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.
Introduction

- Multinational affiliates are more productive than domestic firms
- Governments often provide incentives to attract them
- How do they impact a host country through the labor market?

Our view of the labor market:

Multinationals affect labor market in two ways:
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- Due to **search frictions**, firms pay **less than marginal product**
- But workers are mobile: outside options along **job ladder**
- Can climb job ladder both **inside** and **outside** current firm

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Multinationals affect labor market in two ways:

1. Direct effect on workers employed at multinationals
2. Indirect effect on outside options of workers at local firms
   - Low productivity firms: workers more likely to leave
   - High productivity firms: better outside options bid up wages
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   - Low productivity firms: workers more likely to leave
   - High productivity firms: better outside options bid up wages

- Overall workers gain, local firms lose
- Impact heterogeneous across workers and local firms
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

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
   ▶ Multinational presence on avg helps workers, hurts local firms
   ▶ But heterogeneous effects across workers, local firms
   ▶ Multinational presence increases wage inequality, unemployment

Literature
Data
Data


1. For each individual, annual earnings (all sources) & establishment identifier for main employer each November
2. Ownership of establishments (MN vs domestic)

- Focus on private sector establishments & linked individuals

### Summary statistics

<table>
<thead>
<tr>
<th></th>
<th>All</th>
<th>Domestic</th>
<th>MN</th>
<th>MN share</th>
</tr>
</thead>
<tbody>
<tr>
<td>Worker-years</td>
<td>12,001,918</td>
<td>9,815,230</td>
<td>2,186,688</td>
<td>0.18</td>
</tr>
<tr>
<td>Establishment-years</td>
<td>1,166,928</td>
<td>1,091,231</td>
<td>75,687</td>
<td>0.06</td>
</tr>
<tr>
<td>Avg establishment size</td>
<td>10.29</td>
<td>8.99</td>
<td>28.89</td>
<td></td>
</tr>
</tbody>
</table>

[Industry] [Occupations]
Job-to-job transitions are not random: job ladder

- Use November cross-sections to code transitions: EE, NE, EN
- Rank establishments by sample share of hires from employment: poaching index
  - Revealed preference, consistent with model
Multinationals are high up on the job ladder

Poaching index

- Dom
- For

Firms
Model
Model overview

- Discrete time
- **Homogeneous** workers, firms with *heterogeneous productivity*
- Convex vacancy cost pins down firm size
- On-the-job and off-the-job search, *random* matching
- Wages determined by *bargaining*
- Look for *stationary equilibrium*

How do multinational affiliates differ from domestic firms?
1. Different *entry cost*, draw from different *productivity dist*
2. Entry cost paid by *foreigners*, profit rebated to *foreigners*
Model assumptions 1/4: Workers

- Continuum of infinitely-lived workers on $[0, 1]$
- Linear utility, discount future at rate $\beta$
- Flow utility in unemployment is $b$
- Flow income for employed is endogenous wage $w$
- Match with employer breaks with probability $\delta$ each period
  - Pass through one period of unemployment before searching
- Unemployed search for jobs with probability 1
- Employed search with probability $s \leq 1$
Model assumptions 2/4: Firms

- Firm is a draw of productivity $p$ from cdf $\tilde{\Gamma}^i(p)$, $i \in \{D, F\}$
- Output per worker employed by firm of type $p$ is $p$
- Firms discount future at rate $\beta$, die at rate $\delta_f$
- Surviving firms lose workers exogenously at rate $\delta_m$
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- Each firm pays $c(v)$ to post $v \in \mathbb{R}$ vacancies with
  \[ c(0) = 0, \quad c'(v) > 0, \quad c''(v) > 0 \]
- Choose: optimal $v(p)$ given wage setting protocol
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  \[ c(0) = 0, \ c'(v) > 0, \ c''(v) > 0 \]

- Choose: optimal $v(p)$ given wage setting protocol
- Free entry condition:
  \[
  C^i = \int_b^p 0d\tilde{\Gamma}^i(p) + \int_{\underline{p}}^p \frac{B(p)}{1 - (1 - \delta_f)\beta}d\tilde{\Gamma}^i(p)
  \]
  - $B(p)$ value to entrant of draw $p$
  - $\underline{p} > 0$: endogenous cutoff below which firm attracts no workers
  - $\rightarrow$ Prod dist of active firms: $\Gamma(p)$, mass of firms $M$
Model assumptions 3/4: Matching

- Total measure of vacancies is $V$:
  \[ V = M \int_{\tilde{p}}^{\bar{p}} \nu(p) d\Gamma(p) \]

- 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: $\lambda$
    - Prob vacancy meets worker: $\chi$

  \[ \lambda = \frac{\mu(S, V)}{S}, \quad \chi = \frac{\mu(S, V)}{V} \]
Model assumptions 4/4: Bargaining & wages

- Follow Cahuc-Postel-Vinay-Robin (2006)

- When worker and firm match, they split match value
  - i.e. appropriately discounted flow of $p$

- Worker gets value of outside option + share $\phi$ of match surplus (i.e. value of match less value of outside option)

- Implemented by constant wage until outside option increases

- Outside option depends on origin / best on-the-job meeting

- If outside option is better than current match, worker moves
Model results 1/2: Wages

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

$$w(q, p) = \phi p + (1 - \phi) q - \int_{q}^{p} \frac{(1 - \phi)^2 \beta (1 - \delta) \lambda s (1 - F(x))}{1 - \beta (1 - \delta)(1 - \phi \lambda s (1 - F(x)))} dx$$

  discount due to value of moving up ladder in firm $p$

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

$$dF(x) = \frac{v(x) d\Gamma(x)}{\int_{p}^{\bar{p}} v(y) d\Gamma(y)}$$

- Note: $w(q, p)$ need not be monotonic in $p$

- Multinational presence affects joint distribution of $\{p, q\}$

- Multinational presence affects $F(x)$, $\lambda$, and therefore wages conditional on $\{p, q\}$
Aside: Ranking firms

- Average wage at the firm level need *not* be monotonic in $p$
  - Due to value of option to move up

- But share of hires from employment *is* increasing in $p$:

$$poach(p) = \frac{(1-u)(1-\delta)s \int_0^p dL(x)}{u + (1-u)(1-\delta)s \int_0^p dL(x)}$$

- Intuition: All firms hire all the unemployed workers they meet, but higher $p$ firms hire more employed workers
Model results 2/2: Vacancy posting

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

$$B(p, v) = v \chi \left[ \frac{u}{S} J(p, p) + \frac{(1-u)(1-\delta)s}{S} \int_p^p J(x, p) dL(x) \right] - c(v)$$

where

- $J(x, p)$: value to firm $p$ of worker $w$ with outside option $x \leq p$
- $dL(x)$: pdf of distribution of workers by their firm’s productivity

- foc implicitly defines $v(p)$, optimal vacancy posting
- Note: current employment does not enter $B(p) = B(p, v(p))$

- Multinational presence affects incentives to post vacancies through impact on $J(x, p)$, and vacancy yield
- Multinational presence therefore affects size conditional on $p$
Calibration
Calibration

- Functional forms:

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

\[ c(\nu) = \frac{\nu^{1+\frac{1}{\alpha}}}{1 + \frac{1}{\alpha}} \]

\[ \tilde{\Gamma}^D \sim BddPareto\left(b, \sigma^D, \tilde{p}\right) \text{ and } \tilde{\Gamma}^F \sim BddPareto\left(\tau, \sigma^F, \tilde{p}\right) \]

\( \tilde{p} \): bounded above at 99th pctile of more dispersed dist.

- Production function: Cobb-Douglas in capital, labor with capital share \( \kappa \), all firms face same rental price of capital

- Solve for mass of active firms \( M \), share \( \omega \) of foreign firms in potential entrants

- \( \rightarrow \) recover \( C^D, C^F \)
Parameters and targets

- Preset: $\beta = 0.95^{1/4}$, $\kappa = 1/3$, $b = 1$ (normalize), $\theta = 0.5$ (literature), $\delta = 0.038$ (Eurostat), $\delta_f = 0.01$ (Balsvik & Haller)

### Parameters and Targets

<table>
<thead>
<tr>
<th>Target description</th>
<th>Data</th>
<th>Model</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Outside data</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>EE quarterly transition rate (Eurostat)</td>
<td>0.03</td>
<td>0.03</td>
<td>$s$</td>
</tr>
<tr>
<td>Labor share (Statistics Norway)</td>
<td>0.60</td>
<td>0.60</td>
<td>$\phi$</td>
</tr>
<tr>
<td>Nonemp rate 25-54 (Statistics Norway)</td>
<td>0.155</td>
<td>0.155</td>
<td>$A$</td>
</tr>
<tr>
<td><strong>Our data</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Std dev ln estab. employment</td>
<td>1.13</td>
<td>1.12</td>
<td>$\alpha$</td>
</tr>
<tr>
<td>Average establishment size</td>
<td>10.29</td>
<td>10.29</td>
<td>$M$</td>
</tr>
<tr>
<td>Share active estabs that are domestic</td>
<td>0.94</td>
<td>0.94</td>
<td>$\omega$</td>
</tr>
<tr>
<td>Std dev ln estab. wage</td>
<td>0.63</td>
<td>0.63</td>
<td>$\sigma_D$</td>
</tr>
<tr>
<td>Std dev ln estab. employment, MN</td>
<td>1.32</td>
<td>1.33</td>
<td>$\sigma_F$</td>
</tr>
<tr>
<td>Diff in ln av size betw dom &amp; MN estabs</td>
<td>0.96</td>
<td>0.96</td>
<td>$\tau/\bar{\rho}$</td>
</tr>
</tbody>
</table>
Nontargeted moment: poaching index distribution

- Simulate quarterly model for 10 years with 1 million workers, calculate poaching index as in data
Counterfactual
Counterfactual: No multinationals

- Let $C^F \to \infty$, hold $C^D$ fixed
- Solve for counterfactual measure of firms, active firm productivity dist s.t. domestic free entry condition holds

<table>
<thead>
<tr>
<th>Impact of multinationals on output, components</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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<tr>
<td></td>
</tr>
<tr>
<td>Output</td>
</tr>
<tr>
<td>Payments to labor</td>
</tr>
<tr>
<td>Domestic firm profit</td>
</tr>
<tr>
<td>Foreign firm profit</td>
</tr>
<tr>
<td>Hiring cost</td>
</tr>
<tr>
<td>Payments to capital</td>
</tr>
<tr>
<td>Labor + domestic profit</td>
</tr>
<tr>
<td>Labor + dom profit - dom entry cost</td>
</tr>
</tbody>
</table>

* By assumption
Impact of multinationals on workers & local firms

<table>
<thead>
<tr>
<th></th>
<th>Baseline</th>
<th>No MN</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Workers</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Payments to labor</td>
<td>1</td>
<td>0.87</td>
</tr>
<tr>
<td>Avg worker-level wage</td>
<td>1</td>
<td>0.86</td>
</tr>
<tr>
<td>Employment</td>
<td>1</td>
<td>1.004</td>
</tr>
<tr>
<td>Wage Gini</td>
<td>0.51</td>
<td>0.49</td>
</tr>
<tr>
<td><strong>Firms</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Measure of firms</td>
<td>1</td>
<td>1.09</td>
</tr>
<tr>
<td>Measure of local firms</td>
<td>1</td>
<td>1.16</td>
</tr>
<tr>
<td>Avg firm size</td>
<td>10.29</td>
<td>9.49</td>
</tr>
<tr>
<td>Avg local firm size</td>
<td>9.29</td>
<td>9.49</td>
</tr>
</tbody>
</table>

- Overall, multinationals **benefit workers, hurt local firms**
- But **heterogeneous effects** (next slide)
- Also **wage inequality**, **unemployment** increase
Heterogeneous effects across firm productivity distribution

- **Firm average wage**
- **Firm profit**
- **Firm size**
- **Mass of firms**
Intuition: shift in outside option distribution

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

$$w(q, p) = \phi p + (1 - \phi) q - \int_q^p \frac{(1 - \phi)^2 \beta (1 - \delta) \lambda s (1 - F(x))}{1 - \beta (1 - \delta) (1 - \phi \lambda s (1 - F(x)))} dx$$

discount due to value of moving up ladder in firm $p$

Low productivity firm

High productivity firm
Relation to reduced form evidence

Alfaro-Ureña, Manelici & Vasquez (2021)

- 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

We find:

- 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:
  - Low productivity local firms lose workers, shrink, may pay lower wages due to fewer outside options low down on the job ladder
  - High productivity local firms pay higher wages due to more outside options high up on the job ladder
- Wage inequality rises

Extensions

- Worker heterogeneity and sorting: between-group inequality
Worker heterogeneity and sorting

Education & estab. rank

Ability & estab. rank
Model extension: Worker heterogeneity and sorting

- Three (observable) labor types, \( h \in \{1, 2, 3\} \)
- Firms can post vacancies in each skill market
- Random matching within each skill market
- Marginal product of skill type \( h \) at firm \( p \) is

\[
y = \eta_h \nu^h
\]

with

\[
1 = \eta_1 \leq \eta_2 \leq \eta_3
\]

and

\[
1 = \nu_1 \leq \nu_2 \leq \nu_3
\]

- \( \nu_h > 1 \rightarrow \text{sorting} \)

- Identification of \( \{\eta_h, \nu_h\} \): skill premium & skill group share of employment 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

Search and matching models of distributional impact of trade
Industries: Domestic vs MN

**Employment shares**

- oth services
- pubadmin, ed, health
- real estate & bus serv.
- finance
- transp. & comm
- hospitality
- wholes. & retail
- constr
- utilities
- manuf
- mining
- fishing
- agriculture

**Establishment shares**

- oth services
- pubadmin, ed, health
- real estate & bus serv.
- finance
- transp. & comm
- hospitality
- wholes. & retail
- constr
- utilities
- manuf
- mining
- fishing
- agriculture
Occupations: Domestic vs MN

![Employment shares diagram showing the comparison between Domestic and MN for various occupations. The x-axis represents employment share ranging from 0 to 0.25, and the y-axis lists the occupations: Elementary occupations, Plant and machine operators and assemblers, Craft & related trades, Skilled ag, forest & fish workers, Services & sales workers, Clerical workers, Technicians & assoc. professionals, Professionals, Managers, Domestic vs MN. The diagram uses bars to represent the employment share for each occupation in both categories.]
Poaching index distribution by ownership: firms

Poaching index

- Dom
- For

Graph showing the distribution of poaching index by ownership type.
Model assumptions: Bargaining & wages

- Worker at firm $p$ with outside option $q$ gets $w(q, p)$ s.t.

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

where

$$W(q, p) = w(q, p) + \beta$$

$$\begin{aligned}
\delta U_{\text{unemp}} + (1 - \delta)(1 - \lambda s) W(q, p) + \\
(1 - \delta) \lambda s
\end{aligned}$$

$$\begin{aligned}
\int_p^q W(x, p) dF(x) + \\
\int_q^{\bar{p}} W(p, x) dF(x) + \\
\int_p^{\bar{p}} W(p, x) dF(x)
\end{aligned}$$

$$\begin{aligned}
\left\{ \text{meet } x \text{ with } x \leq q \right\} + \\
\left\{ \text{meet } x \text{ with } q < x \leq p \right\} + \\
\left\{ \text{meet } x \text{ with } p < x \right\}
\end{aligned}$$

Do not search on job or match.
Model results: Profits

- Per period profit of firm of type $p$ with age $a$ is

$$
\pi(p) = \left( p - \int_p^w w(x, p) dG(x|p) \right) e(p, a) - c(v(p))
$$

- $dG(x|p)$: pdf of outside options for workers at firm of type $p$
- $e(p, a)$: employment at firm of type $p$ with age $a$

- Multinational presence affects $w(x, p)$, $G(x|p)$, $p$ and therefore average wage conditional on $p$
- Multinational presence also affects $e(p, a)$, $v(p)$
Model results: Firm age and size

- Firms of type $p$ which survive to age $a$ have employment:

$$e(p, a) = \frac{h(p)}{1 - x(p)} (1 - x(p)^a)$$

- with

$$h(p) = \nu(p) \chi \left( \frac{u + (1 - u)(1 - \delta) s \int_p^p dL(x)}{S} \right)$$

$$x(p) = \frac{(1 - \delta)}{(1 - \delta_f)} (1 - \lambda s (1 - F(p)))$$

- Fraction of firms of age $a$ is $(1 - \delta_f)^a \delta_f$
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
Nontargeted moment: joint dist of poaching index & size

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

![Graphs showing data and model comparisons for mean poaching index vs percentiles of mean employment.]

Data  
Model
Nontargeted moment: 2-year log wage growth

- Simulate quarterly model for 10 years, with 1 million workers
- Calculate transitions, wages as in data

![Graphs showing 2-year wage growth data and model predictions for stayers and EE movers.](image-url)
Shift in active firm productivity distribution

![Graph showing the shift in active firm productivity distribution. The graph displays the cumulative distribution function (CDF) of log normalized productivity for baseline and no multinational scenarios. The baseline CDF is represented by a solid line, while the no multinational CDF is represented by a dashed line. The x-axis represents log normalized productivity, and the y-axis represents the CDF. The graph illustrates how the inclusion of multinationals shifts the distribution towards higher productivity levels.]
Shift in worker-level wage distribution

![Graph showing the shift in worker-level wage distribution with two curves: Baseline and No multinationals. The x-axis represents the share of workers, ranging from 0 to 1, and the y-axis represents the share of wage income, also ranging from 0 to 1. The Baseline curve is solid, while the No multinationals curve is dashed.](image)
Shift in employment distribution

![Graph showing CDF of log normalized productivity with and without multinationals.

- Baseline
- No multinationals
- Baseline prod dist, firm size given p without MN]