Global Sourcing and Multinational Activity: A Unified Approach

Pol Antràs[1] Evgenii Fadeev[1] Teresa Fort[2] Felix Tintelnot[3]

[1]Harvard University

[2]Tuck at Dartmouth and US Census Bureau

[3]University of Chicago

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Motivation

- Trade flows are dominated by very large firms
- The largest trading firms tend to be multinational enterprises (MNEs)
- MNEs' foreign sourcing and production decisions are likely related, but studied separately
  - Data limitations
  - Theory too complicated
- We lack a unified framework to study the effects of policy changes on global production
  - Tariffs affect trade cost *and* MNEs' global production costs
  - Domestic policies that affect MNEs indirectly affect trade flows

Main Contributions

- Newly linked Bureau of Economic Analysis and US Census data
  - Strong relationship between importing and FDI
  - Aggregate importance of MNEs
- Framework to analyze firms' *joint* FDI and foreign sourcing decisions
  - One fixed cost for all plants to be able to source from a country
  - Amount of sourcing and production depend on trade costs and wages
  - New "search method" to solve firm's extensive margin sourcing and assembly decisions
- Future: counterfactual analysis of **man-made** trade barriers in global production patterns
  - How do policies affect firms' decisions to locate production stages across countries?
  - What is the optimal shape of those policies? For a country? For the world?

Outline of Talk

- Data description and new facts
- Relationship between sourcing and foreign production
- Theory overview and intuition

We exploit newly-linked 2007 US Census-BEA data

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

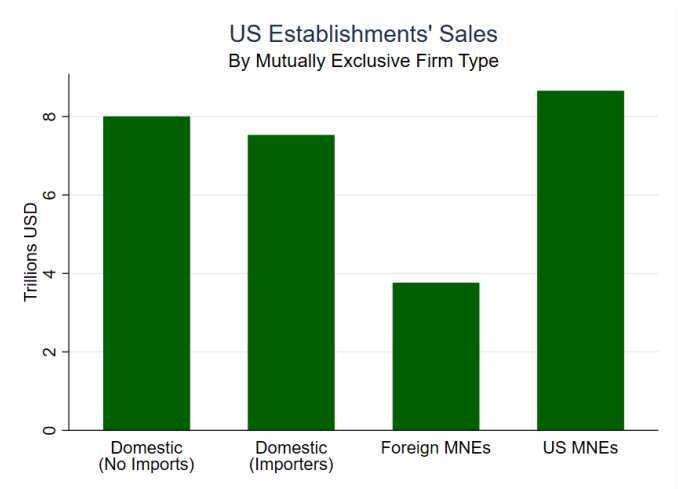
- BEA data on direct investment and multinational enterprises (MNEs)
  - BEA US Direct Investment Abroad (outward FDI, BE-11)
  - BEA Foreign Direct Investment in the United States (inward FDI, BE-12)

- 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

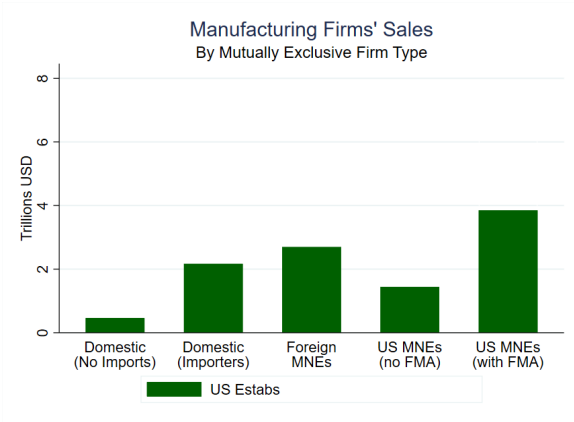
- US MNE:
  - Has majority-owned foreign affiliates (*FAs*)
  - We focus on firms with majority-owned foreign manufacturing affiliates (*FMAs*)
- Foreign-owned MNE:
  - Majority-owned by a foreign firm according to BEA
  - For firms with majority-owned *FA* activity, also use Census employment and ownership data
- Domestic firm:
  - Non-MNE firm that does not import (Domestic)
  - Non-MNE firm that imports (Domestic Importer)
- Manufacturing firm: firm with one or more manufacturing plants in United States

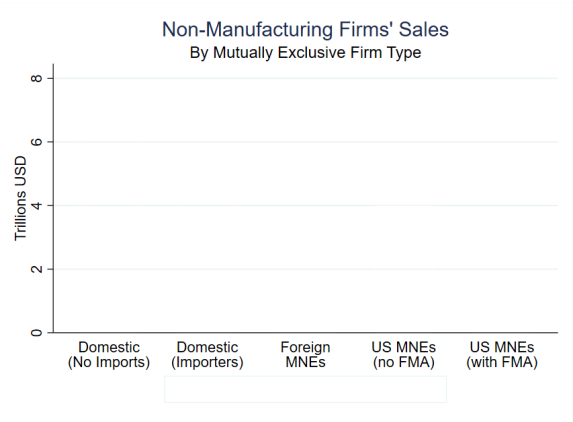
MNEs are few in number, but they are LARGE



- There are 7.8K foreign MNEs (0.17%) that cover 6% of employment and 13% of sales
- There are 2.8k US MNEs (0.06%) that cover 19% of employment and 31% of sales

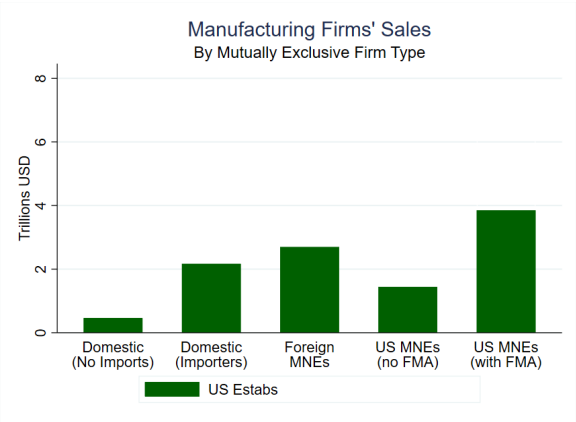
MNEs dominate US manufacturing activity

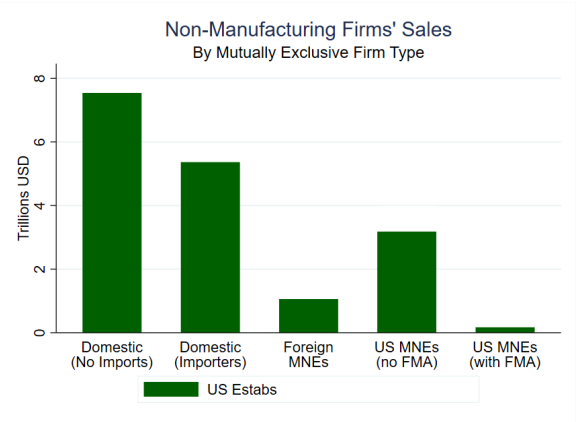




- US MNEs (1,550) and Foreign MNEs (2,200) account for 74% of manuf firms' sales
- We define manufacturing firms as those with 1+ US manuf plant

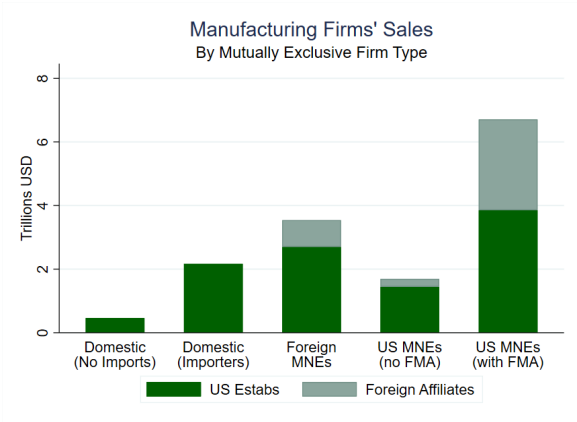
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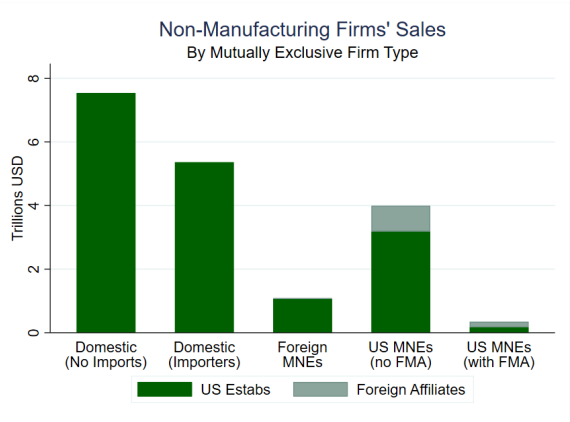




- US MNEs that manufacture abroad also produce in the US

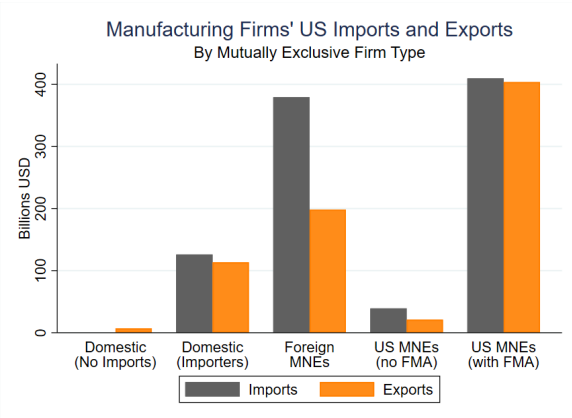
MNEs dominate US manufacturing activity and foreign affiliate sales

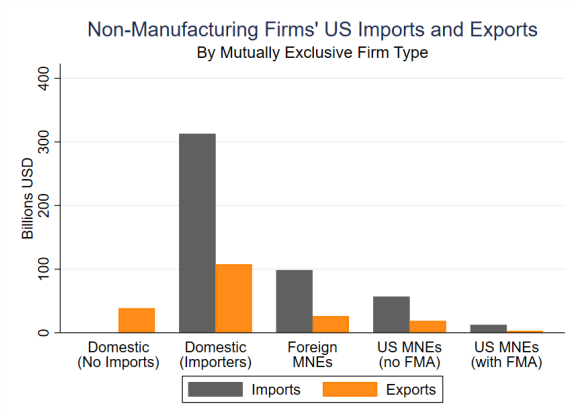




- US manuf MNEs' foreign affiliate sales equal 74% of their US estab sales

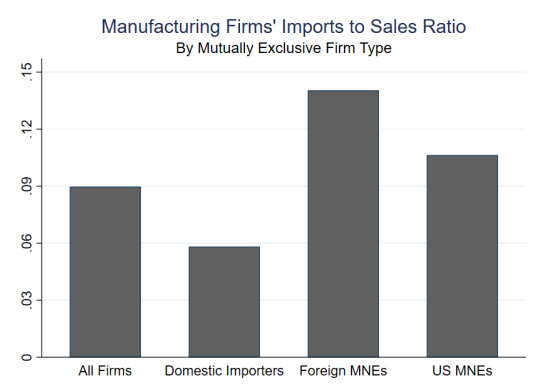
MNEs with US manufacturing activity dominate trade flows

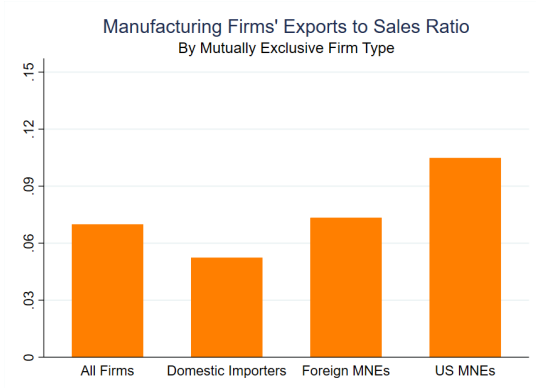




- MNEs with US manuf estabs account for 58% of US imports and 66% of exports
- MNEs account for 87% of manuf firms' imports and 84% of their exports

MNEs are more import and export intensive





- Foreign-owned MNEs are most import intensive
- US MNEs are most export intensive

Estimate relationship between importing and foreign affiliate activity

$$Pr(y_{frc} = 1|X) = \beta_D log(distance_c) + log(GDP_c) + \beta_L Language_c + \beta_C Contiguous_c + \beta_A Affiliate_{fc} + \beta_{AR} AffiliateRegion_{fr} + \beta_F Foreign_{fc} + \beta_{FR} ForeignRegion_{fr} + \gamma_f + \gamma_r$$

- $y_{frc} = 1$ if firm f imports from country c in region r
- Standard gravity variables (distance, GDP, common language, contiguity)
- $Affiliate_{fc}$ is an indicators for whether firm has an affiliate in country c
- $AffiliateRegion_{fr}$ is an indicator for whether firm has an affiliate in the same region
- $Foreign_{fc}$ is indicator for whether firm is foreign owned by country
- $ForeignRegion_{fr}$ is an indicator for whether firm is foreign owned a country in the region

Extensive margin of imports related to country MNE activity

Dependent variable is an indicator for whether firm f imports from country c in region r

	(1)	(2)	(3)	(4)	(5)	(6)
Common Language$_c$	0.002	0.001	0.001	0.001		
	(0.008)	(0.008)	(0.008)	(0.008)		
$log(distance_c)$	-0.017	-0.006	-0.006	-0.006		
	(0.013)	(0.009)	(0.009)	(0.009)		
$log(GDP_c)$	0.015***	0.014***	0.014***	0.014***		
	(0.003)	(0.003)	(0.002)	(0.002)		
Contiguous$_c$		0.133***	0.128***	0.129***		
		(0.013)	(0.013)	(0.013)		
Affilliate$_{fc}$			0.550***	0.582***	0.501***	0.536***
			(0.028)	(0.031)	(0.025)	(0.028)
Foreign-Owned$_{fc}$			0.726***	0.735***	0.669***	0.678***
			(0.046)	(0.047)	(0.047)	(0.047)
Affiliate in Region$_{fr}$				0.069***		0.074***
				(0.015)		(0.015)
Foreign in Region$_{fr}$				0.086***		0.090***
				(0.020)		(0.021)
Firm FEs	Yes	Yes	Yes	Yes	Yes	Yes
Region FEs	Yes	Yes	Yes	Yes	No	No
Country FEs	No	No	No	No	Yes	Yes
Adj. R2	0.194	0.197	0.215	0.216	0.278	0.28
Observations (000s)	6,330	6,330	6,330	6,330	6,330	6,330

Standard errors two-way clustered by firm and by country. ** p<0.05, *** p<0.01.

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Intensive margin of imports is related to country MNE activity

Dependent variable is $log(imports_{frc})$

	(1)	(2)	(3)	(4)	(5)	(6)
Common Language$_c$	-0.264***	-0.252**	-0.272**	-0.269**		
	(0.101)	(0.110)	(0.113)	(0.113)		
$log(distance_c)$	-0.719***	-0.157	-0.105	-0.107		
	(0.191)	(0.347)	(0.386)	(0.385)		
$log(GDP_c)$	0.392***	0.377***	0.326***	0.331***		
	(0.050)	(0.054)	(0.058)	(0.058)		
Contiguous$_c$		0.874**	0.898**	0.885**		
		(0.378)	(0.411)	(0.411)		
Affiliate$_{fc}$			2.265***	2.363***	2.224***	2.331***
			(0.127)	(0.112)	(0.123)	(0.110)
Foreign-Owned$_{fc}$			3.399***	3.545***	3.617***	3.765***
			(0.165)	(0.177)	(0.227)	(0.223)
Affiliate in Region$_{fr}$				0.162		0.181
				(0.115)		(0.113)
Foreign in Region$_{fr}$				0.468***		0.480***
				(0.156)		(0.160)
Firm FEs	Yes	Yes	Yes	Yes	Yes	Yes
Region FEs	Yes	Yes	Yes	Yes	No	No
Country FEs	No	No	No	No	Yes	Yes
Adj. R2	0.233	0.234	0.268	0.269	0.282	0.283
Observations	177,000	177,000	177,000	177,000	177,000	177,000

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Overview of the theory

- Unified framework with global assembly and global sourcing
  - Combines Tintelnot (2017) with Antràs, Fort and Tintelnot (2017)
- Single manufacturing sector with scale economies and free entry
  - CES preferences and monopolistic competition
  - J countries with differing trade costs, wages, and productivities
  - Krugman' 80, Melitz '03, and Eaton-Kortum '02 are special cases
- A final-good producer in the model:
  1. Pays fixed cost to enter a headquarter country and learn its core productivity
  2. Chooses countries in which to produce final goods and learns productivity per good
  3. Chooses countries from which to source inputs and learns marginal cost of each input
  4. Assembly plants source each input from cheapest source
  5. Consumers purchase each good from cheapest assembly plant

Firm's sourcing and assembly decisions are interrelated

- Fixed cost to add assembly country; reduces trade costs to serve some markets
- Fixed cost to add source country; differentially lowers prod costs for all assembly plants
- Assembly plant locations are substitutes – market cannibalization
  - Firm faces diminishing marginal benefits from adding assembly countries
- Input source countries may be substitutes or complements
  - Substitutes if demand is inelastic and comparative advantage forces low
  - May be complements if demand is elastic and potential for cost savings high (as in AFT '17)
  - Or assembly-sourcing interactions could lead to decreasing returns from new source locations
- Complementarity between firm's overall assembly and sourcing strategies

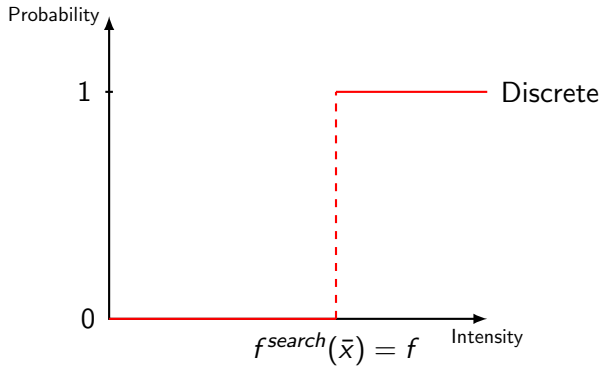
Solving the extensive margin decisions is complicated!

- Necessary to solve the firm's joint decisions to perform counterfactual analyses
- No "single-crossing" property $\Longrightarrow$ no simple iterative algorithm as in Jia' 08 (or AFT '17)
- Brute force method would constrain us to a low number of countries J
- Ideally would like to run estimation with 30 or 40 countries
- What to do?

Probabilistic (Search) Framework

- **The Idea:** Turn the discrete problem into continuous one using randomization
- For example, for sourcing

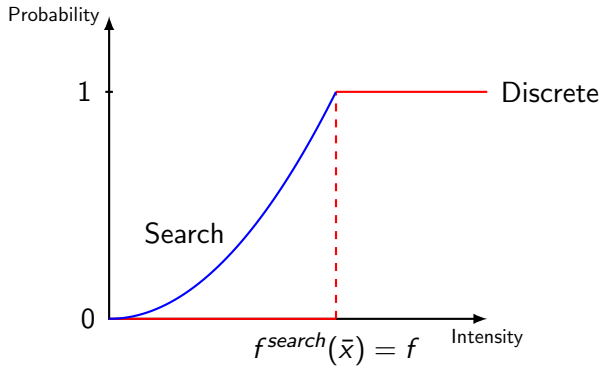
$$\{\text{Fixed Costs: } f_k^s \to \mathbb{I}_k^s = 1\} \Rightarrow \{\text{Search Costs: } f_k^s(x_k) \to \mathbb{P}(\mathbb{I}_k^s = 1 | x_k)\}$$



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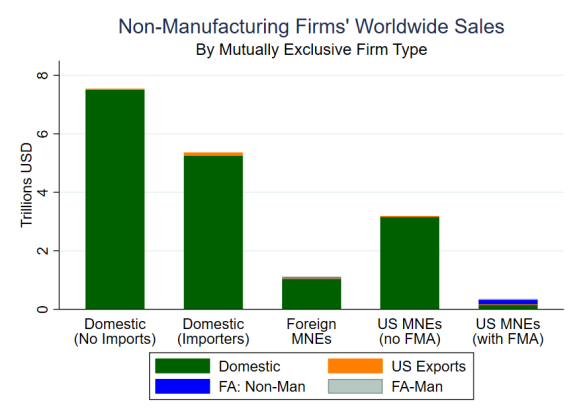


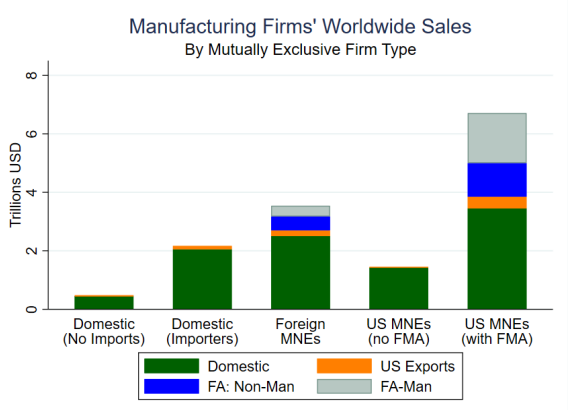
Conclusions

- Multinational firms are dominant players in domestic employment, output, and trade
- MNEs' foreign sourcing and production decisions are interrelated
- Framework to analyze the role of **man-made** trade barriers in GVCs
  - How do policies affect firms' decisions to locate GVC segments across countries?
  - What is the optimal shape of those policies? For a country? For the world?

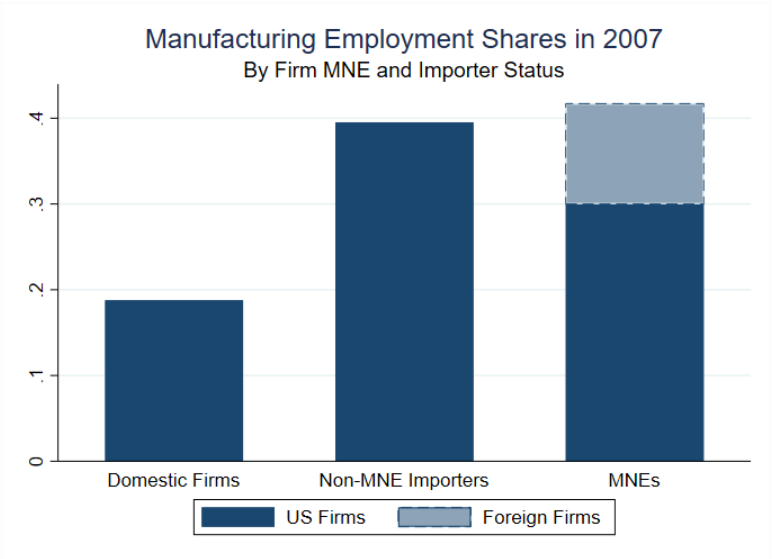
Appendix

Worldwide sales by firm type and good type



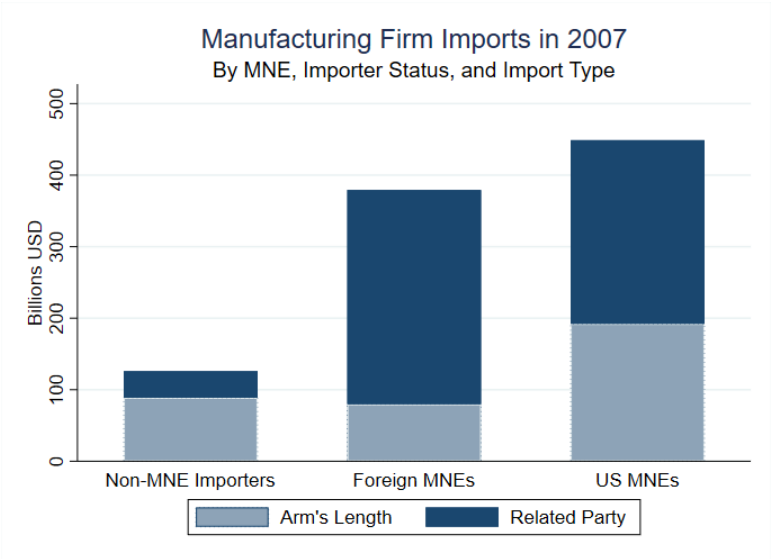


Manufacturing employment



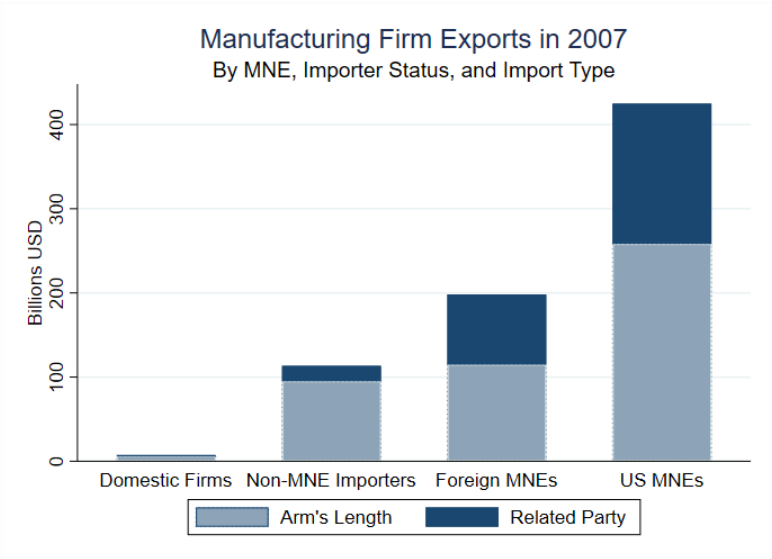
Source: Merged 2007 BEA-Census data

Manufacturing firms' imports by type



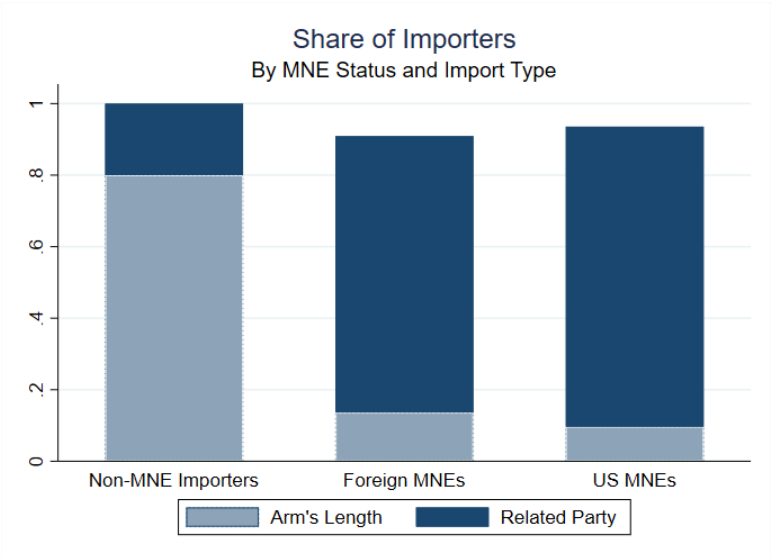
Source: Merged 2007 BEA-Census data

Manufacturing firms' exports by type



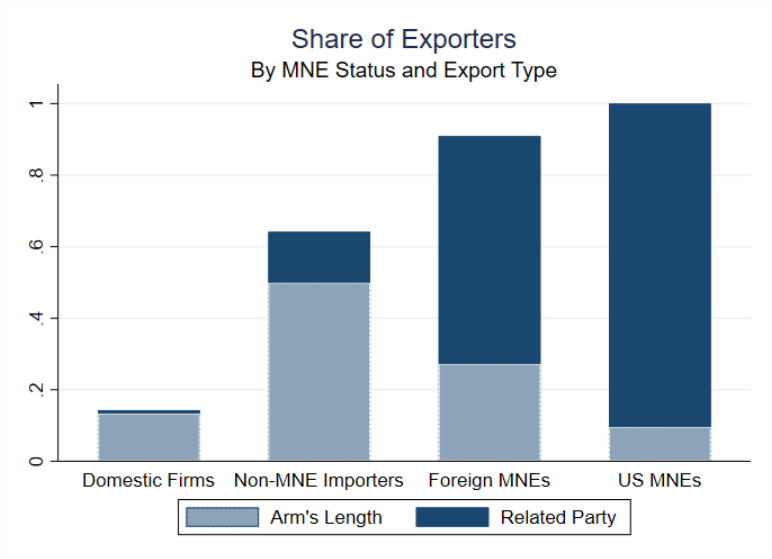
Source: Merged 2007 BEA-Census data

Shares of manufacturing firms that import



Source: Merged 2007 BEA-Census data

Shares of manufacturing firms that export



Source: Merged 2007 BEA-Census data