Global Sourcing and Multinational Activity: A Unified Approach

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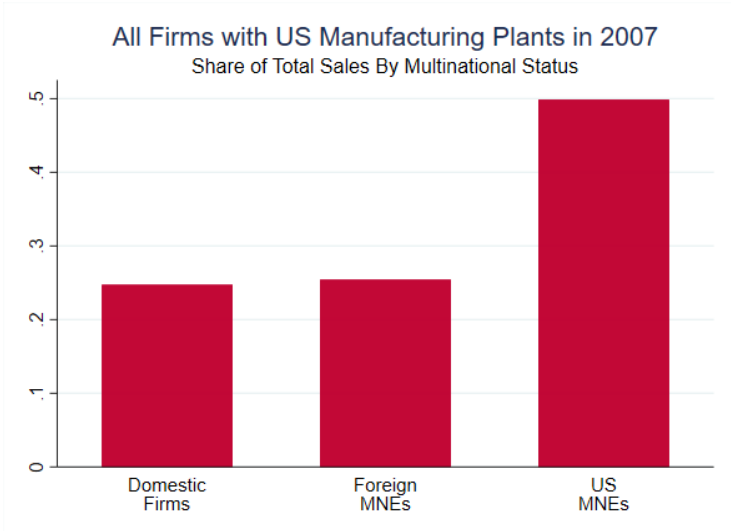
Motivation

- Firms increasingly locate different stages of production in different countries
- These global value chains (GVCs) lead to interdependencies across countries
- Recent events highlight the challenges GVC trade poses for policy
- Trade models often study importing and exporting separately from foreign production
  - Studies on the extensive margins of trade tend to ignore foreign production
  - Many horizontal FDI models treat exporting as a substitute for FDI
  - Most vertical FDI models only consider trade between affiliates and headquarters
- Yet firms' production and trade decisions are likely related

Multinational enterprises (MNEs) dominate aggregate activity



- Only 1,550 out of 246,000 firms with US manufacturing are US multinationals

Main Contributions

- Evidence from newly linked 2007 Bureau of Economic Analysis and US Census data
  - Multinationals dominate trade flows, esp on the extensive margins
  - Firms' with foreign production trade disproportionately more
  - Multinationals' imports and exports tilt towards their affiliate countries *and regions*
- Model of firms' *joint* sourcing, marketing, and final-good production decisions
  - Firm pays a fixed cost for all its plants to source inputs from country j
  - Firm pays a fixed cost for all its plants to sell final goods to country i
  - These fixed costs lead to complementarities between production and trade locations
- Interdependence between input, export, and production country decisions affects policy
  - Third-market effects from bilateral trade cost reductions
  - Trade and FDI policy necessarily interact

Related literature

- The extensive margins of FDI or trade
  - Doms and Jensen (1998); Hummels and Klenow (2005); Bernard et al. (2007, 2009); Bernard, Redding, and Schott (2009); Conconi, Sapir, Zanardi (2016); Kamal, McCloskey, and Ouyang (2022); Conconi et al. (2022)
- Vertical FDI and global sourcing
  - Helpman (1984); Markusen (1984); Antràs and Helpman (2004); Hanson, Mataloni, and Slaughter (2005); Grossman and Rossi-Hansberg (2008); Halpern et al. (2015); Garetto (2013); Keller and Yeaple (2013); Antràs et al. (2017); Blaum et al. (2017)
- Horizontal and export-platform FDI
  - Helpman (1985); Brainard (1997); Yeaple (2003); Helpman et al. (2004); Tintelnot (2017); Ramondo and Rodríguez-Clare (2013); Irarrazabal, Moxnes, and Opromolla (2013); Ramondo, Rappaport, and Ruhl (2016); Arkolakis et al. (2018); Garetto, Oldenski, Ramondo (2021)
- Interdependencies between trade and FDI decisions
  - Yeaple (2003); Grossman, Helpman, and Szeidl (2006); Bernard et al. (2018)

Outline of Talk

- Data description and new facts
- Simple model to rationalize the facts
- An illustrative example

Newly linked 2007 US Census-BEA data

- Data from the US Census Bureau
  - Longitudinal Business Database: universe of private, non-farm employer establishments
  - All Economic Censuses: establishment sales
  - Longitudinal Foreign Trade Transactions: imports and exports (we exclude oil)
  - Company Organization Survey (COS): firm ownership information

- Bureau of Economic Analysis data on foreign direct investment
  - BEA US Direct Investment Abroad (outward FDI, BE-11)
  - BEA Foreign Direct Investment in the United States (inward FDI, BE-12)

- Combine data via EINs and name and address matching
  - Census generally maps more EINs and activity to a unique firm
  - Use COS to distinguish US versus majority-owned foreign firms

New firm definitions using the combined data

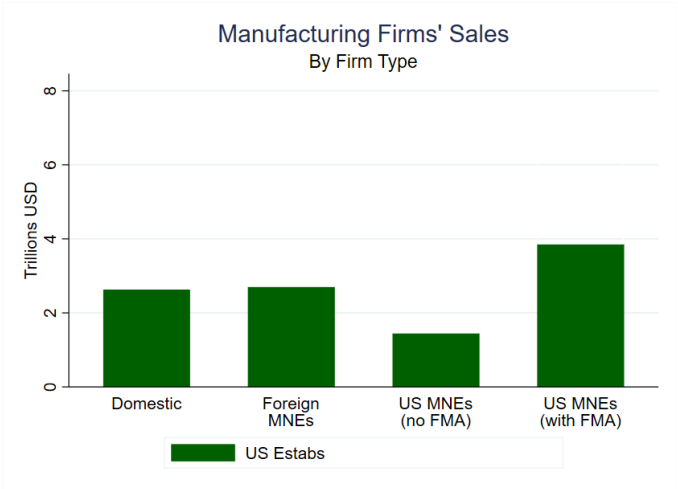
- US MNE:
  - US firm with majority-owned foreign affiliates
  - We focus on firms with majority-owned foreign manufacturing affiliates (*FMAs*)
- Foreign MNE:
  - Majority-owned by a foreign firm
- We focus on firms with one or more manufacturing plants in the United States

Sample of firms with US manufacturing, relative to US economy in 2007

Firm Type	Total Firms	Share of Aggregate					
		Emp	Sales	M Emp	M Sales	Imports	Exports
Domestic	242,000	0.10	0.09	0.58	0.35	0.09	0.12
Foreign MNEs	2,200	0.03	0.10	0.12	0.22	0.26	0.21
US MNEs	1,550	0.10	0.19	0.30	0.43	0.32	0.46
Total	245,750	0.23	0.38	1.00	1.00	0.67	0.79

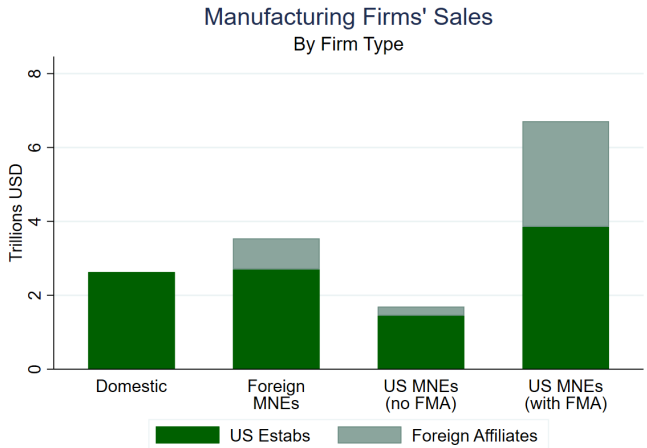
- Separate US MNEs based on whether they have foreign manuf affiliates

Total sales by firms with US manufacturing plants by firm type



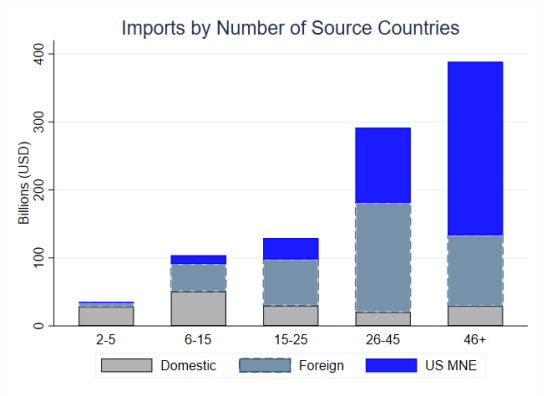
- MNEs account for 74% of manuf firms' sales
- US MNEs with foreign manuf affiliates (FMAs) are 1,200 firms but largest sales

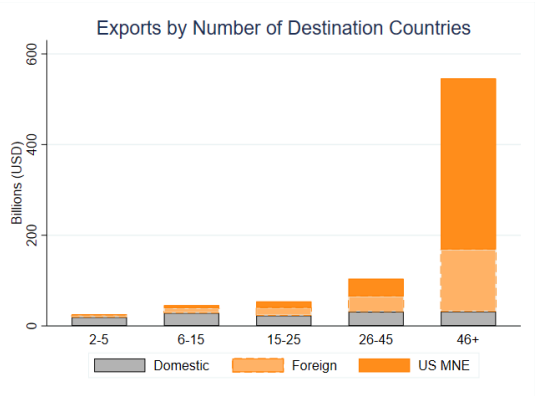
Total sales by firms with US manufacturing plants by firm type



- US MNEs with foreign manuf affiliates (FMAs) even larger globally

US trade flows by traders' extensive margin of countries





- 72% of imports by firms that source from 26+ countries
- 84% of exports by firms that sell to 26+ countries

Estimate MNE extensive and intensive-margin trade premia

$$
\begin{aligned}
log(\text{no. import countries}_f) = \quad & \beta_S log(\text{sales}_f^{US}) + \beta_E log(\text{estabs}_f^{US}) + \\
& \beta_F \text{Foreign}_f + \beta_M \text{US MNE}_f + \\
& \beta_A \text{MNE}_f \times log(\text{no. affiliate countries}) + \gamma_i + \varepsilon_{fi}
\end{aligned}
$$

- Foreign_f is an indicator for foreign-owned firms
- US MNE_f is an indicator for US firms with foreign manufacturing affiliates
- no. affiliate countries is a count of the number of countries in which MNE has affiliates
- γ_i are industry fixed effects for the firm's main NAICS 4

- Focus on firms that import from 2+ countries
- Same specifications for exports

MNEs' extensive-margin trade premia

Dependent variable is firm's log(number of trade countries)

	All Imports		AL Imports	All Exports		AL Exports
	(1)	(2)	(3)	(4)	(5)	(6)
Foreign MNE	0.343***	0.337***		0.130***	0.123***	
	(0.013)	(0.013)		(0.019)	(0.019)	
US MNE	0.558***	0.352***	0.368***	0.643***	0.461***	0.520***
	(0.017)	(0.022)	(0.024)	(0.025)	(0.033)	(0.036)
Log(affiliate countries)		0.115***	0.116***		0.072***	0.069***
		(0.012)	(0.013)		(0.017)	(0.019)
Observations (000s)	33.5	33.5	31.5	39	39	37.5
log(US M industries)	No	Yes	Yes	No	Yes	Yes

Notes: Omitted category is domestic traders. Samples limited to firms that import from or export to 2+ countries. AL denotes arm's-length trade. All regressions include log(US sales), log(US estabs), firm age, and industry FEs.

MNEs' intensive-margin trade premia

Dependent variable is firm's log(trade value)

	All Imports		AL Imports	All Exports		AL Exports
	(1)	(2)	(3)	(4)	(5)	(6)
Foreign MNE	1.651***	1.644***		0.854***	0.843***	
	(0.045)	(0.045)		(0.038)	(0.038)	
US MNE	1.343***	0.963***	0.737***	1.363***	0.983***	0.888***
	(0.061)	(0.080)	(0.082)	(0.050)	(0.065)	(0.071)
Log(affiliate countries)		0.256***	0.179***		0.203***	0.141***
		(0.041)	(0.044)		(0.034)	(0.038)
US industries	No	Yes	Yes	No	Yes	Yes
Observations (000s)	33.5	33.5	31.5	39	39	37.5

Notes: Omitted category is domestic traders. Samples limited to firms that import from or export to 2+ countries. AL denotes arm's-length trade. All regressions control for log(US sales), log(US estabs), firm age, and industry FEs.

Estimate relationship between importing and foreign affiliate activity

- Extensive margin of firm imports:

$$Pr(y_{fjr} = 1|X) = \beta_A Affiliate_{fjr} + \beta_{AR} AffiliateRegion_{fj' \neq jr} + \beta_F Foreign_{fjr} + \beta_{FR} ForeignRegion_{fj' \neq jr} + \gamma_f + \gamma_j$$

  - $y_{fjr} = 1$ if firm f imports from country j in region r
  - $Affiliate_{fjr}$ is an indicator for whether firm has an affiliate in country j and region r
  - $AffiliateRegion_{fj' \neq jr}$ is an indicator for whether firm has an affiliate in the same region
  - $Foreign_{fjr}$ is indicator for whether the firm is headquartered in country j
  - $ForeignRegion_{fj' \neq jr}$ is an indicator whether the firm is headquartered in region r

- Also estimate with $ln(imports_{fjr})$ as dependent variable
- Focus on firms that import from 2+ countries
- Same specifications for exports

MNE activity and the margins of US imports in 2007

	Extensive Margin		Intensive Margin	
	(1)	(2)	(3)	(4)
Affiliate$_{fjr}$	0.501***	0.536***	2.224***	2.331***
	(0.025)	(0.028)	(0.123)	(0.110)
Foreign$_{fjr}$	0.669***	0.678***	3.617***	3.765***
	(0.047)	(0.047)	(0.227)	(0.223)
Affiliate in Region$_{fj'\neq jr}$		0.074***		0.181
		(0.015)		(0.113)
Foreign Region$_{fj'\neq jr}$		0.090***		0.480***
		(0.021)		(0.160)
Adj. R2	0.278	0.28	0.282	0.283
Observations (000s)	6,330	6,330	177	177
Firm & Country FEs	Yes	Yes	Yes	Yes

Dependent variable for extensive margin regressions is an indicator for whether firm f imports from country j in region r. Dependent variable for intensive-margin regressions is the log of imports by firm f from country j in region r. Standard errors two-way clustered by firm and by country.

MNE activity and the margins of US exports in 2007

	Extensive Margin		Intensive Margin	
	(1)	(2)	(3)	(4)
Affiliate$_{fjr}$	0.423***	0.463***	1.906***	1.993***
	(0.032)	(0.035)	(0.108)	(0.102)
Foreign$_{fjr}$	0.518***	0.521***	1.306***	1.286***
	(0.043)	(0.043)	(0.140)	(0.155)
Affiliate in Region$_{fj'\neq jr}$		0.087***		0.163**
		(0.020)		(0.078)
Foreign Region$_{fj'\neq jr}$		0.035**		-0.112
		(0.014)		(0.122)
Adj. R2	0.266	0.267	0.42	0.42
Observations (000s)	7,230	7,230	350	350
Firm & Country FEs	Yes	Yes	Yes	Yes

Dependent variable for extensive margin regressions is an indicator for whether firm f exports from country j in region r. Dependent variable for intensive-margin regressions is the log of exports by firm f from country j in region r. Standard errors two-way clustered by firm and by country.

Additional information from descriptive regressions

- Robust to using the number of affiliates in a region
- Robust to including comparable measures of trade flows (e.g., exporter in the region)
  - Affiliate measure seems to be more important than other trade activity
- Similar patterns when using proxies for bilateral trade costs between j and affiliates
  - The inverse distance-weighted sum of the firm's affiliates and j
  - Sum of affiliates with a free-trade agreement with j

Summary of new facts

1. MNEs have larger extensive and intensive margins of trade, even controlling for US size
   - These MNE premia are increasing in the firm's number of foreign affiliate countries
2. MNEs are more likely to import from countries in regions in which they have an affiliate
3. MNEs are more likely to export to countries in regions in which they have an affiliate

Overview of the theory

- Framework with global assembly, sourcing, and marketing decisions across countries
- Single downstream manufacturing sector with scale economies
  - CES preferences, firm heterogeneity, and monopolistic competition (Melitz '03)
  - Final-goods and inputs are differentiated based on country of production (Armington)
  - J countries with differing trade costs, wages, and productivities
- A final-good producer:
  1. Pays a fixed cost to enter a headquarter country and learn its core productivity)
  2. Chooses set of countries in which to produce final goods
  3. Chooses set of countries from which to source its inputs
  4. Chooses set of countries in which to market its goods
- Country-level fixed costs to source inputs or market goods cover *all* assembly plants

Interdependencies between firms' foreign production and trade margins

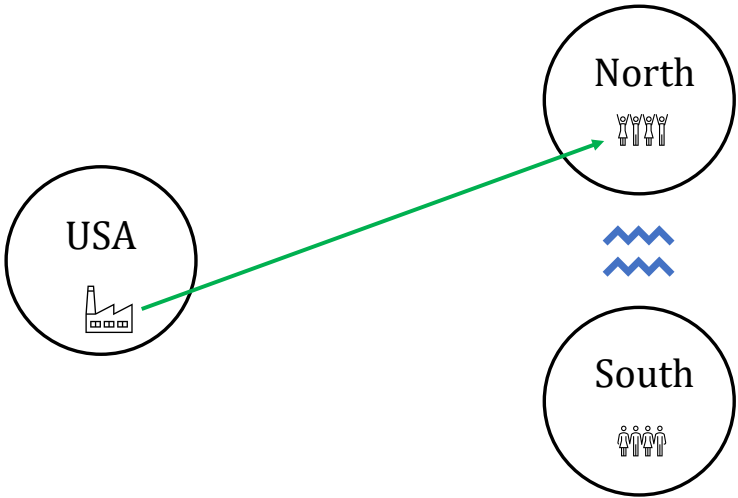
- Complementarity between assembly and sourcing locations
  - Change in profits from adding source country is higher if 'proximate' affiliates
  - Assembly and sourcing are independent under plant-level fixed costs of sourcing
- Complementarity between assembly and marketing locations
  - Change in profits from adding export market is higher if 'proximate' affiliates
  - Assembly and exporting are independent under plant-level fixed costs of sourcing
- Shared fixed cost of sourcing and marketing magnify fundamental productivity differences

Third-market effects of a trade policy change

- Qualitative insights from a three-country model (quantification in process)
- Impact of an FTA between 2 countries (North and South) on a third country (the US)
- Caveats: we ignore competition effects and focus on two configurations of the extensive margins of trade

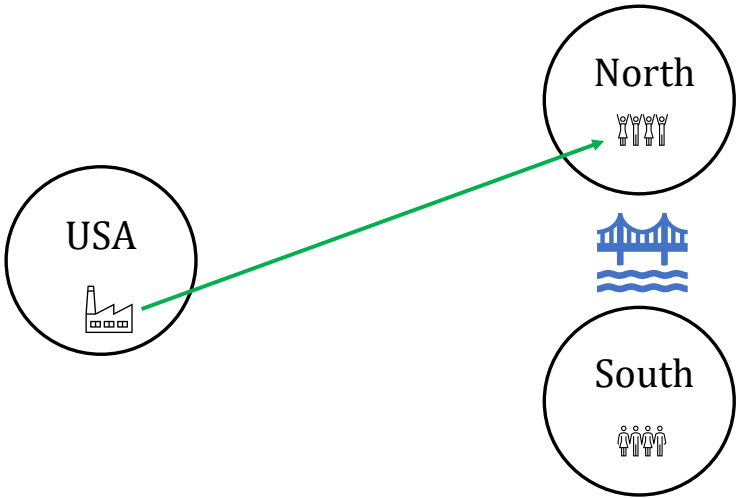
Standard Export-FDI Model: Cannibalization and No Sourcing

Initial Situation Before the FTA



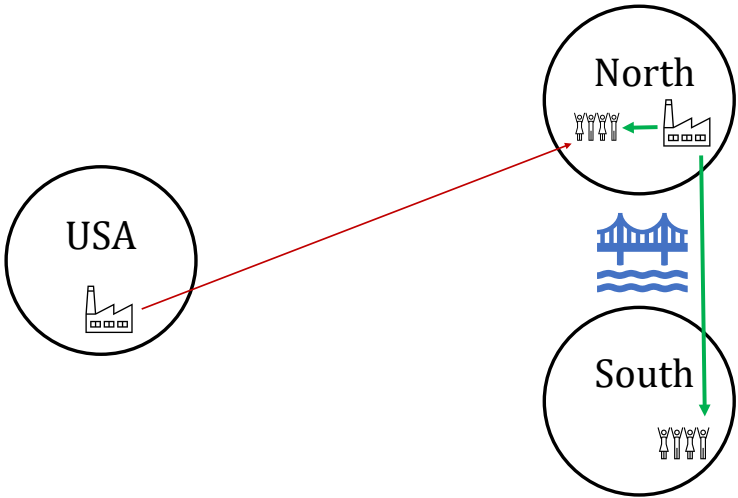
- Focus on a US firm that initially exports only to the North

North and South Sign an FTA



- If US firm does not set up an affiliate in North or South, nothing happens

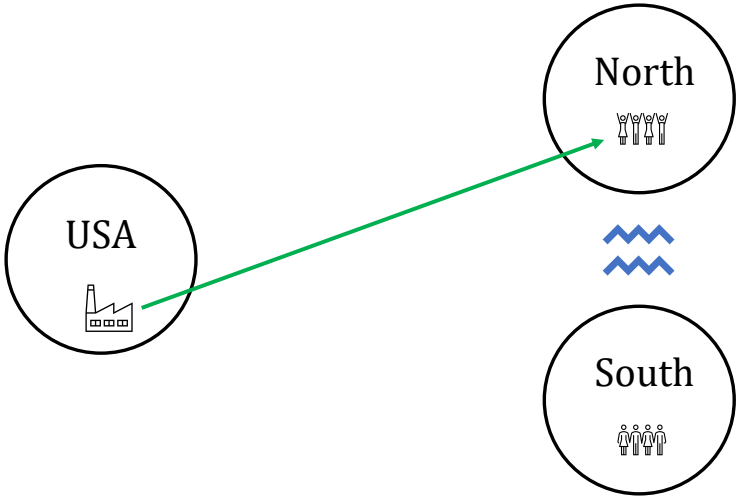
US Outward FDI Reduces US Exports



- If US firm sets up an affiliate in North, US exports to North fall

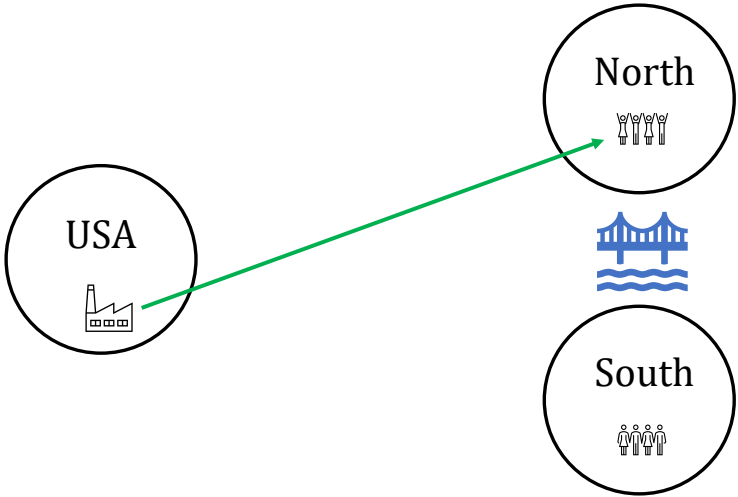
Complementarities via Shared Fixed Cost of Marketing

Initial Situation Before the FTA



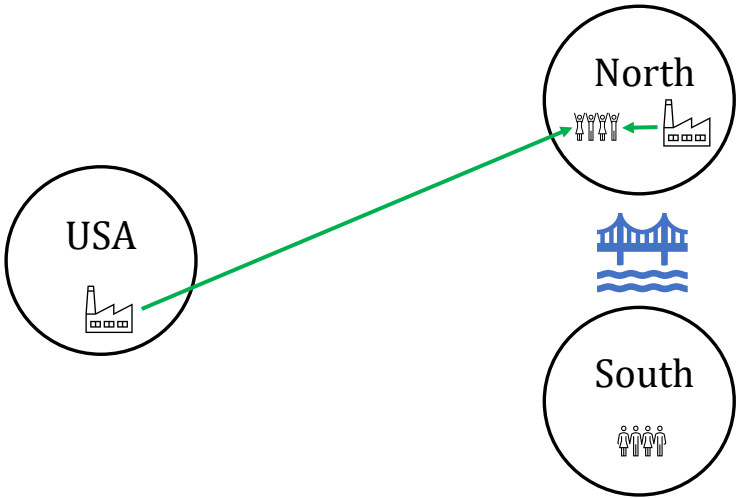
- Same initial situation as before but assume no cannibalization effects

North and South Sign an FTA



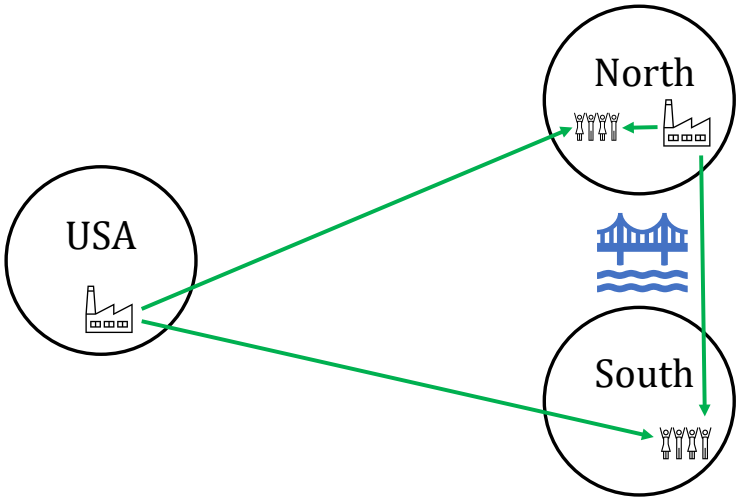
- Same initial situation as before but assume no cannibalization effects

No Cannibalization, No Effect on US Exports under Current Models



- Even if FTA leads to US assembly in North, there is no impact on US exports to North

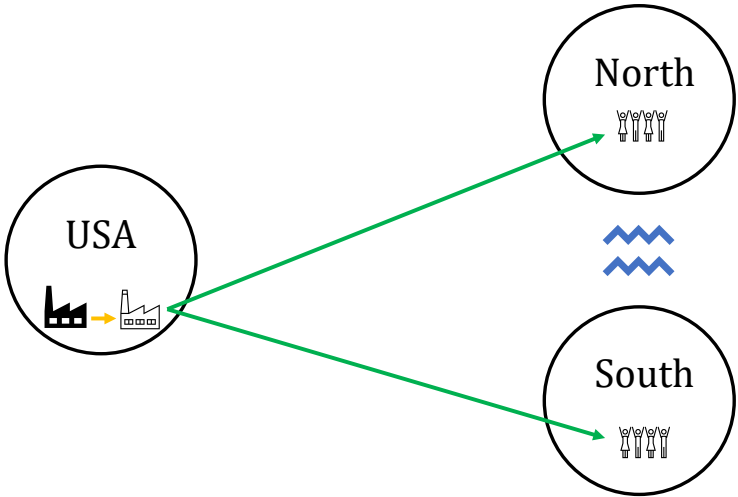
Complementarity via *Firm-Level* Marketing Strategy



- New plant in North may lead firm to activate South as destination of sales!

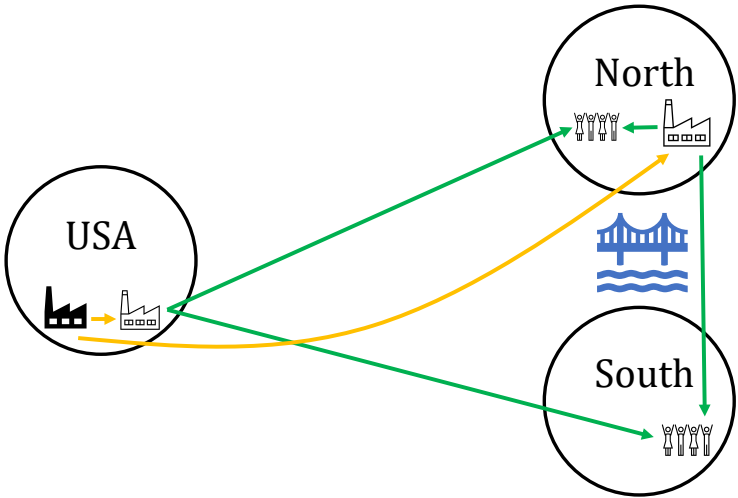
Complementarities via Shared Fixed Cost of Sourcing

Initial Situation Before the FTA



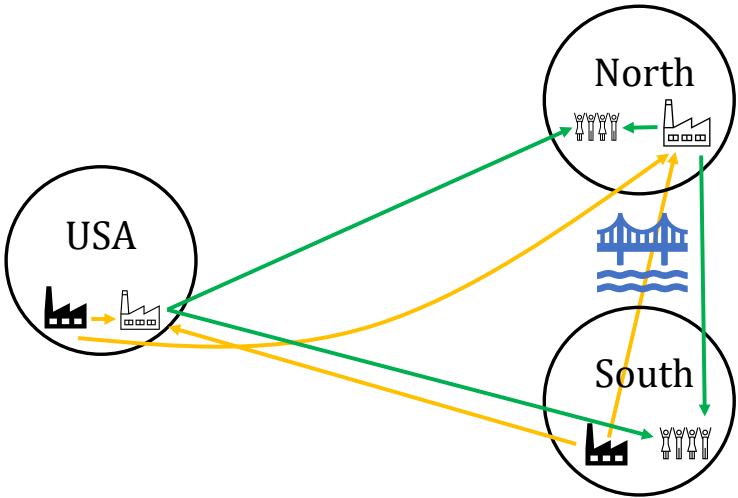
- We now introduce sourcing (for now only in US) and universal exporting

No Cannibalization, Input Sourcing from US grows



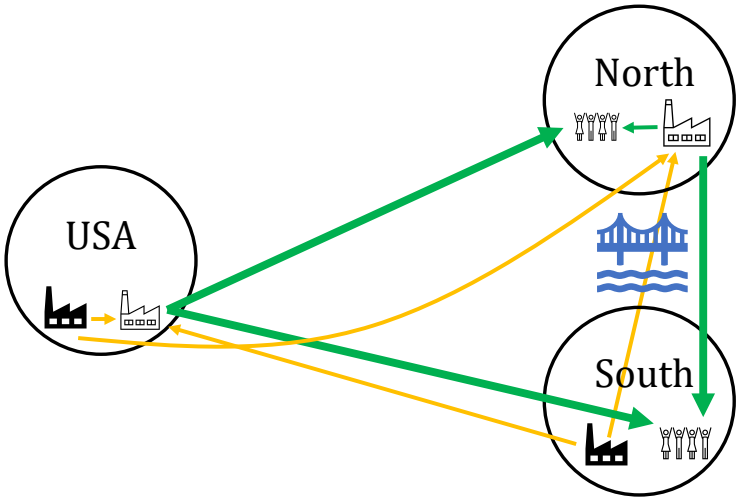
- If FTA leads to outward FDI in North, input sourcing occurs from US

Complementarity via *Firm-Level* Sourcing Strategy



- The new plant in North may lead firm to activate South as source of inputs!

Complementarity via *Firm-Level* Sourcing Strategy



- And this will boost final-good exports from the US!

Conclusions

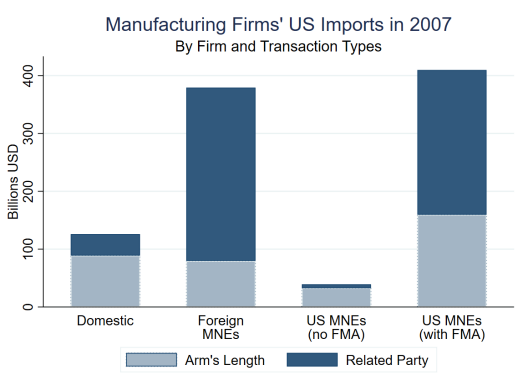
- Multinational firms are dominant players in domestic employment, output, and trade
- MNEs' input-sourcing, marketing, and final-good production decisions are interrelated
- This interdependence affects firms' responses to policy and other shocks
  - Joint sourcing, exporting, and assembly decisions are missing from most models
  - Potential to reverse standard and 'intuitive' predictions on policy effects

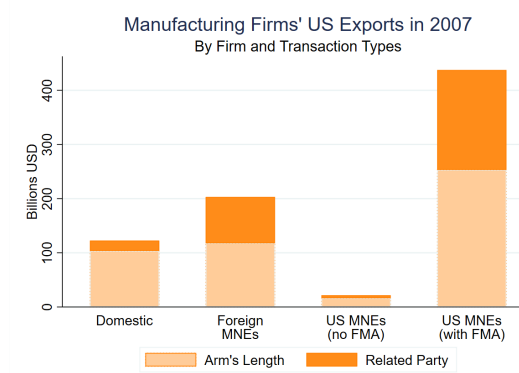
Appendix

Sample of firms with US manufacturing relative to US economy in 2007

		Share of Total				
	Firms	Emp	Man Emp	Sales	Imports	Exports
Total in Sample	245,750	0.22	1.01	0.39	0.67	0.79
Domestic	182,000	0.02	0.19	0.02	0.00	0.01
Importers	60,000	0.07	0.40	0.08	0.09	0.12
Foreign-Owned	2,200	0.03	0.12	0.10	0.26	0.21
US MNEs						
No Foreign Manuf Aff	350	0.04	0.03	0.05	0.03	0.02
With Foreign Manuf Aff	1,200	0.06	0.27	0.14	0.29	0.43
Total Outside Sample	4,318,650	0.77	0.00	0.62	0.34	0.20
Domestic	4,099,000	0.46		0.27	0.00	0.04
Importers	213,000	0.19		0.19	0.22	0.11
Foreign-Owned	5,400	0.03		0.04	0.07	0.03
US MNEs						
No Foreign Manuf Aff	1,100	0.09		0.11	0.04	0.02
With Foreign Manuf Aff	150	0.00		0.01	0.01	0.00

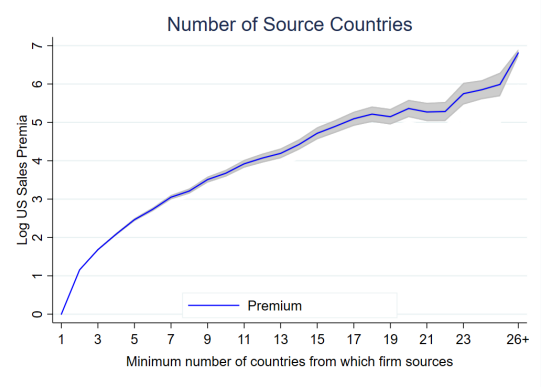
US imports and exports by firm and transaction type





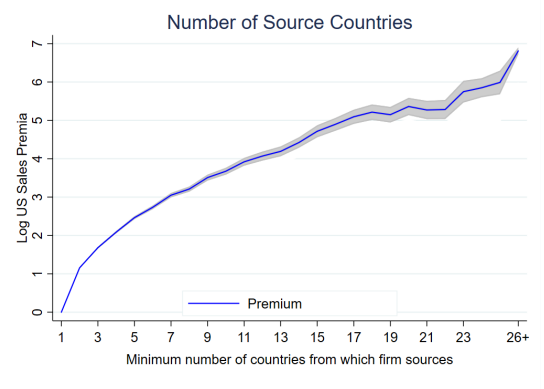
- MNEs account for 87% of manuf firms' imports and 84% of their exports
- A significant share of MNE trade is with arm's length partners

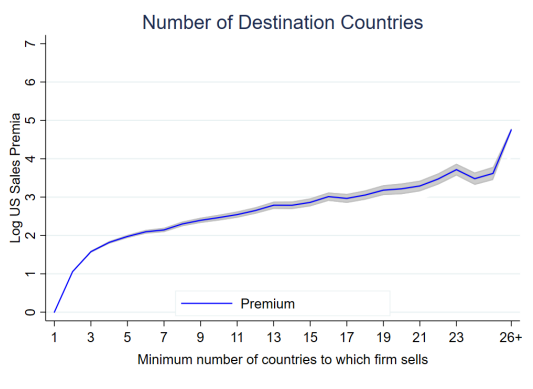
Traders' US sales premia by number of trade countries



- Regress log(US sales) on indicators for firm's number of source countries and industry

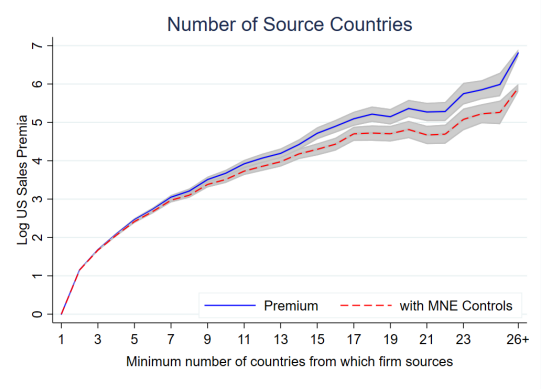
Traders' US sales premia by number of trade countries

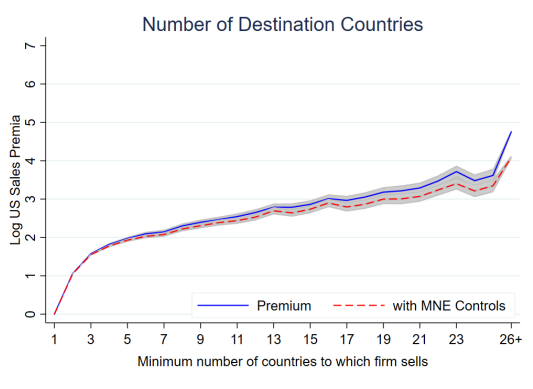




- Regress log(US sales) on indicators for firm's number of destination countries and industry

Traders' US sales premia by number of trade countries





- Add indicators for US MNE and foreign MNE status

Extensive margins of trade for multi-country traders by firm type

	Panel A: Import Statistics				Panel B: Export Statistics			
	Share of Aggregate		No. of Countries		Share of Aggregate		No. of Countries	
Firm Type	Importers	Imports	Avg	Median	Exporters	Exports	Avg	Median
Domestic	0.48	0.17	4	3	0.52	0.18	8	4
Foreign MNEs	0.03	0.40	12	8	0.03	0.27	19	10
US MNEs	0.02	0.43	21	17	0.02	0.54	40	35

Panel A presents the share of US importers and import value, and the average and median number of countries from which firms import by firm type. Panel B presents comparable statistics for US exports. Sample is all firms with US manufacturing plants that import from 2+ countries (left panel) or export to 2+ countries (right panel).

- US MNEs have much larger extensive margins