Supplemental Appendix: "Across-Country Wage Compression in Multinationals" by Hjort, Li, and Sarsons

Appendix I Heterogeneous exposure to minimum wage changes: the Kaitz index

In this appendix, we compare the wage response of *employers* that are differentially exposed to minimum wage changes. Following Lee (1999) and Autor *et al.* (2016), we measure *firm*-level bindingness as the ratio between the ex ante minimum wage and the firm's median wage at the headquarters (the so-called Kaitz index). Specifically, we interact the independent variables of interest in Equation (3) with Kaitz_{ft} and estimate:[1]

$$\%\Delta \text{w}_{jfct} = \alpha_6 \text{Hike}_{h(f)t} + \alpha_7 \text{Hike}_{h(f)t} \times \text{Kaitz}_{ft} + \theta_{jct} + \varepsilon_{jfct} \tag{A1}$$

We find that the wages of foreign workers in low-skill jobs are more affected by a minimum wage increase in the home country/state in firms for which the minimum wage was more binding at the headquarters. The estimates are reported in Appendix Table A15. Columns 1 and 3 imply that the transmission of a (large) minimum hike is around 10 percent higher for a firm whose headquarter is at the 75th percentile of the Kaitz index compared to one at the 25th percentile.[2]

Appendix II Threats to identification: transmission of exchange rate shocks

1. Endogenous timing of exchange rate fluctuations A currency appreciation may take place when a country's economy is doing well and aggregate demand for labor is relatively high. If home country labor demand and multinationals' demand for labor abroad are correlated, a home country currency appreciation could then coincide with a rise in wages paid in foreign establishments absent any wage anchoring.

To investigate this concern, we first break down the estimated impact of home country exchange rate shocks by sectors' export and import shares. If the positive foreign wage response to an increase in the USD value of a home country's currency is driven by underlying labor demand shocks, the impact should be small among output-exporting firms—which are likely to directly suffer from an increase in the relative price of domestically-produced goods—and large among input-importing firms, which conversely are likely to directly benefit from an decrease in the relative price of their inputs. As seen in columns 1-2 of Panel A in Appendix Table A16, we find little evidence that wage impacts of home country exchange rate shocks in foreign establishments are driven by firms in high-import-share and low-export-share home country sectors.[3]

It is worth noting that a story in which labor demand covaries with exchange fluctuations and

[1] Notice that $\theta_{jh(f)t}$ does not subsume Kaitz_{ft}; so unlike in sub-sections 4.2 and 4.3, we estimate this equation with only the foreign establishments sample. In the corresponding first stage estimation, job×city×year fixed effects are replaced with job×year fixed effects, the same as in sub-sections 4.2 and 4.3.

[2] (.2123-.1030)*.0090/(.0094+.0090*.1030)=0.095, and (.2123-.1030)*.0092/(.0090 +.0092*.1030)=0.101.

[3] The country×sector specific input/output shares are calculated using data from the World Input-Output Database (WIOD) in year 2004 (Timmer *et al.*, 2015). We use a pre-sample-period measure to avoid potentially confounding changes in the share of imported inputs/exported outputs, which might be endogenous to exchange rate changes.

this explains the estimated impact of exchange rate shocks on multinationals' foreign wages is hard to reconcile also with the asymmetric response of foreign establishment wages to home country appreciation and depreciation shown in columns 2 & 3 of Table 6. The evidence thus suggests that that endogenous timing of exchange rate fluctuations is not the primary explanation for the estimated transmission of externally imposed headquarter wage increases to multinationals' foreign establishments.

2. Offshoring in response to home country currency appreciation A home country currency appreciation can make some multinationals' headquarter workers more expensive to employ relative to the firm's foreign establishment workers. This could induce the employer to shift jobs to foreign establishments from the headquarters (as in Feenstra & Hanson (1996)) which could in turn raise wages both at home and abroad, contributing to the estimated impact of exchange rate shocks on multinationals' foreign wages.

For task reallocation within jobs to explain our exchange rate results, the effect of home country exchange rate shocks on wages in foreign establishments would need to be concentrated in firms that engage in international trade (see e.g. Campa & Goldberg, 2001).[4] Intuitively, if a firm's headquarters and foreign establishments buy from and sell to the domestic market of the country in which the relevant establishment is located, home country currency appreciation will lead to a similar increase in the dollar value of the firm's revenue, cost of labor and cost of other inputs, resulting in little or no change in the relevant price of labor at the headquarter relative to that at the firm's foreign establishments.

However, recall that we showed in Panel A of Appendix Table A16 that a home country currency appreciation still leads to an increase in the foreign establishment wages of firms purchasing and/or producing less tradable goods and services, although the impact on those low-exporting firms is smaller.

We also find a similar impact on *headquarter* wages of home country exchange rate shocks in firms purchasing and/or producing more/less tradable goods and services (see columns 3 & 4 of Panel A of Appendix Table A16), and little heterogeneity in the impact on foreign establishment wages by job offshorability and multi-task content (see columns 1 & 2 of Panel B of Appendix Table A16). These findings are all hard to reconcile with an across-country task-shifting story.

The evidence thus suggests that a within-firm offshoring phenomenon is not the primary explanation for the transmission of exchange rate variation-induced headquarter wage changes to multinationals' foreign establishments. Such transmission appears to be due, at least in part, to wage anchoring.

3. Technology adoption in response to home country exchange rate shocks In contrast to minimum wage increases—which tend to be permanent—transitory exchange rate shocks are *a priori* unlikely to induce technology adoption. Nonetheless, we also show in Panel C of Appendix Table A16 that the estimated wage impact of home country/state exchange rate shocks do not vary much by job task content that is likely related to the complementarity or substitutability between labor and computer capital (information technology). This is hard to reconcile with technology adoption explaining the estimated impact of home country exchange rate shocks on multinationals' foreign establishment wages.

[4]The within-employer labor in-sourcing explanation has the same prediction as the endogenous labor demand explanation in terms of the wage impact difference between input-importing firms and non-input-importing firms, and the opposite prediction in terms of the wage impact difference between output-exporting firms and non-output-exporting firms.

Appendix III Data

1. Additional Data Sources

1.1 Minimum Wage Data

The International Labour Organisation (ILO) maintains a database of the nominal gross monthly minimum wage (local currency) for 118 of the 170 countries observed in our primary dataset.[5] Monthly numbers are multiplied by 12 to calculate the annual nominal minimum wage. For the United States, we use the annual state minimum wage database in Vaghul & Zipperer (2016). We retrieved the minimum wage data in September 2021.

1.2 Exchange Rate Data

The yearly exchange rate dataset is downloaded from the World Bank, which records the official exchange rate (in currency units per current USD).[6] The yearly exchange rate is calculated as an annual average based on monthly averages.

1.3 Measures of Occupational Characteristics

Occupation crosswalks

i Crosswalk between the detailed job titles in our primary dataset and the 3-digit 2000 Standard Occupational Classification (SOC-00) codes is constructed using O-NET's code connector. We record the SOC code(s) of the first two entries.

ii Crosswalk between the (6-digit) 2000 Standard Occupational Classification (SOC-00) codes and the 2000 US Census Codes is available on the United States Census Bureau website.

iii The crosswalk between the 2000 US Census Codes and the *occ1990dd* occupation classification codes is available on David Dorn's website.[7]

iv Crosswalk between the 2000 Standard Occupational Classification (SOC-00) codes and the 1988 International Standard Classification of Occupations (ISCO-88) codes is available on the Institute for Structural Research (IBS) website.

v Crosswalk between the 1988 International Standard Classification of Occupations (ISCO-88) codes and the 1994 Brazilian Classification of Occupations (CBO-94) is available in Muendler *et al.* (2004).

[5] According to ILO, minimum wages are not reported for countries for which collective bargaining is in place for minimum wages. In cases where a national minimum wage is not mandated, the minimum wage in place in the capital or major city is used. In some cases, an average of multiple regional minimum wages is used. In countries where the minimum wage is set at the sectoral level or occupational level, the minimum wage for manufacturing or unskilled workers is generally applied.

[6] Official exchange rate refers to the exchange rate determined by national authorities or to the rate determined in the legally sanctioned exchange market.

[7] "The *occ1990dd* occupation classification aggregates U.S. Census occupation codes to a balanced panel of occupations for the 1980, 1990, and 2000 Census, as well as the 2005-2008 ACS."

Offshorability The offshorability index comes from Blinder & Krueger (2013)'s externally coded survey measure of job offshorability (the ability to perform the job's work duties from abroad). Micro-level survey data is available on Princeton Data Improvement Initiative (PDII).[8]

Task Complexity Occupations that are categorized as "single-task" include Cleaner, Guard, Messenger, Driver, Administrative Clerk, Shipping & Receiving Clerk, and Data Entry Clerk. All these occupations are low-skill occupations (skill levels 1-5 out of 16 levels in total). Non-single-task low-skill occupations include, for example, Reproductive Machine Operator, Mechanical/Operations Assistant, Accounting Clerk, etc.

Task content Measures for abstract, routine, and manual tasks come from Autor & Dorn (2013) (see their Appendix D for a detailed description). The data is available from the authors' website.[9]

1.4 Measures of Sectoral Characteristics

Sector offshorability The sector offshorability index also comes from Blinder & Krueger (2013), where the survey measure in the raw data is collapsed at the sector level. [10]

Skill share and capital share The sector-specific capital share is calculated using data from the BEA Input-Output Accounts, concorded to 6-digit and reduced to 2-digit NAICS using gross output values as weights. Labor share is by definition equal to 1 - capital share. The sector-level skill share is the share of payroll going to occupations with skill level requirement 3 or 4 according to the ILO. The data is from the occupational employment survey in the US, collected on the NAICS 4-digit level and reduced to the 2-digit level using gross output as weights.[11]

Input and output tradeability The sector specific and country-sector specific tradeability measures are constructed using data from the 2004 World Input-Output Tables in the World Input Out Database (WIOD) (Timmer *et al.*, 2015). Country-sector specific input (output) tradeability is the value of imported input (exported output) as a share of the value of total input (out) in a given sector in a given country in 2004; sector specific tradeability measures are the corresponding shares in all countries.[12]

[8]The offshorability measure is first constructed at the level of 3-digit Standard Occupational Classification (SOC) codes and then mapped to the job titles in our primary dataset using Crosswalk i. When more than one SOC code is recorded for a given job title, the average offshorability measure is taken.

[9]The task content measures are mapped to the job titles in our primary dataset using crosswalks iii - ii - i.

[10]The sector code in Blinder & Krueger (2013) is 6-digit NAICS, and we use a cross-walk between 4-digit NAICS and the International Standard Industrial Classification of All Economic Activities (ISIC), the sector categories used in our primary dataset.

[11]The measures are mapped to the International Standard Industrial Classification of All Economic Activities (ISIC) sector categories used in our primary dataset according to the definition here.

[12]The sector definition in WIOD follows the Crosswalk between the International Standard Industrial Classification of All Economic Activities (ISIC), the same as our primary dataset.

1.5 Measures of Country-Level Characteristics

Hofstede's cultural measures Our preferred measures of cultural attributes come from Hofstede (2001)'s "cultural dimensions". These measures are especially useful as they are available for, and comparable across, over 80 countries, and extensively validated (see e.g. Yoo *et al.*, 2011). They are widely used in social science research, including in economics (starting with Tabellini, 2010).

The measures of Hofstede's national cultural dimensions are downloaded from Hofstede's website. These include Power distance index (PDI), Individualism vs. collectivism (IDV), Uncertainty avoidance index (UAI), Masculinity vs. femininity (MAS), Long-term orientation vs. short-term orientation (LTO), and Indulgence vs. restraint (IND). These measures were developed in the late 1960s and early 1970s through a large-scale survey conducted with IBM employees. Over 100,000 employees from across IBM's worldwide establishments answered questions regarding, for example, identity, beliefs and attitudes toward inequality, and ways of copying with uncertainty. The idea behind the survey was that any differences in how respondents answered could be attributed to differences in national cultures, since all workers were part of the same firm. Follow-up surveys, run by Hofstede, were run with a broader range of workers, including civil servants and airline pilots, throughout the 1990s and confirmed the earlier results (Hofstede, 1991, 2001).

Global Preferences Survey measures The country-level measures of preferences in the Global Preferences Survey are downloaded here. These include patience, risk taking, positive reciprocity, negative reciprocity, altruism and trust. See Falk *et al.* (see 2018) for a detailed description of these measures.

Other measures GDP per capita, Gini index, regulatory index, adult educational attainment, urban population shares are drawn from the World Bank and measured yearly.[13] The measure of collective bargaining (union coverage) in the public or private sector of a given country in a given year is defined as the proportion of all wage earners in this sector covered by collective bargaining agreement or statutory regulations and retrieved from the ICTWSS database. For all these measures, we take the country-level average of these variables during 2005-2015 (our sample period).

1.6 Measures of Country-Pair Bilateral Characteristics

The country-pair-specific bilateral gravity measures, including a common language index, a dummy for common religion, a dummy for common legal origin, a dummy for a historical colonial relationship, the distance between capital cities, a dummy for sharing a border, a dummy for sharing a time zone, a dummy for regional trade agreements, are downloaded from the CEPII datasets. Measures of the bilateral migrant stocks are drawn from the World Bank.

[13] A country's regulatory index is meant to capture the country's regulatory environment that affects growth of the private sector. The index is based on surveys and legal analysis conducted by the World Bank. A higher regulatory index means that a country's government is better able to create and implement regulations that promote private sector development. Adult education is the share of adults over the age of 25 who have received higher education.

1.7 Brazilian RAIS Data

The RAIS data is employer-employee administrative data collected through a mandatory survey by the Brazilian Ministry of Labor and Employment. We use data from the years 2000-2017 (the maximum time-span available in the version of RAIS we have access to). The dataset is at the individual worker level and contains individual identifiers, and firm and establishment identifiers. The firm identifiers are CNPJ numbers (Cadastro Nacional de Pessoa Juridica), identification numbers issued to all firms operating in Brazil (including non-profits).

We first identified 64 firms with establishments in Brazil in the Company data, 56 of which are foreign firms headquartered outside Brazil. We then looked for the CNPJ number of each firm using their name.[14]We use these identifiers to match firms in the multinational data to establishments in Brazil RAIS. We successfully identify 52 firms with establishments in Brazil, 44 of which are headquartered outside Brazil. These multinationals are headquartered in the United States (59%), the UK (9%), the Netherlands (7%), Germany (5%), Switzerland (5%), France (5%), Finland (5%), and the remainder are spread equally across Australia, Canada, and New Zealand.

To classify "jobs" in RAIS, we use its detailed occupation codes: the 6-digit level of the Brazilian CBO-02 codes (of which more than 2,500 jobs/occupation codes are present in RAIS). This does not in itself allow matching of individuals in Brazil to their direct job counterpart in the multinational data, however, because the Company does not use standard occupation codes. We therefore attempt to match by skill level of the job. We do this by dividing jobs in RAIS into 16 buckets based on the average education level of the workers in those jobs, as well as whether or not they are a manager. We then match these into the respective 16 skill levels in the Company's data.

We have information in individual's wages, hiring date, date of job termination and reason for termination, as well as various demographic characteristics including age, gender, race, and education.[15] Summary statistics are provided in Appendix Table A17.

2. Data Processing

2.1 Data trimming

Wages We trim outliers that are in the top and bottom 1% of the overall establishment wage distribution (as well as the headquarters wage distribution when available) in analyses where the outcome variable is in levels. In analyses where the outcome variable is percentage change in wages, we additionally trim percentage changes in wages that are in the top and bottom 1% of the distribution of such changes.

Employment We trim occupation×firm×establishment×year specific worker counts in Brazil that are in the top 1% of the overall distribution where the outcome variable is in levels (Figure 3). In

[14]We manually searched for the CNPJ of each firm using the name reported in the Company data. We first looked in various websites to retrieve a CNJP for each firm. Then, we used the official Government tool to Registration Status to make sure the CNPJ we assigned to each firm was the right one. We identified 61 CNPJs out of the 64 firms found in the Company data.

[15]For RAIS, we convert monthly wage values in Brazilian Real to annual values in USD using the average exchange rate of Brazilian Real in period 2000-2017.

analyses where the outcome is percentage change in worker counts, we trim the top 1% of the distribution of such changes. Many occupation×establishment×year cells are small, so small increases in the employed number of workers can lead to large asymmetric percent changes (Panel B of Table 9).

2.2 Data period used in analysis

The Company informed us that its data collection and harmonization procedures—such as for example whether wage data was originally recorded in local currency; the currency specified in the establishment's employment contracts; that of its pay-outs; or in USD, and how any subsequent currency conversion was done by the Company—were generally less standardized before 2004. For this paper's analysis, we need to avoid first-differencing across different "regimes". We use the full 2000-2015 data whenever the relevant analysis is in levels. In these cases, the fixed effects we include control for procedural differences across country-years, etc. For analyses where we use Company data and the outcome variable is in first-differences, we only use 2004-2015 data (with the earliest first difference we use thus being that between 2005 and 2004).[16]

2.3 Data Imputation for Sample 2

In Sample 2 we do not require that the same occupation is observed in an establishment and the headquarters of the employer in the exact same year. Some multinationals in our sample do not provide data to the Company on all of their establishments every year they are surveyed. For this reason, for a fraction of foreign establishment occupation wages we do not observe a corresponding headquarter occupation wage in the exact same year, but we do observe such a corresponding occupation wage in another close-in-time year within the same employer. In some exercises, we impute the missing occupation-specific wage values using observations on the same occupation at the same establishment or headquarters in close-in-time surveyed years.

To do so, we impute the values of the outcome variable (the wage in a firm's foreign establishment) in missing years using the fitted values from the estimation of the following two-way fixed effect model: $\mathrm{w}_{jfct} = \mathrm{w}_{jfc} + \mathrm{w}_{jct} + \epsilon_{jft}$, $\hat{\mathrm{w}}_{jfc} + \hat{\mathrm{w}}_{jct}$. All establishments—all foreign establishments and headquarters—are included in the estimation, while the imputation is conducted only on foreign establishment occupations to avoid double counting data points which provide effective information. The model has a fit of $R^2 = 0.98$. As the cross-sectional component $\hat{\mathrm{w}}_{jfc}$ is mechanically highly correlated with firm×occupation fixed effect θ_{fj}, we replace θ_{fj} with firm fixed effect θ_f and occupation fixed effect θ_j.

[16] If we instead use the full Company data period also when the outcome variable is in first differences, the estimated coefficients of interest are slightly smaller, but qualitatively unchanged (the reduced form estimate in Column 1 of Table 4 e.g. being 0.005 rather than 0.007 with our preferred approach).

Appendix IV Causal Forest Estimation Procedure

We compute heterogeneous treatment effect using the honest causal forest algorithm, which is an application of the Generalized Causal Forest of Athey *et al.* (2019). Closely following Carlana & La Ferrara (2021), we implement the following procedure:

1 For the full analysis sample (jobs of all skill levels at foreign establishments), we orthogonalize the outcome variable (the percentage change in job-specific wages) and the treatment status variable (the headquarters minimum wage hike dummy) with respect to job×city×year fixed effects, which is consistent with our main regression specification (3). We use the orthogonalized outcome and the treatment variables in the causal forest estimation below.

2 From the full sample, we obtain a random subsample—without replacement— consisting of 50% of the observations in the original sample. This subsample is the training sample and the remaining data is the test sample.

3 We use the training sample to estimate the causal forest. Covariates include skill level and 55 other variables (the characteristics of the headquarter country, the establishment country, the multinational's sector, the job in question, and the headquarter-establishment country pair). We implement this command building a forest with 2000 trees. To build each tree, we use 70% of the sample to determine splits. The other 30% is used to estimate the conditional average treatment effect (CATE). We orthogonalize the outcome and the treatment variables with respect to the covariates using a separate regression forest. We cluster at the headquarters country level, which is consistent with our approach in the linear regressions.

4 We use the causal forest estimation obtained in step 3 to compute the estimated treatment effect for each observation in the test sample.

5 We implement 500 replications of steps 2, 3, and 4.

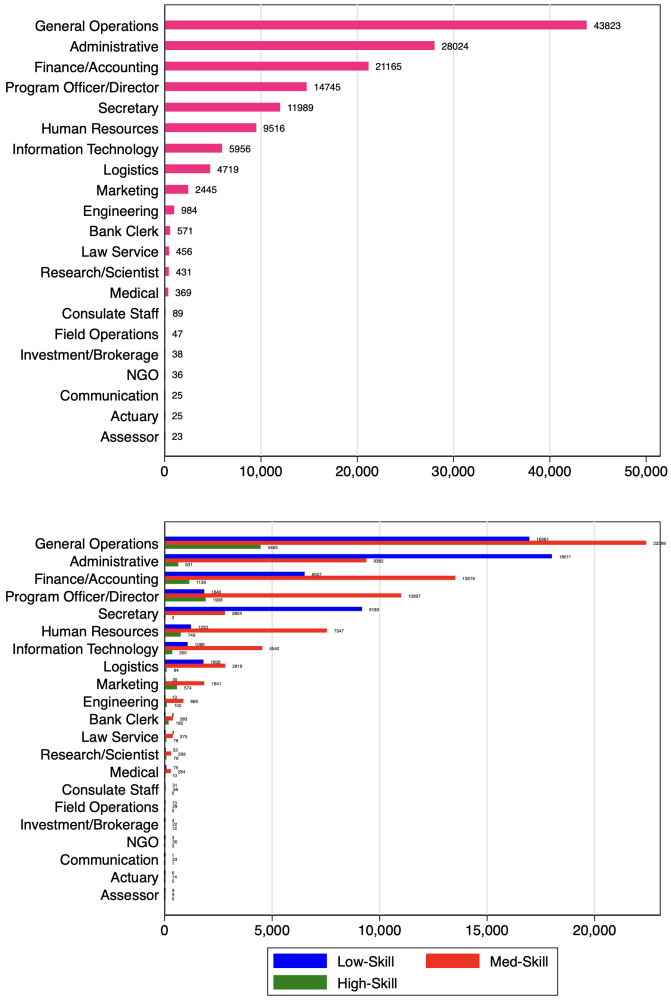
6 We take the mean of the estimated treatment effects across each replication for each observation in the full sample.

7 We divide full sample into low-skill jobs and middle-/high-skill jobs as in sub-section 4.2, and standardize all the covariates to have zero mean and unit standard deviation *within* each skill group.

8 Within each skill group, we sort the observations by the mean of their conditional average treatment effect (CATE) estimates obtained in Step 6, and calculate the value of the 55 covariates for the above-median-CATE subsample. (By construction, the value of the covariates for the below-median-CATE subsample is the opposite number of the same absolute value.)

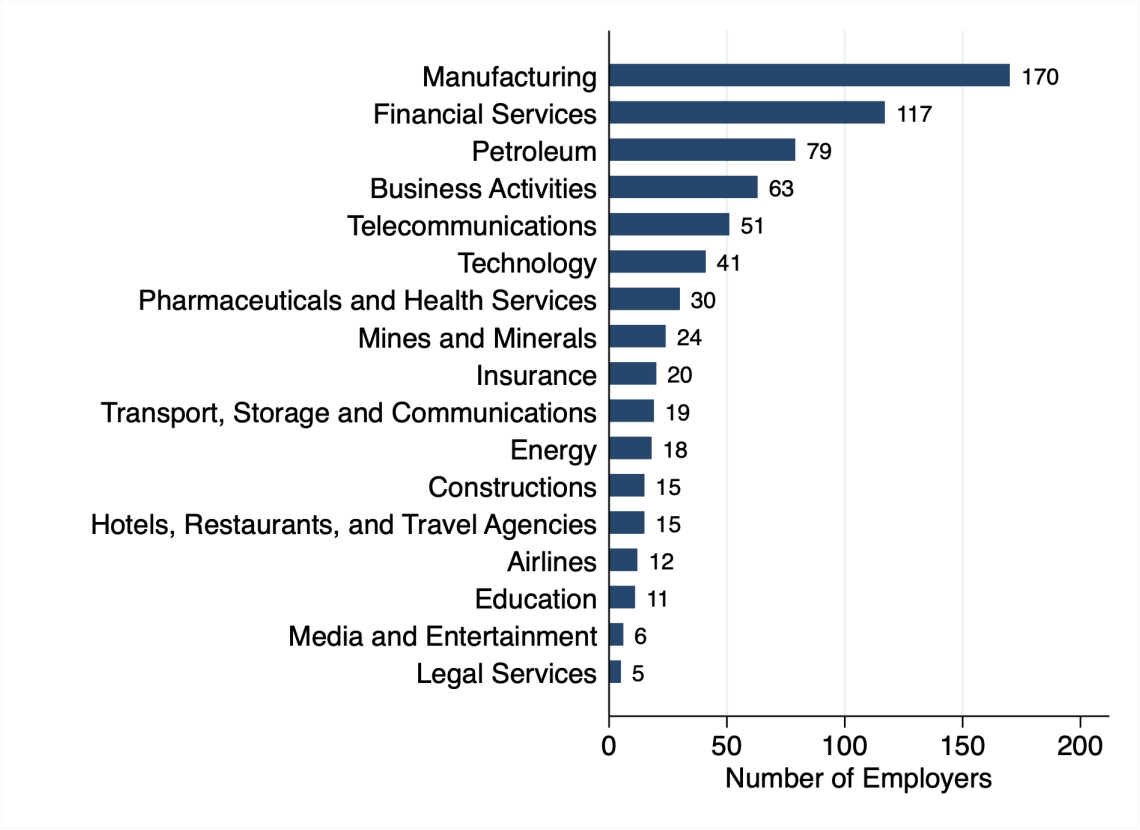
Appendix Figures

FIGURE A1: OCCUPATION DISTRIBUTION BY OCCUPATION CATEGORY AND SKILL LEVEL



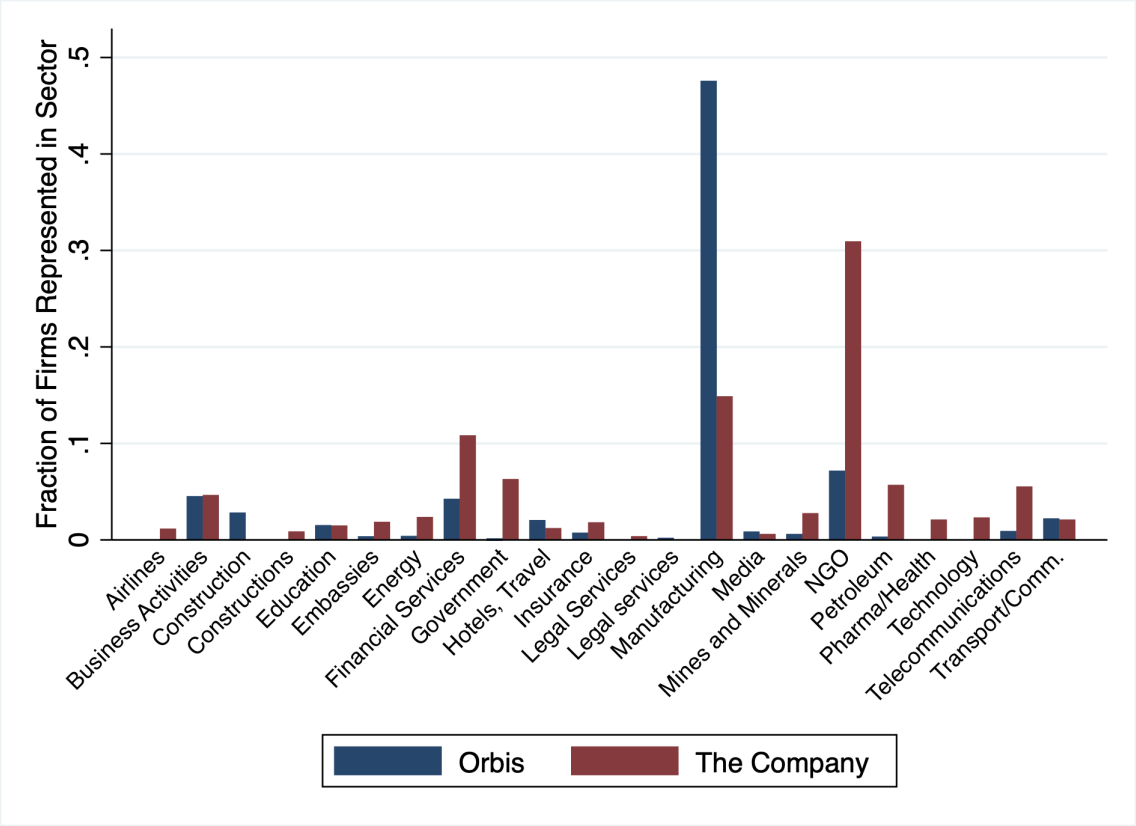
Notes: This figure displays the distribution of occupations in the headquarters and the foreign establishments of multinationals in the full sample of multinationals (Sample 1) according to the Company's global definition of occupation categories and skill levels. Low-skill: skill level 1-5; med-skill: skill levels 6-10; high-skill: skill levels 11 and above. The occupation type "NGO" contains 6 occupation types that only exist in NGOs: Resource Development, Policy Analyst, Technical Advisor, Government Aid Agency Coordinator, Monitoring & Evaluation Coordinator, and Policy Advisor. The unit of observation is an employer $\times$ establishment $\times$ occupation.

FIGURE A2: SECTORAL DISTRIBUTION OF PRIVATE-SECTOR FIRMS



Notes: This figure displays the sectoral distribution of the private-sector multinationals in the full sample of multinationals (Sample 1). The unit of observation is a multinational (employer).

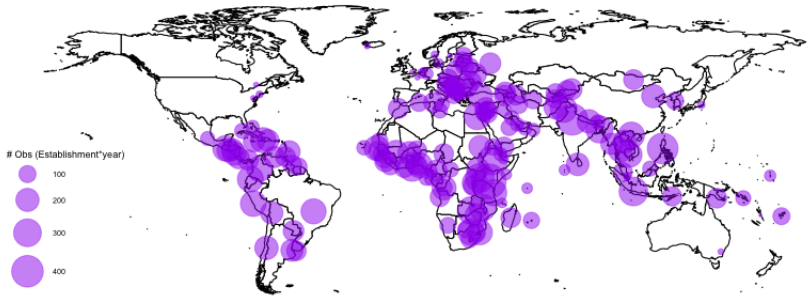
FIGURE A3: SECTORAL DISTRIBUTION OF COMPANY AND ORBIS FIRMS



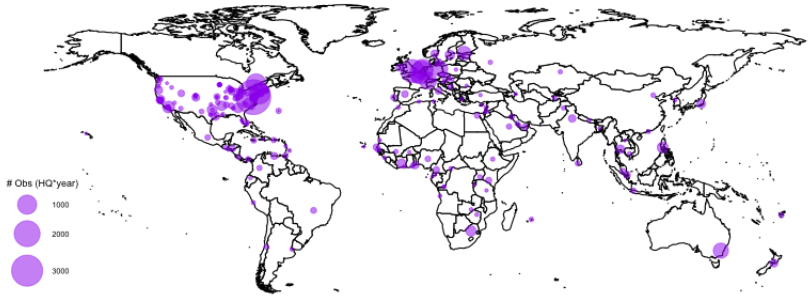
Notes: This figure displays the sectoral distribution of all multinationals in the Company dataset (red bars) and the Orbis sample (blue bars). The Orbis sample contains 1,100 firms randomly selected from the set of all sector $\times$ headquarters country location pairs that exist in the Company data. The unit of observation is a multinational (employer).

FIGURE A4: FOREIGN ESTABLISHMENT AND HQ LOCATIONS

(A) FOREIGN ESTABLISHMENT LOCATIONS

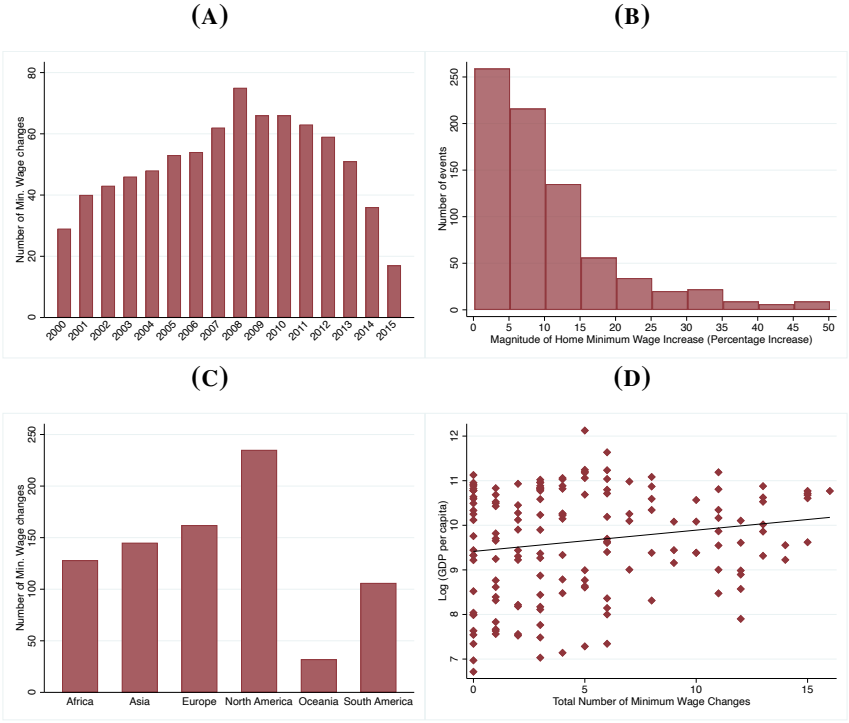


(B) HEADQUARTERS LOCATIONS



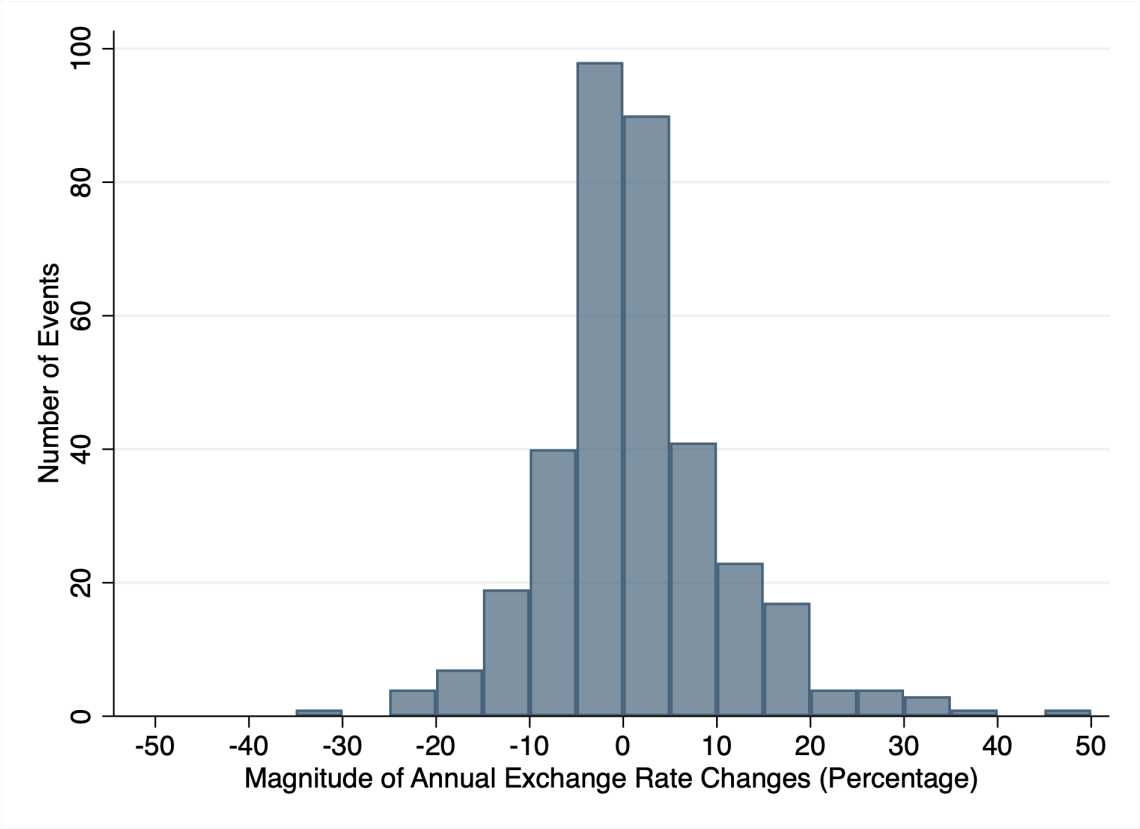
Notes: This figure displays the geographical distribution of the foreign establishments (top panel) in the full sample of multinationals (Sample 1) and their headquarters (bottom panel). The bubble size weight is the number of establishment (headquarters) $\times$ year observations in each city.

FIGURE A5: HQ COUNTRY/STATE MINIMUM WAGE CHANGES



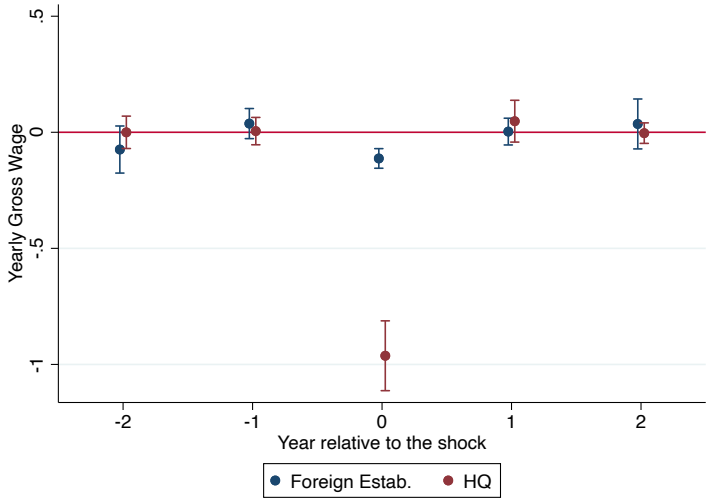
Notes: This figure presents evidence of the HQ-country/state minimum wage changes. Panel A shows the number of countries (or states in the case of the US) that are in the sample as a headquarter location in a particular year and have a minimum wage increase in that year. Panel B shows the distribution of the magnitude of headquarters countries/states' minimum wage increases. There are 808 minimum wage increases (including 42 whose magnitude is larger than 50%) and 746 counts of headquarters-location $\times$ years with zero minimum wage increase during 2000-2015. For the period between 2005 and 2015, the corresponding numbers are 602 (34) and 547.Panel C presents the total number of minimum wage increases grouped by continents. Panel D shows a scatter plot of the total number of minimum wage changes by country (or states in the case of the US), and the GDP per capita for 2015. [Data sources: US population by states from U.S. Census Bureau; US GDP by states from Bureau of Economic Analysis; Per capita GDP of other countries from World Bank, World Development Indicator].

FIGURE A6: HQ COUNTRY CURRENCY APPRECIATION/DEPRECIATION



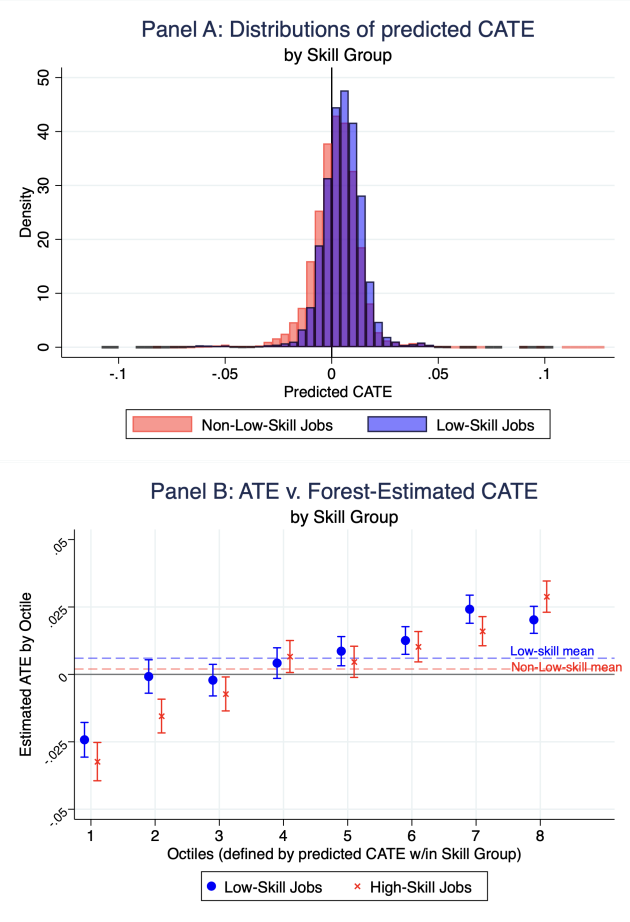
Notes: This figure shows the distribution of the magnitude of headquarters country exchange rate changes used in our main analysis. The unit of observation is currency-zone×year. All establishments located in the same currency zone as the headquarters are excluded; all headquarters countries, including the United States and those which peg their currencies to the USD, are also excluded. There are 352 events (including 2 whose magnitude is larger than 50%), consisting of 169 appreciations (a decrease in the exchange rate), 183 depreciations (an increase in the exchange rate), and 3 instances where the exchange rate does not change.

FIGURE A7: IMPACT OF HQ EX. RATE ON FIRM WAGES



Notes: This impulse response study plots the coefficients from a regression in which occupation-specific log gross wages (in current USD terms) at the foreign establishments (blue coefficients) and the headquarters (red coefficients) of a firm in year $t-3$ to $t+3$ are regressed on the detrended log exchange rate in year t in the firm's home country. Employer$\times$year and establishment-city$\times$year fixed effects are included. Exchange rates are detrended from home-country-specific time trends. All foreign establishments located in the same currency zone as the headquarters are excluded. Standard errors are clustered at the headquarter country currency zone level.

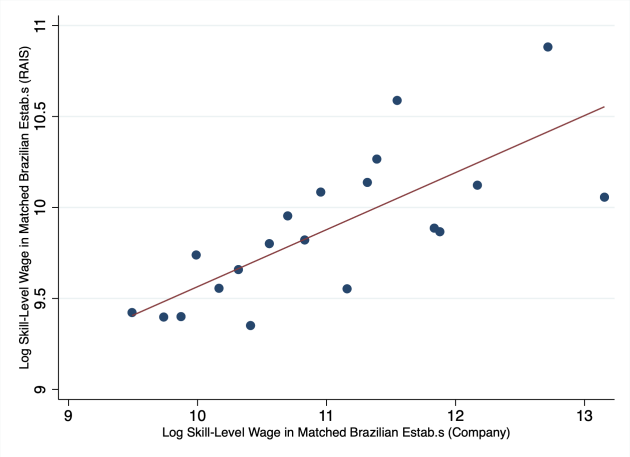
FIGURE A8: CAUSAL FOREST ON THE TRANSMISSION OF HQ MIN WAGE



Notes: Panel A plots the distributions of the predicted conditional treatment effect (CATE) using Causal Forest estimation of the low-skill and non-low-skill jobs. CATE is positive for 74% of low-skill observations and 61% of high-skill observations. Low-skill occupations are those requiring a skill level below 5, whereas non-low-skill occupations are defined as those requiring a skill level between 6-16, as defined by the Company. Panel B plots the average treatment effect (ATE) estimate for each octile of the predicted CATE. Octiles are defined within the samples of low-skill jobs and high-skill jobs respectively. Within-octile ATE estimate is the difference in the mean value of outcome variable (percentage change in foreign establishment wages) between observations in that octile with and without the treatment (minimum wage hike in the headquarters country/state), after controlling for occupation $\times$ establishment city $\times$ year fixed effects.

FIGURE A9: WAGE CORRELATION: BRAZIL

(A) SAME ESTAB.S IN COMPANY VS RAIS



(B) BRAZILIAN VS NON-BRAZILIAN ESTAB.S

Notes: Panel A shows the raw correlation between the skill-level wages at an multinational's foreign establishments located in Brazil from the Company dataset (x-variable) and from the RAIS dataset (y-variable). The correlation coefficient is 0.53. Panel B shows the relationship between the skill-level wages at all of a multinational's foreign establishments not located in Brazil from the Company dataset (x-variable) and the skill-level wages at all of this multinational's foreign establishments located in Brazil (including those which did not appear in the Company data) from the RAIS dataset (y-variable), after controlling for employer $\times$ skill-level fixed effects, Brazilian establishment city $\times$ year fixed effects and non-Brazilian establishment city $\times$ year fixed effects. The slope of the line of best fit is $\hat{\beta} = 0.042$ (s.e. = 0.014). Standard errors are clustered at the employer level. The 16 skill levels defined by the Company are matched to the Brazilian data using the average education for a given job. To construct the plots in Panel B, the log skill-level wage at the Brazilian establishments (y-variable) is first residualized with respect to the fixed effects; then the log skill-level wage at the non-Brazilian establishments (x-variable) is then divided into 20 equal-sized groupings. Within each of these groups, we plot the mean of the residuals of the y-variable against the groupings mean of the x-variable, and add back the unconditional mean of the y-variable to help with interpretation.

Appendix Tables

TABLE A1: COMPARISON WITH ORBIS FIRMS

	Company	Orbis
	(1)	(2)
Total Assets	8966.29	399.88
	[16421.90]	[2977.68]
Working Capital	411.98	35.17
	[3948.84]	[463.62]
Sales	6827.88	224.33
	[14915.55]	[2094.92]
Gross Profit	4018.94	98.21
	[12577.03]	[732.10]
Export Revenue	2782.75	32.28
	[2658.25]	[465.79]
Profit Margin	12.53	4.86
	[17.26]	[15.66]
N Firms	1,060	1,100

Note: This table shows summary statistics for the 1,200 multinationals in the Company dataset, and a random sample of 1,100 multinationals drawn from Orbis. When drawing the multinationals from Orbis, we restrict to the set of multinationals that are in the same headquarter $\times$ sector groupings. Total assets, working capital, sales, gross profit, and export revenue are all reported in the millions. Standard errors are shown in square brackets.

TABLE A2: SUMMARY STATISTICS OF MULTINATIONALS (PRIVATE SECTOR)

Panel A: Summary of Multinational Samples

Unit of Observation	Number of Observations Sample 1	Sample 2	Sample 3
Employer	761	39	29
Employer × Year	3276	190	96
Establishment	2940	199	101
Estab. × Year	11974	715	410
Estab. × Skill-Level × Year	93471	5496	3930
Estab. × Occupation	60511	3459	2462
Estab. × Occ. × Year	209973	13043	9687

Panel B: Multinationals' Foreign Estab. Wages

	Sample 1		Sample 2		Sample 3	
	Mean	SD	Mean	SD	Mean	SD
Gross Wage (2000 USD)	19232.79	11667.65	17426.68	11183.70	21113.67	10692.11

Panel C: Distr. & Compression of Wages (Sample 3)

	HQ-Quart 1	HQ-Quart 2	HQ-Quart 3	HQ-Quart 4	HQ-All Occ
	Headquarter Wage Distribution				
Mean Gross Wage (2000 USD)	9772.20	14794.79	27605.59	46604.99	25216.82
Max. Gross Wage (2000 USD)	46393.92	71939.24	106129.25	117636.55	117636.55
	Establishment Wage as % of HQ Wage				
All Establishments	0.95	0.88	0.93	0.93	0.93
Estabs in Poorer-than-HQ Countries	0.80	0.78	0.84	0.86	0.82
Employer × Occ × Year	513	357	381	309	1560

Note: This table replicates Table 1, restricting the sample to private-sector multinationals.

TABLE A3: RELATIONSHIP BETWEEN HQ AND FOREIGN ESTABLISHMENT WAGES

	Log Wage at Establishment			
	(1)	(2)	(3)	(4)
Log Occ-Level HQ Wage	0.190	0.058		
	(0.077)	(0.135)		
Log Skill-Level HQ Wage			0.148	
			(0.116)	
Log Firm-Level HQ Wage				0.217
				(0.102)
Employer × Occ FE	✓	✓		
Employer × Skill-Level FE			✓	
Employer FE				✓
Estab. City × Year FE				✓
Estab. City × Occ × Year	✓	✓		
Estab. City × Skill-Level × Year			✓	
HQ Country (State) × Year FE		✓		
Observations	5861	5861	3529	721

Note: This table replicates Panel B of Table 2 but directly controls for fixed effects instead of using the Frisch-Waugh method. Standard errors are clustered at the employer level.

TABLE A4: HETEROGENEITY IN CORRELATION BETWEEN HQ AND ESTAB. WAGES

	Log Occ-Level Wage at Establishment				Wage Slope at Estab
	(1)	(2)	(3)	(4)	(5)
				Private Sec.	Private Sec.
Log Occ-Level HQ Wage	0.165	0.278	0.534	0.376	
	(0.087)	(0.109)	(0.205)	(0.115)	
Med Skill x Log Occ-Level HQ Wage		-0.158			
		(0.032)			
High Skill x Log Occ-Level HQ Wage		-0.154			
		(0.054)			
USA x Log Occ-Level HQ Wage			-0.004		
			(0.024)		
Other High Inc x Log Occ-Level HQ Wage			-0.058		
			(0.052)		
HQ Wage Slope					0.531
					(0.061)
Log Local Benchmark Wage				0.044	
				(0.010)	
Local Benchmark Wage Slope					0.020
					(0.006)
Employer × Occ FE	✓	✓		✓	
Employer × Skill-Level FE			✓		
Employer × Occ-Type × Skill-Lev Pair FE					✓
Estab. City × Year FE	✓	✓	✓	✓	✓
Observations	20983	20983	21151	7483	5119

Note: Columns 1-3 show the estimates corresponding to Panels A-C in Figure 1. High income countries are defined by the World Bank. Medium skill jobs are skill levels 6-10 and high skill jobs are skill levels 11-16, as defined by the Company. Columns 4-5 limit the sample to firms operating in the private sector, with column 5 showing the results using the wage slope rather than the log wage. Standard errors are clustered at the employer level for columns 1-4, and at the employer × skill-level-pair for column 5.

TABLE A5: IMPACT OF SHOCKS ON NON-LOW SKILL JOBS

	% Δ Estab Wage		% Δ HQ Wage		Log Estab Wage		Log HQ Wage	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Non-Low		Non-Low		Low	Non-Low	Low	Non-Low
MW Hike	0.002		0.022					
	(0.005)		(0.014)					
Large MW Hike		0.002		0.024				
		(0.007)		(0.015)				
Log HQ Ex. Rate					-0.087	-0.070	-0.742	-0.453
					(0.025)	(0.033)	(0.168)	(0.252)
Occ × Estab City × Year FE	✓	✓						
Occ × Year FE			✓	✓				
Employer × Occ FE					✓	✓	✓	✓
Estab City × Year								
Year FE								
HQ Currency Trend								
Observations	119368	87189	12343	11760	174081	230344	18595	26559

Note: This table shows the impact of minimum wage shocks at a firm's headquarters on wages for non-low-skill workers (columns 1-4), and the impact of exchange rate shocks in the firm's headquarters on wages for low and non-low-skill workers respectively (columns 5-8). Low-skill occupations are defined as those requiring a skill level below 5, whereas non-low-skill occupations are those requiring a skill level between 6-16, as defined by the Company. A large minimum wage hike is a hike of above-sample-median magnitude. Standard errors are clustered at the headquarter country level (columns 1-4) and at the headquarter country currency zone level (columns 5-8). The sample period of analysis is from 2005 to 2015 in columns 1-4.

TABLE A6: ROBUSTNESS TO ALTERNATIVE LOW SKILL DEFINITIONS

% Δ Wage at:	Estab	HQ	Estab	Estab	HQ	Estab
	(1)	(2)	(3)	(4)	(5)	(6)
	Skill Levels 1-4			Skill Levels 1-6		
Min. Wage Hike	0.006	0.030		0.006	0.035	
	(0.003)	(0.018)		(0.004)	(0.016)	
% Δ HQ Wage (IV)			0.189			0.174
			(0.153)			(0.131)
Occ × Estab City × Year FE	✓		✓	✓		✓
Occ × Year FE		✓			✓	
Observations	76639	7771	76639	152354	16024	152354

Note: This table replicates columns 1-3 of Table 4, with low skill jobs defined as those of skill levels 1-4 (columns 1-3) and skill levels 1-6 (columns 4-6) respectively. Standard errors are clustered at the headquarter country level. The sample period of analysis is from 2005 to 2015.

TABLE A7: IMPACT OF MIN WAGE ON ESTAB. WAGES (PRIVATE SECTOR)

% Δ Wage at:	Estab	HQ	Estab
	(1)	(2)	(3)
Min. Wage Hike	0.013	0.042	
	(0.004)	(0.018)	
% Δ HQ Wage (IV)			0.298
			(0.165)
Occ × Estab City × Year FE	✓		✓
Occ × Year FE		✓	
Observations	49159	8758	49159

Note: This table replicates columns 1-3 of Table 4, restricting the sample to private-sector firms. Standard errors are clustered at the headquarter country level. The sample period of analysis is from 2005 to 2015.

TABLE A8: IMPACT OF ESTAB. COUNTRY MIN WAGE/EX RATE SHOCKS ON WAGES

	Estab Country Min Wage Hikes		Estab Country Ex Rate Shocks	
	(1)	(2)	(3)	(4)
	% Δ HQ Wage	% Δ Estab Wage (≠ j)	Log HQ Wage	Log Estab Wage (≠ j)
Min. Wage Hike at Estab. j	-0.000	-0.001		
	(0.000)	(0.000)		
Log Ex. Rate at Estab. j			0.000	-0.000
			(0.000)	(0.000)
Occ × HQ City × Year FE	✓			
Occ × Estab City × Year FE		✓		
Employer× Occ FE			✓	✓
HQ City × Year FE			✓	
Estab City × Year FE				✓
Observations	4981	5427094	17606	16493286

Note: This table shows the impact of a minimum wage hike or exchange rate shock in one of a firm's foreign establishments on wages in the firm's headquarters (columns 1 and 3) and other foreign establishments (columns 2 and 4). We weight by the number of occupations present in a given establishment. The regressions are run by creating a dataset in which a firm's headquarter is matched to every foreign establishment of the firm, and each foreign establishment is matched to every other foreign establishment of the firm. Standard errors in columns 1 and 2 are clustered at establishment j's location country level; standard errors in columns 3 and 4 are clustered at establishment j's location country currency zone level. The sample period of analysis is from 2005 to 2015 in columns 1 and 2.

TABLE A9: ROBUSTNESS TO SHOCK DEFINITIONS

	% Δ Wage						Log Wage		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	Estab.	HQ	Estab.	HQ	Estab.	HQ	Estab.	HQ	Estab.
Min Wage Hike, 25th	0.013	0.027							
	(0.004)	(0.013)							
Min Wage Hike, 50th			0.014	0.028					
			(0.003)	(0.013)					
% Δ HQ Min. Wage					0.018	0.094			
					(0.011)	(0.021)			
Log HQ Ex. Rate							-0.105	-0.517	
							(0.041)	(0.266)	
Log HQ Wage (IV)									0.203
									(0.131)
Occ × Estab City × Year FE	✓		✓		✓				
Occ × Year FE		✓		✓		✓			
Employer × Occ FE							✓	✓	✓
Estab City × Year FE									✓
Year FE									
HQ Currency Trend									✓
Observations	95170	11134	79679	10748	104074	7971	126225	23499	126225

Note: This table shows robustness to different definitions of wage and exchange rate shocks. Min Wage Hike, 25th uses only minimum wage shocks that are above the 25th percentile in terms of the size of the minimum wage change. Similarly, Min Wage Hike, 50th uses only shocks above the median size. % Δ HQ Min. Wage is the percentage change in the minimum wage at the headquarter location from year t-1 to year t. In columns 7-9 we restrict to exchange rate shocks in which the change in the exchange rate from the previous year is greater than 3% (the average minimum wage change from year to year). Column 9 presents the IV estimate using exchange rate shock. Standard errors are clustered at the headquarters country level in columns 1-6, and at the headquarters country currency zone level in columns 7-9. The sample period of analysis is from 2005 to 2015 in columns 1-6.

TABLE A10: FREQUENCY AND MAGNITUDE OF SHOCKS

	Pct. Change			# country (state)-year	
	P(25)	P(50)	P(75)	Neg.	Total Δs
Minimum wage	4.13	8.23	14.83	0	808
Exchange-rate	-3.32	1.25	6.94	470	1084

Note: This table shows different statistics that illustrate the magnitude and frequencies of the changes in the minimum wage and exchange rates for the sample used in the estimations. Columns (1)-(3) contain percentiles of the variable percentages of change, conditional on being different from zero. Columns (4) and (5) present the number of negative percentages of changes and total events. The sample period is from 2000 to 2015.

TABLE A11: IMPACT OF HQ EX RATE SHOCKS WITHOUT CURRENCY TREND

Panel A: Reduced Form			
Log Wage at Establishment			
	(1)	(2)	(3)
		Depreciation	Appreciation
Log HQ Exchange Rate	-0.110	-0.061	-0.116
	(0.025)	(0.018)	(0.045)
Employer × Occ FE	✓	✓	✓
Estab. City × Year FE			
Observations	404425	192541	208840
Panel B: First Stage			
Log HQ Wage			
	(1)	(2)	(3)
		Depreciation	Appreciation
Log HQ Exchange Rate	-0.441	-0.472	-0.480
	(0.121)	(0.150)	(0.175)
Employer × Occ FE	✓	✓	✓
Year FE			
Observations	45154	27644	21206
Panel C: TS2SLS			
Log Establishment Wage			
	(1)	(2)	(3)
		Depreciation	Appreciation
Log HQ Wage	0.249	0.130	0.243
	(0.089)	(0.056)	(0.129)
Employer × Occ FE	✓	✓	✓
Estab. City × Year FE	✓	✓	✓
Observations	404425	192541	208840

Note: This table replicates Table 6 but excludes the headquarter-country currency trend.

TABLE A12: IMPACT OF EXCHANGE RATE SHOCKS (PRIVATE SECTOR)

	Panel A: Reduced Form		
Log Wage at Establishment			
	(1)	(2)	(3)
		Depreciation	Appreciation
Log HQ Exchange Rate	-0.081	-0.038	-0.107
	(0.055)	(0.074)	(0.095)
Employer × Occ FE	✓	✓	✓
Estab. City × Year FE			
HQ Currency - Year Trend			
Observations	191773	91543	100643
	Panel B: First Stage		
Log HQ Wage			
	(1)	(2)	(3)
		Depreciation	Appreciation
Log HQ Exchange Rate	-0.551	-0.520	-0.465
	(0.261)	(0.280)	(0.263)
Employer × Occ FE	✓	✓	✓
Year FE			
HQ Currency - Year Trend			
Observations	39025	24027	18666
	Panel C: TS2SLS		
Log Establishment Wage			
	(1)	(2)	(3)
		Depreciation	Appreciation
Log HQ Wage	0.147	0.074	0.231
	(0.121)	(0.147)	(0.243)
Employer × Occ FE	✓	✓	✓
Estab. City × Year FE	✓	✓	✓
HQ Currency - Year Trend	✓	✓	✓
Observations	191773	91543	100643

Note: This table replicates Table 6 but restricts to the sample of firms operating in the private sector. See the table notes of Table 6.

TABLE A13: ESTAB-HQ WAGE ANCHORING: BRAZIL (EXCH. RATE)

	Data Source: RAIS			
	(1)	(2)	(3)	(4)
	Annual	Effective	Annual	Effective
Log HQ Ex. Rate	-0.252	-0.228	-0.325	-0.338
	(0.082)	(0.060)	(0.231)	(0.080)
Employer × Occ FE			✓	✓
Worker × Estab × Employer × Occ FE	✓	✓		
Estab City × Year FE	✓	✓	✓	✓
HQ Currency Trend	✓	✓	✓	✓
Worker Controls	✓	✓	✓	✓
Observations	1189089	914606	1376944	1075004

Note: This table shows the impact of a $100 local currency depreciation (relative to USD) in a firm's home country on gross wages in its foreign establishments in Brazil. In columns 1 and 3, the outcome variable is the log annual average monthly wage of a worker. In columns 2 and 4, the outcome variable is the log of the average annual monthly wage after accounting for differences in days worked. Worker controls include race and gender fixed effects, as well as controls for age and job tenure. Standard errors are clustered at headquarter country currency zone level.

TABLE A14: IMPACT OF HQ MIN WAGE INCREASE ON FIRM FINANCIALS

	% Δ Gross Profit	% Δ K/L Ratio
	(1)	(2)
Min. Wage Hike	-0.004	-0.014
	(0.038)	(0.031)
Mean of Dep. Var.	.077	.097
St. Dev. of Dep. Var.	.245	.224
Employer FE	✓	✓
Year FE	✓	✓
Observations	231	199

Note: This table shows the impact of a minimum wage hike at a firm's headquarter on the percentage change of the firm's gross profit (column 1) and capital-to-labor ratio (column 2). Capital-to-labor ratio is defined as the total fixed assets divided by the number of employees in the company's payroll. Percentage changes are calculated by taking the first difference of the inverse hyperbolic functions (asinh) of the variables, as they can take negative values. The outcome measures are constructed from Orbis Historical, from which we extract a sample that we could match to the Company data at the firm × year level. There are 107 firms included in the analysis. The sample period is from 2000 to 2015. We use the consolidated accounts which include the statement of a company integrating the statements of its subsidiaries. Top and bottom 1% of the outcome variables are trimmed. Firm fixed effects and year fixed effects are included. Standard errors are clustered at the headquarters country level.

TABLE A15: MORE VS. LESS EXPOSED HEADQUARTERS

% Δ Wage at:	Estab	HQ	Estab	HQ
	(1)	(2)	(3)	(4)
Min. Wage Hike	0.009	0.015		
	(0.005)	(0.014)		
Hike × Firm Bindingness	0.009	0.001		
	(0.001)	(0.000)		
Large Min. Wage Hike			0.009	0.017
			(0.006)	(0.015)
Large Hike × Firm Bindingness			0.009	0.001
			(0.001)	(0.000)
Occ × Estab City × Year FE	✓		✓	
Occ × Year FE		✓		✓
Observations	14988	7971	14137	7554

Note: This table shows the impact of a minimum wage shock on firms whose headquarters are more versus less exposed to the minimum wage shock. The firm-level bindingness measure is a employer-year-specific Kaitz variable calculated as the ratio between the ex ante minimum wage and the employer's median wage at the headquarters. For years in which the HQ was not surveyed, we impute the establishment-occupation level average Kaitz index. Columns 1 and 3 show the reduced form estimate of the impact of respectively any minimum wage hike and large minimum wage hikes (those of an above-sample-median magnitude) in an employer's headquarters location on wages in the foreign establishments; and columns 2 and 4 the impact in the headquarters. We do not require that we see the wages for the same set of occupations in the firm's headquarters and foreign establishments in the same year for these regressions. Standard errors are clustered at the headquarter country level. The sample period of analysis is from 2005 to 2015.

TABLE A16: ROBUSTNESS OF IMPACT OF HQ EX. RATE SHOCKS

	Log Estab. Wage		Log HQ Wage	
	(1)	(2)	(3)	(4)
Log HQ Exchange Rate	-0.089	-0.041	-0.498	-0.463
	(0.051)	(0.043)	(0.138)	(0.161)
Log HQ Ex Rate × High Output Exporting		-0.079		0.022
		(0.044)		(0.204)
Log HQ Ex Rate × High Input Importing	-0.024		0.058	
	(0.046)		(0.158)	
Employer × Occ FE	✓	✓	✓	✓
Year FE			✓	✓
Estab. City × Year FE	✓	✓		
HQ Currency Trend	✓	✓	✓	✓
Observations	404425	404425	45154	45154

	Log Estab. Wage		Log HQ Wage	
	(1)	(2)	(3)	(4)
Log HQ Exchange Rate	-0.102	-0.120	-0.421	-0.454
	(0.025)	(0.025)	(0.128)	(0.136)
Log HQ Ex Rate × Offshorable		0.019		0.022
		(0.018)		(0.039)
Log HQ Ex Rate × Single Task	-0.036		-0.127	
	(0.024)		(0.098)	
Employer × Occ FE	✓	✓	✓	✓
Year FE			✓	✓
Estab. City × Year FE	✓	✓		
HQ Currency Trend	✓	✓	✓	✓
Observations	404425	404425	45154	45154

	Log Estab. Wage		Log HQ Wage	
	(1)	(2)	(3)	(4)
Log HQ Exchange Rate	-0.102	-0.133	-0.498	-0.383
	(0.028)	(0.023)	(0.098)	(0.148)
Log HQ Ex Rate × Abstract	-0.023		0.137	
	(0.023)		(0.098)	
Log HQ Ex Rate × Routine		0.035		-0.093
		(0.022)		(0.074)
Employer × Occ FE	✓	✓	✓	✓
Year FE			✓	✓
Estab. City × Year FE	✓	✓		
HQ Currency Trend	✓	✓	✓	✓
Observations	404386	404386	45148	45148

Note: Panel A compares the differential impact of exchange rate shock in a home country on the firm wages based on the home-country × sector-specific exported output as a share of total output and the home-country × sector-specific imported input as a share of total input in the foreign establishments (cols 1-2) and the headquarters (cols 3-4) of multinationals headquartered in that country. A home-country × sector is defined as highly output exporting (input importing) if its share of exported output (imported input) is above sample mean. The input/output shares are calculated using year-2004 data from the World Input-Output Database (WIOD) (Timmer et al., 2015). For countries without country-specific information in WIOD, we take the worldly sector-specific averages. Panel B compares the differential impact of exchange rate shock in a home country on the gross wages paid to occupations of high and low offshorability and of different task complexity. An occupation is defined as highly offshorable if its offshorability index is above the sample mean. The offshorability index is constructed according to Blinder & Krueger (2013). Occupations defined as single-task include: cleaner, messenger, guard, driver, data entry clerk, administrative clerk and shipping & receiving clerk. Panel C compares the differential impact of exchange rate shock in a home country on the gross wages paid to occupations of high and low abstractness and routineness. An occupation is defined as abstract (routine) if its abstractness (routineness) index is above the sample mean. The abstractness and routineness indices are from Autor & Dorn (2013). HQ country currency time trends are included in all specifications. All foreign establishments located in the same currency zone as the headquarters are excluded. Standard errors are reported in parentheses and clustered at the home-country-currency-zone level.

TABLE A17: RAIS DATA SUMMARY STATISTICS

	Mean	Min	Max	SD
Occupations	14	1	149	19.1
Workers	288.9	1	12804	974.7
% Brazilian	99.0	0	100	3.7
% no High School	11.2	0	100	17.3
Tenure (Months)	61	0.4	525.9	55.3
Yearly Wages (USD)	25412.1	0	394589	22142.0

Note: This table reports the mean, minimum, and maximum values, as well as the standard deviations of the listed variables in the Brazilian establishments of foreign firms in the RAIS data. Variables are measured at the firm establishment-by-year level so that an observation is a firm establishment-year. Occupations is the average number of occupations present in a firm's establishment in a given year. Workers is the number of full-time workers at a firm's establishment in a given year. % no High School is the percent of workers within a firm's establishment who did not finish high school. % Brazilian is the percent of workers who are Brazilian nationals. Tenure is the number of months a worker is at a specific establishment. Wages are measured in current US Dollars.

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