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Jonas Hjort
Xuan Li
Heather Sarsons

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ABSTRACT

Many employers link wages at establishments outside of the home region to the level at headquarters. We show this using new data on 1,213 multinationals' establishments across the world and linked employee-level data on their establishments in Brazil. Headquarters wage changes arising from minimum wage and exchange rate shocks are partially transmitted to workers employed in the same position abroad. Wage change transmission appears to be direct and results from firm-wide wage-setting procedures rather than associated technology or employment changes. "Anchored" wage-setting is associated with particular headquarter country characteristics.

Jonas Hjort
Department of Economics
University College London
Drayton House
30 Gordon Street
London WC1H 0AX
UK
jonas.hjort@gmail.com

Heather Sarsons
Booth School of Business
University of Chicago
5807 South Woodlawn Avenue
Chicago, IL 60637
and NBER
hsarsons@mail.ubc.ca

Xuan Li
Hong Kong University of Science
and Technology
LSK 6042, Department of Economics
Clear Water Bay, Kowloon
Hong Kong
xuanli@ust.hk

1 Introduction

Some firms pay more than others for workers of similar skill levels (Card *et al.*, 2013, 2015, 2018; Barth *et al.*, 2016; Bloom *et al.*, 2018). A prominent example is multinationals. They tend to pay large premiums to employees overseas, even when the establishment is located in a low-wage region (Brown *et al.*, 2004; Lipsey & Sjoholm, 2006; Alfaro-Urena *et al.*, 2019; Setzler & Tintelnot, 2021). This is often attributed to differences in technology or production style.[1] However, there is growing evidence that many firms may be unable or unwilling to fully adjust to the different contexts in which their establishment operate, pointing to a fundamentally different source of firm wage premiums.[2]

We hypothesize that the use of firm-wide wage-setting procedures limit spatial wage differences within firms, pulling wages at establishments in other regions toward the level at headquarters. Using job-level data from large, well-known multinationals, we provide evidence that many firms indeed "anchor" their wages. They appear to directly link wages at home and abroad, partially extending externally imposed headquarters wage increases to their foreign establishments. We find little evidence that wage change transmission arises through associated technology or employment changes.

The 2000-2015 dataset we use reports yearly average wages for narrowly-defined occupations in multinationals' establishments across the world. It was constructed by a consulting company which harmonizes occupations or "jobs" by tasks and responsibilities to provide aggregated information about prevailing wages. The full dataset covers 1,213 multinationals that span 19 broad sectors and operate in 174 different cities around the world. Most are well-known for-profit firms—the publicly listed U.S. firms in our data account for about one-third of the total revenue of all publicly listed U.S. firms—but the dataset also contains many multinational public sector employers. We use an additional data source, matched employer-employee administrative data from Brazil, to corroborate our findings, and to explore pathways underlying wage change transmission.

The first part of the paper is descriptive. We show that the average wage a multinational pays *domestic* (non-expat) workers within a narrowly-defined occupation at foreign establishments is highly correlated with what it pays workers in the same occupation at headquarters. The same is true for the employer's wage slope—the difference between the wages it pays workers in similar jobs of slightly higher versus lower skill requirements. The multinationals in our sample ultimately

[1] Recognition of and interest in "firm effects" in wages have a long history in labor economics (see e.g. Slichter, 1950; Rees & Schultz, 1970; Dickens & Katz, 1987; Van Reenen, 1996; Abowd *et al.*, 1999). That multinationals pay workers more than local firms is extensively documented (see Brown *et al.*, 2004; Lipsey & Sjoholm, 2006; Hijzen *et al.*, 2013; Setzler & Tintelnot, 2021; Alfaro-Urena *et al.*, 2019). See e.g. Conyon *et al.* (2002); Helpman *et al.* (2013); Sun (2020) on technologies or production styles in multinationals that raise worker productivity or attract productive workers.

[2] See Adams & Williams (2019); DellaVigna & Gentzkow (2019) on firms not adjusting their product prices to local contexts. Recent research has also shown that many workers are averse to pay inequality (Card *et al.*, 2012; Mas, 2017; Breza *et al.*, 2017; Cullen & Perez-Truglia, 2022; Dube *et al.*, 2019), and that fairness preferences can influence firms' wage-setting practices (Harrison & Scorse, 2010).

pay most jobs in lower-income foreign countries wages that, relative to GDP per capita, are an order of magnitude higher than what they pay workers in the same position at headquarters.[3] We include fixed effects that rule out conventional explanations operating through firm×occupation or city×year productivity differences. Headquarters wage-anchoring is observed across the occupation range but is highest for low-skill occupations, such as cleaners, drivers, and security guards.

In the second part of the paper we show that multinationals partially transmit externally imposed changes in wages at the headquarters to their foreign establishments. To do so we use changes in minimum wages. Comparing multinational-owned establishments located in the same foreign city, we document that low-skill wages in "treated" and "control" establishments evolve similarly before the minimum wage is increased in the country or state where the headquarters of treated establishments is located. Thereafter (relative) wages in treated establishments abruptly increase. Within low-skill occupations in the same foreign establishment, these wage increases are concentrated among workers in jobs whose headquarter counterparts are more exposed to minimum wage changes. The implied spatial compression of wages is in line with how many firms themselves report to set wages (Culpepper & Associates Inc, 2011; Alfaro-Urena *et al.*, 2019).[4] We show that endogenous timing of minimum wage changes is unlikely to explain the estimated impact on wages paid abroad, and also exploit a second source of externally-imposed changes to wages at headquarters: exchange rate shocks.[5]

In the third part of the paper we examine why wages at multinationals' foreign establishments are linked to the level at headquarters. We argue that wage anchoring is a result of firm-wide wage setting procedures that in effect directly tie foreign establishment wages to headquarter wages, but also consider indirect pathways to foreign wages, including offshoring and firm-wide technology changes.

We first use a causal forest algorithm to estimate the conditional average treatment effect of a minimum wage shock at a firm's headquarters, allowing the foreign wage response to vary with a wide range of characteristics associated with the job. We then construct and compare above- and below-median predicted average treatment groups, following Carlana & La Ferrara (2021). Differences between high- and low-wage-shock-transmission job observations are not large, but high-transmission observations do differ in various characteristics of the firm's headquarter country, such as inequality and long-term orientation. In contrast, links between the headquarter and establishment

[3] In the Appendix we show that our results are very similar for private-sector firms and other types of employers. For simplicity, we use "firm" and "employer" interchangeably.

[4] In a recent survey of primarily North American employers, 29 percent report paying the same *nominal* wages across locations (Culpepper & Associates Inc, 2011) (see also Hazell *et al.*, 2022). Similarly, Amazon, IKEA, Walmart, and at least 58 other large employers have self-imposed, country-wide wage floors in the U.S. (National Employment Law Project, 2016). Alfaro-Urena *et al.* (2019) report survey evidence that multinational corporations pay high wages abroad in part to "ensure cross-country pay fairness within the MNC" (p. 2).

[5] Exchange rates both increase and decrease, are less stable over time, and have different underlying drivers than minimum wages. We show that, when the measured-in-USD headquarters wages of a (non-U.S.) multinational increase after an appreciation of the home country currency, foreign establishment wages are also increased in response.

countries; the sector the multinational operates in; and especially the foreign establishment country, have little explanatory power.[6]

We next link the global multinationals data to Brazilian employer-employee registries. We begin by confirming the results from our earlier analysis. The wage multinationals pay a given individual in Brazil abruptly rises when external shocks raise the wages of workers in the same position at the foreign headquarters. We then look at the employment response at multinationals' Brazilian establishments. The results are hard to reconcile with indirect pathways explaining wage shock transmission. Both event study analysis and panel regressions point toward no change in total employment at foreign establishments. In addition, the estimated wage response does not depend on job offshorability. Overall there is little evidence to suggest that the initial wage impact arises through local labor markets.

In sum, this paper shows that many multinationals do not fully adjust wages to local contexts and instead partially link foreign workers' pay to that of workers in the same position at the headquarters. An important question for future research is whether such wage-setting procedures ultimately benefit the firm. They may do so for example by reducing menu- and information-costs of localized wage-setting (Lemieux *et al.*, 2012); increasing foreign worker morale (Dube *et al.*, 2019); or responding to consumer- or headquarter workers' fairness views (Harrison & Scorse, 2010). Alternatively, firm-wide wage-setting procedures may represent a form of firm mistakes (Goldfarb & Xiao, 2011; DellaVigna & Gentzkow, 2019; Dube *et al.*, 2020).

Our analysis builds on recent findings on invariability in firms' decisions across contexts, especially DellaVigna & Gentzkow (2019).[7] We connect this body of evidence with the literature on spatial wage differences (see e.g. Moretti, 2011). Our research design builds on the pioneering work of Harrison & Scorse (2010) showing that home country attitudes can influence how firms operate abroad, and Bloom *et al.* (2012)'s evidence that multinationals "transport" their practices across borders.[8]

By establishing a particular reason why some firms pay higher wages than others in a given labor market, this paper also helps uncover the nature of the well-known but poorly understood phenomenon of firm wage effects (see e.g. Card *et al.*, 2013, 2015, 2018; Barth *et al.*, 2016; Bloom *et al.*, 2018). The wage anchoring we document is consistent with existing evidence of rent-sharing (Van Reenen, 1996; Card *et al.*, 2018; Mogstad *et al.*, 2018); potential benefits to firms' of compressed wage-setting (Goldschmidt & Schmieder, 2017); and the use of pay benchmarks (Clemens & Gottlieb, 2017), but to our knowledge represents the first direct evidence of firm "wage norms".[9] Such norms'

[6] High-wage-shock-transmission (low-skill) job observations also have less abstract, less routine, and more manual tasks. This may help explain "anchoring" generally being more pronounced in low-skill jobs, but is hard to reconcile with offshoring explaining wage shock transmission (Autor & Dorn, 2013).

[7] The literature on invariability in firms' decisions across contexts originates in the seminal work of Kahneman *et al.* (1986). See also footnote 2 and the lab-based experimental studies surveyed in—and following on from—Rabin (1998).

[8] See also Hermalin (2013)'s surveys of the literature on corporate culture.

[9] Budd *et al.* (2005); Martins & Yang (2015) find a high parent firm profits elasticity of foreign affiliate wages,

impact on wages across a wide span of countries and occupations multinationals operate in points towards similarly wide-ranging firm wage-setting power, and subsequent work suggests that firm wage norms may be even more widespread and consequential within countries (Hazell *et al.*, 2022). In this sense our analysis relates to studies that uncover characteristics of labor markets by identifying and studying the consequences of particular forms of wage-setting (see e.g. Dube *et al.*, 2020).

Finally, this paper shows evidence of across-country margins of adjustment to minimum wages. In this sense it relates to evidence on shocks spreading across space inside firms (Boehm *et al.*, 2019; Giroud & Mueller, 2019; Giroud & Rauh, 2019). We take a first step toward understanding how firm-wide wage-setting procedures affect economic activity across countries—in particular how "wage-anchoring" multinationals adjust employment abroad when wages rise at home. In doing so we build on the literature on how offshoring responds to home wages (Feenstra & Hanson, 1996; Grossman & Helpman, 2008; Muendler & Becker, 2010; Harrison & McMillan, 2011); on institutionally required pay equality (Cappelli & Chauvin, 1991; Propper & Reenen, 2010; Boeri *et al.*, 2021); and on work studying firms' decisions to directly tie worker compensation to performance or not and consequences for wage inequality (Lemieux *et al.*, 2009; Massenkoff & Wilmers, forthcoming).

2 Data and Summary Statistics

2.1 Job-level wages at multinationals' establishments

The primary dataset we use comes from a consulting company ("the Company") that gathers information on compensation at establishments around the world. When a multinational uses its services, H.R. personnel describe positions present in each reported establishment: their tasks, responsibilities, and average gross and net monthly total pay. The ultimate dataset includes 287 harmonized position titles, which we refer to as occupations or jobs. Because they are defined globally by the Company, whose business relies on its ability to harmonize occupations across employers and countries, the data is likely to be far more comparable across contexts than those generated by heterogeneous statistical agencies.

The Company maps the 287 occupations into 15 skill levels and 26 occupational categories. Examples of low-skill jobs (skill levels 1-5) include cleaner, guard, and data entry clerk. Middle-skill jobs (6-10) include administrative assistant, systems analyst, and finance officer, and high-skill jobs (11-16) senior legal counsel, regional office manager, and H.R. director. As seen in Appendix Figure A1, the most common occupation categories are "General Operations" and "Administrative", but others are more specific. Both high- and low-skill jobs are concentrated in the five or so most common occupational categories; middle-skill jobs span a wider range. For example, out of the 986 jobs observed in the "Engineering" category, 303 workers are in middle-skill jobs, while 4958 out of 10556 "Secretary" jobs are low-skill positions. On average, multinationals in our data report information on around 25 dif-

consistent with our results.

ferent occupations, spanning 9 skill levels, that are present in an average of five foreign establishments.

The dataset covers the years 2000 through 2015. Data are collected each year, but not all establishments are included every year. The dataset is thus an unbalanced panel at the establishment×year level. Our primary outcome variable is the average nominal gross total wage of domestic workers employed in a given job at a given establishment and year, measured in current USD.[10]

2.2 Multinationals in the data, sample construction, and summary statistics

The full sample of multinationals we study includes roughly 1,200 employers. The majority are private sector firms, while a sizeable minority are multinational public sector employers (such as large, international NGOs, multilateral organizations, etc). They operate in a variety of sectors, including manufacturing (24 percent), financial services (17 percent), petroleum (11 percent), business activities (9 percent), telecommunications (7 percent), technology (6 percent), and pharmaceuticals and health services (4 percent), as shown in Appendix Figure A2. For comparison, we drew a random sample of multinationals from the same headquarter country×sector combinations from Orbis, a comprehensive database of large and medium-sized formal firms' whose financial records are widely used in economic research. The sectoral comparison is shown in Appendix Figure A3. We cover many of the sectors in Orbis, but the multinationals in our sample are significantly less likely to be in manufacturing and more likely to be in for example petroleum and financial services, and especially to be NGOs.[11]

The employers in the sample are unusually large. They have significantly more assets, capital, revenues, and profits than firms in the Orbis sample (see Appendix Table A1). The publicly listed U.S. firms in our data account for about one-third of the total revenue of all publicly listed U.S. firms.

As clients, the multinationals choose which establishments report data to the Company in a given year, and most do not include all establishments. The Company informed us that a rotation rule for establishments to report is generally chosen[12], and that there is some variation in H.R. personnel's non-response rates. The panel structure of the data appear to confirm this. The included establishments are significantly skewed toward local headquarters, though many also employ production workers.

We include both private-sector and public-sector multinationals in our primary samples because some sources of across-country wage compression may influence both types of employers, and also because the econometric specifications we use limit statistical power in some parts of our analysis.

[10] Our dataset does not cover expat workers. Most multinationals report their compensation data to the Company in USD. The Company converts the data of employers that report in local currency to USD.

[11] Sectors are defined by Standard Industrial Classification, with NGOs and other multinational public sector employers classified separately. The latter include national banks and branches of government that have establishments abroad.

[12] For example, "all foreign establishments report every year, but the headquarters only reports every fifth year" or "foreign establishments rotate in and out, and the headquarters never reports". There is also regional variation: some multinationals include establishments across the globe, while some include only certain continents. For a substantial fraction of foreign establishment wages, we do not observe a corresponding headquarter occupation wage in the same year. This is partly due to the fact that most multinationals seek the Company's services with their foreign establishments in mind.

We show that results are generally robust to restricting analysis to private-sector firms.

The samples of multinationals we construct are summarized in Table 1.[13] Our full Sample 1 is the foreign establishments we observe, regardless of whether there is a job-match between the headquarters and establishments. It includes 6,217 foreign establishments that belong to 1,213 employers. Appendix Figure A4 shows that these are distributed across the world, in 174 cities. In contrast—and also shown in the figure—most headquarters are in Europe and North America, although some are in Asia, Latin America, and Africa, in part because the Company's primary focus is establishments in low- and middle-income countries. We use Sample 1, in addition to narrower samples discussed next, when we analyze the foreign wage impact of external shocks to headquarter wages in Section 4.[14]

In Section 3 we descriptively compare the wages of workers in an employer's foreign establishment to those at the headquarters. We first restrict the sample to employers for which we observe at least one position at both the headquarters and at (one or more of) its foreign establishment(s) (Sample 2), and then to those multinationals for which at least one such job observation is in the same year at the headquarters and foreign establishment(s) (Sample 3). There are substantially fewer employers in subsamples 2 and 3, but they are nevertheless not small. As shown in Panel A of Table 1, Sample 2 (3) includes 101 (80) employers, 1,239 (610) of their foreign establishments, and 111,954 (27,318) establishment×job×year observations. The results of our analysis are generally similar in the smaller samples with "position overlap" and the full Sample 1. Panel B of Table 1 displays summary statistics for employers in each of the three samples of multinationals. The mean nominal wage the multinationals in Sample 1 pay across their foreign establishments is USD 14,442 (in 2000 dollars), with a standard deviation of USD 9,016. The corresponding numbers are USD 13,573 and USD 8,125 in Sample 2 and USD 16,992 and USD 8,598 in Sample 3.

2.3 Additional data sources

Shocks to headquarter wages We gather information on two types of shocks in home countries and states that are external to the firm, but that may influence wages at multinationals' headquarters: changes in minimum wages and exchange rates. Country-level minimum wage data come from the International Labour Organisation (ILO), and state-level minimum wage data from the U.S. come from Vaghul & Zipperer (2016). Yearly data on the headquarter country's exchange rate (in local currency units per USD) come from the World Bank. See Appendix III for details.

Matched employer-employee data from Brazil We use Brazil's longitudinal matched worker-firm database, the *Relação Anual de Informações Sociais* (RAIS) to study wages and employment outcomes in multinationals' foreign establishments in granularity, albeit in a more particular context in

[13] Appendix Table A2 shows summary statistics on the private-sector employers in our sample.

[14] Data on wages at the multinational's headquarters are available for around 10 percent of the multinationals in Sample 1. We observe home country/state wage shocks—minimum wage changes and exchange rate shocks—in auxiliary data.

which a smaller set of multinationals operate. The RAIS data contain information on each individual employee at each establishment, including their wage, education, race, gender, age, and tenure.

We identify the multinationals in the Company data that have an establishment in Brazil, and extract the 2000-2017 RAIS data on all of their Brazilian establishments, matching jobs by skill-level, to form our Brazil sample.[15] This sample includes job level data from 54 multinationals that are headquartered in 20 different locations (most commonly in Australia, France, Germany, the US, and the UK), 37 of which have a headquarter job-match.

Employer, job, and location attributes We use a host of data on the economic, political, and cultural context of headquarter and foreign establishment countries—and characteristics of firms and jobs themselves—that may predict wage-setting practices. We consider economic traits such as urbanization; cultural traits such as trust and inequality aversion; sectoral characteristics like tradability; occupation ones like offshorability; and features of headquarter-establishment country pairs, such as language commonality and geographic distance. The full set are laid out in Table 7 and discussed in Section 5.1 and Appendix III.

3 Anchoring to Headquarter Wages

In this section we document a robust correlation between the wages multinationals pay workers employed in a given position at the headquarters and in foreign establishments.

3.1 Across-country wage patterns

The raw data point toward a close relationship between the two. In the lowest and highest within-headquarters wage distribution quartile, the mean and maximum are roughly USD 11,000/42,000 and USD 37,000/91,000 respectively. We show this in Panel C of Table 1, focusing on Sample 3 as defined in Sub-section 2.2. We also display, by headquarter wage-quartile, wage levels at employers' foreign establishments as percentages of their wage level for the same jobs at headquarters. The nominal wages paid to workers in foreign establishments are on average around 87 percent of those of headquarter workers in the same job in the same year, a number that is quite stable across the wage distribution and similar (77 percent) also for establishments in countries that are poorer than the home country.

3.2 Estimating wage anchoring

To estimate the extent of wage anchoring, we correlate the wages paid to workers in a particular occupation at a firm's foreign establishments with the wages paid to workers in the same occupation

[15] For each such multinational, we keep all available years in the time period for all its establishment in RAIS, including ones located in a different city than the one in the Company data and years that could be missing in the unbalanced panel in the Company data, so as to maximize sample size. We match RAIS and the data from the Company by firm×year×job skill-level due the difficulty of matching individual positions in two data sources with narrowly-defined jobs/positions in the absence of a cross-walk. Recall that the jobs in the data from the Company belong to 16 different skill levels. The wage observations from the two data sources are highly correlated, at around 0.8.

at the firm's headquarters. Specifically, we run

$$\mathrm{w}_{jfct} = \beta_1 \mathrm{HQw}_{jft} + \beta_2 x_{jct} + \theta_{fj} + \theta_{ct} + \varepsilon_{jfct} \quad (1)$$

where w_{jfct} is the log average wage of workers in job j at firm f's establishment in foreign city c in year t. A job or occupation here means a specific position such as driver, administrative assistant, or Human Resources director. HQw_{jft} is the log average wage of workers in the same job at firm f's headquarters in year t. We control for a benchmark measure of the foreign city "market" wage of workers in job j in year t—x_{jct}—in two ways. The first, $\bar{\mathrm{w}}_{j(-f)ct}$, directly measures how much multinationals *other than firm* f in our sample are paying their workers in job j in foreign city c in year t. Our second control for market wages—a fixed effect for job j in city c in year t, θ_{jct}—is more restrictive than $\bar{\mathrm{w}}_{j(-f)ct}$, but does not yield a benchmark correlation to which $\hat{\beta}_1$ can be compared.

We include firm×job fixed effects (θ_{fj}) to account for broader differences between workers in job j across firms, as well as city×year fixed effects (θ_{ct}) so that we only compare establishments in a given city at a given point in time. We measure all wage levels as the log of the relevant nominal, pre-tax wage in USD, and cluster standard errors at the firm level.

Headquarter and foreign establishment wages are strongly correlated. Column 1 of Table 2 shows that 10 percent higher wages at the headquarters is associated with 1.9 percent higher foreign establishment wages for workers in the same position, and 1.1 percent higher foreign wages when we replace the local wage benchmark control and city×year fixed effects with city×job×year fixed effects (Panel B, columns 1).[16] The within-firm-across-country correlation in wage levels is an order of magnitude larger than the correlation between a given establishment's wage level and the local average paid by other multinationals to workers in the same job. In Column 2 we include headquarter country×year fixed effects to account for possible technology shocks that occur in the firm's headquarters that could affect the relationship in wages for different jobs. The results are unchanged.

The estimated correlation is robust to including wage observations from foreign establishment jobs that do not necessarily have a counterpart at the headquarters in the dataset. We show this in three different ways. In Column 3, we collapse the data to the skill level and look at the within-year correlation between the foreign establishment and headquarter wages of jobs that are not necessarily identical positions but of the same skill level.[17] In Column 4, we collapse the data to the firm level

[16] To maximize statistical power in the comparatively small samples in Table 2 (see Sub-section 2.2), we use a Frisch-Waugh approach in Panel B and residualize our dependent variable (log foreign establishment wage) with respect to the fixed effects and then regress the residuals on the (also correspondingly residualized) log establishment wage, where the residualization is performed using the larger Sample 1. We also present the results controlling for the set of fixed effects in Appendix Table A3. This gives very similar but less precisely estimated results.

[17] In Panel A, we replace firm×job fixed effects with firm×skill-level fixed effects, and the job-specific local benchmark with a skill-level-specific local benchmark in Panel A. In Panel B we replace job×city×year fixed effects with skill-level×city×year fixed effects.

and correlate the average wages paid at headquarters and the foreign establishment, regardless of occupation or skill match.[18] In the last approach, shown in Column 5, we include firms for which foreign establishments and the headquarters are not necessarily interviewed in the same years (Sample 2). To do this, we replace w_{jfct} and HQw_{jft} with imputed values of the outcome variable (see Section 2 of Appendix III for details). The within-firm, across-country correlation in wage levels is shown graphically in Panel A of Figure 1.

The estimated wage anchoring is almost twice as large if we restrict the sample to private-sector firms, as shown in Column 4 of Appendix Table A4. In Section 5 we show that these results also hold and are of similar magnitude when using individual worker-level data from Brazil.

3.3 Heterogeneity in wage anchoring

The within-firm-across-country correlation in wages does not vary much with the income level of the headquarter country. Panel B of Figure 1 shows the correlation for firms headquartered in the U.S., other high income countries, and all other countries. The relationship is slightly weaker for lower income countries but the differences are small. Corresponding estimates are in Column 3 of Appendix Table A4. We further characterize the types of employers, jobs, and locations where externally imposed changes in wages are (partially) transmitted to foreign establishments in Section 5.

Wages appear to be anchored to headquarters levels to a greater extent in low-skill than higher-skill jobs. This can be seen in Panel C of Figure 1, where we separately plot the relationship between headquarter and establishment wages for low, middle, and high-skill jobs. In Column 2 of Appendix Table A4, we interact HQw_{jft} with indicators for the relevant job being middle- and high-skill, as opposed to low-skill. A ten percent higher wage at headquarters is associated with a 2.7 percent higher foreign establishment wage in low-skill jobs, and 1.9 and 1.2 percent higher foreign establishment wages in middle and high-skill jobs.

3.4 Correlation in wage slopes

The *slope* of the wage profile across jobs of consecutive skill levels at multinationals' foreign establishments is also highly correlated with the slope at headquarters. To show this, we replace the wage level in equation (1) with a corresponding measure of the establishment's wage slope. We consider occupational categories rather than narrowly-defined occupations (or jobs) themselves. A given occupational category o—for example, administrative jobs—often has jobs of multiple skill levels represented within an establishment. This allows us to construct a measure of the difference between the average wage of jobs that are of skill level $l+1$ versus skill level l but otherwise similar, in the foreign establishment of firm f that is located in city c at time t: $\nabla w_{o(l,l+1)fct}$. We also replace the independent

[18] Firm×job fixed effects are replaced with firm fixed effects, and the controls for market wages are subsumed by city×year fixed effects.

variable of interest HQw_{jft} with an analogously defined measure of the corresponding wage slope at the headquarters, $\nabla\text{HQw}_{o(l,l+1)ft}$.[19] The slope correlation, shown in Table 3, is similar to the wage level correlation in Table 2: a 10 percent greater difference in occupational category-specific wages between jobs of consecutive skill levels at headquarters is associated with a 1.1 percent greater difference in establishment wages between workers of the same occupational category and skill levels.[20]

The results in this section leave open the possibility that changes in wages within firms are linked across space only via overlapping third factors, such as the firm's technology or production style. We next use location-specific external shocks to wages to show that headquarter wages themselves affect foreign establishment wages, while there is no evidence of the reverse effect.

4 Changes in Foreign Wages in Response to Externally Imposed Changes in Headquarter Wages

In this section we provide evidence suggestive of a *direct* link between a multinational's headquarters and foreign establishment wages. We do this by exploiting minimum wage changes in a firm's home country or state, and corroborate the findings using exchange rate fluctuations—another source of externally imposed variation in headquarter wages.

4.1 Event study analysis of minimum wage shocks

Minimum wage increases in headquarter countries and U.S. states occur throughout our 15-year data period. Their frequency, size, and locations are shown in Appendix Figure A5. The size of the increase varies substantially, and minimum wage hikes occur on all continents.

We begin with an event study. We look within a city, using establishments whose headquarters are located in countries/states with a minimum wage increase in year t as our treatment group. Establishments in the same city whose headquarters do not experience a minimum wage increase in year t act as controls. We then compare the evolution of wages in the two groups by estimating:

$$\text{w}_{jfct} = \sum_{k=-3}^{3} \alpha_k^1 \mathbf{I}(\text{MINw}_{h(f),t-k} > 0) + \theta_{fj} + \theta_{ct} + \varepsilon_{jfct} \tag{2}$$

[19] Occupation-specific average wages paid by other employers $\bar{\text{w}}_{j(-f)ct}$, is replaced with the analogously defined slope measure $\nabla\bar{\text{w}}_{o(l,l+1)(-f)ct}$; and the second benchmark measure, occupation×city×year fixed effects, is also replaced by occupation-category×skill level-pair×city×year fixed effects. Firm×occupation fixed effects are analogously replaced by firm×occupational category×skill level-pair fixed effects.

[20] The results are very similar when the control for market wages is the occupational category-specific wage slope of other multinationals and when we instead include city×occupation-category×skill-level pair×year fixed effects (see Column 2). If we measure the wage slope across consecutive skill levels establishment-wide, then the anchoring estimate is similar to the occupational category-specific approach with the first market wage benchmark but substantially higher with the second one, as seen in columns 3 and 4. The estimated within-employer-across-country correlation in wage slopes is also markedly higher if we restrict the sample to private-sector firms, as shown in Column 5 of Appendix Table A4.

on the sample of low-skill jobs (whose wages may directly respond to minimum wage changes). In equation 2, $\mathbf{I}(\text{MINw}_{h(f)t-k}>0)$ is an indicator that firm f experiences a minimum wage hike in its headquarters country or state h in a given year. The dependent variable, w_{jfct}, is defined as in Section 3. The coefficient $\hat{\alpha}_k^1$ thus represents the difference in wages paid to workers in a specific job in treated foreign establishments and that paid to workers in the same job in control establishment in the same city in year k. Standard errors are clustered at the home country/state level.

We see clear evidence that the wages of foreign establishment workers increase after a minimum wage hike in the multinational's home country or state. In Figure 2 we plot the coefficients $\hat{\alpha}_k^1$ estimated relative to the year before the minimum wage shock ($k=-1$). Annual wages in treated establishments increase by over USD 430 relative to control establishments following the minimum wage shock in the home country/state. Importantly, there is no evidence of differential wage growth in treated relative to control establishments before minimum wage changes.[21]

4.2 Average effect of minimum wage shocks on foreign establishment wages

The pattern in Figure 2 suggests that changes in home country and state minimum wage laws can be used to estimate the impact of headquarter wage changes on foreign establishment wages. We first show results from a reduced-form regression relating percent changes in year t from year $t-1$ in the wages paid in a foreign establishment to minimum wage increases in the home country/state, controlling for firm×job and city×year fixed effects as throughout our analysis and clustering standard errors at the home-country level (or the home-state level for U.S.-headquartered firms):

$$\%\Delta \text{w}_{jfct} = \alpha_1 \mathbf{I}(\text{MINw}_{h(f),t}>0) + \theta_{fj} + \theta_{ct} + \varepsilon_{jfct} \tag{3}$$

The indicator $\mathbf{I}(\text{MINw}_{h(f),t}>0)$ now measures current-year changes in minimum wages and the outcome variable is therefore a measure of concurrent changes in wages (Jardim *et al.*, 2018; Cengiz *et al.*, 2019; Dustmann *et al.*, 2022). We use the full Sample 1 (see Section 2).

We find that a 10 percent increase in the home country's or state's minimum wage is associated with a 0.2 percent increase in the wages of workers in low-skill jobs at foreign establishments, as shown in Column 1 of Table 4.[22] In Appendix Table A5 we show that there is no estimated response in the wages of middle- and high-skill jobs in foreign establishments.

Wage anchoring appears to be a headquarters effect. We find no effect of minimum wage changes in the country where a given foreign establishment is located on wages at the headquarters, nor on

[21] We estimate (2) using multinationals whose headquarters do not experience a minimum wage hike during the three-year period before an event so that we can compare treated and control during a pre-period where neither are exposed to headquarter minimum wage hikes. This restricts our sample to roughly 330 firms. Later, when we focus on the impact of a minimum wage change in year t on wages in year t, we use the full sample. Only low-skill workers are included.

[22] In Appendix Table A6, we show that the estimate is robust to alternative definitions of a low-skill job. In Appendix Table A7 we limit the sample to private sector firms.

wages at foreign establishments that are part of the same firm but located in other countries, as shown in columns 1 and 2 of Appendix Table A8.

Next we show evidence that the foreign wage response to minimum wage shocks at headquarters operates through headquarter wages. We first regress the change in the average wage firm f pays workers in a given job j at the headquarters in year t, $\%\Delta\text{HQw}_{jft}$, on the minimum wage change indicator $\mathbf{I}(\text{MINw}_{h(f),t}>0)$. As seen in Column 2 of Table 4, a 10 percent increase in the home country's/state's minimum wage is associated with a roughly 0.6 percent increase in the wages of workers in low-skill jobs at the headquarters.[23] We then instrument for the change in job-specific headquarter wages, replacing $\mathbf{I}(\text{MINw}_{h(f),t}>0)$ in (3) with the first-stage estimates $\%\Delta\widehat{\text{HQw}}_{jft}$. We estimate the second stage using two-sample two-stage least squares (TS2SLS) (Angrist & Krueger, 1992; Inoue & Solon, 2010). Recall that there are many employer×occupation×year cells for which we have data on establishment but not headquarter wages. Using TS2SLS, we can include all jobs in foreign establishments and headquarters in our analysis sample. TS2SLS provides a consistent estimate if (the probability limit of) the correlation between the endogenous variable(s) and the instruments (conditional on controls) is the same in the first-stage sample and the second-stage sample.[24]

We find that a minimum wage change-induced 1 percent increase in the wages of workers in a given low-skill job at headquarters raises the wages of workers in the same job at the foreign establishments of the same multinational by about 0.3 percent. This is shown in Column 3 of Table 4.[25]

We interpret Table 4 as evidence that externally imposed changes in headquarter wages *themselves* affect wages in multinationals' foreign establishments.[26] In the next sub-section we show that endogenous timing of minimum wage changes is unlikely to explain these results: the forces underlying a change to the minimum wage in the country or state where an employer is headquartered appear to be *ignorable* in our analysis. In Section 5 we in turn consider various direct and indirect pathways through which changes in headquarter wages may affect foreign establishment wages.

4.3 An identification concern: endogenous timing of minimum wage changes

Dickens (2015) documents wide variation in how minimum wages are set across countries, and

[23] The first stage is: $\%\Delta\text{HQw}_{jft} = \gamma_1\mathbf{I}(\text{MINw}_{h(f),t}>0) + \theta_{fj} + \theta_t + \varepsilon_{jft}$, where for headquarters ($c = h(f)$), city×year fixed effects ($\theta_{h(f)t}$) are replaced with year fixed effects (θ_t) and city fixed effects ($\theta_{h(f)}$), subsumed by firm×job fixed effects (θ_{fj}), so that the independent variable of interest is not subsumed.

[24] Intuitively, this assumption requires that the average treatment effect of home country/state minimum wage increases on the (unobserved) headquarters low-skill wages in the subset of observations that have no such information in our data is similar to the that on observed headquarter low-skill wages. One can alternatively focus on the reduced form estimates.

[25] Our preferred approach is to use all minimum wage hikes in headquarter countries/states. Using only above-median-size hikes leaves the estimates essentially unchanged. Restricting to the very largest hikes (above the 75th percentile) gives a larger reduced form estimate and increases the IV estimate, as shown in columns 1-6 of Appendix Table A9.

[26] These shocks might additionally affect the wages of other local employers, in which case our estimates capture the impact on the directly affected establishments—the establishments whose headquarters are exposed to the shock itself—over and above the broader impact affecting control establishments in the same foreign city.

across U.S. states.[27] Nevertheless, it could be, for example, that minimum wage increases more often occur when aggregate labor demand is high, and that home labor demand is highly correlated with multinationals' demand for labor abroad.

Fluctuations in demand for foreign labor that co-vary with home country/state minimum wage changes should arguably extend beyond the particular part of the wage distribution most affected by minimum wages themselves. We thus compare wage changes for workers in higher and lower-wage low-skill jobs within a given establishment, thereby differencing-out the impact of broader fluctuations in labor demand on foreign wages. Specifically, we define the minimum wage as (loosely) binding for job j in city c if an establishment in our sample located in the city paid its workers in job j a nominal gross wage lower than the new minimum wage in the year preceding the minimum wage change.[28] "Binding jobs" are thus a subset of low-skill jobs. When firms are headquartered in a city where $\text{Binding}_{jh(f)}=1$, we define the minimum wage as binding also for job j in its foreign establishments. The reduced form relationship between home country/state minimum wage changes and the wages of binding versus non-binding jobs in foreign establishments is:

$$\%\Delta \text{w}_{jfct} = \alpha_2 \mathbf{I}(\text{MINw}_{h(f),t} > 0) \times \text{Binding}_{jh(f)} + \theta_{fj} + \theta_{fct} + \varepsilon_{jfct} \tag{4}$$

The minimum wage change itself and any possibly correlated demand shocks that affect both binding and non-binding jobs are absorbed by firm×establishment×year fixed effects, θ_{fct}.[29]

Within foreign establishments, home country/state minimum wage increases affect the wages of workers in jobs for which the minimum wage binds at headquarters significantly more than those of workers in other low-skill jobs. The estimate in Column 1 of Table 5 indicates that a 10 percent increase in the home country's/state's minimum wage results in a 0.7 percentage point larger increase in wages for binding low-skill jobs. We next leave out firm×establishment×year fixed effects so that the effect of headquarter minimum wage increases on the wages of workers in non-binding jobs can be identified. As seen in Column 2, this effect is much smaller (0.03 percent) than that for binding jobs.[30]

[27] Dickens (2015) writes "In 47% of countries, the government sets the minimum wage on the advice and recommendation of an expert body; a further 11% of countries rely on an expert body alone. Practice varies across countries", "In some countries, the central government sets the national minimum wage. The most notable example of this approach is the US. But US states and even cities have the power to set minimum wages that are higher than the national rate", "Other countries follow a rule or formula for fixing the minimum wage. In France, the interprofessional minimum wage (salaire minimum interprofessionnel de croissance) is tied to the consumer price index and uprated annually", and "In some countries (largely in Europe), minimum wages emerge from bargaining between employers and employees".

[28] Given the unbalanced nature of our establishment×year panel, we face a trade-off between constructing a measure of bindingness that is specific to a given firm/headquarters, and measuring bindingness as close in time as possible to the minimum wage change. We opt for a labor market-level measure of bindingness akin to Card & Krueger (1995) and subsequent industry-level studies for power reasons.

[29] We thus restrict the sample to firm×establishment×years for which we observe both binding and non-binding jobs.

[30] It is possible that the interaction terms in our model are biased given the restrictive fixed effects (Balli & Sørensen, 2013). In the final columns of Table 5 we therefore orthogonalize $\text{Binding}_{jh(f)}$ with respect to firm×establishment×year

The differential wage response in foreign jobs for which the minimum wage binds at headquarters may over- or underestimate the true effect on the wages of low-wage workers in foreign establishments.[31] In Appendix I we instead compare the foreign wage response of *employers* that are differentially exposed to minimum wage changes but headquartered in the same country or state. The impact on firms with less exposed headquarters and any macro-level demand shocks affecting the home country/state that are correlated with minimum wage changes can then be controlled for by including home country/state×year fixed effects. We find much larger impacts on the wages of foreign establishment workers with more exposed headquarters.

The evidence in this sub-section suggests that endogenous timing of minimum wage changes is not the primary explanation for the estimated transmission of headquarter wage increases to multinationals' foreign establishments. In Section 5 we consider a range of alternative pathways through which headquarter country minimum wage shocks might affect establishment wages.

4.4 An alternative source of changes in HQ wages: exchange rate shocks

Transmission of minimum wage shocks appears to occur at least in part because multinationals anchor their wages to headquarter levels. We now use a complementary source of variation in headquarter wages: exchange rate shocks to the home country's currency. Exchange rate-induced variation is a useful complement to the minimum wage shocks for two reasons. First, unlike minimum wages, exchange rates both increase and decrease over time, allowing us to investigate foreign wage responses to both positive and negative shocks to (real) headquarter wages.[32] Second, exchange rate shocks are temporary, meaning that employers are unlikely to make concurrent changes in their technologies or employment structures in response. Relative to minimum wage changes, exchange rate fluctuations also occur more frequently, as we show in Appendix Table A10.

If a multinational does not fully index its headquarter wages to e.g. the USD, a home country currency appreciation will increase headquarter wages measured in such international currencies. Wages at the multinational's foreign establishments will then also rise (in international currency terms) if its wage-setting system entails particular forms of anchoring-to-the-headquarters. These include:

1. USD-value wage-level anchoring A firm that pays in establishments' local currencies or in USD might compute the wages to pay at the headquarters and abroad using up-to-date exchange rates

fixed effects and de-mean $\mathbf{I}(\text{MINw}_{h(f),t} > 0)$ before interacting them. This leaves the estimated interaction effect unchanged.

[31] On the one hand, home country or state labor demand that directly affects multinationals' foreign wages and also encourages minimum wage increases may disproportionately be demand for low-wage workers. On the other hand, causal effects of minimum wage changes on the wages of workers that are higher up in the low-skill wage distribution within a given foreign establishment may arise through market-driven spillover effects in wage-formation (Teulings, 2003; Haanwinckel, 2019), or through firms' wage-setting procedures.

[32] We show this and approximate symmetry of exchange rate changes around zero in Appendix Figure A6.

in a way that ensures that its wages are (partially) aligned in USD terms. The exchange rate updating and the wage adjustment may for example be automatically done within a firm-wide HR system.

2. Home country currency anchoring If a firm pays its workers abroad in, or partially indexes their pay to, the home country currency, then shocks to its value will be directly transmitted to foreign establishments, as long as nominal wages are not fully adjusted for changes in purchasing power.

To estimate the relationship between exchange rate shocks and a firm's wages, we run:

$$\mathrm{w}_{jfct} = \alpha_6 \mathrm{e}_{h(f)t} + \theta_{fj} + \theta_{ct} + \varepsilon_{jfct} \tag{5}$$

where $\mathrm{e}_{h(f)t}$ is the log average nominal exchange rate of home country currency units per unit of USD in year t.[33] Standard errors are clustered at the home country (or currency zone) level. Only foreign establishments located outside the home country or currency zone are included.[34] In our preferred specification we control for the headquarter country currency's longer-run trend, which could reflect persistent, underlying changes in its economy that themselves affect multinationals' wages abroad.[35]

We find that a home country currency appreciation increases the dollar value of the wages paid to workers in multinationals' foreign establishments. The estimate in Column 1 of Panel A in Table 6 implies that a 1 percent decrease in the exchange rate of home country currency to USD leads to a 0.05 percent increase in the dollar value of wages in foreign establishments. Panel B shows that, at headquarters, a 1 percent appreciation leads to a wage increase of about 0.5 percent. In columns 2 and 3, we restrict attention respectively to depreciations and appreciations. Consistent with downward nominal rigidity, we see that the establishment wage response is coming entirely from foreign establishment wages responding to home country currency appreciations.[36]

In Panel C of Table 6, we instrument for headquarter wages by replacing $\mathrm{e}_{h(f)t}$ in (5) with the first stage estimates $\widehat{\mathrm{HQw}}_{jft}$. The estimates are somewhat imprecise but suggest that an exchange rate shock-induced increase in headquarter wages of 1 percent leads to a 0.1 percent increase in

[33] As we do not observe the point-in-time exchange rates when wages are paid out, we approximate these using annual exchange rates retrieved from the World Bank. The resulting measurement error in the exchange rates is the main reason why we adopt the log specification in this section instead of the percentage change specification (as taking the first difference exacerbates measurement error and attenuation bias (see Griliches & Hausman, 1986)). Since we include establishment-city (or country)×year fixed effects (year fixed effects in the first stage), (1) it is equivalent (i) to measure the foreign establishment wages in either the USD (our approach) or the local currency, and (ii) to use the home-country-currency-to-USD exchange rate (our approach) or the home-to-establishment-country-currency bilateral exchange rate; and (2) any depreciation or appreciation of the USD against other currencies is subsumed.

[34] Same-currency-zone establishment wages mechanically respond to exchange rate shocks also absent anchoring.

[35] In Appendix Table A11 we leave this linear trend out. The take-aways from Table 6 are largely unchanged. The estimation results are also robust to including only private-sector firms (see Appendix Table A12.

[36] For multinationals that pay foreign workers in local currency or USD and engage in USD-value wage level anchoring, home country currency appreciation (depreciation) is an upward (downward) force on the nominal wages paid abroad. Downward rigidity then implies that pass-through of appreciation should be larger (see Appendix II).

foreign establishment wages.

The impact of shocks to the exchange rate of the home country currency on headquarter wages (in USD terms) is transitory (see Appendix Figure A7). We therefore do not expect exchange rate fluctuations to affect longer-run "latent" wages at foreign establishments. This is what we find: the impact of home country exchange rate shocks on foreign establishment wages is also transitory, as also shown in Appendix Figure A7.[37] In Appendix II we show that endogenous timing of exchange rate shocks is unlikely to explain the results in Table 6.

Taken together, the evidence in this section suggests that externally imposed changes in multinationals' headquarter wages themselves cause changes in their foreign establishment wages.

5 Why Changes in Headquarters Wages Affect Foreign Wages

In this section we investigate why employers anchor their wages and transmit home wage changes to establishments located in fundamentally different labor markets. We begin by describing the types of employers, jobs, and locations where transmission of headquarter minimum wage shocks to foreign establishments is observed. We then use granular employer-employee data from Brazil to investigate if the transmission of wage shocks appears to operate through indirect pathways, such as offshoring and technology adoption that in turn affects foreign wages. We conclude that wage anchoring is most likely a result of firm-wide wage setting practices.

5.1 Which employers, jobs, and locations?

We collected information on 55 attributes—characteristics of the headquarter country, the establishment country, the multinational's sector, the job in question, and the headquarter-establishment country pair—that may predict wage anchoring.[38] We run a regression akin to equation (3) on all jobs and use a causal forest algorithm to infer which of these attributes to the greatest extent capture heterogeneity in the treatment effect of a headquarter country/state minimum wage change on foreign establishment wages (Wager & Athey, 2018; Carlana & La Ferrara, 2021). We orthogonalize both the outcome variable and the treatment indicator with respect to the firm×job and city×year fixed effects as well as all covariates to minimize confounding (Athey *et al.*, 2019). Standard errors are clustered at the headquarter-location level, and we standardize all potential predictors to have zero mean and unit standard deviation within each skill group to facilitate comparisons. Appendix IV provides a detailed description of the estimation precedure.

[37] Unlike an exchange rate shock, a minimum wage increase in a home country is in effect a permanent shock to the nominal wage of some jobs at headquarters, and therefore enter longer-run "latent" wages. We find no evidence that a minimum-wage-induced foreign wage increase is followed by a slow-down (mean reversion) in wage growth in the following years, as Figure 2 also suggests.

[38] The full set of attributes are shown in Table 7 and described in greater detail in Appendix III.

As in Section 4 we distinguish between low- and higher-skill jobs and focus primarily on the former since their wages may directly respond to minimum wage changes.[39] Appendix Figure A8 shows that the estimates of the conditional treatment effect (CATE) are mostly positive for low-skill jobs (Panel A), and they group observations into those with different average treatment effects (ATE) quite well, especially at the right-tail with large positive treatment effects (Panel B).[40]

Following Carlana & La Ferrara (2021), we present the results by displaying the difference in means of the predictors between above- and below-median conditional average treatment effect observations. Table 7 shows the mean value of the relevant variable among above-median wage shock transmission low-skill job observations, measured in standard deviations, relative to the mean of the low-skill sample.[41]

The difference in the average size of the predictors of high and low shock transmission observations is relatively small for all predictors.[42] The largest difference between the two groups is in job task measures: as seen in Panel C of Table 7, the tasks of jobs in the high transmission group are on average more manual, less routine, and less abstract, than those of the low transmission group. We return to these findings in Sub-section 5.3.

The high and low shock transmission observations are substantially more differentiated in headquarter country characteristics than in establishment country characteristics. The only *economic* characteristic that is substantially different in high versus low transmission headquarter countries is inequality: multinationals' foreign establishment wages are more affected by headquarter country/state minimum wage hikes when the multinational is headquarted in a low-Gini country. There are (much) smaller differences across high and low transmission observations in the other economic characteristics we consider (urbanization, educational attainment, GDP per capita, and regulation). All establishment country characteristics are very similar across the two groups.

We also consider cultural and preference differences across high and low wage shock transmission countries.[43] Perhaps most notably, differences across high and low transmission headquarter countries are much more pronounced than those across high versus low establishment countries. Some of the specific cultural and preference measures that differ across the two groups are arguably intuitive: for

[39] Note that, since the causal forest estimation also includes skill level (and controls for the fixed effects from (3)), our approach here is consistent both with that in Sub-section 4.2 and that in Sub-section 5.2.

[40] The average treatment effect (ATE) within each decile defined by the forest-estimated treatment effect is the difference in the outcome variable between the treated and the untreated groups after controlling for the fixed effects from (3). For higher-than-low-skill jobs, the CATE estimates are centered around a slightly positive mean which is much smaller than that of the low-skill jobs, consistent with the result in Appendix Table A5.

[41] Our standardization makes sure that the below-median conditional average treatment effect observations' mean is the same in absolute value but of the opposite sign (and thus omitted from the table).

[42] The mean value of the majority of predictors of the above-median treatment effect observations are within 0.1 standard deviations of the sample mean, and the largest is below 0.5 standard deviations.

[43] These are measured respectively through Hofstede (2001)'s "cultural dimensions" and the Global Preference Survey.

example, high transmission headquarter countries are more long-term oriented. Others are less intuitive: individuals in such countries for example also display lower positive reciprocity and altruism.

Links between the headquarters and foreign establishment country and attributes of the sector the firm operates in are also weak predictors of the treatment effect of minimum wage shocks on foreign establishment wages.[44] This suggests that bilateral mechanisms and ones that operate through changes in employment probably do not explain wage shock transmission.[45] This finding is important since some of the most plausible indirect transmission pathways—alternatives to wage-setting procedures themselves "carrying" wage changes across borders—involve minimum wage changes triggering offshoring, firm-wide productivity growth, or technological upgrading that in turn raises foreign wages. We next explore this possibility more directly.

5.2 Through employment changes?

There are several different theoretically plausible, indirect pathways from changes in wages at multinationals' headquarters to the wages they pay in other countries that would operate through changes in employment. Our primary interest is in ones that can explain the phenomenon of wage shock transmission itself.[46]

We use both the global data from the Company and the more granular employer-employee data from Brazil to investigate. We first confirm that the findings in sections 3 and 4 also hold in the administrative data from Brazil. In Panel A of Table 8, we show the correlation between headquarters and establishment wages using the set of 37 RAIS firms that have a headquarters job-match. The estimated within-firm across-country correlation in annual wages is almost identical to what we found in the global data: ten percent higher wages at headquarters is associated with 0.8-1.7 percent higher RAIS-measured wages for workers in positions of the same skill-level in Brazilian establishments.[47] This correlation is shown graphically in Appendix Figure A9.

We also find that external shocks to wages at multinationals' headquarters are transmitted to their establishments in Brazil. The event study coefficients from estimating equation (2) using the Brazil sample are shown in Appendix Figure A10.[48] We again see that wages at "treated" foreign

[44] See Appendix III for details on how we measure link and job attributes.

[45] An example of "bilateral" mechanisms is management learning about the benefits of efficiency wages. Suppose a firm, when forced to raise low-skill workers' wages in the headquarter country or state, discovers that supervision costs are lower when wages are higher (see e.g. Georgiadis, 2012), and therefore extends wage increases to its foreign establishments. We cannot rule out this possibility, but note that we might then expect greater wage shocks transmission to foreign locations that are more similar to the headquarter country. We find no systematic evidence of this in Table 7.

[46] Subsequent changes in employment—for example, the establishment attracting more productive workers or outsourcing the lowest-wage establishment jobs as a result of increased wages—may magnify the impact of the shock in foreign establishments and affect the profitability of "anchored" wage-setting procedures. However, such reinforcement dynamics would then follow from headquarter wage changes more directly affecting foreign establishment wages in the first place.

[47] We control for worker characteristics (X_{it}) that are in RAIS, such as education, tenure-at-firm, gender, race, and age; and firm×job and city×year fixed effects as throughout our analysis. Standard errors are clustered at home-location level.

[48] We restrict to firms headquartered in countries that do not have any minimum wage shocks in the pre-period.

establishments evolve similarly to those at other multinationals' establishments nearby before a headquarter country/state minimum wage hike. They then markedly depart in the year of the minimum wage increase, rising further the following year, and thereafter level off. The regression estimate isolating the year-to-year impacts of minimum wage changes is also very similar to what we found in the global data, as seen in Panel B of Table 8. The wage effect is concentrated among low-skill jobs, with the point estimate for higher-skill jobs being close to zero.[49] In Appendix Table A13 we show that the foreign wage impact of exchange rate variation in headquarter wages is also similar to—and if anything somewhat larger than—the impact we found in the global data in Sub-section 4.4.

Within-firm offshoring We now consider specific ways in which externally imposed changes in wages at a multinational's headquarters might affect foreign establishment wages through changes in employment. A first possibility centers on offshoring of jobs or tasks. When forced to pay workers at headquarters more, an employer might reduce the number of workers employed or hours worked there, shifting workload to foreign establishments, which could trigger a simultaneous rise in foreign wages (see e.g. Feenstra & Hanson, 1996).

We test for this possibility in several ways. First, we measure the annual wage normalized by the number of days an individual works during the year.[50] As seen in columns 2 and 4 of Table 8, we find partial transmission of the wage shock also to such "effective" wages, suggesting that multinationals' workers in Brazil are not earning more when the minimum wage rises at headquarters because they are working more days of the year. The estimated passthrough to effective wages is somewhat smaller; it may be that Brazilian workers partially compensate for employer wage-anchoring through moderate adjustments in days worked.[51]

Employers may additionally incentivize foreign workers to do more work *per day or hour* when wages rise at headquarters. This form of offshoring is more difficult to test for. However, low-skill jobs and sectors with high and low wage shock transmission are almost equally offshorable, as we showed in panels B and C of Table 7. We also find no impact of home country/state minimum wage changes on middle- or high-skill job wages at foreign establishments (see columns 1 and 2 of Appendix Table A5).

We next directly examine how employment at foreign establishments responds to minimum wage shocks at headquarters. If certain jobs are offshored to Brazilian establishments, employment should

[49] Recall that the same is true in the global data from the Company, as shown in Appendix Table A5.

[50] This measure captures sick leave, parental leave, military service leave, unpaid leave, and full/part-time adjustments.

[51] Similarly, we found indications of a small increase in contracted work-hours in multinationals' Brazilian establishments when the minimum wage rises at headquarters, but the response is too small for within-firm offshoring to explain the impact on wages in Brazil. Another possible explanation for the smaller impact on effective wages in Table 8 is that the measure of days-not-worked is only available from 2007 onwards. Note also that the impact of exchange rate shocks to headquarter wages on effective wages in Brazil is not smaller than that on annual wages (see Appendix Table A13).

rise there. Using both the global data from the Company and the Brazilian employer-employee data, we first look at the impact on the *extensive margin* of job level employment in foreign establishments (see Goldschmidt & Schmieder, 2017). We estimate equation (3) but now with the outcome being an indicator for a job being present in year t but not in year $t-1$. We next look at *intensive margin* responses—the change in the number of workers employed in a position—using the Brazilian data.[52] The results are presented in Table 9. We see limited impacts of minimum wage shocks on both margins of employment. The estimates are imprecise but close to zero.[53] The results from estimating the event study in equation (2) with the number of employees in a given Brazilian establishment as the outcome are presented in Figure 3, where we again see a zero impact on employment.[54]

Firm level shock propagation A second possibility is that external shocks to wages in the home market are large enough to affect the firm's broader operations in ways that ultimately impact foreign workers' wages through changes in employment. Suppose that a firm shares rents with its workers, but that minimum wage shocks in the headquarter country or state reduce firm-wide profits. This could incentivize the firm to scale down, reducing the size of its foreign establishments. If a firm fires its least productive foreign establishment workers when profits fall, and the remaining, more productive workers have higher wages, such a compositional change in the firm's workforce might itself imply higher average wages within each position.

In Appendix Table A14 we use the Orbis data to show a zero (albeit imprecisely estimated) effect of minimum wage shocks at the headquarters on firms' profits (Column 1). This is arguably not surprising given the (large) size of the employers in our data and the (comparatively small) size of the

[52] Because of the Company's focus on job-level wages, information on the intensive margin of employment is often missing in their data. Note that, since our analysis focuses on across-country wage compression within firm×job cells, extensive margin employment responses are unlikely to explain wage shock transmission on their own.

[53] Because the multinationals in our Brazil sample are headquartered in relatively few locations abroad, we have also wild-cluster-bootstrapped the standard errors in Table 9 (Cameron *et al.*, 2008). This about doubles their magnitude in Panel A and increases their magnitude more modestly in Panel B.

[54] Muendler & Becker (2010) show evidence that German manufacturers' decisions to open establishments abroad (in their terminology, the "extensive margin") and their employment levels there (the "intensive margin") are quite (positively) related to the collectively bargained wages they face at home (see also Harrison & McMillan, 2011). Here we find no (or if anything a small negative) employment-in-Brazil response to minimum wage shocks at multinationals' headquarters. These two findings are not inconsistent, however. First, the multinationals in our sample span a broader range (of both sectors and home locations), and the foreign establishments in our sample are of a different type (many are local headquarters), than those in Muendler & Becker (2010). Second, they find significantly greater responsiveness to home wages on offshoring's extensive margin—a margin that our analysis holds constant. Finally, and perhaps most importantly, we document wage compression—not, and in fact quite far from, equalization—across multinationals' headquarter and foreign establishment countries. In Table 2 the variation in home wages comes, as in Muendler and Becker (2010), not from a wage shock, but rather more general supply and demand movements in the home market. We find that 10 percent higher wages at the headquarters are associated with 1-2 percent higher foreign establishment wages for workers in the same position. This leaves considerable scope for stronger incentives to for example open establishments abroad when wages rise at home, as in Muendler & Becker (2010).

shocks.[55] Recall additionally that the (fairly imprecise) estimates in Table 9 and Figure 3 point towards no or a negative but small impact on foreign establishment employment. It thus appears unlikely that propagation through firms' broader operations explain the documented wage change transmission.

Productivity spillovers A third possibility is that headquarter wage shocks affect the wages of some categories of foreign establishment workers through changes in labor demand and others through productivity spillovers. Rather than being an independent potential explanation for our findings, productivity spillovers may make it difficult to test for other alternative explanations. A specific possibility is that headquarter wage shocks raise demand for workers in offshorable job categories abroad, but that the wages of coworkers in non-offshorable jobs rise because of productivity spillovers.[56] However, recall that Table 7 showed no evidence that wage shocks transmission is greater in the country-pairs where offshoring is likely easiest, such as those that have higher mutual migration stocks or that use the same currency or more similar languages.[57] Additionally, we see little change in foreign establishment employment when minimum wages rise in firms' headquarter country or state.

5.3 Through induced firm-wide technology adoption?

A final possibility is that multinationals invest in capital or upgrade their technology in response to home country/state minimum wage increases (see e.g. Aaronson & Phelan, 2017); that these changes affect the entire firm; and that this in turn increases the productivity of the firm's workers in foreign establishments and consequently raises their wages. Like the employment channels discussed above, this pathway to foreign wages would (i) leave this paper's main findings—the across-country wage shock transmission shown in Section 4—identified and informative, but (ii) represent a mechanism of substantively different nature than transmission through firm-wide wage-setting procedures.

We find no impact of headquarter minimum wage increases on firm-wide capital/labor ratios in Appendix Table A14.[58] The impact on wages in foreign establishment jobs that are more com-

[55] These results are estimated using a sample extracted from Orbis Historical which we can match to the Company data at the firm×year level. It should be noted that this sample consists of a relatively small number of 107 firms. Existing evidence on minimum wage changes' effect on firms' performance and factor choices is mixed, but overall points towards (i) a relatively small—albeit in some contexts robustly negative—impact on firm profits, and (ii) some degree of capital/labor substitution in many contexts (see e.g. Draca *et al.* (2011); Harasztosi & Lindner (2019); Hau *et al.* (forthcoming) and references therein). However, existing research generally studies relatively "localized" firms that are more exposed to minimum wage hikes in the headquarter country/state than multinationals. See also footnote 58.

[56] Another possibility is that higher-skill workers at headquarters (also) become more expensive to employ when low-wage coworkers' wages rise; that high-skill positions therefore move to foreign establishments; that this increases the productivity of low-skill workers abroad through spillovers; and that their wages therefore rise. Recall, though, that we see no impact of headquarter minimum wage shocks on the wages of or employment of foreign workers in higher-skill positions.

[57] High wage shock transmission country-pairs are geographically closer to each other and more likely to have been in a colonial relationship, but these differences are very small in magnitude.

[58] The estimate is negative but small and statistically insignificant. If we alternatively use all available Orbis data for the firms in the Company's data during our data period—not only data from the years that correspond to the unbalanced

plementary with modern technology—Autor & Dorn (2013) argue that such jobs have tasks that are more abstract—are also smaller, while manual-task jobs that are relatively independent of computer capital tend to display higher wage shock transmission (see Panel B of Table 7). These findings are difficult to reconcile with technology adoption explaining the estimated impact of minimum wages at headquarters on multinationals' foreign establishment wages.

We conclude that, absent accompanying direct effects, indirect pathways—changes in employment triggered by within-firm offshoring, broader forms of firm level shock propagation, productivity spillovers, or firm-wide technology adoption—are unlikely to explain why external shocks to headquarter wages affect the pay of same-position employees in foreign establishments.

5.4 Firm-wide wage-setting procedures

To summarize, we have shown the following. First, within multinationals, the wages of foreign establishment workers employed in a given position are highly correlated with those of headquarter workers in the same position. Second, the correlation is especially high for low-skill workers such as cleaners, drivers, and security guards. Third, increases in headquarters wages induced by a change in the home country or state's minimum wage laws also raise wages in foreign establishments. The impact on foreign wages begins in the year of the minimum wage hike. We also show that another form of external shock to headquarters wages—exchange rate fluctuations—similarly affects foreign establishment wages. Fourth, predictors of transmission of headquarters wage shocks to foreign establishments are primarily characteristics of the relevant job and the employer's home location—not the firm's sector, the foreign establishment country, or links between the two countries. Finally, we saw in the previous subsection that the initial impact of external headquarter wage shocks on foreign establishment wages does not appear to arise indirectly, through induced changes in employment or firm-wide technology.

Together, this evidence indicates that multinationals' headquarters wages *directly* affect foreign wages. Our five findings are difficult to reconcile with other explanations. A direct effect likely arises because multinationals use firm-wide wage-setting procedures that either explicitly or effectually tie foreign workers' wages to headquarter wages. Understanding why multinationals use such wage-setting procedures is an important topic for future research.

6 Conclusion

In this paper we show that many large multinationals use firm-wide wage-setting procedures that are imperfectly adjusted to local labor market conditions, instead "anchoring" the wages they pay domestic workers in a given occupation at their foreign establishments to the wages they pay workers in the same occupation in the home country. They do so across the occupational skill range—including for

Company data-panel—and thereby more than triple the observations in Appendix Table A14, then we find a -0.024 (s.e.: 0.016) effect on capital/labor ratios. This approach yields an estimate of the impact on profit of 0.001 (s.e.: 0.027).

low-skill support staff—and partially transmit wage increases externally imposed on the headquarters to their foreign establishments. Our results point toward the existence of consequential "wage norms", which may contribute also to phenomena such as the acyclicality of wages and lack of delegation to establishments outside of firms' home region (see e.g. Lemieux *et al.*, 2012; Aghion *et al.*, 2017).

The reasons why employers use firm-wide wage-setting procedures may have to do with the cost of continuously gathering information about "appropriate" wages to pay in a given, frictional labor market (Lemieux *et al.*, 2009, 2012). The financial consequences to the firm of anchored wage-setting are far from obvious. High wages may for example increase worker morale and effort, or over time attract more productive workers, even if such responses occur only after—and do not in isolation explain why—foreign wages rise. If managers over time learn that efficiency wage-like dynamics can increase worker productivity, this may reduce incentives to tailor wage-setting procedures to each labor market the multinational operates in. On the other hand, there is also growing evidence that informational barriers to optimizing organizational procedures are difficult to overcome even for large firms (see e.g. DellaVigna & Gentzkow, 2019; Almunia *et al.*, forthcoming; Dube *et al.*, 2020).[59]

References

AARONSON, DANIEL, & PHELAN, BRIAN J. 2017. Wage Shocks and the Technological Substitution of Low-wage Jobs. *The Economic Journal*, **129**(617), 1–34.

ABOWD, JOHN M., KRAMARZ, FRANCIS, & MARGOLIS, DAVID. 1999. High Wage Workers and High Wage Firms. *Econometrica*, **67**, 251–333.

ADAMS, BRIAN, & WILLIAMS, KEVIN R. 2019. Zone Pricing in Retail Oligopoly. *American Economic Journal: Microeconomics*, **11**(1), 124–56.

AGHION, PHILIPPE, BLOOM, NICK, LUCKING, BRIAN, SADUN, RAFFAELLA, & VAN REENEN, JOHN. 2017. *Turbulence and Decentralization in Bad Times*. CEP Discussion Paper No. 1479.

ALFARO-URENA, ALONSO, MANELICI, ISABELA, & VASQUEZ, JOSE P. 2019. *The Effects of Multinationals on Workers: Evidence from Costa Rica*. Mimeo Universidad de Costa Rica.

ALMUNIA, MIGUEL, HJORT, JONAS, KNEBELMANN, JUSTINE, & TIAN, LIN. forthcoming. Strategic or Confused Firms? Evidence from "Missing" Transactions in Uganda. *Review of Economics and Statistics*.

ANGRIST, JOSHUA D, & KRUEGER, ALAN B. 1992. The effect of age at school entry on educational attainment: an application of instrumental variables with moments from two samples. *Journal of the American statistical Association*, **87**(418), 328–336.

ATHEY, SUSAN, & WAGER, STEFAN. 2019. Estimating treatment effects with causal forests: An application. *Observational Studies*, **5**(2), 37–51.

ATHEY, SUSAN, TIBSHIRANI, JULIE, & WAGER, STEFAN. 2019. Generalized random forests. *The Annals of Statistics*, **47**(2), 1148–1178.

AUTOR, DAVID H, & DORN, DAVID. 2013. The growth of low-skill service jobs and the polarization of the US labor market. *American Economic Review*, **103**(5), 1553–97.

AUTOR, DAVID H., MANNING, ALAN, & SMITH, CHRISTOPHER L. 2016. The Contribution of the Minimum Wage to US Wage Inequality over Three Decades: A Reassessment. *American Economic Journal: Applied Economics*, **8**(1), 58–99.

BALLI, HATICE OZER, & SØRENSEN, BENT E. 2013. Interaction effects in econometrics. *Empirical Economics*, **45**.

BARTH, ERLING, BRYSON, ALEX, DAVIS, JAMES C, & FREEMAN, RICHARD. 2016. It's Where You Work: Increases in Earnings Dispersion Across Establishments and Individuals in the U.S. *Journal of Labor Economics*, **34**(S2).

[59] Hjort *et al.* (2022) study firm structure consequences of differences in what private-sector multinationals pay *high-skill* workers in richer versus poorer countries using a subset of the data from the Company we analyze in this paper.

BLINDER, ALAN S, & KRUEGER, ALAN B. 2013. Alternative measures of offshorability: a survey approach. *Journal of Labor Economics*, **31**(S1), S97–S128.

BLOOM, N., SADUN, R., & REENEN, J. VAN. 2012. Americans Do IT Better: U.S. Multinationals and the Productivity Miracle. *American Economic Review*, **102**(1), 167–201.

BLOOM, NICHOLAS, SONG, JAE, PRICE, DAVID, GUVENEN, FATIH, & VON WACHTER, TILL. 2018. Firming up inequality. *The Quarterly Journal of Economics*, **134**(1), 1–50.

BOEHM, CHRISTOPH E., FLAAEN, AARON, & PANDALAI-NAYAR, NITYA. 2019. Input Linkages and the Transmission of Shocks: Firm Level Evidence from the 2011 Tohoku Earthquake. *Review of Economics and Statistics*, **101**(1).

BOERI, TITO, ICHINO, ANDREA, MORETTI, ENRICO, & POSCH, JOHANNA. 2021. Wage equalization and regional misallocation: evidence from Italian and German provinces. *Journal of the European Economic Association*, **19**(6), 3249–3292.

BREZA, EMILY, KAUR, SUPREET, & SHAMDASANI, YOGITA. 2017. The Morale Effects of Pay Inequality. *The Quarterly Journal of Economics*, **133**(2), 611–663.

BROWN, DRUSILLA K., DEARDORFF, ALAN, & STERN, ROBERT. 2004. The Effects of Multinational Production on Wages and Working Conditions in Developing Countries. *In:* BALDWIN, ROBERT E., & WINTERS, L. ALAN (eds), *Challenges to Globalization: Analyzing the Economics*. University of Chicago Press.

BUDD, JOHN W., KONINGS, JOZEF, & SLAUGHTER, MATTHEW J. 2005. Wages and International Rent Sharing in Multinational Firms. *Review of Economics and Statistics*, **87**(1), 73–84.

CAMERON, AC, GELBACH, JB, & MILLER, DL. 2008. Bootstrap-based improvements for inference with clustered errors. *The Review of Economics and Statistics*, **90**, 414–427.

CAMPA, JOSE MANUEL, & GOLDBERG, LINDA S. 2001. Employment versus wage adjustment and the US dollar. *Review of Economics and Statistics*, **83**(3), 477–489.

CAPPELLI, PETER, & CHAUVIN, KEITH. 1991. An Interplant Test of the Efficiency Wage Hypothesis. *Quarterly Journal of Economics*, **106**(3), 769–797.

CARD, D., MAS, A., MORETTI, E., & SAEZ, E. 2012. Inequality at work: The effect of peer salaries on job satisfaction. *American Economic Review*, **102**(6), 2981–3003.

CARD, DAVID, & KRUEGER, ALAN B. 1995. *Myth and measurement: the new economics of the minimum wage*. New Jersey: Princeton University Press.

CARD, DAVID, HEINING, JÖRG, & KLINE, PATRICK. 2013. Workplace Heterogeneity and the Rise of West German Wage Inequality. *The Quarterly Journal of Economics*, **128**(3), 967–1015.

CARD, DAVID, CARDOSO, ANA RUTE, & KLINE, PATRICK. 2015. Bargaining, sorting, and the gender wage gap: Quantifying the impact of firms on the relative pay of women. *The Quarterly Journal of Economics*, **131**(2), 633–686.

CARD, DAVID, CARDOSO, ANA RUTE, HEINING, JOERG, & KLINE, PATRICK. 2018. Firms and Labor Market Inequality: Evidence and Some Theory. *Journal of Labor Economics*, **36**(S1), S13–S70.

CARLANA, MICHELA, & LA FERRARA, ELIANA. 2021. *Apart but Connected: Online Tutoring and Student Outcomes during the COVID-19 Pandemic*. CEPR Discussion Paper 15761.

CENGIZ, DORUK, DUBE, ARINDRAJIT, LINDNER, ATTILA, & ZIPPERER, BEN. 2019. The effect of minimum wages on low-wage jobs: Evidence from the United States using a bunching estimator. *The Quarterly Journal of Economics*, **134**(3), 1405–1454.

CLEMENS, JEFFREY, & GOTTLIEB, JOSHUA D. 2017. In the Shadow of a Giant: Medicare's Influence on Private Physician Payment. *Journal of Political Economy*, **125**(1), 1–39.

CONYON, MARTIN J., GIRMA, SOURAFEL, THOMPSON, STEVE, & WRIGHT, PETER W. 2002. The Productivity and Wage Effects of Foreign Acquisition in the United Kingdom. *The Journal of Industrial Economics*, **50**(1), 85–102.

CULLEN, Z., & PEREZ-TRUGLIA, R. 2022. How Much Does Your Boss Make? The Effects of Salary Comparisons. *Journal of Political Economy*, **130**(3), 766–822.

CULPEPPER & ASSOCIATES INC. 2011. *Geographic Pay Differentials: Practices in Managing Pay Between Locations*.

DELLAVIGNA, STEFANO, & GENTZKOW, MATTHEW. 2019. Uniform Pricing in US Retail Chains. *The Quarterly Journal of Economics*, **134**(4), 2011–2084.

DICKENS, R. 2015. How are minimum wages set? *IZA World of Labor*, **2011**.

DICKENS, WT, & KATZ, LF. 1987. Interindustry Wage Differences and Industry Characteristics. *In:* K, LANG, & J, LEONARD (eds), *Unemployment and the Structure of Labor Markets*. Blackwell.

DRACA, MIRKO, MACHIN, STEPHEN, & VAN REENEN, JOHN. 2011. Minimum Wages and Firm Profitability. *American Economic Journal: Applied Economics*, **3**(1), 129–51.

DUBE, ARINDRAJIT, GIULIANO, LAURA, & LEONARD, JONATHAN. 2019. Fairness and Frictions: Impact of Unequal Raises on Quit Behavior. *American Economic Review*, **109**(2), 620–63.

DUBE, ARINDRAJIT, MANNING, ALAN, & NAIDU, SURESH. 2020. *Monopsony and Employer Mis-Optimization Explain Why Wages Bunch at Round Numbers*.

DUSTMANN, CHRISTIAN, LINDNER, ATTILA, SCHÖNBERG, UTA, UMKEHRER, MATTHIAS, & VOM BERGE, PHILIPP. 2022. Reallocation Effects of the Minimum Wage. *Quarterly Journal of Economics*, **137**, 267–328.

FALK, A., BECKER, A., DOHMEN, T., ENKE, B., HUFFMAN, D., & SUNDE, U. 2018. Global Evidence on Economic Preferences. *The Quarterly Journal of Economics*, **133**(4), 1645–1692.

FEENSTRA, ROBERT C., & HANSON, GORDON H. 1996. Foreign Investment, outsourcing and relative wages. *Chap. 6, pages 89–128 of:* GROSSMAN, GENE M., & IRWIN, DOUGLAS A. (eds), *The Political economy of trade policy: essays in honor of Jagdish Bhagwati*. MIT Press.

GEORGIADIS, ANDREAS. 2012. Efficiency Wages and the Economic Effects of the Minimum Wage: Evidence from a Low-Wage Labour Market. *Oxford Bulletin of Economics and Statistics*, **75**.

GIROUD, X., & MUELLER, H. 2019. Firms' Internal Networks and Local Economic Shocks. *American Economic Review*, **109**(10), 3617–49.

GIROUD, X., & RAUH, J. 2019. State Taxation and the Reallocation of Business Activity: Evidence from Establishment-Level Data. *Journal of Political Economy*, **127**(3), 1262–1316.

GOLDFARB, AVI, & XIAO, MO. 2011. Who thinks about the competition? Managerial ability and strategic entry in US local telephone markets. *American Economic Review*, **101**(7), 3130–3161.

GOLDSCHMIDT, DEBORAH, & SCHMIEDER, JOHANNES F. 2017. The rise of domestic outsourcing and the evolution of the German wage structure. *The Quarterly Journal of Economics*, **132**(3), 1165–1217.

GRILICHES, ZVI, & HAUSMAN, JERRY A. 1986. Errors in variables in panel data. *Journal of econometrics*, **31**(1), 93–118.

GROSSMAN, GENE M, & HELPMAN, ELHANAN. 2008. Fair wages and foreign sourcing. *The organization of firms in a global economy*, 273–310.

HAANWINCKEL, DANIEL. 2019. *Supply, Demand, Institutions, and Firms: A Theory of Labor Market Sorting and the Wage Distribution*. Mimeo U.C. Berkeley.

HARASZTOSI, PÉTER, & LINDNER, ATTILA. 2019. Who Pays for the Minimum Wage? *American Economic Review*, **109**(8), 2693–2727.

HARRISON, A, & SCORSE, J. 2010. Multinationals and anti-sweatshop activism. *American Economic Review*, **100**(1).

HARRISON, ANN, & MCMILLAN, MARGARET. 2011. Offshoring jobs? Multinationals and US manufacturing employment. *Review of Economics and Statistics*, **93**(3), 857–875.

HAU, HARALD, HUANG, YI, & WANG, GEWEI. forthcoming. Firm Response to Competitive Shocks: Evidence from China's Minimum Wage Policy. *Review of Economic Studies*.

HAZELL, JOE, PATTERSON, CHRISTINA, SARSONS, HEATHER, & TASKA, BLEDI. 2022. *National Wage Setting*. LSE working paper.

HELPMAN, ELHANAN, ITSKHOKI, OLEG, & REDDING, STEPHEN. 2013. Trade and Labor Market Outcomes. *Advances in Economics and Econometrics, Tenth World Congress, Volume II, Applied Economic*, 459–504.

HERMALIN, BENJAMIN E. 2013. Leadership and Corporate Culture. *Pages 432–476 of:* GIBBONS, R., & ROBERTS, J. (eds), *Handbook of Organizational Economics*. Princeton University Press.

HIJZEN, ALEXANDER, S.MARTINS, PEDRO, SCHANK, THORSTEN, & UPWARD, RICHARD. 2013. Foreign-owned firms around the world: A comparative analysis of wages and employment at the micro-level. *European Economic Review*, **60**, 170–188.

HJORT, JONAS, MALMBERG, HANNES, & SCHOELLMAN, TODD. 2022. *The Missing Middle Managers: Labor Costs, Firm Structure, and Development*. NBER Working Paper No. 30592.

HOFSTEDE, GEERT. 1980. *Culture's Consequences: International Differences in Work-Related Values*. 1st edn. Sage Publications Inc.

HOFSTEDE, GEERT. 1991. *Cultures and Organizations: Software of the Mind*. McGraw-Hill.

HOFSTEDE, GEERT. 2001. *Culture's Consequences: Comparing Values, Behaviors, Institutions, and Organizations across Nations*. 2nd edn. Thousand Oaks, California: Sage Publications, Inc.

INOUE, ATSUSHI, & SOLON, GARY. 2010. Two-sample instrumental variables estimators. *The Review of Economics and Statistics*, **92**(3), 557–561.

JARDIM, EKATERINA, LONG, MARK C., PLOTNICK, ROBERT, VAN INWEGEN, EMMA, VIGDOR, JACOB, & WETHING, HILARY. 2018. *Minimum Wage Increases, Wages, and Low-Wage Employment: Evidence from Seattle*. NBER Working Paper 23532.

KAHNEMAN, D., KNETSCH, J. L., & THALER, R. 1986. Fairness as a constraint on profit seeking: Entitlements in the market. *American Economic Review*, **76**(4), 728–741.

LEE, DAVID S. 1999. Wage Inequality in The United States During The 1980s: Rising Dispersion Or Falling Minimum Wage? *The Quarterly Journal of Economics*, **114**(3), 977–1023.

LEMIEUX, THOMAS, MACLEOD, W. BENTLEY, & PARENT, DANIEL. 2009. Performance Pay And Wage Inequality. *The Quarterly Journal of Economics*, **124**(1), 1–49.

LEMIEUX, THOMAS, MACLEOD, W. BENTLEY, & PARENT, DANIEL. 2012. Contract Form, Wage Flexibility, and Employment. *American Economic Review: Papers and Proceedings*, **102**(3), 526–31.

LIPSEY, RE, & SJOHOLM, F. 2006. Foreign firms and Indonesian manufacturing wages: An analysis with panel data. *Economic Development and Cultural Change*, **55**(1), 201–221.

MARTINS, PEDRO S., & YANG, YONG. 2015. Globalised labour markets? International rent sharing across 47 countries. *British Journal of Industrial Relations*, **53**(4), 664–691.

MAS, ALEXANDRE. 2017. Does Transparency Lead to Pay Compression? *Journal of Political Economy*, **125**(5), 1683–1721.

MASSENKOFF, MAXIM, & WILMERS, NATHAN. forthcoming. Wage Stagnation and the Decline of Standardized Pay Rates, 1974–1991. *AEJ: Applied Economics*.

MOGSTAD, MAGNE, SETZLER, BRADLEY, & LAMADON, THIBAUT. 2018. *Imperfect Competition and Rent Sharing in the U.S. Labor Market*. Mimeo University of Chicago.

MORETTI, ENRICO. 2011. Local Labor Markets. *In:* ASHENFELTER, ORLEY, & CARD, DAVID (eds), *Handbook of Labor Economics*. Elsevier.

MUENDLER, MARC-ANDREAS, & BECKER, SASCHA O. 2010. Margins of multinational labor substitution. *American Economic Review*, **100**(5), 1999–2030.

MUENDLER, MARC-ANDREAS, POOLE, JENNIFER, RAMEY, GAREY, & WAJNBERG, TAMARA. 2004. Job Concordances for Brazil: Mapping the Classificação Brasileira de Ocupações (CBO) to the International Standard Classification of Occupations (ISCO-88). 01.

NATIONAL EMPLOYMENT LAW PROJECT. 2016. *Fight for $15: Four Years, $62 Billion*. "https://www.nelp.org/wp-content/uploads/Fight-for-15-Four-Years-62-Billion-in-Raises.pdf".

PROPPER, CAROL, & REENEN, JOHN VAN. 2010. Can Pay Regulation Kill? Panel Data Evidence on the Effect of Labor Markets on Hospital Performance. *Journal of Political Economy*, **118**(2), 222–273.

RABIN, MATTHEW. 1998. Psychology and Economics. *Journal of Economic Literature*, **36**(1), 11–46.

REES, ALBERT, & SCHULTZ, GEORGE. 1970. Workers in an Urban Labor Market. University of Chicago Press.

SETZLER, BRADLEY, & TINTELNOT, FELIX. 2021. The effects of foreign multinationals on workers and firms in the United States. *The Quarterly Journal of Economics*, **136**(3), 1943–1991.

SLICHTER, SUMNER. 1950. Notes on the Structure of Wages. *Review of Economics and Statistics*, **32**(1), 80–91.

SUN, CHANG. 2020. Multinational production with non-neutral technologies. *Journal of International Economics*, **123**.

TABELLINI, G. 2010. Culture and Institutions: Economic Development in the Regions of Europe. *Journal of the European Economic Association*, **8**(4), 677–716.

TEULINGS, C. N. 2003. The Contribution Of Minimum Wages To Increasing Wage Inequality. *Economic Journal*, **113**(490), 801–833.

TIMMER, MARCEL P, DIETZENBACHER, ERIK, LOS, BART, STEHRER, ROBERT, & DE VRIES, GAAITZEN J. 2015. An illustrated user guide to the world input–output database: the case of global automotive production. *Review of International Economics*, **23**(3), 575–605.

VAGHUL, KAVYA, & ZIPPERER, BEN. 2016. Historical state and sub-state minimum wage data. *Washington Center for Equitable Growth*.

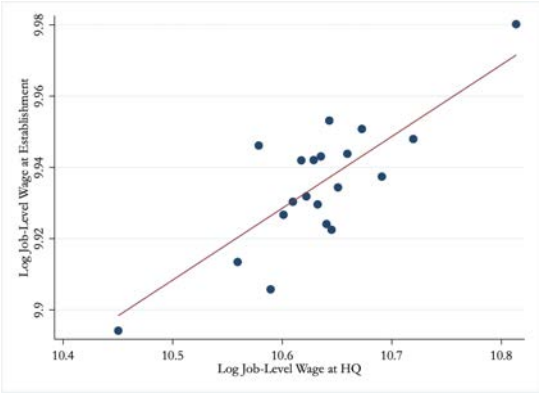
VAN REENEN, JOHN. 1996. The Creation and Capture of Rents: Wages and Innovation in a Panel of U.K. Companies. *The Quarterly Journal of Economics*, **111**(1), 195–226.

WAGER, S., & ATHEY, S. 2018. Estimation and inference of heterogeneous treatment effects using random forests. *Journal of the American Statistical Association*, **113**, 1228–1242.

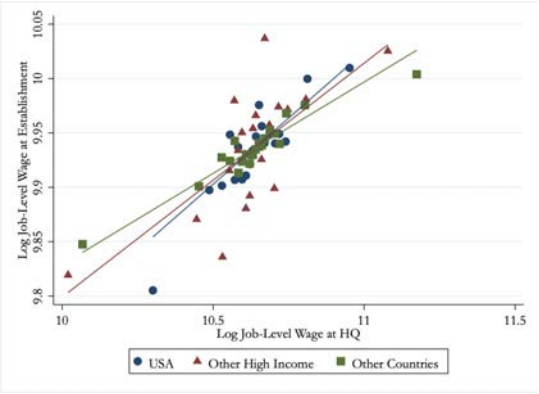
YOO, B N, DONTHU, Y, & LENARTOWICZ, T. 2011. Measuring Hofstede's five dimensions of cultural values at the individual level: Development and validation of cvscale. *Journal of International Consumer Marketing*, **23**(3-4), 193–210.

FIGURES

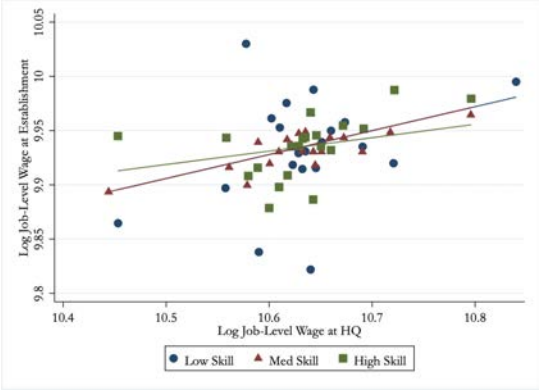
FIGURE 1: CORRELATION BETWEEN HQ AND ESTABLISHMENT WAGE



(A) JOB-LEVEL CORRELATION



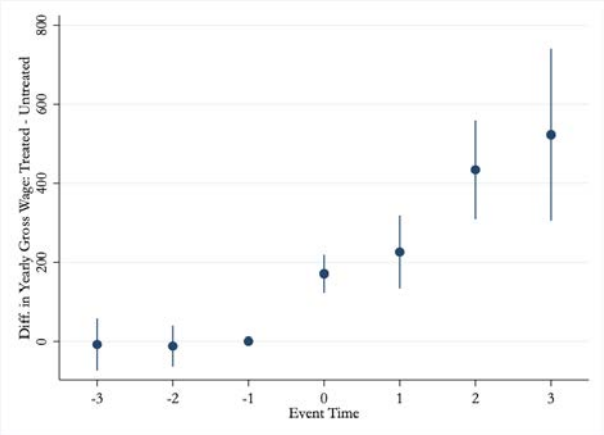
(B) COUNTRY INCOME SPLIT



(C) SKILL LEVEL SPLIT

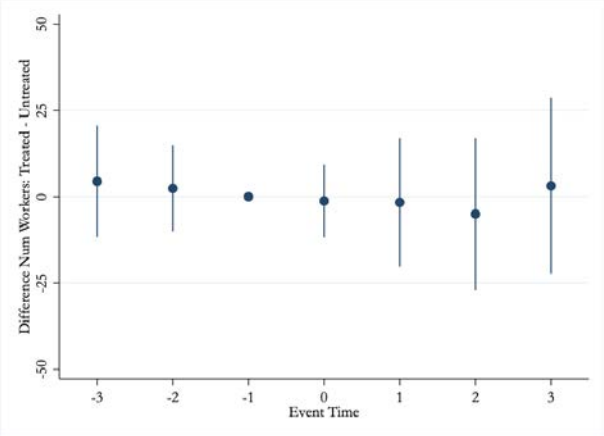
Note This figure presents three binned scatterplots showing the relationship between the wage paid for a given job at a multinational's headquarter (x-axis) and the wage paid for the same job at the multinational's foreign establishments (y-axis). To construct the plots, the log wage at the establishment is first residualized with respect to firm $\times$ job and establishment city $\times$ year fixed effects. In Panel B we residualize with respect to firm $\times$ skill level and occupation-type fixed effects to preserve power. The x-variable, log wage at the firm's headquarter, is then divided into twenty equal-sized groups. Within each of these groups, we plot the mean of the y-variable residuals against the mean of the x-variable. We then add back the unconditional mean of the y-variable (establishment wage) to help with interpretation of the line of best fit. The line of best fit in Panel A is $\hat{\beta} = 0.201$, $(s.e. = 0.019)$. In Panel B, we separate headquarter countries based on whether the multinational is headquartered in the United States (circles), other high income countries as defined by the World Bank (triangles), and all other countries (squares). The lines of best fit/standard errors are $\hat{\beta} = 0.244\, s.e. = 0.035$ for the United States, $\hat{\beta} = 0.215\, s.e. = 0.022$ for other high income countries, and $\hat{\beta} = 0.168\, s.e. = 0.008$ for all other countries. In Panel C, we separate jobs into low, medium, and high-skill occupations. The lines of best fit/standard errors are $\hat{\beta} = 0.124\, s.e. = 0.049$ for high-skill jobs, $\hat{\beta} = 0.220\, s.e. = 0.026$ for medium-skill jobs, and $\hat{\beta} = 0.221\, s.e. = 0.033$ for low-skill jobs.

FIGURE 2: IMPACT OF HQ MIN WAGE ON FOREIGN ESTAB. WAGES



Note: This figure plots the coefficients of the event time indicators from estimating equation (2). The outcome is the job-level wages at a firm's foreign establishment. The sample is restricted to low skill jobs, as defined by The Company, and to those firms that experience only one minimum wage increase at the headquarter during the event time window. The coefficients above are comparing the wages in treated establishments (those establishments at firms whose HQ experienced a minimum wage shock) to control establishments (establishments at firms whose HQ did not experience a minimum wage shock). All coefficients are normalized to $k = -1$, the year before the minimum wage increase.

FIGURE 3: IMPACT OF HQ MIN WAGE ON FOREIGN ESTAB. EMPLOYMENT IN BRAZIL



Note: This figure plots the coefficients on the event time indicators from estimating equation (2) using the sample of matched Brazilian firms, but using employment as the outcome variable. Specifically, the y-variable is the number of workers employed for a given job in a firm's Brazilian establishment. We control for average worker characteristics: age, job tenure, race, and gender. The sample is restricted to low skill jobs and to those firms that experience only one minimum wage increase at the headquarter during the event time window. All coefficients are normalized to $k = -1$, the year before the minimum wage increase.

TABLES

TABLE 1: SUMMARY STATISTICS OF MULTINATIONALS

Panel A: *Summary of Multinational Samples*

	Number of Observations		
Unit of Observation	*Sample 1*	*Sample 2*	*Sample 3*
Employer	1,213	101	80
Employer×year	5,030	586	200
Establishment	6,217	1,239	610
Estab.×year	22,721	5,243	1,339
Estab.×skill-level×year	185,081	47,564	12,184
Estab.×occupation	140,479	31,860	13,527
Estab.×occ.×year	436,137	111,954	27,318

Panel B: *Multinationals' Foreign Establishments' Wages*

	Sample 1		*Sample 2*		*Sample 3*	
	Mean	SD	Mean	SD	Mean	SD
Net Wage (2000 USD)	14,442.84	9,016.22	13,573.49	8,125.58	16,922.06	8,598.13

Panel C: *Distribution & Compression of Wages (Sample 3)*

	HQ-Quart1	HQ-Quart2	HQ-Quart3	HQ-Quart4	HQ-All Occ
	Headquarter Wage Distribution				
Mean Net Wage (2000 USD)	10,859.38	15,257.02	24,547.63	37,311.53	20,485.43
Max. Net Wage (2000 USD)	41,875.64	58,720.98	86,427.27	90,667.58	90,667.58
	Establishment Wage as % of HQ Wage				
All Establishments	0.88	0.87	0.87	0.88	0.87
Estab.s in Poorer-than-HQ-Country Countries	0.74	0.76	0.77	0.81	0.77
Employer×occ.×year	952	678	722	581	2,933

Note: Only foreign establishments are included in panels A & B, while in panel C headquarters are also included. Panel A summarizes the 3 main samples of multinationals and how they are used in the empirical analysis. Sample 1 consists of the full sample of multinationals for which we have wage data from at least one foreign establishment; Sample 2 consists of employers for which we observe at least one job in the headquarters and at least one foreign establishment; Sample 3 consists of employers for which we observe at least one job in the headquarters and at least one foreign establishment in the same year. The sample sizes include only foreign establishments. Occupations refer to the job titles recorded by the Company (298 job titles in total); skill levels are defined globally by the Company (16 levels in total). In Panel B, the numbers are calculated over all foreign establishments of a given multinational in a given year. Wages are measured in 2000 USD. Outlier observations with net wages in the top and bottom 1% of the distribution are excluded. Panel C focuses on Sample 3, and only occupations that are observed in both the headquarters and at least one foreign establishment within the same year are included. We first show the average net wages within each quartile at an employer's headquarters in a given year. We then show the average wage in the firm's establishments as a share of headquarter wages for each quartile."Establishments in poorer-than-HQ-country countries" means we only include establishments which are located in countries with lower GDP per capita than the home country. Only multinationals with multiple establishments ever observed and establishment×occupations observed in multiple years are included.

TABLE 2: RELATIONSHIP BETWEEN HQ AND FOREIGN ESTABLISHMENT WAGES

Sample	*Sample 3*				*Sample 2*
	MNEs w/ est.-HQ match×year w/in occ×year				MNEs w/ est.-HQ match w/in occ
Unit of Observation	est×occ×yr	est×occ×yr	est×skill-lev×yr	est×yr	est×occ×yr
Data Structure	Panel				Imputed Panel
Dep. Var.	Log Wage at Foreign Establishment				
	Panel A: Local Benchmark Wage Control				
	(1)	(2)	(3)	(4)	(5)
Log Occ-Level HQ Wage	0.190	0.225	0.132	0.531	0.298
	(0.052)	(0.046)	(0.044)	(0.111)	(0.063)
Log Local Benchmark Wage	0.013	0.013	0.052		-0.006
	(0.008)	(0.008)	(0.021)		(0.005)
Employer×Occ FE	Y	Y			
Employer×Skill-level FE			Y		
Employer FE				Y	Y
Est.-City×Year FE	Y	Y	Y	Y	Y
Occ FE					Y
HQ×Year FE		Y			
Observations	20054	20054	10030	742	36928
	Panel B: Est.-city×Occupation×Year Fixed Effects				
	(1)	(2)	(3)	(4)	(5)
Log Occ-Level HQ Wage	0.105	0.093	0.134	0.531	0.173
	(0.026)	(0.030)	(0.037)	(0.111)	(0.078)
Employer×Occ FE	Y	Y			
Employer×Skill-level FE			Y		
Employer FE				Y	Y
Est.-City×Year FE				Y	
Est.-City×Occ×Year FE	Y	Y			Y
Est.-City×Skill-level×Year FE			Y		
HQ×Year FE		Y			
Observations	20029	20029	9619	742	36181

Note: This table shows the relationship between a firm's headquarters and establishment wage. Columns 1 and 2 measure wages at the occupation level. Column 3 measures wages and the skill level, and column 4 measures wages at the firm level. The local benchmark wage is the average wage of workers in a given occupation (or skill level) employed by other firms in our sample in the same establishment city c in year t. In Panel B, we residualize the dependent variable (log establishment wage) with respect to establishment-city×occupation×year fixed effects, main independent variable (log headquarter wage) with respect to occupation×year fixed effects, both estimated using Sample 1 (the largest sample); and then regress the residualized log establishment wage on the residualized log headquarter wage including the fixed effects in Panel A (without local benchmark wage as a regressor). Standard errors are reported in parentheses and are clustered at the employer level.

TABLE 3: RELATIONSHIP BETWEEN HQ AND FOREIGN ESTABLISHMENT WAGE SLOPES

	w/in Occ Wage Slope at Estab.		Pooled Wage Slope at Estab.	
	(1)	(2)	(3)	(4)
HQ Wage Slope	0.115	0.110	0.080	0.350
	(0.045)	(0.050)	(0.044)	(0.269)
Log Benchmark Wage Slope	0.009		-0.001	
	(0.003)		(0.005)	
Empl. ×Occ-Type×Skill Level-Pair FE	Y	Y		
Empl. ×Skill Level-Pair FE			Y	Y
Est.-City×Year FE	Y		Y	
Est.-City×Occ-Type×Skill Lev-Pair×Yr FE		Y		
Est.-City×Skill Lev-Pair×Year FE				Y
Observations	13338	12267	8208	8112

Note: This table shows the relationship between a firm's between-skill-level "wage slope" at the firm's headquarter (independent variable)and foreign establishment (outcome variable). The wage slope is the difference between the average log wage of jobs in consecutive skill levels at a foreign establishment, and is calculated within occupation groups in columns 1-3 and by pooling together all occupation groups in columns 4-6. Standard errors are reported in parentheses and are clustered at the firm level.

TABLE 4: IMPACT OF HQ MIN. WAGE CHANGE ON FOREIGN ESTABLISHMENT WAGES

	% Δ Est. Wage	% Δ HQ Wage	% Δ Est. Wage
	(1)	(2)	(3)
Min. Wage Hike	0.019	0.059	
	(0.006)	(0.012)	
% Change HQ Wage (IV)			0.319
			(0.125)
Employer x Occ FE	Y	Y	Y
Estab.-City x Year FE	Y	N	Y
Year FE	N	Y	N
Observations	60513	8447	60513

Note: This table shows the impact of a minimum wage change in a firm's headquarter country on establishment wages.The outcome variable is the percent change in occupation-specific establishment or HQ wages. *Min Wage Hike* is an indicator that takes the value one in year t if a firm's headquarter country experiences a minimum wage increase that year. Column (1) is the reduced form estimate of the impact of a minimum wage hike in a firm's headquarter on wages in the establishment country. We do not require that we see the wages for the same set of jobs in the firm's headquarter for this regression. Column (2) shows the first stage result, and column (3) shows the IV result, using TS2SLS from instrumenting a change in a firm's headquarter wages with a minimum wage shock.

TABLE 5: BINDING VS. NON-BINDING LOW-SKILL OCCUPATIONS

	% Δ Estab. Wage		% Δ HQ Wage		% Δ Estab. Wage	% Δ HQ Wage
	(1)	(2)	(3)	(4)	(5)	(6)
					De-meaned	
Min Wage Hike		0.003		0.001		
		(0.006)		(0.013)		
Min Wage Hike x Binding	0.072	0.071	0.061	0.050	0.072	0.061
	(0.023)	(0.020)	(0.014)	(0.023)	(0.023)	0.061
Employer x Occ FE	Y	Y	Y	Y	Y	Y
Estab.-City x Year FE	N	Y	N	N	N	N
Employer x Est.-City x Year FE	Y	N	N	N	Y	N
Employer x Year FE	N	N	Y	N	N	Y
Year FE	N	N	N	Y	N	N
Observations	260567	260679	30295	30298	260567	30295

Note: In this table we interact the minimum wage hike indicator with an indicator for the job being binding in the headquarter. An occupation is binding in a country if there exists a HQ of foreign establishment that, in the preceding year, paid a wage to that occupation that was below the new minimum wage. Only establishment-years in which at least one HQ minimum-wage-binding occupations existed are included, as they are relevant in within-establishment-year analysis. Column (1) is the reduced form estimate of the impact of a minimum wage hike in a firm's headquarter on wages in the establishment country. We do not require that we see the wages for the same set of jobs in the firm's headquarter for this regression. Column (2) shows the first stage result, and column (3) shows the IV result, using TS2SLS from instrumenting a change in a firm's headquarter wages with a minimum wage shock. In columns (5)-(6) we first de-mean the minimum wage shock with respect to employer, occupation, establishment-city, and year fixed effects prior to interacting it the binding indicator

TABLE 6: IMPACT OF HQ EX. RATE SHOCKS ON FIRM WAGES

Panel A: Reduced Form	Log Establishment Wage		
	(1)	(2)	(3)
		Depreciation	Appreciation
Log HQ Exchange Rate	-0.052	0.002	-0.089
	(0.029)	(0.041)	(0.037)
Employer x Occ FE	Y	Y	Y
Estab.-City x Year FE	Y	Y	Y
HQ Currency Trend	Y	Y	Y
Observations	369847	182842	198984
Panel B: First Stage	Log HQ Wage		
Log HQ Exchange Rate	-0.500	-0.509	-0.546
	(0.221)	(0.218)	(0.231)
Employer x Occ FE	Y	Y	Y
Year FE	Y	Y	Y
HQ Currency Trend	Y	Y	Y
Observations	44995	27547	21130
Panel C: 2SLS	Log Establishment Wage		
Log HQ Wage	0.105	-0.004	0.198
	(0.074)	(0.092)	(0.135)
Employer x Occ FE	Y	Y	Y
Estab.-City x Year FE	Y	Y	Y
HQ Currency Trend	Y	Y	Y

Note: This table shows (1) the impact that a 100% local currency depreciation (relative to USD) in a firm's home country has on gross wages (in USD) in its foreign establishments (Panel A) and its headquarter (Panel B), and (2) the impact that wage headquarter wage changes induced by exchange rate shocks have on wages for the same occupation in the firm's foreign establishments (Panel C). The outcome is the occupation-specific log wage in a firm's establishment (Panels A and C) or headquarter (Panel B). In Panel C we perform two-sample 2SLS by estimating the first stage using all jobs in all headquarters (including those for which we do not observe the same job in a foreign establishment in the same year), and the second stage and reduced form using all jobs in all foreign establishments (including those for which we do not observe their headquarter counterparts in the same year). The results in Column 2 are estimated using appreciation shocks and those in Column 3 are estimated using depreciation shocks. In all specifications, all foreign establishments located in the same currency zone as the firm's headquarter country are excluded. Standard errors are clustered at the headquarter country-currency zone level. TS2SLS standard errors are computed following Pacini & Windmeijer (2016).

TABLE 7: PREDICTORS OF WAGE SHOCKS' TRANSMISSION

Panel A: HQ x Estab. Country Characteristics	
Common Border	0.017
Log Distance	-0.025
Time Difference	-0.076
Ever in Colonial Relationship	0.097
Common Currency	-0.015
Common Religion	0.015
Common Legal Origin	0.047
Regional Trade Agreement	-0.001
Common Language Index	-0.019
Log diff. in GDP per capita (HQ - Estab.)	0.045
Log Estab.-to-HQ Migrant Stock	-0.123
Log HQ-to-Estab. Migrant Stock	-0.094
Panel B: Sector Characteristics	
Sector Offshorability	-0.008
Skill Share	0.085
Capital Share (1-Labor Share)	0.088
Input Tradeability	-0.019
Output Tradeability	-0.053
Panel C: Occupation Characteristics	
Occ. Offshorability	-0.027
Abstract Task	-0.332
Routine Task	-0.418
Manual Task	0.421

	Estab.	HQ
Panel D: Country Characteristics		
Hofstede's Cultural Dimensions		
Power Distance Index	0.026	-0.049
Individualism	-0.018	-0.059
Masculinity vs. Femininity	0.002	-0.126
Uncertainty Avoidance Index	-0.069	0.047
Long-term (vs. Short-term) Orientation	0.042	0.185
Indulgence (vs. Restraint)	-0.066	-0.053
Global Preference Survey		
Patience	0.014	-0.104
Risk Taking	-0.005	-0.043
Positive Reciprocity	0.038	-0.212
Negative Reciprocity	-0.030	0.102
Altruism	0.053	-0.304
Trust	0.054	0.059
Other Socioeconomic Charac's		
Gini Index	-0.025	-0.232
Urbanization	-0.018	0.083
Adult Education Attainment	0.032	0.023
Log GDP per capita	-0.004	0.064
Regulatory Index	-0.029	0.020

Note: This table presents the average value of HQ-establishment, sector, occupation, HQ and destination characteristics for low-skill jobs in foreign establishments with above median conditional treatment effect. The treatment variable is the HQ minimum wage hike, the outcome variable is percentage change in establishment wages, and the panels contain different groups of characteristics. We standardize all the characteristics variables to have zero mean and a unit standard deviation within the subsample of low-skill jobs. These variables are described in more detail in Appendix III. Conditional treatment effects are estimated using the Causal Forest methodology described in Appendix IV. We residualize the outcome variable and the treatment status for employer×occupation and establishment city×year fixed effects for the sample of all jobs. Then, we estimate the conditional treatment effect using the causal forest, where we specify to orthogonalize the residualized outcome variable and the treatment status with respect to all the characteristics variables and cluster at the HQ-location level, following Athey & Wager (2019). The corresponding results for middle-/high-skill jobs are presented in Appendix Table **??**.

TABLE 8: ESTABLISHMENT-HQ WAGE ANCHORING: BRAZIL

	Panel A: Relationship between HQ and Estab. Wages			
	(1)	(2)	(3)	(4)
Log Wages:	Annual	Effective	Annual	Effective
Log Skill-Lev Wage at HQ	0.169	0.077	0.108	0.088
	(0.027)	(0.023)	(0.033)	(0.031)
Employer x Occ FE	N	N	Y	Y
Worker FE	Y	Y	N	N
Estab.-City x Year FE	Y	Y	Y	Y
Worker Controls	Y	Y	Y	Y
Observations	193049	135913	143012	100552
	Panel B: Impact of HQ Min. Wage Change on Estab. Wages			
	(1)	(2)	(3)	(4)
% Δ in Wages:	Annual	Effective	Annual	Effective
Sample:	Full Sample		Matched Sample	
Min Wage Hike	-0.001	-0.003	-0.001	-0.002
	(0.002)	(0.003)	(0.002)	(0.002)
Hike x Low Skill Occ.	0.024	0.012	0.024	0.022
	(0.003)	(0.001)	(0.003)	(0.002)
Worker FE	Y	Y	Y	Y
Estab.-City x Year FE	Y	Y	Y	Y
Worker Controls	Y	Y	Y	Y
Observations	861216	860947	861216	861216

Note: This table shows the relationship between a firm's establishment wage and headquarter wage using the sample of firms that have an establishment in Brazil. Panel A shows the correlation between the log skill-level wage in a firm's headquarter and the log wage at the firm's foreign establishment. In the RAIS data, an occupation's skill level is defined using the average education of workers employed in the occupation, and the coding of skill levels is designed so that the skill level distribution in RAIS is matched to the skill level distribution in the main (Company) dataset. Panel B shows the impact of a minimum wage hike in the firm's headquarter on wages in the firm's establishment. *Min Wage Hike* is an indicator that takes the value one in year t if a firm's headquarter country experiences a minimum wage increase that year. In columns 1 and 3, the outcome variable is log (or percentage change in) annual average monthly wage of a worker. In columns 2 and 4, the outcome variable is the log (or percentage change in) the average annual monthly wage after accounting for differences in hours worked. Worker controls include age and job tenure fixed effects, as well as controls for race and gender. In Panel A, standard errors are clustered at the employer level. In Panel B, standard errors are clustered at the headquarter country (or state) level.

TABLE 9: IMPACT OF HQ MIN. WAGE CHANGE ON FOREIGN ESTAB. EMPLOYMENT

	Panel A: Extensive Margin			
Outcome:	Job Leaves Foreign Establishment			
Data Source:	Company		RAIS	
	(1)	(2)	(3)	(4)
Min Wage Hike	-0.004	-0.002	0.002	0.001
	(0.003)	(0.004)	(0.001)	(0.001)
Hike × Low Skill		-0.006		0.002
		(0.002)		(0.003)
Employer × Occ FE	Y	Y	Y	Y
City × Year FE	Y	Y	Y	Y
Observations	431947	431947	72181	72181
	Panel B: Intensive Margin			
Outcome:	%Δ Workers			
Data Source:	RAIS			
Min Wage Hike	0.001	-0.012	-0.008	-0.012
	(0.011)	(0.012)	(0.011)	(0.012)
Hike × Low Skill			0.005	0.010
			(0.023)	(0.024)
Employer FE	Y	N	Y	N
Occ FE	Y	N	Y	N
Employer × Occ FE	N	Y	N	Y
City × Year FE	Y	Y	Y	Y
Observations	69296	68980	69314	68980

Note: Panel A shows the extensive employment response of Brazilian establishments following a minimum wage shock. Columns 1-2 use data from the Company and columns 3-5 use RAIS data. *Min Wage Hike* is an indicator that takes the value one if a headquarter country experiences in minimum wage increase in a given year. The outcome variable in Panel A is an indicator for an occupation disappearing from a given establishment in the year following the minimum wage hike. Panel B shows the intensive employment response using the RAIS data. The outcome is the percent change in workers in a given occupation from year t to $t+1$ (where a minimum wage hike occurs in year t). Low skill occupations are those with a skill level below 5, as defined by the Company. Standard errors are clustered at the headquarter country (state) level. Because the multinationals in our Brazil sample are headquartered in relatively few locations abroad, we have also wild-cluster-bootstrapped the standard errors in Table 9 (Cameron *et al.*, 2008). This about doubles their magnitude in Panel A and increases their magnitude more modestly in Panel B.

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

In this appendix, we compare the wage response of employers that are headquartered in the same country or state but 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 equations (3) and (4) respectively with Kaitz_{ft} and estimate:

$$\%\Delta \text{w}_{jfct} = \alpha_3 \mathbb{I}(MINw_{h(f)t} > 0) \times \text{Kaitz}_{ft} + \theta_{fj} + \theta_{ct} + \theta_{h(f)t} + \varepsilon_{jfct} \tag{A1}$$

where the minimum hike and any correlated macro-level demand shocks affecting the home country/state are now absorbed by home country/state×year fixed effects $\theta_{h(f)t}$.

We find that the wages of foreign workers in low-skill jobs and the lowest-wage jobs (for which the minimum wage is binding at the headquarters) are more affected by a minimum wage increase in the home country/state in firms for which the prior minimum wage was more binding at the headquarters. The estimates of $\hat{\alpha}_3$ is reported in Column 1, Appendix Table A15. Note that we also leave out home country/state×year fixed effects so that the effect of home country/state minimum wage increases on the wages of workers in low-skill occupations in multinationals with medium-level firm bindingness (Kaitz) can be identified. The estimated coefficients on the interaction terms of home country/state minimum wage change and the firm bindingness measure are robust to whether home country/state×year fixed effects are included (comparing columns 1 and 3 with columns 2 and 4 in Table A15).

The results in Table A15 suggest that potential heterogeneity in labor demand that covaries with minimum wage changes is to a large extent *firm*-specific rather than *occupation*-specific. This in turn implies that the concern discussed above—that home country/state labor demand that directly affects multinationals' foreign wages and also encourages minimum wage increases at home could disproportionately be demand for low-wage workers—is unlikely to drive our estimates.

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 no 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.[60]

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

[60]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.

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).[61] 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.

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, 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.

[61] 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) includes a database on nominal gross monthly minimum wage (local currency) for 118 of the 170 countries observed in our primary dataset. The minimum wage is recorded as of December 31st of each year.[62] 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).

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).[63] 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.

[62] 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.

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

iii The crosswalk between the 2000 US Census Codes and the *occ1990dd* occupation classification codes is available on David Dorn's website.[64]

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).

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).[65]

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.[66]

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. [67]

[64] "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."

[65] 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.

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

[67] 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.

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.[68]

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.[69]

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,

[68] 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.

[69] 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.

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.[70] 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.

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 2005-2013 (the years covered in the multinational data). 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

[70] 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.

non-profits). We use this identifiers to match firms in the multinational data to establishments in Brazil. We find identify 54 firms with establishments in Brazil.

Because the Company does not use standard occupation codes, we are unable to match individuals in Brazil (for whom we have CBO codes of occupations) to their direct job counterpart in the multinational data. We therefore instead match by skill level of the job. We do this by taking the average education level of individuals in a particular CBO in Brazil, as well as the average "level" people are at in the firm (manager, assistant manager), and match into the respective skill level in the Company's data. These multinationals are headquartered in the United States (61%), Germany (13%), Switzerland (12%), the UK (6%), France (5%), Finland (1.5%) and the remainder are spread equally across Australia, Canadaa, Ireland, and New Zealand.

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. Summary statistics are provided in Appendix Table A17. The wages in the Company's data have an roughly 80% correlation with wages in the Brazilian data.

2. Data Processing

2.1 Data trimming

The dataset from the Company is an unbalanced panel at establishment×year level, and contains a few large wage changes within the same establishment in neighboring years that are very likely due to data entry errors. We drop observations with a wage change between two consecutive surveyed years larger than 100%. This trimming procedure drops less than 2% of the total observations.[71] We also drop wages that are in the top and bottom 1% of the overall wage distribution.

2.2 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

[71] If data entry errors were more likely to occur when there was a longer time gap between two consecutive surveys on the same establishment, and home country minimum wage changes were also larger when the time gap was longer, including possibly erroneous outliers with very large wage growth could lead to a spurious positive correlation between the firm wage change and home country minimum wage change.

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 (similarly to in the cross-sectional regression discussed above).

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 (all jobs 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 employer×occupation and establishment-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 treatment effect. 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 estimate treatment effects for the test sample.

5 We implement 200 replications of steps 2, 3, and 4.

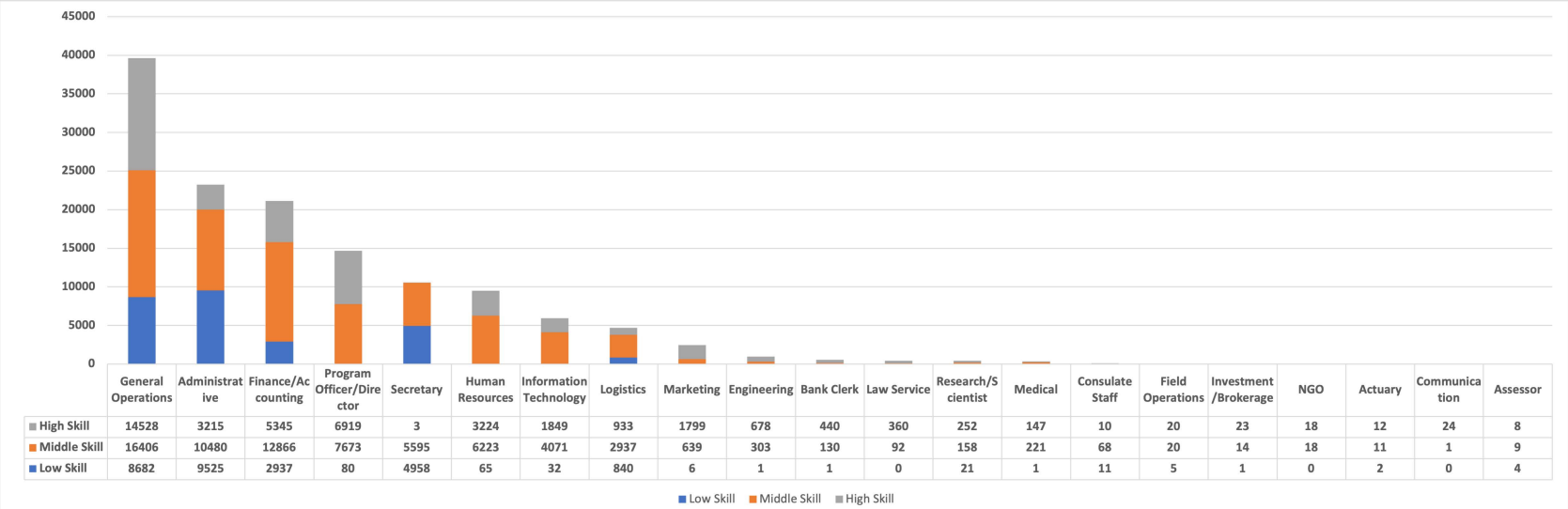
6 We take the average of the estimated treatment effects across each replication for each observation in the full sample.

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 average estimated treatment effects (CATE) 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.)

Appendix V Figure

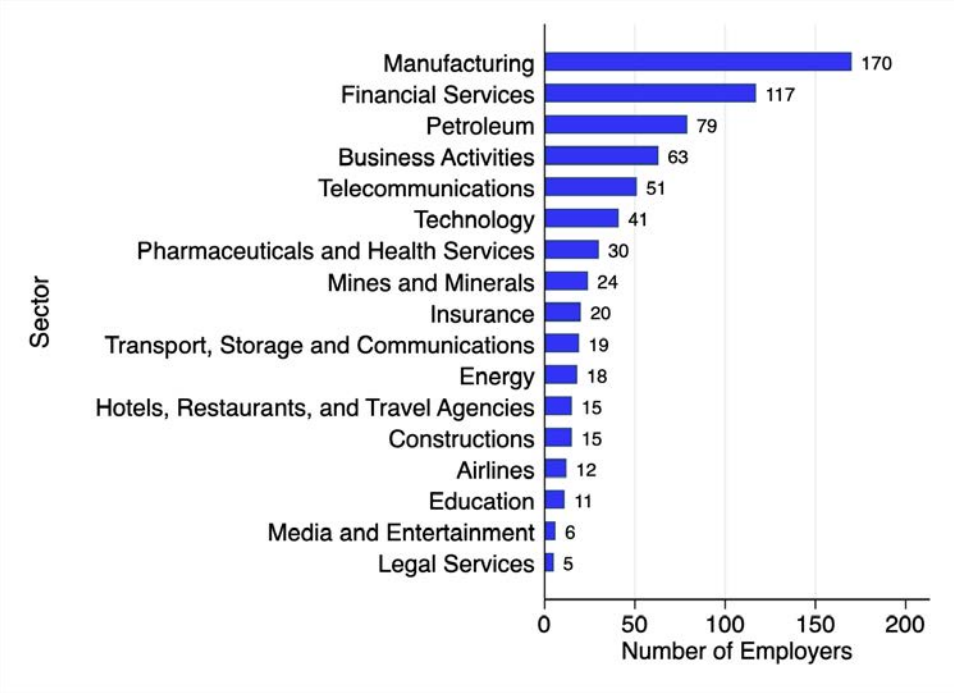
FIGURE A1: OCCUPATION DISTRIBUTION BY OCCUPATION CATEGORY AND SKILL LEVEL



	General Operations	Administrative	Finance/Accounting	Program Officer/Director	Secretary	Human Resources	Information Technology	Logistics	Marketing	Engineering	Bank Clerk	Law Service	Research/Scientist	Medical	Consulate Staff	Field Operations	Investment /Brokerage	NGO	Actuary	Communication	Assessor
High Skill	14528	3215	5345	6919	3	3224	1849	933	1799	678	440	360	252	147	10	20	23	18	12	24	8
Middle Skill	16406	10480	12866	7673	5595	6223	4071	2937	639	303	130	92	158	221	68	20	14	18	11	1	9
Low Skill	8682	9525	2937	80	4958	65	32	840	6	1	1	0	21	1	11	5	1	0	2	0	4

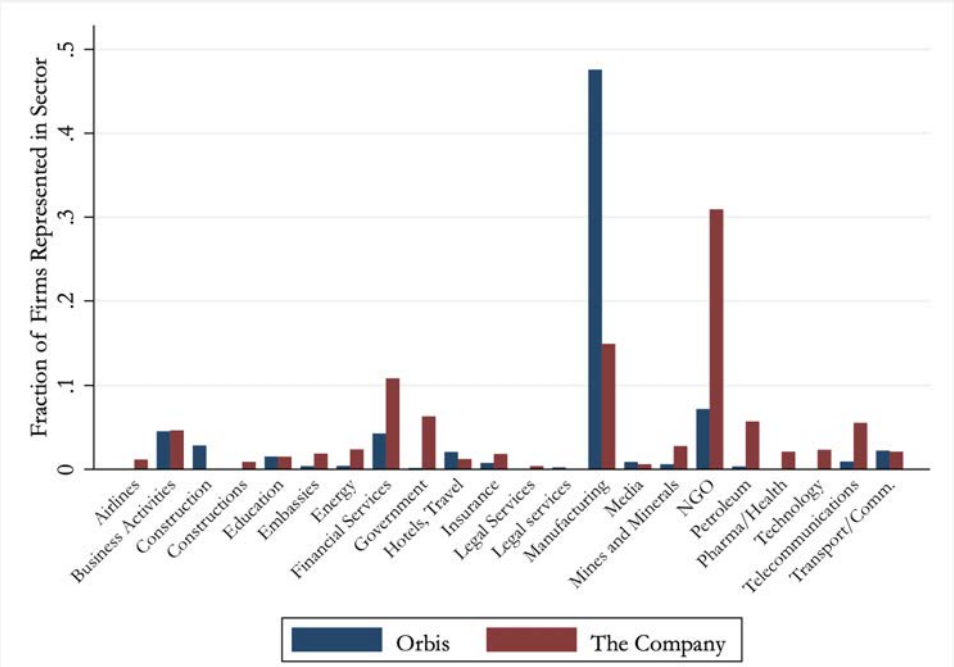
Note: This figure displays the distribution of occupations in the headquarters and the foreign establishments of multinationals according to the Company's global definition of occupation categories and skill levels. Low-skill: skill level 1-4; med-skill: skill levels 5-8; high-skill: skill levels 9-15. The occupation type "NGO" contains 5 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×establishment×occupation.

FIGURE A2: SECTORAL DISTRIBUTION OF PRIVATE-SECTOR FIRMS



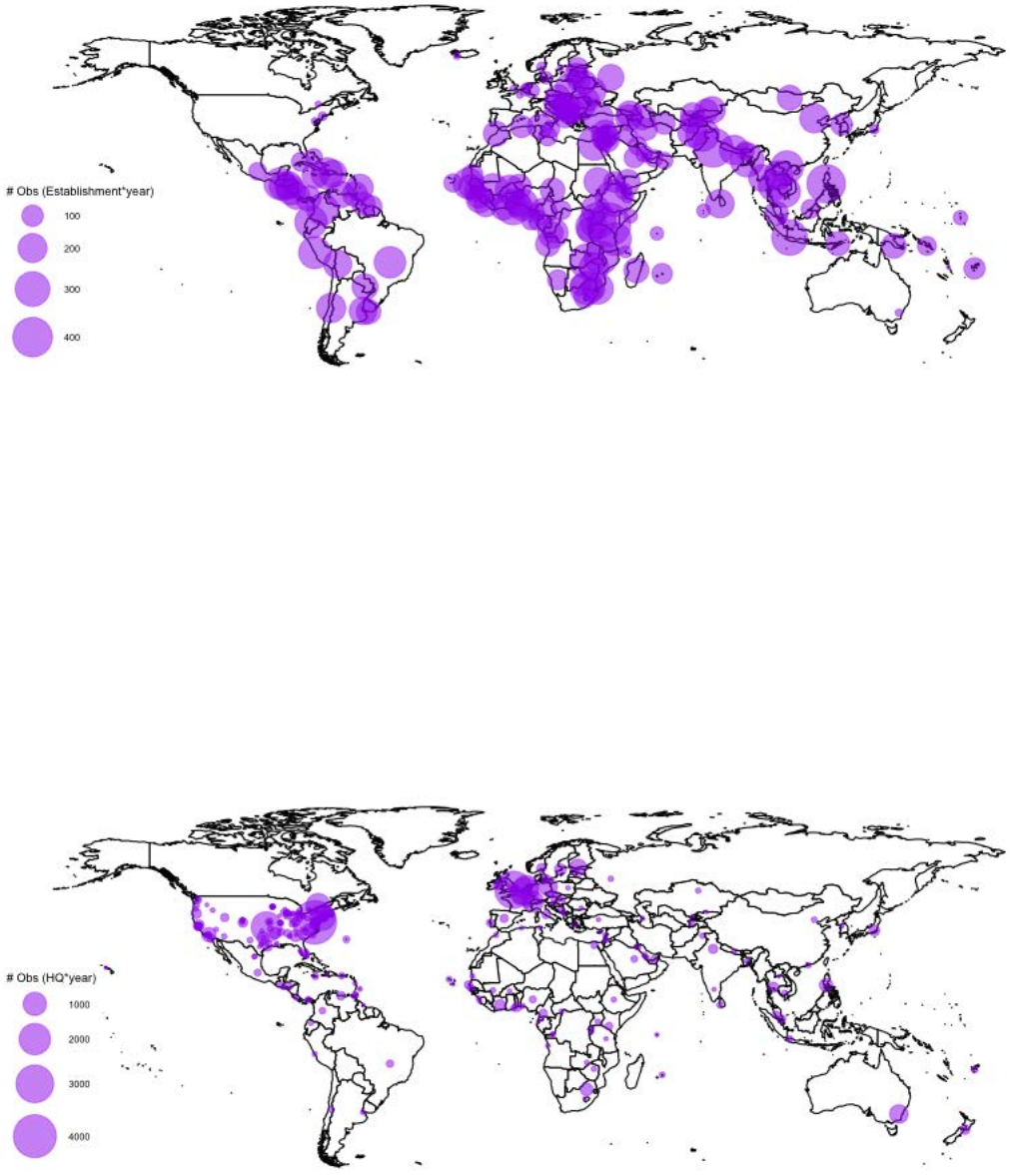
Note: This figure displays the sectoral distribution of the private-sector multinationals in the full sample. The unit of observation is a multinational (employer).

FIGURE A3: SECTORAL DISTRIBUTION OF COMPANY FIRMS AND ORBIS FIRMS



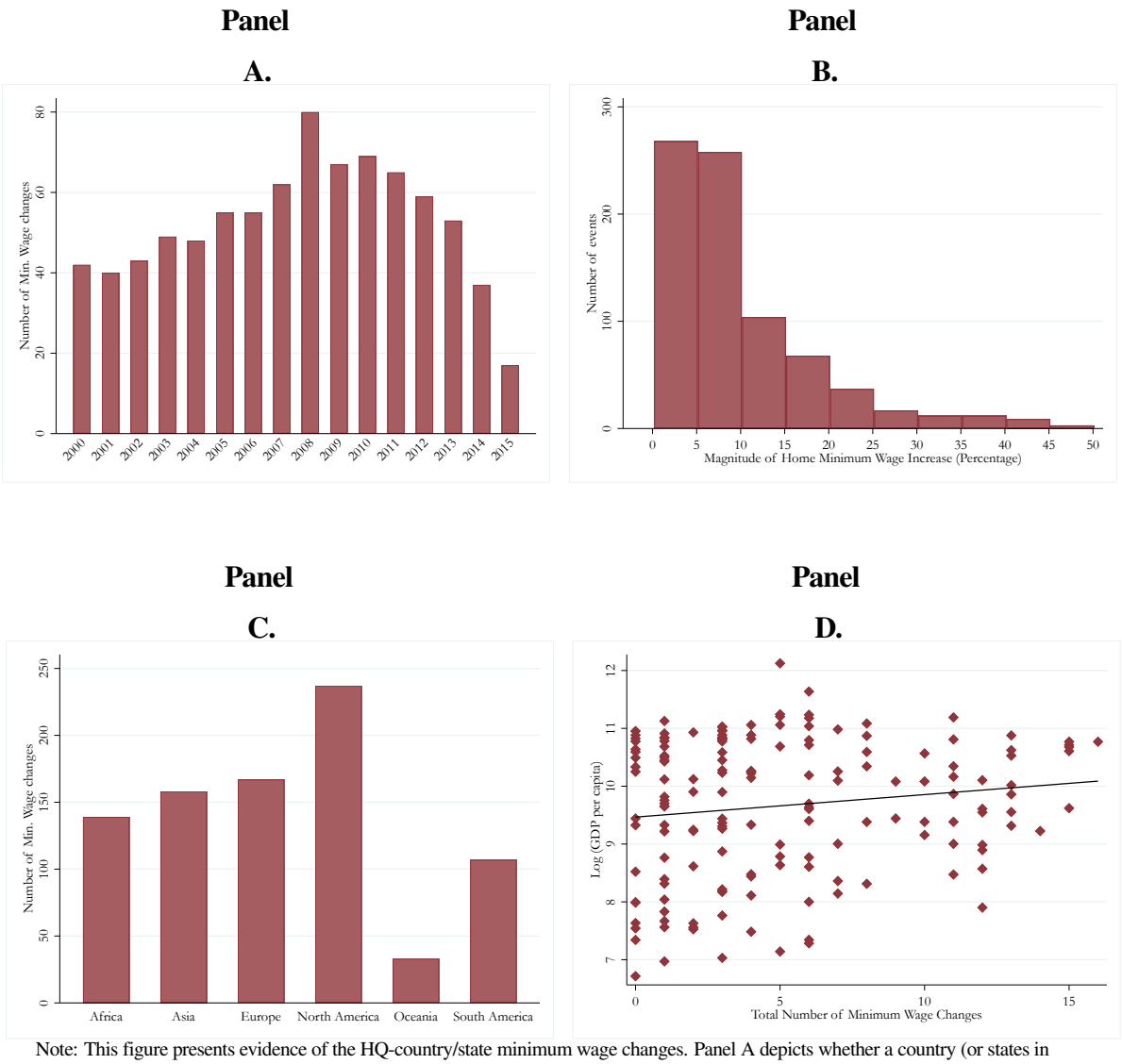
Note: This figure displays the sectoral distribution of all multinationals in the Company dataset (red bars) and the Orbis sample (blue bars). The Orbis sample contains 1,100 firms randomly selected from the set of all sector × headquarters country location pairs that exist in the Company data. The unit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

FIGURE A4: FOREIGN ESTABLISHMENT AND HQ LOCATIONS



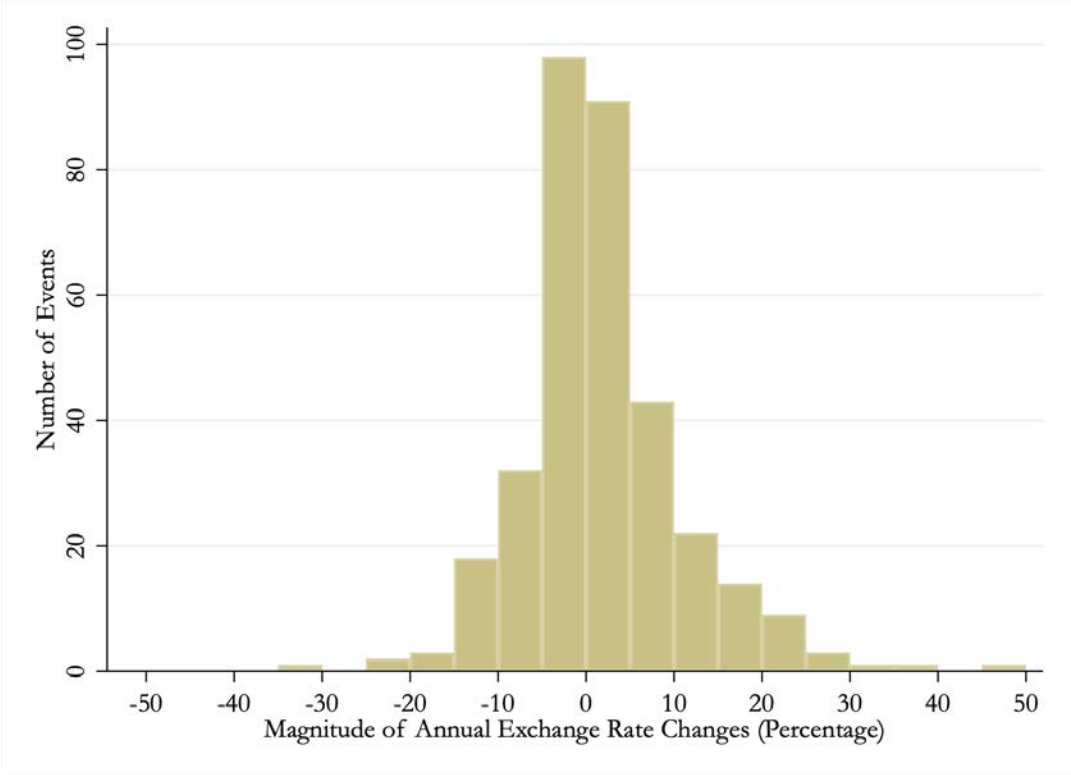
Note: This figure displays the geographical distribution of the establishments (top panel) in the full sample of multinationals and their headquarters (bottom panel). The bubble size weight is the number of establishment (headquarters)×year observations in each city.

FIGURE A5: HQ COUNTRY/STATE MINIMUM WAGE CHANGES



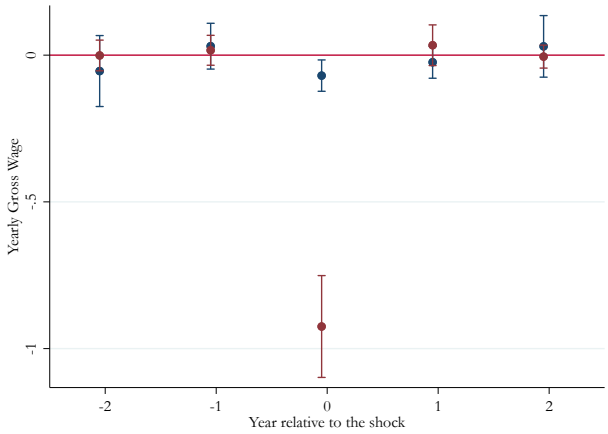
Note: This figure presents evidence of the HQ-country/state minimum wage changes. Panel A depicts whether a country (or states in the case of the US) has a minimum wage increase in a particular year. Panel B shows the distribution of the magnitude of headquarters countries/states' minimum wage increases from 2000 and 2015. There are 841 minimum wage increases (including 53 whose magnitude is larger than 50%) and 742 counts of headquarters-location $\times$ years with zero minimum wage increase. Panel C presents the total number of minimum wage increases between 2000 and 2015 grouped by their 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) between 2000 and 2015, 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 CURRRENCY APPRECIATION/DEPRECIATION



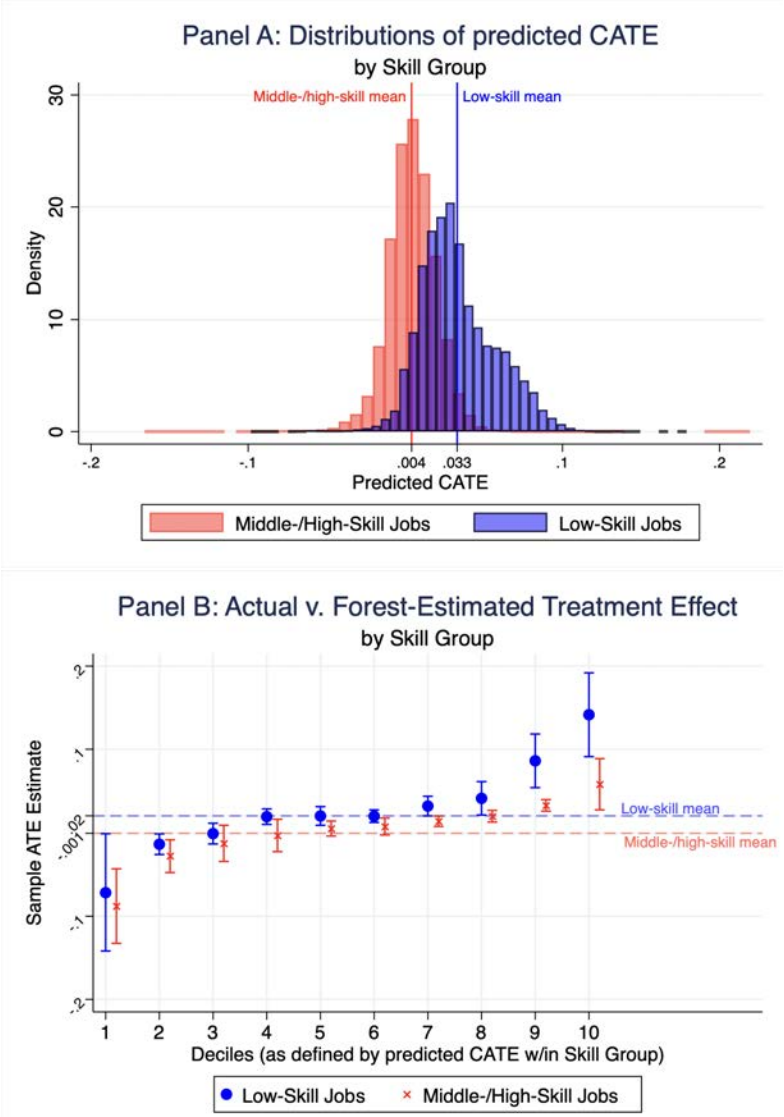
Note: This figure shows the distribution of the magnitude of headquarters country exchange rate changes used in our main analysis. The unit of observation is currency-zone×year. All establishments which are located in the same currency zone as the headquarters are excluded; All headquarters countries including the United States and those which peg their currencies to the USD are also excluded. There are 197 events (including 3 whose magnitude is larger than 50%), including 82 appreciations (a decrease in exchange rate), 109 appreciations (an increase in exchange rate) and 6 instances where the exchange rate does not change .

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



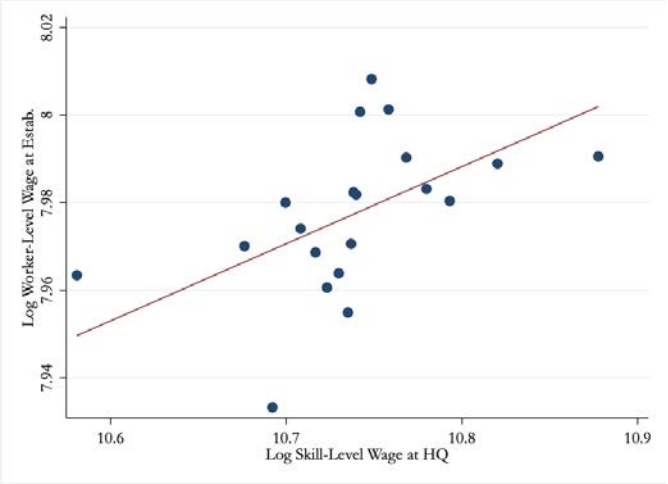
Note: This impulse response study plots the coefficients from a regression in which occupation-specific log gross wages (in current USD terms) at the foreign establishments (green coefficents) and the headquarters (orange coefficients) of a firm in year $t-3$ to $t+3$ are regressed on the detrended log 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.

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



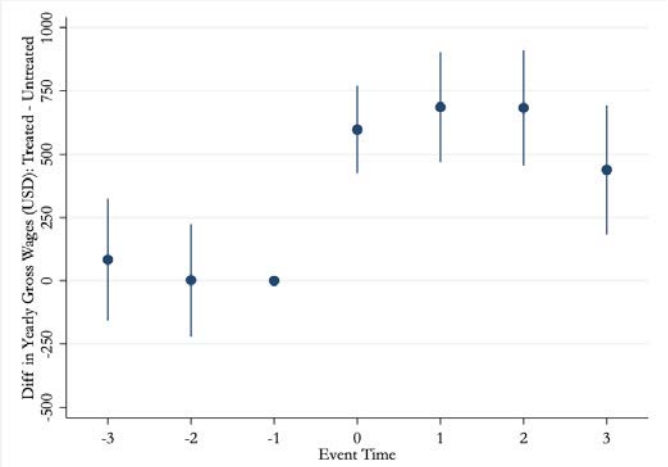
Note: Panel A plots the distributions of the predicted conditional treatment effect (CATE) using Causal Forest estimation of the low-skill and non-low-skill jobs. Panel B plots the sample average treatment effect (ATE) of the deciles of observations defined by the predicted CATE. Deciles are defined within the samples of low-skill jobs and non-low-skill jobs respectively. Sample ATE is the difference in the outcome variable (percentage change in foreign establishment wages) of observations in the same decile between observations with and without the treatment (minimum wage hike in the headquarters country), after controlling for employer×occupation and establishment-city×year fixed effects. Standard errors are clustered at headquarters-location level.

FIGURE A9: RELATIONSHIP BETWEEN HQ AND BRAZILIAN ESTABLISHMENT WAGES



Note: This binned scatterplot shows the relationship between the wage paid for a given skill level at a multinational's headquarter (x-axis) and the wage paid for a given skill level at the multinational's Brazilian establishment (y-axis). Data on headquarter wages come from the Company and data on wages on Brazil comes from *RAIS*. There are 16 skill levels, as defined by the Company. We then match these skill levels to the Brazilian data using the average education for a given job. To construct the plots, the log wage at the establishment if first residualized with respect to establishment city$\times$ year fixed effects, as well as worker age, tenure, race, and gender controls. The log wage at the firm's headquarter is then divided into twenty equal-sized groupings. Within each of these groups, we plot the mean of the establishment wage residuals against the mean of the headquarter wage and add back the unconditional mean of the y-variable to help with interpretation. The slope of the line of best fit is $\hat{\beta} = 0.176$ (s.e. = 0.011).

FIGURE A10: IMPACT OF HQ MIN WAGE ON FOREIGN ESTAB. WAGES IN BRAZIL



Note: This figure plots the coefficients on the event time indicators from estimating equation (2) using the sample of matched Brazilian firms. The outcome is the job-level wages at a firm's foreign establishment, and we additionally control for average worker characteristics for a given establishment-job (race, education, gender, and job tenure). The sample is restricted to low skill jobs and to those firms that experience only one minimum wage increase at the headquarter during the event time window. All coefficients are normalized to $k = -1$, the year before the minimum wage increase.

Appendix VI Table

TABLE A1: COMPARISON WITH ORBIS FIRMS

	Company (1)	Orbis (2)	p-value (3)
Total Assets	8966.29	399.88	0.001
	[16421.90]	[2977.68]	
Working Capital	411.98	35.17	0.001
	[3948.84]	[463.62]	
Sales	6827.88	224.33	0.001
	[14915.55]	[2094.92]	
Gross Profit	4018.94	98.21	0.001
	[12577.03]	[732.10]	
Export Revenue	2782.75	32.28	0.001
	[2658.25]	[465.79]	
Profit Margin	12.53	4.86	0.001
	[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 Private-Sector Multinational Samples*

	Number of Observations		
Unit of Observation	*Sample 1*	*Sample 2*	*Sample 3*
Employer	759	39	29
Employer×year	3,266	189	96
Establishment	2,933	199	101
Estab.×year	11,889	709	408
Estab.×skill-level×year	92,992	5,484	3,944
Estab.×occupation	60,521	3,462	2,464
Estab.×occ.×year	209,198	13,035	9,721

Panel B: *Private-Sector Multinationals' Foreign Establishments' Wages*

	Sample 1		*Sample 2*		*Sample 3*	
	Mean	SD	Mean	SD	Mean	SD
Net Wage (2000 USD)	15,868.30	9,565.90	13,446.80	8,107.82	15,684.87	8,704.26

Panel C: *Distribution & Compression of Wages (Sample 3)*

	HQ-Quart1	HQ-Quart2	HQ-Quart3	HQ-Quart4	HQ-All Occ
	Headquarter Wage Distribution				
Mean Net Wage (2000 USD)	8,306.71	13,789.61	21,844.53	40,213.25	19,392.39
Max. Net Wage (2000 USD)	46,715.80	69,712.34	98,355.27	160,000	160,000
	Establishment Wage as % of HQ Wage				
All Establishments	0.90	0.89	0.97	0.98	0.93
Estab.s in Poorer-than-HQ-Country Countries	0.80	0.79	0.87	0.89	0.83
Employer×occ.×year	519	378	391	332	1,620

Note: Only foreign establishments are included in panels A & B, while in panel C, headquarters are also included. 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	0.156	0.183		
	(0.106)	(0.138)		
Log Skill-Level HQ Wage			0.144	
			(0.185)	
Log Firm-Level HQ Wage				0.531
				(0.111)
Employer x Occ FE	Y	Y		
Employer x Skill-level FE			Y	
Employer FE				Y
Estab.-City x Year FE				Y
Estab.-City x Occ x Year FE	Y	Y		
Estab.-City x Skill-level x Year FE			Y	
HQ x Year FE		Y		
Observations	7093	7089	4808	742

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 Gross Wage at Establishment				Log Wage Slope at Estab.
	(1)	(2)	(3)	(4)	(5)
				Private Sec.	Private Sec.
Log Occ-Level HQ Wage	0.201	0.273	0.420	0.376	
	(0.020)	(0.025)	(0.057)	(0.032)	
Med Skill x Log Occ-Level HQ Wage		-0.088			
		(0.025)			
High Skill x Log Occ-Level HQ Wage		-0.158			
		(0.032)			
USA x Log Occ-Level HQ Wage			-0.205		
			(0.061)		
Other High Inc x Log Occ-Level HQ Wage			-0.249		
			(0.056)		
HQ Wage Slope					0.436
					(0.054)
Employer x Occ FE	Y	Y	N	Y	N
Estab.-City x Year FE	Y	Y	Y	Y	Y
Employer x Skill-level FE	N	N	Y	N	Y
Observations	20957	20957	21251	7939	4994

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 firm level.

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

	(1)	(2)	(3)	(4)	(5)	(6)
	Establishment Occ-Level Wage				HQ Occ-Level Wage	
Sample:	High Skill		Low Skill	High Skill	Low Skill	High Skill
Min Wage Hike	0.006	0.000				
	(0.006)	(0.017)				
Log HQ Ex. Rate			-0.118	-0.079	-0.649	-0.461
			(0.068)	(0.059)	(0.157)	(0.266)
Employer × Occ FE	Y	Y	Y	Y	Y	Y
Estab.-City × Year FE	Y	N	Y	Y	N	N
Year FE	N	Y	N	N	Y	Y
Observations	102866	18906	41878	139330	10251	28605

Note: This table shows the impact of minimum wage shocks (columns 1-2) and exchange rate shocks (columns 3-6) at a firm's headquarters on wages in the firm's foreign establishments. Columns 5-6 also show the impact of exchange rate shocks in the firm's headquarters on wages in the firm's headquarters for low and high-skill workers. High-skill occupations are defined as those requiring a skill level between 6-16, whereas low-skill occupations are those requiring a skill level below 5, as defined by the Company. Standard errors are clustered at the country (columns 1-2) or country currency zone level (columns 3-6).

TABLE A6: ROBUSTNESS TO ALTERNATIVE LOW SKILL DEFINITIONS

	Percent Change in:					
	Est. Wage	HQ Wage	Est. Wage	Est. Wage	HQ Wage	Est. Wage
	(1)	(2)	(3)	(4)	(5)	(6)
	Skill Levels 1-4			Skill Levels 1-6		
Min Wage Hike at HQ	0.034	0.072		0.013	0.050	
	(0.018)	(0.013)		(0.005)	(0.012)	
% Change HQ Min Wage			0.471			0.254
			(0.257)			(0.118)
Employer x Occ FE	Y	Y	Y	Y	Y	Y
Estab.-City x Year FE	Y	N	Y	Y	N	Y
Year FE	N	Y	N	N	Y	N
Observations	25807	4674	25807	102333	12930	102333

Note: This table shows (1) the reduced form impact of a minimum wage change in a firm's headquarter on wages in the firm's foreign establishments (columns 1 and 4), (2) the first stage impact on the firm's headquarter (columns 2 and 5), and (3) the impact of a wage change in a firm's headquarter on the firm's establishment wages, using the minimum wage change as an instrument for headquarter wages (columns 3 and 6). In columns 1-3, occupations that the Company defines as being in skill levels 1-4 are defined as low skill. In columns 4-6, low skill jobs are defined as those occupations that are in skill levels 1-6.

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

	% Δ Estab Wage (1)	% Δ HQ Wage (2)	% Δ Estab Wage (3)
Min Wage Hike at HQ	0.029	0.061	
	(0.008)	(0.015)	
%Δ HQ Wage			0.477
			(0.170)
Employer x Occ FE	Y	Y	Y
Estab.-City x Year FE	Y	N	Y
Year FE	N	Y	N
Observations	32752	7128	32752

Note: This table shows the impact of a minimum wage shock in a firm's headquarters country on wages in the firm's foreign establishments, restricting to private sector firms. Column 1 shows the reduced form result, column 2 shows the first stage result, and in column 3 we instrument for the headquarter wage with the minimum wage shock and estimate the impact on establishment wages. In column 3, we use two sample two-stage least-squares. Standard errors are clustered at the headquarter country (or state) level.

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

	Estab-Country Min. Wage Hikes		Estab-Country Ex. Rate Shocks	
	%Δ HQ Wage	%Δ Estab j Wage	Log HQ Wage	Log Estab j Wage
	(1)	(2)	(3)	(4)
Hike at Estab. ($\neq$j)	0.002	-0.000		
	(0.001)	(0.001)		
Log Ex. Rate at Estab. ($\neq$j)			-0.003	-0.000
			(0.003)	(0.001)
Employer × Occ FE	Y	Y	Y	Y
HQ City × Year FE	Y	N	Y	N
Estab. j-City × Year FE	N	Y	N	Y
Observations	1571	1629751	20345	14783948

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 regression is run by creating a dataset in which each foreign establishment is matched to every other foreign establishment within the firm, as well as the firm's headquarter. Standard errors are clustered at the level of the independent variable establishment.

TABLE A9: ROBUSTNESS TO SHOCK DEFINITIONS

	Estab. (1)	HQ (2)	Estab. (3)	HQ (4)	Estab. (5)	HQ (6)	Estab. (7)
Min Wage Hike, 50th	0.015	0.060.					
	(0.007)	(0.012)					
Min Wage Hike, 75th			0.030	0.043			
			(0.013)	(0.017)			
Log HQ Ex. Rate					-0.107	-0.474	
					(0.049)	(0.250)	
Log HQ Wage (IV)							0.225
							(0.158)
Employer × Occ FE	Y	Y	Y	Y	Y	Y	Y
Estab City × Year FE	Y	N	Y	N	Y	N	Y
Year FE	N	Y	N	Y	N	N	N
HQ Currency Trend	N	N	N	N	Y	Y	Y
Observations	60513	8447	60513	8447	125807	23391	125807

Note: This table shows robustness to different definitions of wage and exchange rate shocks. *Min Wage Hike, 50th* uses only minimum wage shocks that are above the 50th percentile in terms of the size of the minimum wage change. Similarly, *Min Wage Hike, 75th* uses only shocks above the 75th percentile. In columns 5-7, 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 7 presents the IV exchange rate results. Standard errors are clustered at the headquarter country (columns 1-4) or headquarter country currency zone level (columns 5-7).

TABLE A10: FREQUENCY AND MAGNITUDES OF SHOCKS

	% of change			# country (state)-year	
	P(25)	P(50)	P(75)	Neg.	Total changes
	(1)	(2)	(3)	(4)	(5)
Minimum wage	4.07	8.04	15.25	0	841
Exchange-rate	-3.26	1.39	7.07	477	1114

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 negatives percentage of changes and total events.

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

Panel A: Reduced Form	Log Establishment Wage		
	(1)	(2)	(3)
		Depreciation	Appreciation
Log HQ Exchange Rate	-0.089	-0.033	-0.124
	(0.027)	(0.023)	(0.052)
Employer x Occ FE	Y	Y	Y
Estab.-City x Year FE	Y	Y	Y
Observations	369847	182842	198984
Panel B: First Stage	Log HQ Wage		
Log HQ Exchange Rate	-0.358	-0.375	-0.476
	(0.110)	(0.135)	(0.172)
Employer x Occ FE	Y	Y	Y
Year FE	Y	Y	Y
Observations	44995	27547	21130
Panel C: 2SLS	Log Establishment Wage		
Log HQ Exchange Rate	0.249	0.087	0.259
	(0.107)	(0.069)	(0.144)
Employer x Occ FE	Y	Y	Y
Estab.-City x Year FE	Y	Y	Y
Observations	369847	182842	198984

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 Establishment Wage		
	(1)	(2)	(3)
		Depreciation	Appreciation
Log HQ Exchange Rate	-0.114	-0.074	-0.136
	(0.043)	(0.054)	(0.064)
Employer x Occ FE	Y	Y	Y
Estab.-City x Year FE	Y	Y	Y
HQ Currency Trend	Y	Y	Y
Observations	181211	89461	98495
Panel B: First Stage	Log HQ Wage		
Log HQ Exchange Rate	-0.494	-0.517	-0.538
	(0.238)	(0.239)	(0.240)
Employer x Occ FE	Y	Y	Y
Estab.-City x Year FE	Y	Y	Y
HQ Currency Trend	Y	Y	Y
Observations	38856	23925	18592
Panel C: 2SLS	Log Establishment Wage		
Log HW Wage	0.105	-0.004	0.198
	(0.074)	(0.092)	(0.135)
Employer x Occ FE	Y	Y	Y
Estab.-City x Year FE	Y	Y	Y
HQ Currency Trend	Y	Y	Y

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

TABLE A13: ESTABLISHMENT-HQ WAGE ANCHORING: BRAZIL (EXCHANGE RATE)

Log Wage:	Annual	Effective	Annual	Effective
	(1)	(2)	(3)	(4)
Log HQ Ex. Rate	-0.373	-0.318	-0.223	-0.185
	(0.015)	(0.021)	(0.008)	(0.012)
Firm x Occ FE	Y	Y	N	N
Firm x Worker x Occ FE	N	N	Y	Y
Estab.-City x Year FE	Y	Y	Y	Y
HQ Currency Trend	Y	Y	Y	Y
Worker Controls	Y	Y	N	N
Observations	1406880	1095148	1206679	924846

Note: This table shows the impact of a 100$ local currency depreciation (relative to USD) in a firm's home country has on gross wages in its foreign establishments. In columns 1 and 3, the outcome variable is 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 hours worked. Worker controls include age and job tenure fixed effects, as well as controls for race and gender.

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

	% Δ Gross Profit	% Δ K:L Ratio
	(1)	(2)
Hike	0.001	-0.024
	(0.027)	(0.016)
Mean of Dep. Var.	0.070	0.072
St.Dev. of Dep. Var.	(0.150)	(0.131)
Firm FE	Y	Y
Year FE	Y	Y
Observations	253	230

Note: This table shows the impact of 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 sum of tangible and intangible assets devided by the number of employees in the company's payroll. Percentage changes are calculated by taking 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. We use the consolidated accounts which include the statement of a company integrating the statements of its subsidiaries. Firm and year fixed effects are included and standard errors are clustered at the firm level.

TABLE A15: IMPACT OF MIN. WAGE CHANGE AT HQ ON FOREIGN ESTABLISHMENT WAGES: FIRMS WITH MORE VS. LESS EXPOSED HQS

	% Δ Establishment Wage		% Δ Headquarter Wage	
	(1)	(2)	(3)	(4)
Min Wage Hike at HQ	0.006	0.006	-0.015	-0.015
	(0.015)	(0.015)	(0.018)	(0.018)
Hike × Firm Bindingness	0.787	0.787	0.360	0.360
	(0.145)	(0.145)	(0.083)	(0.083)
Firm × Occ FE	Y	Y	Y	Y
HQ Country FE	Y	N	Y	N
Year FE	N	N	Y	Y
Estab City × Year FE	Y	Y	N	N
Observations	23179	23179	4103	4103

Note: This table shows the impact of a minimum wage shock on firms that are more versus less exposed to the shock. The Kaitz index is a measure of firm-level bindingness, calculated as the ratio between the ex ante minimum wage and the firm's median wage at the headquarters. For years in which the HQ was not surveyed, we impute the firm-level average Kaitz index. Only the firms for which the HQ and at least one foreign establishment are observed are included, as the Kaitz index is only available for these firms. Columns 1-2 show the reduced form impact on foreign establishments and columns 3-4 show the first stage impact on headquarters. Standard errors are clustered at the HQ-country (state) level.

TABLE A16: ROBUSTNESS OF IMPACT OF HQ COUNTRY EX. RATE SHOCKS ON WAGES

Panel A: Exporting/Important Sectors	Log Estab. Wage		Log HQ Wage	
	(1)	(2)	(3)	(4)
Log HQ Exchange Rate	-0.188	-0.048	-0.516	-0.265
	(0.108)	(0.084)	(0.141)	(0.250)
Log HQ Ex Rate × High Output Exporting		-0.046		-0.094
		(0.080)		(0.281)
Log HQ Ex Rate × High Input Importing	0.104		0.159	
	(0.096)		(0.137)	
Employer × Occ FE	Y	Y	Y	Y
Year FE	N	N	Y	Y
Estab City × Year FE	Y	Y	N	N
Observations	369847	369847	44995	44995
Panel B: Occupation Offshorability	Log Estab. Wage		Log HQ Wage	
	(1)	(2)	(3)	(4)
Log HQ Exchange Rate	-0.093	-0.087	-0.401	-0.285
	(0.027)	(0.029)	(0.124)	(0.112)
Log HQ Ex Rate × Offshorable		-0.004		-0.126
		(0.021)		(0.045)
Log HQ Ex Rate × Single Task	0.019		0.278	
	(0.034)		(0.171)	
Employer × Occ FE	Y	Y	Y	Y
Year FE	N	N	Y	Y
Estab City × Year FE	Y	Y	N	N
Observations	369847	369847	44995	44995
Panel C: Technology Adoption	Log Estab. Wage		Log HQ Wage	
	(1)	(2)	(3)	(4)
Log HQ Exchange Rate	-0.071	-0.095	-0.351	-0.237
	(0.031)	(0.025)	(0.100)	(0.116)
Log HQ Ex Rate × Abstract	-0.053		-0.016	
	(0.027)		(0.130)	
Log HQ Ex Rate × Routine		0.008		-0.197
		(0.025)		(0.047)
Observations	369808	369808	44989	44989

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 offshorablilty 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	14.6	1	137	17.0
Workers	294.0	1	12,208	937.1
% Brazilian	99.4	28.5	100	2.93
% no High School	7.99	0	100	13.9
Tenure (months)	55.7	0.5	546.4	50.1
Yearly Wages (USD)	10,542.12	543.03	47,152.18	6411.86

Note: This table reports the mean, minimum, and maximum values, as well as the standard deviations of the listed variables 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 US dollars.