Trade Wars with FDI Diversion
Online Appendix

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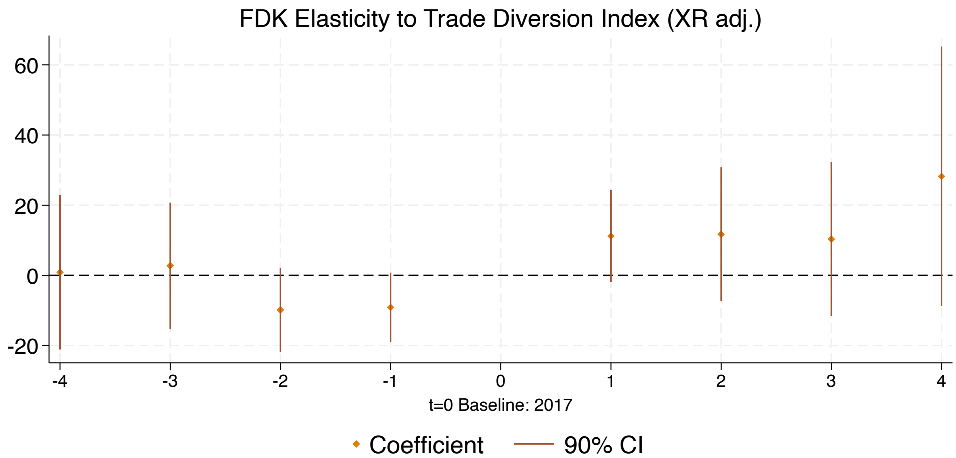
In this Online Appendix, I present an extended model's derivation, as well as a number of robustness results that appear or are discussed in the main paper.

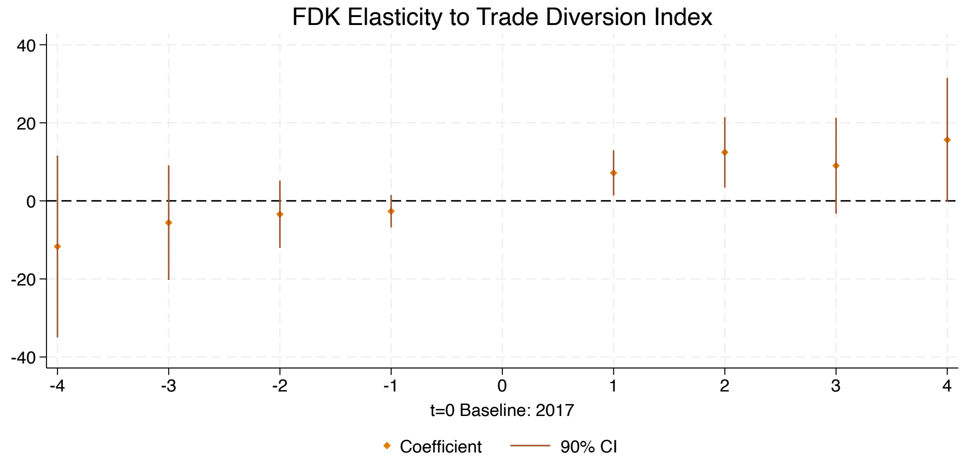
OA.1 Extra Empirical Analysis

OA.1.1 Robustness Check for Country-Level Result



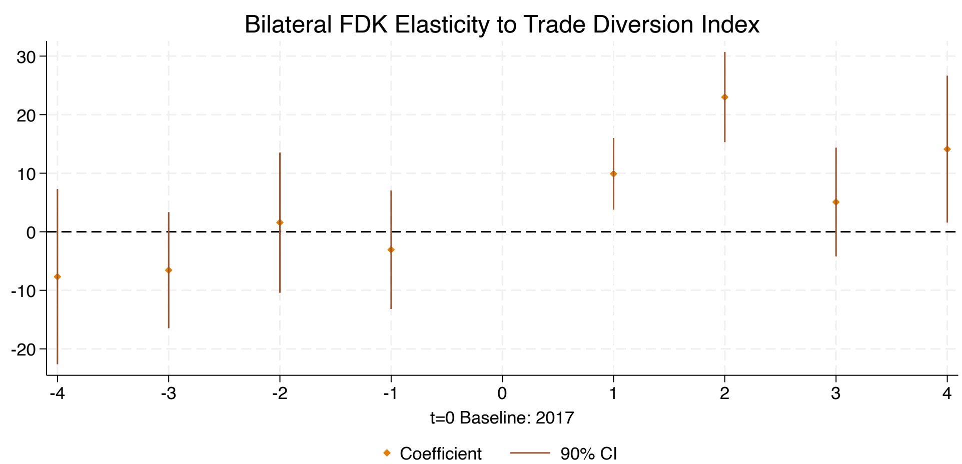
Notes: The FDI data used are the official inward FDI stocks from the OECD, IMF CDIS, and UNCTAD. I constrain the sample to include those countries with the largest inward FDI stocks in 2017, while excluding those typically considered tax havens. This results in 91 countries. The FDI stocks are exchange rate adjusted, i.e., $\text{FDI}_i^{\text{XR}} = \text{FDI}_i \frac{\text{XR}_i^{\text{official}}}{\text{PPP}_i}$, where $\text{XR}_i^{\text{official}}$ is the official exchange rate of country i's currency to USD, and PPP_i is country i's purchasing power parity to the US, both from World Development Index by World Bank. The trade diversion index is constructed using equation (1), with ν at HS 6-digit level, trade value from BACI for year 2017, and the Trump tariff increases from Fajgelbaum et al. (2020). Standard errors are clustered at the receiver country level.

Figure OA.1: Robustness: Event Study at Country Level, Exchange Rate Adjusted FDI Stocks



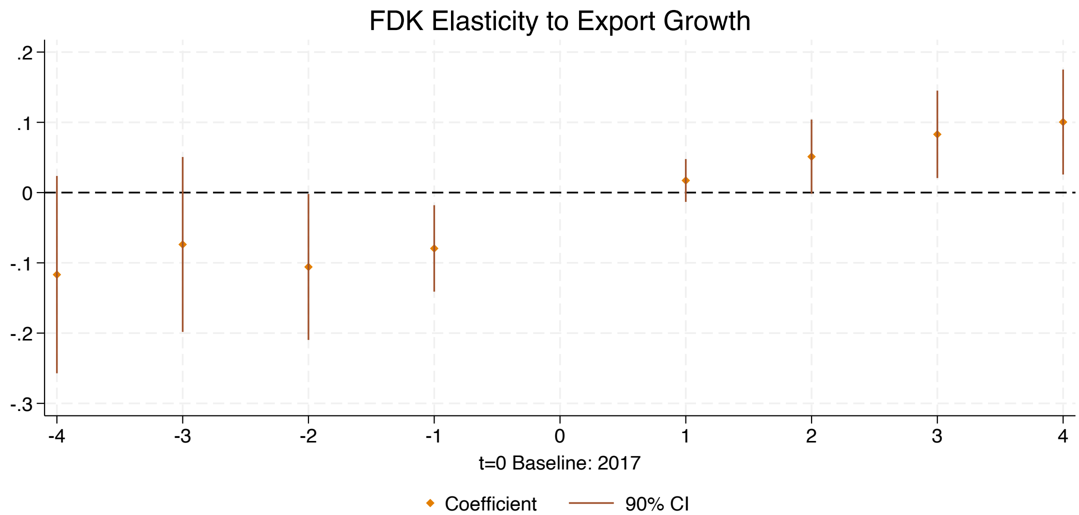
Notes: The FDI data used are the official inward FDI stocks from the OECD, IMF CDIS, and UNCTAD. I constrain the sample to include those countries with the largest inward FDI stocks in 2017, while excluding those typically considered tax havens. This results in 97 countries. The trade diversion index is constructed using equation (1), with ν at ISIC 2-digit level, trade values from BACI for the year 2017, and the Trump tariff increases from Fajgelbaum et al. (2020). Standard errors are clustered at the receiver country level.

Figure OA.2: Robustness: Event Study at Country Level, ISIC 2-digit Level Tariffs



Notes: The FDI data used are the official inward FDI stocks from the OECD, IMF CDIS, and UNCTAD. I constrain the sample to include those countries with the largest inward FDI stocks in 2017, while excluding those typically considered tax havens. I further constrain the sample to include receivers who have FDI investments from more than four source countries. This results in 74 source countries and receiver countries, and 1650 country pairs. The trade diversion index is constructed using equation (1), with ν at the HS 6-digit level, trade values from BACI for the year 2017, and the Trump tariff increases from Fajgelbaum et al. (2020). Standard errors are clustered at the receiver country level.

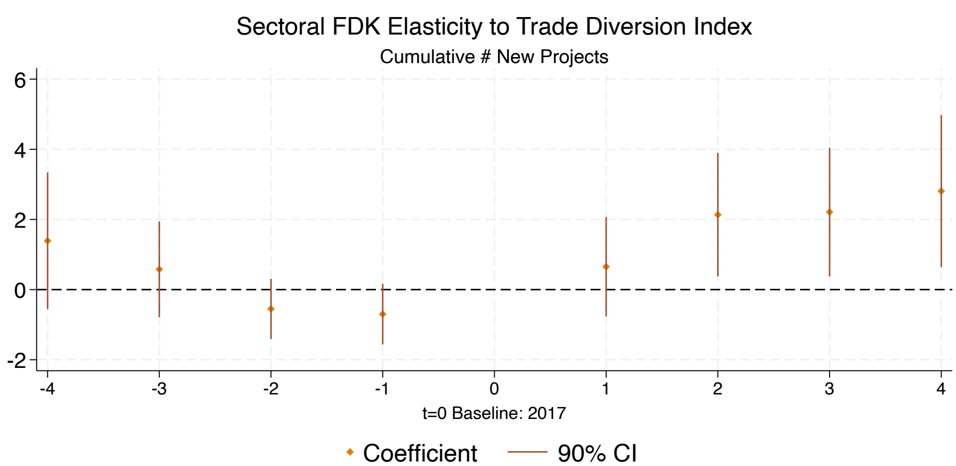
Figure OA.3: Robustness: Event Study at Country Level, Bilateral FDI Stocks



Notes: The FDI data used are the official inward FDI stocks from the OECD, IMF CDIS, and UNCTAD. I constrain the sample to include those countries with the largest inward FDI stocks in 2017, while excluding those typically considered tax havens. This results in 145 countries. The export growth is constructed using BACI data collapsed to get each country's export value growth to the US from 2017 to 2021. Standard errors are clustered at the receiver country level.

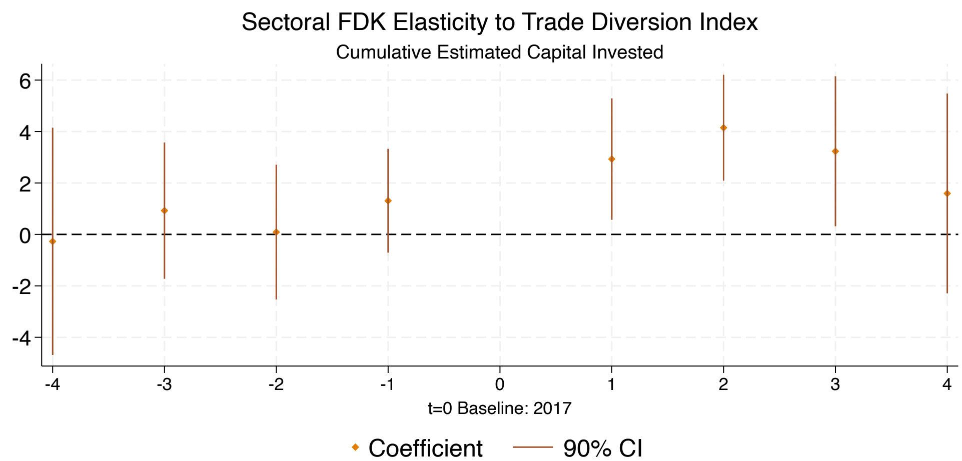
Figure OA.4: Robustness: Observed Export Growth as Explanatory Variable

OA.1.2 Robustness Check for Sector-Level Result



Notes: The FDI data used are the fDi Markets database measure of greenfield FDI investments. The dependent variable is the cumulative number of projects invested, aggregated at the source-receiver-sector level. The sectors are broadly categorized according to the NAICS 2012 3-digit level. I constrain the sample include those receiver-sector pairs with at least 10 projects before 2017, and service sectors are excluded. This results in a sample of 31 receiver countries and 24 sectors. The regression controls for the receiver-year, receiver-sector, and sector-year fixed effects. The trade diversion index is constructed similarly to equation (1) at the country-sector level, with ν at the HS 6-digit level, trade values from BACI for the year 2017, and the Trump tariff increases from Fajgelbaum et al. (2020). Standard errors are clustered at the receiver country level.

Figure OA.5: Robustness: Event Study at Sector Level, Number of Projects



Notes: The FDI data used are the fDi Markets database measure of greenfield FDI investments. The dependent variable is the cumulative estimated amount of capital invested by these projects, aggregated at the source-receiver-sector level. The sectors are broadly categorized according to the NAICS 2012 3-digit level. I constrain the sample include those receiver-sector pairs with at least 10 projects before 2017, and service sectors are excluded. This results in a sample of 31 receiver countries and 24 sectors. The regression controls for the receiver-year, receiver-sector, and sector-year fixed effects. The trade diversion index is constructed similarly to equation (1) at the country-sector level, with ν at the HS 6-digit level, trade values from BACI for the year 2017, and the Trump tariff increases from Fajgelbaum et al. (2020). Standard errors are clustered at the receiver country level.

Figure OA.6: Robustness: Event Study at Sector Level, Estimated Capital Invested

OA.2 FDI Diversion and Export Growth

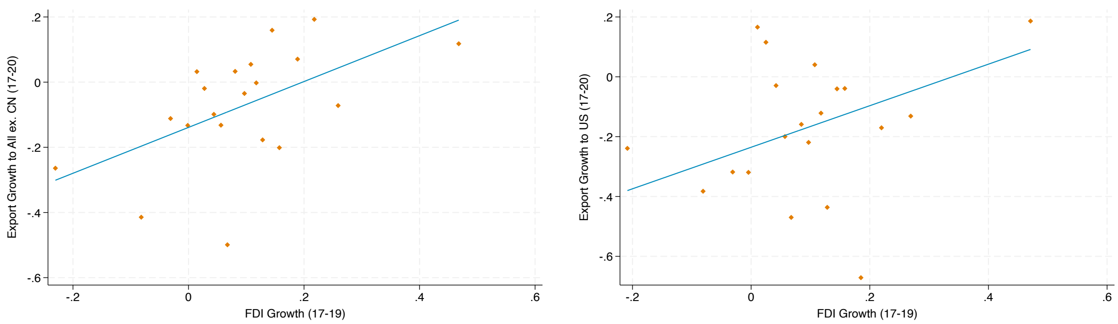
Figure 1 shows that FDI diversion plays a significant role in a country's export (to all countries excluding China and to the US) responses to the Trump tariffs.

	To All (ex. CN)		To US	
	(1)	(2)	(3)	(4)
Diversion Index	26.692	14.536	88.429**	74.273*
	(19.479)	(19.445)	(41.371)	(39.604)
FDK Growth		0.591***		0.791**
		(0.185)		(0.383)
Controls	✓	✓	✓	✓
R2 adj.	.02	.06	.07	.09
# of Obs.	140	140	141	141

Notes: Data uses official inward FDI stocks from OECD, IMF CDIS, and UNCTAD, export value from BACI. The export growth is from 2017 to 2020, while FDI growth is from 2017 to 2019. The trade diversion index is constructed using equation (1), with ν at HS 6-digit level, and trade value from BACI for year 2017, the Trump tariff increases from Fajgelbaum et al. (2020), all at at HS 6-digit level. I constraint the country to be those with the largest inward FDI stocks in 2017 and exclude those that are usually regarded as tax havens, which results in about 140 countries. All regressions control for the log export, inward FDI stock, and GDP per capita levels in 2017. Standard errors in parentheses, * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table 1: Export Growth on Trade Diversion Index and FDI Growth

The FDI diversion caused by the Trump tariffs is interesting and could have many impacts on a country beyond the scope of this paper (e.g., technology diffusion). Figure OA.7 shows a positive correlation between export and FDI growth, which features bin-scatter plots illustrating this relationship.

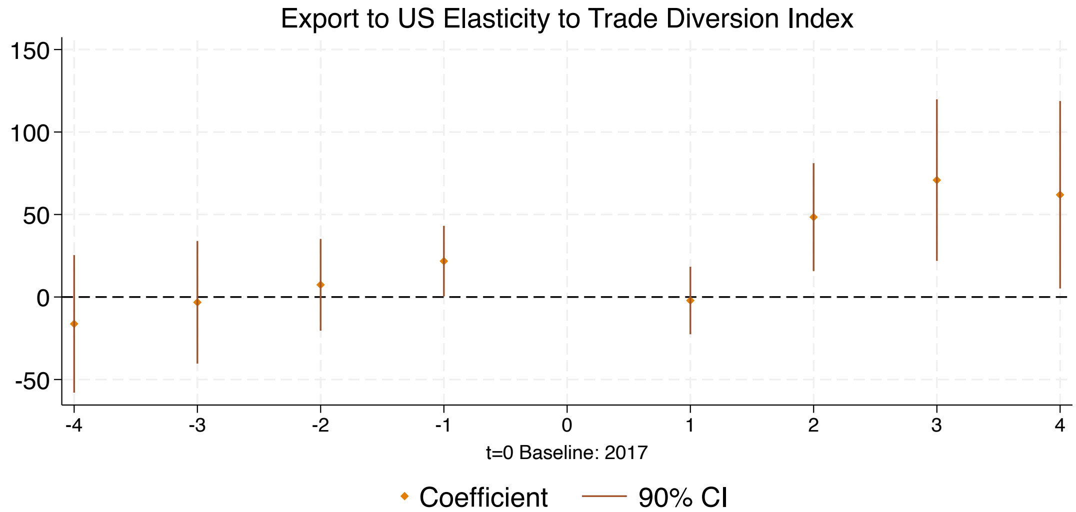


Notes: Data uses official inward FDI stocks from OECD, IMF CDIS, and UNCTAD, export value from BACI. I constraint the country to be those with the largest inward FDI stocks in 2017 and exclude those that are usually regarded as tax havens, which results in 140 countries.

Figure OA.7: Bin-scatter for Export and FDI growth

Complementary to existing findings in the literature (e.g., Fajgelbaum et al. 2021), I show that the trade diversion index constructed above predicts relative export growth. Figure OA.8 presents the results of regression (OA.1), which is analogous to (2) with the log of export to the US for each country $\ln \mathrm{EX}_{\mathrm{US},i,t}$ as the dependent variable.

$$\ln \mathrm{EX}_{\mathrm{US},i,t} = \mathrm{FE}_i + \mathrm{FE}_t + \sum_{t'=2013, t'\neq 2017}^{2021} \vartheta_{t'}^{\mathrm{EX,DI}} \mathbb{1}_{t'} \times \mathrm{DI}_i + u_{it}. \tag{OA.1}$$

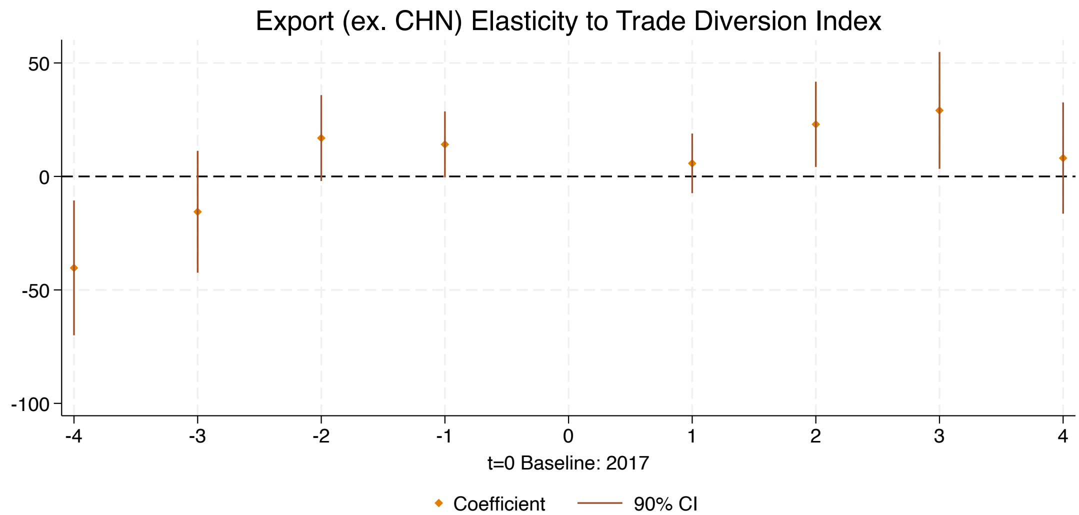


Notes: The dependent variable is the log of export value to the US for each country using data from BACI data from 2013 to 2021. I constrain the sample to include those countries with the largest export values in 2017, while excluding those typically considered tax havens, which results in a sample of 164 countries. The trade diversion index is constructed using equation (1), with ν at the HS 6-digit level, trade values from BACI for year 2017, and the Trump tariffs increases from Fajgelbaum et al. (2020). Standard errors are clustered at the receiver country level.

Figure OA.8: Trade Diversion: Export (to US) Elasticity to Trade Diversion Index

Figure OA.9 shows a similar result to Figure OA.8 with the dependent variable being the log of a country's total export excluding China.[1]

[1] I exclude a country's export to China, given that China is the directly impacted country in the China-US trade war. Thus, its import demand is likely to be lower, exerting a downward pressure on the exports of other countries.



Notes: The dependent variable is the log of total export value (excluding China) for each country using BACI data from 2013 to 2021. I constrain the sample to include those countries with the largest export values in 2017, while excluding those typically considered tax havens, which results in a sample of 170 countries. The trade diversion index is constructed using equation (1), with ν at the HS 6-digit level, trade values from BACI for year 2017, and the Trump tariff increases from Fajgelbaum et al. (2020). Standard errors are clustered at the receiver country level.

Figure OA.9: Trade Diversion: Export (ex. CN) Elasticity to Trade Diversion Index

The impacts of the trade diversion index on relative export growth to the US may result from a combination of expanded domestic production capacity and increased production capacity through FDI. The next logical inquiry is to assess whether the FDI responses are important to a country's export growth. I assume that the contributions of per unit increase in domestic and FDI production capacities to export growth are identical.[2] In this case, I employ two key estimates, the responses of both FDK and domestic capital to the trade diversion index, to offer suggestive evidence on the importance of change in the quantities of FDK for a country's export to the US in response to the Trump tariffs.

The columns (1) and (3) in Table 2 displays the results of two regressions: one with the change in FDK and the other with the change in domestic capital, over the period 2017 to 2019, as dependent variables, examining their responsiveness to the trade diversion index. Columns (2) and (4) are the model regression counterparts used later in the calibration section.

[2]For example, in a world where domestic and foreign producers share identical export portfolios from a common exporting location, and constant returns to scale in production.

	FDK		Domestic Capital	
	Data	Model	Data	Model
	(1)	(2)	(3)	(4)
DI	18.281**	18.291**	-5.621	-4.279
	(8.180)	(7.600)	(3.766)	(4.469)
R2 adj.	.04		.01	
# of Obs.	100		96	

Notes: Columns (1) and (3) reports empirical regression estimates of the coefficients on the Trade Diverion Index. I constrain the sample to include investors with sufficient large number of receivers, while excluding those typically considered tax havens. The dependent variables are FDK growth and domestic capital stocks growth from 2017 to 2019 at the country level. The FDI data used are the official inward FDI stocks from the OECD, IMF CDIS, and UNCTAD. The data for domestic capital use IMF domestic capital from 2017, and GDP growth to infer the 2019 value. Columns (2) and (4) report the median of regression coefficients from 10 model simulation runs explained in calibration. Standard errors in parentheses, * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table 2: FDK and Domestic Capital Responses to the Trade Diversion Index

It suggests that, for those countries that are more exposed to the trade diversion from the Trump tariffs, FDK is likely to be a major contributor of a country's relative export growth to the US in response to the Trump tariffs. In fact, those who are more exposed to the trade diversion from the Trump tariffs might actually have relatively less growth of domestic capital.[3]

OA.3 Model Derivation

I derive model solutions and several model predictions, including the FDI gravity equation, the heterogeneous elasticities, etc, in an extended dynamic version with explicit capital investments, as discussed in Section 2.7.

Pricing. The production function is

$$q_{ij}^{s}(a) = \frac{a^{\frac{1}{\sigma^{s}-1}}}{\kappa_{ij}^{s}} \left(k_{ij}^{s}(a)\right)^{\alpha_i} \left(l_{ij}^{s}(a)\right)^{1-\alpha_i},$$

where $k_{ij}^{s}(a)$ is the capital owned by this producer. The model without capital in the main text simply takes $\alpha_i = 0$.

[3]To be clear, this is only a statement about the relative contribution of FDK and doestic capital responses across countries that are exposed to the Trump tariffs of different magnitudes.

Each producer sets the price it sells its variety to importer h, p^s_{hij}, the amount of labor to hire l^s_{ij}, and the amount of capital investment ι^s_{ij} with depreciation rate δ after production. Let λ^s_{ij} be the Lagrange multiplier on the output constraint; The FOC w.r.t. p^s_{hij}:

$$\begin{aligned} q^s_{hij} + p^s_{hij} \frac{\partial q^s_{hij}}{\partial p^s_{hij}} &= d^s_{hi} \tau^s_{hi} \lambda^s_{ij} \frac{\partial q^s_{hij}}{\partial p^s_{hij}}, \\ \Rightarrow \quad p^s_{hij} &= \frac{\epsilon^s}{\epsilon^s - 1} d^s_{hi} \tau^s_{hi} \lambda^s_{ij}; \end{aligned}$$

and FOC w.r.t. $l_{ij}(s)$:

$$w_i = \lambda^s_{ij} \frac{a^{\frac{1}{\epsilon^s - 1}}}{\kappa^s_{ij,t}} k^{\alpha^s_i} \left(1 - \alpha^s_i\right) \left(l^s_{ij}\right)^{-\alpha^s_i}.$$

Using the resource constraint

$$l^s_{ij} = \left[A^s_i \left(\frac{w^s_i}{1 - \alpha^s_i} \right)^{-\epsilon} \frac{a}{\left(\kappa^s_{ij}\right)^{\epsilon^s - 1}} k^{(\epsilon^s - 1)\alpha^s_i} \right]^{\frac{1}{1 + (\epsilon - 1)\alpha^s_i}},$$

$$\text{where } A^s_i = \sum_h \left(\tau^s_{hi,t}\right)^{-\epsilon^s} \left(d^s_{hi,t}\right)^{1-\epsilon^s} \left(\frac{\epsilon^s}{\epsilon^s - 1} \right)^{-\epsilon^s} \left(P^s_h\right)^{\epsilon^s} Q^s_h.$$

Plug this into the price,

$$p^s_{hij} = d^s_{hi} \tau^s_{hi} \frac{\epsilon^s}{\epsilon^s - 1} \left[\left(A^s_i\right)^{\alpha^s_i} \left(\frac{w_i}{1 - \alpha^s_i} \right)^{1 - \alpha^s_i} \left(\frac{a^{\frac{1}{\epsilon^s - 1}}}{\kappa^s_{ij}} \right)^{-1} k^{-\alpha^s_i} \right]^{\frac{1}{1 + (\epsilon^s - 1)\alpha^s_i}}.$$

Investment and Valuation Function. The producer also decides, for the next period, whether to stay at the current production location, or to exit and relocate. If it decides to stay, it's productivity does not change, and it solves the same problem the next period with new capital level. If the producer decides to exit the current location, it can sell its capital in the old location at market price, and can get a vector of new productivity draws at each location, from which it picks the optimal location to enter. There is an adjustment cost captured by a probability of permanent exit for a producer who relocates. If the producer successfully gets to relocate, it needs to make investments in the new location. Thus, the problem for a producer from j operating in i at an original steady-state with productivity

a and current capital k solves the following problem (I suppress the notation a for each producer with the understanding that all choice variables depend on it)

$$v_{ij}^s(k;a) = \max_{\iota, l_{ij}^s, \{p_{hij}^s\}_{h=1}^N} \Bigg\{ \underbrace{\left(\sum_{h=1}^N \frac{p_{hij}^s q_{hij}^s}{\gamma_{hi}^s} - w_i l_{ij}^s\right)}_{\equiv d_{ij}^s, \text{the profit net of labor cost from total sales}} + \max\left\{\underbrace{\Theta_j\left(v_{ij}^s(k';a) - R_j P_i \iota\right)}_{\text{Continuation value if stay}}, \quad \underbrace{(1-\delta)P_i k + \Theta_j \lambda \bar{v}_j^s}_{\text{if exit and relocate}}\right\}\Bigg\},$$

$$\text{s.t.} \qquad q_{hij}^s = \left(\frac{p_{hij}^s}{P_h^s}\right)^{-\epsilon^s} Q_h^s, \ \forall h, \quad \sum_{h=1}^N \tau_{hi}^s q_{hij}^s = q_{ij}^s, \quad \iota = k' - (1-\delta)k.$$

where the first term on the right hand side denoted as d_{ij}^s is the profit net of labor cost from sales over all markets h. The demand function follows from the CES demand system, and Q_h is country h's final good quantity.

The first term of the inner maximization is the continuation value if the producer chooses to stay at i, where $\Theta_j \equiv \beta$ is the discount rate of the household in steady-state. The capital evolution function is of standard neoclassical form. I assume that the investment has to be externally borrowed from the domestic household, and thus it repays investment cost the next period with gross interest rate R_j.

The second term of the inner maximization is the continuation value if the producer chooses to relocate. In this case, it won't make any investment but can sell its remaining capitals at the market price, and get an expected endogenously value of relocation, $\bar{v}_j^s$, which is the expected value of the value function in the optimal production location given aggregate variables and before a vector of idiosyncratic productivity draws across all locations is realized. Finally, the exogenous permanent exit probability is $1-\lambda$, and the producer is replaced by a new-born producer in this case.

In steady-state, there is a cut-off $\underline{a}_{ij}^s$ for all producers from j of sector s in country i, above which the producers choose to stay, and otherwise choose to exit and relocate. Since there is no fixed cost of entering, the producers always go to the optimal location with current set of draws, although it might exit right away the next period and choose to relocate again. Since the producers can always choose to relocate, in steady state, all producers have draws above the cutoffs, and the productivity distribution of all producers from j of s in i is an endogenous truncated distribution originating from the productivity draw distribution.[4] The producers' location decisions generate endogenous mass of producers from j of s that choose to operate in country i.

For $a \geq \underline{a}^s_{ij,t}$, the FOC w.r.t. k' is

$$P_{i,t}R_{j,t+1} = \frac{\partial v^s_{ij,t+1}(k';a)}{\partial k'}$$

while the Benveniste-Scheinkman envelop condition is

$$\frac{\partial v^s_{ij,t}(k;a)}{\partial k} = \frac{\partial d^s_{ij,t}(k;a)}{\partial k} + \Theta_{j,t+1}R_{j,t+1}P_{i,t}(1-\delta).$$

In steady state, $\Theta_j = \beta, R_j = 1/\beta$, and thus the steady state capital and profit are

$$k^s_{ij}(a) = \Lambda^s_i P_i^{-\left(1+(\epsilon^s-1)\alpha^s_i\right)} \frac{a}{\left(\kappa^s_{ij}\right)^{\epsilon-1}} \left(\frac{w_i}{1-\alpha^s_i}\right)^{-(\epsilon^s-1)\left(1-\alpha^s_i\right)} A^s_i,$$

$$\text{where } \Lambda^s_i \equiv \left(\left(\frac{\epsilon^s}{\epsilon^s-1} - (1-\alpha^s_i)\right)\frac{(\epsilon^s-1)\alpha^s_i}{1+(\epsilon^s-1)\alpha^s_i}\frac{1-\lambda}{\frac{1}{\beta}-(1-\delta)}\right)^{1+(\epsilon^s-1)\alpha^s_i};$$

$$d^s_{ij}(a) = \left(\frac{\epsilon^s}{\epsilon^s-1} - (1-\alpha^s_i)\right)\left(\Lambda^s_i\right)^{\frac{(\epsilon^s-1)\alpha^s_i}{1+(\epsilon^s-1)\alpha^s_i}} P_i^{-(\epsilon^s-1)\alpha^s_i}\left(\frac{w_i}{1-\alpha^s_i}\right)^{-(\epsilon^s-1)\left(1-\alpha^s_i\right)} A^s_i \frac{a}{\left(\kappa^s_{ij}\right)^{\epsilon^s-1}}.$$

Plug this back into the price,

$$p^s_{hij} = \frac{\epsilon^s}{\epsilon^s-1}\gamma^s_{hi}\tau^s_{hi}\left(\Lambda^s_i\right)^{\frac{-\alpha^s_i}{1+(\epsilon-1)\alpha^s_i}} P_i^{\alpha^s_i}\left(\frac{w_i}{1-\alpha^s_i}\right)^{1-\alpha^s_i}\left(\frac{a^{\frac{1}{\epsilon^s-1}}}{\kappa^s_{ij}}\right)^{-1};$$

[4] It might be possible that there exists other distribution of producers in a location that are sustainable and are all above the cut-offs. To kill these, I simply need to add an exogeneous exit shock that can be arbitrarily small.

Entry and Relocation. The entrants' investment decisions conditional on i being the optimal location is

$$\begin{cases} \max_\iota \ v^s_{ij}(\iota; a) - R_j P_i \iota & \text{if } a \geq \underline{a}^s_{ij}, \\ \max_\iota \ d^s_{ij}(\iota; a) + (1-\delta) P_i \iota - R_j P_i \iota + \Theta_j \lambda \bar{v}^s_j & \text{if } a < \underline{a}^s_{ij}. \end{cases}$$

Note that both these two problems give $\iota = k^s_{ij}(a)$. Thus, the entry value gross of entry cost is

$$\begin{cases} v^s_{ij}(a) = d^s_{ij}(a) + \Theta_j \left(v^s_{ij}(a) - R_j \delta P_i k^s_{ij}(a) \right) & \text{if } a \geq \underline{a}^s_{ij}, \\ d^s_{ij}(a) + (1-\delta) P_i k^s_{ij}(a) + \beta \lambda \bar{v}^s_j & \text{if } a < \underline{a}^s_{ij}. \end{cases}$$

And the entry value net of entry cost is

$$\begin{cases} \frac{1}{1-\beta} \left(d^s_{ij}(a) + \left(1 - \delta - \frac{1}{\beta}\right) P_i k^s_{ij}(a) \right) & \text{if } a \geq \underline{a}^s_{ij}, \\ \left(d^s_{ij}(a) + \left(1 - \delta - \frac{1}{\beta}\right) P_i k^s_{ij}(a) \right) + \beta \lambda \bar{v}^s_j & \text{if } a < \underline{a}^s_{ij}. \end{cases}$$

Since $\bar{v}^s_j$ is not affected by producer's decisions, it always picks the location with the highest $d^s_{ij}(a) + \left(1 - \delta - \frac{1}{\beta}\right) P_i k^s_{ij}(a)$. Define

$$\tilde{v}^s_{ij}(a) \equiv d^s_{ij}(a) + \left(1 - \delta - \frac{1}{\beta}\right) P_i k^s_{ij}(a) = \tilde{\Lambda}^s_i \left(P_i^{-(\epsilon^s - 1)\alpha^s_i} \left(\frac{w_i}{1 - \alpha^s_i} \right)^{-(\epsilon^s - 1)\left(1 - \alpha^s_i\right)} A^s_i \frac{a}{\left(\kappa^s_{ij}\right)^{\epsilon^s - 1}} \right),$$

where $\tilde{\Lambda}^s_i = \left(\frac{\epsilon^s}{\epsilon^s - 1} - (1 - \alpha^s_i) \right) (\Lambda^s_i)^{\frac{(\epsilon^s - 1)\alpha^s_i}{1 + (\epsilon^s - 1)\alpha^s_i}} + \left(1 - \delta - \frac{1}{\beta}\right) \Lambda^s_i.$

Note that $\tilde{v}^s_{ij}(a)$ is a linear function in a. Denote $\tilde{v}^s_{ij} = \tilde{v}^s_{ij}(1)$ when suppressing the argument. Let the productivity draw be $a^s_{ij}, i = 1, \ldots, N$, the probability of choosing location

i is

$$\mathbb{P}\left(\tilde{v}_{ij}\left(a_{ij}\right)=\max_{i'}\tilde{v}_{i'j}\left(a_{i'j}\right)\right)=\frac{\tilde{v}_{ij}^{\theta}G_i^j(\tilde{v}_{1j}^{\theta},\tilde{v}_{2j}^{\theta},\ldots,\tilde{v}_{Nj}^{\theta})}{G^j(\tilde{v}_{1j}^{\theta},\tilde{v}_{2j}^{\theta},\ldots,\tilde{v}_{Nj}^{\theta})}$$

$$=\frac{\left(1-\eta_{ij}\right)\tilde{v}_{ij}^{\theta}+\eta_{ij}\left(\frac{\left(\eta_{ij}\tilde{v}_{ij}^{\theta}\right)^{\frac{1}{1-\rho}}}{\sum_{i'}\left(\eta_{i'j}\tilde{v}_{i'j}^{\theta}\right)^{\frac{1}{1-\rho}}}\right)^{\rho}\tilde{v}_{ij}^{\theta}}{\sum_{i'}\left(1-\eta_{i'j}\right)\tilde{v}_{i'j}^{\theta}+\left(\sum_{i'}\left(\eta_{i'j}\tilde{v}_{i'j}^{\theta}\right)^{\frac{1}{1-\rho}}\right)^{1-\rho}},$$

where I cancelled z_j using the correlation function homogeneous degree of one property. The conditional distribution of value is

$$\mathbb{P}\left(\tilde{v}_{ij}\left(a_{ij}\right)<v|\tilde{v}_{ij}\left(a_{ij}\right)=\max_{i'}\tilde{v}_{i'j}\left(a_{i'j}\right)\right)=\mathbb{P}\left(\max_{i'}\tilde{v}_{i'j}\left(a_{i'j}\right)<v\right)=e^{-z_j^{1-\theta}G^j\left(\tilde{v}_{1j}^{\theta},\tilde{v}_{2j}^{\theta},\ldots,\tilde{v}_{Nj}^{\theta}\right)v^{-\theta}},$$

which is a max-stable multivariate Frechet with θ and scale $z_jG^j\left(\tilde{v}_{1j}^{\theta},\tilde{v}_{2j}^{\theta},\ldots,\tilde{v}_{Nj}^{\theta}\right)$. Correspondingly, the conditional distribution of productivity draw is

$$\mathbb{P}\left(a_{ij}<a|\tilde{v}_{ij}\left(a_{ij}\right)=\max_{i'}\tilde{v}_{i'j}\left(a_{i'j}\right)\right)=e^{-z_j\frac{G^j\left(\tilde{v}_{1j}^{\theta},\tilde{v}_{2j}^{\theta},\ldots,\tilde{v}_{Nj}^{\theta}\right)}{\tilde{v}_{ij}^{\theta}}a^{-\theta}},$$

which is again a max-stable multivariate Frechet with θ and scale $z_j\frac{G^j\left(\tilde{v}_{1j}^{\theta},\tilde{v}_{2j}^{\theta},\ldots,\tilde{v}_{Nj}^{\theta}\right)}{\tilde{v}_{ij}^{\theta}}$.

The cutoff for each location equalizes the exit-right-away value and staying value, thus

$$\lambda\bar{v}_j^s+\frac{1}{\Theta_j}(1-\delta)P_ik_{ij}^s(\underline{a}_{ij}^s)=v_{ij}^s(\underline{a}_{ij}^s)-R_j\delta P_ik_{ij}^s(\underline{a}_{ij}^s)$$
$$\Rightarrow\bar{v}_j^s=\frac{1}{\left(1-\beta\right)\lambda}\tilde{v}_{ij}^s(\underline{a}_{ij}^s).$$

This means $\frac{\tilde{v}_{ij}^s(\underline{a}_{ij}^s)}{\tilde{v}_{i'j}^s(\underline{a}_{i'j}^s)}=\frac{\tilde{v}_{ij}^s}{\tilde{v}_{i'j}^s}\frac{\underline{a}_{ij}^s}{\underline{a}_{i'j}^s}=1$, and the exit-right-away probability conditional on entering $G_{ij}^s\left(\underline{a}_{ij}^s\right)$ is the same across locations, which I denote as Pr(exit) (which I will show that only depend on discount rate β and parameter θ). This also means that in steady state, the mass of producers in each location from the same source country is $\Pr_{ij}^s$.

The expected entry value

$$\bar{v}_j^s = \sum_i \Pr_{ij}^s \left(\int_0^{\underline{a}_{ij}^s} \tilde{v}_{ij}^s(a) + \beta\lambda\bar{v}_j^s \,\mathrm{d}G_{ij}^s(a) + \int_{\underline{a}_{ij}^s}^{\infty} \frac{1}{1-\beta}\tilde{v}_{ij}^s(a)\,\mathrm{d}G_{ij}^s(a) \right)$$
$$\Rightarrow (1-\beta\lambda\Pr(\text{exit}))\,\bar{v}_j^s = \frac{\beta}{1-\beta}\sum_i \Pr_{ij}^s \int_{\underline{a}_{ij}^s}^{\infty} \tilde{v}_{ij}^s(a)\,\mathrm{d}G_{ij}^s(a) + \sum_i \Pr_{ij}^s \int_0^{\infty} \tilde{v}_{ij}^s(a)\,\mathrm{d}G_{ij}^s(a)\,.$$

After some algebra, the first term on the right hand side is

$$\frac{\beta}{1-\beta}\sum_i \frac{\tilde{v}_{ij}^{\theta} G_i^j(\tilde{v}_{1j}^{\theta}, \tilde{v}_{2j}^{\theta}, \ldots, \tilde{v}_{Nj}^{\theta})}{G^j(\tilde{v}_{1j}^{\theta}, \tilde{v}_{2j}^{\theta}, \ldots, \tilde{v}_{Nj}^{\theta})}\tilde{\Lambda}_i^s \left(P_i^{-(\epsilon^s-1)\alpha_i^s} \left(\frac{w_i}{1-\alpha_i^s}\right)^{-(\epsilon^s-1)\left(1-\alpha_i^s\right)} A_i^s \frac{1}{\left(\kappa_{ij}^s\right)^{\epsilon^s-1}} \right) \int_{\underline{a}_{ij}^s}^{\infty} a\,\mathrm{d}G_{ij}^s(a)$$
$$= \frac{\beta}{1-\beta}\bar{\Gamma}\left(\bar{y}, 1-\frac{1}{\theta}\right)(z_j)^{-1+\frac{1}{\theta}}\left(G^j\left(\tilde{v}_{1j}^{\theta}, \tilde{v}_{2j}^{\theta}, \ldots, \tilde{v}_{Nj}^{\theta}\right)\right)^{\frac{1}{\theta}},$$

where $\bar{\Gamma}(\cdot;\cdot)$ is the lower incomplete gamma function generally defined as $\Gamma(s,x) = \int_x^{\infty} t^{s-1}\, e^{-t}\ \mathrm{d}t$ (similarly, it turns out that $\bar{y}$ only depends on parameters and thus is the same across locations and producers). Similarly, the second term on the right hand side is

$$\Gamma\left(1-\frac{1}{\theta}\right)(z_j)^{-1+\frac{1}{\theta}}\left(G^j\left(\tilde{v}_{1j}^{\theta}, \tilde{v}_{2j}^{\theta}, \ldots, \tilde{v}_{Nj}^{\theta}\right)\right)^{\frac{1}{\theta}},$$

where $\Gamma(\cdot)$ is the usual gamma function. Thus, the expected entry value equals

$$\bar{v}_j^s = \frac{\Gamma\left(1-\frac{1}{\theta}\right) + \frac{\beta}{1-\beta}\bar{\Gamma}\left(\bar{y}, 1-\frac{1}{\theta}\right)}{1-\beta\lambda\Pr(\text{exit})}(z_j)^{-1+\frac{1}{\theta}}\left(G^j\left(\tilde{v}_{1j}^{\theta}, \tilde{v}_{2j}^{\theta}, \ldots, \tilde{v}_{Nj}^{\theta}\right)\right)^{\frac{1}{\theta}}.$$

From the cutoff condition, I can denote $\underline{a}_{ij}^s$ in terms of $\bar{v}_j^s$.

$$\bar{v}_j^s = \frac{1}{(1-\beta)\,\lambda}\tilde{v}_{ij}^s(\underline{a}_{ij}^s) = \frac{1}{(1-\beta)\,\lambda}\tilde{v}_{ij}^s\frac{\underline{a}_{ij}^s}{z_j} \Rightarrow \underline{a}_{ij}^s = \frac{(1-\beta)\lambda\bar{v}_j^s z_j}{\tilde{v}_{ij}^s}.$$

Plug this into $G_{ij}^s\left(\underline{a}_{ij}^s\right)$, I get an implicit function that defines the cutoff

$$\Pr(\text{exit}) = e^{-\left((1-\beta)\lambda\frac{\Gamma\left(1-\frac{1}{\theta}\right)+\frac{\beta}{1-\beta}\bar{\Gamma}\left(\bar{y},1-\frac{1}{\theta}\right)}{1-\beta\lambda\Pr(\text{exit})}\right)^{-\theta}}.$$

The other implicit function defines the parameter $\bar{y}$ in the lower gamma function

$$\bar{y} = \left((1-\beta)\lambda \frac{\Gamma\left(1-\frac{1}{\theta}\right) + \frac{\beta}{1-\beta}\bar{\Gamma}\left(\bar{y}, 1-\frac{1}{\theta}\right)}{1-\beta\lambda \Pr(\text{exit})} \right)^{-\theta}.$$

To make the model more realistic, one needs to add more cost to exit, e.g. assuming that only a fraction of those who exit can survive. Otherwise, the producers will simply keep trying new draws and the cutoffs will be very high, and in steady state, if one exits and makes new draws, it will certainly exit again.

Aggregate Variables. I now calculate the aggregate variables in steady state. The source-importer-sector level price index is

$$P_h^s = \left(\sum_{j=1}^{N} \sum_{i=1}^{N} \int_{M_{ij}^s} p_{hij}^s(\omega)^{1-\epsilon^s} \, \mathrm{d}\omega \right)^{\frac{1}{1-\epsilon^s}} = \left(\sum_j \sum_i \Pr_{ij}^s \int_0^\infty p_{hij}^s(a)^{1-\epsilon^s} \, \mathrm{d}G_{ij}^s(a) \right)^{\frac{1}{1-\epsilon^s}}$$
$$= \left(\sum_j \sum_i \tilde{M}_{ij}^s \Gamma\left(1-\frac{1}{\theta}\right) (z_j)^{\frac{1}{\theta}} \left(\frac{\epsilon^s}{\epsilon^s - 1} d_{hi}^s \tau_{hi}^s \kappa_{ij}^s \left(\Lambda_i^s\right)^{\frac{-\alpha_i^s}{1+(\epsilon^s-1)\alpha_i^s}} P_i^{\alpha_i^s} \left(\frac{w_i}{1-\alpha_i^s} \right)^{1-\alpha_i^s} \right)^{1-\epsilon^s} \right)^{\frac{1}{1-\epsilon^s}},$$

where

$$\tilde{M}_{ij}^s \equiv \left(\frac{\left(\tilde{v}_{ij}^s\right)^\theta G_i^j\left(\tilde{v}_{1j}^s, \tilde{v}_{2j}^s, \ldots, \tilde{v}_{Nj}^s\right)}{G^j\left(\tilde{v}_{1j}^s, \tilde{v}_{2j}^s, \ldots, \tilde{v}_{Nj}^s\right)} \right)^{\frac{\theta-1}{\theta}} G_i^j\left(\tilde{v}_{1j}^s, \tilde{v}_{2j}^s, \ldots, \tilde{v}_{Nj}^s\right)^{\frac{1}{\theta}},$$

$$\text{and } P_{hij}^s \equiv \frac{\epsilon^s}{\epsilon^s - 1} d_{hi}^s \tau_{hi}^s \kappa_{ij}^s \left(\Lambda_i^s\right)^{\frac{-\alpha_i^s}{1+(\epsilon^s-1)\alpha_i^s}} P_i^{\alpha_i^s} \left(\frac{w_i}{1-\alpha_i^s} \right)^{1-\alpha_i^s} \left(z_j^s\right)^{-1},$$

so that I can ease notation

$$P_h^s = \left(\sum_{j=1}^{N} \sum_{i=1}^{N} \tilde{M}_{ij}^s \left(P_{hij}^s\right)^{1-\epsilon^s} \right)^{\frac{1}{1-\epsilon^s}}.$$

The source-production-sector level capital value is

$$
\begin{aligned}
K_{ij}^s &= \int_{M_{ij}^s} P_i k_{ij}^s(\omega)\,\mathrm{d}\omega \\
&= \tilde{M}_{ij}^s \left(\Lambda_i^s P_i^{-(\epsilon^s-1)\alpha_i^s} \left(\frac{w_i}{1-\alpha_i^s} \right)^{-(\epsilon^s-1)\left(1-\alpha_i^s\right)} A_i^s \left(\frac{z_j^s}{\kappa_{ij}^s} \right)^{\epsilon^s-1} \right), \\
D_{ij}^s &= \int_{M_{ij}^s} v_{ij}^s(\omega)\,\mathrm{d}\omega \\
&= \tilde{M}_{ij}^s \left(\left(\frac{\epsilon^s}{\epsilon^s-1} - (1-\alpha_i^s) \right) (\Lambda_i^s)^{\frac{(\epsilon^s-1)\alpha_i^s}{1+(\epsilon^s-1)\alpha_i^s}} P_i^{-(\epsilon^s-1)\alpha_i^s} \left(\frac{w_i}{1-\alpha_i^s} \right)^{-(\epsilon^s-1)\left(1-\alpha_i^s\right)} A_i^s \left(\frac{z_j^s}{\kappa_{ij}^s} \right)^{\epsilon^s-1} \right).
\end{aligned}
$$

The trade share is

$$
\begin{aligned}
\pi_{hi}^s = \frac{X_{hi}^s}{X_h^s} &= \frac{\sum_j \int_{M_{ij}^s} p_{hij}^s(\omega) q_{hij}^s(\omega)\,\mathrm{d}\omega}{P_{h\cdot j}^s Q_{h\cdot j}^s} \\
&= \frac{\sum_j \tilde{M}_{ij}^s \left(\frac{\epsilon^s}{\epsilon^s-1} d_{hi}^s \tau_{hi}^s \kappa_{ij}^s \left(\Lambda_i^s\right)^{\frac{-\alpha_i^s}{1+(\epsilon^s-1)\alpha_i^s}} P_i^{\alpha_i^s} \left(\frac{w_i}{1-\alpha_i^s} \right)^{1-\alpha_i^s} \left(z_j^s \right)^{-1} \right)^{1-\epsilon^s}}{\left(P_h^s\right)^{1-\epsilon^s}} \\
&= \frac{\sum_j \tilde{M}_{ij}^s \left(P_{hij}^s \right)^{1-\epsilon^s}}{\left(P_h^s\right)^{1-\epsilon^s}}.
\end{aligned}
$$

The FDI gravity is

$$
K_{ij}^s = \frac{\left(\tilde{v}_{ij}^s\right)^\theta G_i^j \left(\tilde{v}_{1j}^s, \tilde{v}_{2j}^s, \ldots, \tilde{v}_{Nj}^s \right) \frac{\Lambda_i^s}{\tilde{\Lambda}_i^s}}{\sum_{i'} \left(\tilde{v}_{i'j}^s\right)^\theta G_{i'}^j \left(\tilde{v}_{1j}^s, \tilde{v}_{2j}^s, \ldots, \tilde{v}_{Nj}^s \right) \frac{\Lambda_{i'}^s}{\tilde{\Lambda}_{i'}^s}} K_j,
$$

which is basically the entry probability adjusted for capital intensity for each production location. Note that $\sum_{i'} \left(\tilde{v}_{i'j}^s\right)^\theta G_{i'}^j \left(\tilde{v}_{1j}^s, \tilde{v}_{2j}^s, \ldots, \tilde{v}_{Nj}^s \right) = G^j \left(\tilde{v}_{1j}^s, \tilde{v}_{2j}^s, \ldots, \tilde{v}_{Nj}^s \right)$, and $G^j \left(\tilde{v}_{1j}^s, \tilde{v}_{2j}^s, \ldots, \tilde{v}_{Nj}^s \right)^{\frac{1}{\theta}} \equiv \tilde{v}_j$ can be understood as an aggregate value index for j, analogous to the usual ideal aggregate price index. I can redefine the correlation function to adjust for the capital intensity

$$
G^j \left(x_1, x_2, \ldots, x_N \right) = \sum_{i=1}^N \left(1-\eta_{ij}\right) \frac{\Lambda_i^s}{\tilde{\Lambda}_i^s} x_i + \left(\sum_{i=1}^N \left(\eta_{ij} \frac{\Lambda_i^s}{\tilde{\Lambda}_i^s} x_i \right)^{\frac{1}{1-\rho}} \right)^{1-\rho}.
$$

The investment portfolio for producers from j can be denoted in a simpler way

$$\lambda_{ij}^{s}=\frac{\left(\tilde{v}_{ij}^{s}\right)^{\theta}\tilde{G}_{i}^{j}\left(\tilde{v}_{1j}^{s},\tilde{v}_{2j}^{s},\ldots,\tilde{v}_{Nj}^{s}\right)}{\sum_{i'}\left(\tilde{v}_{i'j}^{s}\right)^{\theta}\tilde{G}_{i'}^{j}\left(\tilde{v}_{1j}^{s},\tilde{v}_{2j}^{s},\ldots,\tilde{v}_{Nj}^{s}\right)}.$$

With our specific correlation function, this portfolio share can be decomposed as

$$\begin{aligned}
\lambda_{ij}^{s}&=\frac{(1-\eta_{ij})\frac{\Lambda_i^s}{\bar{\Lambda}_i^s}\tilde{v}_{ij}^{\theta}+\eta_{ij}\frac{\Lambda_i^s}{\bar{\Lambda}_i^s}\left(\frac{\left(\eta_{ij}\frac{\Lambda_i^s}{\bar{\Lambda}_i^s}\tilde{v}_{ij}^{\theta}\right)^{\frac{1}{1-\rho}}}{\sum_{i'}\left(\eta_{i'j}\frac{\Lambda_{i'}^s}{\bar{\Lambda}_{i'}^s}\tilde{v}_{i'j}^{\theta}\right)^{\frac{1}{1-\rho}}}\right)^{\rho}\tilde{v}_{ij}^{\theta}}{\sum_{i'}(1-\eta_{i'j})\frac{\Lambda_{i'}^s}{\bar{\Lambda}_{i'}^s}\tilde{v}_{i'j}^{\theta}+\left(\sum_{i'}\left(\eta_{i'j}\frac{\Lambda_{i'}^s}{\bar{\Lambda}_{i'}^s}\tilde{v}_{i'j}^{\theta}\right)^{\frac{1}{1-\rho}}\right)^{1-\rho}}\\
&=\underbrace{\frac{(1-\eta_{ij})\frac{\Lambda_i^s}{\bar{\Lambda}_i^s}\tilde{v}_{ij}^{\theta}}{\sum_{i'}(1-\eta_{i'j})\frac{\Lambda_{i'}^s}{\bar{\Lambda}_{i'}^s}\tilde{v}_{i'j}^{\theta}}}_{\equiv\lambda_{ij}^{W}}\underbrace{\frac{\sum_{i'}(1-\eta_{i'j})\frac{\Lambda_{i'}^s}{\bar{\Lambda}_{i'}^s}\tilde{v}_{i'j}^{\theta}}{\sum_{i'}(1-\eta_{i'j})\frac{\Lambda_{i'}^s}{\bar{\Lambda}_{i'}^s}\tilde{v}_{i'j}^{\theta}+\left(\sum_{i'}\left(\eta_{i'j}\frac{\Lambda_{i'}^s}{\bar{\Lambda}_{i'}^s}\tilde{v}_{i'j}^{\theta}\right)^{\frac{1}{1-\rho}}\right)^{1-\rho}}}_{\equiv\lambda_{j}^{B}}\\
&+\underbrace{\frac{\eta_{ij}\frac{\Lambda_i^s}{\bar{\Lambda}_i^s}\left(\frac{\left(\eta_{ij}\frac{\Lambda_i^s}{\bar{\Lambda}_i^s}\tilde{v}_{ij}^{\theta}\right)^{\frac{1}{1-\rho}}}{\sum_{i'}\left(\eta_{i'j}\frac{\Lambda_{i'}^s}{\bar{\Lambda}_{i'}^s}\tilde{v}_{i'j}^{\theta}\right)^{\frac{1}{1-\rho}}}\right)^{\rho}\tilde{v}_{ij}^{\theta}}{\left(\sum_{i'}\left(\eta_{i'j}\frac{\Lambda_{i'}^s}{\bar{\Lambda}_{i'}^s}\tilde{v}_{i'j}^{\theta}\right)^{\frac{1}{1-\rho}}\right)^{1-\rho}}}_{\equiv\lambda_{ij}^{W*}}\underbrace{\frac{\left(\sum_{i'}\left(\eta_{i'j}\frac{\Lambda_{i'}^s}{\bar{\Lambda}_{i'}^s}\tilde{v}_{i'j}^{\theta}\right)^{\frac{1}{1-\rho}}\right)^{1-\rho}}{\sum_{i'}(1-\eta_{i'j})\frac{\Lambda_{i'}^s}{\bar{\Lambda}_{i'}^s}\tilde{v}_{i'j}^{\theta}+\left(\sum_{i'}\left(\eta_{i'j}\frac{\Lambda_{i'}^s}{\bar{\Lambda}_{i'}^s}\tilde{v}_{i'j}^{\theta}\right)^{\frac{1}{1-\rho}}\right)^{1-\rho}}}_{\equiv\lambda_{j}^{B*}}.
\end{aligned}$$

λ_{ij}^{W} and λ_{ij}^{W*} are the within-factor share for the technology type without correlation (no $*$) and with correlation ρ (with $*$), and λ_{j}^{B} and λ_{j}^{B*} are the between-factor share. $\lambda_{ij}^{W}\lambda_{j}^{B}$ measures the overall share of producer capitals from j that use the first technology type to operate in country i, while $\lambda_{ij}^{W*}\lambda_{j}^{B*}$ measures the share the other technology type.

The cross-elasticity can be shown to be

$$\frac{\partial\ln\lambda_{ij}}{\partial\ln\frac{\tilde{v}_{i'j}}{\tilde{v}_{j}}}=\theta\frac{\tilde{v}_{i'j}^{\theta}\tilde{G}_{ii'}^{j}\left(\tilde{v}_{1j}^{s},\tilde{v}_{2j}^{s},\ldots,\tilde{v}_{Nj}^{s}\right)}{\tilde{G}_{i}^{j}\left(\tilde{v}_{1j}^{s},\tilde{v}_{2j}^{s},\ldots,\tilde{v}_{Nj}^{s}\right)}.$$

OA.4 Extra Quantitative Results

OA.4.1 Estimation for Trade Elasticities ϵ^s

I run the following regression separately for sectors $s = 1, 2$,

$$\ln \text{EX}^s_{hit} = \text{FE}^s_{ht} + \text{FE}^s_{it} - \epsilon^s \ln \tau^s_{hit} + u^s_{hit},$$

where the regression coefficient $\hat{\epsilon}^s$ is used for calibration. However, this standard method using tariff variations is not applicable to the service sector, as service trade (e.g., tourism, legal service) generally does not incur tariffs at customs. To circumvent this issue, I use another cost shifter in the literature, namely the real exchange rate (RER). For sector 3, I substitute $\ln \tau^s_{hit}$ in the above regression with $\ln \text{RER}_{hit}$. Since the real exchange rate is defined such that $\text{RER}_{hit} = \text{RER}_{hjt}\text{RER}_{jit}$, the fixed effects FE^s_{ht}, FE^s_{it} would absorb all variations. Thus, I use FE^s_h, FE^s_i, FE^s_t as fixed effects instead:

$$\ln \text{EX}^3_{hit} = \text{FE}^3_h + \text{FE}^3_i + \text{FE}_t - \epsilon^3_{\text{RER}} \ln \text{RER}_{hit} + u^3_{hit}.$$

The bilateral trade values data from 2008 to 2021 are sourced from BACI. I constrain the sample to the largest 100 economies in terms of their total export values in 2017. I aggregate the HS 6-digit product-level export values to the model's three sectors and calculate the tariffs for each sector weighted by the product-level export values, where the tariffs are the AVEMFN from WITS TRAINS. For the service sector, I get the total service trade values from ICIO for the available countries from 2008 to 2018 (the 2021 version ICIO is only available up to 2018). The real exchange rates are calculated using official exchange rates and PPP from WDI.

It is well-known that the trade elasticities inferred from RER shifters are often significantly lower than those inferred from tariff shifters.[5] To ensure that the elasticity for the service sector is comparable to those of the other two sectors, I assume that the underlying factors causing the discrepancy between RER and tariff pass-throughs affect all sectors sim-

[5] See a survey paper related to this by Burstein and Gopinath (2014).

ilarly. Consequently, I adjust the service sector's estimated elasticity from RER shifters by multiplying it with the ratio of the manufacturing sector's estimated elasticities from both tariff and RER shifters. This approach yields the following calibrated parameter values: $\hat{\epsilon}^1 = 5.34, \hat{\epsilon}^2 = 3.29$, and $\hat{\epsilon}^3 = 2.84$.[6]

OA.4.2 Calibrated η_{ij}

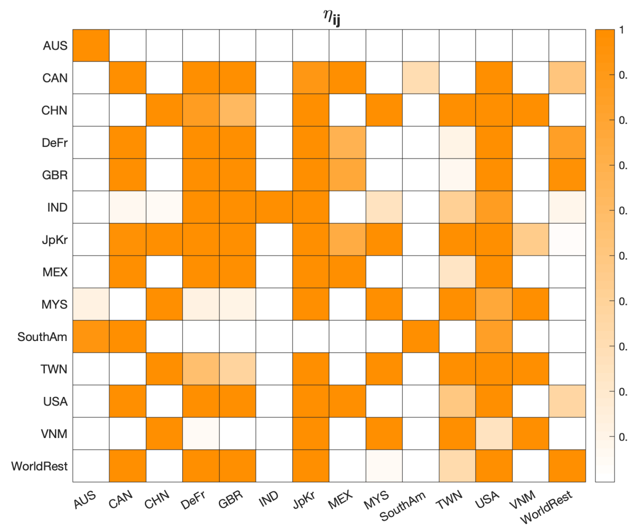


Figure OA.10: Calibrated η_{ij}

Figure OA.10 shows the resulting bilateral η_{ij} values, where each column represents a producer economy, and each row represents a receiver economy. Rich economies in general have high η_{ij} to most of the receiver economies. Economy pairs that are close to each other also have high η_{ij}. The VNM row highlights the comparison between Taiwan and French FDI investment in it. For example, the smaller geographic distance and larger comparative advantage similarity between Vietnam and Taiwan, compared to Vietnam and France, contribute to a much larger $\eta_{\text{VNM,TWN}}$ than $\eta_{\text{VNM,DeFr}}$.

[6] Let $\hat{\epsilon}^2_{\text{tariff}}$ and $\hat{\epsilon}^2_{\text{RER}}$ be the coefficients estimated using tariff and RER shifters, respectively, for the manufacturing sector, and let $\hat{\epsilon}^3_{\text{RER}}$ be the coefficients estimated using RER shifters for the service sector. I infer the elasticity that would have been estimated if there were tariff shifters to the service sector to be $\hat{\epsilon}^3_{\text{RER}} \times \frac{\hat{\epsilon}^2_{\text{tariff}}}{\hat{\epsilon}^2_{\text{RER}}}$. The regressions have $\hat{\epsilon}^3_{\text{RER}} = 0.066, \hat{\epsilon}^2_{\text{RER}} = 0.077$, and thus $\hat{\epsilon}^3_{\text{RER}} \times \frac{\hat{\epsilon}^2_{\text{tariff}}}{\hat{\epsilon}^2_{\text{RER}}} = 2.84$.

OA.4.3 Welfare Responses and Income-based Decomposition for Other Economies

Figure OA.11 presents the corresponding aggregate and distributional welfare implications for the two other economies that are significantly affected by the Trump tariffs, Mexico and Vietnam. Both economies experience an approximate 0.1% increase in aggregate consumption, primarily driven by increases in domestic wage rates. However, domestic profits for both countries decrease slightly, which is again related to the fact that the influx of more productive foreign producers raises the production costs in Mexico and Vietnam's domestic markets.

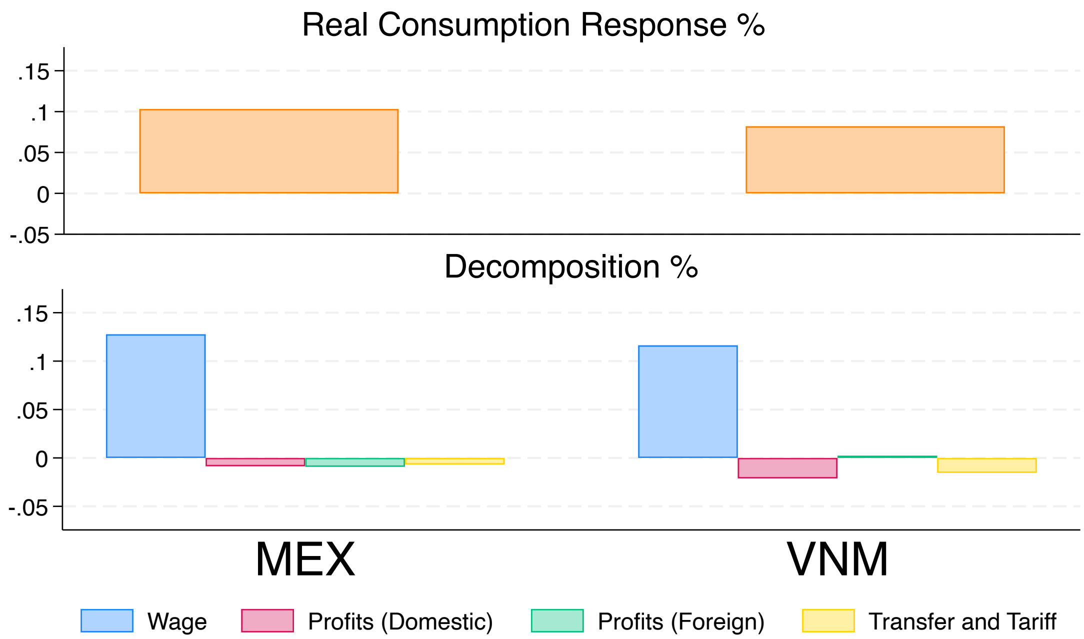


Figure OA.11: Real Consumption Implications for Mexico and Vietnam

Figure OA.12 presents the welfare implications for the remaining calibrated economies. For example, Canada and Malaysia's gains are primarily due to wage rate increases, similar to the US and Vietnam. Taiwan's losses are mostly attributable to decreasing profits, as Taiwan heavily invests in China. Some Taiwanese producers move back to Taiwan, leading to increases in labor and domestic profits.

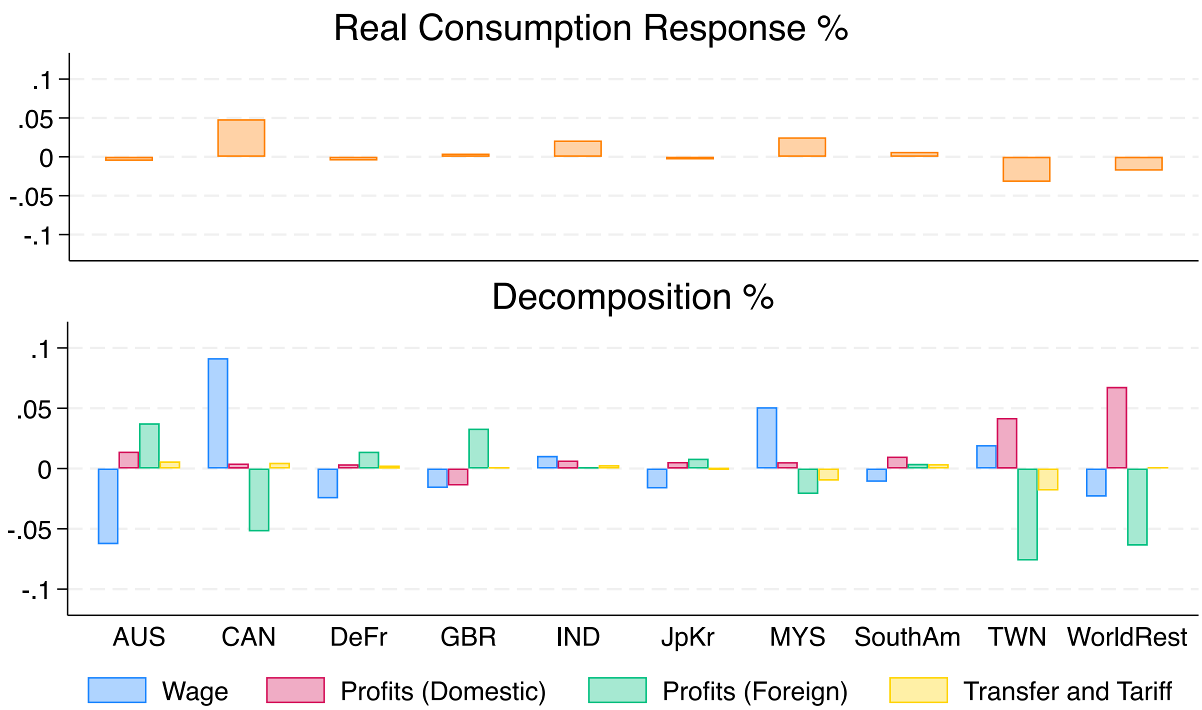


Figure OA.12: Real Consumption Implications for Other Economies

OA.4.4 Decomposition with Fixed FDI Allocations

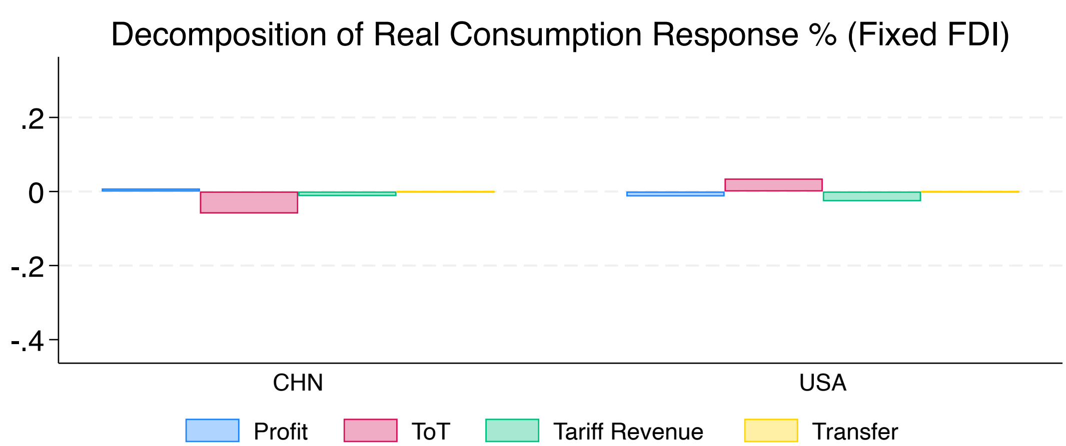


Figure OA.13: Decomposition of Real Consumption Responses: Fixed FDI

OA.4.5 Optimal Tariffs: The Best Response Function

Figure OA.14 and OA.15 show the best tariff response functions for both countries, under the Baseline and Fixed FDI assumption.

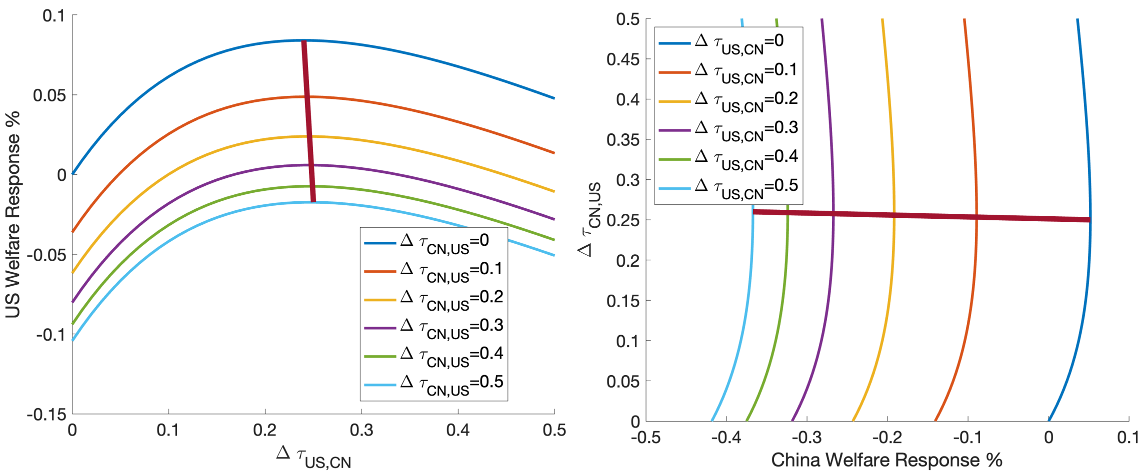


Figure OA.14: Nash Optimal Tariffs (Baseline)

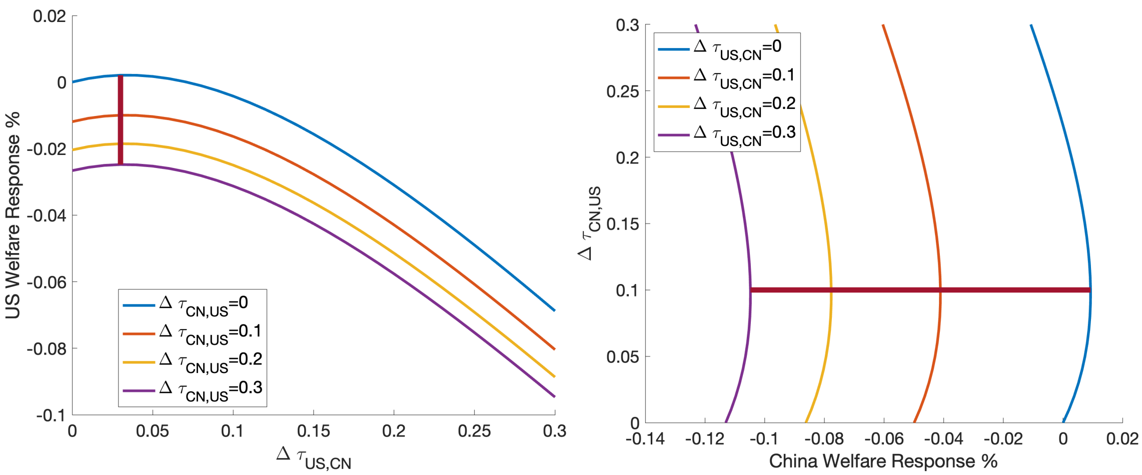


Figure OA.15: Nash Optimal Tariffs (Fixed FDI)

OA.4.6 FDI Diversion and Export Responses

Besides implications on real consumptions, I study the implications of the Trump tariffs on a country's export responses in the baseline model that incorporates FDI diversion. The export value net of tariff payments from country i to country h in sector s can be expressed as (see Section OA.3):

$$\frac{X_{hi}^s}{\tau_{hi}^s} = \frac{X_h^s}{\tau_{hi}^s}\pi_{hi}^s = \frac{X_h^s}{\tau_{hi}^s}\frac{\sum_j \tilde{M}_{ij}^s \left(P_{hij}^s\right)^{1-\epsilon^s}}{\left(P_h^s\right)^{1-\epsilon^s}},$$

where $\tilde{M}_{ij}^s \equiv \left(\left(\tilde{v}_{ij}^s\right)^\theta G_i^j/G^j\right)^{\frac{\theta-1}{\theta}} \left(G_i^j\right)^{\frac{1}{\theta}}$, and $P_{hij}^s = \frac{\epsilon^s}{\epsilon^s-1} d_{hi}^s \tau_{hi}^s \kappa_{ij}^s w_i / \left(\left(\Gamma(1-\frac{1}{\theta})\right) z_j^{\frac{1}{\theta}}\right)^{\frac{1}{\epsilon^s-1}}$. $\tilde{M}_{ij}^s \left(P_{hij}^s\right)^{1-\epsilon^s}$ captures the aggregate price index for varieties that are imported to h by producers from j operating in i in sector s. $\tilde{M}_{ij}^s$ captures the mass of producers, adjusted for the productivity distribution of producers from j that are located in i, while P_{hij}^s takes into account the producer fundamentals z_j, production location cost w_i, and bilateral frictions $d_{hi}^s, \tau_{hi}^s, \kappa_{ij}^s$. The numerator captures the contributions to exports from i to h by all producers from different source countries j, and the denominator captures the exports from different i, including those domestically from h. The first-order deviation decomposes the change of export values $\frac{X_{hi}^s}{\tau_{hi}^s}$ into three parts:

$$\mathrm{d}\ln\frac{X_{hi}^s}{\tau_{hi}^s} = \mathrm{d}\ln\frac{X_h^s}{\tau_{hi}^s}\frac{1}{\left(P_h^s\right)^{1-\epsilon^s}} + \left(1-\omega_h^s\right)\mathrm{d}\ln\tilde{M}_{ii}^s\left(P_{hii}^s\right)^{1-\epsilon^s} + \omega_h^s\,\mathrm{d}\ln\sum_{j\neq i}\tilde{M}_{ij}^s\left(P_{hij}^s\right)^{1-\epsilon^s}, \tag{OA.2}$$

where $\omega_h^s \equiv \frac{\sum_{j\neq i}\tilde{M}_{ij}^s\left(P_{hij}^s\right)^{1-\epsilon^s}}{\sum_j \tilde{M}_{ij}^s\left(P_{hij}^s\right)^{1-\epsilon^s}}$ captures the share of foreign production capacity in country i for sector s. The first term on the right-hand-side captures the change of the importer's sectoral expenditure, which includes general equilibrium effects on its sectoral price index, and the effect of direct tariff change. The second and third terms capture the export value changes that are associated with adjustments in domestic and foreign production capacity.

Figure OA.16 shows the aggregate changes in export values to the US for all economies (other than China) at the country level (aggregated over sectors), as well as the decomposition into the three terms specified in equation (OA.2).

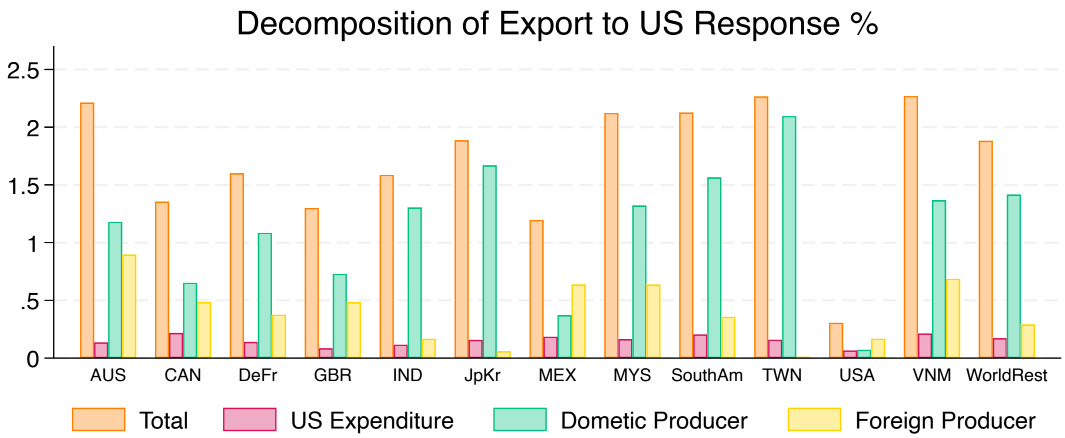


Figure OA.16: Export Response Decomposition

All economies substitute for Chinese exports to the US in terms of total export responses (shown in orange). Moreover, there are large heterogeneities in the relative contributions from FDI (shown in yellow) and domestic production capacity (shown in green) across economies. FDI is particularly important for Mexico, and is also significant for economies such as Vietnam, Australia, Canada, the UK, and Malaysia. In contrast, FDI is less impactful for economies like Japan/Korea, Germany/France, and Taiwan. The relative importance of FDI versus domestic production capacity hinges on the significance of foreign producers for the exporting economy i, as well as the extent of FDI diversion. For example, FDI accounts for a large part of the production capacity in the manufacturing sector for economies such as Mexico, Australia, Canada, and the UK, while its role is small for Japan/Korea. In the case of Mexico, it also experiences a large increase in inward FDI stocks (see next section). What's more, Mexico's domestic producers are relatively less productive compared to the incoming foreign producers, further amplifying the importance of FDI diversion in the country's export growth.

In the empirical section, I show that country more exposed to the Trump tariffs have higher relative FDK following the Trump tariffs. In Section OA.2, I show that countries more exposed, counterintuitively, have lower domestic capital after the Trump tariffs. This observation should not be misconstrued as implying that more exposed countries necessarily have reduced domestic capital following the tariffs. For example, the large increase of FDK in Mexico can itself be a reason for smaller increase of domestic capital in a general equilibrium environment. The empirical analysis in Section OA.2 and model decomposition in this section suggest a narrative where countries more exposed receive more FDK, and the impact of these FDI responses is significant enough that these countries increase their domestic capital investment by a lesser amount.

OA.4.7 Counterfactuals Comparison: Homogeneous vs. Heterogeneous FDI Elasticities

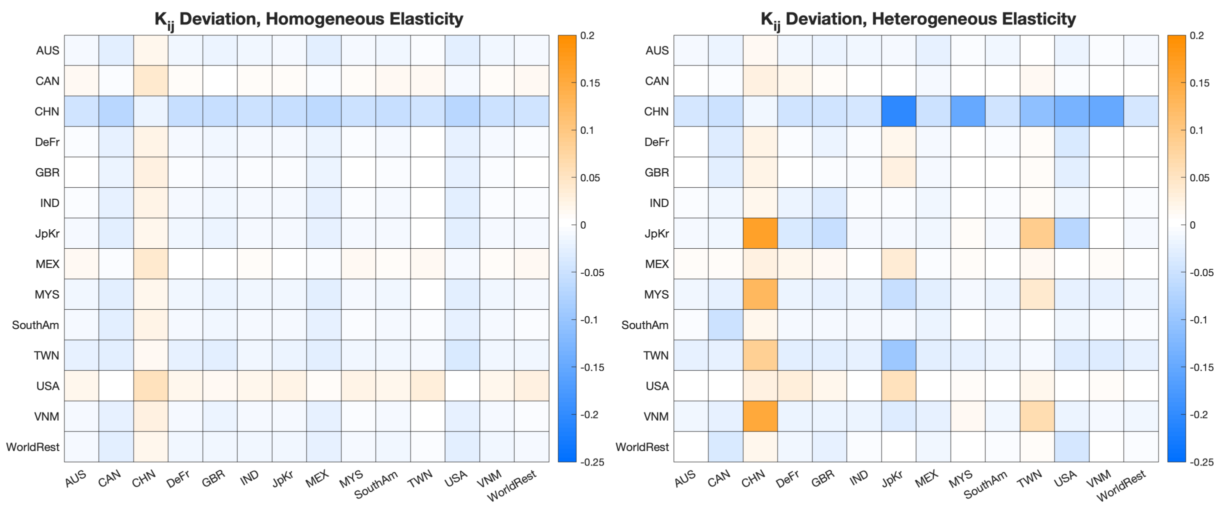


Figure OA.17: Bilateral FDK Deviation: Homo. vs. Hetero. Elasticity Model

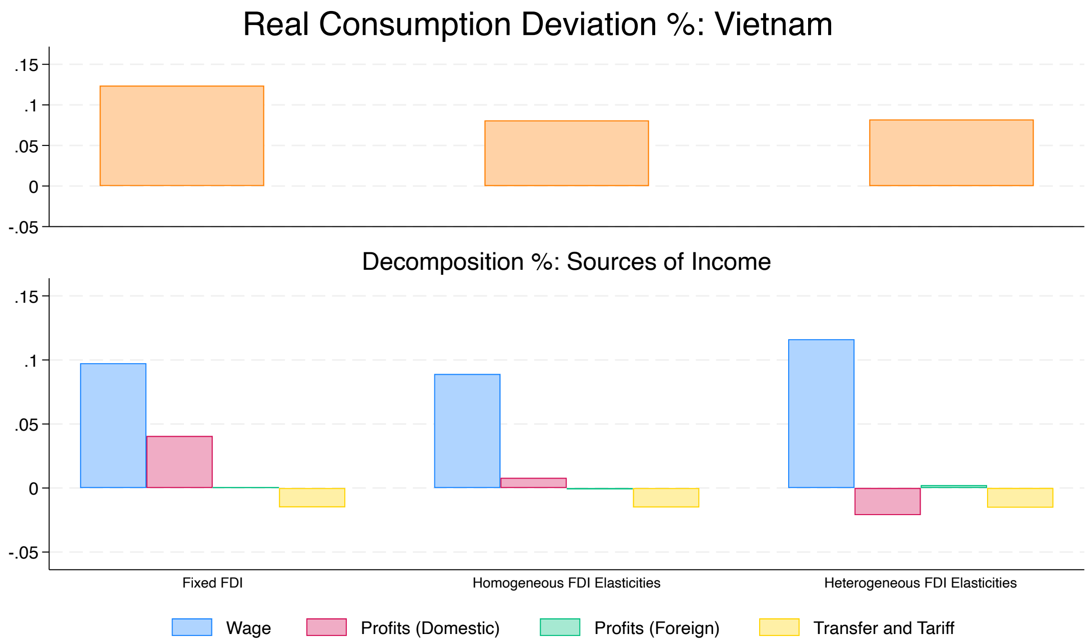


Figure OA.18: Vietnam Welfare Response: The Role of Heterogeneous FDI Elasticities

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