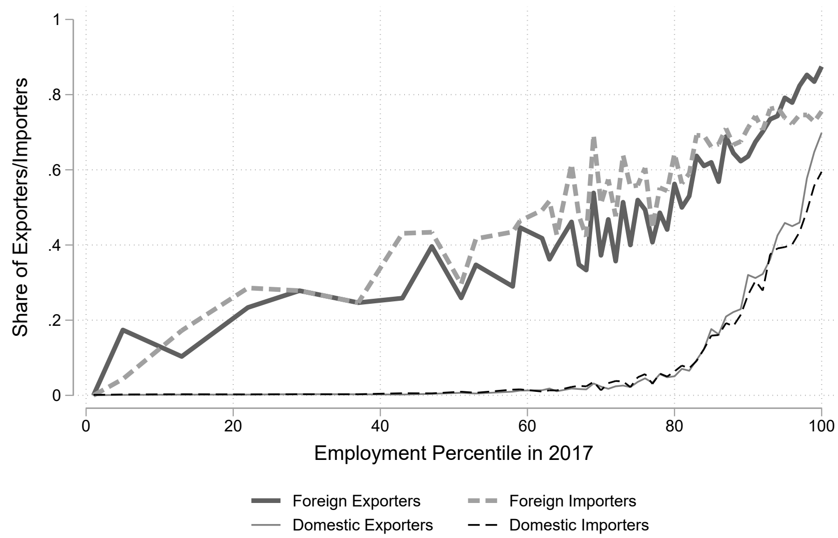
In Figure 2, I show the share of importers and exporters among domestic and foreign-owned manufacturers from 2015 to 2019. Consistent with Table 1, the shares of importers and exporters have been approximately 70 percent for foreign-owned manufacturers and 10 percent for domestic manufacturers. It is worth noting that export participation by foreign-owned manufacturers increased during the trade war period (2018–2019) in the samples of all, incumbent, and new manufacturers alike.

Figure 1: Employment Distribution and Trade Participation in 2017

(a) Employment Distribution



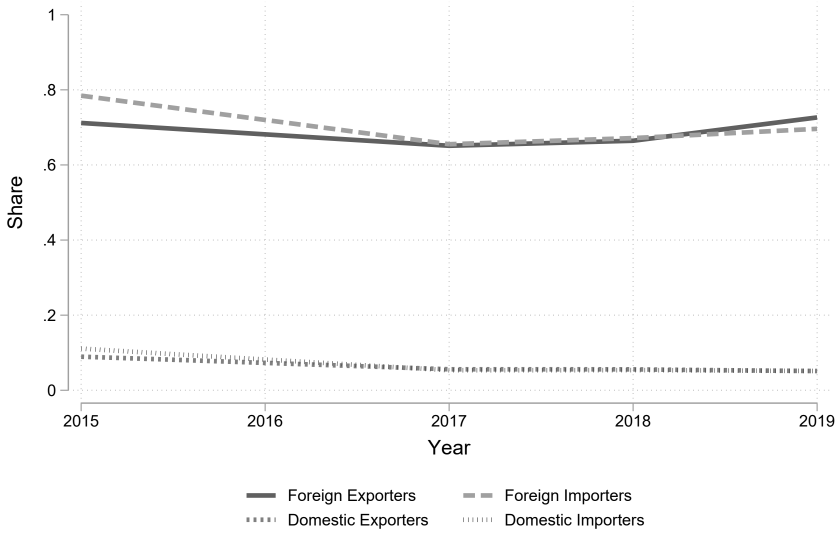
(b) Trade Participation



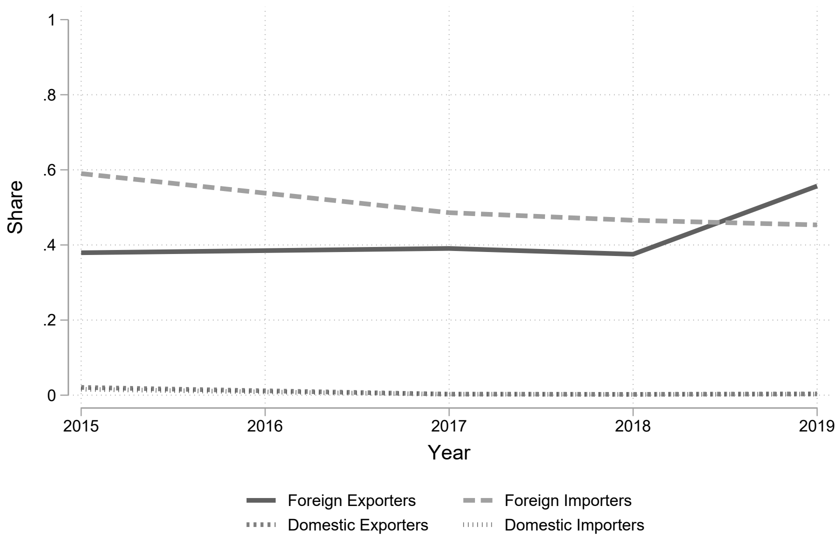
Note: Sample is Vietnamese manufacturers with positive employment and assets in the Vietnam Enterprise Survey.

Figure 2: Trade Participation of Vietnamese Manufacturers by Ownership Status

(a) Incumbent Manufacturers



(b) New Manufacturers



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

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 and the manufacturing production response at the sector level in Vietnam. The product-level results highlight that the Trump tariffs on Chinese exports triggered 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 sector level, I also see that the exposed sectors in Vietnam increased their employment, assets, sales, and exports, predominantly driven by foreign-owned manufacturers.

3.1 Product-Level Responses

Using the bilateral trade flow data from CEPII's BACI (Gaulier and Zignago, 2010), I examine how the growth rate of Vietnamese trade with all countries/US/China/rest of the world (ROW) responded to the US–China trade war at the product level. The following regression specification is adopted:

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

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 country k from 2017 to 2019, $\Delta_{17,19}\log(1+\tau_p^{US,CN})$ is the change in the log US import tariff on exports of product p from China, $\Delta_{17,19}\log(1+\tau_p^{CN,US})$ is the change in the log Chinese import tariff on exports of product p from the US, and $\Delta_{17,19}\log(1+\tau_p^{US,VN})$ is the change in the log US import tariff on exports of product p from Vietnam. One caveat is that products that have zero values in 2017 or 2019 won't be included under this specification.[3]

The changes of log tariffs in 2017-2019 are summarized in Table 2. On average, US import tariffs on Chinese exports increased by 15 percentage points in this period, while they increased merely by 0.2 percentage points for Vietnamese exports. In response, the Chinese retaliatory tariffs on imports from the US increased by 11 percentage points. The standard deviations of the log change of US–China, China–US, and US–Vietnam import

[3] In Appendix B.1, I run a robustness check using the Davis–Haltiwanger growth rate measure, which produces similar results.

tariffs are about 0.10, 0.09, and 0.02 respectively.

Table 2: Summary of Trade War Tariffs

	$\Delta_{17,19}\log(1+\tau_p^{US,CN})$	$\Delta_{17,19}\log(1+\tau_p^{CN,US})$	$\Delta_{17,19}\log(1+\tau_p^{US,VN})$
Mean	0.154	0.113	0.002
Median	0.214	0.118	0.000
SD	0.096	0.088	0.020

Note: Sample is all HS 6-digit products. The US–China trade war tariffs in 2017-2019 are obtained from Fajgelbaum et al. (2020b).

The corresponding estimates of β_1 for Vietnamese import and export values by destination in equation (1) are shown in Table 3. On the one hand, Vietnamese exports for a given product responded significantly to the rise in US–China import tariffs. On the other hand, Vietnamese imports also rose in response to the US–China import tariffs, particularly imports from China. In Column (1) of Panel (a), the average increase in US tariffs on Chinese exports (15%) led to the overall Vietnamese export growth by 0.14 log points (15%).[4] In Column (2)-(4) of Panel (a), the same tariff change increased the growth of exports to the US, China, and ROW by 25%,[5] 15 % (insignificant),[6] and 14 %,[7] respectively. On the other hand, the same tariff increase led to average Vietnamese import growth of 5% overall (insignificant),[8] 7% from the US (insignificant),[9] 11% percent from China,[10] and 2% from ROW (insignificant)[11] in Column (1)-(4) of Panel (b). Using the classification by Broad Economic Categories (BEC) from the United Nations Statistics Division, I further separate the products into intermediates and final goods and run the same specification in Tables 12 and 13 of Appendix B.1. It can be seen that the response of exports to the US is driven mostly by final goods, while the response of imports from China is driven mainly by the surge in intermediate and capital goods.

[4] $0.949 \times 0.15 \approx 0.14; e^{0.14} - 1 \approx 0.15.$
[5] $1.479 \times 0.15 \approx 0.22; e^{0.22} - 1 \approx 0.25.$
[6] $0.932 \times 0.15 \approx 0.14; e^{0.14} - 1 \approx 0.15.$
[7] $0.851 \times 0.15 \approx 0.13; e^{0.13} - 1 \approx 0.14.$
[8] $0.335 \times 0.15 \approx 0.05; e^{0.05} - 1 \approx 0.05.$
[9] $0.496 \times 0.15 \approx 0.07; e^{0.07} - 1 \approx 0.07.$
[10] $0.711 \times 0.15 \approx 0.11; e^{0.11} - 1 \approx 0.11.$
[11] $0.147 \times 0.15 \approx 0.02; e^{0.02} - 1 \approx 0.02.$

Table 3: Effect of Trade War Tariffs on Vietnamese Trade Value

(a) Export Value

	(1) Total Export	(2) Export to US	(3) Export to China	(4) Export to ROW
$\Delta \log(1+\tau_p^{US,CN})$	0.949^{***}	1.479^{***}	0.932	0.851^{***}
	(0.311)	(0.531)	(0.725)	(0.314)
Observations	4217	1785	1664	4155
R^2	0.006	0.020	0.005	0.003

(b) Import Value

	(1) Total Import	(2) Import from US	(3) Import from China	(4) Import from ROW
$\Delta \log(1+\tau_p^{US,CN})$	0.335	0.496	0.711^{**}	0.147
	(0.236)	(0.415)	(0.288)	(0.252)
Observations	4871	2669	3976	4785
R^2	0.001	0.001	0.002	0.003

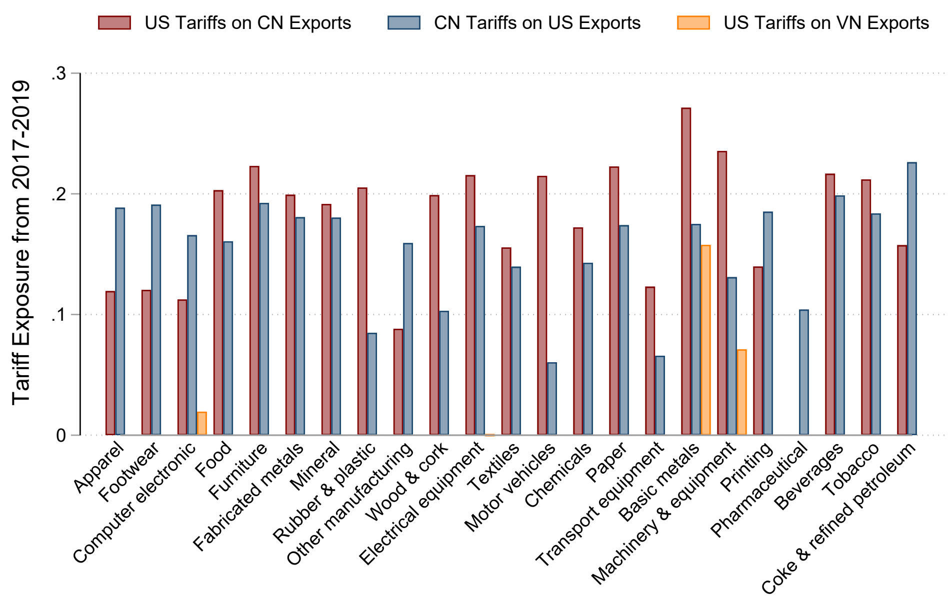
Note: Standard errors are clustered at the HS 6-digit product level. ROW stands for the rest of the world.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

3.2 Sector-Level Responses

Because the VES data do 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 the product-level tariffs, with the weights given by the value shares of Vietnamese exports to the US for every product within the given sector.[12] On average, manufacturers in our firm sample in 2017–2019 were exposed to 15, 14, 0.7 percent increases in US import tariffs on Chinese exports, Chinese import tariffs on US exports, and US import tariffs on Vietnamese exports, respectively (see Table 16 of Appendix B.2). The average tariff exposure by 2-digit manufacturing sector is illustrated in Figure 3. There are rich variations in the exposure to the US tariffs on Chinese exports and the Chinese retaliatory tariffs, while the exposure to tariffs on Vietnamese exports concentrates mostly in the basic metals sector due to the steel and aluminum tariffs imposed by the Trump administration.

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

Figure 3: Sectoral Tariff Exposure by Manufacturing Sector in Vietnam



Note: The figure illustrates the tariff exposure measure by ISIC 2-digit manufacturing sector. Sectors are ordered by their total employment (from left to right) in Vietnam in 2017.

With the exposure measure, I study Vietnamese production response at the sector level with the following regression specification analogous to the product-level analysis:

$$\begin{aligned}\Delta_{17,19} \log Y_{vj} =& \beta_0 + \beta_1 \, \Delta_{17,19} \log(1+\tau_j^{US,CN}) + \beta_2 \, \Delta_{17,19} \log(1+\tau_j^{CN,US}) \\ &+ \beta_3 \, \Delta_{17,19} \log(1+\tau_j^{US,VN}) + \beta_3 \, \Delta_{13,15} \log Y_{vj} + \alpha_v + \epsilon_{vj},\end{aligned} \tag{2}$$

where v indexes a Vietnamese province and j indexes a ISIC 4-digit industry. Consistent with the product-level analysis, I use the difference-in-log measure for sectoral outcomes.[13] The outcomes of interests, Y, include employment, assets, sales, and exports. To avoid overrepresentation of extreme observations, all the monetary outcomes are winsorized at their annual 1st and 99th percentiles. $\tau_j^{US,CN}$, $\tau_j^{CN,US}$, and $\tau_j^{US,CN}$ are the respective sectoral tariff exposure measures. α_v is the Vietnamese province fixed effect. Same as Equation (1), the outcome growth rate in 2013–2015 is included to control for potential pretrends.

In Table 4, the effects of tariff exposure on sectoral employment and sales are reported. The overall response is small and insignificant in Column (1) of both panels. However,

[13] Alternative measure using the Davis–Haltiwanger growth rate yields similar results. The tables are included in Appendix B.2.

foreign-owned manufacturers responded positively and strongly to the tariff exposure. An average increase in tariff exposures led to about 15% growth in employment [14] and 11% growth in assets for foreign-owned manufacturers.[15] On the contrary, the same magnitude of tariff exposure saw domestic manufacturers decreasing their employment growth by 13%[16] and asset growth by 14%.[17]

Table 4: Effect of Trade War Tariffs on Employment and Assets Growth

(a) Employment Growth in 2017–2019

	(1) All	(2) Domestic	(3) Foreign
$\Delta \log(1+\tau_j^{\text{US,CN}})$	-0.206	-0.818***	0.948**
	(0.237)	(0.275)	(0.429)
Province FE	Yes	Yes	Yes
Observations	1104	1068	437
R^2	0.135	0.101	0.294

(b) Total Assets Growth in 2017–2019

	(1) All	(2) Domestic	(3) Foreign
$\Delta \log(1+\tau_j^{\text{US,CN}})$	-0.083	-0.871***	0.711**
	(0.236)	(0.286)	(0.337)
Province FE	Yes	Yes	Yes
Observations	1104	1068	437
R^2	0.122	0.199	0.274

Note: Sample is Vietnamese manufacturers present in the Vietnam Enterprise Survey from 2013 to 2019 with positive employment and assets. Monetary outcomes are winsorized at the 1st and 99th percentiles. Standard errors are clustered at the sector–region level. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

[14] $e^{0.948\times 0.15}-1 \approx 0.15$.
[15] $e^{0.711\times 0.15}-1 \approx 0.11$.
[16] $e^{0.818\times 0.15}-1 \approx 0.13$.
[17] $e^{0.871\times 0.15}-1 \approx 0.14$

In Table 5, the effects of tariff exposure on sales and export growth are reported. Overall, manufacturers did not have a significant change in overall sales from Column (1) of Panel (a), but they raised their export sales by 49%[18] in response to an average increase in tariff exposure in Column (1) of Panel (b). When dividing the sample by ownership, foreign-owned manufacturers again exhibited positive sales and export responses; in particular, their export growth increased by a staggering 60%.[19] On the other hand, domestic manufacturers experiencing the same tariff exposure saw their total sales decreased by 8%.[20]

Table 5: Effect of Trade War Tariffs on Sales and Export Growth

(a) Sales Growth in 2017–2019

	(1) All	(2) Domestic	(3) Foreign
$\Delta \log(1+\tau_j^{\mathrm{US,CN}})$	-0.123	-0.494**	0.205
	(0.231)	(0.251)	(0.389)
Province FE	Yes	Yes	Yes
Observations	1091	1056	425
R^2	0.154	0.151	0.346

(b) Export Growth in 2017–2019

	(1) All	(2) Domestic	(3) Foreign
$\Delta \log(1+\tau_j^{\mathrm{US,CN}})$	2.674***	2.118	3.137***
	(0.913)	(1.690)	(1.147)
Province FE	Yes	Yes	Yes
Observations	506	343	335
R^2	0.369	0.306	0.507

Note: Sample is Vietnamese manufacturers present in the Vietnam Enterprise Survey from 2013 to 2019 with positive employment and assets. Monetary outcomes are winsorized at the 1st and 99th percentiles. Standard errors are clustered at the sector–region level. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

[18] $e^{2.674\times0.15}-1 \approx 0.49$.

[19] $e^{3.137\times0.15}-1 \approx 0.60$.

[20] $e^{0.494\times0.15}-1 \approx 0.08$.

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 product-level analysis indicates that Vietnam increased its imports from China, in particular in capital and intermediate goods, and 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 sector-level analysis focusing on manufacturers shows the positive increases in employment, assets, sales, and exports were mainly coming from the foreign-owned manufacturers. The strong employment rise contradicts the claim that all these responses corresponded to mere repackaging and relabeling of products produced elsewhere, consistent with the recent findings in Iyoha et al. (2025). In fact, the employment and export responses are strongest in labor-intensive subsectors such as textiles, apparel, and footwear, as shown in Table 19 of Appendix B.2.

One important caveat of the regression analysis is that it captures only the relative, not the absolute, effects of tariff exposure. A foreign demand shock at the scale of the trade war could have a general equilibrium effect on prices and wages, thus affecting products or sectors 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 under the assumption that foreign-owned firms' net profits do not contribute to local consumption.

4 Model of Trade Participation With Firm Ownership

The reduced-form analysis in the previous section confirms that firms' response to foreign demand shocks can differ starkly with their 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 of Antràs et al. (2017). In the following, I first describe the overall environment and 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,[21] 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 from 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. 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 prefer to stay inactive if they cannot 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 generates self-selection into import and export activities. Last, domestic firms are owned by the representative household, and hence their net profits contribute wholly to domestic consumption; however, I assume that foreign-owned firms contribute only 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 implications for the home country.

Before proceeding to the model details, I summarize the timing of firm decisions. First,

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

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 constant-elasticity-of-substitution (CES) utility over differentiated manufacturing final goods[22]:

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

where σ is the elasticity of substitution over varieties.

The representative consumer in each country maximizes her utility by choosing how much to consume for each variety given her 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 et al. (2016), I assume that the 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 the choice of foreign currency for simplicity. Therefore, the aggregate price index at home is

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

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

Following Antràs et al. (2017), I define a residual demand term 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. The firms are indexed by their ownership status $i \in \{d, f\}$, i.e., domestic or foreign. 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 the labor expenditure share and ρ is the 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:

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

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 requirements of the input at home and abroad, and $J_i^M(\varphi)$ is an indicator for whether a manufacturer with ownership i and productivity φ engages 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 the 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 demand 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:

$$\pi_v(\varphi, J_i^M, J_i^X) = \left(\frac{\varphi}{w_h^\gamma \beta}\right)^{\sigma-1} \left(\underbrace{\frac{T_h}{w_h^\theta}}_{\Theta_h^M} + J_i^M \underbrace{\frac{T_a}{(\tau^M \epsilon w_a)^\theta}}_{\Theta_a^M}\right)^{\frac{(1-\gamma)(\sigma-1)}{\theta}} \left(\underbrace{B_h}_{\Theta_h^X} + J_i^X \underbrace{\frac{B_a}{(\tau^X)^{\sigma-1}}}_{\Theta_a^X}\right),$$

$$\pi_i(\varphi, J_i^M, J_i^X) = \pi_v(\varphi, J_i^M, J_i^X) - w_h f_i^O - J_i^M w_h f_i^M - J_i^X w_h f_i^X \quad \forall i \in \{d, f\}, \tag{11}$$

where β is some constant,[23] $J_i^X(\varphi)$ is an indicator for whether a manufacturer with ownership i and productivity φ engages in export activities, $\{\Theta_h^M, \Theta_a^M\}$ are defined as the **sourcing potential** at home and abroad, and $\{\Theta_h^X, \Theta_a^X\}$ are defined as the analogous **sales potential**. Furthermore, manufacturers have to pay ownership-specific operation costs f_i^O to stay active in production. They also have to pay sourcing and exporting fixed costs $\{f_i^M, f_i^X\}$ if they decide to participate in either of these activities; these costs also differ by ownership status.

The following proposition shows that the trade participation decisions are complementary to each other and to firms' 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, and*
2. *improvement in sales potential abroad weakly increases manufacturers' export and import participation.*

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

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

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

4.4 Equilibrium

Fixed numbers of potential entrants $\{N_d, N_f\}$ are present at home with knowledge of their own core productivity φ. A manufacturer will pay the associated operation costs f_i^O to stay active in production if its 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 $\{\underline{\varphi}_d^*, \underline{\varphi}_f^*\}$:

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

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^*.

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

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 consider the welfare implication when $\lambda_f = 1$.

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

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

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:

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

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

Last, the set of parameters in the model is defined as Λ and 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 by defining 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 that the trade balance condition in equation (14) is satisfied.*
4. *E_h^* satisfies the budget constraint in equation (15).*
5. *P_h^* ensures that 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 relative sourcing and sales potential abroad $\{\frac{\Theta_a^M}{\Theta_h^M}, \frac{\Theta_a^X}{\Theta_h^X}\}$, 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 et al. (2017) very closely, so I relegate the details to Appendix D and focus on the second part of the estimation. I 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 its core productivity φ from a Pareto distribution with shape parameter κ. The manufacturer will not produce anything if the draw is below its ownership-specific productivity cutoff $\underline{\varphi}_i$ pinned down by the zero-profit conditions in equation (13).[24] In addition, firms draw their sourcing and exporting fixed costs from two separate log-normal distributions. Specifically, the means of the log-normal distributions are parameterized as $\{\log \beta^M_{cons} + \log \beta^M_f \mathbb{1}(\text{Foreign-owned}), \log \beta^X_{cons} + \log \beta^X_f \mathbb{1}(\text{Foreign-owned})\}$. The additional coefficients for foreign-owned firms $\{\beta^M_f, \beta^X_f\}$ indicate their cost ratios relative to the costs of domestic firms. Last, the variances of the log-normal distributions are denoted by $\{\beta^M_{disp}, \beta^X_{disp}\}$.

5.2 Simulation Procedure

Together with the labor expenditure share γ and manufacturing residual demand term B_h,[25] there are 11 objects to be estimated jointly: $\delta = [\underline{\varphi}_d, \underline{\varphi}_f, \kappa, \beta^M_{cons}, \beta^M_f, \beta^M_{disp}, \beta^X_{cons}, \beta^X_f, \beta^X_{disp}, \gamma, B_h]$.

[24] Despite the fact that $\{\underline{\varphi}_d, \underline{\varphi}_f\}$ are actually endogenously determined in the model, their baseline values are estimated jointly with the shape parameter κ. Given the baseline estimates, the fixed operation costs $\{f^O_d, f^O_f\}$ can be backed out from equation (13), which are the deep parameters of the model. In the counterfactual analysis in Section 6, $\{\underline{\varphi}_d, \underline{\varphi}_f\}$ will be resolved when the foreign demand shock is imposed.

[25] Similar to the productivity cutoffs, B_h is an endogenous object that governs the scale of firm profits at home. The estimate is a baseline value and will be updated in the counterfactual analysis.

I estimate all objects 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 choose for the identity matrix.

A total of 66,300 domestic firms and 6,400 foreign-owned firms are simulated—approximately corresponding to the number of active manufacturers in the 2017 VES data. Each firm draws its core productivity and sourcing and exporting fixed costs from the parameterized distributions.[26] 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 as explained below.

5.3 Moments and Identification

The first set of moments concerns the estimation of productivity cutoffs and shape parameter $\{\underline{\varphi}_d, \underline{\varphi}_f, \kappa\}$. When productivity is Pareto distributed, the log share of firms with productivity larger than each productivity percentile is proportional to the log percentile.[27] 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:

$$\log \underbrace{Pr(\text{Sales} \geq x_{pi})}_{\text{Share of firms with sales more than percentile } x_{pi}} = a_{0i} + a_{1i} \log x_{pi} + \epsilon_{pi} \; \forall i \in \{d, f\}, \tag{19}$$

where x_i is p–th 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

[26] 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 objects $\{\underline{\varphi}_d, \underline{\varphi}_f, \kappa\}$ can be treated as estimating two different Pareto distributions with different scales and the same shape.

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

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 among firms below the median sales than among 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 residual demand at home B_h. Intuitively, I use the average wage bill over the 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 bring 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 6. Regarding the productivity parameters, the productivity cutoff of foreign-owned firms is higher than that of domestic firms, reflecting the former's higher productivity. Then, note that the estimates of the 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 approximately 19 percent and 7 percent of the domestic firms' costs, respectively.[28]

The median sourcing and exporting fixed costs are shown in Table 7. Consistent with our parameter estimates, foreign-owned firms have significantly lower fixed costs, ranging from 35K–83K USD, while the median costs for domestic firms range from 360K–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 8 confirms that foreign-owned firms in Vietnam face higher operation costs to stay active in production activities, which in turn leads to their having higher productivity than the domestic firms on average.

[28]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 6: Summary of Model Objects and Baseline Estimates

Object	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 sales 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)			
$\underline{\varphi}_d$	Productivity cutoff of domestic firms	0.667	5
$\underline{\varphi}_f$	Productivity cutoff of foreign-owned firms	0.857	5
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
B_h	Residual demand at home	0.008	5

Table 7: Median Fixed Costs by Firm Ownership Status

	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 8: Operation Costs by Firm Ownership Status

	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 status. In Figure 4, I show that the SMM does a reasonably good job of matching the participation rate from the 2017 VES data. The remaining moment fits are provided in Table 9.

Figure 4: Moment Fit: Trade Participation by Firm Ownership Status

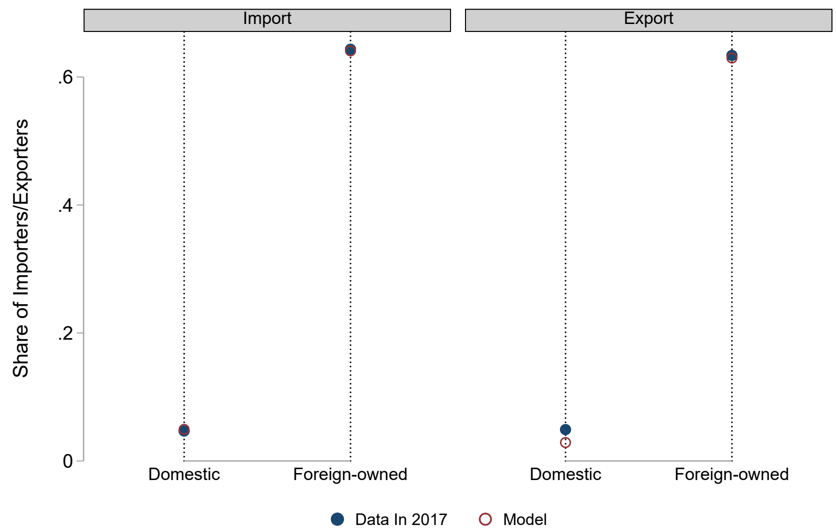


Table 9: Moment Fit: Other Moments

Moment in 2017	Data	Model
Moments for productivity		
$\log Pr(\text{Sales} \geq x_{pi}) = a_{0i} + a_{1i} \log x_{pi} + \epsilon_{pi}\ \forall i \in \{d, f\}$		
Intercept for domestic firms	-1.580	-1.251
Coefficient for $\log x_{pd}$	-0.357	-0.259
Intercept for foreign-owned firms	-0.542	-0.534
Coefficient for $\log x_{pf}$	-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 those in the actual data during the US–China trade war in 2017–2019. There are two main objectives of this exercise. The first is to understand the welfare implications of the shock when foreign-owned firms retain different levels of profits in Vietnam. The second is to understand the extent to which differences in the trade response between domestic and foreign-owned firms can be explained by their differences in productivity and fixed costs of sourcing and exporting.

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 Θ_a^X such that the average export growth generated from the model is approximately 0.3 percent, close to the estimated export growth induced by the US trade war tariffs.[29] Specifically, I raise the sales potential abroad by 1 percent and resolve the residual demand at home, exchange rate, aggregate price, aggregate expenditure, and number of active firms such that the zero-profit conditions in equation (13), the trade balance condition in equation (14), and the goods market clearing condition in equation (16) are all satisfied under the new equilibrium.[30]

The percentage changes of key model moments in response to the foreign demand shock are summarized in Table 10. A one-percent increase in the sales potential abroad lowers the aggregate price by 6 percent. It also raises labor demand and the real wage by 6 percent. Overall, consumer welfare as measured by real expenditure increases by 5 percent. In response to rising wages and lower prices at home, less productive firms cannot earn positive profits and stay out of the market. As a result, the total numbers of active domestic and foreign-owned firms both decrease by 25 percent.

The changes in firm production outcomes over the initial distribution are demonstrated in Figure 5. 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,

[29] The details of how I estimate the average export growth induced by the trade war tariffs are provided in Appendix E.1.

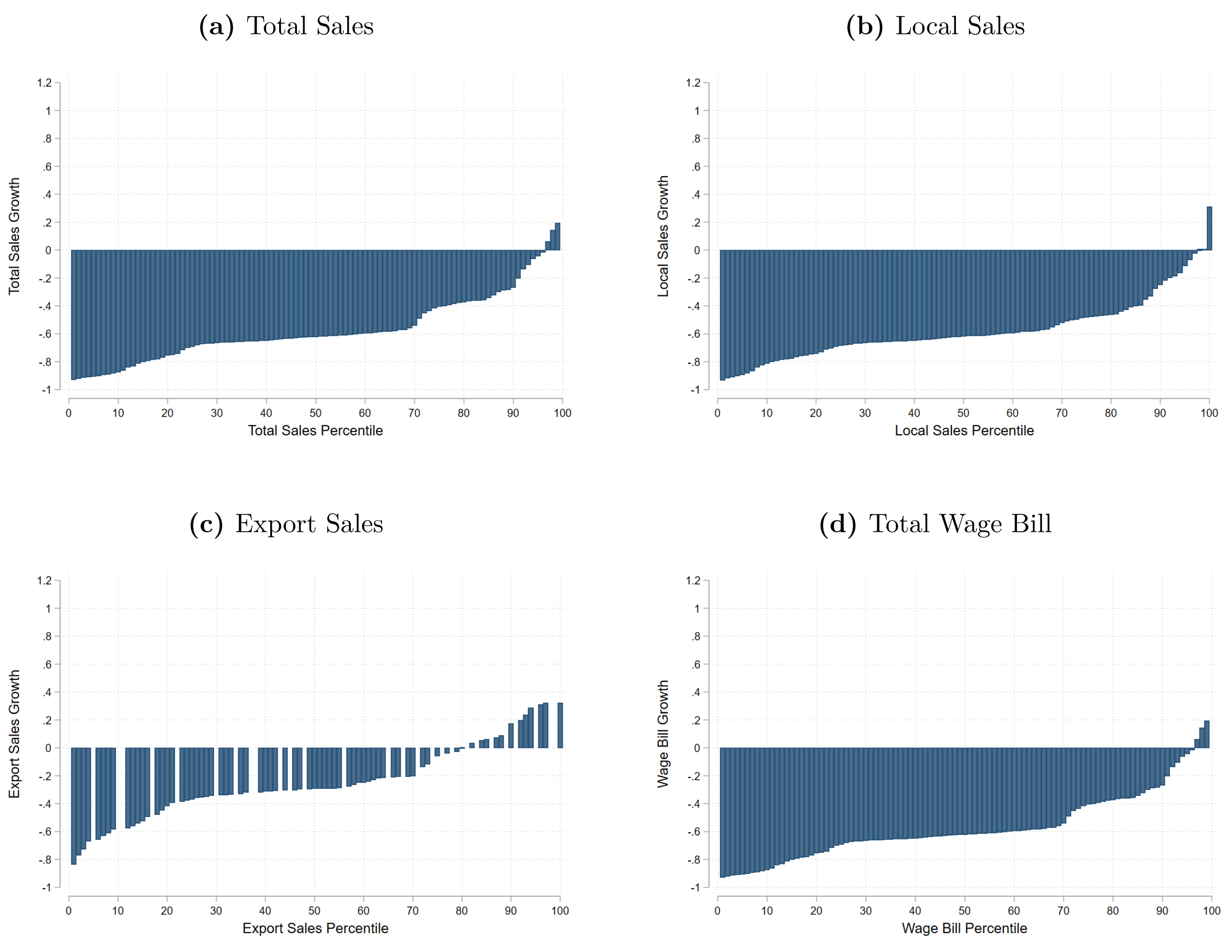
[30] The algorithm is provided in Appendix E.2.

which 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.

Table 10: Percentage Change of Model Moments to the Foreign Demand Shock

Model Moment	Percentage Change (%)
Sales potential abroad	1
Aggregate price index	-6
Real wage	6
Real expenditure	5
Number of active domestic firms	-25
Number of active foreign firms	-25
Number of active firms	-25

Figure 5: Change in Sales and Wage Bill of Manufacturers



6.2 Decomposing the Roles of Productivity and Fixed Costs

The trade response of firms to the foreign demand shock is illustrated in Figure 6. The baseline predictions of the model (in red circles) do match the trade participation rate in the 2019 data (in blue dots) reasonably well, 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 square points in Figure 6, the trade participation rates of foreign-owned firms drop significantly when firms share the same productivity cutoff. The remaining discrepancy in trade participation is driven by the heterogeneity in fixed costs, which explains approximately 44 percent of the difference in the import response and 42 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 the triangle points in the same figure. Somewhat surprisingly, the heterogeneity in productivity actually explains only approximately 14 percent of the differences in the import response and 9 percent of those in the export response. Overall, this exercise highlights the importance of heterogeneous fixed costs in explaining the different trade responses by firm ownership status.

6.3 Contribution to Real Expenditure

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 and calculate the growth of each component following the simulated foreign demand shock. The results are summarized in the first column of Table 11. While the demand shock raises labor demand and thus total labor income by about 5.3 percent, it also decreases the net profits by about 0.3 percent, leading to an overall welfare change of 5 percent. Note that most contributions in labor income and net profit are driven by the most productive firms, which 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 results in the second column in Table

11. This setting corresponds to the conventional quantitative models in trade. Despite positive changes in both labor income and net profits, the welfare response under this setup is only about 0.2 percent, much smaller than the baseline. The intuition is that the force of resource reallocation induced by the demand shock is weaker with higher real expenditure before the shock implied by equation (15). The demand shock thus drives away less marginal and unproductive firms under this setup.

Figure 6: Trade Response to Foreign Demand Shocks

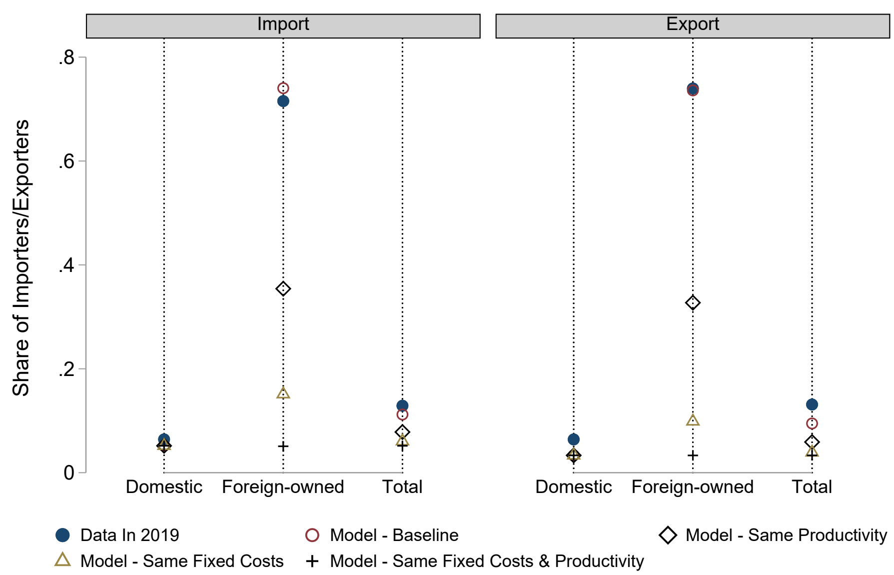


Table 11: Decomposition of Real Expenditure Growth to the Foreign Demand Shock

Component	Percentage Change (%)	
	Baseline ($\lambda_f = 0$)	Convention ($\lambda_f = 1$)
Labor income	5.30	0.15
Net profit	-0.28	0.08
Real expenditure	5.02	0.23

7 Conclusion

The US-China trade war in 2018–2019 presents challenges but also opportunities for the bystander countries in the developing world. To the author's best knowledge, this paper is the first one to quantify the welfare implication of the trade war on a third country in a general equilibrium model. The role of foreign-owned manufacturers is highlighted as they are often the largest and most productive firms in developing countries despite the concern of profit shifting and tax evasion. This paper takes the role of foreign ownership seriously and studies its implication for trade participation, production responses, 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 even conditional on firm size. Utilizing the US–China trade war episode as a foreign demand shock to Vietnam, I provide evidence that (1) the shock induced stronger import responses in intermediate goods from China and export responses in final goods to the US and the rest of the world and that (2) foreign-owned manufacturers in Vietnam were more likely to participate in trade activities and increase their employment, assets, and 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. In the counterfactual exercise, a foreign demand shock is fed into the model, generating the same magnitude of export growth by the trade war tariffs estimated from the data. The welfare decomposition implies that the gains from the demand shock in Vietnam are predominantly driven by the increase in labor income, not net profits. 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 of the foreign-owned firms are retained locally matters for real expenditure in Vietnam, as full retention of foreign profits actually weakens the force of resource reallocation and implies lower welfare contribution of the foreign demand shock.

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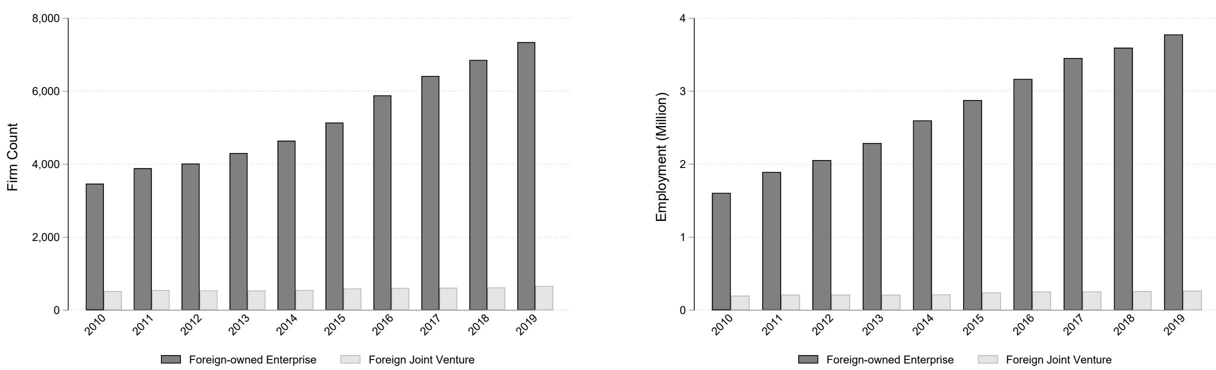
Appendices

A Additional Descriptive Facts

Fact 4. Foreign-owned manufacturers in Vietnam are predominantly greenfield investments.
In Figure 7, 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 that their count and employment were both increasing in the 2010s.

Figure 7: Vietnamese Manufacturers by Ownership Type in 2010–2019

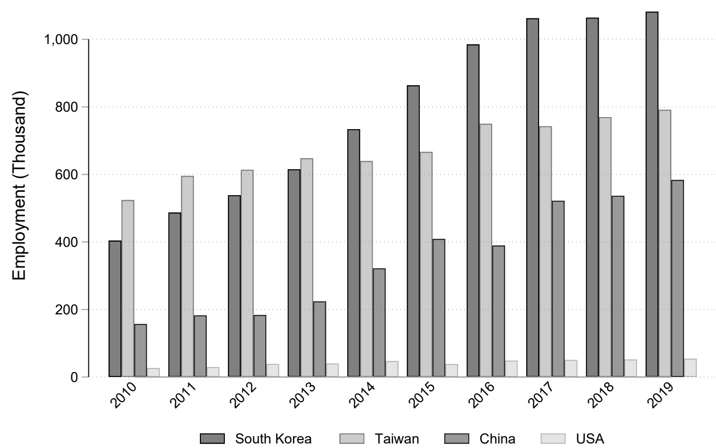
(a) Firm Count **(b)** Employment



Note: Sample is Vietnamese manufacturers with positive employment and assets in the Vietnam Enterprise Survey from 2010 to 2019.

Fact 5. Foreign-owned manufacturers come mostly from nearby Asian countries.
Last, I show the employment of foreign-owned manufacturers by their origin in Figure 9. Foreign investments in Vietnam come mostly from nearby Asian countries. By the year 2019, the largest foreign investor in Vietnam was South Korea, followed by Taiwan and China. Notably, employment by Chinese manufacturers rose in the 2010s.

Figure 9: Employment of Foreign-Owned Manufacturers by Origin (Top 3 + USA)



Note: Sample is Vietnamese manufacturers with positive employment and assets in the Vietnam Enterprise Survey from 2010 to 2019.

B Additional Results for the Reduced-Form Analysis

B.1 Product-Level 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 Statistics Division. The estimates for final goods are in Table 12, and the estimates for intermediates are in Table 13. The growth of final goods exports from Vietnam to the US is particularly strong, as shown in column 2 of Table 12. On the other hand, the growth of intermediate imports from China to Vietnam is also large.

Table 12: Effect of US Trade War Tariffs on Vietnamese Trade Value (Final Goods)

(a) Export Value

	(1) Total Export	(2) Export to US	(3) Export to China	(4) Export to ROW
$\Delta \log(1+\tau_p^{US,CN})$	0.364	1.219	-1.524	0.239
	(0.480)	(0.753)	(1.114)	(0.477)
Observations	1355	853	643	1345
R^2	0.001	0.032	0.013	0.004

(b) Import Value

	(1) Total Import	(2) Import from US	(3) Import from China	(4) Import from ROW
$\Delta \log(1+\tau_p^{US,CN})$	0.742	-0.260	0.760	0.648
	(0.462)	(0.769)	(0.532)	(0.505)
Observations	1400	668	977	1368
R^2	0.007	0.008	0.017	0.003

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

Table 13: Effect of US Trade War Tariffs on Vietnamese Trade Value (Intermediates)

(a) Export Value

	(1) Total Export	(2) Export to US	(3) Export to China	(4) Export to ROW
$\Delta \log(1+\tau_p^{US,CN})$	1.362***	0.071	2.020	1.468***
	(0.469)	(1.000)	(1.271)	(0.478)
Observations	2862	932	1021	2810
R^2	0.009	0.011	0.008	0.005

(b) Import Value

	(1) Total Import	(2) Import from US	(3) Import from China	(4) Import from ROW
$\Delta \log(1+\tau_p^{US,CN})$	0.035	0.435	0.795**	-0.208
	(0.308)	(0.546)	(0.371)	(0.319)
Observations	3471	2001	2999	3417
R^2	0.001	0.000	0.004	0.009

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

Alternative specification of the product-level analysis. To account for zero values for certain products in either 2017 or 2019, I employ the Davis–Haltiwanger growth rate measure for the product-level export and import values:

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

where $\Delta_{17,19} Y_p^{k,VN}$ is the difference in import/export values of an HS 6-digit product p between Vietnam and the country $k \in \{\text{All, US, China, ROW}\}$ from 2017 to 2019, $\Delta_{17,19} \log(1+\tau_p^{US,CN})$ is the change in the log US import tariff on exports of product p from China, $\Delta_{17,19} \log(1+\tau_p^{CN,US})$ is the change in the log Chinese import tariff on exports of product p from US, and $\Delta_{17,19} \log(1+\tau_p^{US,VN})$ is the change in the log US import tariff on exports of product p from Vietnam. Same as Equation (1), the growth rate from 2013 to 2015 is included to account for potential pre–trade war trends. As Table 15 shows, the strong trade responses to Trump tariffs, in particular exports to the US and imports from China, are also present under this alternative specification.

Table 15: Effect of US Trade War Tariffs on Vietnamese Trade Value (Davis–Haltiwanger Growth Rate)

(a) Export Value

	(1) Total Export	(2) Export to US	(3) Export to China	(4) Export to ROW
$\Delta \log(1 + \tau_p^{US,CN})$	0.803***	0.521	0.436	0.669***
	(0.195)	(0.356)	(0.387)	(0.197)
Observations	4694	2442	2552	4651
R^2	0.009	0.005	0.002	0.007

(b) Import Value

	(1) Total Import	(2) Import from US	(3) Import from China	(4) Import from ROW
$\Delta \log(1 + \tau_p^{US,CN})$	0.389***	0.227	0.711**	0.147
	(0.151)	(0.413)	(0.288)	(0.252)
Observations	5059	2969	3976	4785
R^2	0.003	0.001	0.002	0.003

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

B.2 Sector-Level Responses

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

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

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

$$\Delta_{17,19}\log(1+\tau_j^{US,VN}) = \sum_{p\in\Omega_j} \frac{X_{p,17}^{US,VN}}{X_{j,17}^{US,VN}} \times \Delta_{17,19}\log(1+\tau_p^{US,VN}), \tag{23}$$

where j stands for a ISIC 4-digit sector and p stands for a 6-digit HS product code. Ω_j is the set of products belonging to sector j.[31] The summary of the resulting exposure measure is provided in Table 16.

Table 16: Summary of Sectoral Tariff Exposures in 2017–2019

	$\Delta_{17,19}\log(1+\tau_j^{US,CN})$	$\Delta_{17,19}\log(1+\tau_j^{CN,US})$	$\Delta_{17,19}\log(1+\tau_j^{US,VN})$
Mean	0.152	0.139	0.007
Median	0.156	0.159	0.000
SD	0.069	0.061	0.029

Note: This table shows average tariffs at the ISIC 2-digit level.

Alternative specification of the sector-level analysis. Similar to the product-level analysis, I also implement the Davis-Haltiwanger growth rate measure for the sector-level outcomes:

$$\begin{aligned}\frac{\Delta_{17,19}Y_{vj}}{\frac{1}{2}(Y_{vj,17}+Y_{vj,19})} =& \beta_0 + \beta_1\,\Delta_{17,19}\log(1+\tau_j^{US,CN}) + \beta_2\,\Delta_{17,19}\log(1+\tau_j^{CN,US}) \\ &+ \beta_3\,\Delta_{17,19}\log(1+\tau_j^{US,VN}) + \beta_4\,\frac{\Delta_{13,15}Y_{vj}}{\frac{1}{2}(Y_{vj,13}+Y_{vj,15})} + \alpha_v + \epsilon_{vj},\end{aligned} \tag{24}$$

[31] Ω_j is defined according to the HS–ISIC correspondence table from the Jordan Industrial Observatory: https://observatory.huzaifazoom.org/blog/2022/04/18/hs-isic-correspondence-table/.

where v indexes a Vietnamese province and j indexes a ISIC 2-digit industry. Note that observations with zero value in either 2017 or 2019 are dropped under this specification. The results for employment and sales growth are provided in Table 17, and the results for export and import growth are included in Table 18. As the tables illustrate, the strong employment and export responses from foreign-owned manufacturers are still robust under this alternative specification.

Table 17: Effect of Trade War Tariffs on Employment and Assets Growth (Davis–Haltiwanger Growth Rate)

(a) Employment Growth in 2017–2019

	(1) All	(2) Domestic	(3) Foreign
$\Delta \log(1+\tau_j^{\text{US,CN}})$	-0.068	-0.763***	0.862**
	(0.225)	(0.260)	(0.388)
Province FE	Yes	Yes	Yes
Observations	1157	1132	494
R^2	0.173	0.112	0.330

(b) Total Assets Growth in 2017–2019

	(1) All	(2) Domestic	(3) Foreign
$\Delta \log(1+\tau_j^{\text{US,CN}})$	-0.030	-0.818***	0.632*
	(0.225)	(0.265)	(0.324)
Province FE	Yes	Yes	Yes
Observations	1157	1132	494
R^2	0.137	0.220	0.318

Note: Sample is Vietnamese manufacturers present in the Vietnam Enterprise Survey from 2013 to 2019 with positive employment and assets. Monetary outcomes are winsorized at the 1st and 99th percentiles. Standard errors are clustered at the sector–region level. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 18: Effect of Trade War Tariffs on Sales and Export Growth (Davis–Haltiwanger Growth Rate)

(a) Sales Growth in 2017–2019

	(1) All	(2) Domestic	(3) Foreign
$\Delta \log(1+\tau_j^{\text{US,CN}})$	-0.027	-0.464**	0.286
	(0.216)	(0.237)	(0.368)
Province FE	Yes	Yes	Yes
Observations	1148	1124	485
R^2	0.189	0.178	0.380

(b) Export Growth in 2017–2019

	(1) All	(2) Domestic	(3) Foreign
$\Delta \log(1+\tau_j^{\text{US,CN}})$	2.256***	1.884	2.828***
	(0.784)	(1.296)	(0.919)
Province FE	Yes	Yes	Yes
Observations	647	518	415
R^2	0.347	0.282	0.528

Note: Sample is Vietnamese manufacturers present in the Vietnam Enterprise Survey from 2013 to 2019 with positive employment and assets. Monetary outcomes are winsorized at the 1st and 99th percentiles. Standard errors are clustered at the sector–region level. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Sectoral heterogeneity. I break down the sample by two-digit industry code and estimate the employment and export response by sector in Table 19 and 20. In general, the sectors with stronger responses are more labor intensive.

Table 19: Sectoral Heterogeneity of Employment and Asset Growth

(a) Employment Growth by Sector

	(1) Food	(2) Textile	(3) Paper	(4) Chemical	(5) Pharmaceutical	(6) Mineral	(7) Electronic	(8) Transport	(9) Other
$\Delta \log(1+\tau_j^{\mathrm{US,CN}})$	-106.540	12.690	0.310	7.094	0.517**	15.339***	1.070*	1.736*	-1.095*
	(92.235)	(11.152)	(1.108)	(14.277)	(0.235)	(2.952)	(0.621)	(0.964)	(0.568)
Province FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	139	127	180	44	88	171	109	50	165
R^2	0.595	0.621	0.704	0.400	0.723	0.437	0.503	0.609	0.564

(b) Asset Growth by Sector

	(1) Food	(2) Textile	(3) Paper	(4) Chemical	(5) Pharmaceutical	(6) Mineral	(7) Electronic	(8) Transport	(9) Other
$\Delta \log(1+\tau_j^{\mathrm{US,CN}})$	-203.059*	3.526	-1.342	7.194	0.655***	8.340***	0.074	1.234	-0.085
	(115.594)	(13.509)	(1.285)	(13.448)	(0.130)	(2.258)	(0.473)	(1.817)	(0.881)
Province FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	139	127	180	44	88	171	109	50	165
R^2	0.682	0.430	0.658	0.439	0.750	0.526	0.486	0.653	0.361

Note: Sample is Vietnamese manufacturers who were present in the Vietnam Enterprise Survey from 2013 to 2019 with positive employment and assets. Monetary outcomes are winsorized at the 1st and 99th percentiles. Standard errors are clustered at the sector-region level. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 20: Sectoral Heterogeneity of Sales and Export Growth

(a) Sales Growth by Sector

	(1) Food	(2) Textile	(3) Paper	(4) Chemical	(5) Pharmaceutical	(6) Mineral	(7) Electronic	(8) Transport	(9) Other
$\Delta \log(1+\tau_j^{\text{US,CN}})$	-244.860*	23.078	-1.001	21.056	0.906***	10.989***	0.168	1.107	-0.620
	(128.181)	(14.209)	(0.819)	(20.592)	(0.235)	(2.386)	(0.345)	(1.541)	(0.839)
Province FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	139	125	178	38	82	170	109	50	158
R^2	0.619	0.482	0.546	0.402	0.709	0.445	0.594	0.558	0.476

(b) Export Growth by Sector

	(1) Food	(2) Textile	(3) Paper	(4) Chemical	(5) Pharmaceutical	(6) Mineral	(7) Electronic	(8) Transport	(9) Other
$\Delta \log(1+\tau_j^{\text{US,CN}})$	-412.347	169.280***	8.731*	-22.838	-1.313	10.151	1.910	3.556**	-0.315
	(796.584)	(41.605)	(4.508)	(34.671)	(0.781)	(15.033)	(1.134)	(1.253)	(1.489)
Province FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	42	92	62	10	26	74	54	26	42
R^2	0.431	0.728	0.601	0.774	0.497	0.584	0.546	0.887	0.676

Note: Sample is Vietnamese manufacturers who were present in the Vietnam Enterprise Survey from 2013 to 2019 with positive employment and assets. Monetary outcomes are winsorized at the 1st and 99th percentiles. 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:

The 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 et al. (2017), I first estimate each foreign country's sourcing and sales potential relative to Vietnam's and then average the figures 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 equations (10) and (12):

$$\chi_{i,j}^M = \frac{(\tau_j^M w_j)^{-\theta} T_j}{\sum_l (\tau_l^M w_l)^{-\theta} T_l} = \frac{\Theta_j^M}{\sum_l \Theta_l^M}, \tag{25}$$

$$\chi_{i,k}^X = \frac{(\tau_k^X)^{1-\sigma} B_k}{\sum_l (\tau_l^X)^{1-\sigma} B_l} = \frac{\Theta_k^X}{\sum_l \Theta_l^X}, \tag{26}$$

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 the log of the shares and subtracting the log shares in Vietnam, I can obtain the following:

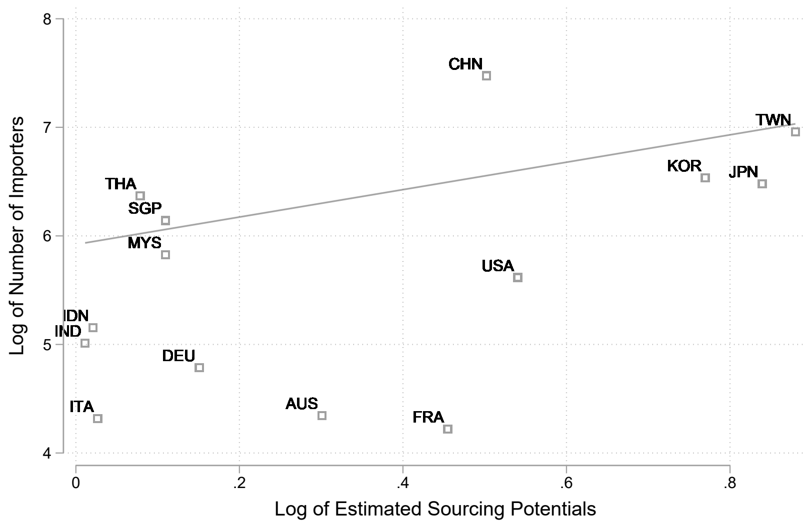
$$\log \chi_{i,j}^M - \log \chi_{i,h}^M = \log \underbrace{\Theta_j^M / \Theta_h^M}_{\text{Relative sourcing potential of country j}}, \tag{27}$$

$$\log \chi_{i,k}^X - \log \chi_{i,h}^X = \log \underbrace{\Theta_k^X / \Theta_h^X}_{\text{Relative sales potential of country k}}, \tag{28}$$

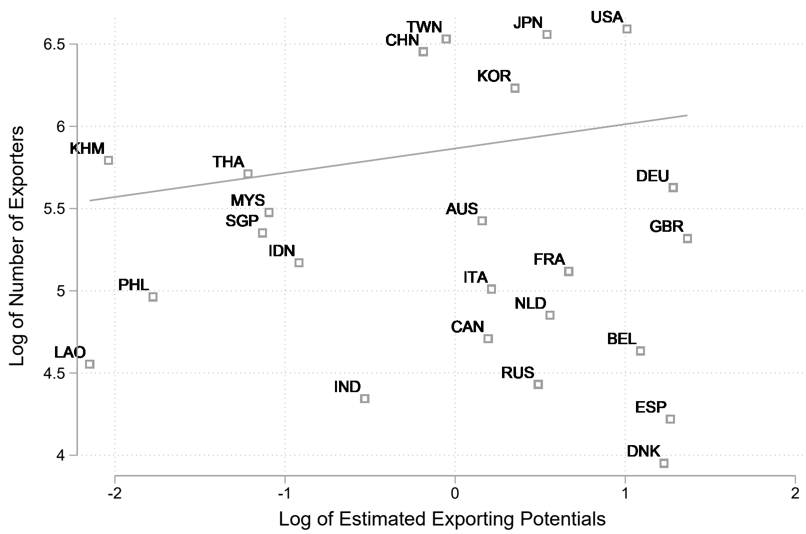
where $\{\chi_{i,h}^M, \chi_{i,h}^M\}$ are firm i's shares of domestic sourcing and sales. The relative sourcing and sales potentials can then be estimated by regressing the log differences in shares on the country dummies. Figure 10 illustrates the estimates and associated log number of importers and 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 10: Estimates of Relative Sourcing and Sales Potential by Country

(a) Sourcing Potential



(b) Sales Potential



Note: The sourcing and sales potential is estimated with the Vietnam Technology and Competitiveness Survey (TCS) from years 2009–2014. The estimates are relative to the potential for 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:

$$\Theta_k^X = (\tau_k^X)^{1-\sigma} B_k. \tag{29}$$

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

$$\begin{aligned}\log \widehat{\Theta_k^X} =& (1-\sigma)\log \tau_k^X + \alpha_d \log \text{distance}_{hk} + \alpha_c \text{ control of corruption}_k + \alpha_g \log \text{GDP}_k \\ &+ \alpha_0 + \epsilon_k,\end{aligned} \tag{30}$$

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.[32] The estimation result is shown in Table 21. The estimates indicate an estimate of σ of approximately 5.2, implying an average markup of 24 percent.[33]

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

$$\Theta_j^M = (\tau_j^M w_j)^{-\theta} T_j. \tag{31}$$

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

$$\begin{aligned}\log \widehat{\Theta_j^M} =& -\theta \log(\tau_j^M w_j) + \beta_d \log \text{distance}_{hj} + \beta_c \text{ control of corruption}_j + \beta_g \log \text{GDP}_j \\ &+ \beta_r \log \text{R\&D}_j + \beta_k \log \text{capital}_j + \beta_e \log \# \text{ establishments}_j + \beta_0 + \epsilon_j,\end{aligned} \tag{32}$$

where variations in $\log(\tau_j^M w_j)$, the log multiple of average import tariffs and manufacturing monthly wage in country j,[34] identify the input trade elasticity. In addition to the standard gravity variables, I control for R&D expenditure, the capital–labor ratio, and the 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-

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

[33] The estimate of σ in Antràs et al. (2017) with the US data is 3.85, implying an average markup of 35 percent.

[34] Wages are adjusted by country-level human capital based on 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 in Antràs et al. (2017), using country population as an instrument. The results are shown in Table 22. The instrument seems to do a reasonably good job of correcting the selection bias associated with sourcing activities at the country level. I end up using $\theta = 1.334$.[35]

Table 21: 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

Note: Sample is at the country-year level. Standard errors are clustered at the region level. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

[35]The estimate of θ in Antràs et al. (2017) with the US data is 1.789.

Table 22: 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	.

Note: 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 23: 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 Details of Counterfactual Analysis

E.1 Estimation of Average Export Response from the Trade War

Here I explain the estimation procedure to obtain the average export response of Vietnamese manufacturers induced by the US–China trade war for the counterfactual analysis. Unlike the firm-level analysis in Section 3 focusing on a subset of manufacturers that were in the data in 2013-2019, I use all manufacturers in the 2017 VES with positive export values in either 2017 or 2019 and estimate a regression similar to the equation (2):

$$\frac{\Delta_{17,19} Y_{ijk}}{\frac{1}{2}(Y_{ijk,17} + Y_{ijk,19})} = \beta_0 + \beta_1 \, \Delta_{17,19} \log(1 + \tau_j^{US,CN}) + \epsilon_{ijk}. \tag{33}$$

With the estimates of β_0 and β_1, the predicted export growth can be derived by rearranging terms and summing over all firms:

$$\sum_{i=1}^{N} \frac{\widehat{\Delta_{17,19} Y_{ijk}}}{Y_{ijk,17}} = \sum_{i=1}^{N} \frac{\frac{1}{2}(Y_{ijk,17} + Y_{ijk,19})}{Y_{ijk,17}} \times \left[\widehat{\beta}_0 + \widehat{\beta}_1 \, \Delta_{17,19} \log(1 + \tau_j^{US,CN}) \right] \tag{34}$$

E.2 Algorithm

The parameters in the model include the following: 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 the following: 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. Given a foreign demand shock $\Delta\Theta_a^X$, exchange rate ϵ, and aggregate price index P_h, run the following loops to solve for the new equilibrium.

1. Loop for the trade balance condition:

   (a) Update $\{\underline{\varphi}_d, \underline{\varphi}_f\}$ from the zero-profit conditions given the productivity and fixed cost parameters.

(b) Update the number of active domestic and foreign-owned firms, i.e., $N_i(1-G(\underline{\varphi}_i))$.

(c) Draw the productivities and fixed costs and then simulate the firm response $\{J_i^M, J_i^X\}$ following equation (11).

(d) Calculate the import and export values at home following equation (14).

(e) Update the exchange rate ϵ.

(f) Repeat until equation (14) holds.

2. Loop for the goods market clearing condition:

   (a) Calculate the aggregate expenditure (i.e., goods demand) and goods supply following equations (15) and (16).

   (b) Update the aggregate price index P_h and then B_h following equation (6).

   (c) Repeat from step 1. until equation (16) holds.

3. Loop for the foreign demand shock:

   (a) Calculate the average export growth from the model.

   (b) Update the foreign demand shock $\Delta\Theta_a^X$.

   (c) Repeat from step 1. until the average export growth matches the estimate from Appendix E.1.