CESifo WORKING PAPERS

7347
2018

November 2018

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CESifo

Impressum:

CESifo Working Papers
ISSN 2364-1428 (electronic version)
Publisher and distributor: Munich Society for the Promotion of Economic Research - CESifo GmbH
The international platform of Ludwigs-Maximilians University's Center for Economic Studies and the ifo Institute
Poschingerstr. 5, 81679 Munich, Germany
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Editors: Clemens Fuest, Oliver Falck, Jasmin Gröschl
www.cesifo-group.org/wp

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CESifo *Working Paper No. 7347*
Category 8: Trade Policy

Distance and the Multinational Wage Premium

Abstract

Combining administrative data on German workers with commercial data on German firms, we find evidence for a *distance effect* on the multinational wage premium: Foreign multinationals pay lower wages than German multinationals if the ultimate owner is located in close proximity to Germany, whereas the opposite is true if the ultimate owner is located further away. In addition to this so far unexplored effect, our results confirm previous evidence that *on average* foreign multinationals and domestic multinationals pay wages of similar size, with both types of firms paying a premium relative to other local firms. To provide a rationale for this pattern, we develop a theoretical model in which wages are firm-specific and firms can serve the foreign market via exporting or via FDI. In case of FDI, they face uncertainty about the wages to be paid abroad, and due to this uncertainty, firms that pay high wages at home are more likely to seek foreign investment. In the model, the observed distance effect on the multinational wage premium occurs since the alternative of exporting is less attractive for distant locations, and firms are therefore more willing to accept higher wages for foreign production in locations that are further away from their headquarters.

JEL-Codes: F120, F140, F210, F230.

Keywords: multinational wage premium, heterogeneous firms, distance effects.

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October 2, 2018
We are grateful to participants at the Annual conference of the German Economic Association, at the Göttingen Workshop in International Economics and at the CESifo Global Economy conference, and to seminar participants at TU Dresden for helpful comments and discussion. Hartmut Egger and Elke Jahn acknowledge financial support by the German Research Foundation for the project "Theory and Evidence on the Multinational Wage Premium".

1 Introduction

It is a well-established empirical fact that multinational firms pay higher wages than other firms. This wage gap falls drastically, but does not disappear, when controlling for observable differences, thereby restricting the comparison of multinationals and non-multinationals to firms that have the same size, workforce composition, industry affiliation, etc. (Aitken et al., 1996; Girma et al., 2001; Lipsey and Sjöholm, 2004; Balsvik, 2011; Malchow-Møller et al., 2013). The (*residual*) wage premium conditional on characteristics of the firm and its workforce has sparked a lot of interest in academic research, and the literature has produced evidence supportive of the conclusion that "multi-nationality – not nationality – is important" (Heyman et al., 2007, p. 356) for its existence. In one dissenting finding for the UK, Girma and Görg (2007) show that the geographical origin of the parent affects the wage premium paid by foreign multinationals. In particular, their study finds that a wage premium is paid by the UK plants of US-based multinationals, while no such premium is paid by multinationals whose headquarters are in other EU countries.

To analyse more generally how the parent's geographical origin affects the wage payments of its foreign subsidiaries, we build a new dataset that combines information on plant and workforce characteristics of German establishments with information on their ownership structure. Using this new dataset, we find evidence for a non-monotonic distance effect that is in line with the findings of Girma and Görg (2007). In particular, we find that foreign multinationals pay lower wages than German multinationals if the ultimate owner is located nearby, whereas the opposite is true if the ultimate owner is located further away. In the second part of our paper, we develop a theoretical model that provides a rationale for the role of distance in our data.[1]

The dataset we develop links administrative data on German workers from the Institute for Employment Research (IAB) in Nuremberg with firm-level information from Bureau van Dijk's commercial database Orbis. We rely on the Establishment History Panel (BHP) of the IAB, which aggregates worker information to the plant level, and use record linkages to match German plants from BHP with German firms from the Orbis database. Since Orbis provides detailed information on ownership structure, we can distinguish non-multinationals and multinationals, and we can furthermore distinguish multinationals by the location of their ultimate owners. A particular advantage of the linked BHP/Orbis data is that it contains detailed information on parents and their subsidiaries in other countries, and hence it offers a rich set of controls for national and

[1]Our theoretical model complements a small theoretical literature on the multinational wage premium building on the premise that the parent has access to a superior technology and that this causes higher wage payments by their subsidiaries. This may be to reduce the risk of technology dissipation due to job turnover (Fosfuri et al., 2001; Glass and Saggi, 2002), because of workplace learning (Girma and Görg, 2007; Malchow-Møller et al., 2013), due to (international) rent sharing (Egger and Kreickemeier, 2013; Orefice et al., 2016), or to compensate their workforce because multinationals require the workforce in their subsidiaries to perform tasks more independently (Gumpert, 2017). Whereas these mechanisms seem empirically relevant, they cannot explain the non-monotonic distance effect on multinational wage premia we find in our empirical analysis.

international corporate networks for our empirical analysis.

We employ the linked BHP/Orbis data to collect evidence on the multinational wage premium in Germany and find, in line with previous empirical work, that the premium falls but is not eliminated when controlling for observable differences in plant and workforce characteristics (see Hijzen et al., 2013). Unobserved differences between plants and their workforces are accounted for by including AKM fixed effects (see Abowd et al., 1999). Adding controls for the profitability of the ultimate owner, job turnover, the type of occupations distinguished by their functions and qualifications needed to perform the required tasks, and a proxy for workplace training still leaves a sizable part of the multinational wage premium unexplained. Moreover, we find that the average wage premium paid by subsidiaries of foreign multinationals is almost identical to the average wage premium paid by the subsidiaries of domestic multinationals. Zooming in on the group of foreign multinationals, we find a significant non-monotonic effect of the distance between Germany and the location of the ultimate owner on the multinational wage premium. Wages paid by multinationals with an ultimate owner in close proximity to Germany are 10 log points lower whereas wages paid by multinationals with an ultimate owner located far away are almost 10 log points higher than the wages paid by German multinationals with similar observables.

In the theoretical part of the paper, we construct a model that produces wage patterns in line with three key findings from our data. First, multinationals pay higher wages than non-multinationals even after controlling for observable differences in plant and workforce characteristics. Second, subsidiaries of domestic and foreign multinationals pay on average wages of similar size. Third, foreign multinationals pay lower wages than German multinationals if the ultimate owner is located nearby, whereas the opposite is true if the ultimate owner is located further away. The model we suggest has two important building blocks. The first one is a mechanism that explains the existence of firm-specific wages. In line with a large literature on compensating differentials we assume that wage differences between firms are the result of exogenous differences in workplace attributes (*amenities*, in short).[2] The second building block is a mechanism underlying foreign investment in our model. There, we assume that a firm makes its investment decision under uncertainty about the perception by foreign workers of the firm-specific workplace attributes it has to offer. This implies that at the time of the investment an uncertainty exists for firms about the wages they have to pay to their foreign workers.[3] We capture this uncertainty by a lottery

[2] Recent evidence on the willingness to pay for attractive working conditions is provided by Wiswall and Zafar (2018). The idea that non-wage workplace attributes are important determinants of wage dispersion is not new, and an informal account can be attributed to Adam Smith's book on the *Wealth of Nations* (cf. Smith, 1979). Rosen (1986) summarizes the main idea by noting that compensating wage differentials between firms arise *inter alia* because of inter-firm differences in working conditions or work-time schedules. Based on such theoretical insights, a sizable literature has evolved trying to asses the willingness to pay for workplace amenities, and evidence from Gronberg and Reed (1994), Bonhomme and Jolivet (2009), and others suggests that wage differences compensating for differences in workplace amenities can be sizable.

[3] Whereas direct evidence for cross-country differences in the perception of workplace amenities is to the best

that gives investors a single amenity draw for their foreign production plant from a distribution common to all firms, once they have paid the fixed cost of investment as a participation fee.

Firms can serve foreign consumers either as exporters through the shipment of domestic output or as multinationals through foreign production. Foreign investment is more attractive for firms whose amenities are low-valued by domestic workers, because these firms have to pay high compensating wages to attract workers at home and are therefore more likely to benefit from a better amenity draw when choosing to invest abroad. This selection mechanism suffices to explain, why, consistent with the first stylized fact, multinationals pay higher wages than non-multinationals at home and abroad. Regarding the wages multinationals pay at home relative to abroad, there are two counteracting effects. On the one hand, foreign investment offers the chance of obtaining a better amenity for the foreign production plant, which is the main reason for entering the lottery in the first place. On the other hand, the investment is risky and may result in a bad amenity draw, leading to higher wage payments abroad than at home. Whereas foreign investors can opt out of foreign production if the drawn amenity is too bad, they will accept higher foreign labor costs to a certain extent because foreign production bears the additional advantage of saving trade costs, which is a net gain if the investment cost is sunk. It is a priori not clear which of the two effects dominates, and, depending on the distribution of amenities, our model allows for wages in the domestic subsidiary to be higher or lower on average than wages in the foreign subsidiary of a multinational firm. This implies multinational wage premia that are consistent with the second empirical finding in our paper.

Finally, associating higher trade costs with larger distance, as it is common, for instance, in the gravity literature (cf. Anderson and van Wincoop, 2003; Anderson, 2011), our model also captures the third empirical finding, regarding the role of distance for the relative wage premium paid by the foreign subsidiary. To see this, note that larger distance has two effects. First, it lowers the return to exporting, and hence increases the incentive for foreign investment. Consequently, the average wage in the domestic subsidiary of firms choosing to invest abroad decreases with distance due to a composition effect. Whereas this effect also exists for foreign subsidiaries, it is counteracted by a second selection effect specific to foreign subsidiaries: With larger distance to the foreign market, a larger share of investors accept the amenity draw abroad, therefore leading to higher foreign wages in the group of investors. On net, our model therefore predicts in line with our empirical results that larger distance between two countries increases the wage premium paid by domestic

of our knowledge not available, indirect evidence supportive of such differences can be derived from three different observations. The first one is the finding of Wiswall and Zafar (2018) that preferences for workplace attributes are quite diverse even within groups of similar people. The second one is the finding of Simón (2010) that workplace attributes are an important determinant for explaining differences in wage inequality across European countries, suggestive for the conclusion that the willingness to pay for amenities differs between these countries. The third one is the insight from a literature dealing with health effects of job satisfaction that the same workplace attributes have different effects in different countries (see Cottini and Lucifora, 2014).

subsidiaries of foreign multinationals relative to the wage premium paid by domestic subsidiaries of local multinationals.

We also consider two extensions of our model. First, we introduce productivity differences as an additional source of firm heterogeneity. This allows us to narrow down the comparison of multinationals and non-multinationals to firms of equal workforce size and thus to the comparison used in the empirical analysis. In a second extension, we allow multinationals to replace domestic by foreign production if the outcome of the amenity lottery is particularly good. This generates a setting in which vertical and horizontal multinationals co-exist, and it shows that the former pay lower wages than the latter, which finds support in our data.

Our analysis is closely related to a sizable literature that aims at measuring and explaining multinational wage premia. In particular, the empirical part of our paper complements, using German data, evidence reported by Girma and Görg (2007) on the role of the geographic origin of the parent for the wage rate paid by its subsidiaries in the UK. Our finding of a non-monotonic distance effect in a large sample of parent countries is in line with the more specific finding in Girma and Görg (2007) that the average wages paid by UK plants of US-based and EU-based multinationals are different from each other. Furthermore, emphasizing the role of distance in an environment of uncertainty, we provide a theoretical model that can rationalize the non-monotonicity in the distance effect observed in our data. This complements theoretical work by Gumpert (2017), who explains a monotonic distance effect by the incentive of multinational firms to allocate more knowledge to those subsidiaries further away from their headquarters, empowering the workforce there to make decisions more independently and paying higher wages to compensate for this.

The remainder of the paper is organized as follows. In Section 2 we introduce the dataset and conduct the empirical analysis. Section 3 presents our baseline model and a detailed analysis upon the wage patterns of multinational and non-multinational firms. There, we also discuss how our model can be embedded into a general equilibrium environment. In Section 4, we consider two model extensions and discuss the robustness of our results when abandoning several restrictive assumptions made in the baseline specification to improve analytical tractability. The last section concludes.

2 Empirical evidence

This section introduces a new dataset that merges information on German plants from the Establishment History Panel (BHP) of the Institute for Employment Research (IAB) with information from the commercial firm database Orbis of Bureau van Dijk (BvD). After discussing its construction in detail, we use the new dataset to provide evidence on the existence and magnitude of the multinational wage premium in Germany. We then analyze to what extent the determinants put forward by the literature can explain the residual, unexplained part of the wage premium that still exists after controlling for observables. Finally, we investigate whether the distance between the parent's location and the German subsidiary provides additional insights into its magnitude. For this purpose, we use detailed and unique information on ownership structure of German plants, including the network size of the conglomerate of firms they belong to.

2.1 Data description and sample statistics

For our empirical analysis, we merge data on plants from BHP with international firm data from Orbis. Plants in BHP are constructed from administrative data on workers and refer to local units of a firm that employ at least one worker subject to social security contributions at reference date June 30 of a given year. BHP is available for the period 1975-2014 and contains information on workforce, such as age, gender, education, vocational training, nationality, occupations, and gross mean daily wages, as well as information on size, industry affiliation, location, and job turnover of the plant (see Schmucker et al., 2016, for further details).[4]

Information of the plants' corporate networks comes from the commercial provider of global business and company information BvD. BvD collects data from almost 160 different sources, which are stored in their global firm database Orbis. A particularly attractive feature of this database for our purpose is that Orbis provides comprehensive information on corporate hierarchies and ownership structures of companies. Based on the shareholding structure, BvD determines the shareholder with the highest direct or total percentage of ownership, and it classifies this shareholder as ultimate owner (parent) if it ranks highest in the hierarchy of companies.[5] Using the shareholding structure, BvD can therefore provide a comprehensive picture about the networks of firms and, since Orbis also provides information on the country in which a firm is located, one can determine in this database whether a firm is ultimately owned by a domestic or foreign parent, and whether it belongs to a network of firms or is an independent producer. Aside from the ownership structure, Orbis also contains information on key financial indicators, including revenues and the size of the workforce at the firm level.

Since Orbis and BHP do not provide a common identifier, firm information from Orbis and plant information from BHP cannot be directly merged. To overcome this problem, IAB has performed a record linkage based on firm and plant names, legal forms, addresses, numbers of

[4]Since wages are top-coded at the social security ceiling, BHP provides information on imputed wages that are constructed following Card et al. (2013). Furthermore, missing information on workers' education has been imputed, following Fitzenberger et al. (2006) and Kruppe et al. (2014).

[5]In our dataset a firm is linked to a shareholder at the next higher layer of the multinational network if more than 25 percent of the equity is owned by this shareholder. Whereas we cannot investigate whether our results are sensitive to this definition, Martins (2004) and Barbosa and Louri (2002) provide evidence that the specific choice of the cut-off level plays a minor role for their estimations.

employees, and the main industrial affiliations. Matching success rate for German firms in BvD with more than five employees is well above 80 percent and increases with the size of the firm.[6] The linked BHP/Orbis data allows us to go beyond the current literature on multinational wage premia in three dimensions. First, due to detailed information on corporate structures, we can not only study the consequences of foreign ownership on the payment of German workers, but also investigate whether German subsidiaries of a foreign multinational pay differently than German subsidiaries of a German multinational. Second, since our dataset provides information on the (domestic or foreign) ultimate owner, we can shed light on how the nationality of the parent and the geographic distance to its subsidiary affects the wage payment of a multinational in Germany. Third, the detailed data on German plants and their parents allows us to discriminate between competing theories explaining the existence of a multinational wage premium.

For now, record linkages between Orbis and BHP are available for just a single year, and we therefore use a cross section of firms from Orbis (*subject* firms) which were active and located in Germany in 2014 and meet the following criteria. First, there exists valid information on the ultimate owner and the country in which the parent and its subsidiaries are located. Second, information on the number of employees, the operating revenues, and industry classification codes of the subject firm and its ultimate owner is available. Third, at least one active plant from BHP with reliable information on mean full-time wages (above the threshold of 'midijobs' at a daily wage of 30 Euros) must be observed for each subject firm in 2014. Applying the three criteria gives a final dataset with 134,582 unique parents, 145,599 subject firms, and 174,895 plant observations.

Making use of the ownership structure in our dataset, we can distinguish between three different types of subject firms in the subsequent analysis. The first one are firms owned by a foreign multinational parent, which is a company outside of Germany that is ultimate owner of at least one German subsidiary. The second one are firms owned by a local multinational parent, which is a German company that is ultimate owner of at least one foreign subsidiary. The third one are non-multinational firms, which either belong to a German ultimate owner with no foreign subsidiary or are independent firms that do not belong to another company. Beyond that, our dataset also provides information about the size of the corporate network and the share of subsidiaries located in countries different from the parent's location, and hence gives a nuanced picture about the ownership structure of multinational firms.

Table 1 shows descriptives of firm-plant linkages in our dataset. The first column displays the number of ultimate owners for the three different firm types outlined above. The majority of ultimate owners are classified as non-multinationals (most of them small, single-plant producers).

[6] Matching success rates drop to 55 percent for small firms with less than five employees. For details on the crosswalk between BHP and Orbis, see (Schild, 2016; Antoni et al., 2018).

Table 1: *Descriptives of firm-plant linkages*

	No. of ultimate owners	Mean no. of plants	Total no. of plants	Network size	Mean share foreign subsidiaries
Foreign multinational parent	2,465	4.26	10,513	185.20	0.69
Distance ≤ 700 km	508	4.80	2,436	120.94	0.69
Distance $701 - 7,000$ km	1,613	4.42	7,134	209.36	0.72
Distance $> 7,000$ km	344	2.74	943	166.82	0.68
Local multinational parent	2,388	7.85	18,749	44.50	0.57
Non-multinational parent	129,729	1.12	145,633	0.22	0.00

Notes: Data sources are BvD and BHP. Distance of country j to Germany (i) is measured by the distance between the country's capital to Berlin in km, using the 'great circle' formula: $D_{ij} = 6378.39 \arccos(\sin[\text{rad}(Y_i) \cdot \text{rad}(Y_j)] + \cos[\text{rad}(Y_i) \cdot \text{rad}(Y_j) \cdot \cos(\text{rad}(X_j) - \text{rad}(X_i))])$, where X and Y are longitude and latitude in degrees from https://simplemaps.com/data/world-cities. Network size refers to the total number of the ultimate owner's subsidiaries reported by Orbis. Parent firms maintain at least 25 percent of controlling interest.

About four percent of the parents are multinationals, and half of them have their headquarters outside of Germany. Columns (2) and (3) inform about the mean and total number of German plants by firm type. As can be expected, multinational firms are bigger and therefore own more German plants than non-multinationals. However, there is also evidence in our data that local multinationals own more German plants than foreign multinationals. This is suggestive of a home bias, in particular when noting from column (4) that the network size, measured by the total number of an ultimate owner's subsidiaries, is bigger on average for foreign than for German multinationals.[7] From column (5), we can furthermore conclude that corporate networks of foreign multinationals are more international than corporate networks of German multinationals. Finally, the descriptives in Table 1 are supportive of the idea that the costs of foreign investment increase in distance, because remoter investors hold fewer plants in Germany.

Table 2 presents further descriptives and points to important differences in plant and workforce characteristics of multinationals and non-multinationals. Similar to other studies, multinationals in our dataset are larger and pay higher wages than their non-multinational competitors (see, for instance, Malchow-Møller et al., 2013). Furthermore, there is no difference between multinationals and non-multinationals regarding their prevalence in Eastern Germany, and hence no evidence in our data that Eastern and Western Germany differ in their attractiveness for multinational ownership. Log local population density is a proxy for the local labor market conditions and constructed using information on the location of plants in 141 local labor markets identified by Kosfeld and Werner (2012), based on commuter links. There is almost no difference between non-multinationals and multinationals in this variable, and hence no evidence for selection of the latter

[7] For non-multinationals, the difference between mean number of plants and network size reflects three things. First, a large fraction of non-multinationals are single-plant firms without any subsidiaries, and hence a network size of zero. Second, we cannot match all firms from Orbis with plants from BHP (with a lower success rate for smaller firms) and, third, we dropped plants from BHP because of missing controls.

into regions promising more favorable labor market conditions.

Table 2: *Descriptives of plant and workforce characteristics*

	Non-multinationals		Multinationals	
	mean	sd	mean	sd
		Plant characteristics		
Log (imputed) mean wage	4.414	0.335	4.745	0.406
Plantsize (in 1,000 employees)	0.024	0.075	0.099	0.687
Eastern Germany	0.197	0.398	0.199	0.399
Log local population density	7.565	1.190	7.620	1.167
		Workforce characteristics		
Education				
Share low-skilled	0.112	0.142	0.093	0.130
Share medium-skilled	0.767	0.225	0.719	0.258
Share high-skilled	0.121	0.197	0.188	0.256
Age structure				
Share aged 15-24	0.112	0.139	0.091	0.133
Share aged 25-34	0.203	0.184	0.209	0.183
Share aged 35-44	0.210	0.174	0.226	0.176
Share aged 45-54	0.274	0.196	0.300	0.207
Share aged 55 +	0.202	0.189	0.174	0.185
Others				
Share full-time	0.643	0.246	0.740	0.264
Share female	0.365	0.278	0.420	0.316
Share foreigner	0.078	0.154	0.069	0.122

Notes: Data sources are BvD and BHP. In the Appendix, we provide further descriptives on occupations and industry affiliations. Parent firms maintain at least 25 percent of controlling interest.

Regarding the workforce composition, BHP distinguishes workers by their skill level and assigns them to three distinct groups. The first one is the group of low-skilled workers, which are employees with a secondary school-leaving certificate but no vocational training. The group of medium-skilled workers comprises employees with a secondary school-leaving certificate and vocational training. Finally, employees with a degree from a university of applied sciences or a university are classified as highly skilled. Table 2 confirms the finding from previous studies that the workforce of multinationals is better skilled (see Heyman et al., 2007; Balsvik, 2011). Beyond that, multinationals have a higher employment share in the core age group of 25- to 55-year-olds, offer a larger share of full-time jobs, and employ more females and fewer foreigners than non-multinationals.

2.2 Empirical results on multinational wages

We employ a linear specification akin to the baseline specification of Malchow-Møller et al. (2013), and estimate an equation of the following form, using OLS:

$$\ln w_i = \alpha + m_i\beta + \mathbf{x}_i'\gamma + \mathbf{z}_i'\delta + \varepsilon_i, \tag{1}$$

where w_i is the mean full-time gross daily wage in plant i, m_i is a dummy variable (with coefficient β) that is 1 if the ultimate owner is a multinational and 0 otherwise, $\mathbf{x}_i$, $\mathbf{z}_i$ are vectors of plant and parent controls, respectively, with γ and δ denoting the corresponding vectors of coefficients, and ε_i is an error term.

In the parsimonious specification reported in column (1) of Table 3, we set dummy m_i equal to one for plants whose ultimate owner is a *foreign* multinational and estimate the effect of foreign ownership on domestic wages without conditioning on other controls. This gives a sizable wage premium of 33.6 log points.[8] However, it is well-known from previous empirical work that this premium is inflated by neglecting observable differences between multinationals and non-multinationals in their workforce and plant characteristics. We therefore use the variables listed in Table 2 as well as 10 dummies for the occupations of workforce and 24 dummies for broad sector categories, which are constructed as aggregates of the 88 two-digit NACE Rev.2 industry divisions (see the Appendix), to control for these differences. In column (2) of Table 3, we see that adding these controls reduces the wage premium of foreign ownership considerably.

In column (3) of Table 3, we additionally consider information on the size of the corporate network in order to take into account the possibility that average wages are higher in plants belonging to large (domestic or foreign) conglomerates than in independent plants. This further reduces but does not eliminate the premium from foreign ownership. In column (4), we consider the same controls as above, but now distinguish between subsidiaries of foreign multinationals and local (German) multinationals. This exercise differs from the previous estimation, because it changes the control group of plants to those not classified as part of a multinational network. Accordingly, the respective estimates reported in column (4) refer to the wage premium paid by domestic and foreign multinationals, respectively. These wage premia are conceptually different from and significantly higher than the foreign ownership premium displayed in column (3). The average wage premium increases to more than 27 log points, and it is almost identical for foreign and German multinationals. In column (5), we use a single dummy for *all* multinational subsidiaries. By construction, this specification gives an estimate for the multinational wage premium that

[8]For small estimates of β the log point change is close to a percentage change. However, for sizable estimates the difference can be quite big. For instance, in our case a wage premium of 33.6 log points corresponds to a wage premium of 39.9 percent.

Table 3: *Wages and multinational ownership*

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Foreign multin. parent	0.336**	0.237**	0.199**	0.274**				
	(0.039)	(0.023)	(0.026)	(0.024)				
Local multin. parent				0.271**				
				(0.004)				
Multinational parent					0.272**	0.271**		0.182**
					(0.012)	(0.012)		(0.008)
Horizontal multinational							0.277**	
							(0.014)	
Vertical multinational							0.271**	
							(0.013)	
Constant	4.449**	4.085**	4.092**	4.088**	4.088**	4.088**	4.088**	4.047**
	(0.000)	(0.009)	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)	(0.006)
Other controls								
Plant and workforce	N	Y	Y	Y	Y	Y	Y	Y
Network size	N	N	Y	Y	Y	Y	Y	Y
Ind. countries only	N	N	N	N	N	Y	N	N
Plant fixed effects	N	N	N	N	N	N	N	Y
Observations	174,895	174,895	174,895	174,895	174,895	174,494	174,895	157,189
R-squared	0.047	0.417	0.429	0.463	0.463	0.462	0.463	0.631

Notes: Data sources are BvD and BHP. The dependent variable is the log of the plant's gross mean daily wage. Plant and workforce controls are plant size, the shares of full-time, female, non-German, medium skilled, high skilled workers among the plant's workforce, the share of workers aged 25–34, 35–44, 45–54, above 55 as well as groups of dummies for workforce occupations and broad sector categories. We further add the log of local labor market density, and a dummy indicating whether the plant is located in former East Germany. Parent firms maintain at least 25 percent of controlling interest. Standard errors in parentheses are clustered at the parent country level: $** \ p < 0.01$, $* \ p < 0.05$, and $+ \ p < 0.1$.

lies between the respective estimates for domestic and foreign multinational parents reported in column (4).

In column (6), we restrict the sample of parent countries to economies that are classified as industrialized by United Nations (2014). This has two reasons. First, there is some evidence in our data that ultimate owners are clustered in tax havens, and we want to make sure that our estimates are not affected by location choices mainly driven by the incentive to lower profit taxes. Second, findings by Aitken et al. (1996) and others suggest that income differences between the source and the host country of investment can help explaining existence of a multinational wage premium. We find that dropping multinationals with an ultimate owner from non-industrialized countries has only a minor effect on the wage premium – maybe because only few observations are lost in this case. In column (7) we distinguish between horizontal and vertical multinationals. Thereby, we follow Alfaro and Charlton (2009) and classify parent-plant relationships as horizontal if both firms are from the same three-digit NACE Rev.2 industry and as vertical, otherwise.[9] The point

[9]Alfaro and Charlton (2009) consider a narrower definition of vertical multinationals using information from input-output tables at a disaggregated industry level. We do not follow their approach, because we can capture vertical linkages only for a low fraction of industries, and hence would end up with an unrealistically small number

estimate for the wage premium is higher for horizontal than for vertical multinationals. However, the difference is small and not statistically significant, indicating that even in the context of vertical investment the main motive for acquiring a German plant is not the low labor cost.

Finally, in column (8) we add AKM fixed effects for German plants provided by the IAB as further controls. These fixed effects are constructed using longitudinal information on German establishments, following Abowd et al. (1999).[10] As the AKM fixed effects take into account unobserved plant and workforce characteristics, including them allows us to investigate whether selection into multinational activity based on unobservables drives our results. This guards the interpretation of our estimates against problems associated with omitted (time-invariant) variables. Since the AKM fixed effects are not available for the full sample of German plants, the estimates from column (8) are not directly comparable to the estimates from column (5). To make sure that the drop in the multinational wage premium is not a consequence of the reduced sample, we have also estimated the multinational wage premium for the smaller sample of plants, excluding the AKM fixed effects. The multinational wage premium for this robustness check (not shown here) is 25.2 log points. This shows that controlling for unobserved heterogeneity has indeed a sizable impact on the multinational wage premium. The now lower but still highly significant positive coefficient of the multinational dummy in column (8) makes us confident that ownership is indeed an important (causal) determinant of wages.

Whereas there is consensus in the literature that multinational plants pay higher wages than non-multinational plants because they are exceptional producers, evidence of Girma and Görg (2007) on wage payments of foreign multinationals in the UK challenge the conclusion of Heyman et al. (2007) that the nationality of the multinational parent plays just a minor role. To provide a more systematic view on the role of nationality, we build on a sizable literature pointing to the elimination of shipment costs as an important motive for firms choosing (horizontal) foreign investment instead of exporting (cf. Markusen, 2002; Barba Navaretti and Venables, 2004) and analyze the role of geographic distance between the ultimate owner and its subsidiary for explaining the wage premium paid in Germany. Thereby, we compute 'greater circle' distances between Berlin and the capital of the country the parent is located in, using the formula described in Table 1. The results in columns (1) of Table 4 are supportive of a distance effect and show that subsidiaries whose ultimate owner is located further away pay higher wages to German workers. Column (2) shows that the distance effect remains unaffected when controlling for the network size in addition to plant and workforce characteristics.

In column (3) we distinguish three distance groups as outlined in Table 1 and thereby allow for

of vertical multinationals in our dataset when using the classification suggested by Alfaro and Charlton (2009).

[10]See Card et al. (2015) for further details.

Table 4: *Multinational wages and distance*

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Multinational parent	0.276**	0.262**	0.273**	0.271**	0.175**	0.180**	0.178**
	(0.013)	(0.012)	(0.004)	(0.004)	(0.009)	(0.003)	(0.004)
Distance in 1,000 km	0.010**	0.011**			0.008**		
	(0.001)	(0.002)			(0.001)		
Distance 1-700 km			-0.102**			-0.057**	
			(0.032)			(0.018)	
Distance 701-7,000 km			0.026*			0.025**	
			(0.012)			(0.008)	
Distance > 7,000 km			0.097**			0.066**	
			(0.014)			(0.010)	
Distance 1-2,500 km				-0.017			-0.004
				(0.023)			(0.015)
Distance > 2,500 km				0.077**			0.056**
				(0.015)			(0.008)
Constant	4.089**	4.091**	4.092**	4.089**	4.049**	4.050**	4.048**
	(0.007)	(0.007)	(0.006)	(0.008)	(0.006)	(0.006)	(0.006)
Other controls							
Plant and workforce	Y	Y	Y	Y	Y	Y	Y
Network size	N	Y	Y	Y	Y	Y	Y
Plant fixed effects	N	N	N	N	Y	Y	Y
Observations	174,895	174,895	174,895	174,895	157,189	157,189	157,189
R-squared	0.463	0.464	0.465	0.464	0.632	0.632	0.632

Notes: Data sources are BvD and BHP. The dependent variable is the log of the plant's gross mean daily wage. Plant and workforce controls are plant size, the shares of full-time, female, non-German, medium skilled, high skilled workers among the plant's workforce, the share of workers aged 25–34, 35–44, 45–54, above 55 as well as groups of dummies for workforce occupations and broad sector categories. We further add the log of local labor market density, and a dummy indicating whether the plant is located in former East Germany. Parent firms maintain at least 25 percent of controlling interest. Standard errors in parentheses are clustered at the parent country level: $** \ p < 0.01$, $* \ p < 0.05$, and $+ \ p < 0.1$.

a flexible form of the distance effect. The estimation results show that wages of plants owned by foreign multinationals with an ultimate owner in close proximity (less than 700 km away) are lower than wages of plants owned by multinationals with a German ultimate owner. This changes if the ultimate owner of the foreign multinational comes from a more distant location (more than 700 km away), which is well in line with the finding of Girma and Görg (2007) that a foreign ownership premium in UK exists if the multinational is from the US, but does not exist if the multinational is from the EU. Our results indicate that their finding can plausibly be interpreted as a specific case of the more general non-monotonic distance effect we find in our empirical exercise.[11] In column (4) we use, as a robustness check, just two distance groups, effectively putting all EU countries in a broad "near" category and all other countries in a broad "remote" category. We see that in this specification the negative distance effect for ultimate owners located nearby becomes smaller and

[11]Using simply the square of distance as a control for non-monotonicities leads to an insignificant distance effect (not shown), and hence is too restrictive to capture the role of distance for the multinational wage premium in our data.

turns insignificant, while the positive distance effect for remote ultimate owners stays significant. This suggests that the negative distance effect is confined to ultimate owners located in truly close proximity – which is an effect that will be picked up in the model we develop below. In columns (5) to (7), we repeat the estimations from columns (2) to (4), but add AKM fixed effects as additional controls. This reduces the sample of German plants considerably and has quite strong quantitative effects. However, it does not change our results qualitatively.[12]

From the analysis above, we can take away three regularities that are characteristic of the way multinationals remunerate workers in their German subsidiaries. First, multinationals pay higher wages than non-multinationals and there is empirical support for a multinational wage premium even after controlling for observable differences in plant and workforce characteristics. Second, subsidiaries of domestic and foreign multinationals pay wages of similar size. Third, distance between the location of the ultimate owner and the location of the subsidiary is an important determinant of the size of the premium paid by foreign multinationals in their German subsidiaries. To be more specific, our results suggest a non-monotonic distance effect on the multinational wage premium, with the effect being negative if the ultimate owner of the German subsidiary is from a country nearby, while turning positive if the ultimate owner is from a far-off country.[13]

In the next section, we present a theoretical model that accords with all three observations and can, in contrast to previous theoretical approaches, provide a rationale why distance plays a prominent role for explaining the size of multinational wage premia.

3 A model of the multinational wage premium

3.1 The model: basics

We consider a model of two symmetric countries, each populated by an exogenous mass of homogeneous workers L and an exogenous mass of entrepreneurs H. Entrepreneurs can choose between two occupations. They can either become self-employed and supply one unit of services in a perfectly competitive service sector, which pays a remuneration of s; or they can become owner-manager of a firm, earning its profit as personal income. As firm owners, entrepreneurs supply a variant of an industrial good v under monopolistic competition, facing iso-elastic demand:

$$q(v) = Ap(v)^{-\sigma}, \tag{2}$$

[12] To make sure that the distance effect does not capture country-specific determinants of the multinational wage premium, we have run regressions in which we have split the three distance groups into their individual components, corresponding to the countries covered by them. These exercises have not revealed a clear country pattern and have shown that plants with ultimate owners in high-income or low-income countries from the closest (furthest) distance groups pay lower (higher) wage premia than plants of multinationals headquartered in Germany.

[13] In the Appendix, we show that these important insights are robust to the exclusion of outliers or vertical multinationals and to the use of additional controls or a non-binary variable for measuring multinational activity.

where $p(v)$ is the price of v, A is a market size term, determined in general equilibrium but treated parametrically by each firm, and $\sigma > 1$ is the constant price elasticity of demand. Assuming that firms can produce one unit of output with one unit of labor input ($\widehat{=}$ one worker), profit maximization establishes the following revenues from domestic sales

$$r(v) = A\left(\frac{\sigma w(v)}{\sigma - 1}\right)^{1-\sigma}, \tag{3}$$

where wages $w(v)$ are firm-specific and compensate for differences in workplace attributes (amenities), $x(v)$, provided by the employer. Amenity differences are exogenous and originate from an ex ante heterogeneity of entrepreneurs.[14] In the spirit of Rosen (1986), we assume that amenities affect worker utility according to $u = xw/P$, where P is a price index that is common to all consumers. To hire the required labor input and to avoid overpaying their workers, firms offer a wage that makes applicants indifferent between accepting their job offer and being employed elsewhere. As a consequence, heterogeneity of two firms in all endogenous variables is the result of these firms' heterogeneity in their amenities, and we can therefore drop index v from now on and use amenity x as firm index in the subsequent analysis. Relative domestic wages and relative domestic revenues of two firms featuring amenities x' and x'', respectively, can then be expressed as

$$\frac{w(x')}{w(x'')} = \left(\frac{x'}{x''}\right)^{-1}, \qquad \frac{r(x')}{r(x'')} = \left(\frac{x'}{x''}\right)^{\sigma-1}. \tag{4}$$

Operating profits are a constant fraction $1/\sigma$ of revenues, and therefore they are also increasing in amenities with elasticity $\sigma - 1$. Entrepreneurs endowed with low amenities choose to become self-employed, and there is an endogenous cutoff $\underline{x} > 1$ below which this happens.

Firms can serve consumers in the other country either through exports or through local production. An exporter hires additional domestic workers to satisfy foreign demand, respecting the wage it has to pay according to Eq. (4) and respecting the iceberg trade costs for transporting their goods to foreign consumers, which imply that $\tau > 1$ units of output must be shipped in order for one unit to arrive in the foreign market. As multinationals, firms can save on trade costs but have to make an investment of f units of services (at a cost of s per service unit) in order to set up a local production facility abroad. Foreign investment gives the firm a new x-draw for the foreign market, and its realization is unknown prior to the (irreversible) payment of sf. Provided that the support of x abroad includes sufficiently low amenities, there is a positive probability of an unsuccessful investment, which is associated with a low x-realization and therefore with foreign

[14] In the Appendix, we show that all results of our model continue to hold if we assume that the marginal cost of providing amenities (rather than the exogenous level of amenities) differs between firms, leading to endogenous amenity differences between firms due to profit maximisation.

labor costs that are too high to make foreign production attractive for the firm.

In the interest of analytical tractability, we assume that amenities have a Pareto distribution of the form $G(x) = 1 - x^{-g}$, with $g > 1$. Taking into account the cutoff $\underline{x}$ resulting from occupational choice, the *conditional* distribution of amenities among domestic firms (exporters and local multinationals) equals $G(x|x \geq \underline{x}) = 1 - (x/\underline{x})^{-g}$. The investment of sf buys an x-draw from $G(x|x \geq \alpha\underline{x})$ for the foreign production facility, where $\alpha < 1 < \alpha\tau$ is assumed. The first constraint, $\alpha < 1$, implies that all firms – including those with the least favorable domestic workplace attributes – can end up with an amenity draw in the foreign country that is lower than the domestic level. As outlined below, this assumption is necessary to allow for the possibility that foreign wages of multinationals are higher on average than domestic wages of multinationals. The second constraint, $\alpha\tau > 1$, implies that irrespective of their foreign draw the firms with the least favorable domestic workplace attributes are better off with foreign production than exporting, provided that the foreign investment costs are sufficiently low. This assumption is useful to exclude uninteresting corner solutions.

Once a firm has paid investment cost sf, the decision to start foreign production (or not) depends on the relative size of its foreign amenity draw x_a and its export-effective domestic amenity level x/τ. If and only if the former exceeds the latter it is worthwhile to actually start foreign production, conditional on having paid sf. Consequently, a foreign investor accepts *all* foreign amenity draws if x/τ is lower than $\alpha\underline{x}$, the lower bound of the foreign amenity distribution, while she rejects some of the draws otherwise. This implies that the lottery – while unbiased – leads to a positive correlation of domestic and foreign amenities. The expected *total* revenue of a firm with domestic amenity x choosing to invest abroad is therefore given by

$$\mathbb{E}\left[r_t(x)|\text{inv}\right] = \int_{\alpha\underline{x}}^{\infty} \left[r(x) + r(x_a)\right] \frac{dG(x_a)}{1 - G(\alpha\underline{x})}, \tag{5}$$

if $x/\tau < \alpha\underline{x}$, and it is given by

$$\mathbb{E}\left[r_t(x)|\text{inv}\right] = \int_{\alpha\underline{x}}^{x/\tau} \left(1 + \tau^{1-\sigma}\right) r(x) \frac{dG(x_a)}{1 - G(\alpha\underline{x})} + \int_{x/\tau}^{\infty} \left[r(x) + r(x_a)\right] \frac{dG(x_a)}{1 - G(\alpha\underline{x})} \tag{6}$$

otherwise.[15] Solving the integrals in Eqs. (5) and (6) establishes

$$\mathbb{E}\left[r_t(x)|\text{inv}\right] = \begin{cases} r(x)\left[1 + \dfrac{g\alpha^{\sigma-1}}{g-\sigma+1}\left(\dfrac{x}{\underline{x}}\right)^{1-\sigma}\right] & \text{if} \quad x/\tau < \alpha\underline{x} \\ (1+\tau^{1-\sigma})r(x) + r(x)\dfrac{(\sigma-1)\alpha^g}{g-\sigma+1}\tau^{g-\sigma+1}\left(\dfrac{x}{\underline{x}}\right)^{-g} & \text{if} \quad x/\tau \geq \alpha\underline{x} \end{cases}, \tag{7}$$

[15]Eqs. (5) and (6) exclude the possibility of imports of goods produced by the foreign affiliate, for instance because importing from the foreign subsidiary requires an additional, prohibitively high investment of service input. We consider imports from foreign subsidiaries in an extension of our model presented in Section 4.

where $\sigma < g$ is assumed to ensure finite, positive means of revenues, wages, and firm-level employment.

Firms choose to invest abroad if the expected gain in operating profits compared to the alternative of serving the foreign market by exports, $\mathbb{E}[\Delta\pi_{\text{op}}(x)]$, is larger than the fixed cost of foreign investment, sf. Using Eqs. (4) and (7), we get

$$sf \leq \mathbb{E}[\Delta\pi_{\text{op}}(x)] \equiv \begin{cases} \dfrac{r(\underline{x})}{\sigma}\left[\dfrac{g\alpha^{\sigma-1}}{g-\sigma+1} - \tau^{1-\sigma}\left(\dfrac{x}{\underline{x}}\right)^{\sigma-1}\right] & \text{if} \quad x/\tau < \alpha\underline{x} \\ \dfrac{r(\underline{x})}{\sigma}\dfrac{(\sigma-1)\alpha^{g}}{g-\sigma+1}\tau^{g-\sigma+1}\left(\dfrac{x}{\underline{x}}\right)^{\sigma-1-g} & \text{if} \quad x/\tau \geq \alpha\underline{x} \end{cases}, \tag{8}$$

and it is easily checked that $\mathbb{E}[\Delta\pi_{\text{op}}(x)]$ is decreasing in x, which implies that foreign investors are negatively selected on domestic amenities. Compared to the literature emphasizing a proximity-concentration trade-off for explaining the costs and benefits of horizontal multinational activity (cf. Brainard, 1997), our model points to costs and benefits that are rooted in the amenity draw under uncertainty. Due to a common amenity floor, the expected gain from this draw is higher for firms with a less favorable domestic amenity level, and hence the selection of firms into foreign investment following from Eq. (8) differs from the one described by Helpman et al. (2004), who show that the proximity-concentration trade-off makes investment more attractive for firms producing at the same lower cost at home and abroad, because these firms can more easily cover the fixed cost involved in foreign investment.

In order to have at least *some* firms choose to invest abroad, irrespective of the level of trade cost, it must be the case, according to Eq. (8), that the marginal firm with an amenity level of $\underline{x}$ is better off with multinational production than with exporting even if τ is at its lower bound of $1/\alpha$. Eq. (8) in this case becomes

$$sf < \frac{r(\underline{x})}{\sigma}\left[\frac{g\alpha^{\sigma-1}}{g-\sigma+1} - \alpha^{\sigma-1}\right]. \tag{8'}$$

Endogenous remuneration s must satisfy the indifference condition of the marginal entrepreneur between occupations. Using Eq. (7), this condition is given by

$$s = \frac{r(\underline{x})}{\sigma}\left[1 + \frac{g\alpha^{\sigma-1}}{g-\sigma+1}\right] - sf \tag{9}$$

Solving for s and substituting into Eq. (8′), we find the sufficient condition for the marginal firm to be better off with foreign investment:

$$f < \frac{\sigma-1}{g-\sigma+1}\frac{\alpha^{\sigma-1}}{1+\alpha^{\sigma-1}}. \tag{10}$$

Furthermore, the firm with amenity $x = \alpha\tau\underline{x}$ is also better off with foreign investment in this case, and hence there exists a second amenity cutoff $\hat{x} > \alpha\tau\underline{x}$, separating firms that are better off (in expectation) with investment ($x < \hat{x}$) from firms that are better off without investment ($x > \hat{x}$). According to Eqs. (8) and (9), this amenity cutoff is given by

$$\hat{x} \equiv \alpha\tau\underline{x}\Phi, \qquad \Phi \equiv \left(\frac{1+f}{f} \frac{(\sigma-1)\alpha^{\sigma-1}}{g[1+\alpha^{\sigma-1}]-\sigma+1} \right)^{\frac{1}{g-\sigma+1}} > 1. \tag{11}$$

Figure 1 illustrates for the firms that are foreign investors the set of accepted foreign amenity draws x_a as a function of these firms' domestic amenities x.

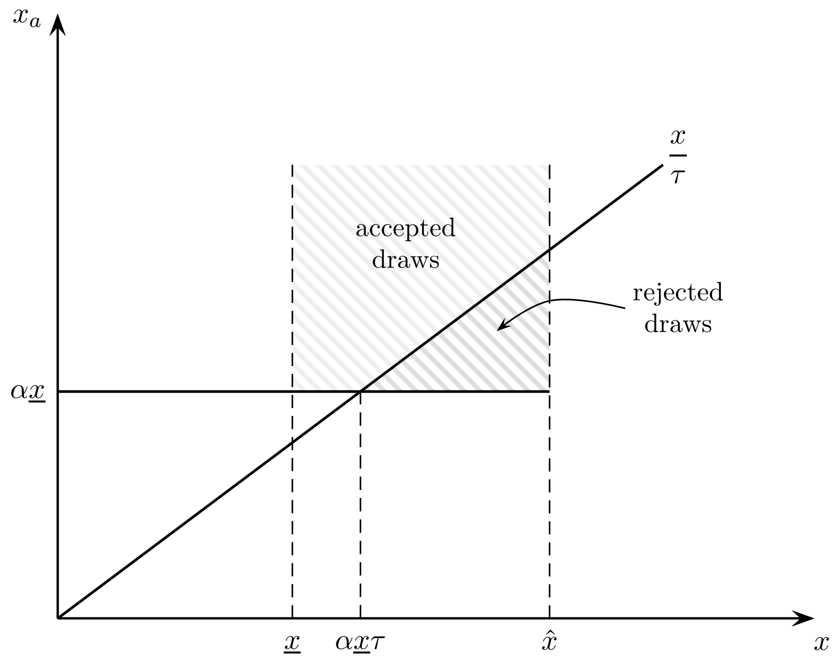

Figure 1: *Foreign investors' accepted and rejected foreign amenity draws*

With these insights at hand, we can compute the share of multinational firms, which is lower than the share of firms making the foreign investment, because firms with domestic amenity $x \geq \alpha\tau\underline{x}$ start multinational production only if the amenity drawn abroad is larger than or equal to x/τ and export, otherwise. The ex ante probability for firms with $x > \alpha\tau\underline{x}$ to draw an amenity larger than x/τ is given by $[x/(\alpha\tau\underline{x})]^{-g}$, and hence the share of multinationals can be computed according to

$$\chi = \int_{\underline{x}}^{\alpha\tau\underline{x}} \frac{dG(x)}{1-G(\underline{x})} + (\alpha\tau)^g \int_{\alpha\tau\underline{x}}^{\hat{x}} \left(\frac{x}{\underline{x}}\right)^{-g} \frac{dG(x)}{1-G(\underline{x})} = 1 - \frac{(\alpha\tau)^{-g}}{2}\left(1+\Phi^{-2g}\right), \tag{12}$$

which establishes the intuitive result that the share of multinationals increases in τ from a low level of $\chi = (1 - \Phi^{-2g})/2$ if $\tau = 1/\alpha$ to a high level of $\chi = 1$ if $\tau \to \infty$.

3.2 The multinational wage premium

Equipped with the insights from the analysis above, we now investigate how foreign investment affects wage payments and to what extent our model is capable to accord with the evidence outlined in Section 2. For this purpose, we first compute *average* wages of domestic and foreign subsidiaries of multinationals as well as the *average* wage paid by exporters. For the domestic subsidiary of a multinational, this gives

$$\begin{aligned}\mathbb{E}\left[w|\text{MNE}, d\right] &= \frac{1}{\chi}\left\{\int_{\underline{x}}^{\alpha\tau\underline{x}} w(x)\frac{dG(x)}{1-G(\underline{x})} + (\alpha\tau)^g \int_{\alpha\tau\underline{x}}^{\hat{x}} w(x)\left(\frac{x}{\underline{x}}\right)^{-g}\frac{dG(x)}{1-G(\underline{x})}\right\} \\ &= \frac{w(\underline{x})}{\chi}\frac{g}{g+1}\left\{1-(\alpha\tau)^{-g-1}\left[1-\frac{g+1}{2g+1}\left(1-\Phi^{-2g-1}\right)\right]\right\}, \qquad (13)\end{aligned}$$

where the second line uses $w(x)/w(\underline{x}) = (x/\underline{x})^{-1}$ from Eq. (4).

In a similar vein, we can compute the average wage paid by a multinational firm in its foreign subsidiary according to

$$\begin{aligned}\mathbb{E}\left[w_a|\text{MNE}, a\right] &= \frac{1}{\chi}\left\{\int_{\underline{x}}^{\alpha\tau\underline{x}} \mathbb{E}\left[w_a|x_a \geq \alpha\underline{x}\right]\frac{dG(x)}{1-G(\underline{x})} + (\alpha\tau)^g \int_{\alpha\tau\underline{x}}^{\hat{x}} \mathbb{E}\left[w_a|x_a \geq \frac{x}{\tau}\right]\left(\frac{x}{\underline{x}}\right)^{-g}\frac{dG(x)}{1-G(\underline{x})}\right\} \\ &= \frac{w_a(\underline{x})}{\alpha\chi}\frac{g}{g+1}\left\{1-(\alpha\tau)^{-g}\left[1-\frac{g}{2g+1}\left(1-\Phi^{-2g-1}\right)\right]\right\}, \qquad (14)\end{aligned}$$

where $w_a(\underline{x}) = w(\underline{x})$ holds due to the symmetry of countries and

$$\mathbb{E}\left[w_a|x_a \geq x_b\right] = w_a(x_b)\int_{x_b}^{\infty}\left(\frac{x_a}{x_b}\right)^{-1}\frac{dG(x_a)}{1-G(x_b)} = w_a(x_b)\frac{g}{g+1}$$

is the average wage of foreign subsidiaries with amenity levels $x \geq x_b$. In a next step, we compute the average wage paid by exporters according to

$$\begin{aligned}\mathbb{E}\left[w|\text{EXP}\right] &= \frac{1}{1-\chi}\left\{\int_{\alpha\tau\underline{x}}^{\hat{x}}\left[1-(\alpha\tau)^g\left(\frac{x}{\underline{x}}\right)^{-g}\right]w(x)\frac{dG(x)}{1-G(\underline{x})} + \int_{\hat{x}}^{\infty} w(x)\frac{dG(x)}{1-G(\underline{x})}\right\} \\ &= \frac{w(\underline{x})}{1-\chi}\frac{g}{g+1}(\alpha\tau)^{-g-1}\left[1-\frac{g+1}{2g+1}\left(1-\Phi^{-2g-1}\right)\right]. \qquad (15)\end{aligned}$$

From Eqs. (13), (14), and (15), we can compute the ratio of average wages paid by exporters on the one hand and domestic or foreign subsidiaries of multinationals on the other hand as

$$\omega_{ed} \equiv \frac{\mathbb{E}\left[w|\text{EXP}\right]}{\mathbb{E}\left[w|\text{MNE}, d\right]} = \frac{\chi}{1-\chi}\frac{(\alpha\tau)^{-g-1}\left[1-\frac{g+1}{2g+1}\left(1-\Phi^{-2g-1}\right)\right]}{1-(\alpha\tau)^{-g-1}\left[1-\frac{g+1}{2g+1}\left(1-\Phi^{-2g-1}\right)\right]}, \qquad (16)$$

and

$$\omega_{ea} \equiv \frac{\mathbb{E}\left[w|\text{EXP}\right]}{\mathbb{E}\left[w|\text{MNE},a\right]} = \frac{\alpha\chi}{1-\chi}\frac{(\alpha\tau)^{-g-1}\left[1-\frac{g+1}{2g+1}\left(1-\Phi^{-2g-1}\right)\right]}{1-(\alpha\tau)^{-g}\left[1-\frac{g}{2g+1}\left(1-\Phi^{-2g-1}\right)\right]}, \tag{17}$$

respectively. The following proposition summarizes the properties of ω_{ed} and ω_{ea}.

Proposition 1 *Domestic and foreign subsidiaries of multinationals pay higher wages (on average) than domestic non-multinationals, i.e.* $\omega_{ed}, \omega_{ea} < 1$.

Proof See the Appendix.

For the wage premium paid by domestic subsidiaries of multinationals, two factors play a role. First, firms choosing investment abroad have domestic amenities below $\hat{x}$ and are therefore high wage firms relative to those firms that do not invest. And second, within the group of investors, firms paying particularly high wages at home are more likely to accept the amenity draw and actually become MNEs. Therefore, both selection effects work in favor of a multinational wage premium in domestic plants of MNEs. The logic behind the wage premium paid by foreign plants of MNEs is more subtle, since – in contrast to domestic plants – the amenity distribution of MNEs' foreign plants is not truncated from above, and it therefore includes plants paying very low wages. But the presence of high-wage plants close to the lower bound of the amenity distribution lead to an unambiguously higher average relative to the plants of non-MNEs, implying an MNE wage premium also for the foreign plants.

Regarding the relative wage paid by foreign and domestic multinationals, we use $w_a(\underline{x}) = w(\underline{x})$ from above and find that the ratio of average wages is given by

$$\omega_{ad} \equiv \frac{\mathbb{E}\left[w|\text{MNE},a\right]}{\mathbb{E}\left[w|\text{MNE},d\right]} = \frac{1-(\alpha\tau)^{-g}\left[1-\frac{g}{2g+1}\left(1-\Phi^{-2g-1}\right)\right]}{1-(\alpha\tau)^{-g-1}\left[1-\frac{g+1}{2g+1}\left(1-\Phi^{-2g-1}\right)\right]}\frac{1}{\alpha}. \tag{18}$$

The following proposition summarizes the key properties of ω_{ad}.

Proposition 2 *The wage ratio* ω_{ad} *increases monotonically in trade cost parameter* τ *from a low level of* $\alpha^{-1}g/(g+1)$ *if* $\tau = \alpha^{-1}$ *to a high level* α^{-1} *if* $\tau \to \infty$. $\omega_{ad} > 1$ *holds for high levels of* τ, *and* $\omega_{ad} > 1$ *extends to all possible* τ *if* $\alpha < g/(g+1)$.

Proof See the Appendix.

Intuitively, a low level of τ implies that exporting is attractive, and therefore only a small share of the firm population – those with the highest domestic wages – invest abroad. Conditional on foreign investment, there are two effects: a low level of τ implies that there is a high threshold for the foreign amenity draw to be acceptable, implying that the average wage in foreign subsidiaries is low. But among the investors, those that accept the draw tend to be those with the worst amenities, implying high wages in the domestic subsidiaries. Higher trade costs make foreign investment more attractive. In the limiting case of $\tau \to \infty$ there is no exporting alternative, implying that all firms make the investment and choose multinational activity irrespective of the outcome of the amenity lottery. Due to our assumption of $\alpha < 1$, the amenity distribution among foreign subsidiaries can therefore not be better than the respective distribution among domestic subsidiaries, establishing $\omega_{ad} > 1$ in this case.

The results in Propositions 1 and 2 are well in line with the evidence on multinational wages reported in Section 2. In particular, associating higher trade costs with larger distance, as it is common, for instance, in the gravity literature, the model outlined above can not only explain the observation from our data that German subsidiaries of domestic and foreign multinationals pay wages of similar size but pointing to the important role of composition effects it also provides a rationale for the non-monotonic distance effect found in our data.

To round off the analysis, we illustrate that the model outlined above can be embedded into a general equilibrium environment in a fairly simple way. For instance, in a one-sector economy, in which varieties v are assembled to a homogeneous consumption good by perfectly competitive firms, using a linear-homogeneous technology that features constant elasticity of substitution $\sigma > 1$ between the respective varieties (cf. Ethier, 1982; Matusz, 1996), market size parameter A corresponds to aggregate real expenditures for intermediates, R/P, where R equals total revenues of domestic firms, and P is a CES price index of the form: $P = \left[\int_{v \in V} p(v)^{1-\sigma}\right]^{1/(1-\sigma)}$ with V capturing the set of available consumer goods. In this setting, the general equilibrium outcome can be determined, combining the market clearing conditions for workers and entrepreneurs with constant markup pricing and the indifference conditions between firm ownership and self-employment as well as for investment and non-investment outlined above. Since the respective outcome is not relevant for our analysis, we leave the computations to the interested reader.

4 Extensions

Based on the insight from the previous section that a model featuring ex ante uncertainty about foreign labor costs can provide a rationale for the empirical findings on multinational wages reported in Section 2, we now discuss two extensions of our model. First, we add productivity differences as a further source of firm heterogeneity. Productivity differences generate wage differences in our model even if we control for firm size, a feature that helps us in this extension to narrow the gap between our stylized theoretical model and the wage premia from the empirical analysis. Second, we allow multinationals to replace domestic production by imports from the foreign country, establishing a new form of multinationals, which are vertical in nature as they shift their whole production abroad (cf. Helpman, 1984). We use this extension to illustrate that the endogenous investment decision under wage uncertainty highlighted in our model can also explain the observation from our data that horizontal multinationals tend to pay higher wages than vertical ones.

4.1 Productivity differences between firms

In this extension, we consider two types of firms, distinguished by their labor productivity. In analogy to the benchmark model, entrepreneurs running either type of firm have the outside option of becoming self-employed in the service sector. In low-productivity firms, one unit of labor produces one unit of non-tradable output, and the output of these firms can only be produced in the domestic market. They are called national producers in the following. In high-productivity firms, one unit of labor produces $\varphi > 1$ units of output in the domestic market, and the good can be shipped abroad, subject to iceberg trade costs captured by parameter $\tau > 1$, as in the benchmark model. National producers offer homogeneous amenities x_n, whereas high-productivity firms have heterogeneous amenities that are distributed according to $G(x) = 1 - (x/\underline{x})^{-g}$.

If high-productivity firms decide to become multinational, they produce in their foreign subsidiary with productivity $\delta\varphi$, potentially different from their domestic productivity φ.[16] The lower bound of the foreign amenity draw is again $\alpha\underline{x}$, and in analogy to the benchmark model we assume $\alpha\delta\tau > 1 \geq \alpha$. Using the reasoning from above, the expected revenues from foreign investment are given by

$$\mathbb{E}\left[r_t(x)|\text{inv}\right] = \begin{cases} r(x)\left[1 + \dfrac{g(\alpha\delta)^{\sigma-1}}{g-\sigma+1}\left(\dfrac{x}{\underline{x}}\right)^{1-\sigma}\right] & \text{if} \quad x/\tau < \alpha\delta\underline{x} \\ (1+\tau^{1-\sigma})r(x) + r(x)\dfrac{(\sigma-1)(\alpha\delta)^g}{g-\sigma+1}\tau^{g-\sigma+1}\left(\dfrac{x}{\underline{x}}\right)^{-g} & \text{if} \quad x/\tau \geq \alpha\delta\underline{x} \end{cases}, \tag{19}$$

where $r(x)$ are domestic revenues of a firm with high productivity φ.

To ensure that high-productivity firms with unfavorable domestic workplace attributes choose to invest abroad, we impose the additional assumption that fixed costs are sufficiently low. In an equilibrium in which only entrepreneurs running national firms become self-employed in the service sector, the respective parameter constraint is given by

$$f < \frac{\sigma-1}{g-\sigma+1}\left(\frac{\alpha\delta\varphi\underline{x}}{x_n}\right)^{\sigma-1}. \tag{20}$$

[16] For instance, $\delta < 1$ may reflect higher communication costs for foreign subsidiaries with the firm's headquarters relative to domestic ones, as postulated by Gumpert (2017).

As in the main text, this parameter constraint ensures that there exists a unique cutoff amenity $\hat{x} = \alpha\delta\tau\underline{x}\Phi$, with

$$\Phi = \left[\frac{1}{f}\left(\frac{\varphi\underline{x}}{x_n}\right)^{\sigma-1}\frac{(\sigma-1)(\alpha\delta)^{\sigma-1}}{g-\sigma+1}\right]^{\frac{1}{g-\sigma+1}} > 1, \tag{21}$$

that separates high-productivity firms choosing to invest abroad ($x \leq \hat{x}$) from high-productivity firms choosing not to do so ($x > \hat{x}$). The parameter constraint in (20) has been derived under the assumption that irrespective of their domestic amenity draw high-productivity entrepreneurs do not choose to become self-employed, providing the fixed input necessary for foreign investment. To ensure this outcome, we impose the additional parameter constraint

$$\varphi > \frac{x_n}{\underline{x}}\left[\frac{1+f}{1+g(\alpha\delta)^{\sigma-1}/(g-\sigma+1)}\right]^{\frac{1}{\sigma-1}}, \tag{22}$$

which implies that the productivity advantage of international (exporting or multinational) firms is sufficiently high to make the outside occupation in the service sector unattractive for these producers.[17]

Noting that in the model with productivity differences $\alpha\delta\tau$ assumes the role of $\alpha\tau$ from the baseline model, the share of multinationals can be derived in analogy to Eq. (12), and in this extension it measures the ratio of multinationals to all *high-productivity* firms. Furthermore, aside from the change of $\alpha\tau$ to $\alpha\delta\tau$ the equations determining relative wages, Eqs. (16) to (18), do not change, and hence the results presented in Propositions 1 and 2, which do not depend on the level of Φ, are robust to the distinction between high- and low-productivity firms. However, there is now a fourth wage ratio worthwhile to look at, namely the ratio of the average wage of national firms relative to the average wage of exporters, which, noting that $\mathbb{E}[w|\text{NAT}] = w(x_n)$, is given by

$$\omega_{nc} \equiv \frac{\mathbb{E}[w|\text{NAT}]}{\mathbb{E}[w|\text{EXP}]} = \frac{\alpha\delta\tau\underline{x}}{x_n}\frac{g+1}{g}\frac{1-\frac{1}{2}\left(1-\Phi^{-2g}\right)}{1-\frac{g+1}{2g+1}\left(1-\Phi^{-2g-1}\right)}. \tag{23}$$

For sufficiently high levels of x_n we have $\omega_{nc} < 1$, and our model accords with the empirical finding that exporters pay higher wages than non-exporters (cf. Bernard and Jensen, 1999).

We can now condition on *endogenous* differences in firm size – which themselves are the result of unobservable differences in amenities – when determining the wage premia of multinationals. Contrasting domestic and foreign subsidiaries with equal size shows that these plants pay equal wages if $\delta = 1$. However, multinationals pay higher (lower) wages in their domestic than their foreign subsidiaries if $\delta < (>)1$ because in this case the productivity disadvantage of the foreign

[17] For a proof, see the Appendix. There, we also show that the two parameter constraints in (20) and (22) are not mutually exclusive.

(domestic) subsidiary must be compensated by an amenity disadvantage and thus a wage premium of the domestic (foreign) subsidiary to establish similarity of the two plants in their sales levels. The model outlined here also allows for a comparison of wages paid by multinationals and national firms with equal plant size. Because multinationals have a higher productivity – which is true for domestic as well as foreign subsidiaries provided that $\delta > 1/\varphi$ – lower wages paid by national firms must compensate for their productivity disadvantage in order to achieve the same plant size as multinational firms. This requires that the amenity level of low-productivity national producers is higher than the lower bound of amenities of high-productivity multinational firms. In particular, in our model domestic (foreign) subsidiaries of multinationals pay higher wages than national firms of equal size, as suggested by the empirical findings in Section 2, if $\varphi < x_n/\underline{x}$ ($\alpha\delta\varphi < x_n/\underline{x}$) holds.[18]

4.2 Vertical multinationals

In this subsection, we allow firms that have chosen foreign investment to replace domestic production by imports. Abstracting from further investment requirements of multinationals to make such imports accessible and setting $\alpha = 1$ to facilitate our analysis, we can determine two cutoffs, namely $\overline{x}_a = \max\{\underline{x}, x/\tau\}$ and $\overline{x}_a^2 \equiv \tau x$ that confine the range of foreign amenity draws supporting horizontal multinational production, $[\overline{x}_a, \overline{x}_a^2)$, and separate it from the range of foreign amenity draws supporting vertical multinational production, $x_a \geq \overline{x}_a^2$. Following the computation steps from the main text, the expected total revenue from investing abroad can be expressed as

$$\mathbb{E}\left[r_t(x)\middle|\text{inv}\right] = \begin{cases} r(x)\left[1 + \dfrac{g}{g-\sigma+1}\left(\dfrac{x}{\underline{x}}\right)^{1-\sigma} + \dfrac{\sigma-1}{g-\sigma+1}\tau^{-g}\left(\dfrac{x}{\underline{x}}\right)^{-g}\right] & \text{if} \quad x/\tau < \underline{x} \\ (1+\tau^{1-\sigma})r(x) + r(x)\dfrac{\sigma-1}{g-\sigma+1}\left[\tau^{g-\sigma+1} + \tau^{-g}\right]\left(\dfrac{x}{\underline{x}}\right)^{-g} & \text{if} \quad x/\tau \geq \underline{x} \end{cases}, \tag{24}$$

where $r(x)\frac{\sigma-1}{g-\sigma+1}\left(\frac{\tau x}{\underline{x}}\right)^{-g}$ is the expected revenue gain that exists because firms with $x_a \geq \overline{x}_a^2$ switch from horizontal to vertical multinational status and replace domestic output with cheaper foreign production.

Under parameter constraint (10) – here applied for the limiting case of $\alpha = 1$ – the firms with the lowest amenities choose to invest abroad, and similar to the baseline model we can determine a cutoff amenity level

$$\hat{x} \equiv \tau\underline{x}\Phi(\tau), \qquad \Phi(\tau) \equiv \left(\frac{1+f}{f}\frac{(\sigma-1)\left[1+\tau^{-2g+\sigma-1)}\right]}{2g-(\sigma-1)(1-\tau^{-g})}\right)^{\frac{1}{g-\sigma+1}} > 1, \tag{25}$$

[18] In our data, we cannot distinguish non-multinationals by their export status. However, it is easily seen that the ranking established here does not change when using all non-multinationals as the reference group, provided that there are sufficiently many non-exporters in this group. We show in the Appendix that $\varphi < x_n/\underline{x}$ (and in extension $\alpha\delta\varphi < x_n/\underline{x}$) is consistent with the two parameter constraints in (20) and (22).

where $\Phi(\tau)$ is non-monotonic in τ. To be more specific, there exists a unique $\hat{\tau} > 1$, such that $\Phi'(\tau) >, =, < 0$ if $\tau >, =, < \hat{\tau}$, and we consider a parameter domain establishing $\Phi(\hat{\tau}) > 1$. A higher τ lowers the additional gains from vertical multinational production and the non-monotonicity captures two opposing effects this has on the foreign investment decision. Lower revenues from vertical multinational production reduce the expected profits from foreign investment and therefore the incentive to make the investment. This direct effect is counteracted, however, by an indirect effect that is rooted in the occupational choice of entrepreneurs. Since in expectation higher trade costs reduce profits of the marginal firm with amenity $\underline{x}$, which chooses to invest abroad and opts for multinational production, and since the marginal producer is indifferent between becoming owner manager of a firm or becoming self-employed in the service sector, lower revenues from vertical multinational activity lead to lower service costs of foreign investment, making the investment more attractive ceteris paribus.

The total share of multinationals can then be computed following the steps described in the main text,

$$\chi = \int_{\underline{x}}^{\tau\underline{x}} \frac{dG(x)}{1-G(\underline{x})} + \tau^g \int_{\tau\underline{x}}^{\hat{x}} \left(\frac{x}{\underline{x}}\right)^{-g} \frac{dG(x)}{1-G(\underline{x})} = 1 - \frac{\tau^{-g}}{2}\left(1+\Phi(\tau)^{-2g}\right). \tag{26}$$

Noting further that the ex ante probability of drawing a foreign amenity high enough to support vertical multinational production is given by $(\tau x/\underline{x})^{-g}$, we can compute the share of vertical and horizontal multinational firms according to

$$\chi_v \equiv \int_{\underline{x}}^{\hat{x}} \left(\frac{\tau x}{\underline{x}}\right)^{-g} \frac{dG(x)}{1-G(\underline{x})} = \frac{\tau^{-g}}{2}\left(1-\tau^{-2g}\Phi(\tau)^{-2g}\right) \tag{27}$$

and

$$\chi_h \equiv \chi - \chi_v = 1 - \tau^{-g}\left[1 + (1-\tau^{-2g})\frac{\Phi(\tau)^{-2g}}{2}\right], \tag{28}$$

respectively. Since vertical multinationals do not produce at home, we can distinguish wages paid by horizontal multinationals domestically (d) and abroad (a) from wages paid by vertical multinationals in their foreign production facilities (v). It suffices to compute two wage averages in order to pin down the relative wages paid by the various types of production facilities. As shown in the Appendix, the average wage paid by foreign relative to domestic subsidiaries of horizontal multinationals is given by

$$\omega_{ad} = \frac{1-\tau^{-g}\left[1-\frac{g}{2g+1}\left(1-\Phi(\tau)^{-2g-1}\right)\right] - \frac{g}{2g+1}\tau^{-g-1}\left[1-\tau^{-2g-1}\Phi(\tau)^{-2g-1}\right]}{1-\tau^{-g-1}\left[1-\frac{g+1}{2g+1}\left(1-\Phi(\tau)^{-2g-1}\right)\right] - \frac{g+1}{2g+1}\tau^{-g}\left[1-\tau^{-2g-1}\Phi(\tau)^{-2g-1}\right]}. \tag{29}$$

As in the baseline model with $\alpha \to 1$, the wage ratio is smaller than one for all finite values of τ and equal to one if $\tau \to \infty$. In a similar vein, we can compute the average wage paid by foreign subsidiaries of vertical multinationals relative to the average wage paid by foreign subsidiaries of horizontal multinationals according to

$$\omega_{va} = \frac{\chi_h}{\chi_v} \frac{\tau^{-g-1} \frac{g}{2g+1} \left[1 - \tau^{-2g-1} \Phi(\tau)^{-2g-1}\right]}{1 - \tau^{-g} \left[1 - \frac{g}{2g+1} \left(1 - \Phi(\tau)^{-2g-1}\right)\right] - \frac{g}{2g+1} \tau^{-g-1} \left[1 - \tau^{-2g-1} \Phi(\tau)^{-2g-1}\right]}. \tag{30}$$

In the Appendix, we show that $\omega_{va} < 1$ for all possible τ, reaching a minimum value of $\omega_{va} = 0$ if $\tau \to \infty$. Together, Eqs. (29) and (30) establish the result that vertical multinationals pay lower wages on average than domestic and foreign subsidiaries of horizontal multinationals. This is intuitive, because firms in our model choose to become a vertical multinational only if their foreign amenity draw is sufficiently good, capturing the widespread view that vertical multinationals are low-cost seeking. However, in contrast to other papers dealing with the decision between vertical and horizontal activity, domestic-foreign wage differences are firm-specific, so that vertical multinational activity is not confined to countries that differ in their economic fundamentals (cf. Markusen, 2002). Rather, similar to horizontal foreign investment it is two-way and exists in our model even though countries are symmetric (see Alfaro and Charlton, 2009, for evidence supportive of vertical foreign investment between similar economies). Furthermore, the ranking of wages in our model provides a rationale for the somewhat stronger positive effect of the horizontal multinational dummy in the empirical analysis in Section 2.

5 Concluding remarks

Using a new dataset that links information on German plants with information on national and international ownership structure from a global firm database, we provide evidence on the existence of a residual wage premium of multinational firms that exists even after controlling for observable and unobservable differences to other plants. This new dataset allows us to analyze determinants of residual wage premia of multinationals put forward by existing theoretical work and show that they are only partially successful in explaining their existence. We furthermore obtain important new insights when taking into account the role of distance between the foreign parent and the local subsidiary. Our empirical results point to a non-monotonic distance effect on the multinational wage premium. This effect turns positive if the parent is based in a far-off country, explaining why in this case wages paid by foreign multinationals are higher than those paid by domestic multinationals.

Based on these empirical results, we set up a theoretical model that takes into account the role of distance for explaining existence and magnitude of multinational wage premia. The model features firm-specific wages and points to uncertainty about foreign wage payments as an important obstacle to foreign investment for firms with low domestic wage payments. The reason is that firms rely on their domestic labor costs when choosing to export to the foreign economy instead of investing there, and this alternative of exporting is more attractive for firms with more favorable domestic labor costs. The decision of firms between exporting and foreign investment generates a multinational wage premium since firms choosing to invest abroad are firms with high domestic wages and will therefore accept even comparatively high foreign wages in order to avoid the unfavorable labor costs in their domestic production facility. Associating lower distance with lower export costs, the model can explain that the multinational wage premium is lower in plants with a foreign parent in close proximity than in plants with a domestic parent. The reason is that in the case of low trade costs firms that choose to invest abroad will opt out of foreign investment and start exporting if their foreign labor costs are too high. The model also predicts that the distance effect on the multinational wage premium turns positive if the parent is located further away, because the incentive to opt out of foreign investment decreases and firms will accept less favorable wage realizations in their foreign plant if trade costs are high. Overall, the model is therefore well in line with the patterns of multinational wage premia observed in our data. In two extensions we show that the results do not change when abandoning restrictive assumptions that are imposed by the baseline model to facilitate analytical tractability.

This paper relies on detailed information on ownership structure of international production networks to shed new light on the determinants of multinational wage premia. Using information on nationality and financial indicators of ultimate owners, we draw a nuanced picture about the premium paid by multinational firms to German workers, with a particular emphasis on the role of distance between the parent and its subsidiary. Whereas the analysis in this paper is a first attempt to put the network structure of multinationals into the focus of analysis of multinational wages, important aspects of these networks, such as the location of other subsidiaries, the role of layers of ownership, or the issue of joint ownership, and their effect on the remuneration of workers, have not been considered in this paper and are left for future research.

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A Theoretical appendix

A.1 Proof of Proposition 1

We first consider the properties of ω_{ed}. From Eqs. (12) and (16), we have $\omega_{ed} = \hat{\omega}_{ed}(\tau) \equiv aA(\tau)$, with

$$a \equiv \frac{1 - \frac{g+1}{2g+1}(1-\Phi^{-2g-1})}{1-\frac{1}{2}(1-\Phi^{-2g})}, \quad \text{and} \quad A(\tau) \equiv \frac{1-(\alpha\tau)^{-g}\left[1-\frac{1}{2}(1-\Phi^{-2g})\right]}{(\alpha\tau)-(\alpha\tau)^{1-g}\left[1-\frac{g+1}{2g+1}(1-\Phi^{-2g-1})\right]}. \tag{A.1}$$

To determine the size of constant a, we can look at the properties of $\hat{a}(\zeta) \equiv [(g+\zeta)/(2g+\zeta)](1-\Phi^{-2g-\zeta})$, where $\zeta \geq 0$ and $a = [1-\hat{a}(1)]/[1-\hat{a}(0)]$ follows by definition. Hence, $a >, =, < 1$ if $\hat{a}(0) >, =, < \hat{a}(1)$. Differentiating $\hat{a}(\cdot)$ gives $\hat{a}'(\zeta) = [g/(2g+\zeta)^2](1-\Phi^{-2g-\zeta}) + [(g+\zeta)/(2g+\zeta)]\Phi^{-2g-\zeta}\ln\Phi > 0$. This implies $\hat{a}(1) > \hat{a}(0)$ and thus $a = [1-\hat{a}(1)]/[1-\hat{a}(0)] < 1$ as well as $A(1/\alpha) = \hat{a}(0)/\hat{a}(1) < 1$, and it establishes $\hat{\omega}_{ed}(1/\alpha) < 1$. Beyond that, we can also compute $\lim_{\tau\to\infty}\hat{\omega}_{ed}(\tau) = 0$. We next look at the derivative of ω_{ed}, which, according to Eq. (A.1), is given by

$$\hat{\omega}'_{ed}(\tau) = \frac{a\kappa(\tau)/\tau}{\alpha\tau-(\alpha\tau)^{1-g}\left[1-\frac{g+1}{2g+1}(1-\Phi^{-2g-1})\right]}, \tag{A.2}$$

with

$$\kappa(\tau) \equiv \frac{g(\alpha\tau)^{-g}}{2}\left(1+\Phi^{-2g}\right) - \left[\alpha\tau + (g-1)(\alpha\tau)^{1-g}\left(\frac{g}{2g+1}+\frac{g+1}{2g+1}\Phi^{-2g-1}\right)\right]A(\tau). \tag{A.3}$$

For $A(\tau) \geq 1$, we have $\kappa(\tau)\big|_{A(\tau)\geq 1} < g(1-\alpha\tau) - \left[\alpha\tau - (\alpha\tau)^{1-g}\left(\frac{g}{2g+1}+\frac{g+1}{2g+1}\Phi^{-2g-1}\right)\right]$, which is negative, provided that $\tau \geq 1/\alpha$. Due to differentiability, $A(\tau) > 1$ would require $A'(\tau)\big|_{A(\tau)=1} > 0$ to hold for some $\tau > 1/\alpha$, because $A(1/\alpha) < 0$ has been shown above. Since this is in contradiction to the finding $\kappa(\tau)\big|_{A(\tau)\geq 1} < 0$, it follows that $A(\tau) < 1$ and thus $\omega_{ed} < 1$ must hold for all $\alpha\tau > 1$. This completes the first part of the proof.

Let us now consider the properties of ω_{ea}. From Eqs. (12) and (17), we have $\omega_{ea} = \hat{\omega}_{ea}(\tau) \equiv a\alpha B(\tau)$, with a given above and

$$B(\tau) \equiv \frac{1-(\alpha\tau)^{-g}\left[1-\frac{1}{2}(1-\Phi^{-2g})\right]}{\alpha\tau-(\alpha\tau)^{1-g}\left[1-\frac{g}{2g+1}(1-\Phi^{-2g-1})\right]}. \tag{A.4}$$

We can compute of $\lim_{\tau\to\infty}\hat{\omega}_{ea}(\tau) = 0$, whereas $\hat{\omega}_{ea}(1/\alpha) >, =, < \alpha$ is equivalent to $\alpha\Phi^{-2g}\mu(\Phi) >, =, < 0$, with

$$\mu(\Phi) \equiv -\frac{2g}{2g+1} + \Phi^{-1} - \frac{1}{2g+1}\Phi^{-2g-1}, \tag{A.5}$$

$\mu(1) = 0$, $\mu'(\Phi) < 0$, and $\lim_{\Phi\to\infty}\mu(\Phi) = -2g/(2g+1) < 0$. This establishes $\mu(\Phi) < 0$ and thus

$\hat{\omega}_{ea}(1/\alpha) < \alpha$ for all $\Phi > 1$. Furthermore, differentiating ω_{ea} gives

$$\hat{\omega}'_{ea}(\tau) = \frac{a\alpha\nu(\tau)/\tau}{\alpha\tau - (\alpha\tau)^{1-g}\left[1 - \frac{g}{2g+1}(1 - \Phi^{-2g-1})\right]}, \tag{A.6}$$

with

$$\nu(\tau) \equiv \frac{g(\alpha\tau)^{-g}}{2}\left(1 + \Phi^{-2g}\right) - \left[\alpha\tau + (g-1)(\alpha\tau)^{1-g}\left(\frac{g+1}{2g+1} + \frac{g}{2g+1}\Phi^{-2g-1}\right)\right] B(\tau), \tag{A.7}$$

Following the derivation steps from above, we can compute

$$\hat{\omega}''_{ea}(\tau)\big|_{\omega'_{ea}(\tau)=0} = -\frac{a\alpha}{\tau^2}\frac{(g+1)\alpha\tau + (g-1)(\alpha\tau)^{1-g}\left(\frac{g+1}{2g+1} + \frac{g}{2g+1}\Phi^{-2g-1}\right)}{\alpha\tau - (\alpha\tau)^{1-g}\left[1 - \frac{g}{2g+1}(1 - \Phi^{-2g-1})\right]} < 0, \tag{A.8}$$

and hence, we can safely conclude that if ω_{ea} has an extremum in τ, it must be a maximum. We can note that $\nu(1/\alpha) = [2(1-\Phi^{-2g-1})]^{-1}\hat{\nu}(\Phi)$, with $\hat{\nu}(\Phi) \equiv -2+2(g+1)\Phi^{-2g}-(2g-1)\Phi^{-2g-1}-\Phi^{-4g-1}$, $\hat{\nu}(1) = 0$, $\lim_{\Phi\to\infty}\hat{\nu}(\Phi) = -2$, and $\hat{\nu}'(\Phi) = \Phi^{-2(g+1)}\hat{\nu}_0(\Phi)$, $\hat{\nu}_0(\Phi) \equiv 4g^2 - 1 - 4g(g+1)\Phi + (4g+1)\Phi^{-2g}$. Then, acknowledging $\hat{\nu}_0(1) = 0$ and $\hat{\nu}'_0(\Phi) < 0$, it follows that $\hat{\nu}_0(\Phi) < 0$ and thus $\hat{\nu}'(\Phi) < 0$ hold for all $\Phi > 1$. This implies $\hat{\nu}(\Phi) < 0$ and finally $\nu(1/\alpha) < 0$. Accordingly, we have $\hat{\omega}'_{ea}(1/\alpha) < 0$ and can therefore safely conclude that ω_{ea} has no extremum and is monotonically decreasing in τ. This completes the proof.

A.2 Proof of Proposition 2

Let us define

$$Z(\tau) \equiv 1 - (\alpha\tau)^{-g}\left[1 - \frac{g}{2g+1}\left(1 - \Phi^{-2g-1}\right)\right], \tag{A.9}$$

$$N(\tau) \equiv 1 - (\alpha\tau)^{-g-1}\left[1 - \frac{g+1}{2g+1}\left(1 - \Phi^{-2g-1}\right)\right], \tag{A.10}$$

such that $\omega_{ad} = Z(\tau)/[\alpha N(\tau)]$, according to Eq. (18). Then, twice differentiating ω_{ad} with respect to τ gives

$$\frac{d\omega_{ad}}{d\tau} = \frac{Z'(\tau) - N'(\tau)\frac{Z(\tau)}{N(\tau)}}{\alpha N(\tau)}, \qquad \frac{d^2\omega_{ad}}{d\tau^2} = \frac{Z''(\tau) - N''(\tau)\frac{Z(\tau)}{N(\tau)}}{\alpha N(\tau)} - 2\frac{N'(\tau)}{N(\tau)}\frac{d\omega_{ad}}{d\tau}. \tag{A.11}$$

Accounting for

$$Z'(\tau) = -\frac{g[Z(\tau) - 1]}{\tau} > 0, \qquad N'(\tau) = -\frac{(g+1)[N(\tau) - 1]}{\tau} > 0 \tag{A.12}$$

and

$$Z''(\tau) = -\frac{(g+1)Z'(\tau)}{\tau} < 0, \qquad N''(\tau) = -\frac{(g+2)N'(\tau)}{\tau} < 0, \tag{A.13}$$

it is immediate that $d\omega_{ad}/d\tau = 0$ establishes $d^2\omega_{ad}/d\tau^2 = Z'(\tau)[\alpha\tau N(\tau)]^{-1} > 0$. From this, we can conclude that if ω_{ad} has an extremum in τ, it must be a minimum. Since evaluating $d\omega_{ad}/d\tau$ at the minimum trade cost level $\tau = \alpha^{-1}$ gives $d\omega_{ad}/d\tau = g/(g+1) > 0$, it follows that $d\omega/d\tau > 0$

must hold for all possible $\tau > \alpha^{-1}$. Finally, evaluating Eq. (18) at the two limiting cases $\tau = 1/\alpha$ and $\tau \to \infty$ yields $\omega_{ad} = \alpha^{-1}g/(g+1)$ and $\omega_{ad} = \alpha^{-1}$, respectively. This completes the proof of Proposition 2.

A.3 Discussion of parameter constraints (20) and (22)

In Section 4.1, we claim that the parameter constraint in (20) ensures that high-productivity firms with unfavorable domestic amenity draws choose foreign investment if the services necessary to make such investments are provided by individuals from the group of entrepreneurs running national producers. In order to show this, we can note that revenues of a low-productivity national producer are linked to domestic revenues of the high-productivity firm with the least favorable amenity level by $r_n = r(x)(\varphi \underline{x}/x_n)^{1-\sigma}$. Then, the condition rendering national producers indifferent between the two available occupations can be expressed as $s = (\varphi \underline{x}/x_n)^{1-\sigma} r(\underline{x})/\sigma$, and the constraint in (20) can be derived in total analogy to the respective constraint of the baseline model in (8'). Furthermore, self-employment in the service sector is unattractive for high-productivity firms with the lowest domestic amenity levels, $\underline{x}$, if

$$s < \frac{r(\underline{x})}{\sigma}\left[1 + \frac{g(\alpha\delta)^{\sigma-1}}{g-\sigma+1}\right] - sf. \tag{A.14}$$

Evaluated at $s = (\varphi \underline{x}/x_n)^{1-\sigma} r(\underline{x})/\sigma$, condition (A.14) can be reformulated to (22). Finally, it is notable that the two constraints in (20) and (22) are related, because both condition on a link between $\varphi \underline{x}/x_n$ and f. To see that they can be fulfilled simultaneously, we can combine (20) and (22) to obtain the sufficient conditions

$$f < \frac{\sigma-1}{g-\sigma+1}\frac{(\alpha\delta)^{\sigma-1}}{1+(\alpha\delta)^{\sigma-1}}, \qquad \varphi > \frac{x_n}{\underline{x}}\left(\frac{1}{1+(\alpha\delta)^{\sigma-1}}\right)^{\frac{1}{\sigma-1}}, \tag{A.15}$$

which show that (20) and (22) are not mutually exclusive. Finally, since the two parameter constraints in (A.15) do not rule out $\varphi < x_n/\underline{x}$, it is possible in our model that domestic as well as foreign subsidiaries of multinationals pay higher wages than national firms of equal size.

A.4 Derivation of Eq. (29) and Eq. (30)

Let us first consider the derivation of ω_{ad} in the model variant with vertical multinational activity. Noting that firms with a foreign amenity draw higher than $x\tau$ opt for serving domestic consumers through foreign production, we can compute the average wage paid by domestic plants of horizontal multinationals according to

$$\begin{aligned}
\mathbb{E}[w|\text{MNE}, d] = \frac{1}{\chi_h}\Bigg\{ &\int_{\underline{x}}^{\tau\underline{x}} \left[1 - \left(\frac{x\tau}{\underline{x}}\right)^{-g}\right] w(x)\frac{dG(x)}{1-G(\underline{x})} \\
&+ \int_{\tau\underline{x}}^{\hat{x}} \left[\left(\frac{x/\tau}{\underline{x}}\right)^{-g} - \left(\frac{x\tau}{\underline{x}}\right)^{-g}\right] w(x)\frac{dG(x)}{1-G(\underline{x})}\Bigg\} \\
= \frac{w(\underline{x})}{\chi_h}\frac{g}{g+1}\Bigg\{ &1 - \tau^{-g-1}\left[1 - \frac{g+1}{2g+1}\left(1-\Phi(\tau)^{-2g-1}\right)\right] \\
&- \frac{g+1}{2g+1}\tau^{-g}\left[1 - \tau^{-2g-1}\Phi(\tau)^{-2g-1}\right]\Bigg\},
\end{aligned} \tag{A.16}$$

where χ_h is given by Eq. (28). In a similar vein, we can compute the average wage paid by foreign subsidiaries of horizontal multinationals according to

$$\begin{aligned}\mathbb{E}[w|\text{MNE}, a] &= \frac{1}{\chi_h}\left\{\int_{\underline{x}}^{\tau\underline{x}} \mathbb{E}[w_a|\underline{x} \leq x_a < x\tau]\frac{dG(x)}{1-G(\underline{x})} + \int_{\tau\underline{x}}^{\hat{x}} \mathbb{E}[w_a|x/\tau \leq x_a < x\tau]\frac{dG(x)}{1-G(\underline{x})}\right\} \\ &= \frac{w(\underline{x})}{\chi_h}\frac{g}{g+1}\left\{1-\tau^{-g}\left[1-\frac{g}{2g+1}\left(1-\Phi(\tau)^{-2g-1}\right)\right]\right. \\ &\qquad \left. -\frac{g}{2g+1}\tau^{-g-1}\left[1-\tau^{-2g-1}\Phi(\tau)^{-2g-1}\right]\right\}, \end{aligned} \tag{A.17}$$

where

$$\mathbb{E}[w_a|x_b \leq x_a < x\tau] \equiv w_a(\underline{x})\int_{x_b}^{\tau x}\left(\frac{x_a}{\underline{x}}\right)^{-1}\frac{dG(x_a)}{1-G(\underline{x})} = \frac{w_a(\underline{x})g}{g+1}\left[\left(\frac{x_b}{\underline{x}}\right)^{-g-1} - \left(\frac{\tau x}{\underline{x}}\right)^{-g-1}\right] \tag{A.18}$$

and $w_a(\underline{x}) = w(\underline{x})$ have been used. Eq. (29) is then established by $\omega_{ad} = \mathbb{E}[w|\text{MNE}, a]/\mathbb{E}[w|\text{MNE}, d]$. In a further step, we can compute the average wage paid by a foreign subsidiary of a vertical multinational according to

$$\begin{aligned}\mathbb{E}[w|\text{MNE}, v] &= \frac{1}{\chi_v}\int_{\underline{x}}^{\hat{x}} \mathbb{E}[w_a|x_a \geq \tau x]\frac{dG(x)}{1-G(\underline{x})} \\ &= \frac{w(\underline{x})}{\chi_v}\frac{g}{g+1}\frac{g}{2g+1}\tau^{-g-1}\left[1-\tau^{-2g-1}\Phi(\tau)^{-2g-1}\right], \end{aligned} \tag{A.19}$$

where

$$\mathbb{E}[w_a|x_a \geq \tau x] \equiv w_a(\underline{x})\int_{\tau x}^{\infty}\left(\frac{x_a}{\underline{x}}\right)^{-1}\frac{dG(x_a)}{1-G(\underline{x})} = \frac{w_a(\underline{x})g}{g+1}\left(\frac{\tau x}{\underline{x}}\right)^{-g-1} \tag{A.20}$$

and $w_a(\underline{x}) = w(\underline{x})$ have been considered. Eq. (30) then follows from $\omega_{va} = \mathbb{E}[w|\text{MNE}, v]/\mathbb{E}[w|\text{MNE}, a]$.

To complete the proof, we show that $\omega_{ad} < 1$ and $\omega_{va} < 1$. For this purpose, we treat $\Phi(\tau)$ parametrically and set $\Phi \equiv \Phi(\hat{\tau})$ to emphasize that derivatives with respect to τ are partial and computed for a given level of Φ in the subsequent analysis. Then, we can note that $\mathbb{E}[w|\text{MNE}, a] >, =, < \mathbb{E}[w|\text{MNE}, d]$ is equivalent to $\tau^{-g-1}\Phi^{-2g-1}C(\tau) >, =, < 0$, with

$$C(\tau) \equiv \frac{g+1}{2g+1} - \frac{g+1}{2g+1}\tau^{-2g} - \frac{g}{2g+1}\tau + \frac{g}{2g+1}\tau^{-2g-1}. \tag{A.21}$$

Accounting for $C(1) = 0$, $\lim_{\tau\to\infty} C(\tau) = -\infty$, and

$$C'(\tau) = -\frac{g}{2g+1}\left[1 + (2g+1)\tau^{-2(g+1)} - 2(g+1)\tau^{-2g-1}\right] < 0, \tag{A.22}$$

it follows that $C(\tau) < 0$ and thus $\mathbb{E}[w|\text{MNE}, a] < \mathbb{E}[w|\text{MNE}, d]$ holds for all $\tau > 1$, establishing $\omega_{ad} < 1$. In the limiting case of $\tau \to \infty$, we furthermore have $\lim_{\tau\to\infty} \tau^{-g-1}\Phi^{-2g-1}C(\tau) = 0$.

To establish $\omega_{va} < 1$, we can write $\omega_{va} = \nu_0(\tau)\nu_1(\tau)$, with

$$\nu_0(\tau) \equiv \frac{2g}{2g+1}\frac{1-\tau^{-2g-1}\Phi^{-2g-1}}{1-\tau^{-2g}\Phi^{-2g}}, \tag{A.23}$$

$$\nu_1(\tau) \equiv \frac{1-\frac{1}{2}\tau^{-g}(1+\Phi^{-2g})-\frac{1}{2}\tau^{-g}(1-\tau^{-2g}\Phi^{-2g})}{\tau-\tau^{1-g}\left[1-\frac{g}{2g+1}(1-\Phi^{-2g-1})\right]-\frac{g}{2g+1}\tau^{-g}(1-\tau^{-2g-1}\Phi^{-2g-1})}, \tag{A.24}$$

according to Eqs. (27), (28), and (30). Then, differentiating $\nu_0(\tau)$ gives

$$\nu_0'(\tau) = \frac{2g}{\tau}\frac{(\tau\Phi)^{-2g-1}}{[1-(\tau\Phi)^{-2g}]^2}\hat{\nu}_0(\tau\Phi), \quad \text{with} \quad \hat{\nu}_0(\tau\Phi) \equiv 1-\frac{2g}{2g+1}\tau\Phi-\frac{1}{2g+1}.(\tau\Phi)^{-2g} \tag{A.25}$$

Accounting for $\hat{\nu}_0'(\tau\Phi) < 0$, $\hat{\nu}_0(1) = 0$, and $\tau\Phi > 1$, it follows that $\nu_0'(\tau) < 0$. Hence, $\lim_{\tau\to 1/\Phi} = 1$ and the observation that $\tau > 1 > 1/\Phi$ establish $\nu_0(\tau) < 1$.

Let us now consider $\nu_1(\tau)$. Evaluating $\nu_1(\tau)$ for the two limiting cases of τ gives

$$\lim_{\tau\to 1}\nu_1(\tau) = \frac{2g+1}{2(g+1)}\frac{1-\Phi^{-2g}}{1-\Phi^{-2g-1}} < 1 \quad \text{and} \quad \lim_{\tau\to\infty}\nu_1(\tau) = 0. \tag{A.26}$$

Differentiating $\nu_1(\tau)$ further establishes

$$\nu_1'(\tau) = \frac{g[1-\tau\nu_1(\tau)]-\left\{\tau-\tau^{1-\gamma}\left[1-\frac{g}{2g+1}(1-\Phi^{-2g-1})\right]\right\}\nu_1(\tau)-g\tau^{-3g}\Phi^{-2g}\left[1-(\tau\Phi)^{-1}\nu_1(\tau)\right]}{\tau^2-\tau^{2-g}\left[1-\frac{g}{2g+1}(1-\Phi^{-2g-1})\right]-\frac{g}{2g+1}\tau^{1-g}(1-\tau^{-2g-1}\Phi^{-2g-1})}.$$

Under the assumptions that there exists a $\bar{\tau}$ implicitly determined by $\nu_1(\bar{\tau}) = 1$, we can compute

$$\nu_1'(\bar{\tau}) = -\frac{g(\bar{\tau}-1)+\left\{\bar{\tau}-\bar{\tau}^{1-\gamma}\left[1-\frac{g}{2g+1}(1-\Phi^{-2g-1})\right]\right\}+g\bar{\tau}^{-3g}\Phi^{-2g}\left[1-(\bar{\tau}\Phi)^{-1}\right]}{\bar{\tau}^2-\bar{\tau}^{2-g}\left[1-\frac{g}{2g+1}(1-\Phi^{-2g-1})\right]-\frac{g}{2g+1}\bar{\tau}^{1-g}(1-\bar{\tau}^{-2g-1}\Phi^{-2g-1})} < 0.$$

However, $\nu_1(1) < 1$ implies that if there exists a τ-range with $\nu_1(\tau) > 1$ there must be at least one $\bar{\tau} > 1$ such that $\nu_1'(\bar{\tau}) > 0$. This is in contradiction to our finding that $\nu_1'(\bar{\tau}) < 0$ holds for all $\bar{\tau} > 1$. This proves that $\nu_1(\tau) < 1$, and together with $\nu_0(\tau) < 1$ it establishes $\omega_{va} < 1$, which completes the proof.

A.5 A model with endogenous amenities

In the parsimonious model outlined in the main text, we have assumed that amenities are exogenous to the firm. This stands in contrast to the well established fact that some (in particular, large) firms make significant investment in their workplace amenities. For instance, Ben (2016) notes that the list of workplace amenities offered by SAS include "a gymnasium, billiard hall, sauna, massages, hair salon, Olympic-size pool, and many other perks" (p. 166), whose provision is, of course, associated with costs. In our setting, amenity provision helps reducing firm-specific wages and thus the marginal costs the producer faces in the production process, complementing work by Helpman et al. (2010) and Bustos (2011) who assume that firms can make an investment to improve the productivity of their workforce.

Firms, rather than drawing the quality of their amenities as in our benchmark model, now draw a parameter c that influences the marginal cost of providing amenities. After realisation of the domestic cost parameter firms decide on foreign investment, which results in an independent draw for a cost parameter in the foreign market. Once the outcome of all lotteries is known, firms decide on investing in amenities (potentially in both markets), and on employment levels (again, potentially in two markets).

To keep things simple, we assume that the fixed cost of amenity provision is increasing in the level of amenities with constant elasticity $\mu > 0$: scx^{μ}/μ. Furthermore, we assume that cost parameter c is firm-specific and (for domestic producers) distributed over the unit interval according to $G(c) = c^g$, $g > 0$.[19] Under the sufficient condition of $\mu > \sigma - 1$ all active firms choose to invest in their amenities and, from standard profit maximization, the amenity ratio of two firms sharing the same strategy of foreign market penetration (two exporters or two multinationals) is decreasing with constant elasticity in these firms' relative cost parameters:

$$\frac{x'}{x''} = \left(\frac{c'}{c''}\right)^{-\frac{\xi}{\sigma-1}}, \qquad \xi \equiv \frac{\sigma - 1}{\mu - \sigma + 1}. \tag{A.27}$$

Using Eq. (4), we therefore have

$$\frac{r(x')}{r(x'')} = \left(\frac{c'}{c''}\right)^{-\xi}. \tag{A.28}$$

With revenues – and, by implication, operating profits – decreasing in c, there is a cutoff cost level $\overline{c} < 1$ above which entrepreneurs choose to become self-employed. Ceteris paribus, the incentive to invest in domestic amenities is higher for an exporter than for a multinational, since the multinational uses domestic amenities only to serve domestic customers. We find that the relative amenity provision of an exporter and a multinational sharing the same level of c equals $(1 + \tau^{1-\sigma})^{\xi}$.

Payment of the foreign investment cost sf buys a draw from the foreign cost distribution $G(c) = c^g$, where in analogy to the baseline model c is uniformly distributed over the interval $[0, \overline{c}/\alpha]$, with $\alpha \leq 1$. We now compute the expected total revenue of a firm that has chosen to invest abroad. Depending on their domestic draw for the cost of amenity provision, we can distinguish the case in which all foreign investors choose to start foreign production and the case in which some foreign cost draws are rejected.

Denoting by $r(c)$ the domestic revenue of a non-exporting firm with domestic cost draw c, the revenue increase for this firm from choosing to export (and optimally adjusting its amenity level) amounts to $[(1+\tau^{1-\sigma})^{\frac{\mu\xi}{\sigma-1}} - 1]r(c)$. With $r(c_a)$ as the revenue from producing abroad for a given cost draw c_a, foreign production is preferred by firms over exporting if $[(1 + \tau^{1-\sigma})^{\frac{\mu\xi}{\sigma-1}} - 1]r(c) < r(c_a)$. Accounting for Eq. (A.28) we can define

$$\hat{t} \equiv \left[(1 + \tau^{1-\sigma})^{\frac{\mu\xi}{\sigma-1}} - 1\right]^{-\frac{1}{\xi}} > 0, \tag{A.29}$$

such that firms prefer multinational production over exporting if $c_a \leq \hat{t}c$, while they prefer exporting over multinational production if $c_a > \hat{t}c$. In the presence of international trade costs, the export-effective domestic cost of amenity provision is therefore given by $c\hat{t}$.

This implies that the foreign investor accepts all cost draws if $c\hat{t}$ exceeds $\overline{c}/\alpha$, the upper bound

[19] Using g for the shape parameter of the x and the c distribution is a slight abuse of notation. However, it is useful for showing the similarity between the exogenous and endogenous amenity model afterwards.

of the foreign cost distribution, and rejects some draws otherwise. We impose $\hat{t} > 1/\alpha$ to ensure that $c\hat{t} > \overline{c}/\alpha$ holds for sufficiently high domestic cost draws and can then compute the expected (total) revenues from foreign investment according to

$$\mathbb{E}\left[r_t(c)|\text{inv}\right] = r(\overline{c}) \int_0^{\overline{c}/\alpha} \left[1 + \left(\frac{c_a}{c}\right)^{-\xi}\right] \frac{dG(c)}{G(\overline{c})}, \tag{A.30}$$

if $c\hat{t} > \overline{c}/\alpha$, and according to

$$\mathbb{E}\left[r_t(c)|\text{inv}\right] = \int_{c\hat{t}}^{\overline{c}/\alpha} (1 + \tau^{1-\sigma})^{\frac{\mu\xi}{\sigma-1}} r(c) \frac{dG(c)}{G(\overline{c}/\alpha)} + r(\overline{c}) \int_0^{c\hat{t}} \left[1 + \left(\frac{c_a}{c}\right)^{-\xi}\right] \frac{dG(c)}{G(\overline{c})}, \tag{A.31}$$

if $c\hat{t} \leq \overline{c}/\alpha$. Solving the integrals establishes

$$\mathbb{E}\left[r_t(x)|\text{inv}\right] = \begin{cases} r(c)\left[1 + \frac{g\alpha^\xi}{g-\xi}\left(\frac{\overline{c}}{c}\right)^\xi\right] & \text{if} \quad c\hat{t} > \overline{c}/\alpha \\ (1 + \hat{t}^{-\xi}) r(c) + r(c)\frac{\xi\alpha^g}{g-\xi}\hat{t}^{g-\xi}\left(\frac{c}{\overline{c}}\right)^k & \text{if} \quad c\hat{t} \leq \overline{c}/\alpha \end{cases}. \tag{A.32}$$

Provided that the marginal firm with cost parameter $\overline{c}$ chooses to invest, the indifference condition for the marginal entrepreneur establishes

$$s = \frac{r(\overline{c})}{\sigma} \frac{\sigma - 1}{\mu\xi} \frac{g[1 + \alpha^\xi] - \xi}{g - \xi} \frac{1}{1 + f}, \tag{A.33}$$

where term $(\sigma - 1)(\mu\xi)^{-1} < 1$ corrects operating profits for the cost of amenity provision. Then, under the sufficient condition $f < [\xi/(g - \xi)]\alpha^\xi/(1 + \alpha^\xi)$, there exists a unique cost cutoff

$$\hat{c} \equiv \overline{c}\left(\alpha\hat{t}\Phi\right)^{-1}, \qquad \Phi \equiv \left(\frac{1 + f}{f} \frac{\alpha^\xi}{1 + \alpha^\xi}\right)^{\frac{1}{k-\xi}}, \tag{A.34}$$

separating firms that invest abroad ($c \geq \hat{c}$) from firms that do not invest abroad ($c < \hat{c}$). Following the derivation steps in the baseline scenario, we can furthermore express the share of multinationals, χ, and the average wage of foreign subsidiaries relative to the average wage of domestic subsidiaries, ω_{ad}, according to

$$\chi = 1 - \frac{(\alpha\hat{t})^{-g}}{2}\left(1 + \Phi^{-2g}\right) \tag{A.35}$$

and

$$\omega_{ad} = \frac{1 - (\alpha\hat{t})^{-g}\left[1 - \frac{g}{2g+\xi/(\sigma-1)}\left(1 - \Phi^{-2g-\xi/(\sigma-1)}\right)\right]}{1 - (\alpha\hat{t})^{-g-\xi/(\sigma-1)}\left[1 - \frac{g+\xi/(\sigma-1)}{2g+\xi/(\sigma-1)}\left(1 - \Phi^{-2g-\xi/(\sigma-1)}\right)\right]} \frac{1}{\alpha}, \tag{A.36}$$

respectively. This reveals that the solutions for χ and ω_{ad} from the baseline scenario with exogenous amenities are structurally equivalent to their solutions in the model variant with endogenous amenities, with $\hat{t}$ taking the role of τ and ξ taking the role of $\sigma - 1$. Therefore, the findings in Proposition 2 remain valid in the more sophisticated model considered here. A similar conclusion can be drawn for relative wages ω_{ed} and ω_{ea}, which in the case of endogenous amenities are given by

$$\omega_{ed} = \frac{\chi}{1-\chi} \frac{(\alpha\hat{t})^{-g-\xi/(\sigma-1)} \left[1 - \frac{g+\xi/(\sigma-1)}{2g+\xi/(\sigma-1)} \left(1 - \Phi^{-2g-\xi/(\sigma-1)}\right)\right]}{1 - (\alpha\hat{t})^{-g-\xi/(\sigma-1)} \left[1 - \frac{g+\xi/(\sigma-1)}{2g+\xi/(\sigma-1)} \left(1 - \Phi^{-2g-\xi/(\sigma-1)}\right)\right]}, \tag{A.37}$$

and

$$\omega_{ea} = \frac{\alpha\chi}{1-\chi} \frac{(\alpha\hat{t})^{-g-\xi/(\sigma-1)} \left[1 - \frac{g+\xi/(\sigma-1)}{2g+\xi/(\sigma-1)} \left(1 - \Phi^{-2g-\xi/(\sigma-1)}\right)\right]}{1 - (\alpha\hat{t})^{-g} \left[1 - \frac{g}{2g+\xi/(\sigma-1)} \left(1 - \Phi^{-2g-\xi/(\sigma-1)}\right)\right]}, \tag{A.38}$$

respectively. Hence, the findings from Proposition 1 extend to the model variant with endogenous amenities, and we can therefore complete our analysis by noting that qualitatively the findings upon multinational wages do not depend on the assumption of exogenous amenities.

B Empirical appendix

B.1 Further descriptives

Tables B.1 and B.2 summarize descriptives of additional control variables used in Section 2 and in Appendix B.2 below. The first set of controls reported in Table B.1 are observed at the parent level. On average, parent profitability, which is measured by the log of revenues per employee, is more than ten percent higher for multinational than for non-multinational parents. This is not surprising, because a large fraction of non-multinationals are small, single-plant firms in our dataset. In line with Table 1, we find a sizable difference in the corporate network sizes of multinationals and non-multinationals. The indicators *parents from industrialized countries* and *horizontal ownership* are defined for multinationals only. In our dataset, the vast majority of parents are from countries that are classified as industrialized by United Nations (2014) and about 26 percent of the plants have a parent from the same industry and are therefore classified as horizontal according to Alfaro and Charlton (2009).

Table B.1: *Additional controls*

	Non-multinational plants		Multinational plants	
	mean	sd	mean	sd
		Parent controls		
Parent profitability	4.762	0.944	5.339	0.998
Network size in 1,000	0.001	0.005	1.069	1.570
Parents from ind. countries			0.986	0.116
Horizontal ownership			0.259	0.438
		Workforce occupations		
Agricultural occupations	0.015	0.102	0.003	0.037
Simple manual occupations	0.115	0.227	0.067	0.171
Simple service occupations	0.168	0.260	0.114	0.230
Simple commercial and admin. occupations	0.101	0.209	0.215	0.354
Advanced manual occupations	0.223	0.294	0.090	0.199
Advanced service occupations	0.022	0.110	0.073	0.226
Advanced commercial and admin. occupations	0.252	0.280	0.274	0.328
Technicians	0.048	0.129	0.081	0.202
Semiprofessions	0.019	0.104	0.016	0.090
Engineers	0.025	0.096	0.044	0.129
Professions	0.007	0.047	0.011	0.062
		Further plant controls		
Outflow from advanced occ.	0.272	0.610	0.349	2.437
Outflow from age group 25-55	0.275	0.730	0.355	3.280
Inflow to advanced occ.	0.246	0.252	0.252	0.282
Share of simple occ.	0.399	0.338	0.398	0.380

Notes: Data sources are BvD and BHP. Parent firms maintain at least 25 percent of controlling interest.

The second set of controls in Table B.1 refers to workforce occupations, which are divided into

11 groups following Blossfeld (1987) with the "objective of making these groups as homogeneous as possible in their average general and vocational training requirements as well as in their occupational activities" (p. 98). The workforce composition along the occupational dimension differs considerably between multinational and non-multinational plants.

Table B.2: *Descriptives of industrial affiliation of workforce (in shares)*

	Nace Rev 2.2	Non-multinational plants		Multinational plants	
	2-digit	mean	sd	mean	sd
Agriculture	1-3	0.399	0.338	0.398	0.380
Mining	5-9	0.002	0.047	0.004	0.059
Manufacture of food, beverages, and tobacco products	10-12	0.012	0.107	0.009	0.094
Manufacture of textiles, wearing apparel, leather, and related products	13-15	0.005	0.067	0.003	0.055
Manufacture of wood and of products of wood and cork	16	0.007	0.085	0.002	0.041
Manufacture of paper, paper products, and media	17, 18, 58, 59	0.021	0.144	0.012	0.107
Manufacture of coke and refined petroleum products	19	0.000	0.012	0.001	0.030
Manufacture of chemicals, chemical products, and pharmaceutical products	20, 21	0.004	0.064	0.015	0.120
Manufacture of rubber and plastic products	22	0.010	0.101	0.009	0.094
Manufacture of other non-metallic mineral products	23	0.008	0.089	0.013	0.112
Manufacture of basic and fabricated metals	24, 25	0.053	0.223	0.023	0.149
Manufacture of machinery and equipment n.e.c.	28	0.024	0.153	0.029	0.168
Manufacture of computer, electronic and optical products, and electrical equipment	26, 27	0.018	0.131	0.027	0.161
Manufacture of motor vehicles, trailers and semi-trailers, and other transport equipment	29, 30	0.004	0.062	0.011	0.104
Other manufacturing (including furniture)	31, 32	0.020	0.139	0.006	0.076
Electricity, gas, steam, air conditioning supply, and water collection, treatment and supply	35, 36	0.005	0.070	0.024	0.076
Construction of buildings, civil engineering, and specialized construction activities	41-43	0.212	0.409	0.026	0.159
Wholesale and retail trade, repair and installation	33, 45-47, 95	0.253	0.435	0.268	0.443
Accommodation, food and beverage service activities	55, 56	0.022	0.146	0.023	0.149
Transport, warehousing, postal and courier services, and travel	49-53, 79	0.055	0.228	0.200	0.400
Financial services and insurance	64-66	0.010	0.100	0.033	0.180
Programming, consultancy, information services, research and development, real estates, household services	62, 63, 68, 72, 77, 97	0.066	0.248	0.069	0.254
Other services (including legal ones)	69-71, 73, 74, 78, 80-82, 96, 98	0.138	0.345	0.159	0.366
Public services (including sewerage, waste collection, telecommunication, etc.)	37-39, 60, 61, 75, 84, 86-88, 90-94, 99	0.039	0.193	0.027	0.163
Education	85	0.007	0.082	0.007	0.084

Notes: Data sources are BvD and BHP. Parent firms maintain at least 25 percent of controlling interest.

The third set of controls listed in Table B.1 are defined at the plant level and are used as explanatory variables in Table B.4. Outflow of workers is expressed relative to the total number of workers from the same occupation or age group, where advanced occupations refer to the bottom seven items from the list of workforce occupations. Since the outflow variables refer to workers no longer employed in the current period whereas the reference group are workers currently employed, the share of workers leaving a plant can be larger than one if there was a general downsizing of the workforce at the respective plant. Inflows of workers are defined as new hirings between the previous and the current business year relative to the current workforce from the same occupation group. Simple occupations capture the top four items of the occupation list (and thus include agricultural occupations). We find sizable differences between multinational and non-multinational plants with respect to the outflow variables, and it is notable that the share of workers in simple occupations (requiring less vocational and general training) is similar in the two groups.

Table B.3: *List of countries and their distances to Germany*

Country	Distance in km	Country	Distance in km
Germany	0	Russian Federation	1611
Czech Republic	281	Greece	1806
Denmark	356	Malta	1853
Poland	517	Spain	1872
Austria	525	Turkey	2040
Slovakia	554	Portugal	2315
Netherlands	576	Iceland	2391
Luxembourg	603	Cyprus	2493
Belgium	653	Egypt	2896
Liechtenstein	661	Israel	2904
Hungary	691	India	5788
Slovenia	724	Canada	6136
Switzerland	756	Bermuda	6461
Croatia	772	United States of America	6717
Sweden	814	China	7363
Lithuania	822	Virgin Islands, GB	7664
Norway	839	Korea, Rep. of	7943
Latvia	845	Curacao	8433
France	879	Cayman Islands	8639
United Kingdom	932	Hong Kong	8762
Bosnia	1033	South Africa	8827
Finland	1107	Japan	8930
Italy	1185	Taiwan	8969
Ukraine	1206	Malaysia	9624
Romania	1296	Mexico	9737
Ireland	1318	Singapore	9936
Bulgaria	1322	Australia	16085

Notes: Countries with a German affiliate covered by BvD. Distance of country j to Germany (i) is measured by the distance between the country's capital to Berlin in km, using the 'great circle' formula: $D_{ij} = 6378.39\,\arccos(\sin[\text{rad}(Y_i)\cdot\text{rad}(Y_j)]+\cos[\text{rad}(Y_i)\cdot\text{rad}(Y_j)\cdot\cos(\text{rad}(X_j)-\text{rad}(X_i))])$, where X and Y are longitude and latitude in degrees, from https://simplemaps.com/data/world-cities.

Table B.2 lists 25 broad sector categories, which are constructed using the two-digit NACE Rev 2.2 industry classification system. The table describes in detail how the 88 industry divisions are aggregated to the 25 broad sector categories. Contrasting sector affiliations of multinationals and non-multinationals reveals some notable differences. For instance, multinational plants are less prevalent in manufacture of basic and fabricated metals, construction, and public services, while they are more prevalent in utilities, transportation, and financial services. To complete the discussion of descriptives, we list the 54 countries hosting ultimate owners in Table B.3 and report the 'great circle' distance (in km) between the capitals of these countries and Berlin.

B.2 Additional control variables and robustness checks

In this section, we provide robustness checks of our main results.[20]

Table B.4: *Multinational wages and their determinants*

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Multinational parent	0.228**	0.202**	0.199**	0.190**	0.218**	0.219**	0.236**
	(0.012)	(0.013)	(0.012)	(0.013)	(0.010)	(0.013)	(0.018)
Parent profitability		0.049**	0.049**	0.048**	0.048**	0.049**	0.048**
		(0.007)	(0.007)	(0.007)	(0.007)	(0.007)	(0.006)
Outflow from adv. occ. (OA)			-0.031**				-0.021**
			(0.001)				(0.000)
Interaction OA x MNP			0.012				0.015**
			(0.009)				(0.005)
Outflow from age 25-55 (OC)				-0.058**			
				(0.001)			
Interaction OC x MNP				0.051**			
				(0.007)			
Inflow into adv. occ. (IA)					-0.126**		-0.116**
					(0.002)		(0.003)
Interaction IA x MNP					-0.082*		-0.094**
					(0.035)		(0.035)
Share simple occ. (SO)						-0.582**	-0.541**
						(0.019)	(0.023)
Interaction SO x MNP						-0.043	-0.049
						(0.033)	(0.032)
Constant	4.063**	3.840**	3.844**	3.863**	3.865**	4.423**	4.408**
	(0.007)	(0.035)	(0.034)	(0.034)	(0.031)	(0.021)	(0.014)
Other controls							
Plant and workforce	Y	Y	Y	Y	Y	Y	Y
Network size	Y	Y	Y	Y	Y	Y	Y
Observations	108,462	108,457	108,457	108,342	108,457	108,457	108,457
R-squared	0.543	0.558	0.560	0.562	0.567	0.558	0.568

Notes: Data sources are BvD and BHP. The dependent variable is the log of the plant's gross mean daily wage. Plant and workforce controls are plant size, the shares of full-time, female, non-German, medium skilled, high skilled workers among the plant's workforce, the share of workers aged 25–34, 35–44, 45–54, above 55 as well as groups of dummies for workforce occupations and broad sector categories. We further add the log of local labor market density, and a dummy indicating whether the plant is located in former East Germany. Parent firms maintain at least 25 percent of controlling interest. Standard errors in parentheses are clustered at the parent country level: $** \ p < 0.01$, $* \ p < 0.05$, and $+ \ p < 0.1$.

In Table B.4 we add, step by step, further determinants of multinational wage premia put forward in the theoretical literature. As a benchmark, column (1) repeats the estimation from Table 3, column (5), for the now smaller sample of plants for which the additional controls used

[20]In the robustness checks reported here, we do not control for plant fixed effects. However, the results do not change qualitatively when including those controls. The estimation outcomes from these additional exercises are available upon request.

in this table are available. In column (2) of Table B.4, we add log revenues per employee in the parent firm as a proxy for its profitability to account for the fact that most existing theoretical explanations build on the premise that multinationals are exceptional firms, paying higher wages because they use a superior technology, which should also be reflected in higher profits. The small reduction of the multinational wage premium indicates that access to a superior technology of the parent does not explain a major part of the wage premium paid by their subsidiaries in Germany.[21]

In columns (3) and (4) we use information on the outflow of workers to investigate the negative link between turnover and multinational wage premia proposed by Fosfuri et al. (2001), Glass and Saggi (2002), and Scheve and Slaughter (2004). The former two papers argue that multinationals pay higher wages to reduce voluntary quits by workers and thus the risk of technology dissipation. We can address this channel by adding a plant control for worker outflow from occupations classified as advanced according to Blossfeld (1987) relative to the total number of workers in such occupations. The negative effect of this turnover variable in column (2) suggests that the incentive to pay higher wages in order to avoid technology dissipation can explain higher wage payments. However, the observation from our data that multinationals experience on average higher turnover of workers from advanced occupations than non-multinationals (see the descriptives in the Appendix) indicates that paying higher wages is not a particularly successful strategy to avoid worker fluctuations. Moreover, the positive (though insignificant) coefficient of the interaction term with the multinational dummy seems to be at odds with the reasoning of Fosfuri et al. (2001) and Glass and Saggi (2002). Scheve and Slaughter (2004) point to an alternative explanation for a negative link between job turnover and wages. They argue that multinationals pay higher wages to compensate workers for a higher risk of job loss. Using information on the outflow of workers in the core age group of 25- to 55-year-olds relative to the total employment of workers from this group as further plant control allows us to address this channel. The negative effect of this variable and the observation that multinationals have higher turnover of workers in the relevant age group lends support to the channel highlighted by Scheve and Slaughter (2004). However, the positive interaction term with the multinational dummy seems in conflict with their reasoning.

In column (5) we add a control that is motivated by Girma and Görg (2007) who argue that multinationals have to train their workforce and pay a wage premium later on to compensate workers for the wage loss during the training period. Whereas our dataset lacks direct information on on-the-job training, we expect, following the reasoning in Girma and Görg (2007), that a larger inflow of workers into advanced occupations relative to the employment in these occupations lowers a plant's wage payments. This is in line with the direct negative effect of this variable reported in column (5). Girma and Görg (2007) also argue that this effect should be more pronounced for multinationals than non-multinationals, which is in line with the significant negative effect of the interaction term with the multinational dummy. In column (6) we analyze to what extent the wage premium reflects a compensation because workers in the subsidiaries of multinationals receive less support from the headquarters and therefore have to solve workplace problems more independently than non-multinationals (see Gumpert, 2017). To measure the independence of workers in the execution of tasks, we use information on the share of workers in occupations

[21] Using network size as an additional explanatory variable, it is possible that we underestimate the effect of parent profitability on wages if more profitable parents build up larger firm networks – in particular because the coefficient of network size is positive and significant.

that are classified as simple by Blossfeld (1987) as a proxy for the share of jobs, which do not require input from headquarters. A lower share of workforce in simple occupations should then be associated with higher wages with the effect more pronounced for multinationals. This is in line with the estimates reported in column (6).

In column (7) we report the results, when using the various controls outlined in columns (2) to (6) simultaneously. Since the two outflow variables are highly collinear, we cannot add these controls simultaneously and rely on the outflow of workers from advanced occupations as our preferred proxy for job turnover in the estimation reported in column (7). There, we see that accounting for the determinants put forward in the literature lowers the (residual) multinational wage premium but does not eliminate it. Taking into account the interaction terms, we compute a residual, unexplained multinational wage premium of 19.8 log points, which is only a little smaller than the estimate from the baseline specification in column (1).

Table B.5 repeats the estimation from column (5) of Table 3, but column (1) excludes very large multinational conglomerates with more than 600 subsidiaries; column (2) excludes headquarters from the sample of German subsidiaries; column (3) adds 25 sector dummies for the industry affiliation of the ultimate owner as further controls; column (4) excludes plants that are not classified as subsidiaries of horizontal multinationals; and column (5) uses the share of foreign subsidiaries instead of a dummy as an alternative, non binary measure of multinational activity.

Table B.5: *Wages and multinational ownership (robustness)*

	(1) No large networks	(2) Subsidiaries only	(3) Parent ind. controls	(4) Horizontal multinationals	(5) Non-binary measure
Multinational parent	0.259**	0.266**	0.253**	0.238**	
	(0.014)	(0.015)	(0.011)	(0.014)	
Share foreign subsidiaries					0.380**
					(0.029)
Constant	4.096**	4.083**	4.078**	4.091**	4.096**
	(0.009)	(0.009)	(0.007)	(0.006)	(0.007)
Other controls					
Plant and workforce	Y	Y	Y	Y	Y
Network size	Y	Y	Y	Y	Y
Observations	170,025	167,984	174,895	153,199	174,895
R-squared	0.469	0.452	0.469	0.387	0.455

Notes: Data sources are BvD and BHP. The dependent variable is the log of the plant's gross mean daily wage. Plant and workforce controls are plant size, the shares of full-time, female, non-German, medium skilled, high skilled workers among the plant's workforce, the share of workers aged 25–34, 35–44, 45–54, above 55 as well as groups of dummies for workforce occupations and broad sector categories. We further add a dummy indicating whether the plant is located in former East Germany and the log of the local labor market density. Parent firms maintain at least 25 percent of controlling interest. Standard errors in parentheses are clustered at the parent country level: $**\ p < 0.01$, $*\ p < 0.05$, and $+\ p < 0.1$.

From columns (1) and (2) we see that dropping outliers with very large multinational networks or dropping plants that are classified as headquarters reduces but does not eliminate the multinational wage premium. This indicates that multinational plants operating in a larger network pay higher wages and that multinationals pay higher wages in their headquarters than in their local subsidiaries, in line with the knowledge-based rationale for multinational wage premia put forward by Gumpert (2017). Column (3) shows that adding controls for the parent's industry affiliation also reduces the multinational wage premium. The results in column (4) provide further evidence for a wage premium paid by subsidiaries of horizontal multinationals. Finally, using the share of foreign subsidiaries as a measure for multinationality, we find again a considerable wage premium of multinational plants. Evaluated at the mean share of foreign subsidiaries of multinationals (0.610) this gives a wage premium of 23.2 log points, which is close to the point estimate for the dummy variable reported in Table 3.

Table B.6: *Multinational wages and distance (robustness)*

	(1) No large networks	(2) Subsidiaries only	(3) Parent ind. controls	(4) Horizontal multinationals	(5) Non-binary measure
Multinational parent	0.254**	0.256**	0.256**	0.240**	
	(0.006)	(0.003)	(0.005)	(0.014)	
Share foreign subsidaries (SFS)					0.418**
					(0.005)
Distance 1–700 km	-0.085*	-0.084*	-0.097**	-0.096^{+}	-0.016
	(0.033)	(0.032)	(0.032)	(0.049)	(0.020)
Distance 701–7,000 km	0.040**	0.047**	0.021^{+}	0.016	0.224**
	(0.012)	(0.011)	(0.011)	(0.025)	(0.021)
Distance > 7,000 km	0.110**	0.115**	0.066**	0.041*	0.346**
	(0.014)	(0.013)	(0.019)	(0.016)	(0.024)
SFS * distance 1–700 km					-0.157*
					(0.059)
SFS * distance 701–7,000 km					-0.310**
					(0.045)
SFS * distance > 7,000 km					-0.385**
					(0.032)
Constant	4.101**	4.088**	4.080**	4.091**	4.096**
	(0.006)	(0.007)	(0.006)	(0.006)	(0.006)
Other controls					
Plant and workforce	Y	Y	Y	Y	Y
Network size	Y	Y	Y	Y	Y
Observations	170,025	167,984	174,895	153,199	174,895
R-squared	0.471	0.454	0.470	0.387	0.459

Notes: Data sources are BvD and BHP. The dependent variable is the log of the plant's gross mean daily wage. Plant and workforce controls are plant size, the shares of full-time, female, non-German, medium skilled, high skilled workers among the plant's workforce, the share of workers aged 25–34, 35–44, 45–54, above 55 as well as groups of dummies for workforce occupations and broad sector categories. We further add the log of local labor market density, and a dummy indicating whether the plant is located in former East Germany. Parent firms maintain at least 25 percent of controlling interest. Standard errors in parentheses are clustered at the parent country level: $** \ p < 0.01$, $* \ p < 0.05$, and $+ \ p < 0.1$.

Table B.6 reports robustness checks regarding the role of distance for the size of the multinational wage premium. In these robustness checks, we rely on our preferred specification from column (4) in Table 4 and conduct the same experiments as in Table B.5. The results reported in columns (1) to (4) show that the main finding of a non-monotonic distance effect seems to be robust to changes in the sample of subsidiaries. Finally, evaluated at the mean shares of foreign subsidiaries the marginal effect of the non-binary multinational variable in column (5) gives a similar distance pattern as the one reported for the dummy variable in Table 4.[22]

[22]Our results are also robust to including the additional plant controls from column (7) in Table B.4, which, as outlined above, would reduce the sample of plants considerably.