The Effects of Foreign Multinationals on Workers and Firms in the United States - Online Appendix

by Bradley Setzler and Felix Tintelnot

Contents

A. Data: Sources and Definitions

Worker data. Worker data are constructed from annual Form W-2 tax filings over the years 1999-2017.

- Worker identifier: The worker is identified by the taxpayer identification number (TIN), which is unique and allows us to follow the same worker over time and across firms. In our data, the TIN is masked to protect confidentiality.
- Employer: Form W-2 is filed by the firm on behalf of the worker and includes that firm's masked employer identification number (EIN), which we use to link workers to their employers. In the event that multiple EINs file Form W-2 for the same TIN in year t, we define the EIN with the greatest earnings as the employer in year t, as is standard in the literature on firm-worker panel data.
- Earnings: Reported on Form W-2, box 1, earnings are defined as all remuneration for labor services deemed taxable by the IRS, including wages and salaries, bonuses, tips, and exercised stock options. Following Lamadon et al. (2020), the analysis sample focuses on workers with earnings above the full-time equivalence (FTE) threshold, approximated by the minimum wage, which equates to 15,000 USD in 2015. Note that we observe annual earnings, but since workers do not report hours worked in tax records, it is not possible to construct a measure of the hourly wage. To protect against outliers, we winsorize both log earnings and changes in log earnings from above and below at the one-half percent level.
- Location: Form W-2 reports the residential ZIP code of the worker. We define the location as the commuting zone associated with this ZIP code using the year 2000 commuting zone definitions from the Bureau of Labor Statistics. In the event that the ZIP code is missing or invalid in year t but not in year s with $|t-s| \leq 2$, and the worker receives a W-2 from the same EIN in t and s, we impute it in t using the value from s.
- Age: We obtain year of birth from SSA birth records. Following Lamadon et al. (2020), the analysis sample focuses on workers between age 25 and 60.

Firm data. Firm data are constructed from annual business tax returns over the years 1999-2017. The source tax forms are Form 1120 (C-corporations), Form 1120-S (S-corporations), and Form 1065 (Partnerships). We improve the data by imputing industry codes from other tax forms when missing, correcting value added for the particular industries that partially deduct labor costs, and using subsidiary links to associate foreign ownership with each subsidiary instead of only the parent corporation. Exhaustive variable definition and improvement steps are as follows:

- Firm identifier: A unique firm in the business tax filings is defined by the employer identification number (EIN). The EIN is the level at which companies file their tax returns with the IRS, so it reflects a distinct business unit for tax and accounting purposes. The EIN is often, but not always, the parent corporation in a multi-establishment firm. See Song et al. (2018), who also define the firm as the EIN, for further discussion of differences between EINs and establishments. In our data, the EIN is masked to protect confidentiality.

- Foreign ownership: We define an EIN as foreign owned in year t if it files Form 5472 in year t. Form 5472 is the "Information Return of a 25% Foreign-Owned U.S. Corporation or a Foreign Corporation Engaged in a U.S. Trade or Business." The country of foreign ownership is also reported on Form 5472. Note that S-corporations were restricted by law to only be owned by U.S. citizens during our time frame. Note that even a domestic-owned firm could be in the hands of many small foreign owners, particularly, when the company is publicly listed. We do not have hard data on this, but we think these cases are likely to be rare and not necessarily associated with the same effects. In the event that the employer fails to file Form 5472 in year t but files as foreign owned with ownership country c in one of $(t-2, t-1)$ as well as one of $(t+1, t+2)$, we improve the data by imputing foreign ownership in year t as c.[45] Since we do not observe the previous year for the initial year of the sample, we cannot carry out the same imputation and exclude the initial year from the estimation.

- Multinational: We define an EIN as a multinational in year t if it reports a non-zero foreign tax credit on Schedule J, Part I, line 5a of Form 1120 or Form 1118, Schedule B, Part III, line 6 of Form 1118 for a C-corporation in year t, or if it reports a positive Total Foreign Taxes Amount on Schedule K, line 16l of Form 1065 for a partnership in year t, while S-corporations are restricted by law from carrying out foreign business.

- Subsidiary: As emphasized by Yagan (2019), many workers cannot be linked to a corporate tax filing, often because the employer is not required to file (especially because the employer is a government or non-profit organization) or because the employer is a subsidiary and only the parent corporation files while the subsidiary uses its distinct EIN to issue W-2 forms. To overcome this challenge, we combine two sources of information on subsidiary linkages. The first source is Schedule K, line 3b, which provides the EIN of the parent corporation in the years in which the subsidiary is a filer, from which we learn the EIN of the parent corporation in future years in which the subsidiary is a non-filer. The second source is the Affiliations Schedule from Form 851, which defines a subsidiary as 80 percent owned by another corporation. However, we only observe a running list of parent-subsidiary relationships taken from the Affiliations Schedules through 2016, so changes over time due to extensive margin changes in subsidiary relationships may be mismeasured when using the second source. For this reason, we only utilize the second source for subsidiary linkages that are not covered by the first source (i.e., subsidiaries that are missing Schedule K filings).

- Industry: The industry of the firm in year t is reported as the 6-digit NAICS code on line 21 on Schedule K for C-corporations, line 2a Schedule B for S-corporations, and Box A for partnerships in year t. In the baseline specification, we consider the 3-digit NAICS code to be the industry, while we consider the 6-digit NAICS code in robustness checks. In the event that the NAICS code is missing in year t, we impute the NAICS code in year t-1, t-2, t+1, or t+2 (in that order). In the event that the NAICS code is missing in all such years, we attempt to impute the NAICS code from Form 5500, "Annual Return/Report of Employee Benefit Plan," as this filing sometimes

[45] An additional issue that may result in measurement error is that some firms may outsource their employee administration to third-party payroll processors whose EINs appear on the W-2 rather than the EINs of the actual employers. In this case, we would treat the payroll processor as a separate employer, rather than combining it with the firm that directly employs the workers, since we do not have a way of mapping payroll processors back to direct employers. However, as noted by Yagan (2019), only a small number of firms is likely to use the EINs of payroll processors.

includes the NAICS code even when the main business filing does not. In the data, we find that a large share of foreign-owned firms are concentrated in NAICS sector 55, "management of other companies," while very few domestic firms belong to this sector. Because sector 55 does not correspond to any particular product market, it is difficult to define its upstream or downstream industries. To avoid losing much of the sample of foreign-owned firms in the input/output network regression, we use the NAICS code of the largest subsidiary to replace a NAICS code beginning with 55 if a different NAICS is available at the largest subsidiary. Lastly, we omit the finance, insurance, and real estate (FIRE) industries throughout all analysis because of the difficulties in interpreting value added for these industries.

- Tradables and Non-tradables: Mian and Sufi (2014) provide two methods for defining the tradable industries. We say an industry is tradable if either: (A) the industry has imports plus exports equal to at least \$10,000 per worker, or if total exports plus imports for the NAICS four-digit industry exceed \$500M; or (B) the industry has a high level of geographic concentration (i.e., is in the highest quartile of the geographical Herfindahl index constructed by Mian and Sufi 2014). We define an industry as non-tradable if it belongs to the retail sector or restaurants (corresponding to the first classification by Mian and Sufi 2014).

- Value added: We define value added as the difference between gross business receipts and the cost of goods sold (COGS). This difference is reported on line 3 for Forms 1120, 1120-S, and 1065. The IRS provides instructions to businesses on the calculation of COGS in Publication 334. To quote this publication, "Labor costs are usually an element of cost of goods sold only in a manufacturing or mining business. Small merchandisers (wholesalers, retailers, etc.) usually do not have labor costs that can properly be charged to cost of goods sold. In a manufacturing business, labor costs properly allocable to the cost of goods sold include both the direct and indirect labor used in fabricating the raw material into a finished, saleable product." Labor expenses are not included in COGS—and therefore are not subtracted out of gross business receipts when defining value added—for any business that does not engage in manufacturing or mining. Among firms that engage in manufacturing and mining, labor expenses are included for workers engaged in production ("production workers"), but not for workers who are not engaged in production ("non-production workers"). Form 1125-A is not available to us, so we do not observe the labor expense for production workers. However, we are able to recover the non-production wage and salary expenses (lines 12 plus 13 for Form 1120, lines 7 plus 8 for Form 1120S, and lines 9 plus 10 for Form 1065). We observe total wage and salary expenses from the worker data discussed below. The difference in total wage and salary expenses and non-production wage and salary expenses is production wage and salary expenses. Thus, we are able to add production wage and salary expenses into the line 3 measure for the manufacturing and mining industries (NAICS codes beginning 31, 32, 33, or 212) in order to recover value added for these industries. To protect against outliers, we winsorize changes in log value added from above and below at the three percent level.

- Location: Our analysis requires a firm's activity to be associated with *each* commuting zone in which it is active. This differs from using the address of the firm's headquarter to define its location, as the headquarter may be chosen to obtain favorable state-level tax rates rather than to represent the firm's actual location of activity, and the firm may be active in many locations. Since specific establishments of multi-establishment firms are not observable in U.S. tax data, we follow Yagan (2019) by inferring firms' commuting zone-level operations from workers' residential locations. We aggregate the number of workers and wages within the commuting zone of the worker's address on the W-2 to define the firms' local employment and wage bill. However, we do not observe value added at the firm-commuting zone level directly because it is reported only on EIN-level tax forms. To overcome this challenge, we use the share of the wage bill paid in the commuting zone of each firm to allocate value added to commuting zones. For example, if 75 percent of a firm's wage bill is paid in the first commuting zone and 25 percent in the second commuting zone, we allocate 75 percent of value added to the first and 25 percent to the second.

B. Data: Descriptive Statistics

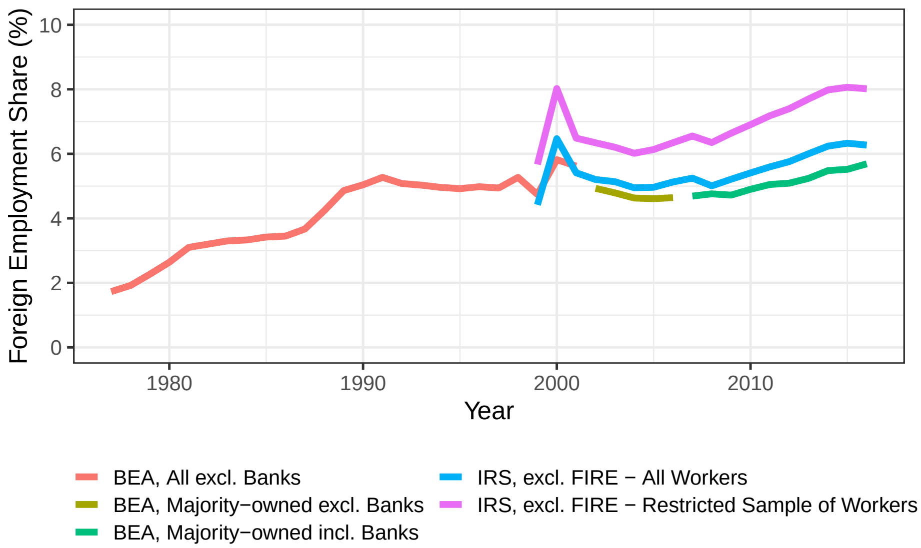


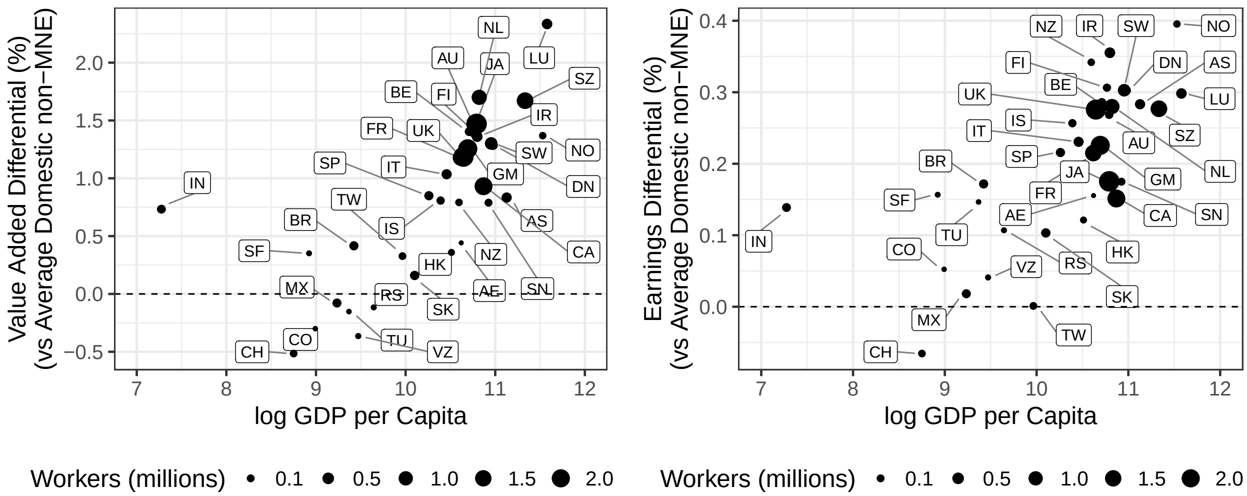
Figure A1
Employment at Foreign-owned Firms

Notes: This figure displays the share of American private sector employees at foreign-owned firms between 1977 and 2017. It compares three series available from BEA to the analysis sample of firms we construct from tax data, both for all workers and for only the workers that satisfy our FTE and other restrictions. Each of the series use different sample selection rules.

TABLE A1
Descriptive Statistics for the Main Sample of Firms, 2015

	Domestic	Foreign
Firms in Main Sample of Firms (thousands)	2,781.1	30.3
Firm-Location Pairs in Main Sample of Firms (thousands)	4,762.9	218.7
Number of Workers at Main Sample of Firms (millions):		
All Workers:	77.1	5.2
FTE Analysis Sample:	41.3	3.6
Mean Wage at Main Sample of Firms (thousands):		
All Workers:	41.4	60.7
FTE Analysis Sample:	62.6	75.7
Value Added per Worker at Main Sample of Firms (thousands):		
All Workers:	82.7	153.1
FTE Analysis Sample:	154.3	220.1

Notes: This table displays descriptive statistics for domestic and foreign filers of Forms 1120, 1120-S, and 1065, matched to subsidiaries and W-2 forms. The set of firms is the same across all rows and has already been restricted to satisfy the sample restrictions. The analysis sample restrictions on the workers are at least FTE earnings ($15,000 per year), the firm is the worker's highest-paying W-2 in that year, the worker is prime age (25-60 years old), and the ZIP code is non-missing and valid on the highest-paying W-2 form.

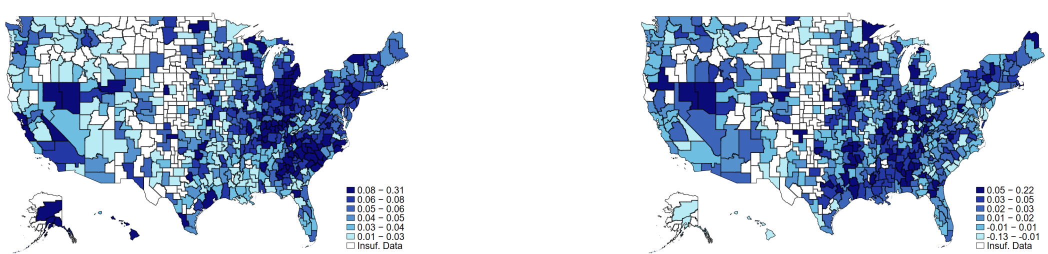


(a) Value-added differential

(b) Wage differential

Figure A2
Descriptive Statistics by Country of Ownership

Notes: This figure presents average value added and earnings during 2010-2015. The vertical axis is the difference in the average value added (subfigure a) or average earnings (subfigure b) for foreign multinationals with the countries of ownership indicated by the labels, relative to the average domestic non-multinational. We control for industry-year and commuting-zone-year fixed effects, so reported differentials in log value added and log earnings do not reflect differences due to location or industry selection.



(a) Share of employment at foreign firms by commuting zone in 2001

(b) Change in share of employment at foreign firms by commuting zone from 2001 to 2015.

Figure A3
The Spatial Distribution of Employment at Foreign Firms

Notes: The two figures display spatial variation in employment at foreign-owned firms observed in the tax data for the workers sample of interest. In the first figure, the share of workers employed at foreign-owned firms is plotted in 2001 for each commuting zone. In the second figure, changes from 2001 to 2015 in the share of employment at foreign-owned firms are plotted by commuting zone.

C. Model: Derivations

We now provide details on the model and prove several claims made in Section .

Wage setting. Recall that all firms produce the same homogeneous good whose price is normalized to one. Each firm solves the following problem:

$$\max_{w_{js},w_{ju}} \phi_j \left(w_{ju}^{\eta} \left(\frac{\bar{L}_u}{W_u} \right) + \zeta_{js} w_{js}^{\eta} \left(\frac{\bar{L}_s}{W_s} \right) \right) - w_{js}^{\eta+1} \frac{\bar{L}_s}{W_s} - w_{ju}^{\eta+1} \frac{\bar{L}_u}{W_u}. \tag{A1}$$

The first-order condition that ignores any effect of w_{js} and w_{ju} on $\frac{\bar{L}_s}{W_s}$ and $\frac{\bar{L}_u}{W_u}$ is simply equation (5).

Mean difference in log wages between foreign and domestic firms.

$$\begin{aligned} \mathbb{E}[\log w_{F\cdot}] - \mathbb{E}[\log w_{D\cdot}] &= C_F \log w_{Fs} + (1 - C_F) \log w_{Fu} - C_D \log w_{Ds} - (1 - C_D) \log w_{Du} \\ &= \log \phi_F - \log \phi_D + C_F \log \zeta_{Fs} - C_D \log \zeta_{Ds} \end{aligned} \tag{A2}$$

Proof of Proposition 1. Part (a) follows from $\phi_F > \phi_D$ and the definition in equation (6). For part (c), note that the skill composition at a firm of nationality N is

$$C_N = \frac{\ell_{Ns}}{\ell_{Ns} + \ell_{Nu}} = \frac{w_{Ns}^{\eta} \frac{\bar{L}_s}{W_s}}{w_{Ns}^{\eta} \frac{\bar{L}_s}{W_s} + w_{Nu}^{\eta} \frac{\bar{L}_u}{W_u}} = \frac{\zeta_{Ns}^{\eta}}{\zeta_{Ns}^{\eta} + \frac{\bar{L}_u / W_u}{\bar{L}_s / W_s}}, \tag{A3}$$

which only depends on N through ζ_{Ns}^{η}. Since C_N is increasing in ζ_{Ns}^{η}, then $\zeta_{Ds}^{\eta} > \zeta_{Ds}^{\eta}$ implies $C_F > C_D$, which proves part (c). Since $\zeta_{Fs} > \zeta_{Ds} \geq 1$, then $C_F > C_D$ and $C_F \log \zeta_{Fs} > C_D \log \zeta_{Ds}$, which proves part (b).

Indirect effect first-order approximations (FOA). We derive the first-order approximations around an initial equilibrium featuring a small share of employment at foreign firms. First, compute the change in foreign employment share $p = \frac{L_F}{L_F + L_D}$:

$$\Delta p = \frac{\Delta L_F}{L_F + L_D} - \frac{L_F(\Delta L_F + \Delta L_D)}{(L_F + L_D)^2} = \frac{(1-p)\Delta L_F - p \Delta L_D}{L_F + L_D} \approx \frac{\Delta L_F}{L_F + L_D} = \hat{X}.$$

It then follows that

$$\Delta \log \phi_D = \frac{\tau(\phi_F - 1)\Delta p}{1 + \tau(\phi_F - 1)p} \approx \tau(\phi_F - 1)\hat{X}. \tag{A4}$$

Indirect effect FOA for wages. From equation (5), the change in log wages at domestic firms is

$$\Delta \log w_{Dh} = \Delta \log \phi_D \approx \tau(\phi_F - 1)\hat{X}. \tag{A5}$$

Indirect effect FOA for employment. The change in log employment of skilled workers at a domestic firm $\Delta \log \ell_{Ds} = \eta \Delta \log w_{Ds} - \Delta \log W_s$ where

$$\Delta \log W_s = \frac{\ell_{Fs}}{\bar{L}_s} \Delta M_F + \eta E_s \Delta \log w_{Ds} \approx \left(\frac{C_F}{C_D} E_s + \eta \tau (\phi_F - 1) E_s \right) \hat{X}.$$

Note that we replace ΔM_F utilizing $\Delta L_F \approx \Delta M_F(\ell_{Fs} + \ell_{Fu})$.[46] Therefore,

$$\Delta \log \ell_{Ds} \approx \tau\eta(\phi_F - 1)(1 - E_s)\hat{X} - \frac{C_F}{C_D} E_s \hat{X}. \tag{A6}$$

Similarly, for the change in log employment of unskilled workers,

$$\Delta \log \ell_{Du} \approx \tau\eta(\phi_F - 1)(1 - E_u)\hat{X} - \frac{1 - C_F}{1 - C_D} E_u \hat{X}. \tag{A7}$$

The change in log total employment at a domestic firm is the mean change in log employment of both types weighted by the respective employment share. That is,

$$\Delta \log(\ell_{Ds} + \ell_{Du}) = C_D \Delta \log \ell_{Ds} + (1 - C_D)\Delta \log \ell_{Du} \approx \tau\eta(\phi_F - 1)(1 - \bar{E}_D)\hat{X} - \bar{E}_F \hat{X}, \tag{A8}$$

where $\bar{E}_N = C_N E_s + (1 - C_N)E_u$.

Indirect effect FOA for value added. From equation (1), the change in log value added at a domestic firm is $\Delta \log q_D = \Delta \log \phi_D + R_D \Delta \log \ell_{Ds} + (1 - R_D)\Delta \log \ell_{Du}$ where $R_D = \frac{\zeta_{Ds}\ell_{Ds}}{\zeta_{Ds}\ell_{Ds} + \ell_{Du}}$ is the output share of skilled workers at a domestic firm. Based on equations (A4), (A6) and (A7), we have

$$\begin{aligned} \Delta \log q_D \approx\ & \tau(\phi_F - 1)\left(1 + \eta\left[1 - R_D E_s - (1 - R_D)E_u\right]\right)\hat{X} \\ & - \left(\frac{C_F}{C_D} R_D E_s + \frac{1 - C_F}{1 - C_D}(1 - R_D)E_u\right)\hat{X}. \end{aligned} \tag{A9}$$

Indirect effect FOA for wage bill. Since $\Delta \log b_{Dh} = \Delta \log w_{Dh} + \Delta \log \ell_{Dh}$,

$$\begin{aligned} \Delta \log b_{Ds} &= \left(\tau(\phi_F - 1)[1 + \eta(1 - E_s)] - \frac{C_F}{C_D} E_s\right)\hat{X}, \\ \Delta \log b_{Du} &= \left(\tau(\phi_F - 1)[1 + \eta(1 - E_u)] - \frac{1 - C_F}{1 - C_D} E_u\right)\hat{X}. \end{aligned}$$

The change in log total wage bill at a domestic firm is the mean change in log wage bill of both types weighted by respective output share. That is,

$$\begin{aligned} \Delta \log b_D &= R_D \Delta \log b_{Ds} + (1 - R_D)\Delta \log b_{Du} \\ &\approx \tau(\phi_F - 1)\left(1 + \eta\left[1 - R_D E_s - (1 - R_D)E_u\right]\right)\hat{X} \\ &\quad - \left(\frac{C_F}{C_D} R_D E_s + \frac{1 - C_F}{1 - C_D}(1 - R_D)E_u\right)\hat{X}. \end{aligned} \tag{A10}$$

Up to the first order, the change in log wage bill is the same as the change in log value added at a domestic firm.

[46] Specifically, the first term in the equation above can be approximated as follows:

$$\frac{\ell_{Fs}}{\bar{L}_s}\Delta M_F \approx \frac{\ell_{Fs}}{\bar{L}_s}\frac{\Delta L_F}{\ell_{Fs} + \ell_{Fu}} = C_F \frac{L_F + L_D}{\bar{L}_s}\frac{\Delta L_F}{L_F + L_D} \approx \frac{C_F}{C_D}\frac{C_D L_D}{\bar{L}_s}\hat{X} = \frac{C_F}{C_D}E_s\hat{X}.$$

Indirect effect FOA for value added per worker and wage bill per worker. From equations (A8) and (A9), the change in log value added per worker at a domestic firm is

$$\Delta \log q_D - \Delta \log(\ell_{Du} + \ell_{Ds}) \approx \tau(\phi_F - 1)\left[1 - \eta(R_D - C_D)(E_s - E_u)\right]\hat{X} - (R_D - C_D)\left(\frac{C_F}{C_D}E_s - \frac{1 - C_F}{1 - C_D}E_u\right)\hat{X}. \tag{A11}$$

The change in the wage bill per worker is identical to the right hand side of (A11).

Proof of Proposition 2. We prove Proposition 2 taking equations (7), (8), and (9) as given; they are proven above. Part (a) follows from equation (7). For part (b), consider the case in which $\tau(\phi_F - 1)$ is sufficiently large. The spillover effect from equation (8) or (9) is unbounded and increasing in ϕ_F, while the competition effect is bounded. Hence, there exists a $\bar{\phi}_F > 1$ such that $\Delta \log(\ell_{Du} + \ell_{Ds}) > 0$ and $\Delta \log q_D > 0$ for $\phi_F > \bar{\phi}_F$. Alternatively, consider the case in which E_s and E_u are sufficiently small. From equation (8) or (9), the spillover effect is decreasing in E_s and E_u, while the competition effect is increasing in E_s and E_u. When E_s and E_u are sufficiently small, the spillover effect is positive, while the competition effect approaches zero. Hence, $\Delta \log(\ell_{Du} + \ell_{Ds}) > 0$ and $\Delta \log q_D > 0$. For part (c), from equation (A11), the sign is ambiguous and depends on the magnitudes of the various terms.

Claim in footnote 16. Equation (7) uses a first-order approximation to show that the indirect effect of foreign investment has the same sign as τ. We now show that the sign of the wage effect is the same as the sign of τ without a first-order approximation:

Specifically, we show that $\frac{dw_{Dh}}{dM_F} > 0$ when $\tau > 0$ and $\frac{dw_{Dh}}{dM_F} = 0$ when $\tau = 0$. Notice that

$$\frac{dw_{Dh}}{dM_F} = \frac{\eta}{\eta + 1}\frac{d\phi_D}{dM_F}\zeta_{Dh}.$$

When $\tau = 0$, $\phi_D = 1$ and $\frac{dw_{Dh}}{dM_F} = 0$. When $\tau > 0$, let

$$F(\phi_D, M_F) \equiv 1 + \tau(\phi_F - 1)\frac{L_F}{L_F + L_D} - \phi_D.$$

From the implicit function theorem, $\frac{d\phi_D}{dM_F} = -\frac{F_{M_F}}{F_{\phi_D}}$. First, we provide the elements that are used to compute F_{M_F}.

$$F_{M_F} = \tau(\phi_F - 1)\frac{\partial \frac{L_F}{L_F + L_D}}{\partial M_F} = \tau(\phi_F - 1)\frac{\frac{\partial L_F}{\partial M_F}L_D - L_F\frac{\partial L_D}{\partial M_F}}{(L_F + L_D)^2}. \tag{A12}$$

Using equations (4) and (5), we have

$$L_D = \frac{M_D(\gamma\phi_D)^\eta}{M_F(\gamma\phi_F)^\eta + M_D(\gamma\phi_D)^\eta + w_0^\eta}\bar{L}_u + \frac{M_D(\gamma\phi_D\zeta_{Ds})^\eta}{M_F(\gamma\phi_F\zeta_{Fs})^\eta + M_D(\gamma\phi_D\zeta_{Ds})^\eta + w_0^\eta}\bar{L}_s \tag{A13}$$

$$L_F = \frac{M_F(\gamma\phi_F)^\eta}{M_F(\gamma\phi_F)^\eta + M_D(\gamma\phi_D)^\eta + w_0^\eta}\bar{L}_u + \frac{M_F(\gamma\phi_F\zeta_{Fs})^\eta}{M_F(\gamma\phi_F\zeta_{Fs})^\eta + M_D(\gamma\phi_D\zeta_{Ds})^\eta + w_0^\eta}\bar{L}_s, \tag{A14}$$

where $\gamma = \frac{\eta}{\eta+1}$. Therefore,

$$\frac{\partial L_D}{\partial M_F} = -\frac{M_D(\gamma\phi_D)^\eta \cdot (\gamma\phi_F)^\eta}{W_u^2}\bar{L}_u - \frac{M_D(\gamma\phi_D\zeta_{Ds})^\eta \cdot (\gamma\phi_F\zeta_{Fs})^\eta}{W_s^2}\bar{L}_s,$$
$$\frac{\partial L_F}{\partial M_F} = \frac{[M_D(\gamma\phi_D)^\eta + w_0^\eta] \cdot (\gamma\phi_F)^\eta}{W_u^2}\bar{L}_u + \frac{[M_D(\gamma\phi_D\zeta_{Ds})^\eta + w_0^\eta] \cdot (\gamma\phi_F\zeta_{Fs})^\eta}{W_s^2}\bar{L}_s.$$

We see that $\frac{\partial L_D}{\partial M_F} < 0$ and $\frac{\partial L_F}{\partial M_F} > 0$. This implies that $F_{M_F} > 0$.

Next, we provide the elements that are used to compute F_{ϕ_D}:

$$F_{\phi_D} = \tau(\phi_F - 1)\frac{\partial \frac{L_F}{L_F + L_D}}{\partial \phi_D} - 1 = \tau(\phi_F - 1)\frac{\frac{\partial L_F}{\partial \phi_D}L_D - L_F\frac{\partial L_D}{\partial \phi_D}}{(L_F + L_D)^2} - 1, \tag{A15}$$

where

$$\frac{\partial L_D}{\partial \phi_D} = \frac{\gamma\eta M_D(\gamma\phi_D)^{\eta-1}[M_F(\gamma\phi_F)^\eta + w_0^\eta]}{W_u^2}\bar{L}_u + \frac{\gamma\eta\zeta_{Ds}M_D(\gamma\phi_D\zeta_{Ds})^{\eta-1}[M_F(\gamma\phi_F\zeta_{Fs})^\eta + w_0^\eta]}{W_s^2}\bar{L}_s$$
$$\frac{\partial L_F}{\partial \phi_D} = -\frac{\gamma\eta M_D(\gamma\phi_D)^{\eta-1}M_F(\gamma\phi_F)^\eta}{W_u^2}\bar{L}_u - \frac{\gamma\eta\zeta_{Ds}M_D(\gamma\phi_D\zeta_{Ds})^{\eta-1}M_F(\gamma\phi_F\zeta_{Fs})^\eta}{W_s^2}\bar{L}_s.$$

We see that $\frac{\partial L_D}{\partial \phi_D} > 0$ and $\frac{\partial L_F}{\partial \phi_D} < 0$. This implies that $F_{\phi_D} < 0$ and $\frac{d\phi_D}{dM_F} = -\frac{F_{M_F}}{F_{\phi_D}} > 0$. Therefore, we have $\frac{dw_{Dh}}{dM_F} = \frac{\eta}{\eta+1}\frac{d\phi_D}{dM_F}\zeta_{Dh} > 0$ when $\tau > 0$.

D. Model: Extension with Many Skill and Firm Types

We next provide a model with an arbitrary number firm and worker types as well as many foreign nationalities.

Environment. We assume there is a large set of locations in the U.S. All regions are trading frictionless within the U.S. and workers are immobile across locations. We focus on the outcomes in one particular location and, to simplify notation, omit the locations subscript. Let $N \in \{D, 1, ..., \bar{N}\}$ denote the firm country of origin, where $N = D$ is domestic and $N \geq 1$ indexes the foreign nationalities. Let $N(j)$ denote the nationality of firm j. Denote by M_N the number of firms of nationality N. Let $h(i)$ denote the skill level of a worker i. Denote by L_{Nh} the number of employees with skill level h, and $L_N = \sum_h L_{Nh}$ is the total number of employees at firms of nationality N. Each region is equipped with $\bar{L}_h$ potential employees of skill type h.

Preferences and labor supply. These are unchanged from the main text, except there are more values of h; see equation (4). We normalize the minimum value of h to 1 without loss of generality.

Technology. Each firm produces a homogeneous good q that is freely traded, where the price is normalized to 1. A firm produces using technology,

$$q_j(\{\ell_h\}_h) = \phi_j \sum_h h^{\theta_j} \ell_h, \tag{A16}$$

where ϕ_j is firm-specific TFP and θ_j is the firm-specific skilled-labor-augmenting productivity parameter. If $\theta_j > 1$, the firm-specific productivity of labor is increasing at an increasing rate in skill level h; if $0 < \theta_j < 1$, the firm-specific productivity of labor is increasing at a decreasing rate in skill level h.

Equilibrium wages. Given the production function in (A16) and labor supply in equation (4), equilibrium wages are given by

$$w_{ij} = \frac{\eta}{\eta + 1} \phi_j h_i^{\theta_j} \tag{A17}$$

Defining $\mu \equiv \log \frac{\eta}{\eta+1}$, $\psi_j \equiv \log \phi_j$, and $x_i \equiv \log h_i$, the equilibrium log wage is

$$\log w_{ij} = \mu + \psi_j + \theta_j x_i. \tag{A18}$$

From this expression, the mean difference in log wages for firms with foreign nationality N relative to domestic firms D is

$$\begin{aligned} &\underbrace{\mathbb{E}[\log w_{ij}|N(j) = N] - \mathbb{E}[\log w_{ij}|N(j) = D]}_{\text{Total country } N \text{ wage differential}} = \underbrace{\mathbb{E}[x_i|N(j) = N] - \mathbb{E}[x_i|N(j) = D]}_{\text{Skill composition difference for country } N} \\ &+ \underbrace{\mathbb{E}[\psi_j|N(j) = N] - \mathbb{E}[\psi_j|N(j) = D]}_{\text{Low-skill country } N \text{ premium}} + \underbrace{\mathbb{E}[(\theta_j - 1)x_i|N(j) = N] - \mathbb{E}[(\theta_j - 1)x_i|N(j) = D]}_{\text{Additional country } N \text{ premium due to skill augmentation}} \end{aligned} \tag{A19}$$

Suppose that there are $\bar{F}$ ($\bar{D}$) different types of foreign (domestic) firms. Denote the set of foreign (domestic) firm types by $\mathcal{F}$ ($\mathcal{D}$). Foreign firms with type $f \in \mathcal{F}$ are characterized by the pair (ϕ_f, θ_f). The type of domestic firms is characterized by a pair of base productivities, $(\tilde{\phi}_d, \tilde{\theta}_d)$, with $d \in \mathcal{D}$. The *ex post* productivities at a type-d domestic firm are determined as follows:

$$\phi_d = \tilde{\phi}_d + \tau \sum_f \frac{L_f}{L_D + L_F}(\phi_f - \tilde{\phi}_d) \tag{A20}$$

$$\theta_d = \tilde{\theta}_d + \tau \sum_f \frac{L_f}{L_D + L_F}(\theta_f - \tilde{\theta}_d), \tag{A21}$$

where $L_F = \sum_f \sum_h L_{fh}$ is the total employment at foreign firms.

In addition, denote the mass of type-f foreign firms with nationality N as M_f^N and the total mass of firms with nationality N as $M^N = \sum_f M_f^N$. Without loss of generality, we order (ϕ_f, θ_f) such that θ_f is increasing in f.

Assumption 1 *For any two countries N and N', either $\frac{\sum_{f>\bar{f}} M_f^N}{M^N} \geq \frac{\sum_{f>\bar{f}} M_f^{N'}}{M^{N'}}$ or $\frac{\sum_{f>\bar{f}} M_f^N}{M^N} \leq \frac{\sum_{f>\bar{f}} M_f^{N'}}{M^{N'}}$ holds for all $\bar{f}$. In addition, $\frac{\sum_{f>\bar{f}} M_f^N}{M^N} \geq \frac{\sum_{d>\bar{f}} M_d^D}{M^D}$ holds for all N and $\bar{f}$.*

Based on Assumption 1, we are able to rank foreign countries by their respective average skilled-labor-augmenting productivity, $\bar{\theta}^N = \sum_f \frac{M_f^N}{M^N}\theta_f$. Note that given two foreign countries N and N', $\frac{\sum_{f>\bar{f}} M_f^N}{M^N} \geq \frac{\sum_{f>\bar{f}} M_f^{N'}}{M^{N'}}$ for all $\bar{f}$ if and only if $\bar{\theta}^N \geq \bar{\theta}^{N'}$ for all increasing sequences of θ_f.

Lemma 1 *$\sum_{h>\bar{h}} C_{fh}$ is non-decreasing in θ_f for all $\bar{h}$.*

Proof. Define the share of workers with skill level h in a type-f foreign firm as $C_{fh} = \frac{\ell_{fh}}{\sum_g \ell_{fg}}$. When $\bar{h} \geq \bar{H}$, $\sum_{h>\bar{H}} C_{fh} = 0$ for all θ_f. When $0 < \bar{h} < \bar{H}$,

$$\sum_{h>\bar{h}} C_{fh} = \frac{1}{1 + \frac{\sum_{g\leq\bar{h}} g^{\eta\theta_f}\bar{L}_g/W_g}{\sum_{h>\bar{h}} h^{\eta\theta_f}\bar{L}_h/W_h}}. \tag{A22}$$

Let $G(\theta_f, \bar{h}) = \frac{\sum_{g\leq\bar{h}} g^{\eta\theta_f}\bar{L}_g/W_g}{\sum_{h>\bar{h}} h^{\eta\theta_f}\bar{L}_h/W_h}$, then

$$\begin{aligned}\frac{\partial G(\theta_f, \bar{h})}{\partial \theta_f} &= \frac{den \cdot \eta \sum_{g\leq\bar{h}} g^{\eta\theta_f} \log g \cdot \bar{L}_g/W_g - num \cdot \eta \sum_{h>\bar{h}} h^{\eta\theta_f} \log h \cdot \bar{L}_h/W_h}{den^2} \\ &< \eta \log \bar{h} \frac{num \cdot den - num \cdot den}{den^2} = 0.\end{aligned}$$

In this case, $\sum_{h>\bar{h}} C_{fh}$ is strictly increasing in θ_f. ■

Proposition 3 (Direct effects with many foreign countries and skill types) *Suppose that Assumption 1 holds, then in equation (A19),*

(a) *"Skill composition difference for country N" and "Additional country N premium due to skill augmentation" are positive.*

(b) *"Skill composition difference for country N" and "Additional country N premium due to skill augmentation" are increasing in $\bar{\theta}_N$.*

Proof. For the function $H = \log h$ or $H = (\theta_f - 1)\log h$,

$$\mathbb{E}[H|N(j) = N] - \mathbb{E}[H|N(j) = N'] = \sum_{f\in\mathcal{F}} \frac{M_f^N}{M^N} \sum_{h\in\mathcal{H}} C_{fh} H - \sum_{f\in\mathcal{F}} \frac{M_f^{N'}}{M^{N'}} \sum_{h\in\mathcal{H}} C_{fh} H$$

Suppose that $\bar{\theta}_N \geq \bar{\theta}_{N'}$, which implies that $\mathbb{E}[H|N(j) = N] - \mathbb{E}[H|N(j) = N'] \geq 0$ from Assumption 1. In particular, let $N' = D$, and part (a) can be proved based on Assumption 1 and Lemma 1. ■

Two-way fixed effect model. Consider a special case in which $\theta_j \equiv \bar{\theta}$, so that the skill-augmenting technology is homogeneous. Furthermore, we assume x_i can be decomposed as $x_i = \tilde{x}_i + \chi_i'\tilde{\beta}$, where $\tilde{x}_i$ is unobserved to the econometrician and $\chi_i'\tilde{\beta}$ is observed to the econometrician. Then, we can write $\theta_j x_i = \bar{\theta}\left(\tilde{x}_i + \chi_i'\tilde{\beta}\right) = \grave{x}_i + \chi_i'\beta$ where $\grave{x}_i \equiv \bar{\theta}\tilde{x}_i$ and $\beta \equiv \bar{\theta}\tilde{\beta}$. This implies that $\log w_{ij} = \phi_j + \grave{x}_i + \chi_i'\beta$.

Indirect effect first-order approximations (FOA). First, we derive the FOA of $p_f = \frac{L_f}{L_D + L_F}$, the share of workers employed in a type-f foreign firm. Throughout this section, we conduct the FOA around an initial equilibrium in which the employment share at foreign-owned firms is small:

$$\Delta p_f = \frac{\Delta L_f - \frac{L_f}{L_F}\Delta L_F}{L_D + L_F} + \frac{L_f}{L_F}\Delta p \approx \frac{L_f}{L_F}\hat{X}.$$

Indirect effect FOA for wages.

$$\Delta \log w_{dh} = \Delta \log \phi_d + \Delta\theta_d \log h,$$

where

$$\Delta \log \phi_d = \frac{\tau \sum_{f\in\mathcal{F}} \Delta p_f(\phi_f - \tilde{\phi}_d)}{\tilde{\phi}_d + \tau \sum_{f\in\mathcal{F}} p_f(\phi_f - \tilde{\phi}_d)} \approx \tau \sum_{f\in\mathcal{F}} \frac{\phi_f - \tilde{\phi}_d}{\tilde{\phi}_d} \frac{L_f}{L_F}\hat{X}$$

$$\Delta\theta_d = \tau \sum_{f\in\mathcal{F}} (\theta_f - \tilde{\theta}_d)\Delta p_f \approx \tau \sum_{f\in\mathcal{F}} (\theta_f - \tilde{\theta}_d)\frac{L_f}{L_F}\hat{X}.$$

Therefore,

$$\Delta \log w_{dh} \approx \tau \sum_{f\in\mathcal{F}} \left[\frac{\phi_f - \tilde{\phi}_d}{\tilde{\phi}_d} + (\theta_f - \tilde{\theta}_d)\log h\right] \frac{L_f}{L_F}\hat{X},$$

and the expected change in wage across all domestic firm types and worker skill levels is

$$\mathbb{E}[\Delta \log w_{dh}] = \tau \sum_{d\in\mathcal{D}} \frac{M_d^D}{M^D} \sum_{h\in\mathcal{H}} C_{dh} \sum_{f\in\mathcal{F}} \left[\frac{\phi_f - \tilde{\phi}_d}{\tilde{\phi}_d} + (\theta_f - \tilde{\theta}_d)\log h\right] \frac{L_f}{L_F}\hat{X}. \tag{A23}$$

Indirect effect FOA for employment. Since

$$\begin{aligned}\Delta \log W_h &= \sum_{f\in\mathcal{F}} \frac{\ell_{fh}}{\bar{L}_h}\Delta M_f + \eta \sum_{d\in\mathcal{D}} E_{dh}\Delta \log w_{dh} \\ &\approx \sum_{f\in\mathcal{F}} C_{fh}\frac{L_D}{\bar{L}_h}\frac{L_f}{L_F}\hat{X} + \tau\eta \sum_{d\in\mathcal{D}} E_{dh} \sum_{f\in\mathcal{F}} \left[\frac{\phi_f - \tilde{\phi}_d}{\tilde{\phi}_d} + (\theta_f - \tilde{\theta}_d)\log h\right] \frac{L_f}{L_F}\hat{X},\end{aligned}$$

then

$$\begin{aligned}\Delta \log \ell_{dh} &= \eta\Delta \log w_{dh} - \Delta \log W_h \\ &\approx \eta \left[(1 - E_{dh})\Delta \log w_{dh} - \sum_{g\in\mathcal{D}\backslash d} E_{gh}\Delta \log w_{gh}\right] - \sum_{f\in\mathcal{F}} C_{fh}\frac{L_D}{\bar{L}_h}\frac{L_f}{L_F}\hat{X}.\end{aligned}$$

Therefore,

$$\begin{aligned}&\Delta \log \left(\sum_{h\in\mathcal{H}} \ell_{dh}\right) = \sum_{h\in\mathcal{H}} C_{dh}\Delta \log \ell_{dh} \\ \approx&\eta \sum_{h\in\mathcal{H}} C_{dh} \left[(1 - E_{dh})\Delta \log w_{dh} - \sum_{g\in\mathcal{D}\backslash d} E_{gh}\Delta \log w_{gh}\right] - \frac{L_D}{L_d}\sum_{h\in\mathcal{H}}\sum_{f\in\mathcal{F}} C_{fh}E_{dh}\frac{L_f}{L_F}\hat{X},\end{aligned}$$

and the expected change in employment across all domestic firm types is

$$\begin{aligned}&\mathbb{E}\left[\Delta \log \left(\sum_{h\in\mathcal{H}} \ell_{dh}\right)\right] = \sum_{d\in\mathcal{D}} \frac{M_d^D}{M^D} \sum_{h\in\mathcal{H}} C_{dh}\Delta \log \ell_{dh} \\ \approx&\eta \sum_{d\in\mathcal{D}} \frac{M_d^D}{M^D} \sum_{h\in\mathcal{H}} C_{dh} \left[(1 - E_{dh})\Delta \log w_{dh} - \sum_{g\in\mathcal{D}\backslash d} E_{gh}\Delta \log w_{gh}\right] - \sum_{d\in\mathcal{D}} \frac{M_d^D}{M^D}\frac{L_D}{L_d}\sum_{h\in\mathcal{H}}\sum_{f\in\mathcal{F}} C_{fh}E_{dh}\frac{L_f}{L_F}\hat{X}.\end{aligned} \tag{A24}$$

Indirect effect FOA for wage bill. Since

$$\Delta \log b_{dh} = \Delta \log w_{dh} + \Delta \log \ell_{dh} \approx [1 + \eta(1 - E_{dh})]\Delta \log w_{dh} - \eta \sum_{g\in\mathcal{D}\backslash d} E_{gh}\Delta \log w_{gh} - \sum_{f\in\mathcal{F}} C_{fh}\frac{L_D}{\bar{L}_h}\frac{L_f}{L_F}\hat{X},$$

then

$$\Delta\log\left(\sum_{h\in\mathcal{H}}b_{dh}\right)=\sum_{h\in\mathcal{H}}R_{dh}\Delta\log b_{dh}$$

$$\approx\sum_{h\in\mathcal{H}}R_{dh}\left([1+\eta(1-E_{dh})]\Delta\log w_{dh}-\eta\sum_{g\in\mathcal{D}\setminus d}E_{gh}\Delta\log w_{gh}\right)-\sum_{h\in\mathcal{H}}R_{dh}\frac{L_D}{L_{dh}}\sum_{f\in\mathcal{F}}C_{fh}E_{dh}\frac{L_f}{L_F}\hat{X},$$

and the expected change in wage bill across all domestic firm types is

$$\begin{aligned}\mathbb{E}\left[\Delta\log\left(\sum_{h\in\mathcal{H}}b_{dh}\right)\right]&=\sum_{d\in\mathcal{D}}\frac{M_d^D}{M^D}\sum_{h\in\mathcal{H}}R_{dh}\Delta\log b_{dh}\\ &\approx\sum_{d\in\mathcal{D}}\frac{M_d^D}{M^D}\sum_{h\in\mathcal{H}}R_{dh}\left([1+\eta(1-E_{dh})]\Delta\log w_{dh}-\eta\sum_{g\in\mathcal{D}\setminus d}E_{gh}\Delta\log w_{gh}\right)\\ &\quad-\sum_{d\in\mathcal{D}}\frac{M_d^D}{M^D}\sum_{h\in\mathcal{H}}R_{dh}\frac{L_D}{L_{dh}}\sum_{f\in\mathcal{F}}C_{fh}E_{dh}\frac{L_f}{L_F}\hat{X}.\end{aligned}\tag{A25}$$

Indirect effect FOA for value added.

$$\begin{aligned}\Delta\log q_d=&\Delta\log\phi_d+\Delta\log\left(\sum_{h\in\mathcal{H}}h^{\theta_d}\ell_{dh}\right)=\Delta\log\phi_d+\sum_{h\in\mathcal{H}}R_{dh}(\Delta\theta_d\log h+\Delta\log\ell_{dh})\\ \approx&\tau\sum_{f\in\mathcal{F}}\frac{\phi_f-\tilde{\phi}_d}{\tilde{\phi}_d}\frac{L_f}{L_F}\hat{X}+\sum_{h\in\mathcal{H}}R_{dh}\left(\tau\log h\sum_{f\in\mathcal{F}}(\theta_f-\tilde{\theta}_d)\frac{L_f}{L_F}\hat{X}+\Delta\log\ell_{dh}\right)\\ \approx&\sum_{h\in\mathcal{H}}R_{dh}(\Delta\log w_{dh}+\Delta\log\ell_{dh})=\sum_{h\in\mathcal{H}}R_{dh}\Delta\log b_{dh}=\Delta\log\left(\sum_{h\in\mathcal{H}}b_{dh}\right)\end{aligned}$$

Therefore,

$$\mathbb{E}\left[\Delta\log q_d\right]=\mathbb{E}\left[\Delta\log\left(\sum_{h\in\mathcal{H}}b_{dh}\right)\right]$$

Indirect effect FOA for value added per worker.

$$
\begin{aligned}
&\Delta \log q_d - \Delta \log \left(\sum_{h\in\mathcal{H}} \ell_{dh} \right) \\
\approx &\sum_{h\in\mathcal{H}} R_{dh} \left([1+\eta(1-E_{dh})]\Delta \log w_{dh} - \eta \sum_{g\in\mathcal{D}\backslash d} E_{gh}\Delta \log w_{gh} \right) - \sum_{h\in\mathcal{H}} R_{dh} \frac{L_D}{L_{dh}} \sum_{f\in\mathcal{F}} C_{fh} E_{dh} \frac{L_f}{L_F} \hat{X} \\
&- \eta \sum_{h\in\mathcal{H}} C_{dh} \left[(1-E_{dh})\Delta \log w_{dh} - \sum_{g\in\mathcal{D}\backslash d} E_{gh}\Delta \log w_{gh} \right] - \frac{L_D}{L_d} \sum_{h\in\mathcal{H}} \sum_{f\in\mathcal{F}} C_{fh} E_{dh} \frac{L_f}{L_F} \hat{X} \\
= &\sum_{h\in\mathcal{H}} \left([R_{dh} + \eta(R_{dh}-C_{dh})(1-E_{dh})]\Delta \log w_{dh} - \eta(R_{dh}-C_{dh}) \sum_{g\in\mathcal{D}\backslash d} E_{gh}\Delta \log w_{gh} \right) \\
&- \sum_{h\in\mathcal{H}} (R_{dh}-C_{dh}) \frac{L_D}{L_{dh}} \sum_{f} C_{fh} E_{dh} \frac{L_f}{L_F} \hat{X} \qquad \text{(A26)}
\end{aligned}
$$

Proposition 4 (Indirect effects with many foreign countries and skill types) *If $\min_{f\in\mathcal{F}} \phi_f \geq \max_{d\in\mathcal{D}} \tilde{\phi}_d$, $\min_{f\in\mathcal{F}} \theta_f \geq \max_{d\in\mathcal{D}} \tilde{\theta}_d$, and foreign firms have positive spillovers onto domestic firms (i.e., $\tau > 0$), then — up to a first-order approximation around an initial equilibrium featuring a small share of employment at foreign firms — an increase in the share of employment at foreign firms causes*

(a) A positive effect on mean wages at domestic firms;

(b) A positive effect on mean employment, mean wage bill, and mean value added at domestic firms if E_{dh} is sufficiently small for all $d \in \mathcal{D}$ and $h \in \mathcal{H}$;

(c) An ambiguous effect on mean value added per worker at domestic firms.

Proof. Part (a) follows from equation (A23). For part (b), when E_{dh} is sufficiently small for all d and h, the spillover effect is decreasing in E_{dh}, while the competition effect is increasing in E_{dh} in equations (A24) and (A25). When E_{dh} is sufficiently small for all d and h, the spillover effect is positive, while the competition effect approaches zero. Hence, $\mathbb{E}[\Delta \log(\sum_{h\in\mathcal{H}} \ell_{dh})] > 0$ and $\mathbb{E}[\Delta \log(\sum_{h\in\mathcal{H}} b_{dh})] = \mathbb{E}[\Delta \log q_D] > 0$. For part (c), from equation (A26), the sign is ambiguous and depends on the magnitudes of the various terms. ■

E. Direct Effects: Evidence from Movers

As an alternate to equation (10), we use a difference-in-differences design for workers that move across firms. Here, we allow for asymmetric wage changes between workers that move from domestic to foreign firms and those that move the other way. However, as in the theory, domestic and foreign are the only firm types. By looking at within-worker differences in wages, we remove the worker-specific time-invariant wage level.

To implement the difference-in-differences design for movers across firms, we define the following indicator variables:

$M_{i,t,DF}$: worker i moving from a domestic firm in $t-1$ to a foreign firm in t;
$M_{i,t,FD}$: worker i moving from a foreign firm in $t-1$ to a domestic firm in t;
$M_{i,t,DD}$: worker i moving from a domestic firm in $t-1$ to a domestic firm in t; and
$M_{i,t,FF}$: worker i moving from a foreign firm in $t-1$ to a foreign firm in t.

Equipped with these indicator variables summarizing the workers job transition status, we estimate the following regression model:

$$\log w_{i,t+1} - \log w_{i,t-2} = \beta_{FF} M_{i,t,FF} + \beta_{FD} M_{i,t,FD} + \beta_{DF} M_{i,t,DF} + \mu_{cz(i),t+1} + \nu_{ind(i),t+1} + \tilde{\mu}_{cz(i),t-2} + \tilde{\nu}_{ind(i),t-2} + \epsilon_{i,t}, \quad \text{(A27)}$$

where we omit $M_{i,t,DD}$ so that domestic to domestic moves serve as the control group. The regression controls consist of the industry-year fixed effects (both for the industry in year $t+1$ and in year $t-2$), commuting-zone-year fixed effects (both for the commuting zone in year $t+1$ and in year $t-2$), and a polynomial in age (to remove age-related wage growth). The sample consists only of workers that are in different firms in $t+1$ and $t-2$. We do not measure the outcome during the intermediate years $t-1$ and t because earnings may account for partial years of employment only while the worker is in the process of moving.

The main results are presented in Appendix Table A2. In the baseline specification, we find that moving from a domestic to a foreign firm is associated with a 6 percent increase in wages (relative to wage growth for workers who move between domestic firms), while a 4 percent decrease in wages is associated with moving from a foreign to a domestic firm (either could be interpreted as an estimate of the average foreign firm premium).[47] Appendix Figure A4 provides suggestive visual evidence that the effects are not driven by trends that existed prior to the moves. The slight asymmetry in effects is consistent with firm-worker interactions, as in Subsection F.

We consider three sample restrictions. First, we restrict the sample of domestic firms to only include non-multinationals. We find that the estimates become stronger at 8 percent when moving to a foreign firm and 6 percent when moving from a foreign firm. Second, we further restrict the sample to workers that separate in a mass layoff event. To do so, we restrict the sample to firms that had at least 10 workers in the first two years and 30 percent of those workers move to a different firm in the latter two years.[48] We find a 6 percent wage gain when moving from a domestic to a foreign firm and a 5 percent wage loss when moving in the reverse direction. Third, we restrict the domestic firms to only include multinationals. We find a 0 percent wage gain when moving from a domestic multinational to a foreign firm and a 1 percent wage gain when moving in the reverse direction. This is consistent with our

[47] Similar results for job movers are found by Martins and Esteves (2015) in Brazil.
[48] We follow Yagan (2019) in using a 30 percent separation rate threshold when defining mass layoffs.

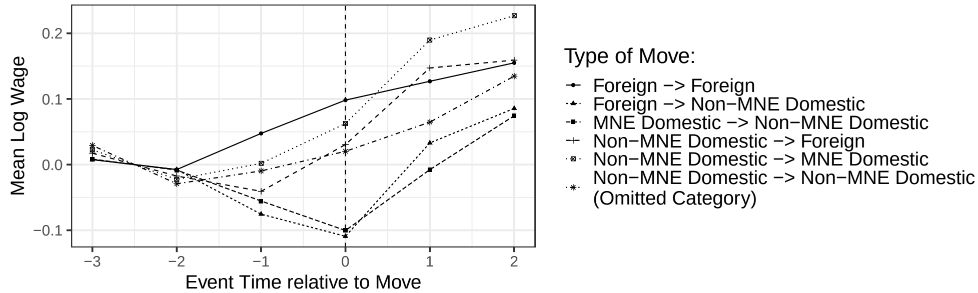
finding above that there is little to no difference in the average premiums of domestic and foreign multinationals.

TABLE A2
Difference-in-Differences Estimates of the Average Foreign Firm Premium

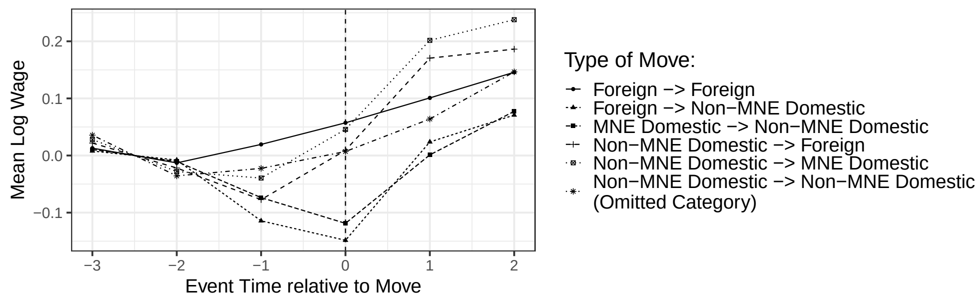
	(1)	(2)	(3)
Type of Move:			
Domestic to Foreign	0.078***	0.059***	-0.002
	(0.002)	(0.003)	(0.004)
	(N=242,207)	(N=126,178)	(N=48,795)
Foreign to Domestic	-0.056***	-0.052***	0.014***
	(0.002)	(0.004)	(0.004)
	(N=172,896)	(N=46,729)	(N=37,966)
Foreign to Foreign	0.020***	0.042***	0.006*
	(0.003)	(0.004)	(0.003)
	(N=246,192)	(N=128,396)	(N=246,192)
Domestic to Domestic	0	0	0
(Omitted Category)	(N=7,900,458)	(N=3,290,933)	(N=223,424)
Specification Details:			
Domestic Firms Restriction	Exclude MNE	Exclude MNE	Only include MNE
Type of Separation	All	Mass Layoff	All

Notes: This table presents the main effects of interest in the saturated difference-in-differences specification described in the text. The sample consists of only workers who were employed for two straight years at one firm followed by two straight years at a different firm. In column (1), we restrict the sample to domestic non-multinationals and foreign firms. In column (2), we restrict the sample to domestic non-multinationals and foreign firms and also restrict the sample to workers who separated from a firm as part of a mass layoff. In column (3), we restrict the sample to domestic multinationals and foreign firms. Standard errors are clustered by commuting-zone-year.

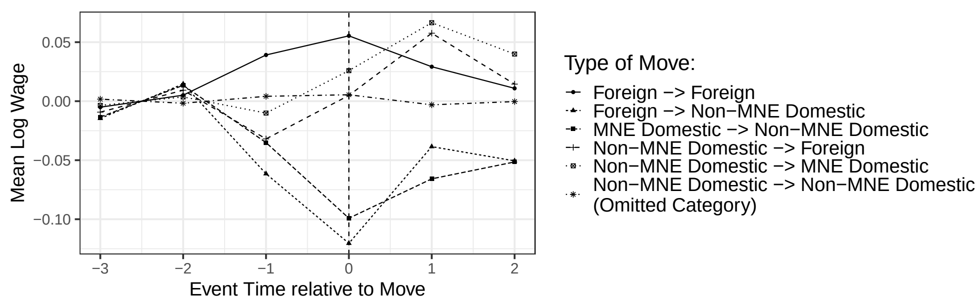
(a) Full Sample: Raw Log Wage (not controlling for age, industry-year, or CZ-year)



(b) Mass Layoff Sample: Raw Log Wage (not controlling for age, industry-year, or CZ-year)



(c) Full Sample: Residual Log Wage (controlling for age, industry-year, or CZ-year)



(d) Mass Layoff Sample: Residual Log Wage (controlling for age, industry-year, or CZ-year)

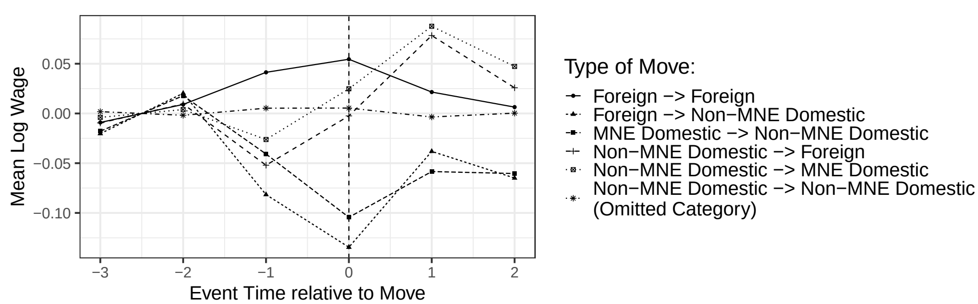


Figure A4
Event Study for Movers to and from Foreign Firms

Notes: This figure plots mean log wages for the sample of workers that move firms. Mean log wages are normalized to be zero on average over event times -3 and -2. This figure considers two samples: Full Sample (subfigures a and c), which indicates all workers satisfying the employment spell requirements, and Mass Layoff Sample (subfigures b and d), indicating workers at firms that lost 30 percent or more of their employees in a given year. It provides two measures of the mean log wage: Raw Log Wage (subfigures a and b), indicating the unadjusted log wage, and Residual Log Wage (subfigures c and d), indicating the log wage residuals from a regression on an age polynomial, commuting-zone-year fixed effects, and industry-year fixed effects.

F. Direct Effects: Extension with Firm-Worker Interactions

Identification of θ. The model of firm-specific skill-augmenting productivity presented in Appendix D implies the equilibrium wage-setting regression equation,

$$\log w_{i,t} = \psi_{j(i,t)} + \theta_j x_i + \epsilon_{i,t}.$$

Firms are grouped into k types, where all firms of the same type have the same ψ and θ. To understand how this model is identified, consider workers moving from firm type A at time t to firm type B at time $t+1$. Denoting this set of movers by $A_t \to B_{t+1}$, we consider the identifying content of the estimator $\widehat{\theta}_{A,B}$ defined by

$$\widehat{\theta}_{A,B} \equiv \frac{\mathbb{E}[\log w_{i,t+1}|A_t \to B_{t+1}] - \mathbb{E}[\log w_{i,t}|B_t \to A_{t+1}]}{\mathbb{E}[\log w_{i,t+1}|B_t \to A_{t+1}] - \mathbb{E}[\log w_{i,t}|A_t \to B_{t+1}]}.$$

The identification argument follows Bonhomme et al. (2019). First, notice that

$$\begin{aligned}
\mathbb{E}[\log w_{i,t}|A_t \to B_{t+1}] &= \psi_A + \mathbb{E}[\theta_A x_i + \epsilon_{i,t}|A_t \to B_{t+1}] \\
\mathbb{E}[\log w_{i,t+1}|A_t \to B_{t+1}] &= \psi_B + \mathbb{E}[\theta_B x_i + \epsilon_{i,t+1}|A_t \to B_{t+1}].
\end{aligned}$$

Second, we see that $\widehat{\theta}_{A,B}$ does not involve ψ, as it simplifies to

$$\begin{aligned}
\widehat{\theta}_{A,B} &= \frac{(\psi_B + \mathbb{E}[\theta_B x_i + \epsilon_{i,t+1}|A_t \to B_{t+1}]) - (\psi_B + \mathbb{E}[\theta_B x_i + \epsilon_{i,t}|B_t \to A_{t+1}])}{(\psi_A + \mathbb{E}[\theta_A x_i + \epsilon_{i,t+1}|B_t \to A_{t+1}]) - (\psi_A + \mathbb{E}[\theta_A x_i + \epsilon_{i,t}|A_t \to B_{t+1}])} \\
&= \frac{\theta_B \left(\mathbb{E}[x_i|A_t \to B_{t+1}] - \mathbb{E}[x_i|B_t \to A_{t+1}]\right) + \left(\mathbb{E}[\epsilon_{i,t+1}|A_t \to B_{t+1}] - \mathbb{E}[\epsilon_{i,t}|B_t \to A_{t+1}]\right)}{\theta_A \left(\mathbb{E}[x_i|B_t \to A_{t+1}] - \mathbb{E}[x_i|A_t \to B_{t+1}]\right) + \left(\mathbb{E}[\epsilon_{i,t+1}|B_t \to A_{t+1}] - \mathbb{E}[\epsilon_{i,t}|A_t \to B_{t+1}]\right)}.
\end{aligned}$$

Third, under the assumption that workers endogenously move across firms based only on (x, ψ, θ) but do not select moves based on the measurement error ϵ, it follows that the expectation of ϵ is zero conditional on $A_t \to B_{t+1}$ or $B_t \to A_{t+1}$. Therefore,

$$\widehat{\theta}_{A,B} = \frac{\theta_B \left(\mathbb{E}[x_i|A_t \to B_{t+1}] - \mathbb{E}[x_i|B_t \to A_{t+1}]\right) + 0}{\theta_A \left(\mathbb{E}[x_i|B_t \to A_{t+1}] - \mathbb{E}[x_i|A_t \to B_{t+1}]\right) + 0} = \frac{-\theta_B}{\theta_A}, \tag{A28}$$

where the second equality requires $\mathbb{E}[x_i|B_t \to A_{t+1}] \neq \mathbb{E}[x_i|A_t \to B_{t+1}]$. This means that different firm types must attract different skill types, which is consistent with our model and empirical findings.

Thus, for any two firm types A and B, the estimator $\widehat{\theta}_{A,B}$ identifies θ_B/θ_A. Normalizing the first firm type to $\theta = 1$, which is without loss of generality since we are only interested in relative differences, this estimator identifies θ_j for each firm j.

Estimation of θ and ψ. While the derivation above helps to understand how θ_j is identified separately from ψ_j, in practice we simultaneously estimate (ψ_j, θ_j) using the following moment equation:

$$\mathbb{E}\left[\left(\frac{\log w_{i,t+1}}{\theta_{j'}} - \frac{\psi_{j'}}{\theta_{j'}}\right) - \left(\frac{\log w_{i,t}}{\theta_j} - \frac{\psi_j}{\theta_j}\right) \Big| j(i,t) = j, j(i,t+1) = j'\right] = 0. \tag{A29}$$

With $k = 10$ firm types, there are 90 such moment equations with $j \neq j'$ that we can use to estimate the 20 parameters, so this is an over-identified system of equations for (ψ_j, θ_j). In practice, we use the limited information maximum likelihood (LIML) estimator of Bonhomme et al. (2019) and the R software implementation provided by their paper.

Identification and estimation of x. The final step is to identify x_i. To do so, we rearrange the wage equation and take the expectation across time periods for a given worker i:

$$x_i = \mathbb{E}\left[\frac{\log w_{i,t} - \psi_{j(i,t)}}{\theta_{j(i,t)}}\middle| i\right] - \mathbb{E}\left[\frac{\epsilon_{i,t}}{\theta_{j(i,t)}}\middle| i\right]. \tag{A30}$$

Again using that $j(i,t)$ is chosen exogenously of the measurement error $\epsilon_{i,t}$, the second expectation term is zero, so x_i is identified if (ψ_j, θ_j) are identified. In practice, we estimate x_i by simply replacing this moment condition with its sample counterpart

$$x_i = \frac{1}{|\mathcal{T}_i|} \sum_{t \in \mathcal{T}_i} \frac{\log w_{i,t} - \psi_{i,j(i,t)}}{\theta_{i,j(i,t)}}, \tag{A31}$$

where $\mathcal{T}_i$ denotes the set of time periods during which individual i is employed, and the right-hand side uses the estimates of (ψ_j, θ_j) discussed above. See also Lamadon et al. (2020) for related discussion.

Clustering firms into types. We demonstrated above that, given the k firm types, we identify (x_i, ψ_j, θ_j). To determine the assignment of firms to types, we follow Bonhomme et al. (2019) in grouping firms into k clusters using the k-means algorithm applied to the within-firm distribution of log wages. Let $c(j)$ denote the cluster of firm j, where $c = 1, 2, ..., k$. To determine the clusters, we solve the weighted k-means problem

$$\min_{c(1),\ldots,c(J),H_1,\ldots,H_k} \sum_{j=1}^{J} N_j \int \left(\widehat{F}_j(w) - H_{c(j)}(w)\right)^2 d\mu(w),$$

where $\widehat{F}_j(w)$ denotes the empirical cumulative distribution function (CDF) of log wages within firm j, N_j is the total number of workers in firm j, μ is the measure corresponding to a grid of quantiles at which the CDF is evaluated, and H_c is a candidate CDF of the log wages in cluster c. The algorithm seeks the partition of firms to clusters as well as the set of within-cluster CDFs that minimize this weighted sum of squared deviations between the empirical CDF and the candidate CDF (evaluated at the specified quantiles). In practice, we evaluate the CDF at 20 equally-spaced quantiles, and repeat the algorithm at 100 random starting values, choosing the partition associated with the starting value that achieves the lowest value of the objective function.

Expected firm premiums with firm-worker interactions. Given the firm types and the estimates of (x_i, ψ_j, θ_j), we can estimate the expected firm premiums in the model with firm-worker interactions. Using the wage equation above, the premium for a worker of type x of being employed by a firm of type B relative to a firm of type A is

$$(\psi_B + \theta_B x) - (\psi_A + \theta_A x).$$

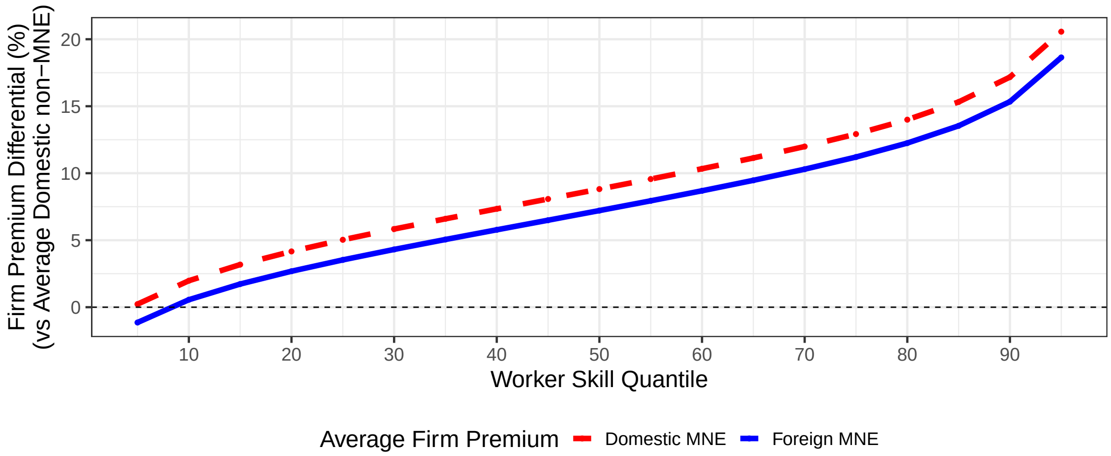


Figure A5
Firm Premiums with Firm-Worker Interactions

Notes: This figure presents estimates of the model in equation (11) from the grouped fixed effect estimator during 2010-2015. The horizontal axis is a quantile in the distribution of estimated worker skill level. The vertical axis is the difference in the average firm premium for a worker of a given skill level for foreign (blue, solid line) or domestic (red, dashed line) multinationals, relative to the average domestic non-multinational.

In our empirical application, we compare foreign multinationals and domestic non-multinationals. Let $P_F(k)$ denote the share of foreign multinationals that are of type k, and $P_D(k)$ denote the share of domestic non-multinationals that are of type k. For a worker of type x, the expected difference in wages when employed by a foreign firm (drawn randomly with probability $P_F(k)$) versus a domestic firm (drawn randomly with probability $P_D(k)$) is,

$$\sum_k (\psi_k + \theta_k x)\,(P_F(k) - P_D(k))$$

This is the expected direct effect, or foreign firm premium, for a worker of type x — it is the difference in log wages that a worker of type x is expected to receive at a randomly drawn foreign multinational versus a randomly drawn domestic non-multinational. We now estimate this quantity for various quantiles in the empirical distribution of x.

Results. Figure A5 presents the mean difference in firm premiums between foreign and domestic firms for workers who have above average and below average quality using the estimated parameters from equation (11), finding substantial differences. We find that the foreign firm premium is monotonically increasing in the skill of workers compared to the premium offered by domestic non-multinationals to workers of the same skill. Foreign multinationals pay a 19 percent greater premium to workers in the top skill decile, but a 1 percent negative premium to workers in the bottom skill decile. Furthermore, we find that domestic-owned multinationals pay a 21 percent greater premium to workers in the top skill decile than domestic non-multinationals, but no premium to workers in the bottom skill decile. These results are consistent with multinationals having more skill-augmenting technology than non-multinationals. Skill-augmenting technology would lead multinational firms (both foreign owned and domestic owned) to bid up the price of local labor for skilled workers such as managers, as found by Bloom et al. (2019), but not bid up the price of routine labor.

G. Direct Effects: Supplementary Results

(a) Firm Premium Differential (%) (b) Skill Composition Differential (%)

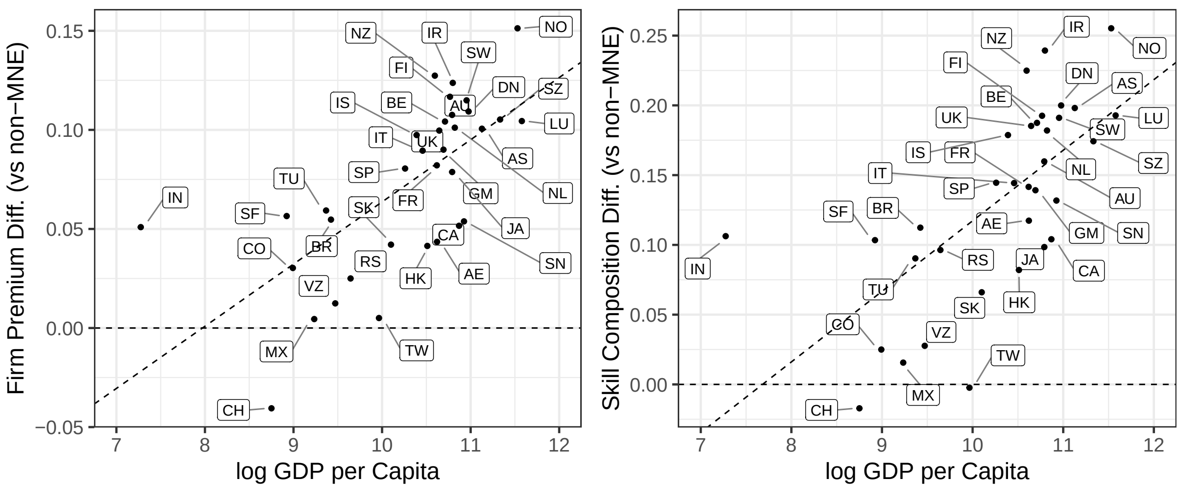


Figure A6

Direct Effects: Comparison to GDP per Capita

Notes: This figure presents estimates of equation (10) from the grouped fixed effect estimator during 2010-2015. The vertical axis is the difference in the average firm premium (subfigure a) or average worker skill level (subfigure b) for foreign multinationals with the countries of ownership indicated by the labels, relative to the average domestic non-multinational.

(a) Firm Premium Differential (%) (b) Skill Composition Differential (%)

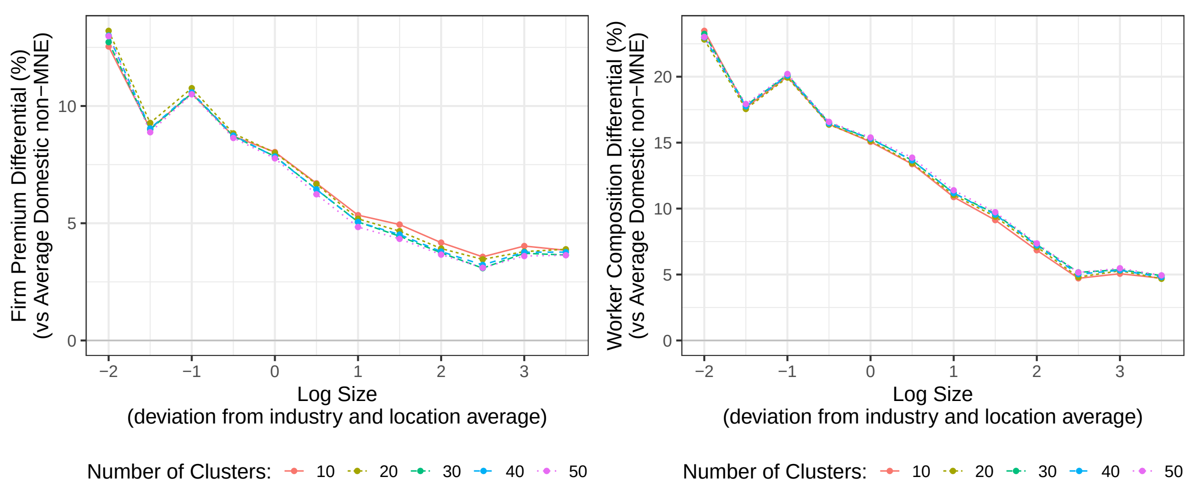


Figure A7

Direct Effects: Robustness to Number of Clusters

Notes: This figure presents estimates of equation (10) from the grouped fixed effect estimator during 2010-2015 for different numbers of firm clusters. The horizontal axis is an equally spaced grid of width 0.5 in the residual log firm size distribution, where each unit is associated with the nearest grid point. The vertical axis is the difference in the average firm premium (subfigure a) or average worker skill level (subfigure b) for foreign multinationals, relative to the average domestic non-multinational in the same size bin.

(a) Firm Premium Differential (%) (b) Skill Composition Differential (%)

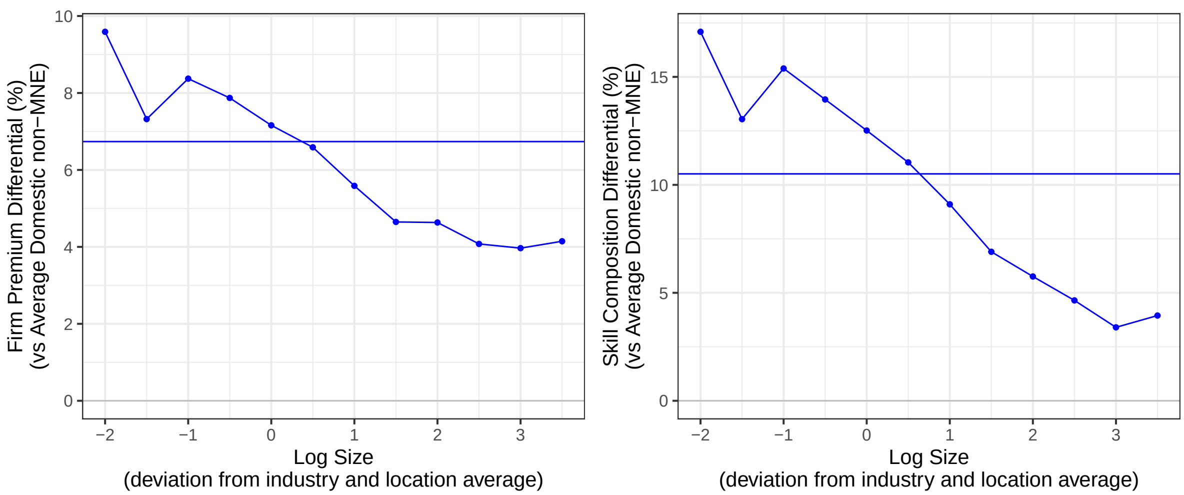


Figure A8

Direct Effects: Estimates for 2001-2006

Notes: This figure presents estimates of the model in equation (10) from the grouped fixed effect estimator during 2001-2006. The horizontal axis is an equally spaced grid of width 0.5 in the residual log firm size distribution, where each unit is associated with the nearest grid point. The vertical axis is the difference in the average firm premium (subfigure a) or average worker skill level (subfigure b) for foreign multinationals, relative to the average domestic non-multinational in the same size bin. The horizontal lines indicate the overall averages (not conditional on a size bin).

H. Indirect Effects: Alternative Specifications and Robustness Checks

We now provide alternative specifications and robustness checks for the indirect effects.

Placebo tests: To improve our confidence in the orthogonality of the country of origin shocks to local growth factors, we provide a placebo test. This test uses the log changes in domestic firms' value added, wage bill, employment, and earnings of continuous workers measured in the pre-period (i.e., before the exposure shares are measured) as if they were the contemporaneous outcomes. Under our orthogonality assumption, contemporaneous country of origin shocks should not predict growth in the pre-period, conditional on the control variables. The placebo test results are presented in Appendix Table A3. The estimated second-stage coefficients become small in magnitude and statistically insignificant for all of the outcomes, consistent with our identifying assumption.

Alternative control sets: Appendix Table A4 adds controls one at a time in order to examine the sensitivity of the main results to additional controls, as well as to help understand which of the controls in our baseline specification are important. Appendix Table A5 performs the same exercise but for the OLS estimates that do not use the instrumental variable. First, as predicted above, industry-year and Census-division-year controls are important, so we include these in the baseline specification. Second, we find some marginal sensitivity to adding urban concentration controls, perhaps because of the disproportionate representation of foreign multinationals in major urban areas. Third, the results are not statistically significantly different when adding commuting zone controls for educational attainment, poverty and unemployment, or farm and manufacturing concentration. Fourth, we consider interacting the commuting-zone-year domestic employment share measure with indicators for the financial crisis of 2007-2009 as well as with all 3-year intervals in the outcome sample, finding similar results though with some loss in precision.

Controlling for past country of origin shocks: One potential concern with shift-share instruments is that, if the shocks have impacts that are slowly evolving over time, then the estimated second-stage coefficient will conflate the effects of contemporaneous and past shocks, resulting in biased estimates of the effects of contemporaneous shocks. Jaeger et al. (2018) provide theoretical justification for this type of bias in the context of immigration and propose the natural correction (i.e., controlling for lagged shocks corrects for the bias induced by lagged shocks). In column (2) of Table A6, we show that our results are nearly identical when controlling for the lagged shocks, implying that our results are not confounded by slow adjustments to past shocks.[49]

Controlling for finer industry shocks: In column (3) of Table A6, we show that the results are robust to replacing the 3-digit NAICS industry-year fixed effects with fully disaggregated 6-digit NAICS industry-year fixed effects. This suggests that we have successfully controlled for all relevant industry shocks with the baseline industry-year fixed effects.

Leaving out nearby commuting zones: A potential concern is that some workers reside in one commuting zone but commute to work in a different commuting zone nearby. As a result, workers may be affected by country of origin employment growth shocks in nearby

[49] In practice, we follow the implementation suggested by Borusyak et al. (2020, footnote 22). In particular, we control linearly for a lagged instrument constructed using the same exposure shares as the main instrument, but measuring the aggregate employment growth by a country of origin between $t-2$ and $t-1$ instead of between $t-1$ and t. To allow for more complicated dynamics, we also verify that results are robust to simultaneously controlling for shocks between $t-2$ and $t-1$ and between $t-3$ and $t-2$.

commuting zones, which is not captured in our baseline specification. To investigate the sensitivity of our results to shocks in nearby commuting zones, we consider not only leaving out the worker's own commuting zone when constructing the shocks, but also leaving out any commuting zone within a specified radius of the worker's own commuting zone. In Appendix Table A7, we consider leaving out any commuting zone within a radius of 50 miles, 100 miles, 150 miles, 200 miles, 250 miles, or 300 miles of the worker's own commuting zone. The top of the table characterizes the distributions of the number of commuting zones left out. When using a 300-mile radius, the nearest 76 commuting zones are left out on average, with at least 117 commuting zones left out for one-fourth of the observations. Despite leaving out so many commuting zones over such a long distance, we find that the results are nearly the same, indicating that cross-commuting-zone commutes do not confound our estimates. We also consider leaving out any foreign investment in the same Census division as the worker, which amounts to leaving out 77 commuting zones on average when constructing the shocks, again finding that our results are robust to this exercise.

Excluding domestic multinationals: A possible threat to identification is that aggregate employment growth from a specific country of origin may lower transportation costs for U.S. exports to that country. For example, if Germany opens a plant in South Carolina and invests in shipping lanes from Germany to South Carolina, these shipping lanes could also be used by South Carolina domestic firms to increase exports to Germany. Although export transactions are not available in our data, most U.S. exports are carried out by multinationals (Bernard et al., 2005). When restricting the domestic sample to only non-multinationals in column (5) of Table A6, we find that the estimates are unaffected, indicating that the effects are not due to transportation costs faced by domestic exporters.

Excluding tax havens: A potential concern is that tax havens should not be included as foreign countries of ownership in our analysis, as some firms owned in tax havens may be misclassified domestic-owned firms. Hines (2010) classifies 52 countries as tax havens. We consider excluding all 52 tax havens from the analysis as a robustness check in column (6) of Table A6.[50] We find that the indirect effect estimates are not greatly affected or become slightly stronger when excluding tax havens.

DHS transformation of the outcome variables: Our indirect effect estimates so far have been provided for continuing domestic firms. As an alternative approach, we consider the transformation of Davis et al. (1998, "DHS") rather than log changes. The advantage of this approach is that it incorporates entry and exit into the outcome measures.[51] The results are provided in column (7) of Table A6. We find that the estimated effects become stronger, which ameliorates any concern that our main effects for continuing firms arise from survival bias. On the contrary, our results indicate net entry of domestic firms due to foreign employment growth.

[50] Using the inverse HHI measure proposed by Borusyak et al. (2020), the effective number of country shocks falls from 154 to 122, indicating that we drop about one-fifth of all effective country of origin shocks. We report this inverse HHI measure for all results shown in Table A6.

[51] In particular, the DHS transformation is $2\frac{Y_{j,t}-Y_{j,t-1}}{Y_{j,t}+Y_{j,t-1}}$. If $Y_{j,t} > 0$ and $Y_{j,t-1} > 0$, this transformation is approximately $\log(Y_t) - \log(Y_{j,t-1})$. Thus, any differences between our baseline results in log changes and the results from the DHS transformation are due to firms with $Y_{j,t} \leq 0$ or $Y_{j,t-1} \leq 0$, such as firms that employ no workers at either t or $t-1$. Note that we usually weight firms by the number of workers at $t-1$. Of course, the number of workers is zero at $t-1$ for new entrants. Instead, we weight firms by the average number of workers across t and $t-1$ in the regressions with DHS transformations.

TABLE A3
Indirect Effects Estimates: Placebo Tests

	Value Added		**Employment**		**Wage bill**		**Earnings of Cont. Workers**	
	Main	**Placebo**	**Main**	**Placebo**	**Main**	**Placebo**	**Main**	**Placebo**
Second-Stage:								
Coefficient	**0.96**	**-0.05**	**0.53**	**-0.17**	**0.63**	**-0.09**	**0.15**	**0.04**
(Std. Error Clustered by Commuting Zone)	(0.30)	(0.22)	(0.14)	(0.12)	(0.17)	(0.16)	(0.07)	(0.09)
(Std. Error Clustered by Country of Origin)	(0.51)	(0.45)	(0.18)	(0.14)	(0.22)	(0.16)	(0.08)	(0.09)
First-Stage:								
Coefficient	0.56	0.66	0.56	0.66	0.56	0.66	0.56	0.67
(F-statistic Clustered by Commuting Zone)	(232)	(341)	(235)	(351)	(235)	(351)	(239)	(360)
(F-statistic Clustered by Country of Origin)	(42)	(27)	(44)	(27)	(44)	(27)	(44)	(26)
Number of Firms by Commuting Zones (Millions)	41.8	36.2	46.0	38.7	46.0	38.7	44.6	37.6
Number of Workers (Millions, measured at $t-1$)	416.8	402.0	477.3	441.1	477.3	441.1	369.6	336.8

Notes: The outcome sample only includes continuing domestic firms. Observations are weighted by lagged firm size. Controls are industry-year indicators, Census-division-year indicators, measures of urban concentration, and the sum of commuting zone exposure shares. Placebo outcomes are measured as changes between t_0-2 and t_0-1, where t_0 is the time period at which the exposure shares are measured.

TABLE A4
Indirect Effect Estimates: Alternative Control Sets

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Control Specification									
CZ-year domestic employment share	✓	✓	✓	✓	✓	✓	✓	✓	✓
Industry-year fixed effects	✗	✓	✓	✓	✓	✓	✓	✓	✓
Census-division-year fixed effects	✗	✗	✓	✓	✓	✓	✓	✓	✓
CZ controls:									
Urban density measures (pre-period)	✗	✗	✗	✓	✓	✓	✓	✓	✓
Educational attainment measures (pre-period)	✗	✗	✗	✗	✓	✓	✓	✓	✓
Poverty and employment measures (pre-period)	✗	✗	✗	✗	✗	✓	✓	✓	✓
Farm and manufacturing measures (pre-period)	✗	✗	✗	✗	✗	✗	✓	✓	✓
CZ-year domestic employment share × Financial Crisis	✗	✗	✗	✗	✗	✗	✗	✓	✓
CZ-year domestic employment share × All 3-year intervals	✗	✗	✗	✗	✗	✗	✗	✗	✓
Panel A.	**Outcome: Log Change in Value Added**								
Second-Stage Coefficient	**-0.26**	**0.66**	**1.01**	**0.96**	**0.93**	**0.90**	**0.90**	**0.88**	**1.13**
(Std. Error Clustered by Commuting Zone)	(0.15)	(0.27)	(0.32)	(0.30)	(0.30)	(0.30)	(0.30)	(0.31)	(0.49)
(Std. Error Clustered by Country of Origin)	(0.37)	(0.44)	(0.50)	(0.51)	(0.50)	(0.49)	(0.49)	(0.48)	(0.90)
First-Stage Coefficient	0.96	0.61	0.56	0.56	0.56	0.56	0.56	0.55	0.44
(F-statistic Clustered by Commuting Zone)	(2,890)	(232)	(232)	(232)	(233)	(232)	(231)	(224)	(100)
(F-statistic Clustered by Country of Origin)	(1,367)	(30)	(42)	(42)	(43)	(42)	(42)	(40)	(19)
Number of Firms by Commuting Zones (Millions)	41.8	41.8	41.8	41.8	41.8	41.8	41.8	41.8	41.8
Number of Workers (Millions, measured at $t-1$)	416.8	416.8	416.8	416.8	416.8	416.8	416.6	416.6	416.6
Panel B.	**Outcome: Log Change in Employment**								
Second-Stage Coefficient	**-0.24**	**0.46**	**0.60**	**0.53**	**0.50**	**0.46**	**0.46**	**0.46**	**0.66**
(Std. Error Clustered by Commuting Zone)	(0.07)	(0.15)	(0.15)	(0.14)	(0.13)	(0.13)	(0.13)	(0.13)	(0.21)
(Std. Error Clustered by Country of Origin)	(0.18)	(0.20)	(0.22)	(0.18)	(0.18)	(0.17)	(0.17)	(0.17)	(0.30)
First-Stage Coefficient	0.95	0.61	0.56	0.56	0.56	0.56	0.56	0.56	0.44
(F-statistic Clustered by Commuting Zone)	(2,890)	(233)	(235)	(235)	(236)	(235)	(234)	(227)	(102)
(F-statistic Clustered by Country of Origin)	(1,402)	(30)	(44)	(44)	(44)	(44)	(43)	(42)	(19)
Number of Firms by Commuting Zones (Millions)	46.0	46.0	46.0	46.0	46.0	46.0	45.9	45.9	45.9
Number of Workers (Millions, measured at $t-1$)	477.3	477.3	477.3	477.3	477.3	477.3	477.1	477.1	477.1
Panel C.	**Outcome: Log Change in Wage Bill**								
Second-Stage Coefficient	**-1.19**	**0.54**	**0.70**	**0.63**	**0.59**	**0.55**	**0.54**	**0.53**	**0.72**
(Std. Error Clustered by Commuting Zone)	(0.14)	(0.18)	(0.18)	(0.17)	(0.16)	(0.16)	(0.16)	(0.16)	(0.26)
(Std. Error Clustered by Country of Origin)	(0.36)	(0.25)	(0.25)	(0.22)	(0.22)	(0.21)	(0.20)	(0.20)	(0.35)
First-Stage Coefficient	0.95	0.61	0.56	0.56	0.56	0.56	0.56	0.56	0.44
(F-statistic Clustered by Commuting Zone)	(2,890)	(233)	(235)	(235)	(236)	(235)	(234)	(227)	(102)
(F-statistic Clustered by Country of Origin)	(1,402)	(30)	(44)	(44)	(44)	(44)	(43)	(42)	(19)
Number of Firms by Commuting Zones (Millions)	46.0	46.0	46.0	46.0	46.0	46.0	45.9	45.9	45.9
Number of Workers (Millions, measured at $t-1$)	477.3	477.3	477.3	477.3	477.3	477.3	477.1	477.1	477.1
Panel D.	**Outcome: Log Change in Earnings of Cont. Workers**								
Second-Stage Coefficient	**-1.21**	**0.11**	**0.17**	**0.15**	**0.13**	**0.13**	**0.13**	**0.11**	**0.13**
(Std. Error Clustered by Commuting Zone)	(0.08)	(0.08)	(0.08)	(0.07)	(0.07)	(0.07)	(0.07)	(0.07)	(0.11)
(Std. Error Clustered by Country of Origin)	(0.23)	(0.11)	(0.09)	(0.08)	(0.07)	(0.07)	(0.07)	(0.07)	(0.13)
First-Stage Coefficient	0.95	0.61	0.56	0.56	0.56	0.56	0.56	0.56	0.44
(F-statistic Clustered by Commuting Zone)	(2,930)	(238)	(239)	(239)	(240)	(239)	(238)	(231)	(104)
(F-statistic Clustered by Country of Origin)	(1,340)	(29)	(43)	(44)	(44)	(43)	(43)	(41)	(19)
Number of Firms by Commuting Zones (Millions)	44.6	44.6	44.6	44.6	44.6	44.6	44.6	44.6	44.6
Number of Workers (Millions, measured at $t-1$)	369.6	369.6	369.6	369.6	369.6	369.6	369.5	369.5	369.5

Notes: The outcome sample only includes continuing domestic firms. Observations are weighted by lagged firm size. Controls are indicated at the top of the table. Our baseline control set is in column (4).

TABLE A5
Indirect Effect Estimates: OLS Estimates for Various Control Sets

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Control Specification									
CZ-year domestic employment share	✓	✓	✓	✓	✓	✓	✓	✓	✓
Industry-year fixed effects	✗	✓	✓	✓	✓	✓	✓	✓	✓
Census-division-year fixed effects	✗	✗	✓	✓	✓	✓	✓	✓	✓
CZ controls:									
Urban density measures (pre-period)	✗	✗	✗	✓	✓	✓	✓	✓	✓
Educational attainment measures (pre-period)	✗	✗	✗	✗	✓	✓	✓	✓	✓
Poverty and employment measures (pre-period)	✗	✗	✗	✗	✗	✓	✓	✓	✓
Farm and manufacturing measures (pre-period)	✗	✗	✗	✗	✗	✗	✓	✓	✓
CZ-year domestic employment share × Financial Crisis	✗	✗	✗	✗	✗	✗	✗	✓	✓
CZ-year domestic employment share × All 3-year intervals	✗	✗	✗	✗	✗	✗	✗	✗	✓
Panel A.	**Outcome: Log Change in Value Added**								
OLS Coefficient	**0.05**	**0.49**	**0.34**	**0.33**	**0.33**	**0.32**	**0.32**	**0.31**	**0.31**
(Std. Error Clustered by Commuting Zone)	(0.13)	(0.10)	(0.08)	(0.08)	(0.08)	(0.08)	(0.08)	(0.08)	(0.08)
Number of Firms by Commuting Zones (Millions)	41.8	41.8	41.8	41.8	41.8	41.8	41.8	41.8	41.8
Number of Workers (Millions, measured at $t-1$)	416.8	416.8	416.8	416.8	416.8	416.8	416.6	416.6	416.6
Panel B.	**Outcome: Log Change in Employment**								
OLS Coefficient	**-0.03**	**0.28**	**0.24**	**0.22**	**0.22**	**0.21**	**0.21**	**0.21**	**0.22**
(Std. Error Clustered by Commuting Zone)	(0.07)	(0.05)	(0.05)	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)
Number of Firms by Commuting Zones (Millions)	46.0	46.0	46.0	46.0	46.0	46.0	45.9	45.9	45.9
Number of Workers (Millions, measured at $t-1$)	477.3	477.3	477.3	477.3	477.3	477.3	477.1	477.1	477.1
Panel C.	**Outcome: Log Change in Wage Bill**								
OLS Coefficient	**-0.58**	**0.39**	**0.31**	**0.29**	**0.30**	**0.29**	**0.29**	**0.28**	**0.29**
(Std. Error Clustered by Commuting Zone)	(0.13)	(0.07)	(0.05)	(0.05)	(0.05)	(0.05)	(0.05)	(0.05)	(0.05)
Number of Firms by Commuting Zones (Millions)	46.0	46.0	46.0	46.0	46.0	46.0	45.9	45.9	45.9
Number of Workers (Millions, measured at $t-1$)	477.3	477.3	477.3	477.3	477.3	477.3	477.1	477.1	477.1
Panel D.	**Outcome: Log Change in Earnings of Cont. Workers**								
OLS Coefficient	**-0.68**	**0.16**	**0.13**	**0.13**	**0.13**	**0.13**	**0.13**	**0.12**	**0.13**
(Std. Error Clustered by Commuting Zone)	(0.09)	(0.03)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
Number of Firms by Commuting Zones (Millions)	44.6	44.6	44.6	44.6	44.6	44.6	44.6	44.6	44.6
Number of Workers (Millions, measured at $t-1$)	369.6	369.6	369.6	369.6	369.6	369.6	369.5	369.5	369.5

Notes: The outcome sample only includes continuing domestic firms. Observations are weighted by lagged firm size. Controls are indicated at the top of the table. Our baseline control set is in column (4).

TABLE A6
Indirect Effects Estimates: Robustness Checks

	(1) Baseline	(2) Control Lag IV	(3) Control NAICS-6	(4) Leave out 300m Radius	(5) Exclude Dom MNE	(6) Exclude Tax Havens	(7) DHS Transform
Panel A.	**Outcome: Log Change in Value Added**						
Second-Stage Coefficient	**0.96**	**0.98**	**0.93**	**0.97**	**0.87**	**1.10**	**1.44**
(Std. Error Clustered by Commuting Zone)	(0.30)	(0.32)	(0.26)	(0.35)	(0.25)	(0.36)	(0.47)
(Std. Error Clustered by Country of Origin)	(0.51)	(0.51)	(0.34)	(0.51)	(0.35)	(0.62)	(0.53)
First-Stage Coefficient	0.56	0.54	0.56	0.59	0.57	0.55	0.57
(F-statistic Clustered by Commuting Zone)	(232)	(208)	(233)	(143)	(260)	(233)	(264)
(F-statistic Clustered by Country of Origin)	(42)	(42)	(43)	(42)	(40)	(35)	(41)
Number of Firms by Commuting Zones (Millions)	41.8	40.5	41.8	41.8	40.6	41.8	66.6
Number of Workers (Millions, measured at $t-1$)	416.8	401.0	416.8	416.8	344.1	416.8	497.8
Effective Number of Country Shocks (Inverse HHI)	153.6	153.6	153.6	153.6	153.6	122.2	153.6
Panel B.	**Outcome: Log Change in Employment**						
Second-Stage Coefficient	**0.53**	**0.56**	**0.50**	**0.56**	**0.42**	**0.55**	**0.83**
(Std. Error Clustered by Commuting Zone)	(0.14)	(0.15)	(0.14)	(0.17)	(0.14)	(0.17)	(0.29)
(Std. Error Clustered by Country of Origin)	(0.18)	(0.18)	(0.17)	(0.18)	(0.18)	(0.22)	(0.23)
First-Stage Coefficient	0.56	0.54	0.56	0.59	0.57	0.55	0.58
(F-statistic Clustered by Commuting Zone)	(235)	(211)	(236)	(145)	(258)	(241)	(270)
(F-statistic Clustered by Country of Origin)	(44)	(43)	(44)	(44)	(42)	(37)	(41)
Number of Firms by Commuting Zones (Millions)	46.0	44.6	46.0	46.0	44.6	46.0	69.2
Number of Workers (Millions, measured at $t-1$)	477.3	459.6	477.3	477.3	395.6	477.3	519.7
Effective Number of Country Shocks (Inverse HHI)	153.6	153.6	153.6	153.6	153.6	122.2	153.6
Panel C.	**Outcome: Log Change in Wage Bill**						
Second-Stage Coefficient	**0.63**	**0.61**	**0.59**	**0.69**	**0.49**	**0.67**	**0.88**
(Std. Error Clustered by Commuting Zone)	(0.17)	(0.19)	(0.17)	(0.21)	(0.17)	(0.20)	(0.29)
(Std. Error Clustered by Country of Origin)	(0.22)	(0.22)	(0.21)	(0.22)	(0.22)	(0.27)	(0.26)
First-Stage Coefficient	0.56	0.54	0.56	0.59	0.57	0.55	0.58
(F-statistic Clustered by Commuting Zone)	(235)	(211)	(236)	(145)	(258)	(241)	(270)
(F-statistic Clustered by Country of Origin)	(44)	(43)	(44)	(44)	(42)	(37)	(41)
Number of Firms by Commuting Zones (Millions)	46.0	44.6	46.0	46.0	44.6	46.0	69.2
Number of Workers (Millions, measured at $t-1$)	477.3	459.6	477.3	477.3	395.6	477.3	519.7
Effective Number of Country Shocks (Inverse HHI)	153.6	153.6	153.6	153.6	153.6	122.2	153.6
Panel D.	**Outcome: Log Change in Earnings of Continuing Workers**						
Second-Stage Coefficient	**0.15**	**0.10**	**0.13**	**0.17**	**0.09**	**0.15**	**0.15**
(Std. Error Clustered by Commuting Zone)	(0.07)	(0.08)	(0.07)	(0.09)	(0.07)	(0.08)	(0.07)
(Std. Error Clustered by Country of Origin)	(0.08)	(0.08)	(0.07)	(0.08)	(0.07)	(0.09)	(0.08)
First-Stage Coefficient	0.56	0.55	0.56	0.59	0.57	0.56	0.56
(F-statistic Clustered by Commuting Zone)	(239)	(214)	(240)	(150)	(265)	(247)	(239)
(F-statistic Clustered by Country of Origin)	(44)	(43)	(44)	(44)	(41)	(37)	(44)
Number of Firms by Commuting Zones (Millions)	44.6	43.3	44.6	44.6	43.3	44.6	44.6
Number of Workers (Millions, measured at $t-1$)	369.6	356.0	369.6	369.6	304.3	369.6	369.6
Effective Number of Country Shocks (Inverse HHI)	153.6	153.6	153.6	153.6	153.6	122.2	153.6

Notes: The outcome sample only includes continuing domestic firms (unless otherwise specified). Observations are weighted by lagged firm size (unless otherwise specified). Controls are industry-year indicators, Census-division-year indicators, measures of urban concentration, and the sum of commuting zone exposure shares (unless otherwise specified).

TABLE A7
Indirect Effects Estimates: Leave-out Specifications

	Leave out No CZ (include Own)	Leave out Own CZ	Leave out CZs within Radius (based on nearest distance in miles)						Leave out Entire Census Division
			50	100	150	200	250	300	
	Number of CZs excluded								
Mean	0	1	7	16	28	42	59	76	77
25th quantile	0	1	5	10	17	24	30	37	58
50th quantile	0	1	8	16	28	42	57	74	84
75th quantile	0	1	9	21	38	59	84	114	104
Panel A.	**Outcome: Log Change in Value Added**								
Second-Stage Coefficient	**0.87**	**0.96**	**0.96**	**0.94**	**0.95**	**0.97**	**1.01**	**0.97**	**0.89**
(Std. Error Clustered by Commuting Zone)	(0.28)	(0.30)	(0.32)	(0.33)	(0.32)	(0.33)	(0.33)	(0.35)	(0.32)
(Std. Error Clustered by Country of Origin)	(0.51)	(0.51)	(0.51)	(0.51)	(0.51)	(0.51)	(0.51)	(0.51)	(0.51)
First-Stage Coefficient	0.59	0.56	0.56	0.56	0.58	0.58	0.59	0.59	0.61
(F-statistic Clustered by Commuting Zone)	(273)	(232)	(212)	(199)	(185)	(172)	(161)	(143)	(189)
(F-statistic Clustered by Country of Origin)	(42)	(42)	(42)	(42)	(42)	(42)	(42)	(42)	(42)
Number of Firms by Commuting Zones (Millions)	41.8	41.8	41.8	41.8	41.8	41.8	41.8	41.8	41.8
Number of Workers (Millions, measured at $t-1$)	416.8	416.8	416.8	416.8	416.8	416.8	416.8	416.8	416.8
Panel B.	**Outcome: Log Change in Employment**								
Second-Stage Coefficient	**0.52**	**0.53**	**0.54**	**0.55**	**0.55**	**0.55**	**0.57**	**0.56**	**0.55**
(Std. Error Clustered by Commuting Zone)	(0.13)	(0.14)	(0.15)	(0.15)	(0.15)	(0.16)	(0.16)	(0.17)	(0.15)
(Std. Error Clustered by Country of Origin)	(0.18)	(0.18)	(0.18)	(0.18)	(0.18)	(0.18)	(0.18)	(0.18)	(0.18)
First-Stage Coefficient	0.59	0.56	0.56	0.56	0.58	0.58	0.59	0.59	0.61
(F-statistic Clustered by Commuting Zone)	(277)	(235)	(214)	(201)	(188)	(175)	(163)	(145)	(192)
(F-statistic Clustered by Country of Origin)	(44)	(44)	(44)	(44)	(44)	(44)	(44)	(44)	(44)
Number of Firms by Commuting Zones (Millions)	46.0	46.0	46.0	46.0	46.0	46.0	46.0	46.0	46.0
Number of Workers (Millions, measured at $t-1$)	477.3	477.3	477.3	477.3	477.3	477.3	477.3	477.3	477.3
Panel C.	**Outcome: Log Change in Wage Bill**								
Second-Stage Coefficient	**0.61**	**0.63**	**0.64**	**0.64**	**0.65**	**0.66**	**0.69**	**0.69**	**0.64**
(Std. Error Clustered by Commuting Zone)	(0.16)	(0.17)	(0.18)	(0.18)	(0.19)	(0.19)	(0.20)	(0.21)	(0.18)
(Std. Error Clustered by Country of Origin)	(0.22)	(0.22)	(0.22)	(0.22)	(0.22)	(0.22)	(0.22)	(0.22)	(0.22)
First-Stage Coefficient	0.59	0.56	0.56	0.56	0.58	0.58	0.59	0.59	0.61
(F-statistic Clustered by Commuting Zone)	(277)	(235)	(214)	(201)	(188)	(175)	(163)	(145)	(192)
(F-statistic Clustered by Country of Origin)	(44)	(44)	(44)	(44)	(44)	(44)	(44)	(44)	(44)
Number of Firms by Commuting Zones (Millions)	46.0	46.0	46.0	46.0	46.0	46.0	46.0	46.0	46.0
Number of Workers (Millions, measured at $t-1$)	477.3	477.3	477.3	477.3	477.3	477.3	477.3	477.3	477.3
Panel D.	**Outcome: Log Change in Earnings of Continuing Workers**								
Second-Stage Coefficient	**0.15**	**0.15**	**0.14**	**0.14**	**0.15**	**0.16**	**0.17**	**0.17**	**0.14**
(Std. Error Clustered by Commuting Zone)	(0.07)	(0.07)	(0.07)	(0.08)	(0.08)	(0.08)	(0.08)	(0.09)	(0.08)
(Std. Error Clustered by Country of Origin)	(0.08)	(0.08)	(0.08)	(0.08)	(0.08)	(0.08)	(0.08)	(0.08)	(0.08)
First-Stage Coefficient	0.59	0.56	0.56	0.56	0.58	0.59	0.59	0.59	0.61
(F-statistic Clustered by Commuting Zone)	(281)	(239)	(218)	(205)	(192)	(179)	(167)	(150)	(196)
(F-statistic Clustered by Country of Origin)	(44)	(44)	(44)	(44)	(44)	(44)	(44)	(44)	(44)
Number of Firms by Commuting Zones (Millions)	44.6	44.6	44.6	44.6	44.6	44.6	44.6	44.6	44.6
Number of Workers (Millions, measured at $t-1$)	369.6	369.6	369.6	369.6	369.6	369.6	369.6	369.6	369.6

Notes: The outcome sample only includes continuing domestic firms. Observations are weighted by lagged firm size. Controls are industry-year indicators, Census-division-year indicators, measures of urban concentration, and the sum of commuting zone exposure shares. Our baseline specification is in column (2).