

The Impact of Multinationals Along the Job Ladder

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¹The views expressed here are those of the authors and not necessarily those of the Federal Reserve Bank of Minneapolis or the Federal Reserve System.

Motivation

Our question

- ▶ Multinational affiliates are **more productive** than domestic firms
- ▶ How do they impact host country through the **labor market**?
- ▶ In particular: what is impact on wage **inequality**?

- ▶ Issue: endogeneity of multinational presence
- ▶ Literature to date differences across local labor markets, instruments for multinational presence, focuses on wage **levels**
 - ▶ e.g. Alfaro-Ureña et al (2021), Setzler & Tintelnot (2021)

- ▶ Our contribution: model-based **general equilibrium** approach
- ▶ Use matched employer-employee data to **calibrate job ladder model** of labor market with multinationals
- ▶ **Counterfactual**: infinite entry cost for multinationals

What we do & what we find

1. Matched employer-employee **data** for Norway
 - ▶ Confirm existence of a **job ladder**
 - ▶ (New) Multinationals **high up** on this job ladder
2. GE job ladder **model** of labor market with multinationals
 - ▶ Helpman-Melitz-Yeaple (2004) meets Cahuc-Postel-Vinay-Robin (2006) + DMP
3. **Calibration**: match firm size dist (MN and non-MN), wage dist, labor share, unemployment, labor market transitions
4. **Counterfactual**: infinite entry cost for multinationals
 - ▶ Multinationals on average help **workers**, hurt local **firms**
 - ▶ But **heterogeneous** effects: workers at high productivity firms gain, workers at low productivity firms lose
 - ▶ Wage **inequality** increases
 - ▶ Due to shifts in intensity of competition along job ladder

Related literature

Applications of general equilibrium job ladder models with firms

- ▶ Bagger & Lentz (2019), Engbom & Moser (2021), Gouin-Bonenfant (2022)

Impact of multinationals through the labor market

- ▶ Alfaro-Ureña et al (2021), Setzler & Tintelnot (2021)

Empirical literature on job ladders

- ▶ Haltiwanger, Hyatt, Kahn & McEntarfer (2018), Moscarini & Postel-Vinay (2018)

Search and matching models of distributional impact of trade

- ▶ Helpman, Itskhoki, Redding (2010), Cosar, Guner and Tybout (2016), Helpman, Itskhoki, Muendler & Redding (2017), Rodrigue & Tsuyuhara (2018), Fajgelbaum (2020)

Data

Data

- ▶ Matched employer-employee data for Norway 1996-2007
- 1. Population Register: for each individual, annual earnings (all sources) & estab. identifier for main employer in November
- 2. Income tax files: match establishments to firms
- 3. SIFON registry of foreign ownership: ownership at firm level
 - ▶ Code as multinational if share of largest foreign owner >50%
- ▶ Baseline: estab. as unit of analysis (robustness with firms)
- ▶ Focus on private sector establishments & linked individuals

Summary statistics

	All	Domestic	MN	MN share
Worker-years	12,001,918	9,815,230	2,186,688	0.18
Establishment-years	1,166,928	1,091,231	75,687	0.06
Avg establishment size	10.29	8.99	28.89	

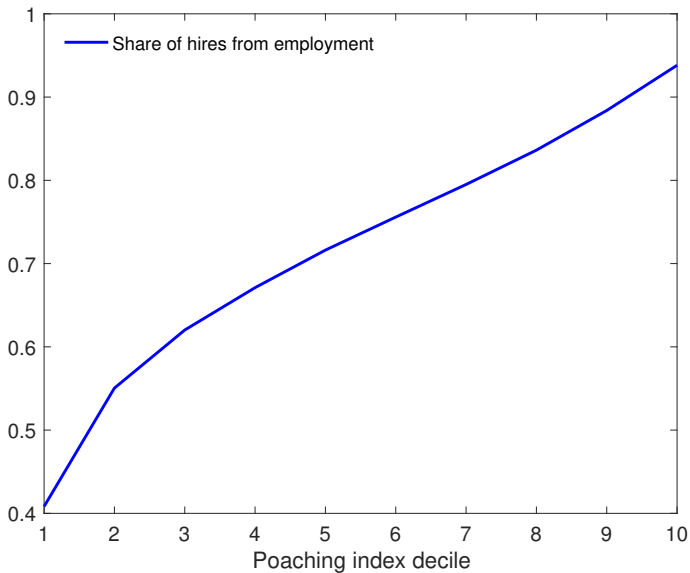
Measurement of transitions & wages

- ▶ Use November cross-sections to code transitions
 - ▶ Stayer: same employer at t and $t+1$
 - ▶ EE transition: different employers at t and $t+1$
 - ▶ NE transition: not employed at t , employed at $t+1$
- ▶ Attribute individual's total earnings in year t to plant of employment in November of year t
- ▶ Don't observe establishment-level revenue or productivity
- ▶ Rank establishments by their share of hires from employment ("poaching index"):

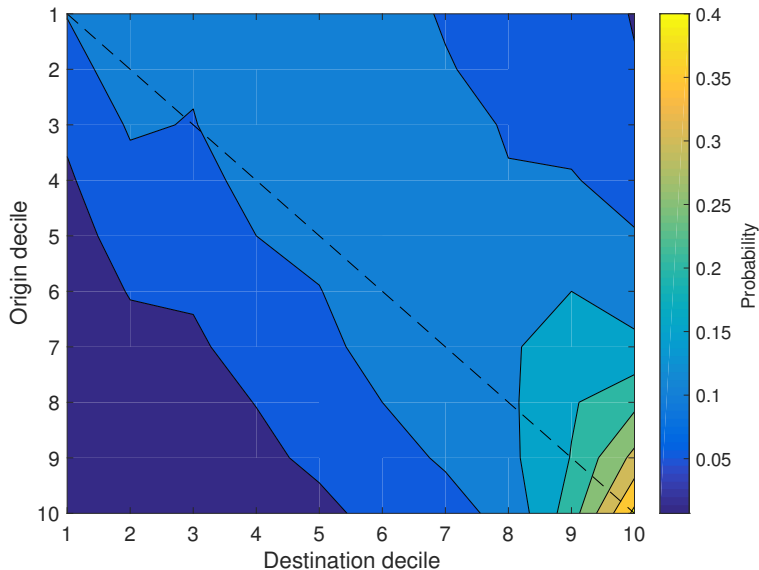
$$poach_i = \frac{\sum_{t=1998}^{2007} hire_{it}^{EE}}{\sum_{t=1998}^{2007} hire_{it}^{EE} + \sum_{t=1998}^{2007} hire_{it}^{NE}}$$

- ▶ Require $\sum_t hire_{it}^{EE} + \sum_t hire_{it}^{NE} \geq 10$ and $\sum_t hire_{it}^{NE} > 0$

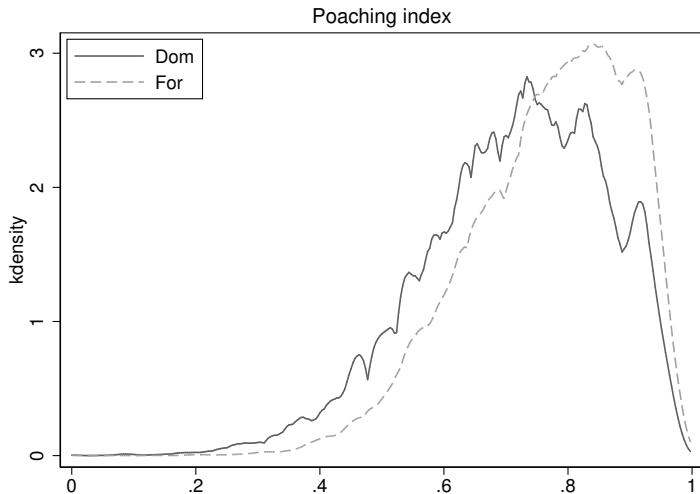
Job-to-job transitions are frequent



Job-to-job transitions are not random (job ladder)



Multinationals are high up on the job ladder



Model

Model overview

- ▶ Helpman-Melitz-Yeaple (2004) meets Cahuc-Postel-Vinay-Robin (2006) + DMP
- ▶ Discrete time
- ▶ Firms have **heterogeneous productivity**
- ▶ Firms face **convex cost** of posting vacancies (finite firm size)
- ▶ Firm **free entry condition**: multinationals pay higher cost to draw from productivity distribution with higher mean
- ▶ **Homogeneous workers** with linear utility
- ▶ **On-the-job** search and **random** matching
- ▶ Wages determined by **bargaining**
 - ▶ Workers get outside option plus fraction of match surplus
- ▶ Look for **stationary equilibrium**

Why this model?

- ▶ Frictional labor market with unemployment & monopsony power of firms
- ▶ Generates wage dispersion **within** and **across** firms
- ▶ **Outside options** matter
 - ▶ Alfaro-Ureña et al (2021), Setzler & Tintelnot (2021)
- ▶ Large empirical literature documenting job ladder (nonrandom transitions):
 - ▶ e.g. Haltiwanger, Hyatt, Kahn & McEntarfer (2018), Moscarini & Postel-Vinay (2018)

Multinationals vs domestic firms in the model

- ▶ How do multinational affiliates differ from domestic firms?
 1. Pay different **entry cost** to draw from different **productivity distribution**
 2. Entry costs paid by **foreigners**, profits rebated to **foreigners**
- ▶ But conditional on productivity, multinational affiliates make same choices as domestic firms

Model assumptions 1/5: Workers

- ▶ Continuum of infinitely-lived workers on $[0, 1]$
- ▶ Linear utility, discount future at rate β
- ▶ Flow income for employed is wage w
- ▶ Flow utility in unemployment is b
- ▶ Match with employer broken with probability δ each period
 - ▶ Pass through one period of unemployment before searching
- ▶ Unemployed search for jobs with probability 1
- ▶ Employed search with probability $s < 1$

Model assumptions 2/5: Firms

- ▶ Firm is draw of productivity p from cdf $\tilde{\Gamma}^i(p)$, $i \in \{D, F\}$
- ▶ Output per worker employed at firm of type p is p
- ▶ Each firm pays $c(v)$ to post $v \in \mathbb{R}$ vacancies with

$$c(0) = 0, c'(v) > 0, c''(v) > 0$$

- ▶ Firms discount future at rate β
- ▶ Choose: optimal $v(p)$ given wage setting protocol
- ▶ Free entry condition:

$$c^i = \int_b^{\bar{p}} 0 \tilde{\gamma}^i(p) dp + \int_{\underline{p}}^{\bar{p}} \frac{B(p)}{1-\beta} \tilde{\gamma}^i(p) dp$$

- ▶ $B(p)$ value to entrant of draw p
 - ▶ $\underline{p} > 0$: endogenous cutoff below which firm attracts no workers
- ▶ \rightarrow Prod dist of active firms: $\Gamma(p)$, $\gamma(p)$, mass of firms M

Model assumptions 3/5: Matching

- ▶ Total measure of vacancies is V :

$$V = M \int_{\underline{p}}^{\bar{p}} v(p) \gamma(p) dp$$

- ▶ Total measure of searching workers is S :

$$S = u + s(1 - \delta)(1 - u)$$

- ▶ u : unemployment rate & number of unemployed
- ▶ CRS matching function $\mu(S, V)$
 - ▶ Probability unemployed worker meets vacancy: λ
 - ▶ Prob vacancy meets worker: χ

$$\lambda = \frac{\mu(S, V)}{S}, \quad \chi = \frac{\mu(S, V)}{V}$$

Model assumptions 4/5: Wage setting I

- ▶ Wage setting as in Cahuc-Postel-Vinay-Robin (2006):
- ▶ Worker gets outside option plus fraction ϕ of match surplus
- ▶ Wage is constant until worker's outside option increases

Model assumptions 5/5: Wage setting II

- ▶ U : value of unemployment
- ▶ $W(w, p)$: value to worker of wage w at firm p
- ▶ $w(q, p)$: wage of worker at firm p with outside option of firm q
- ▶ Unemployed worker meeting firm p accepts offer $w_0(p)$ s.t.

$$W(w_0(p), p) = U + \phi(W(p, p) - U)$$

- ▶ Employee at firm p with outside option q meets firm p' :
 1. $p' \leq q \leq p$: nothing happens
 2. $q < p' \leq p$: worker stays, gets wage $w(p', p)$ s.t.

$$W(w(p', p), p) = W(p', p') + \phi(W(p, p) - W(p', p'))$$

3. $p < p'$: worker moves to p' , gets wage $w(p, p')$ s.t.

$$W(w(p, p'), p') = W(p, p) + \phi(W(p', p') - W(p, p))$$

Model results 1/5: Worker transitions

Separations to unemployment

- ▶ Matched workers & firms separate w/ prob δ each period

Hires from unemployment

- ▶ Unemployed searchers meet a firm with probability λ each period; accept all offers

Job-to-job transitions

- ▶ Worker employed at firm p meets new firm with probability λs each period
 - ▶ If new firm has productivity $p' > p$, worker moves to new firm
 - ▶ Otherwise stays at original firm
- ▶ Surplus split does not affect transitions given vacancies, λ
- ▶ Split *does* affect firms' incentives to post vacancies, λ

Model results 2/5: Wages

- ▶ Wage for worker at firm p with outside option $q \leq p$ is

$$w(q, p) = \phi p + (1 - \phi) q - \underbrace{\int_q^p \frac{(1 - \phi)^2 \beta (1 - \delta) \lambda s (1 - F(x))}{1 - \beta (1 - \delta) (1 - \phi \lambda s) (1 - F(x))} dx}_{\text{discount due to value of moving up ladder in firm } p}$$

- ▶ $F(x)$: cdf of job offer distribution (endogenous)
- ▶ $f(x)$: pdf of job offer distribution

$$f(x) = \frac{v(x) \gamma(x)}{\int_{\underline{p}}^{\bar{p}} v(y) \gamma(y) dy}$$

- ▶ Note: productivity distribution affects $F(x)$, λ , and therefore wages conditional on $\{p, q\}$
- ▶ Productivity distribution also affects joint distribution of $\{p, q\}$

Model results 3/5: Vacancy posting

- ▶ Value of match to firm p if worker's outside option is $q \leq p$:

$$J(q, p) = 0 + (1 - \phi)(W(p, p) - W(q, q))$$

- ▶ Value to firm with productivity p of posting v vacancies:

$$B(p, v) = \max_v \left\{ \chi v \left[\begin{array}{l} \frac{u}{s} J(\underline{p}, p) + \\ \frac{(1-u)(1-\delta)s}{s} \int_{\underline{p}}^p J(x, p) l(x) dx \end{array} \right] - c(v) \right\}$$

- ▶ $l(p)$: pdf of dist of workers by their firm's productivity
- ▶ foc implicitly defines $v(p)$, optimal vacancy posting
- ▶ Note: current employment does not enter $B(p) = B(p, v(p))$

Model results 4/5: Profits

- ▶ Per period profit of firm p is

$$\pi(p) = \left(p - \underbrace{\int_{\underline{p}}^p w(x, p) g(x|p) dx}_{\text{average wage at firm } p} \right) e(p) - c(v(p))$$

- ▶ $g(x|p)$: pdf of outside options for workers at firm of type p
- ▶ $e(p)$: employment at firm of type p
- ▶ $v(p)$: vacancies at firm of type p

- ▶ Note: productivity distribution affects $w(x, p)$, $g(x|p)$ and therefore average wage conditional on p
- ▶ Productivity dist also affects profits through $e(p)$, $v(p)$

Model results 5/5: Note on ranking firms

- ▶ Average wage at the firm level need not be monotonic in p
 - ▶ Value of option to move up
- ▶ Share of hires from employment *is* increasing in p
- ▶ Why? Higher p firms more likely to attract employed workers

$$poach(p) = \frac{(1-u)(1-\delta)\delta s \int_{\underline{p}}^p \frac{\delta+(1-\delta)s\lambda f(x)}{(\delta+(1-\delta)s\lambda(1-F(x)))^2} dx}{u+(1-u)(1-\delta)\delta s \int_{\underline{p}}^p \frac{\delta+(1-\delta)s\lambda f(x)}{(\delta+(1-\delta)s\lambda(1-F(x)))^2} dx}$$

Calibration

Calibration

- ▶ Functional forms:

$$\mu(S, V) = AS^\theta V^{1-\theta}$$

$$c(v) = \frac{v^{1+\frac{1}{\alpha}}}{1+\frac{1}{\alpha}}$$

$$\tilde{\Gamma}^i \sim \text{Pareto}(1, \sigma^i)$$

- ▶ Production function: Cobb-Douglas in capital, labor with capital share κ , all firms face same rental price of capital
- ▶ Solve for mass of active firms M , share ω of foreign firms in potential entrants
- ▶ \rightarrow recover C^D , C^F

Parameters and targets

- ▶ Preset parameters: $\beta = 0.95^{1/4}$, $\kappa = 1/3$, $b = 1$ (normalization), $\theta = 0.5$ (literature), $\delta = 0.038$ (Eurostat),

Calibrated parameters

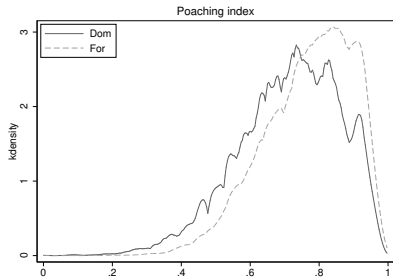
s	ϕ	A	α	σ^D	σ^F	M	ω
0.52	0.85	0.46	0.27	1.67	0.71	0.08	0.01

Targets

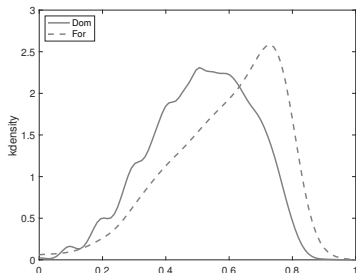
Description	Data	Model
EE quarterly transition rate (Eurostat)	0.03	0.03
Labor share (Statistics Norway)	0.60	0.60
Nonemployment rate 25-54 (Statistics Norway)	0.15	0.15
Std dev log estab. level employment (our data)	1.13	1.13
Std dev log estab. level wage (our data)	0.63	0.63
Diff in avg emp betw domestic & MN estabs (our data)	19.90	19.91
Average establishment size (our data)	10.29	10.29
Share of active estabs that are domestic (our data)	0.94	0.94

Nontargeted moment: poaching index distribution

- ▶ Simulate quarterly model for 10 years with 1 million workers, calculate poaching index as in data



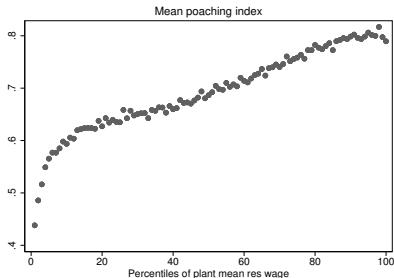
Data



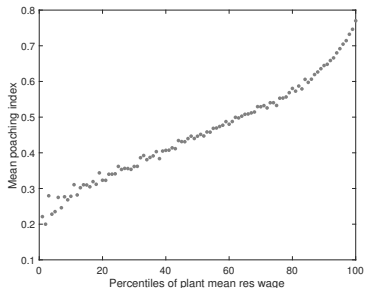
Model

Nontargeted moment: joint dist of poaching index & wages

- ▶ Simulate quarterly model for 10 years with 1 million workers, calculate poaching index, wages as in data



Data



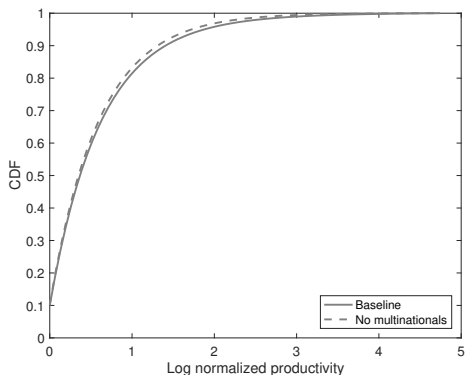
Model

Counterfactual

Counterfactual: No multinationals

- ▶ $C^F \rightarrow \infty$, C^D held fixed
- ▶ Domestic free entry condition: solve for counterfactual mass of firms M' & active firm productivity distribution $\Gamma'(p), \gamma'(p)$

$$C^D = \int_b^{\underline{p}(M')} 0 \tilde{\gamma}^D(p) dp + \int_{\underline{p}(M')}^{\bar{p}} \frac{B(p, M')}{1 - \beta} \tilde{\gamma}^D(p) dp$$



Aggregate impact of multinational presence

- ▶ Compare steady states

	Level		Share of output	
	Baseline	No MN	Baseline	No MN
Payments to labor	1	0.74	0.60	0.60
Domestic firm profit	1	1.18	0.03	0.05
Foreign firm profit	1	0.00	0.03	0.00
Payments to capital	1	0.73	0.33*	0.33*
Hiring cost	1	0.70	0.01	0.01
Output	1	0.73		

* By assumption

- ▶ Multinational presence on aggregate **benefits workers, hurts domestic firms**
- ▶ Increase in labor income due to multinational presence more than offsets decrease in domestic firm profit

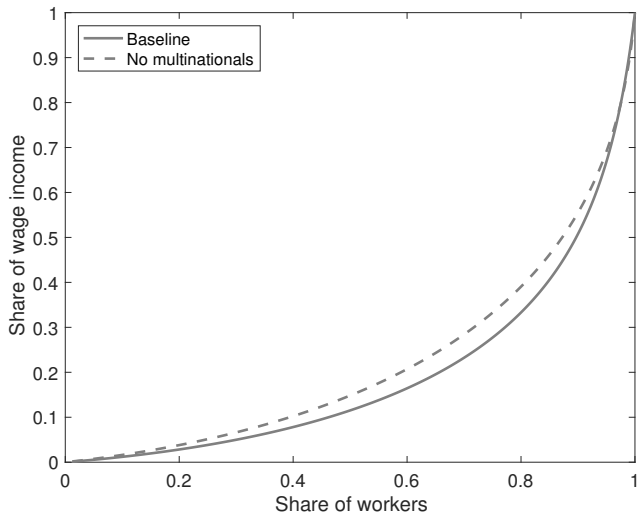
Labor market impact of multinational presence

	Level	
	Baseline	No MN
Employment	1	1.005
Average worker-level wage	1	0.73
Wage Gini coefficient	0.61	0.55
Average firm size	10.29	9.28
Mass of firms	1	1.12

- ▶ Multinational presence increases **average wages**
- ▶ But also increases unemployment and **wage inequality**

Impact on worker-level wage distribution

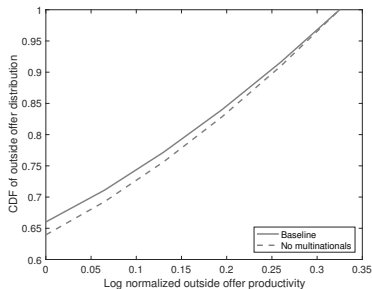
- ▶ Multinational presence increases wage inequality



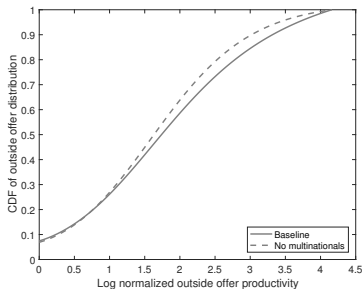
Intuition: shift in outside offer distribution

- ▶ Wage for worker at firm p with outside option $q \leq p$ is

$$w(q, p) = \phi p + (1 - \phi) q - \underbrace{\int_q^p \frac{(1 - \phi)^2 \beta (1 - \delta) \lambda_s (1 - F(x))}{1 - \beta (1 - \delta) (1 - \phi \lambda_s) (1 - F(x))} dx}_{\text{discount due to value of moving up ladder in firm } p}$$



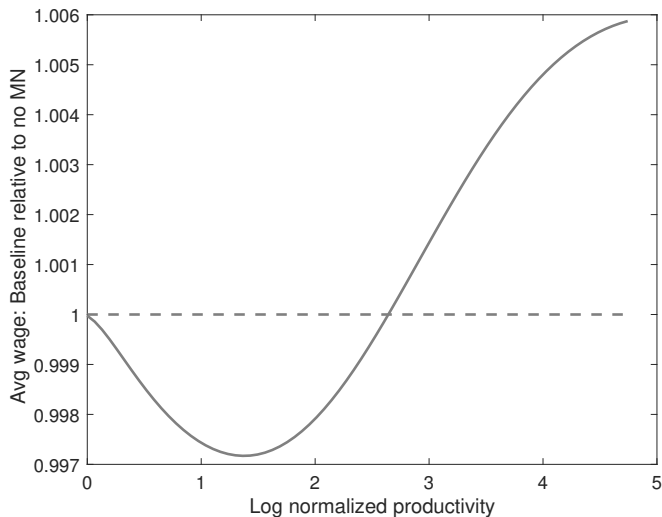
Low productivity firm



High productivity firm

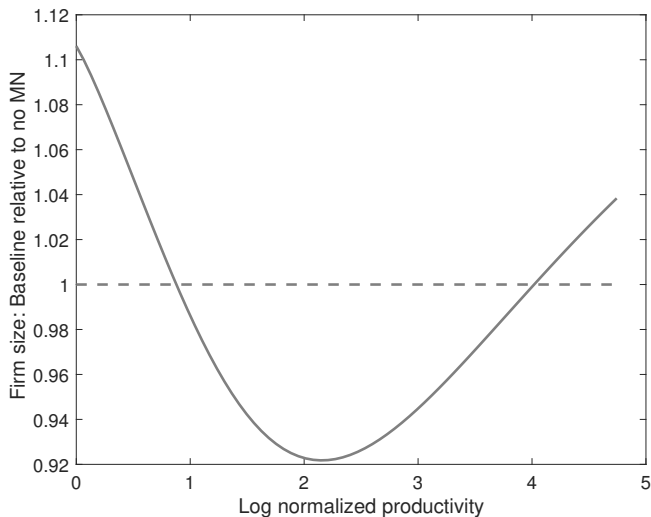
Heterogeneous impact on firm-level average wages

- ▶ Multinational presence increases firm-level average wages for high productivity firms, reduces them for low productivity firms



Heterogeneous impact on domestic firm size

- ▶ Multinational presence shrinks employment at firms in middle of the productivity distribution, increases it at the extremes



Relation to reduced form evidence

Alfaro-Ureña, Manelici & Vasquez (2021)

- ▶ Bigger wage gains for DM transitions than DD or MD
- ▶ **Positive impact** of (instrumented) multinational presence in local labor market on **wages of employees of domestic firms**
- ▶ Insufficient college workers to distinguish effects for high and low skill groups

Setzler & Tintelnot (2021)

- ▶ **Positive impact** of (instrumented) multinational presence in local labor market on **wages of employees of domestic firms**
- ▶ **Increase bigger** for **high-paid** workers (don't see education)
- ▶ Employment at domestic firms increases

Our findings:

- ▶ **Heterogeneous** effects across workers & local firms

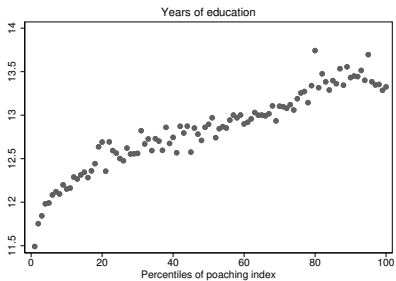
Conclusion

- ▶ Labor market is characterized by a **job ladder**, with **multinationals at the top**
- ▶ Multinational presence increases productivity and labor market competition: on average **helps workers, hurts local firms**
- ▶ But impact is **heterogeneous**:
 - ▶ Average wages fall at low-productivity firms, rise at high-productivity firms
 - ▶ Wage **inequality rises**

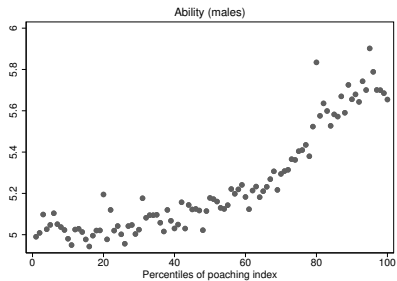
Extensions

- ▶ Worker heterogeneity and sorting
- ▶ Are there two job ladders?

Worker heterogeneity and sorting



Education & estab. rank



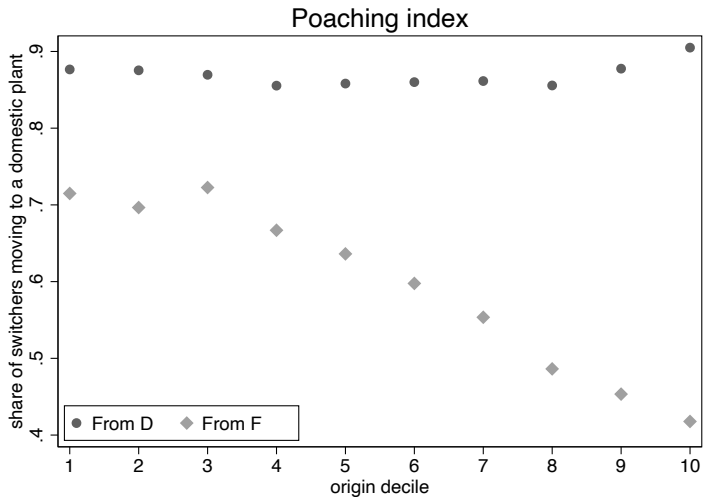
Ability & estab. rank

Model extension: Worker heterogeneity and sorting

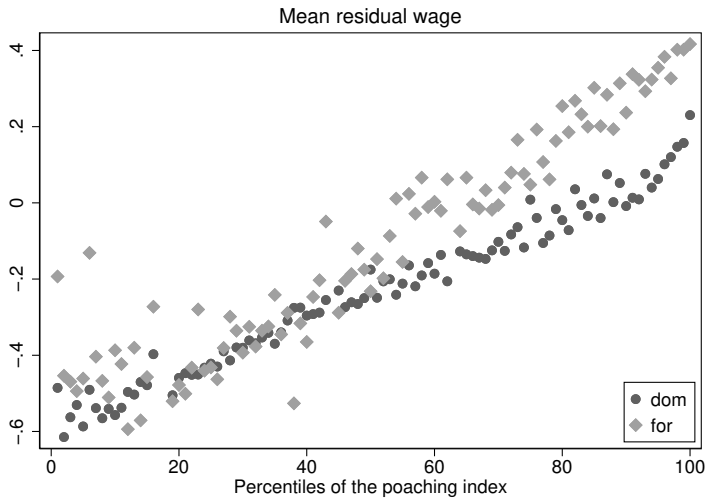
- ▶ Two (observable) labor types, L and H
- ▶ Firms can post vacancies in each skill market
- ▶ Random matching within each skill market
- ▶ Marginal product of L at firm p normalized to p
- ▶ Marginal product of H at firm p is ηp^v with $\eta > 1$, $v \geq 1$
- ▶ $v > 1 \rightarrow$ sorting

- ▶ Identification of $\{\eta, v\}$: skill premium & share of high skill employment along job ladder

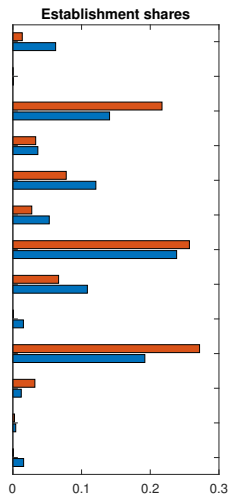
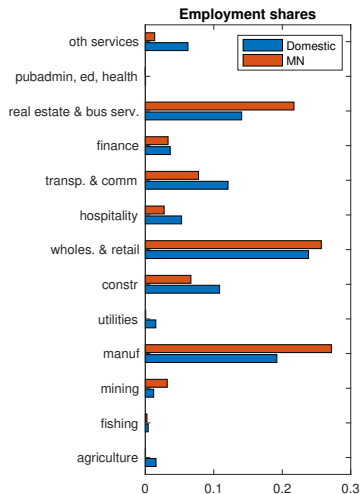
Are there two job ladders?



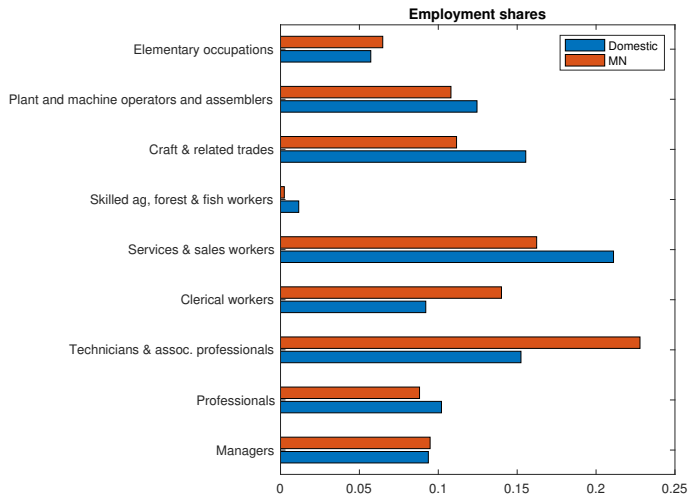
Are there two job ladders?



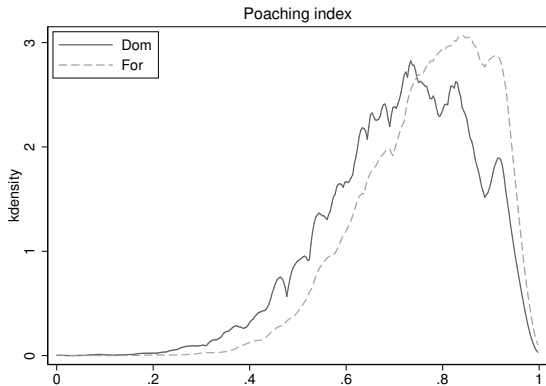
Industries: Domestic vs MN



Occupations: Domestic vs MN



Poaching index distribution by ownership: firms



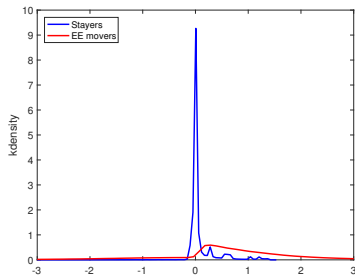
	p25	p50	p75	Mean	sd	N
Domestic	0.62	0.73	0.82	0.71	0.15	403,629
Multinational	0.68	0.79	0.87	0.77	0.13	50,977

Nontargeted moment: 2-year log wage growth

- ▶ Note: simulate quarterly model for 10 “years,” calculate transitions, wages as in data



Data



Model