Exporters, Multinationals and Residual Wage Inequality: Evidence and Theory*

Sarah Schroeder†

Aarhus University

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Abstract

This paper studies the implications for wage inequality of two distinct forms of globalisation, namely trade and foreign direct investment. I use German linked employer-employee data to (1) jointly estimate the exporter and the multinational wage premium and (2) to further distinguish between wage premia of multinational firms that are foreign owned (inward FDI) and domestically owned (outward FDI). My findings exhibit a clear hierarchy of firms' international activities with regard to wage premia and workforce ability. I interpret these patterns using a theoretical framework, which incorporates ex-ante homogeneous workers, heterogeneous firms and search and matching frictions into a multi-region model of trade and FDI with monopolistic competition. The model allows me to account for the observed empirical patterns, and delivers novel insights about the interplay between trade, FDI and labour market institutions.

JEL classification: F14, F16, J31

Keywords: wage inequality, trade, fdi, labour market frictions

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†Department of Economics, Aarhus University, 3 Fuglesangs Allé 4, 8210 Aarhus V, Denmark; sschroeder@econ.au.dk

1. Introduction

A number of studies have documented that exporters pay more for seemingly identical workers than firms that only serve the domestic market. This is known as the "exporter wage premium".[1] However, exporting is not the only manner in which firms can access foreign markets: some firms do so through foreign direct investment (FDI) and, indeed, many exporting firms also engage in FDI. This raises the question whether exporting per se, or multinational activity, has been the driving force of wage inequality between observationally equivalent workers.

Figure 1 presents the share of workers in German firms with different modes of foreign market entry, for the years 2006 and 2010. It highlights that a growing share of workers are employed by firms which are active in international markets via either exporting, FDI or both.[2] Moreover, the share of workers employed by multinational firms – those who engage in FDI – has grown the most.

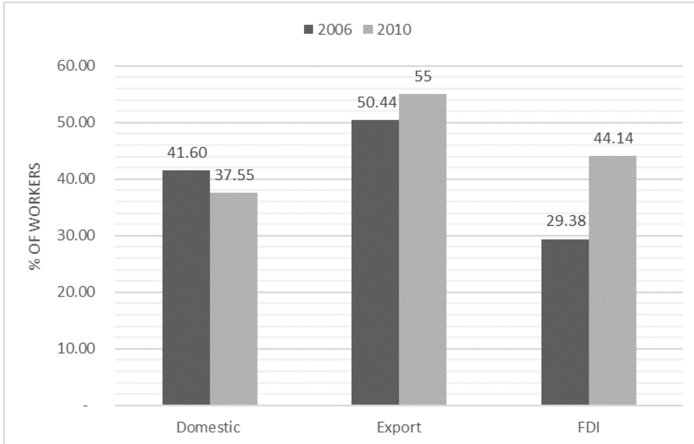
Figure 2, in turn, presents the kernel density of the (log) daily wage in 2006 for German workers employed in three different firm types: firms which only serve the domestic market ("local firms"), firms which export but do not report FDI ("exporters"), and firms which report some FDI ("MNEs"). The graph suggests that the wage distribution of workers at MNEs first order stochastically dominates the wage distributions of workers at local firms and exporters.

Figure 1 and 2 together highlight that the distinction between exporters and multinationals is important when studying the impact of different facets of globalistaion for wage inequality. This paper is among the first to (1) jointly estimate the exporter and the multinational wage premium and (2) to further distinguish between wage premia of multinational firms that are foreign owned (inward FDI) and domestically owned (outward FDI). My findings exhibit a clear hierarchy of firms' international activities with regard to wage premia and the average workforce ability, where MNEs can be ranked highest. I interpret these patterns using a theoretical framework, which incorporates ex-ante homogeneous workers, heterogeneous firms and search and matching frictions into a three-region model of trade and FDI with monopolistic competition.
The model allows me to account for the observed empirical patterns, and delivers novel insights about the interplay between trade, FDI and labour market institutions. The empirical analysis of this paper is based on linked employer-employee data for Germany (LIAB), which contains detailed information concerning worker and firm characteristics, firms' ownership status, as well as exporting and FDI activity. Information on outward FDI is only available for 2006 and 2010 and hence, limits the analysis to these two sample periods.[3]

[1] See for example Bernard, Jensen, and Lawrence (1995),Schank, Schnabel, and Wagner (2007), Verhoogen (2008) and Helpman, Itskhoki, Muendler, and Redding (2017) for empirical evidence on the exporter wage premium.

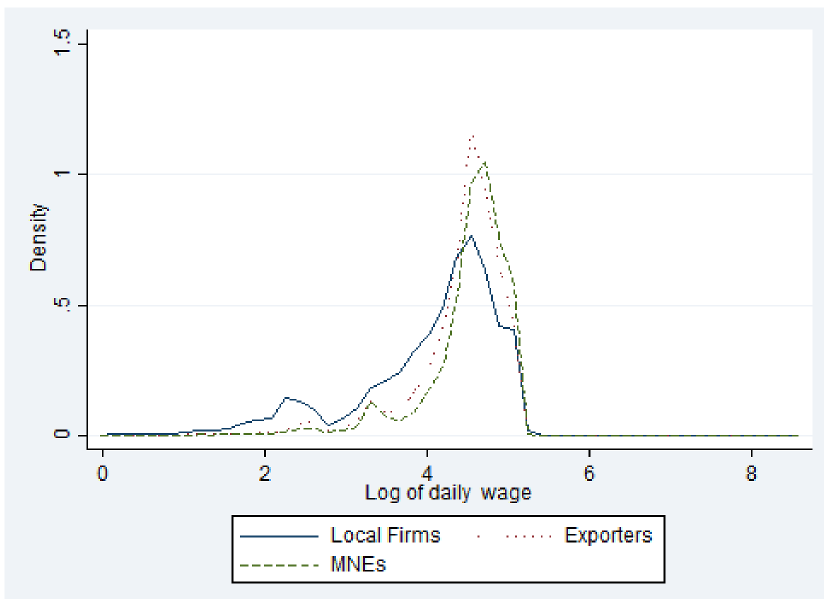
[2] Shatz and Venables (2000), Navaretti, Venables, and Barry (2004) and Antràs and Yeaple (2014) provide some stylized facts concerning recent developments regarding exporting and multinational activity.

[3] The fact that the major share of German FDI flows is in the form of outward FDI (OECD (2018)), suggests that, when analysing the MNE wage premium for Germany, it is particularly important to include information on German firms' multinational activity.



Notes: The figure shows the share of workers in domestic, exporting and FDI establishments in Germany. Firms are classified as: (1) Domestic, i.e. firms with no international activity, (2) exporters, which are firms that report positive exporting, and (3) 'FDI', are firms that report inward/outward FDI. The analysis is based on German linked employer-employee (LIAB) data for the year 2006 and 2010. The sample corresponds to all private sector firms with at least 5 employees and workers between 16 and 65 years for which data is available on a set of individual characteristics.

Figure 1: Share of Workers in Exporting and FDI Firms in Germany (2006-2010)



Notes: The figure shows the kernel density of the (log) daily wage distribution in 2006, broken down by firm-types, i.e. Local firms , exporters and MNEs. MNEs here include, foreign owned MNEs, domestic MNEs and hybrid MNEs. Statistics refer to all observations in the sample. See Table 1 & 2 for detailed descriptive statistics on individuals and firms.

Figure 2: Wage density by firm-type

In the baseline regression I focus on the cross-sectional data of 2006 in order to shed some light on how observed firm and worker heterogeneity can explain part of the variation in wages. Estimation results of this specification show that pure exporters pay, on average, 1.4% and MNEs 7.3% more for seemingly identical workers. For the representative worker in my sample (in 2006) this implies that he would receive about 2810.5 euros extra per year if employed for a MNE.[4]

Because the cross-sectional analysis ignores the possible sorting of workers with higher unobserved ability into specific firm types, I further explore to what extent unobserved worker ability shape my findings. To do so, I make use of the available panel dimension (2006-2010), by adding individual-, firm- and spell fixed effects. After controlling for time-invariant unobserved and observed firm and worker heterogeneity, the exporter premium is about 1.9% and the MNE wage premium 2.5%. The fact that MNE wage premia reduce by relatively more, after controlling for unobserved heterogeneity, is suggestive evidence for assortative matching between firm type and workers on observable unobservable ability.

In order to account for these observed features in the data, I build a three-country, two-sector general equilibrium model that links these two distinct forms of globalisation, namely trade and FDI, to differences in wages, employment and workforce composition across firms. The mechanism is based on a model with ex-ante homogeneous workers, heterogeneous firms and search and matching frictions as in Helpman et al. (2017), within a trade model with monopolistic competition á la Melitz, Helpman, and Yeaple (2004).[5] By including foreign direct investment by multinational firms, this paper provides novel insights into the interaction between firm specific factors and firms' international activities in determining wage inequality and in particular, the multinational wage premium.

The model features three sources of firm heterogeneity. Besides the by now standard productivity heterogeneity à la Melitz (2003), the model additionally incorporates firm heterogeneity with respect to the size of fixed costs of market entry, and heterogeneity in the cost of screening workers. While the first source of heterogeneity may be attributed to a firm's ability to *use* the given resources of the firm, the efficiency in screening relates to a firm's ability to *find* the right labour inputs.[6]

The choice of serving the foreign market is modeled as in Melitz et al. (2004), where firms can choose between two ways of foreign market access. Relative to FDI, exporting involves lower sunk costs but higher per-unit trade cost. The idea is that, firms engage in FDI activity when the gains from avoiding transport costs outweigh the costs of maintaining capacity in multiple markets.[7] Firm characteristics are systematically related to international activity, where firms with superior

[4]The example of the median worker serves a mere illustrative purpose. The median worker in the sample receives a daily wage of about 105.5 euros per day. Hence, a MNE premium of 7.3% implies that an observationally identical worker receives about 7.7 euros more per day and aggregated to a year this would be about 2810.5 euros extra. Given that the average worker is about 40 years old, all other things equal, he would have earned about 70,060 euros more when entering retirement than his 'identical twin' in the local firm.

[5]Melitz et al. (2004) build upon the Melitz (2003) trade model to explain the decisions of heterogeneous firms to serve foreign markets through exports or local subsidiary sales.

[6]Alternatively, the cost of screening can be interpreted as the unobserved part of a firm's productivity, as this kind of information is usually unavailable to the econometrician.

[7]This is more generally known as the proximity-concentration trade-off. Brainard (1993) shows how trade costs, market size, and plant-level economies of scale interact to explain the export and FDI decision of firms producing differentiated products.

average characteristics – in terms of productivity, screening efficiency or fixed export/FDI cost – become exporters and firms with an even higher firm specific triplet, serve foreign markets via FDI.

Firms and workers meet in a labour market characterized by Diamond-Mortensen-Pissarides-type search and matching frictions. *Ex-ante* a worker's ability is not directly observable by his employer. Firms have access to a costly screening technology which allows them to identify workers with ability below a certain ability threshold, but it cannot identify the precise ability of each worker. Due to complementarities between the firm productivity and the average ability of its workers, firms have an incentive to screen workers to exclude those which fall below the chosen ability-threshold and in so doing, improve the average ability of their workforce. Hence, the model features imperfect assortative matching on unobservables in the labour market.

The main result can be described as follows. Firms with higher average characteristics are larger, more selective in the labour market and since higher-ability workforces are more costly to replace in the bargaining game, they also pay higher wages. Through this mechanism, internationalising firms are larger, have workforces of higher average ability and pay higher wages than non-internationalising firms.[8] Moreover, in line with my empirical findings, the mode of foreign market entry exhibits a clear hierarchy, where FDI firms can be ranked higher with regard to size, average workforce ability and wage premia.

I use this general equilibrium model of three regions to further discuss the implications of the model for wage differences between exporters, FDI firms and non-internationalising firms. Furthermore, a back-of-the-envelope calculation provides novel insights concerning the interplay of firms' internationalisation decisions and firms' ability to find the right workers in a frictional labour market. The analysis suggests that the hierarchy of firms' international activities with regard to their screening efficiency, mirrors the ranking of wages across these firm types. This finding implies that differences in the screening efficiency across various types of firms plays a key role in explaining wage premia and thus, constitutes an important part of the 'black box' of the firm, which previously in the literature have been proxied by fixed effects estimations.

To further investigate the sorting pattern between internationally active firms and workers on unobserved skills, I back out the worker fixed effect to obtain a measure of unobserved worker ability. The mean of of this worker effect on the firm level helps to identify, whether on average exporters and MNEs have workforces of higher average unobserved skills. A simple OLS regression of the mean unobserved skills per firm on a set of firm characteristics, confirms that workers with higher unobserved ability sort into exporters and even more so into MNEs. Hence, the estimation results provide corroborating evidence for the theoretical framework, suggesting that the proposed theoretical mechanism is a reasonable approximation of the observed patterns in the

[8]Therefore, this framework features residual wage inequality in the sense that *ex ante* identical workers receive different wages depending on whether they are matched with an exporter, a multinational firm or non-internationalising firms.

data. I additionally explore the sorting pattern with regard to observed worker skills in terms of educational level and the complexity of tasks performed. The estimation results suggests that exporters and MNEs employ, on average, more skilled workers than local firms. To the extent that unobserved and observed individual characteristics also matter for firm outcomes, these findings suggest that there is a 'skill-internationality' complementarity.

Related Literature. This paper contributes to the growing literature on the effects of globalisation on labour market outcomes. The empirical part of the paper is related to a number of recent studies, which analyse the link between globalisation and wages using firm-level and linked employer–employee data.[9] My theoretical framework, in turn, shares some basic features of heterogeneous firm models that link firms' employment and wage outcomes to trade participation through a Melitz (2003) mechanism (e.g. Egger and Kreickemeier (2009), Helpman, Itskhoki, and Redding (2010), Felbermayr, Prat, and Schmerer (2011) and Coşar, Guner, and Tybout (2016)).[10]

The paper by Helpman et al. (2017) is most closely related to mine for two reasons. First, they use Brazilian data to estimate the exporter wage premium. However, their paper is silent on whether the exporter premium is driven by 'pure' exporters or MNE-exporter, which I distinguish in my analysis. Furthermore, they only report the exporter wage premium for the cross-section of 1994 and do not exploit to what extent unobserved worker abilities matter.

Second, my theoretical framework can be viewed as an extension of Helpman et al. (2017). Motivated by stylised facts regarding the exporter wage premium, they build a model that focuses on wage inequality between firms for workers with similar observed characteristics. They extend Helpman et al. (2010) which features heterogeneity in firm productivity, to also incorporate heterogeneity in the cost of screening workers and the size of fixed exporting costs. In doing so their theory explains positive exporter premia for employment and wages and predicts imperfect correlations between firm employment, wages and export status.[11]. Concerning the theory part, my main point of departure from Helpman et al. (2017) is the introduction of multinational activity. This part of my theory is based on the framework by Melitz et al. (2004).[12]

Apart from papers, which relate to the exporter wage premium (e.g. Bernard et al. (1995) Schank et al. (2007), Verhoogen (2008), and Baumgarten (2013)) , my analysis is in particular related to a growing literature that aims at measuring and explaining multinational wage premia.[13]

[9]The paper also contributes to research that investigates the effect of openness on the process of matching between firms and workers, as for example studied by Davidson, Heyman, Matusz, Sjöholm, and Zhu (2012), Sampson (2014), Bombardini, Orefice, and Tito (2015) and Grossman, Helpman, and Kircher (2017).

[10]Many other recent papers examine the effects of trade on labour market outcomes, such as
Davidson, Martin, and Matusz (1999), Davidson, Matusz, and Shevchenko (2008)Amiti and Davis (2011), Dix-Carneiro (2014), and Grossman et al. (2017).

[11]Their findings are in line with other empirical studies that establish the existence of the exporter wage premium, such as Bernard et al. (1995) Schank et al. (2007), Verhoogen (2008), and Baumgarten (2013)

[12]Other theories of exporting and FDI are for example Horstmann and Markusen (1992), Brainard (1993) and Markusen and Venables (2000).

[13]Studies based on firm-level data (e.g. Lipsey (2004) or using linked employer-employee data, such as Heyman, Sjöholm, and Tingvall (2007), Görg, Strobl, and Walsh (2007) and Martins (2011) analyse the foreign ownership

As most studies can not distinguish between domestically owned and foreign owned MNEs, what has been labeled in the literature as MNE wage premium, usually refers to the foreign ownership wage premium.[14] Most closely related to my paper is Tanaka (2015), who estimates the MNE wage premium for Japan. To the best of my knowledge, this is the only other paper, using employer-employee data, to jointly estimate the exporter and MNE premium. His study uses the quantile regression technique to reveal the premium in each quantile of the wage distribution. This is a dimension I do not explore. Instead, my paper focuses on establishing facts with respect to differences in pay between different firm types and sorting and matching patterns between internationalising firms and workers of different skills.

Finally, as my paper provides a theoretical explanation for the multinational wage premium, it contributes to the growing literature examining the implications of multinational activity for labour market outcomes. Theoretical contributions include Fosfuri et al. (2001), Glass and Saggi (2002), Egger and Kreickemeier (2013) and Gumpert (2015) and Heyman et al. (2007), Görg et al. (2007) and Martins (2011) provide empirical evidence for the multinational wage premium.

The remainder of the paper is structured as follows. In section 2, I present the data and analyse the different wage premia based on different specification. Section 3 outlines the model and solves for general equilibrium. In section 4 I discuss the model implications regarding wage premia, including a quantitative assessment of the theory. Lastly, section 5 concludes.

2. The Exporter and MNE Wage Premium for Germany

This section formally documents wage premia for exporters and multinationals in Germany. To do so, I first present the data and describe the classification of the different firm types. Subsequently, I run regressions for the cross-section of 2006 to unravel the different wage premia. I then add the panel dimension to my analysis to account for time-invariant unobserved firm and worker heterogeneity.

2.1. Data

2.1.1. Data Description

The analysis is based on matched employer-employee data for Germany, which is provided in the the linked employer-employee data (LIAB) from the Institute for Employment Research (IAB). I focus on the years 2006 and 2010, which are the years where information on exporting and multi-

wage premium. However, the overall implications of these recent studies are not well understood, as the results are qualitatively mixed. Some studies seem to confirm the existence of a MNE (foreign ownership) wage premium and others find insignificant or even a negative effect.

[14] Theoretical contributions in the literature have suggested different mechanisms for the existence of the MNE wage premium. See for example Fosfuri, Motta, and Rønde (2001), Glass and Saggi (2002), and Egger and Kreickemeier (2013)Gumpert (2015).

national activity is available. The core of this dataset is the IAB establishment panel, which is a representative employer survey of employment parameters at individual establishments. Using a common establishment identifier, administrative worker-level information from the German Federal Employment agency is matched with the survey. See Alda, Bender, Gartner et al. (2005) for an overview of the LIAB data set.

IAB Establishment Panel

The IAB Establishment Panel is a longitudinal survey, i.e. a large majority of the same establishments are interviewed every year. As a result, it enables both analysis of developments across time through comparison of cross-sectional data at different points in time, and also longitudinal studies of individual establishments. It contains about 16,000 establishments in Germany that employ at least one worker who pays social security contributions. As there are about 2.9 million establishments in Germany (in 2014), the IAB Establishment Panel covers roughly 0.55% of all establishments. The survey was launched in western Germany in 1993, with the aim of building up a representative information system for continuous analysis of labour demand. It was extended to eastern Germany in 1996, making it a nationwide survey. Establishments in the IAB Panel are surveyed on various employment policy-related subjects, including business policy and business development, employment development, personnel structure, wages and salaries, investment activities and other general data on the establishment. The survey also includes varying focal topics every year. The IAB Establishment Panel is regarded as containing high data quality, achieved by means of the high-quality sample, the high exploitation level and the sophisticated process of data monitoring and error correction. Fischer, Janik, Müller, and Schmucker (2009) provide an in-depth discussion about the sampling methods.

Individual-Level Data

Data on individuals come from the Integrated Employment Biographies (IEB) of the IAB. The IEB cover all workers, subject to social security contributions. This amounts to about 80 percent of German workers, excluding civil servants, self-employed, family workers and workers in marginal employment. This data includes detailed information on several worker characteristics, such as gender, age, nationality, education, tenure and wage compensation. According to the social security notification regulations, employers ought to report these data at the end of each year, and at the beginning and end of each employment spell. However, because of a reporting ceiling in the German social-security system, wages are right-censored at the contribution limit. The data allows to comprehensively follow individuals over time, including a large number of individuals who switch from one plant in the sample to another one also in the sample.

International Activity and Classification of Firms

At the plant-level, the data comprise information about exporting as well as multinational activity of firms. While information on exporting is available for all years, information of FDI activity is only available for the years 2006 and 2010.[15] Exporting is measured as the share of sales obtained in export markets. As the LIAB contains variables that can be used as proxies for outward FDI, I am able to distinguish between domestic and foreign owned MNEs. In 2006 establishments were asked whether they had any 'foreign investment in 2004-2005', where foreign investment involves extensive ownership stakes in domestic companies and assets of more than 10%. However, in 2010, establishments are required to report if they have 'current activity abroad (takeover, foundation or equity participation)'. This is a more general question, since equity participation may be less than 10% of the foreign company's asset. As a result, it may difficult to identify among the firms that switch their firm type between 2006 and 2010, those that actually changed their mode of foreign market. However, only about 5.6% of all MNEs that are in the 2006 and 2010 panel, switch their status from MNE to non-MNE firm. The percentage of firms switching from non-MNE to MNE between the periods is a bit higher with 27.4%.

Furthermore, I can use the ownership status of the firm to identify foreign owned MNEs. By definition, a firm under foreign ownership is a multinational enterprise. With the information on whether a firm exports and/or is a classified as a MNEs, we can distinguish between two types of exporting firms. First, 'pure exporters' are exporters that are non MNEs and second, 'hybrids' are MNEs that engage in exporting. The classification of firms is in correspondence to the ownership status (foreign or domestic) and the internationalisation decision (exporting and/or FDI) of the firm, which gives rise to 5 different types of firms:

1. *Local*: firms that are domestically owned and do not participate in international markets.
2. *Exporters*: these are the 'pure' exporting firms, i.e. firms that are domestically owned and serve foreign markets via exporting, but do not report outward FDI.
3. *Domestically owned MNEs*: firms under domestic ownership that report positive outward FDI, but do not export.
4. *Foreign owned MNEs*: are establishments under foreign ownership, without positive exports.
5. *Hybrid*: firms that report positive exports and are MNEs, i.e. either fall into category (3) or (4)

[15] Information about the export destination and FDI recipient countries is limited and, thus, cannot be used for the purpose of this study.

Sample Restriction

The sample includes all firms within the private sector, for which we have information on ownership, industry and size of the workforce (at least 5 employees). On the worker side, I take all individuals into account that are within the working age population, i.e. between 16 and 65 years. Furthermore, I restrict the sample to all fulltime workers where information is available in both sample years.

2.1.2. Descriptive and Non-parametric Statistics

Firm Level Statistics

Table 1: Number of firms and workers by firm-type (2006)

Firm type	No. of firms	%	No. of workers	%
Local	**3,086**	**64.57**	**105,776**	**31.80**
Exporter	**1,090**	**20.88**	**128,372**	**38.59**
MNE	**603**	**12.61**	**98,506**	**29.61**
Domestic	48	1.00	5,133	1.54
Foreign	150	3.14	12,210	3.67
Hybrid	405	8.47	271,386	24.40
Total	**4,779**	**100.00**	**332,654**	**100.00**

Notes: Analysis based on LIAB data for the year 2006. The sample corresponds to full-time workers between 16 and 65 years of age, where data is available for a set of worker and firm characteristics in both sample periods.

Table 1 gives the frequency distribution of firms and workers by firm-type for the year 2006. Among 4,779 firms in the sample, 3,086 (65%) are local, 1,090 (21%) are exporters and a total of 603 (13%) are MNEs. Within the category of MNEs only 48 (1.00%) are domestically owned MNEs, 150 (3%) are foreign owned MNEs and 405 (9%) are hybrid MNEs, i.e. firms that export and engage in FDI activity.

With respect to the number of workers by firm-type, we ascertain that the majority (39%) works for exporters , 32% for local firms and about 30% is employed by MNEs, where 2% work for domestic MNEs, 4% in foreign owned MNEs and 24% in hybrid MNEs. The total number of employees in the 2006 sample is 332,654. Notice that although the percentage share of MNEs accounts for only 13% , these firms employ an over-proportional fraction of the total workforce in the sample. This observation suggests that MNEs tend to be on average larger firms.

Table 2: Firm - Worker Statistics

	Local				Exporter				MNE			
	min	mean	max	sd	min	mean	max	sd	min	mean	max	sd
daily wage	1.03	96.33	212.97	38.77	1	105.56	237.77	36.73	1.13	115.10	212.05	38.14
tenure	0	10.13	31.50	7.41	0	12.22	31.5	7.89	1.13	115.10	212.05	38.14
age	16	41.16	61	9.96	16	40.66	61	9.87	16	40.63	61	9.59
woman	0	0.28	1	0.45	0	0.16	1	0.34	0	0.17	1	0.34
foreign	0	0.04	1	0.20	0	0.06	1	0.24	0	0.07	1	0.25
firm size	5	897.64	13702	11055.461	5	9958.35	44494	16949.73	5	2501.34	15096	3700.11
Observations	105776				128372				98497			

Notes: Analysis based on LIAB data for the year 2006. The sample corresponds to full-time workers between 16 and 65 years of age, where data is available for a set of worker and firm characteristics in both sample periods.

Worker-Level Statistics
Worker-level descriptive statistics of daily wages according to the different firm-types are presented in Table 2 above. The table indicates that local firms pay the lowest wages, followed by ascending order of exporters, foreign owned MNEs, domestic MNEs and hybrid MNEs. Furthermore, Table 2 summarises some additional worker statistics for the three different firm types, including tenure at the firm (in years), age, and information on the dummies for gender (1 equals woman) and nationality (1 equals foreign).

Table 2 and Figure 2, indicate that the differentiation between exporter and MNEs is important when studying the implications of globalistaion for wage inequality in Germany.

2.2. *The Exporter and MNE Wage Premium*

This section outlines the empirical strategy to analyse the existence and magnitude of the MNE and exporter wage premium. In the baseline regression I focus on the cross-sectional data of 2006 in order to shed some light on how observed firm and worker heterogeneity can explain part of the variation in wages. The subsequent subsection then accounts for unobserved firm and worker characteristics by adding fixed effects to the baseline regression. For this purpose, I explore the panel dimension of the data (2006-2010). This enables us to disentangle the different sources of the wage premia and may highlight potential sorting patterns on unobservables. Complementary, the analysis of a sample of firm-movers, examines and compares the wage growth of workers moving to different firm types.

2.2.1. *Baseline Regression*

Using German linked employer-employee data for the year 2006, I test whether firms that participate in international markets via different modes of market entry (i.e. exporting, FDI or both), pay different wages relative to firms that are only active in the domestic market. I employ a OLS estimation using the following Mincer wage regression

$$logw_{ij} = d_s + d_o + FTYPE_j'\beta_1 + FSIZE_j'\beta_2 + X_i'\beta_3 + \upsilon_{ij}, \tag{1}$$

where the index j identifies the firm at which worker i is employed. The dependent variable is the log daily wage $logw_{ij}$ of individual i; d_s and d_o denote sector and occupation fixed effects;

the categorical variable $FTYPE_j$ indicates the firm type, i.e. *Local*, *Exporter*, MNE_{For}, MNE_{Dom} and *Hybrid*. $FSIZE_j$ controls for the size of the firm, measured by the log size of the firm's workforce, X_i is a vector of observable worker characteristics and υ_{ij} is a residual. The coefficients of interest are contained in the vector β_1, which captures the wage premia the different firm types pay, i.e. an exporter wage premium and premia for working for any of the three types of MNEs (domestic MNEs, foreign owned MNEs and hybrid MNEs). Moreover, β_2 represents the employment size wage premium.

The five different firm types follow the classification as outlined in section 2.1. Furthermore, I control for worker observables nonparametrically, including, gender, age, nationality (foreign or not), education (low, medium, high), occupation and tenure at the firm.

Table 3: Unravelling the different Wage Premia (2006)

	(1) No Controls	(2) +Size	(3) +Industry	(4) +Occ	(5) +obs
$Exporter$	0.117***	-0.00797***	0.00954***	0.0208***	0.0138***
	(0.00181)	(0.00178)	(0.00216)	(0.00189)	(0.00165)
MNE_{For}	0.185***	0.116***	0.0914***	0.0987***	0.0826***
	(0.00417)	(0.00390)	(0.00396)	(0.00341)	(0.00299)
MNE_{Dom}	0.173***	0.103***	0.111***	0.0239***	0.0384***
	(0.00623)	(0.00583)	(0.00584)	(0.00499)	(0.00436)
MNE_{Hyb}	0.215***	0.106***	0.117***	0.0721***	0.0744***
	(0.00203)	(0.00196)	(0.00235)	(0.00205)	(0.00180)
$\log size$		0.0881***	0.0802***	0.0741***	0.0667***
		(0.00034)	(0.00042)	(0.00038)	(0.00045)
Observations	332,645	332,645	332,645	332,645	332,645
Firms	4,779	4,779	4,779	4,779	4,779
R^2	0.035	0.158	0.188	0.430	0.565

Notes: Regressions based on LIAB data for the year 2006. The sample corresponds to full-time workers between 16 and 65 years of age, where data is available in both sample periods. Dependent variable is the log daily wage. Firm variables include the firm type (local, exporter and 3 different MNEs), the log of employment (size) and 17 industry catagories. Worker observables include: gender, age, nationality (dummy for foreign), tenure at the firm, 340 different occupations and the educational level. The education groups are defined as: 1) low: no vocational training, no high-school; 2) medium: high school and/or vocational training; 3) high: university or technical college. Standard errors in parentheses. Asterisks indicate significance at: * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

Table 3 summarises the estimation results based on five different types of wage regressions, which differ with respect to the controls included at the right hand side. The first regression in column 1, captures the 'raw' difference in pay between the different firm types, excluding any further controls for firm or worker characteristics. The wage premia can consequently be interpreted as follows: Firms that serve foreign markets by exporting only, pay on average, 11.7%

higher wages than local firms. Foreign MNEs, domestic MNEs and hybrids, on average, pay a premium of 18.3%, 17.2% and 21.9%, respectively. Not surprisingly, this reduced form regression has a very low adjusted R^2 of 0.035.

The second specification (see column 2) adds the log of the total number of employees to the regression. Consistent with a large empirical literature in labour economics, larger firms on average pay higher wages (see e.g. Brown and Medoff (1989) and Oi and Idson (1999) for surveys).The coefficient for the log of employment is given by 0.088, implying that an increases in employment by one percent, increases the wage rate by about 0.088 percent. As MNEs and exporting firms tend to be larger than local firms, the coefficients for the different firm types decrease. Note, however, that after controlling for the size of the firm, the coefficient for exporters negative, implying a negative exporter premium of -0.8%. As documented by Felbermayr, Hauptmann, and Schmerer (2014) the exporter wage premium in Germany is non-monotonic, with firms with medium-sized export shares paying the largest premium. Note as well that I classify exporters in a more narrow way than previous studies, who would include hybrid-MNEs, i.e. firms that engage in FDI and exporting activity into their 'exporter' category. This, together with the fact that I do not control for firms' export shares, might explain the negative, yet very small coefficient after controlling for the size of the firm. The coefficients for the different MNEs become more similar to one another, but remain with on average 11% still relatively large. Similarly, the small increase of the adjusted R^2 to 0.158, suggests that some of the observed differences in pay of exporters and MNEs, relative to local firms (see column 1), can be explained by the size of the firms.

The results in column 3 and 4 are based on a regression that further includes industry and occupation fixed effects, respectively. The exporter premium now becomes positive again, implying that industry and occupation characteristics are strongly enough correlated with the export status to reestablish a positive premium of about 2.8%. The decrease in the coefficients for the different MNEs under these specifications suggests that the difference in pay between the different firm types, as captured in column 1, are mainly due to specific industry and occupation characteristics. This result implies that MNEs belong to high-wage industries and/or have a larger share of high-paying occupations. The strong increase of the adjusted-R^2 to now 0.430 in column 4 confirms this finding. Thus, after controlling for firm-size, industry and occupation fixed effects, the exporter wage premium is still about 2.8% and that of MNEs on average about 7.5%.

The last specification, presented in column 5, adds the vector X_i of worker characteristics, including gender, age, nationality (dummy for whether worker is foreign), education and tenure at the firm, to the regression. As expected, adding worker observables further raises the adjusted-R^2, now taking a value of 0.565. However, the coefficients for the different firm types change very little relative to the previous specification with industry and occupation fixed effects. More precisely, the exporter wage premium reduces to 1.4% and for foreign owned MNEs, domestic MNEs and hybrids to 8.2%, 3.7% and 7.3%, respectively. The coefficients of the different firm-types are statistically significant at the 1% in all four specifications. Furthermore, the MNE and exporter premium are significantly different from one another.

Taken together, the results from the cross-sectional regressions establish the first stylised fact:

Fact 1: *Even after controlling for firm-size, industry, occupation and worker characteristics, Firms participating in global markets pay higher wages than firms that operate only in the domestic market, where MNEs pay higher premia than exporters.*

Lastly, it should be noted that previous studies, documenting the exporter wage premium, do not distinguish between 'pure exporting' firms and MNEs with exporting activity. Moreover, estimations of the traditional exporter wage premium include domestic non-exporting MNEs. Hence, their exporter premium picks up both, the effect of exporting and of FDI. A look at Table 3 makes clear that the 'traditional' exporter premium would be precisely driven by hybrid MNEs, i.e. multinationals, which report positive exporting. This finding establishes the second stylised fact:[16]

Fact 2: *Part of the exporter wage premium estimated by previous studies is in fact a MNE premium, i.e. MNEs with exporting activity.*

2.2.2. Panel Regression

The cross-sectional analysis ignores the possible sorting of workers with higher unobserved ability into specific firm types. In order to account for time invariant unobserved worker and firm heterogeneity, I estimate a regression of log daily wages on worker and firm observables, including worker, firm or a unique worker–firm combination (spell) fixed effects. In the labour literature this method is known as the AKM decomposition (Abowd, Kramarz, and Margolis (1999)). For this estimation, I use the available data for 2006 and 2010. I next extend the baseline regression in (1) to exploit the panel dimension of the data. The adjusted OLS mincer wage estimation is then given by

$$logw_{ijt} = d_s + d_o + FTYPE'_{jt}\beta_1 + FSIZE'_{jt}\beta_2 + X'_{it}\beta_3 + \mu + \alpha_i + \sigma_j + \psi_{(i,j)} + v_{ijt} \quad (2)$$

again firms are indexed by j and workers by i and $logw_{ijt}$ is the log daily wage worker i employed by firm j at time t. This estimation now includes a year fixed effect μ, an individual fixed effect α_i, an establishment fixed effect σ_j and a spell fixed effect $\psi_{(i,j)}$. Introducing worker fixed effects allows me to address the issue of workers sorting on unobserved ability into specific firm types. A firm fixed effect controls for time-invariant firm characteristics. The fixed effects method implies

[16] Table 8 in the Appendix presents the 'traditional' exporter wage premium, where pure exporters and MNEs with exporting activities are pooled together.

that identification of the firm type coefficient (β_1) is driven only by those workers who move to firms of a different type between the two sample periods, or by firms which switch type. Moreover, for this specification I aggregate the three different MNE firm types together as I am going to focus on the difference in pay between local firms, exporters and MNEs as a whole.

Table 4: Controlling for Unobserved Heterogeneity

	(1)	(2)	(3)	(4)
Exporter	0.0299***	0.0206***	0.026***	0.0191***
	(0.000877)	(0.000958)	(0.00165)	(0.000932)
MNE	0.0492***	0.0269***	0.0161***	0.0250***
	(0.000932)	(0.00104)	(0.00181)	(0.00102)
log *size*	0.0692***	0.0332***	0.0463***	0.0259***
	(0.000232)	(0.00109)	(0.00181)	(0.00102)
Individual FE		x		
Firm FE			x	
Spell FE				x
Time FE	x	x	x	x
Worker controls	x	x	x	x
Firm controls	x	x	x	x
Observations	665290	665290	665290	665290
Firms	5,490	5,490	5,490	5,490
R^2	0.430	0.574	0.456	0.579

Notes: Regressions based on LIAB data for the year 2006 and 2010. The sample corresponds to full-time workers between 16 and 65 years of age, where data is available in both sample periods. Dependent variable is the log daily wage. See notes of table 4 for the set of firm and worker observables. Standard errors in parentheses. Asterisks indicate significance at: * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

Table 4 summarises the estimation results of equation (2). The first three specifications capture three different conventional models, as each controls for heterogeneity from only one side of the market, at best. The fourth specification includes both sets of time-invariant heterogeneity through a spell fixed effect effect. The idea here is to assess the extent to which estimates on the firm-type are affected by worker- and firm-level covariates. This allows me to assess to what extent time-invariant unobserved worker and firm characteristics are correlated with the firm-type. Firm type coefficients remain significant at the 1% level for all specifications and coefficients for exporters and MNE status are significantly different from each other.[17] The first column captures the results of a simple pooled ordinary least squares (POLS) estimation including year fixed effects. This estimation confirms the findings presented in Table 4 that MNEs pay higher wage premia than exporters. Note, however, that relative to the numbers from the cross-sectional analysis, the premium for exporters has now increased slightly, taking a value of 2.9% and the equivalent coefficient for MNEs has decreased from about 8% to 4.9%.

The second column shows the results for the individual fixed effect regression, which takes care of unobserved worker heterogeneity, such as ability, productivity, social competence, networks and so forth. The increase in the R^2 from 0.487 to 0.574, indicates that unobserved characteristics of workers, captured by individual fixed effects, contribute to the variance of log wages. This is also reflected in lower wage premia for exporters and MNEs, where the coefficient for MNEs reduces by relatively more, suggesting a potentially stronger correlation between worker unobservables and MNE status.

The third column includes firm fixed effects to control for time-invariant unobserved firm heterogeneity. The results of this regression, however, have to be interpreted with caution. One potential limitation is that there may be only little variation in the firm-type variable during this relatively short period of 4 years (2006-2010). Furthermore, variation in firm-types, may not be caused by actual changes in the way firms participate in international activity, but may be due to to the fact that the survey questions concerning outward FDI vary slightly in the two given years.[18] This caveat may affect the estimated coefficient for exporter and MNE wage premia. Keeping this caveat in mind, the table reports that after controlling for unobserved characteristics of employers, captured by employer fixed effects, the exporter wage premium (2.6%) is now larger than the premium payed by MNEs (1.6%). The low value of the R^2, relative to the other specifications, suggest that firm fixed effects on their own contribute little to the variance of log wages.

Combining worker fixed effects and firm fixed effects (see column 4) through a spell fixed effect, accounts for unobserved match-specific heterogeneity. A potential source of match heterogeneity in wages is complementarity between the skills of the worker and the needs of the firm. To the extent that the individual worker has significant bargaining power, this complementarity will be rewarded in the form of higher wages. Concerning the validity of the coefficients, however, the same caveats hold as were the case for the firm fixed effects specification: within-group variation may be a noisy measure of true firm-type changes. Under this last specification, MNEs on average, pay the highest wages with a premium of 2.5% and the exporter premium is 1.9%. Under this last specification the R^2 takes the highest value of 0.580.

[17] In the Appendix I provide results for the panel regression with the more detailed classification of MNEs.

[18] In 2006 establishments were asked whether they had any 'foreign investment in 2004-2005'. In 2010 the question is formulated in a more general sense, whether they have 'current activity abroad (takeover, foundation or equity participation)'. Foreign investment involves extensive ownership stakes in domestic companies and assets of more than 10%. Whereas, the question in 2010 refers to equity participation in general, which may be less than 10% of the foreign company's asset.

In summary, after including worker fixed effects the exporter and MNE wage premia reduce significantly, implying that unobserved worker characteristics are positively correlated with firms' international activities. Additionally, taking results from the spell fixed effects regression into account, gives suggestive evidence for complementarities between (unobserved) worker skills and firm technologies.[19]

The results from the panel estimations establish the third stylised fact:

Fact 3: *After controlling for unobserved firm and worker heterogeneity the ranking of wage premia persists. Quantitatively, however, the effect of exporting and the MNE status reduce.*

3. The Model

I build a two-sector, three-region model, where firms in the differentiated product sector can choose between exporting and (horizontal) FDI to enter foreign markets. International activity is based on a proximity-concentration tradeoff as in Melitz et al. (2004). Furthermore, heterogeneous firms meet with *ex-ante* identical workers in a labour market characterized by matching frictions similar to Helpman et al. (2010) and Helpman et al. (2017). The main prediction of the model relates to the distribution of wages and employment across firms that engage in international activity through diverse modes of foreign market entry in the presence of frictions in the labour market.

3.1. Model Setup

3.1.1. Household problem

There are three regions, home and two foreign regions, where foreign variables are denoted by $m = 1, 2$ indexes the foreign markets. A country is endowed by a unit measure of identical households of size L. Each member of the household has one indivisible unit of labour which is supplied inelastically with zero disutility. Consumers are risk neutral and have preferences represented by a utility function which is defined over a Cobb-Douglas aggregate (C) of a homogeneous good (q_0) and a real consumption index of differentiated varieties (Q):[20]

$$C = q_0^{\alpha} Q^{1-\alpha}, \qquad 0 < \alpha < 1 \tag{3}$$

where α is a share parameter.

The household's budget constraint is given by

[19] The Appendix provides further robustness checks, i.e. I consider the robustness of my results to different subsamples of the data set and by further analysing differences in the wage premia among MNEs.

[20] For simplicity I consider a single differentiated sector. The analysis can be generalised to the case of multiple differentiated sectors.

$$q_o + \int_{j \in J} p(j) q(j) dj \leq Y, \tag{4}$$

where I have chosen the homogeneous good as the numeraire and j indexes varieties and J is the set of varieties within the differentiated sector; $q(j)$ denotes consumption of variety j and $p(j)$ is its price. Y denotes the household's aggregate income.

Consumption of the differentiated product (Q), is given by a CES aggregator of individual varieties:

$$Q = \left[\int_{j \in J} q(j)^{\beta} dj \right]^{1/\beta}, \qquad 0 < \beta < 1 \tag{5}$$

where elasticity of substitution between varieties is given by β.[21]

The Household maximises its expected utility by choosing how much to consume of each good and where to send its labour to work. More precisely, it allocates its L workers between the two sectors, where L is the sum of workers searching in the homogeneous (l_0) and differentiated sector (l). The homogeneous product sector has no labour market frictions and workers searching for jobs in this sector are expected to be employed with certainty and receive the wage w_0. The differentiated sector is characterised by search frictions, where workers searching in this sector meet firms with some positive probability. Unmatched workers become unemployed. Conditional on being matched, workers learn the match-specific productivity, after which, they may be hired and receive a wage, or enter into unemployment. The value of being unemployed is assumed to be equal to zero.

3.1.2. Firm problem

In the homogeneous sector firms are perfectly competitive, and one unit of labor is required to produce one unit of output. There are no trade costs. I focus on equilibria with incomplete specialisation, in which every country produces both homogeneous and differentiated goods. Under this assumption, normalising the price in the homogeneous sector to one, implies that the wage payed by a homogeneous good producers is also equal to one ($w_0 = 1$) in both countries.[22]

The differentiated sector consists of a large number of monopolistically competitive firms, each supplying a distinct horizontally-differentiated variety. A firm's revenue in this sector depends on the prices $p(j)$ of an individual variety j and a firm's output $y(j)$:

$$r(j) = p(j) y(j) \tag{6}$$

A firm can choose to enter the differentiated sector by paying an entry cost of $f_e > 0$. The

[21] While I here only display expressions for the home country, analogous relationships hold for foreign variables.

[22] In the model solution, in section 3.2, the conditions for incomplete specialisation shall be further defined.

firm learns its type and then has to decide whether to produce any output, produce solely for the domestic market or to produce for both the domestic and foreign market. Production in the domestic market involves a fixed cost of $ef_d > 0$ units of the numeraire. The fixed cost is common to all firms and e is firm specific, independently distributed and drawn from a distribution $G_e(e)$. The choice of serving the foreign market is modeled similar to Melitz et al. (2004), where firms can choose between two ways of foreign market access: They can export domestically-produced goods and they can supply the destination market by setting up a foreign affiliate (FDI). In both cases a firm has to incur fixed costs when entering the foreign market, i.e. $ef_x > 0$ for exporting and $ef_i > 0$ for FDI activity, respectively. Furthermore, exporting is subject to iceberg variable trade cost, such that $\tau_m > 1$ units of a variety must be exported in order for one unit to arrive in the foreign market. Relative to exports, FDI saves transport costs, but duplicates production facilities and therefore requires higher fixed costs, which requires $f_i > f_x$. Moreover, fixed cots of exporting (f_x) are the same across regions, but the variable trade cost of serving Region 1 is assumed to be lower than the transportation cost of serving Region 2, i.e. $\tau_1 < \tau_2$. Setting τ_1 equal to 1 is sufficient to ensure that only exporting to Region 1 takes place. This implies that Region 1 can be served via exporting only and Region 2 via exporting and FDI. This is motivated by empirical observations that some regions with a closer proximity have low transportation costs and hence, give rise to low incentive for horizontal FDI. On the other hand, some regions, which need to be served with higher variable trade costs make FDI relatively more attractive option. Hence, firms in Home face a tradeoff between exporting vs FDI to Region 2, but will always serve Region 1 via exporting. The two foreign regions can be ranked as follows: no firm in the home country serves destination $m + 1$ before it serves destination m. This implies that firms will always first serve Region 1 via exporting before it decides to either serve Region 2 via exporting *or* FDI.

Consequently, this 3-region version of the model, allows me to account for the empirical finding presented in section 2, namely that the majority of MNEs are hybrid firms, i.e. firms with FDI *and* exporting activity. Furthermore, this is in line with empirical evidence, for example by Allub (2015)), who show that trade barriers can affect the location decision of FDI firms as trade costs change the relative cost of exporting compared to producing in the consumption location. Hence, a firm may decide to become multinational if it is cheaper to serve a market via FDI rather than by exporting.

Output of each variety (y) depends on the productivity of the firm (z), the measure of workers hired (h), and the average ability of these workers ($\bar{a}$):

$$y = zh^{\gamma}\bar{a}, \qquad 0 < \gamma < 1 \tag{7}$$

where the productivity of the firm z is independently distributed and drawn from a distribution

$G_z(z)$.[23] The firm technology in (4) has the following important features.[24] First, $\gamma < 1$ implies that there are decreasing returns to hiring more workers as, for example captured in the span of control model by Lucas (1978). Second, the productivity of a worker depends on the average ability of the entire workforce in the firm. Third, there is a complementarity between a firm's productivity and workers' ability. As will be shown below, these assumptions imply that firms face a trade-off between the quality and quantity of hired workers and worker ability matters relatively more for more productive firms.

The labour market is characterized by search frictions, where a firm has to pay bn units of the numeraire in order to be matched randomly with a measure n of workers.[25]

Workers differ in their ability , which is drawn from a Pareto distribution with support on $[1, \infty)$ and shape parameter $k > 1$: $G(a) = 1 - a^{-k}$ for $a \succeq 1$. Worker ability is assumed to be match-specific, and it is unknown both to the firm and to the worker. However, once the match is formed, the firm has access to a costly screening technology which allows it to identify workers with ability below a certain ability threshold a_c, but it cannot identify the precise ability of each worker. Screening costs increase with the ability threshold and equal $ca_c^{\delta}/d\delta$, where $c > 0$ and $\delta > 0$ are common to all firms and d is firm specific, independently distributed and drawn from a distribution $G_d(d)$. The intuition of this screening technology is that more complex and costlier tests are required for higher ability cutoffs.

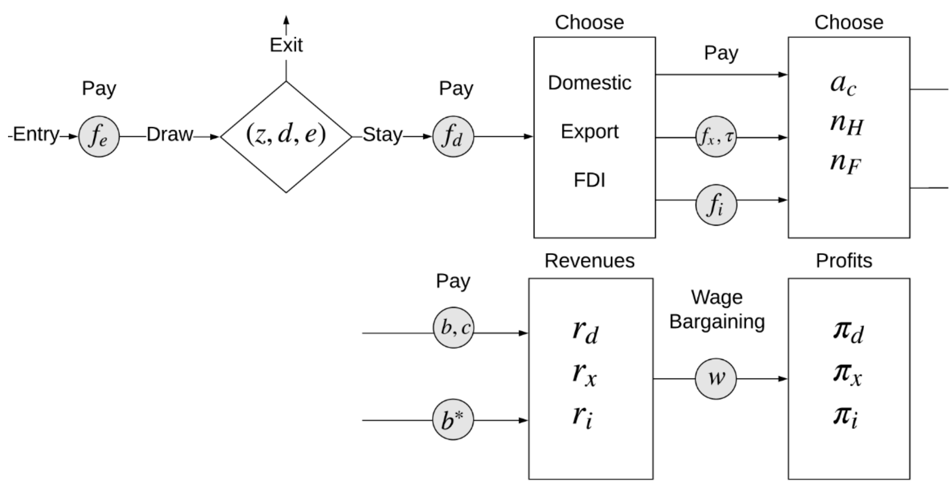


Figure 3: Timing of Decisions

The timing of decisions is as follows. Firms choose to enter and pay the free entry cos (f_e) Each firm learns its idiosyncratic draw (z, d, e), corresponding to productivity, screening costs, and fixed

[23] Since in equilibrium all firms with the same productivity behave symmetrically, firms are indexed by z.

[24] Helpman et al. (2010) show that this production function can be derived from human capital complementarities (e.g., production takes place in teams and the productivity of a worker depends on the average productivity of her team), or from a model of a managerial time constraint (e.g. a manager with a fixed amount of time who needs to allocate some time to every worker).

[25] For simplicity I assume that the hiring cost b is exogenous. Making b a function of labor market conditions, as in Helpman et al. (2010), does not affect the main results.

costs of market entry, respectively. Given this triplet, the firm chooses whether or not to produce, whether to serve only the domestic market or to also serve the foreign market, either via exporting or by setting up a production plant abroad. Each firm then pays the search costs and matches with its chosen number of workers. After matching, the firm chooses its screening threshold and employs the workers with abilities above this threshold. Firms with FDI activity are able to transfer their screening technology to their foreign affiliate.[26] Once these decisions have been made, the firm and its hired employees engage in bilateral Nash bargaining with equal weights over the division of revenue from production in the manner proposed by Stole and Zwiebel (1996).[27] The outcome of the bargaining game implies that the the firm receives the fraction $1/(1+\beta\gamma)$ of revenues, while each worker receives the fraction $\beta\gamma/(1+\beta\gamma)$ of average revenue per worker.

A firm that has searched for n workers and has chosen the ability cutoff a_c hires $h = n\left[1 - G(a_c)\right] = n\left(1/a_c\right)^k$ workers whose expected ability is $\bar{a} = \mathbb{E}\left\{a|a \geq a_c\right\} = a_c k/(k-1)$. The production technology can thus, be rewritten as

$$y(z) = \frac{k}{k-1} z n^{\gamma} (a_c)^{1-\gamma k} \tag{8}$$

where output of a firm is increasing in the ability cutoff a_c. I further make an assumption on the following parameters which is maintained throughout.

Technical Assumption 1: $\gamma < 1/k$

This assumption implies that there are sufficiently strong diminishing returns relative to the dispersion of ability such that a firm can increase its output by not hiring the least productive workers. Therefore, firms have an incentive to screen workers to identify low-ability matches.[28]

3.1.3. Equilibrium

In equilibrium the household takes prices and wages as given and maximises its utility subject to the budget constraint. It allocates its labour endowment between the two sectors to generate income and then uses its labour income to purchase its utility maximising bundle of goods.

Firms maximise profits subject to fixed costs of market entry, search and screening costs. The optimal choices of the firm crucially depend on the idiosyncratic draw z, d and e. As it is the triplet as a whole that matters, I will subsequently define Z as a function of the firm's idiosyncratic shocks

[26] Bloom, Sadun, and Van Reenen (2012) provide evidence that US multinationals transplant their business models to their overseas affiliates and that tougher "people management" practices are related to US firms' productivity advantages. They show that this holds for both domestically based US firms as well as US multinationals operating in Europe.

[27] See Appendix A for a detailed description of the the wage bargaining outcome.

[28] If $\gamma > 1/k$ no firm wants to screen because employing even the least productive worker raises the firm's output and revenue, while screening is costly.

to describe equilibrium outcomes.[29]

The equilibrium will then consist of Z-cutoffs in the home and foreign regions for domestic production, exporting and FDI activity, which in turn yields five conditions that characterise the equilibrium in the home country: a distribution of prices, wages, employment and ability thresholds in the differentiated sector $(p(Z), w(Z), y(Z), h(Z), a_c(Z))$ and analogous equilibrium vectors for the foreign regions $m \in (1, 2)$ $((p_m(Z), w_m(Z),\ y_m(Z), h_m(Z), a_{c,m}(Z))$. The set of prices and quantities are such that all markets clear: supply matches demand on the labour and on the goods market.

3.2. Model Solution

3.2.1. Household choices

Expenditure

The consumer's maximisation problem implies that consumers spend α on the homogeneous good and $1 - \alpha$ on the differentiated good. Thus, aggregate expenditure in the differentiated sector is given by $E = PQ$ and in terms of expenditure shares can be expressed as

$$PQ = (1 - \alpha)Y, \tag{9}$$

where P is price index in the differentiated sector and is the dual of the demand function of the differentiated good in (3), given by:

$$P = \left[\int_{j \in J} p(j)^{\frac{-\beta}{1-\beta}} dj \right]^{-\frac{1-\beta}{\beta}} \tag{10}$$

where the price of a variety is given by

$$p(j) = PQ^{1-\beta} y(j)^{-(1-\beta)} \tag{11}$$

Income

The market clearing condition for the labour market is given by the following equation:

$$L = l_0 + l, \tag{12}$$

which implies that aggregate labour supply is equal to the sum of workers searching in the homogeneous (l_0) and differentiated sector (l). In equilibrium workers are indifferent between searching in the two sector. This requires that the expected wage rate in the differentiated sector equals the wage in the homogeneous sector. As expected income equals one in each sector, each country's

[29]See equation (20) for the exact functional form of $Z(z, d, e)$.

aggregate labour income is determined by its labour endowment:

$$Y = L, \tag{13}$$

and direct utility is given by

$$V = \frac{L}{P^{1-\alpha}}. \tag{14}$$

In the main analysis I assume that parameters are such that both countries produce the homogeneous good. As discussed in Helpman et al. (2010)) incomplete specialization can be ensured by appropriate choice of labor endowments (L, L) and relative preferences for the homogeneous and differentiated goods (α).

3.2.2. Firm choices

Revenues

Given the solution of the household problem, a firm's revenue can be expressed in terms of its output supplied $y(Z)$ and a demand shifter A for the sector:

$$r(Z) = Ay(Z)^{\beta}, \qquad A \equiv PQ^{1-\beta} \tag{15}$$

The demand shifter A is a measure of product market competition, increasing in the sectoral expenditure and decreasing in the sectoral price index P. Since every firm is small relative to the sector, firms take this demand shifter as given.

Given consumer love of variety and fixed production costs, no firm will ever serve the export or FDI market without also serving the domestic market. Total output of a firm is the sum of production for the domestic and the foreign market, which the firm serves either via exporting or through multinational production. In order to distinguish between plants in the home country and abroad, I introduce the subscripts H and F, where H refers to production in the home country and F relates to production in the foreign market, i.e. in Region 2. Hence, production by a home firm for the home market is denotes as $y_H(Z)$ and $y_F(Z)$ is the amount produced by a home firm in the foreign market through FDI activity.[30]

Total revenues can then be rewritten as the sum of revenues from the home plant $r_H(Z)$ and the foreign plant $r_F(Z)$:

$$r(Z) = \Upsilon_H(Z)^{1-\beta} Ay_H(Z)^{\beta} + I_i(Z)A_2 y_F(Z)^{\beta} \tag{16}$$

where $I_{x,m} \in 0, 1$ is an indicator function for whether a firm exports and $I_i \in 0, 1$ for FDI activity respectively and $m = 1, 2$ indexes the foreign markets and $m = 0$ represents the home market

[30]For simplicity, I exclude the possibility of exports by foreign affiliates. See Appendix of Melitz et al. (2004), for an extension.

respectively, where in the following I will omit the subscript for the home market. Note that if a firm decides to serve the foreign markets via exporting, i.e. $I_{x,1} = 1$, then the indicator function for FDI activity will be $I_i = 0$ and vice versa if the firm engages in FDI the indicator function I_i equals 1 and I_x is equal to zero. Moreover, $\Upsilon_H(Z)$ refers to the "market access" variable:

$$\Upsilon_H(Z) \equiv 1 + \sum_{m=1,2} I_{x,m}(Z)\tau_m^{-\frac{\beta}{1-\beta}} \left(\frac{A_m}{A}\right)^{\frac{1}{1-\beta}}. \tag{17}$$

which depends on whether a home producer, in addition to selling in the home market, also serves the foreign market(s) via exporting. The equation further highlights that exporting activity does not only depend on the relative demand shifters of the foreign and home country, but also on the variable trade cost τ_m.[31]

Search and Screening Choice

The solution to the firm's problem is solved in a recursively: Anticipating this bargaining outcome, a firm maximizes its profits by choosing the number of workers to match with in the home plant(n_H) and in the FDI-plant (n_F), the screening threshold (a_c), and whether to export or to set up a foreign affiliate:

$$\pi(z) \equiv \max_{\substack{n_H \geq 0; \quad n_F \geq 0 \\ a_c \geq 1 \\ I_x \in \{0,1\}; \quad I_i \in \{0,1\} \\ if I_x = 1, I_i = 0}} \left\{ \frac{1}{1+\beta\gamma} \left[\Upsilon_H^{1-\beta} A \left(\frac{k}{k-1} z n_H^{\gamma} a_c^{1-\gamma k} \right)^{\beta} + I_i A_2 \left(\frac{k}{k-1} z n_F^{\gamma} a_c^{1-\gamma k} \right)^{\beta} \right] + \right.$$
$$\left. - b n_H - I_i b_2 n_F - \frac{c}{d\delta} a_c^{\delta} - e f_d - \sum_{m=1,2} I_{x,m} e f_x - I_i e f_i \right\} \tag{19}$$

The firm's first order conditions for the measure of workers sampled for the home establishment (n_H) and for the foreign affiliate (n_F) are:

$$\frac{\beta\gamma}{1+\beta\gamma} r_H(Z) = b n_H(Z) \tag{20}$$

$$\frac{\beta\gamma}{1+\beta\gamma} r_F(Z) = b_2 n_F(Z) \tag{21}$$

[31] The market access variable $\Upsilon_H(z)$ is derived by noting that a home producer with exporting activity, equate marginal revenues in the two markets, which from (1) implies

$$\frac{y_x}{y_d} = \tau^{-\frac{\beta}{1-\beta}} \left(\frac{A_m}{A}\right)^{\frac{1}{1-\beta}} \tag{18}$$

and output of a home plant can then be written as $y_H(Z) = y_d(Z)\Upsilon_H(z)$.

And first order condition with respect to the screening ability threshold (a_c) is given by

$$\frac{\beta(1-\gamma k)}{1+\beta\gamma} r(Z) = \frac{c}{d} a_c(Z)^{\delta} \tag{22}$$

Equations (20) and (21) can be combined to express the optimal sampling decision of workers in Home in terms of total revenues ($r(Z)$):

$$\frac{\beta\gamma}{1+\beta\gamma} r(Z) = b n_H(Z) \frac{\Upsilon_H(Z)^{\frac{1-\beta}{1-\gamma\beta}} + I_i(Z) \left(\frac{b}{b_m}\right)^{\frac{\gamma\beta}{1-\gamma\beta}} \left(\frac{A_m}{A}\right)^{\frac{1}{1-\gamma\beta}}}{\Upsilon_H(Z)^{\frac{1-\beta}{1-\gamma\beta}}} \tag{23}$$

As a result, a firm's optimal choice depends on the *relative* level of labour market frictions (b/b_m) and demand shifters (A_m/A), rather than the absolute values.

Equations (22) and (23) imply that, ceteris paribus, firms with larger revenue interview more workers (higher n_H) and screen more intensively (higher a_c) and consequently, hire workers with higher average ability.[32] I next make an assumption that ensures that firms that screen to a higher ability cutoff also hire more workers (higher h_H):

Technical Assumption 2: $\delta > k$

Using the firms' first-order conditions (22) and (23), firm revenue (16) and the production technology (8), we can solve explicitly for firm revenue as a function of the firm variable z, the demand shifter A, the search cost b, and parameters:

$$r(Z) = \kappa_r \left[c^{-\frac{\beta(1-\gamma k)}{\delta}} b^{-\gamma\beta} A \Upsilon(Z) \right]^{\frac{1}{\Gamma}} z^{\frac{\beta}{\Gamma}} d^{\frac{\beta(1-\gamma k)}{\delta\Gamma}} \tag{24}$$

where $\kappa_r \equiv (k/k-1)^{\Gamma} (\beta\gamma/1+\beta\gamma)^{\beta\gamma/\Gamma} [\beta(1-\gamma k)/1+\beta\gamma]^{\beta(1-\gamma k)/\delta k}$ and $\Gamma \equiv 1-\beta\gamma-\beta(1-\gamma k)/\delta$. Technical Asumption 1 and 2 together imply that $\Gamma > 0$, which ensures that revenues are increasing in firm characteristics.

Furthermore, $\Upsilon(Z)$ denotes a firm's aggregate market access variable, including exporting and FDI activity and is hence, given by

[32] See Appendix B for a detailed derivation of the first order conditions.

$$\Upsilon(Z) \equiv \begin{cases} 1 & \text{if} \quad I_{x,m}(Z) = I_i(Z) = 0 \\ \Upsilon_{x,m} & \text{if} \quad I_{x,1}(Z) = 1, I_{x,2}(Z) \geq 1, I_i(Z) = 0; \Upsilon_{x,m} \equiv \left(1 + \sum_{m=1,2} I_{x,m}(Z)\tau_m^{-\frac{\beta}{1-\beta}} \left(\frac{A_m}{A}\right)^{\frac{1}{1-\beta}}\right)^{1-\beta} \\ \Upsilon_i & \text{if} \quad I_i(Z) = 1, I_{x,1}(Z) = 1, I_{x,2}(Z) = 0 \quad \Upsilon_i \equiv \left(\Upsilon_{x,1}^{\frac{1}{1-\gamma\beta}} + \left(\frac{A_2}{A}\right)^{\frac{1}{1-\gamma\beta}} \left(\frac{b}{b_2}\right)^{\frac{\gamma\beta}{1-\gamma\beta}}\right)^{1-\gamma\beta} \end{cases} \tag{25}$$

which includes additional revenue premium of exporters ($\Upsilon_{x,m}$) and of FDI activity (Υ_i), depending on which mode of foreign market access is chosen by the firm. Using the first order conditions and the expression of revenues in (24), firm profits can be rewritten as

$$\pi(Z) = \frac{\Gamma}{1+\beta\gamma} r(Z) - ef_d - \sum_{m=1,2} I_x(Z)ef_x - I_i(Z)ef_i \tag{26}$$

where I define the combination of firm-specific idiosyncratic draws as $Z \equiv zd^{(1-\gamma k)/\delta}/e^{\Gamma/\beta}$.

Firm Outcomes

Wages are determined by wage bargaining as described above, where bargaining takes place at the plant level. The wage payed to workers in establishments of home producers is given by

$$w_H(Z) = \frac{\beta\gamma}{1+\beta\gamma} \frac{r_H(Z)}{n_H(Z)a_c(Z)^{-k}} = ba_c(Z)^k \tag{27}$$

and workers in in the foreign affiliate of the home firm receive

$$w_F(Z) = \frac{\beta\gamma}{1+\beta\gamma} \frac{r_F(Z)}{n_F(Z)a_c(Z)^{-k}} = b_m a_c(Z)^k \tag{28}$$

These equations imply that the wage is equal to the replacement cost of a worker, which is proportional to the search cost b and increasing in the screening cutoff a_c.[33]. From (22),and (23) it follows that if the revenue premium from FDI activity (Υ_i) is larger than the one from exporting (Υ_x), firms with multinational activity are more selective in the labour market and hence, pay higher wages than exporting and local firms. I will further discuss the implications of FDI and exporting activity for wage inequality in section 4.

As stated above, if $\delta > k$, the ability threshold a_c is increasing with h and we can state that the model exhibits an employer-size wage premium, where firms that employ more workers (and screen more intensively), pay higher wages.[34]

[33] Note that conditional on being sampled, the expected wage is the same same across firms: $w(Z)h(Z)/n(Z) = b$

[34] This feature of the model is in line with empirical findings that the employer-size wage premium is partly

Next, we can find the analogous expressions for employment in home and foreign plants by noting that $h \equiv na_c^{-k}$. Employment can then be expressed as function of revenues of the plant which is hiring the workers, i.e. either by the home plant $r_H(Z)$ or by a home firm's foreign affiliate $r_F(Z)$, proportional to total revenues:

$$h_H(Z) = \kappa_h c^{\frac{k}{\delta}} b^{-1} r_H(Z) r(Z)^{-\frac{k}{\delta}} d^{-\frac{k}{\delta}} \tag{29}$$

$$h_F(Z) = \kappa_h c^{\frac{k}{\delta}} b_2^{-1} r_F(Z) r(Z)^{-\frac{k}{\delta}} d^{-\frac{k}{\delta}} \tag{30}$$

where $\kappa_h \equiv (\beta\gamma/1+\beta\gamma)(\beta(1-\gamma k)/1+\beta\gamma)^{-k/\delta}$. The implications for employment are as follows. Exporters and FDI firms both hire more workers than firms that are only active in the domestic market and for $\Upsilon_i > \Upsilon_x$, multinational firms tend to be largest in terms of their workforce. Furthermore, firms which generate more revenue in the home plant also hire more workers, holding revenue in the foreign affiliate constant. Vice versa holds for firms which generate more revenues in the foreign plant.

Export and FDI Choice

As a result of fixed costs of production (f_d, f_x and f_i, respectively) and variable trade costs, a firm's decision whether or not to produce and to export or engage in FDI, imply that there is a zero-profit cutoff for the firm-specific triplet $Z(z, d, e)$, for which a firm will be willing to serve the domestic market (Z_d), choose to export to region 1 ($Z_{x,1}$), to region 2 ($Z_{x,2}$) and if the observed productivity draw is high enough (Z_i) the firm will find it profitable to set up a foreign affiliate. This implies the following order of cutoffs: $Z_i \geq Z_{x,2} \geq Z_{x,1} \geq Z_d$. Using the expression for profits in (26) we can find the zero profit-cutoffs.

The Z-cutoff below which firms exit is determined by the requirement that a firm with this combination of z, d, e, makes zero profits, i.e. $\pi(Z_d) = 0$. Hence, a firm will produce if

$$Z \geq Z_d \equiv A^{-\frac{1}{\beta}} c^{\frac{1-\gamma k}{\delta}} b^{\gamma} \left[\frac{f_d}{\kappa_r} \frac{1+\beta\gamma}{\Gamma} \right]^{\frac{\Gamma}{\beta}} \tag{31}$$

The analogous export-cutoff to Region 1 can be found by noting that the firm's zero profit conditions require that firms are indifferent between serving only the domestic market and serving both the domestic and foreign market through exporting ($\pi(Z_{x,1}) - \pi(Z_d) = 0$). A firm's exporting decision to region 1 is determined by the following two equations :

$$Z \geq Z_{x,1} \equiv \left[\Upsilon_{x,1}^{\frac{1}{\Gamma}} - 1 \right]^{-\frac{\Gamma}{\beta}} \left(\frac{f_x}{f_d} \right)^{\frac{\Gamma}{\beta}} Z_d \tag{32}$$

explained by differences in the unobserved heterogeneity of workers across firms as shown by Abowd et al. (1999), Card, Heining, and Kline (2013) and Song, Price, Guvenen, Bloom, and Von Wachter (2015).

$$Z < Z_{x,2} \tag{33}$$

where the cutoff above which firms serve the second region via exporting ($Z_{x,2}$) is determined by the requirement that a firm is indifferent between serving both foreign markets via exporting and only exporting to region 1 ($\pi(Z_{x,2}) - \pi(Z_{x,1}) = 0$). Consequently, firms export to both regions if the following two conditions are satisfied:

$$Z \geq Z_{x,2} \equiv \left[\Upsilon_{x,2}^{\frac{1}{\Gamma}} - \Upsilon_{x,1}^{\frac{1}{\Gamma}} \right]^{-\frac{\Gamma}{\beta}} \left(\frac{f_x}{f_d} \right)^{\frac{\Gamma}{\beta}} Z_d \tag{34}$$

$$Z < Z_i \tag{35}$$

where the cutoff above which firms set up a foreign affiliate (Z_i) is determined by the requirement that a firm is indifferent between serving region 2 via exporting and FDI activity ($\pi(Z_i) - \pi(Z_{x,2}) = 0$). Consequently, firms engage in FDI activity if

$$Z \geq Z_i \equiv \left[\Upsilon_i^{\frac{1}{\Gamma}} - \Upsilon_{x,2}^{\frac{1}{\Gamma}} \right]^{-\frac{\Gamma}{\beta}} \left(\frac{f_i - f_x}{f_d} \right)^{\frac{\Gamma}{\beta}} Z_d \tag{36}$$

Note that theoretically there are many possible cases for the order of cutoffs. For example, it could be that only the most productive export and less productive firms do FDI, which implies $Z_{x,m} \geq Z_i \geq Z_d$.[35] However, here I am focusing on the case where all firms that export or do FDI, also serve the domestic market, and firms that produce for the domestic market may or may not participate in international activities. Moreover, I assume that only the most productive firms engage in FDI. This implies the following order of cutoffs$Z_i \geq Z_{x,2} \geq Z_{x,1} \geq Z_d$, as described above. Under the assumption that $f_i > f_x$ it is sufficient to require that the revenue premium from FDI activity (Υ_i) to be larger than for exporting ($\Upsilon_{x,2}$) in order to ensure that the cutoff of FDI to be greater than the exporting cutoff (see (32) and (36)).

Hence, whether a firm will choose to engage in FDI activity, rather than exporting, will depend on the difference between the fixed costs of FDI (f_i) and exporting (f_x), and on the difference between the firm revenue premium of FDI activity (Υ_i) and exporting to region 2 ($\Upsilon_{x,2}$). The latter difference in turn, depends on the size of the variable trade costs τ_2; the closer τ_2 to 1, the larger $\Upsilon_{x,2}$, which implies that firms find it relatively more profitable to export as iceberg trade costs vanish.

Furthermore, equations (32) - (36) highlight that firm characteristics through $Z(z, d, e)$ are systematically related to export and FDI participation. Given this triplet, the distribution of exporters and firms engaging in FDI, depends not only on the distribution of productivities (z), but also on the the distribution of d and e between exporters and domestic firms, and between

[35] We can also think of cases where everyone who produces also does FDI and there is no exporting, i.e. $Z_d \geq Z_i \geq Z_{x,m}$. However, this case seems empirically less relevant.

exporters and FDI-firms.

Moreover, these cutoffs depend on two dimensions of trade openness in (32) - (36). First, they depend on an extensive margin of trade openness, as captured by the ratio of the firm-specific variable Z-cutoffs $Z_d/Z_{x,m}$, which determines the fraction of firms exporting to region 1 and 2, respectively. Similarly, $Z_{x,2}/Z_i$, which, in turn, determines the fraction of firms engaging in FDI activity. Second, the cutoffs depend on an intensive margin of trade openness, as captured by the two market access variables, $\Upsilon_{x,m} > 1$ and the revenue mark-up of FDI activity, which determine the ratio of revenues from domestic sales and exporting or FDI.

Entry

In equilibrium, we also require the free entry condition to hold, which equates the expected value of entry to the sunk entry cost:

$$f_d \int_{Z_d}^{\infty} \left[\left(\frac{Z}{Z_d} \right)^{\frac{\beta}{\Gamma}} - 1 \right] dG_Z + f_x \int_{Z_{x,1}}^{\infty} \left[\left(\frac{Z}{Z_{x,1}} \right)^{\frac{\beta}{\Gamma}} - 1 \right] dG_Z +$$
$$+ f_x \int_{Z_{x,2}}^{Z_i} \left[\left(\frac{Z}{Z_{x,2}} \right)^{\frac{\beta}{\Gamma}} - 1 \right] dG_Z + f_i \int_{Z_i}^{\infty} \left[\left(\frac{Z}{Z_i} \right)^{\frac{\beta}{\Gamma}} - 1 \right] dG_Z = f_e \tag{37}$$

where $I_{x,2}(Z) = 1$ only if $Z_{x,2} \le Z < Z_i$ and $I_{x,2}(Z) = 0$ otherwise. Similarly, $I_i(Z) = 1$ for $Z \ge Z_i$ and is zero otherwise. Evaluating the integrals in (37) using a Pareto distribution, together with the cutoff condition in (31), we can express the free entry condition as a function of the exit cutoff Z_d.

Market clearing

Next, the mass of firms within the sector (M) can be determined from the market clearing condition that total domestic expenditure on differentiated varieties equals the sum of the revenues of domestic and foreign firms that supply varieties to the domestic market:

$$(1-\alpha)L = M \int_{Z_d}^{\infty} r_d(Z) dG_Z(Z) + M_1 \int_{Z_{x,1}}^{\infty} r_{x,1}(Z) dG_Z(Z) +$$
$$+ M_2 \int_{Z_{x,2}}^{Z_i} r_{x,2}(Z) dG_Z(Z) + M_2 \int_{Z_i}^{\infty} r_i(Z) dG_Z(Z) \tag{38}$$

Labour

The equilibrium will then consist of Z-cutoffs in the home and foreign country for production, exporting and FDI activity, which in turn yields five conditions that characterise the equilibrium in the home country: a distribution of prices, wages, employment and ability thresholds in the differentiated sector $(p(Z), w(Z), y(Z), h(Z), a_c(Z))$ and an analogous equilibrium vector for the foreign countries $((p_m(Z), w_m(Z), y_m(Z), h_m(Z), a_{cm}(Z))$. The set of prices and quantities are such that all markets clear: supply matches demand on the labour and on the goods market. The sectoral labour force (l) can be determined from the outcome of the bargaining game, where the total sectoral wage bill equals a constant fraction of total revenue:

$$l = M \int_{Z_d}^{\infty} w(Z)h(Z)dG_Z(Z) = M \frac{\beta\gamma}{1+\beta\gamma} \int_{Z_d}^{\infty} r(Z)dG_Z(Z) \tag{39}$$

3.2.3. Equilibrium

There are five equations that characterize the equilibrium in each country as a function of the three Z-cutoffs.

Equations (31)-(36) determine the cutoffs for the home country $(Z_d, Z_{x,1}, Z_{x,2}, Z_i)$ and five analogous expressions yield the cutoffs for each of the foreign countries $(Z_{d,m}, Z_{x,m}, Z_{x,m+1}, Z_{i,m})$.

Combining the fact that first, the demand shifter is a function of total expenditure $A = PQ^{1-\beta}$ and second, that Cobb-Douglas preferences imply that expenditure of a good is a constant share $(1-\alpha)$ of income (Y), i.e. $PQ = (1-\alpha)Y$:

$$A = [(1-\alpha)L]^{1-\beta} P^{\beta} \tag{40}$$

where I used the fact that income is equal to labour endowments from (13). We can again make use of an equivalent expression for the demand shifter to obtain A_m.

The expression for the demand shifters, together with the cutoffs and the mass of firms in (38) in the home and foreign regions yield 18 conditions in total: $(Z_d, Z_{x,1}, Z_{x,2},$
$Z_i, Z_{d,m}, Z_{x,m}, Z_{x,|m+1|}, Z_{i,m}, A, A_1, A_2, M, M_1, M_2)$. Together, with the firm outcomes in (59) - (30) as functions of Z, fully describe the model equilibrium.

4. Model Implications

In this section, I will use this general equilibrium model of three regions to further discuss the implications of the model for wage differences between exporters, FDI firms and non-internationalising firms.

4.1. Exporter and MNE Wage Premia

4.1.1. Wage Equations

I will now consider the implications of exporting and FDI for wages and the resulting difference in pay between exporters and multinationals in the home country. I start by taking logs of the wage equation in (27), and (28), as well as logs of the firm's employment in equations (29) and (30). We can then find a wage equation conditional on firm size for producers in the home country given by the following two equations

$$\begin{aligned}\ln w_H =& \kappa_H + \frac{k}{\delta - k} \ln h_H(Z) + \frac{k}{\delta - k} \ln \tilde{I}(Z) + \\ &+ \frac{k}{\delta - k} E[\ln d \mid I(Z)] + \frac{k}{\delta - k}\big(\ln d - E[\ln d \mid I(Z)]\big)\end{aligned} \tag{41}$$

$$\begin{aligned}\ln w_{H,m} =& \kappa_{H,m} + \frac{k}{\delta - k} \ln h_{H,m}(Z_m) + \frac{k}{\delta - k} \ln \tilde{I}_m(Z_m) + \\ &+ \frac{k}{\delta - k} E[\ln d_m \mid I(Z_m)] + \frac{k}{\delta - k}\big(\ln d_m - E[\ln d_m \mid I(Z_m)]\big)\end{aligned} \tag{42}$$

Equation (41) refers to the wage payed by a firm in the home country with domestic ownership and equation (42)to the wage of a firm under foreign ownership. Furthermore, κ_H includes parameters that are common to all home country producers in their home establishments, $\kappa_{H,m}$ refers to affiliated plants where the source country is foreign (with $m \in (1,2)$)and $E[\ln d \mid I(Z)]$ is the expected value of the (log) of the firm specific characteristic d.[36] Equation (42) captures wages of foreign owned affiliates in the home country and hence, from the perspective of Home captures inward FDI.

The additional variable $\ln \tilde{I}(Z)$ comes from the fact that FDI firms sample workers in the home and in the foreign labour market, as captured by the firm's first order condition (23) and is thus, given by

$$\tilde{I}(Z) \equiv \begin{cases} 1 & \text{if} \quad I_i(Z) = 0 \\ \left(\frac{\Upsilon_i}{\Upsilon_{x,1}}\right)^{\frac{1}{1-\gamma\beta}} & \text{if} \quad I_i(Z) = 1 \end{cases} \tag{43}$$

where the FDI market access variable Υ_i is defined in (25).[37] Note that $\tilde{I}(Z)$ is different from the general market access variable $\Upsilon(Z)$, as (43) only distinguishes between FDI firms and non-FDI

[36] The constant κ_H includes parameters and a country's labour market friction b, which are common to all producers within the home country. See the Appendix for a derivation of κ_H and equation (41).

[37] More precisely, the variable $\tilde{I}(Z)$ in (23) is given by

$$\tilde{I}(Z) \equiv \frac{\Upsilon_H(Z)^{\frac{1-\beta}{1-\gamma\beta}} + I_i(Z)\left(\frac{b}{b_2}\right)^{\frac{\gamma\beta}{1-\gamma\beta}} \left(\frac{A_2}{A}\right)^{\frac{1}{1-\gamma\beta}}}{\Upsilon_H(Z)^{\frac{1-\beta}{1-\gamma\beta}}} \tag{44}$$

firms, whereas $\Upsilon(Z)$ also includes the exporter premium (Υ_x).

Furthermore, (41) highlights that the model features wage premia for international activity conditional on firm size due to differences in the idiosyncratic firm shock d between domestic firms, exporters and multinationals. Under the assumption that the three stochastic shocks are individually as well as jointly normally distributed, in the expression above the firm-specific shock d is written in terms of its deviation from the mean value. This formulation will be useful when comparing exporter and MNE wage premia, as will be discussed below. While z may be attributed to a firm's ability to *use* the given resources of the firm, d relates to a firm's ability to *find* the right labour inputs. In this model d corresponds to the screening cost shock. However, more generally the cost of screening can be interpreted as the unobserved part of a firm's productivity, as this kind of information is usually unavailable to the econometrician.

The relationship between firms' international activities and firm characteristics can then be described as follows. Similar to Helpman et al. (2017), heterogeneity in firm productivity (z) drives differences in firm revenue, employment size and international activity. Heterogeneity in the screening efficiency (d) allow for differences in wages across firms after controlling for their employment size and mode of foreign market access, while idiosyncratic market entry costs (e), implicitly in Z, allow some small low-wage firms to engage in exporting and FDI activity and vice versa some large high-wage firms to serve only the home market. Consequently, incorporating these three idiosyncratic shocks allows the model to produce a positive but imperfect correlation between wages, international activity and employment, as observed in the data.

4.1.2. Export vs FDI

Recall that the wage equation in (41) can be viewed as the theoretical counterpart of a wage regression similar to the one in (1). Hence, the parameter κ_H captures the constant and the last term, i.e. the deviation of d from its expected value, represents the error term. Under the standard OLS assumptions the error term has a zero conditional mean, here given by

$$\frac{k}{\delta - k}\big(\ln d - E[\ln d \mid I(Z)]\big) \equiv 0 \tag{45}$$

Given that the above stated condition holds, we can then find reduced form equations for the exporter and MNE wage premium.

Exporter Wage Premium

First, we will consider the case in which firms do not participate in FDI activity, i.e $I_i = 0$, but allow for exporting $\sum_{m=1,2} I_{x,m}(Z) \geq 1$. From equation (41), we inferred that the difference in pay between a domestic firm and an exporter conditional on controlling for employment size, is

which is equal to 1 for non-FDI firms and is $\left(\frac{\Upsilon_i}{\Upsilon_{x,1}}\right)^{\frac{1}{1-\gamma\beta}}$ for multinationals.

solely due to the difference in the expected screening efficiency between these two firm types. I will, thus, define the reduced form exporter wage premium as follows

$$\omega_x \equiv \frac{k}{\delta - k} E\big[\ln d \mid I_{x,m}(Z)\big] \tag{46}$$

where $E\big[\ln d_x \mid I_{x,m}(Z) = 1\big]$ is the expected screening efficiency among exporting firms. Hence, the effect of exporting on wages, controlling for employment, is governed by the difference in the mean of the (log) firm shock d between domestic firms and exporters, which can be expressed as follows:

$$E\big[\ln d \mid I_{x,m}(Z) = 0\big] \quad \text{for} \quad Z_{x,m} \geq Z > Z_d \tag{47}$$

$$E\big[\ln d \mid I_{x,m}(Z) = 1\big] \quad \text{for} \quad Z_i \geq Z > Z_{x,m} \tag{48}$$

Therefore, given the ranking of productivity cutoffs ($Z_i > Z_{x,m} > Z_d$) the expected values of screening efficiency between exporters and domestic firms is as follows

$$E\big[\ln d \mid I_{x,m}(Z) = 1\big] \geq E\big[\ln d \mid I_{x,m}(Z) = 0\big] \tag{49}$$

Intuitively, this expression implies that exporters have on average higher average characteristics ($Z(z, d, e)$), which is informative about the mean value of d of a particular firm type. Therefore, a higher mean screening efficiency among exporters translates into higher average screening intensity, higher average ability of the workforce and as a result higher average wages for workers employed by exporters.

FDI Wage Premium

Next, let us consider the case for FDI ($I_i = 1$). Similarly to the exporter wage premium, we can use (27) and (45) to define the reduced form MNE wage premium as follows

$$\omega_i \equiv \frac{k}{\delta - k}\Big(\ln \tilde{I}(Z) + E\big[\ln d \mid I_i = 1\big]\Big) \tag{50}$$

where $E\big[\ln d_i \mid I_i = 1\big]$ is the expected screening efficiency among MNEs and $\ln \tilde{I}(Z)$ again is the log of the market access variable of FDI. From this expression it is clear to see that the multinational wage premium is determined through two channels. First, through the positive FDI market access variable $\tilde{I}(Z)$ and second, similarly to the exporting-only case, through higher average firm characteristics $E\big[\ln d \mid I_i = 1\big]$, for $Z_i > Z_{x,m}$. The subsequent relationship between domestic and FDI-firms regarding the expected idiosyncratic firm shock d can be expressed as:

$$E\big[\ln d \mid I_i(Z) = 1\big] \geq E\big[\ln d \mid I_i(Z) = 0\big] \tag{51}$$

Export vs FDI

The wage premium of multinationals is, hence, unambiguously larger than the exporter wage premium. It is clear to see that the presence of the additional market access variable of FDI ($\tilde{I}(Z)$) implies, *ceteris paribus*, higher wages for multinationals. The size of this effect, in turn, depends on the relative demand shifter (A_m/A) and the relative labour market friction (b/b_m).

Moreover, given that the cutoffs $Z_i > Z_{x,m}$ are informative regarding the distribution of idiosyncratic firm shock d between exporters and FDI firms, implies:

$$E\big[\ln d \mid I_i = 1 - I_{x,m} = 1\big] \geq E\big[\ln d \mid I_{x,m} = 1 - I_i = 1\big] \tag{52}$$

As there is a common wage for all workers *within* the same firm, wage differences *between* firms are driven by differences in the bargaining outcomes of firms with their employees. Therefore, as in Helpman et al. (2017), this framework features residual wage inequality in the sense that *ex ante* identical workers receive different wages depending on whether they are matched with an exporter or non-exporter. This is consistent with recent empirical evidence (e.g. Schank et al. (2007) and Helpman et al. (2017)), exporters not only have higher revenue and employment than firms that only operate in the domestic market, but also pay higher wages. Additionally, my analysis features a multinational wage premium as found by Heyman et al. (2007) and Martins (2011).

Moreover, equation (52), (27) and (29) together imply that both, the productivity (z) of the firm *and* the screening efficiency (d), determine a firm's size, international activity and thus, the wage a firm pays to its workforce. Although, both – a higher z and d – increase the incentive to export (FDI), selection into exporting (FDI) works through the differential sensitivity of exporting (FDI) to these these two firm characteristics. While a higher productivity unambiguously increases both profits and size of the firm, the effect of a higher screening efficiency is more subtle. Similarly to a higher productivity, a firm with a better screening technology, ceteris paribus, is both more picky concerning its workforce ability and more profitable, and hence pays higher wages. However, the effect of the screening efficiency on firm employment is more subtle because of two competing forces. A higher screening efficiency (i) raises the firm's profitability and hence, it increases the number of matches n, but (ii) it also increases a firm's selectivity in the labour market, which reduces the ratio of hires (h/n). Overall, the effect of a higher screening efficiency on employment is negative, which implies a positive yet imperfect correlation between firm type, size and wages. In other words, if we observe two firms that are similar in size, but one is an exporter (MNE) and the other one is a domestic (non exporting or FDI) firm, the exporting (FDI) firm has in expectation a better screening technology d and the domestic firm has the higher productivity z.

4.1.3. *Outward vs Inward FDI*

Equation (42) further highlights that foreign owned multinationals (inward FDI) may pay different wages to domestically owned multinationals (outward FDI). For example, if we consider two multinational firms with identical firm specific draws ($Z(z, d, e)$), but that only differ with respect to their country of origin we can express the difference in pay between these firms as follows

$$\ln w_H - \ln w_{H,m} = (\kappa_H - \kappa_{H,m}) + \frac{k}{\delta - k}\left(\ln \tilde{I}(Z) - \ln \tilde{I}(Z_m)\right) \tag{53}$$

where the remaining variables and parameters on the right hand side of this equation depend on the relative demand shifter (A_m/A) and the relative labour market friction (b/b_m). Whether inward or outward FDI firms pay more will, thus, depend on which country has higher (lower) labour market frictions.

Equation (53) together with (41) and (42), points to the role of relative labour market rigidities in shaping differences in pay between the various MNE types, i.e. difference sin pay between domestically and foreign owned MNEs and between the domestic establishment and the foreign affiliate. However, in the data only wage differences between domestic and foreign owned MNEs can be observed in the data and information on the foreign affiliate is not available. Therefore, equation (53) provides novel theoretical predictions on how labour market frictions across countries determine differences in pay *within* MNEs across their different affiliates.

4.2. *Screening Efficiency*

In order to serve foreign markets, firms require higher average characteristics $Z(z, d, e)$, which may derive from a superior productivity z, a higher screening efficiency d and/or a lucky draw of lower fixed costs e. There is ample evidence supporting the notion that exporters and MNEs are more productive than non-internationalising firms (see e.g. Bernard, Eaton, Jensen, and Kortum (2003), Melitz et al. (2004) and Bloom et al. (2012)). To account for this stylised fact, seminal work, such as Hopenhayn (1992) and Melitz (2003), has introduced firm heterogeneity that refers to a firm's capability to *use* the given inputs they have. However, little is known about the relationship between a firm's mode of foreign market access and their ability to *find* the right inputs.

In this section, I provide novel insights concerning the interplay of firms' internationalisation decisions and firms' ability to find the right workers in a frictional labour market. In order to confirm the quantitative relevance of this relationship, I will subsequently provide a back-of-the-envelope calculation on some of the parameters and the resulting ranking of firms with regard to their international activity and their screening efficiency.

4.2.1. Screening efficiency of Exporters and MNEs

From the expression of the exporter wage premium in (46) we can find an explicit expression for the expected screening efficiency of exporters.

$$E\left[\,\ln d \mid I_{x,m}\right] \equiv \frac{\delta - k}{k}\omega_x \tag{54}$$

Similarly, we can use (50) to define the expected screening efficiency of MNEs as follows:

$$E\left[\,\ln d \mid I_i\right] \equiv \frac{\delta - k}{k}\omega_i - \ln \tilde{I}(Z) \tag{55}$$

Section 2 presented the estimation results for exporter wage premium ω_x, MNE wage premium ω_i and the employment coefficient $k/(\delta - k)$ for a set of different specifications. Hence, in the following section I will make use of this information to find the unknown expected screening efficiency among exporters $E\left[\,\ln d \mid I_{x,m}\right]$ and FDI firms $E\left[\,\ln d \mid I_i\right]$.

4.2.2. Paramaterisation and Data Sources

I begin by noting that the coefficient on employment in the above wage equations is given by $k/(\delta - k)$, which I infer from the estimated values in section 2. As noted above in (54), the expected average screening efficiency of exporters $E\left[\,\ln d \mid I_{x,m}\right]$ is pinned down by the value for the exporter wage premium ω_x and the inverse of the coefficient of $E\left[\,\ln d \mid I_{x,m}\right]$. The relevant coefficient, in turn, is given by $k/(\delta - k)$, which is identical to the employment coefficient. The empirical counter part of ω_x and $k/(\delta - k)$, however, will depend on which specification in section 2 we consider to be the appropriate one, i.e. the estimated employment coefficient with/without firm and worker controls. The choice of the suitable specification, in turn, is based on our interpretation of what the firm-idosyncratic shock d captures.

In a similar way, we can use the estimated values for the employment coefficient and the MNE wage premium ω_i to back out the expected average screening efficiency of FDI firms $E\left[\,\ln d \mid I_i\right]$ (see equation (55)). Furthermore, we need additional information on the following expression: $\ln \tilde{I}(Z)$, which was defined in equation (43). Given the centrality of this term in determining the screening efficiency, I will provide a sensitivity analysis of $E[d \mid I_i]$ with regard to different values of $\ln \tilde{I}(Z)$. In doing so, I will also be able to compare the value for the FDI market access variable as inferred from the data, with hypothetical other values that represent scenarios where the labour market is more/less frictional.

In order to infer $\ln \tilde{I}(Z)$ from the data requires further values for the market access variable of exporting (Υ_x) and FDI activity (Υ_i), and on the parameters β and γ. Moreover, Υ_i is a function of the relative labour market friction (b/b_m) and of the relative demand shifter (A_m/A).

Table 5: Data and Paramatrisation Strategy

Data & Parameters	Value	Description	Source
β	0.75	Elasticity of substitution between varieties	Broda and Weinstein (2006)
γ	0.5	Elasticity of employment	Helpman et al. (2017)
k	4/3	Shape parameter of the ability distribution	Helpman et al. (2017)
ω_x	data	Exporter wage premium	Germany 2006- LIAB
ω_i	data	MNE wage premium	Germany 2006- LIAB
$k/(\delta - k)$	data	Employment coefficient	Germany 2006- LIAB
b_m/b	data	Relative Labour Market Friction	EPL (OECD, 2006)
A_m/A	data	Relative demand shifter	WIOD (2006), PWT (2006)

Notes: The market access variable for exporting (Υ_x) and FDI (Υ_i) can be obtained from the relative demand shifter A_m/A and the relative labour market friction (Υ_i). See also equation (76) in the Appendix.

As is standard in the literature (see Broda and Weinstein (2006)), I set $\beta = 0.75$, corresponding to an elasticity of substitution within the sector equal to 4. Additionally, following Helpman et al. (2017), I set $\gamma = 0.5$. Finally, I find Υ_i by inferring the relative labour market friction (b/b_m) from the OECD *strictness of Employment Protection Legislation* indicator (EPL), which measures the procedures and costs involved in dismissing individuals or groups of workers and the procedures involved in hiring workers in fixed-term. The value for the relative labour market friction is 1.25, implying that the German labour market is more rigid than the ROW.[38]

The relative demand shifter can be derived from expenditure and price data on Germany's imports and exports, which serves as a proxy for the Home country's spending on differentiated goods from Foreign and Foreign's expenditure on Home's goods, respectively. The relative demand shifter between the ROW and Germany A_m/A takes the value 1.19. Knowing the values for for the relative demand shifter and the relative labour market rigidity allows us to now find the value for the market access variable $\tilde{I}(Z)$, which takes the value 1.83. Table 5 above summarises the data sources and the parameterisation strategy.

4.2.3. Quantification

Table 6 presents the results of this quantification exercise for the different estimated values of the firm size coefficient and exporter and MNE wage premium. Column three to five capture the different specifications and thus, the different controls included into the regressions. Here,

[38] See the Appendix for further details on data for labour market frictions.

[38] Data on Germany's imports and exports are taken from input output tables (OECD (2012)) for the German manufacturing sector in 2006 and prices can be obtained from Penn World Tables (Feenstra, Inklaar, and Timmer (2015)) See Appendix for details on how the relative demand shifter is constructed.

I have allowed for three different interpretations of the the firm specific shock d: in (1) only employment size has been added as a control, (2) controls for the fact that, in line with the theoretical framework, firms operate in a specific industry, and (3) allow us to make a connection between the screening technology and the skill-mix across firms. The estimated coefficients for all three specifications are based on the baseline regression in equation (1), which are presented in Table 3. Furthermore, the last row of the table indicates the obtained R^2 from these regressions.

Under the first specification, the calibration of the expected average screening efficiency of exporters $E\big[\ln d \mid I_{x,m}\big]$ takes a value of -0.091. In (54) the expected screening efficiency of exporters is determined by the employment coefficient (here equal to 0.088 and the exporter wage premium. Since in specification (1) the latter takes a negative value ($\omega_x = -0.008$), the resulting value for $E\big[\ln d \mid I_{x,m}\big]$ is negative as well. This implies that the average expected screening efficiency among exporters ought to be smaller than that of domestic firms in order to explain the negative exporter wage premium. Given the employment coefficient of 0.088, a MNE wage premium of 0.107 and $\ln \tilde{I}(Z) = 0.605$, the expected screening efficiency among MNEs is given by $E\big[\ln d \mid I_i\big] = 0.611$. This number, in turn, captures the difference in the expected screening efficiency between MNEs and domestic firms. Furthermore, in line with the predictions from the theoretical framework, MNEs are better at screening workers than exporters. Note, however, that here the R^2 of the regression takes a rather low value of 0.158 and the estimated exporter wage premium is close to zero.

Table 6: Calibration of Screening Efficiency

	Source	(1) + Size	(2) +Industry	(3) +Occ
$k/(\delta - k)$	data	0.088	0.080	0.074
ω_x	data	-0.008	0.007	0.022
ω_i	data	0.107	0.112	0.073
$E[\ln d \mid I_{x,m}]$	Calibration	-0.091	0.089	0.297
$E[\ln d \mid I_i]$	Calibration	0.611	0.795	0.385
R^2		0.158	0.188	0.430

Notes: Here, the screening efficiency is calibrated for a MNE market access variable $ln\tilde{I}(Z) = 0.605$; the calibration of $I(\tilde{Z})$ is based on the data and parameterisation strategy as described in Table 5.

The results from specification (2) allow for additional industry fixed effects, which reduces the estimated employment coefficient slightly and the exporter premium now becomes positive. Consequently, we obtain a positive value for $E\big[\ln d \,|\, I_{x,m}\big] = 0.089$. The difference in the expected screening efficiency between MNEs and domestic firms increases as well and takes the value 0.795. As in the previous specification, the screening efficiency of MNEs is higher than the equivalent value for exporting firms.

The last specification (3), allows us to make a connection between firms' ability to find the right workers and the resulting occupational mix across firms. The significant increase in ω_x from 0.007 in the previous specification to 0.022, results in a rise of $E\big[\ln d \mid I_{x,m}\big]$ from 0.089 to 0.297. Contrary, $E\big[\ln d \,|\, I_i\big]$ reduces from 0.795 to 0.385 due to the reduction in the MNE wage premium to 0.073. Nonetheless, the ranking of firms with respect to their international activity and their ability in finding the right workforce remains unchanged.

This analysis suggests that the hierarchy of firms' international activities with regard to their ability to find the right workers, mirrors the ranking of wages across these firm types. This finding highlights the relevance of the mechanism from the theoretical framework in explaining *Fact 1* and *Fact 3*, as established in th empirical analysis: *Fact 1* stated that firms participating in global markets pay higher wages than firms that operate only in the domestic market, where MNEs pay higher premia than exporters. As discussed above, firms' ability to screen workers is crucial in explaining differences in pay between domestic, exporting and MNE firms. *Fact 3* stated that unobserved worker and firm heterogeneity matters in explaining the observed wage patterns. The analysis of this subsection points toward the firm's efficiency in finding the right workers as constituting an important part of the 'black box' of the firm, which empirically are proxied by fixed effects estimations.

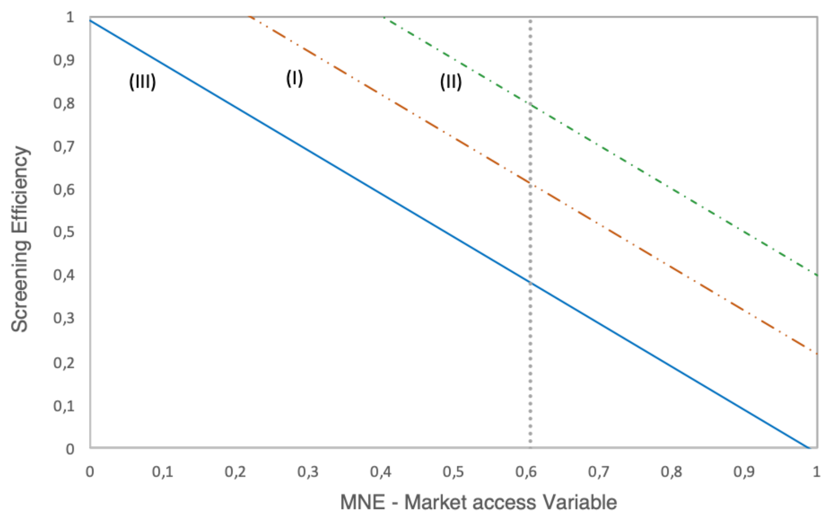
4.2.4. Discussion

The previous subsection highlighted that exporters and MNEs have on average a higher expected screening efficiency than domestic firms and the one of MNEs exceeds that of exporters. While $E\big[\ln d \mid I_{x,m}\big]$ was pinned down by the exporter wage premium and the employment coefficient, key to the calibration of the screening efficiency of MNEs is the additional market access variable for FDI $\ln \tilde{I}(Z)$. Thus, for a given exporter and MNE wage premium, differences in the expected screening efficiency between exporters and MNEs are going to be driven by this term. From equations (50) and (55) it is clear to see that the larger this term is the less we require of $E\big[\ln d \,|\, I_i\big]$ in order to explain a given MNE wage premium. Furthermore, for high enough values of $\ln \tilde{I}(Z)$, the expected screening efficiency of MNEs may even fall below the one of exporters.

Below, I provide a sensitivity analysis of $E[d \mid I_i]$ with regard to different values of $\ln \tilde{I}(Z)$. In doing so, I will also be able to compare the value for the FDI market access variable, as inferred from the data, with hypothetical other values that represent scenarios where the labour market is more/less frictional.

FDI market access

Following the parametarisation strategy described in Table 5, the FDI market access variable $\ln \tilde{I}(Z)$ took a value of 0.605. The parameterisation, in turn, was based on the assumption that home has a relatively higher labour market rigidity than its trading/FDI partners.[39] Thus, changes in the FDI market access variable can be viewed as an increase/decrease in the relative labour rigidity across countries.



Notes: The figure shows the relationship between the log of FDI market access variable $I(\tilde{Z})$ and the expected screening efficiency of MNEs. Here, $\ln \tilde{I}(Z)$ takes hypothetical values from 0 to 1, where 0.605 is the calibrated value (see Table 5 for parametarisation and data description).

Figure 4: FDI Market Access and Screening Efficiency

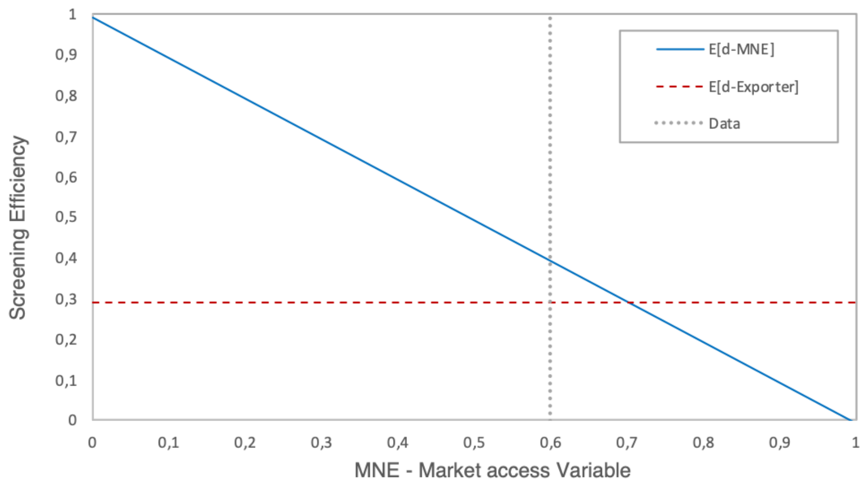
Figure 4 shows the relationship between the log of the FDI market access variable and the expected screening efficiency of MNEs, where $\ln \tilde{I}(Z)$ takes hypothetical values from 0 to 1. The dashed vertical line indicates the value of 0.605 as inferred from the data. As expected, the higher the FDI market access variable is, the lower the screening efficiency of MNEs, where each of the three downward sloping lines captures a different empirical specification from Table 6. The analogous expected screening efficiencies for MNEs from Table 6 are given by the intersection between the vertical line with the corresponding downward sloping line. For example, the lowest of the three lines, indicated by (III), represents specification (3), where $E\big[\ln d \mid I_i\big]$ is given by 0.385. Since this is also the most conservative value for the expected screening efficiency of MNEs, I will base the following comparison with exporters on this value.

Exporters vs MNEs

Similar to the previous Figure, Figure 5 shows the relationship between the log of FDI market access variable $\tilde{I}(Z)$ and firms' expected screening efficiency. While the downward sloping line represents – as before –the negative relationship between the MNE market access variable, the horizontal line captures the expected screening efficiency of exporters. $E\big[\ln d \mid I_{x,m}\big]$ is pinned

[39] I computed the relative labour market friction for the specific case of Germany based on the OECD strictness of Employment Protection Legislation indicator (EPL), which measures the procedures and costs involved in dismissing individuals or groups of workers and the procedures involved in hiring workers in fixed-term.

down by the exporter wage premium and the employment coefficient and thus, does not vary with different levels of $\tilde{I}(Z)$. The intersection between $E\big[\ln d \mid I_i\big]$ and$E\big[\ln d \mid I_{x,m}\big]$ occurs at a value of about $\ln \tilde{I}(Z) = 0.7$. For values greater than 0.7, the expected screening efficiency of exporters is larger than the one for MNEs. For values smaller than 0.7 the expected screening efficiency of MNEs exceeds that of exporters, where the true value of $\ln \tilde{I}(Z)$ lies in this interval (see dashed vertical line at 0.605).



Notes: The figure shows the relationship between the log of FDI market access variable $I(Z)$ and the expected screening efficiency of exporters and MNEs. Here, $\ln I(Z)$ takes hypothetical values from 0 to 1, where 0.605 is the calibrated value (see Table 5 for parametarisation and data description).

Figure 5: Screening Efficiency - Exporters vs MNEs

The FDI market access variable captures the revenue premium of MNE activity, which depends on the relative labour market friction and the relative demand shifter between home and the foreign country. The reduced-form analysis so far suggests that for given wage premia a larger market access variable for MNEs translates into smaller differences between the expected screening of exporters and MNEs. Technically speaking, this is due to the fact that the larger the term $\ln I(\tilde{Z})$, less of the 'residual' $E\big[\ln d | I_i\big]$ is needed to explain a given wage premium. If we interpret a larger market access variable as capturing Home to be more frictional than the foreign country, we can explain the above findings as follows: The higher the labour market friction at Home relative to the other country, the stronger the incentive to make use of the more flexible labour market abroad by setting up a foreign affiliate. While MNEs can circumvent a more stringent labour market at home by transferring their screening technology abroad and then hiring and producing in the foreign market, exporters are bound to the conditions of the labour market at home. Therefore, a higher value $\ln I(\tilde{Z})$, i.e. a more rigid labour market at home relative to foreign, allows MNEs with relatively low screening efficiency (d) to still successfully screen in the foreign market.

Note, however, that the conditions in (51)-(52) concerning the ranking of *average* firm characteristics ($Z_i > Z_x > Z_d$) still need to hold in order to ensure that the hierarchy of wages across firm types is preserved. Moreover, equations (46)-(55) are reduced form expressions of wage premia and screening efficiencies and hence, abstract away general equilibrium effects. For example, a higher FDI market access variable $\ln \tilde{I}(Z)$ due to higher labour market frictions at home, will also alter the market access variable of exporters, productivity cut-offs and firms' optimal decisions how many workers to hire (h) at home and abroad.

5. Conclusion

Globalisation has various faces. While some firms choose to serve foreign markets via exporting at arms length, other firms decide to 'go full in' by selling through foreign affiliates. The first part of this paper provided empirical evidence for the hypothesis that differences in firms' mode of foreign market entry, have diverse implications for labour market outcomes. My findings exhibit a clear hierarchy of firms' international activities with regard to wage premia and the average observed and unobserved workforce ability, where MNEs can be ranked highest. This observed pattern between the ranking of wages and the skills required, suggests worker-firm-type complementary.

In the second part of the paper, I provide a unified framework to analyse the complex interplay between diverse forms of globalisation, labour market frictions and wage inequality. In doing so I build a theoretical model that accounts for the observed features in the data, which provides a theoretical explanation for positive exporter and multinational premia for employment and wages and predicts imperfect correlations between firm employment, wages and international activity.

The analysis suggests that firms with superior average characteristics - in terms of productivity, screening efficiency or fixed export or FDI cost - become exporters and firms with an even higher firm specific triplet, serve foreign markets via FDI. As in Helpman et al. (2017), the participation of some but not all firms in international activities provides a mechanism for heterogeneous forms of globalisation to affect wage inequality. As wages and international activities are closely linked to heterogeneous firm characteristics, exporting and FDI firms pay higher wages, and multinationals can be ranked at the top of this wage hierarchy.

Moreover, the back-of-the-envelope calculation provides novel insights concerning the interplay of firms' internationalisation decisions and firms' ability to find the right workers in a frictional labour market. This analysis suggests that the hierarchy of firms' international activities with regard to their screening efficiency, mirrors the ranking of wages across these firm types. This finding implies that differences in the screening efficiency across various types of firms plays a key role in explaining wage premia and thus, constitutes an important part of the 'black box' of the firm, which previously in the literature have been proxied by fixed effects estimations.

The analysis further highlights a number of interesting areas for further research. Traditionally, exporter and MNE premia have been interpreted as wage differences received by "identical" workers at different types of firms. My results show that unobserved worker ability varies across the different firm types in a systematic way. This suggests that these workers may not be identical after all and that there are reasons to believe that the observed sorting pattern on unobserved ability, especially prevalent in MNEs, is not mere coincidence. As suggested in the theoretical framework of this paper, MNEs may be better at identifying econometrically unobserved talent. My findings concerning the 'skill-internationality' complementarity, merit further empirical and theoretical investigation.

Furthermore, the theory provides further insights into the interdependence between labour market rigidities and firms' mode of foreign market entry. More specifically, changes in a country's labour market institution (such as a labour market reform) may change the pattern of trade and FDI within and across countries. Hence, the framework developed in this paper has the potential to capture and explain the interdependence between firms international activities, institutional changes and labour market outcomes. Estimating the model with Data for Germany is left for future research.

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Appendix A. Data

A.1. LIAB

Data Access

This study uses the Linked-Employer-Employee Data (LIAB) cross-sectional model 2 1993-2014 (LIAB QM2 9314), provided by the German Institute for Employment Research (IAB). Data access was provided via on-site use at the UK Data Archive at the University of Essex and subsequently remote data access.

Complexity of tasks performed

Occupations can be described on the basis of the requirement level. The objective of classifying occupations according to their complexity is to be able to depict the various degrees of complexity within those occupations which have a high similarity of occupational expertise. Four Requirement Levels are distinguished to map the degree of complexity of an occupation. The assumption behind it is that a certain standard of skills, abilities and knowledge must exist for practicing a certain occupation. The standard of skills, abilities and knowledge required for practicing an occupation need not be based on the educational level, but can also be acquired through work experience and learning-by-doing. Here, the formal qualification of the person practicing the occupation is irrelevant; the subject of consideration is rather the Requirement Level that is typically demanded for this occupational activity.[40]

A.2. Foreign Direct Investment (FDI)

Definition

According to international standards, FDI refers to cross-border investments made by residents and businesses from one country into another, with the aim of establishing a lasting investment in the company receiving investment.The "lasting interest" is evidenced when the direct investor owns at least 10% of the voting power of the direct investment enterprise.[41] Furthermore, one can distinguish between inward and outward FDI: The outward FDI stock is the value of the resident investors' equity in and net loans to enterprises in foreign economies. The inward FDI stock is the value of foreign investors' equity in and net loans to enterprises resident in the reporting economy.

German FDI

[40] For further information see Paulus, Matthes et al. (2013).

[41] The 'OECD Benchmark Definition of Foreign Direct Investment, 4th edition', OECD (2008), provides operational guidelines on how foreign direct investment activity should be measured and sets the world standard for collecting direct investment statistics.

Germany is one of the main recipients and source countries of FDI in the world, where it ranked 4th in terms of outward FDI and 6th with respect to inward FDI stocks in 2017 (see OECD (2018)). Outward investment (46% of GDP in 2017) by German residents tends to be much larger than inward FDI (26% of GDP in 2017). Furthermore, FDI stock statistics, published by the Deutsche Bundesbank, show that more than half of Germany's inward FDI originate from within the EU. In contrast, the main recipients of German outward FDI are invested in non-EU countries.[42]

A.3. Robustness Checks

I consider the robustness of my results to different subsamples of the data set and by further analysing differences in the wage premia among MNEs.

Table 9 presents estimation results equivalent to the ones in Table 3, where I include workers that may only appear in the sample in 2006. Consequently, the sample correspond to full-time workers between 16 and 65 years of age, where data is available at least in 2006. The qualitative interpretation of the different firm type coefficients only changes with respect to the second column, which adds the firm size to the regression: The exporter premium is now positive at the 1% significance level.

Additionally, I present estimation results for the different wage premia equivalent to Table 5, using a sample excluding all firms that switch their type between 2006 and 2010. This address the concern regarding the varying survey questions on outward FDI in the two sample periods.[43] Table 10 summarises the results.

Table 11 presents estimation results based on a regression as in equation (2), additionally controlling for whether a worker moved during the sample period. As shown in the table, based on a simple POLS estimation firm-movers earn on average 9.2% less and the firm fixed specification suggests that movers are being payed about 9% less relative to stayers.

Another way to test whether there is a positive association between wages and firms' international activity is to use the panel of workers moving to different firm types. switchers. The results of the switchers analysis are presented in Table 12. The estimated coefficients for firm-type switchers highlight two distinct findings: First, workers that move from a local to an exporter or MNE experience, on average, larger wage gains relative to workers that move within the same firm type. Second, transitions in the opposite direction, i.e. workers moving away from exporters or MNEs to local firms, experience a wage growth that is significantly lower than the equivalent wage growth of individuals that move within the same firm type.

[42]It is important to additionally record secondary investment via dependent holding companies when analysing the main trends in cross-border investment. Consequently, FDI data usually refers to the consolidated sum of primary FDI and secondary FDI (held through dependent holding companies). The original investment in the holding company is factored out of the latter to avoid double counting.

[43]See discussion related to estimation results of Table 4

Table 8: Robustness 1 - Traditional Exporter Premium (2006)

	(1) No Controls	(2) +Size	(3) +Industry	(4) +Occ	(5) +obs
Exporter	0.128***	0.0211***	0.0321***	0.0270***	0.0237***
	(0.00157)	(0.00155)	(0.00193)	(0.00168)	(0.00147)
log *size*		0.0883***	0.0801***	0.0747***	0.0671***
		(0.000400)	(0.000419)	(0.000382)	(0.000346)
Observations	332,645	332,645	332,645	332,645	332,645
Firms	4,779	4,779	4,779	4,779	4,779
R^2	0.020	0.145	0.178	0.428	0.562

Notes: This Table presents estimation results for the 'traditional' exporter premium. The sample corresponds to full-time workers between 16 and 65 years of age, where data is available in 2006. Dependent variable is the log daily wage. Firm variables include the firm type (local, exporter and 3 different MNEs), the log of employment (size) and 17 industry catagories. Worker observables include: gender, age, nationality (dummy for foreign), tenure at the firm, 340 different occupations and the educational level. The education groups are defined as: 1) low: no vocational training, no high-school; 2) medium: high school and/or vocational training; 3) high: university or technical college. Standard errors in parentheses. Asterisks indicate significance at: * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

A.3.1. Extended Sample

Table 9: Robustness 2 - Unravelling the different Wage Premia (2006)

	(1) No Controls	(2) +Size	(3) +Industry	(4) +Occ	(5) +obs
Exporter	0.216***	0.110***	0.0412*	0.00305***	0.0316***
	(0.00125)	(0.00124)	(0.00148)	(0.00127)	(0.00116)
MNE_{For}	0.250***	0.177***	0.110***	0.103***	0.0846***
	(0.00231)	(0.00222)	(0.00219)	(0.00187)	(0.00158)
MNE_{Dom}	0.172***	0.105***	0.107***	0.0209***	0.0372***
	(0.00611)	(0.00573)	(0.00574)	(0.00489)	(0.00428)
MNE_{Hyb}	0.324***	0.186***	0.156***	0.0645***	0.0624***
	(0.00346)	(0.00333)	(0.00326)	(0.00138)	(0.00116)
Observations	332,645	332,645	332,645	332,645	332,645
Firms	4,779	4,779	4,779	4,779	4,779
R^2	0.035	0.158	0.188	0.430	0.565

Notes: This Table presents estimation results equivalent to the ones in Table 3, where here workers are included that may only appear in the sample in 2006. The sample corresponds to full-time workers between 16 and 65 years of age, where data is available in 2006. Dependent variable is the log daily wage. Firm variables include the firm type (local, exporter and 3 different MNEs), the log of employment (size) and 17 industry catagories. Worker observables include: gender, age, nationality (dummy for foreign), tenure at the firm, 340 different occupations and the educational level. The education groups are defined as: 1) low: no vocational training, no high-school; 2) medium: high school and/or vocational training; 3) high: university or technical college. Standard errors in parentheses. Asterisks indicate significance at: * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

A.3.2. Restricted Sample

Table 10: Robustness 3 - Controlling for Unobserved Heterogeneity

	(1)	(2)	(3)	(4)
Exporter	0.02258***	0.0756***		
	(0.00165)	(0.00576)		
MNE	0.102***	0.0813***		
	(0.00153)	(0.00549)		
log *size*	0.0776***	0.0332***	0.0463***	0.0259***
	(0.000354)	(0.00142)	(0.00387)	(0.00221)
Individual FE		x		
Firm FE			x	
Spell FE				x
Time FE	x	x	x	x
Worker controls	x	x	x	x
Firm controls	x	x	x	x
Observations	425,323	425,323	425,323	425,323
Firms	4,774	4,774	4,774	4,774
R^2	0.541	0.545	0.434	0.547

Notes: This Table presents estimation results equivalent to the ones in Table 4, but I now exclude all firms that change their type between 2006 and 2010. The sample corresponds to full-time workers between 16 and 65 years of age, where data is available in both sample periods. Dependent variable is the log daily wage. Firm variables include the firm type (local, exporter and 3 different MNEs), the log of employment (size) and 17 industry catagories. Worker observables include: gender, age, nationality (dummy for foreign), tenure at the firm, 340 different occupations and the educational level. The education groups are defined as: 1) low: no vocational training, no high-school; 2) medium: high school and/or vocational training; 3) high: university or technical college. Standard errors in parentheses. Asterisks indicate significance at: * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

A.3.3. Movers & Switchers

Table 11 presents estimation results based on a regression as in equation (2), additionally controlling for whether a worker moved during the sample period. As shown in the table, based on a simple POLS estimation firm-movers earn on average 9.2% less and the firm fixed specification suggests that movers are being payed about 9% less relative to stayers. One potential explanation for this finding could be that movers had some unemployment spell between moving from one firm to another. Another reason that might explain why movers earn less on average may be that these workers accept a lower starting wage at another firm in exchange of a steeper wage profile during their time at the new firm. Alternatively, incentives may be going the other way: because movers are dissatisfied with their low wages they move to a different firm, with the expectation of receiving more at another firm.

Another way to test whether there is a positive association between wages and firms' international activity is to use the panel of workers moving to different firm types. If it is the exporter/MNE status that matters then we should expect to see that (conditioning for firm size and other firm characteristics) the wage growth for workers who move from local to exporters/MNEs to be different to the wage growth for those who move in the opposite direction or remain within the same firm type. Th different firm-type switchers are defined as follows: Firstly, workers that move to another firm but remain in the same firm type, including local to local (LL), exporter to exporter (EE) and MNE to MNE (MM) switchers. I denote these movers as $Same$-switchers. Second, individuals that switch to and from local firms: Local to exporter (LE), local to MNE (LM), exporter to local (EL) and MNE to local (ML). Third, workers switching between exporter and MNEs, namely exporter to MNE (EM) and MNE to exporter (ME) switchers.

The results of the switchers analysis are presented in Table 12 below. The estimated coefficients for firm-type switchers highlight two distinct findings: First, workers that move from a local to an exporter or MNE experience, on average, larger wage gains relative to workers that move within the same firm type. Second, transitions in the opposite direction, i.e. workers moving away from exporters or MNEs to local firms, experience a wage growth that is significantly lower than the equivalent wage growth of individuals that move within the same firm type.

Table 11: Robustness - Firm Movers

	(1)	(2)	(3)	(4)
Exporter	0.0299***	0.0206***	0.0259***	0.0191***
	(0.00112)	(0.000958)	(0.00165)	(0.000932)
MNE	0.0492***	0.0269***	0.0164***	0.0250***
	(0.000932)	(0.00104)	(0.00181)	(0.00102)
log *size*	0.0691***	0.0332***	0.0488***	0.0259***
	(0.000231)	(0.00109)	(0.00301)	(0.00171)
Mover	-0.0924***		-0.0878***	
	(0.00246)		(0.00319)	
Individual FE		x		
Firm FE			x	
Spell FE				x
Time FE	x	x	x	x
Worker controls	x	x	x	x
Firm controls	x	x	x	x
Observations	665290	665290	665290	665290
Firms	5,490	5,490	5,490	5,490
R^2	0.430	0.574	0.457	0.579

Notes: This Table presents estimation results equivalent to the ones in Table 4, additionally including a dummy variable for whether a worker transitions to a different firm between 2006 and 2010. Regressions based on LIAB data for the year 2006 and 2010. The sample corresponds to full-time workers between 16 and 65 years of age, where data is available in both sample periods. Dependent variable is the log daily wage. See notes of table 4 for the set of firm and worker observables. Standard errors in parentheses. Asterisks indicate significance at: * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

Table 12: Robustness - Analysing Firm-Type Switchers

	(1) POLS	(2) Firm-FE
Exporter	-0.165***	
	(0.0345)	
MNE	-0.227***	
	(0.0289)	
1 L-EX	0.0969**	0.176**
	(0.0373)	(0.0604)
2 L-MNE	0.295***	0.308***
	(0.0260)	(0.0316)
3 EX-MNE	0.113***	0.0587
	(0.0241)	(0.0306)
4 MNE-EX	0.000276	-0.0489
	(0.0393)	(0.0619)
5 EX-L	-0.206***	-0.313***
	(0.0323)	(0.0473)
6 MNE-L	-0.148***	-0.368***
	(0.0324)	(0.0487)
$\Delta \log size$	-0.0572	0.0818
	(0.0508)	(0.0611)
Observations	7302	7302
R^2	0.208	0.210

Notes: Dependent variable is the change in the log daily wage. Controls include firm-type, 7 switcher types (see Figure 2), log of employment size in levels and changes, industry, age tenure and education. Standard errors in parentheses. Asterisks indicate significance at: * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

Table 13: Robustness - Share of High Skilled Workers (2006)

	(1) No Controls	(2) +Size	(3) +Industry	(4) +Obs
Exporter	0.0198***	0.0124***	0.0261***	0.0259***
	(0.00331)	(0.00338)	(0.00355)	(0.00353)
MNE	0.0589***	0.0438***	0.0552***	0.0568***
	(0.00418)	(0.00447)	(0.00445)	(0.00443)
$\log size$		0.0083***	0.0061***	0.0072***
		(0.0009)	(0.00090)	(0.00092)
Observations	4779	4779	4779	4779
R^2	0.042	0.058	0.176	0.192

Notes: Table presents regression results based on a firm-level sample, with the share of high skilled workers in a firm as dependent variable. Firm controls include industry, firm size, and the firm type. Worker characteristics are averaged on the firm level, i.e. the share of foreign and female workers and the average age and tenure of workers in the firm. Standard errors in parentheses. Asterisks indicate significance at: * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

Table 14: Robustness - Share of Workers performing Complex Tasks (2006)

	(1) No Controls	(2) +Size	(3) +Industry	(4) +Obs
$Exporter$	0.0122*	0.000146	0.0267***	0.0263***
	(0.00487)	(0.00497)	(0.00501)	(0.00496)
MNE	0.0733***	0.0486***	0.0759***	0.0784***
	(0.00616)	(0.00657)	(0.00628)	(0.00624)
$\log size$		0.0136***	0.0091***	0.0105***
		(0.00135)	(0.00128)	(0.00130)
Observations	4779	4779	4779	4779
R^2	0.029	0.049	0.233	0.251

Notes: Table presents regression results based on a firm-level sample, with the share workers performing complex tasks in a firm as dependent variable. Firm controls include industry, firm size, and the firm type. Worker characteristics are averaged on the firm level, i.e. the share of foreign and female workers and the average age and tenure of workers in the firm. Standard errors in parentheses. Asterisks indicate significance at: * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

Appendix B. Theory

B.1. Wage Bargaining

I follow Stole and Zwiebel (1996) and assume that wages are determined by continuous bargaining between the firm and its employees. Before production takes place, firms and workers can engage in an arbitrary number of pairwise negotiations, where wage contracts are unenforceable: the firm may fire any employee and any employee may decide to quit. If the worker is forced to, or voluntarily enters into unemployment, where in the baseline model the value of being unemployed ($\underline{w}$) is normalised to zero. It is assumed that once negotiations begin the firm cannot hire additional employees from the unemployment pool. All the firm's other decisions – sampling, screening, production, exporting – are sunk by the bargaining stage and can thus, be regarded as state variables for the firm.

Stole and Zwiebel (1996) formally characterize the stable division of production into wages and profits such that renegotiating does not improve neither the firm's nor the workers' pay-offs. They show that the stable profile can be derived as the unique subgame perfect equilibrium of an extensive form game where the firm and workers play the alternating-offer bargaining game of Binmore, Rubinstein, and Wolinsky (1986) within each bargaining session. The stable profile is characterized by the following generalised Nash-bargaining condition between the firm and its h employees:

$$\lambda \frac{\partial}{\partial h}\left[r(Z,h) - w(Z,h)h\right] = (1-\lambda) w(Z,h) \tag{56}$$

where λ represents the bargaining power of the firm. This equation implies that the surplus of a worker from employment ($w(Z, h$is equal to the marginal surplus of the firm from employing the worker, weighted by their respective bargaining powers.[44] Using the assumed functional forms for revenues this differential equation yields the solution

$$w(\theta) = \frac{\lambda\beta\gamma}{1-\lambda+\lambda\beta\gamma}\frac{r(Z)}{h(Z)} \tag{57}$$

And with equal bargaining power between the firm and workers and assuming that $\underline{w} = 0$:

$$w(Z) = \frac{\beta\gamma}{1+\beta\gamma}\frac{r(Z)}{h(Z)} \tag{58}$$

[44] Stole and Zwiebel (1996) show that because if a worker quits, renegotiations ensue with all remaining workers, and this in turn allows a worker to obtain the same share of surplus associated with workers prior to him in the order as those after him. Thus, this structure allows workers, through their ability to renegotiate if breakdown occurs later, to effectively achieve the same outcome as a wage agreement up front that is contingent on which workers are ultimately present.

Thus, as in Stole and Zwiebel (1996) the wage is equal to the the worker's share of his contribution to the value of the firm, taking into account that if the worker were to quit, this would also influence the wages of other employees of the firm.

B.2. Firm's optimisation problem

Given the profit function in (19), a firm's firs order condition for the number of workers sampled for the home establishment (n_H) and additionally if a firm is a MNE for the foreign establishment (n_F) are: he firm's first order conditions for the measure of workers sampled for the home establishment (n_H), the foreign affiliate (n_F) and the screening ability threshold (a_c) are:

$$\frac{\beta\gamma}{1+\beta\gamma}\Upsilon_H^{1-\beta}A\left(\frac{k}{k-1}zn_H^{\gamma}a_c^{1-\gamma k}\right)^{\beta} \equiv \frac{\beta\gamma}{1+\beta\gamma}r_H = bn_H \tag{59}$$

$$\frac{\beta\gamma}{1+\beta\gamma}A_2\left(\frac{k}{k-1}zn_F^{\gamma}a_c^{1-\gamma k}\right)^{\beta} \equiv \frac{\beta\gamma}{1+\beta\gamma}r_F = b_2 n_F \tag{60}$$

$$\frac{\beta(1-\gamma k)}{1+\beta\gamma}\left[\Upsilon_H^{1-\beta}A\left(\frac{k}{k-1}zn_H^{\gamma}a_c^{1-\gamma k}\right)^{\beta} + I_i A_2\left(\frac{k}{k-1}zn_F^{\gamma}a_c^{1-\gamma k}\right)^{\beta}\right] = \frac{c}{d}a_c^{\delta} \tag{61}$$

Combining equations (59) and (60), number of workers sampled in home plant relative to foreign plant for a given firm is given by

$$\frac{n_H}{n_F} = \left(\frac{b}{b_2}\frac{A_2}{A}\right)^{-\frac{1}{1-\gamma\beta}} \tag{62}$$

In a next step we can use this expression to find the market access variable for FDI firms by expressing total revenue in (16) in terms of home revenues

$$r = r_H\left(1+\frac{r_F}{r_H}\right) \equiv r_H\left(1+\left(\frac{A_2}{A}\right)^{\frac{1}{1-\gamma\beta}}\left(\frac{b}{b_2}\right)^{\frac{\gamma\beta}{1-\gamma\beta}}\right) \tag{63}$$

which captures the market access variable (revenue premium) of FDI activity as defined in equation (25).

B.3. Wage Equations

I start with the wage (see equation (27))and employment equation :

$$w_H(Z) = \frac{\beta\gamma}{1+\beta\gamma}\frac{r_H(Z)}{n_H(Z)a_c(Z)^{-k}} = ba_c(Z)^k \tag{64}$$

$$h_H(Z) = n_H(Z)a_c(Z)^{-k} \tag{65}$$

and by noting that total revenue of a firm can be expressed from (23):

$$r(Z) = \frac{1+\beta\gamma}{\beta\gamma} bn_H(Z)\tilde{I}(Z) \tag{66}$$

where $\tilde{I}(Z)$ is defines as

$$\tilde{I}(Z) \equiv \frac{\Upsilon_H(Z)^{1-\beta} + I_i(Z)\left(\frac{b}{b_2}\right)^{\frac{\gamma\beta}{1-\gamma\beta}}\left(\frac{A_2}{A}\right)^{\frac{1}{1-\gamma\beta}}}{\Upsilon_H(Z)^{1-\beta}} \tag{67}$$

which is equal to 1 for non-FDI firms and is $\Upsilon_i^{\frac{1}{1-\gamma\beta}}$ for multinationals.

Next we can multiply both sides of (66) with a_c^{-k} to express the equation in terms of employment $h_H(Z)$:

$$r(Z) = \left[\frac{d}{c}\frac{\beta(1-\gamma k)}{1+\beta\gamma}\right]^{\frac{k}{\delta-k}}\left[\frac{1+\beta\gamma}{\beta\gamma}\right]^{\frac{\delta}{\delta-k}} b^{\frac{\delta}{\delta-k}} h_H(Z)^{\frac{\delta}{\delta-k}}\tilde{I}(Z)^{\frac{\delta}{\delta-k}} \tag{68}$$

Given that wages are a constant share $\beta\gamma/(1+\beta\gamma)$ of revenues per worker we can express (68) as follows

$$w_H = \left[\frac{d}{c}\frac{\beta(1-\gamma k)}{\beta\gamma}\right]^{\frac{k}{\delta-k}} b^{\frac{\delta}{\delta-k}} h_H(Z)^{\frac{k}{\delta-k}}\tilde{I}(Z)^{\frac{k}{\delta-k}} \tag{69}$$

Next, taking logs of this expression yields the wage equation in (41):

$$\ln w_H = \kappa_H + \frac{k}{\delta-k}\ln h_H(Z) + \frac{k}{\delta-k}\ln\tilde{I}(Z) + \frac{k}{\delta-k}\big(\ln d - E[\ln d]\big) + \frac{k}{\delta-k}E[\ln d] \tag{70}$$

where κ_H is defined as

$$\kappa_H \equiv \frac{k}{\delta-k}\ln\left[\frac{1}{c}\frac{\beta(1-\gamma k)}{\beta\gamma}\right] + \frac{\delta}{\delta-k}\ln b. \tag{71}$$

B.4. Paramatrisation

B.4.1. Labour Market Friction (b/b_2)

I use the OECD indicator of employment protection legislation (EPL) as a proxy for labour market frictions. The EPL indicator measures the procedures and costs involved in dismissing individuals or groups of workers and the procedures involved in hiring workers on fixed-term or temporary work agency contracts. For each country, EPL is described along 21 basic items which can be classified in three main areas: (i) protection of regular workers against individual dismissal; (ii) regulation of temporary forms of employment; and (iii) additional, specific requirements for collective dismissals. For each item and country, legislation, case law, and collective agreements – in force at a specific date- are reviewed and used to assign scores on a scale from 0 to 6 (from the least to the most strict regulation.

Table 12 presents the index for 28 countries. The mean for the rest of the world includes values for all listed countries accept Germany.

Alternative measures of labour market rigidities confirm that Germany has, on average, a less flexible labour market relative to other developed economies. For example Botero, Djankov, Porta, Lopez-de Silanes, and Shleifer (2004) and Cuñat and Melitz (2012) use the World Bank's *Employing Workers* indicator, which capture different dimensions of the rigidity of employment laws across countries. According to this indicator, in the 2000s Germany was among the five high-income countries with the least flexible labour market.

Table 13 : Employment Protection & Legislation Index (2006)

Country	EPL
Australia	1.42
Austria	2.37
Belgium	1.89
Canada	0.92
Czech Republic	3.31
Denmark	2.13
Finland	2.17
France	2.47
Greece	2.80
Hungary	2.00
Ireland	1.27
Italy	2.76
Japan	1.70
Korea	2.37
Mexico	2.19
Netherlands	2.88
New Zealand	1.56
Norway	2.33
Poland	2.23
Portugal	4.42
Slovak Republic	2.22
Spain	2.36
Sweden	2.61
Switzerland	1.60
Turkey	2.31
United Kingdom	1.26
United States	0.26
Germany	**2.68**
Mean ROW	2.14

B.4.2. Relative Demand shifter (A/A_m)

I start by defining M_F as the Home country's spending on differentiated goods from Foreign:

$$M_F = \int_{Z_x}^{Z_i} \left[\frac{\tau p(Z)}{P}\right]^{-\frac{\beta}{1-\beta}} dG_Z(1-\alpha)L =$$

$$= \tau^{-\frac{\beta}{1-\beta}} A^{\frac{1}{1-\beta}} \int_{Z_x}^{Z_i} p(Z)^{-\frac{\beta}{1-\beta}} dG_Z =$$

$$= \tau^{-\frac{\beta}{1-\beta}} A^{\frac{1}{1-\beta}} P_M^{-\frac{\beta}{1-\beta}} \tag{72}$$

where P_M is the Home country's import price index. Using the equivalent expression for the Foreign country, we can find the relative demand shifter by taking ratios of (76) for Home and Foreign, which yields:

$$\frac{A}{A_m} = \left(\frac{P_M}{P_{M_m}}\right)^{\frac{\beta}{1-\beta}} \frac{M_F}{M_H} \tag{73}$$

We can find the empirical counterpart of M_F/M_H from input output tables (OECD (2012)) for the German manufacturing sector in 2006. Imports in the manufacturing sector (M_F) were 765028 Mio (in US Dollar) in 2006 and exports by German firms (M_H) amounted to 1018505 Mio. Hence, the ratio M_F/M_H is given by 0.75. Prices on imported and exported goods, in turn, can be obtained from the Penn World Tables (see Feenstra et al. (2015)), where $P_M = 0.69$ and $P_{\underline{M}} = 0.66$. With $\beta = 0.75$ yields:

$$\frac{A}{A_2} = \left(\frac{0.69}{0.66}\right)^{\frac{0.75}{1-0.75}} \frac{765028}{1018505} = 0.84 \tag{74}$$

B.4.3. Market Access Variable $(\Upsilon(Z))$

The market access variable for exporters is given by

$$\begin{aligned}\Upsilon_x &= \left[1 + \tau^{-\frac{\beta}{1-\beta}} \left(\frac{A}{A}\right)^{\frac{1}{1-\beta}}\right]^{1-\beta} = \\ &= \left[1 + 2.7^{(-3)} \left(1.19\right)^{4}\right]^{0.25} = \\ &= [1.09]^{0.25} = \\ &= 1.03\end{aligned} \tag{75}$$

and for FDI firms:

$$\begin{aligned}\Upsilon_i &= \left[1 + \left(\frac{b}{b}\right)^{\frac{\gamma\beta}{1-\gamma\beta}} \left(\frac{A}{A}\right)^{\frac{1}{1-\gamma\beta}}\right]^{1-\gamma\beta} = \\ &= \left[1 + 1.25^{(0.6)} \left(1.19\right)^{1.6}\right]^{0.6} = \\ &= [2.5]^{0.25} = \\ &= 1.73\end{aligned} \tag{76}$$

B.5. *Average Workforce Ability*

Given that there are complementarities between a firm's productivity and workers' ability, the model predicts that firms engaging in international activities are not only larger, but also have a workforce of higher (unobserved) ability. Empirically, the results from the panel regression in section 2 already gave supportive evidence for the presence of complemantarities between (unobserved) worker ability and firm types: First, results from the fixed effects estimation in section 3.2 pointed out that unobserved worker and firm heterogeneity are important factors in explaining some of the variation in wages among observationally identical individuals. Moreover, I show that wage premia reduce after controlling for worker and spell fixed effects and that multinational wage premia reduce relatively more. These results are indicative for positive assortative matching between worker and firm type, which is in line with the theoretical prediction of the model presented above. In this section, I will further investigate the sorting patterns between internationally active firms and workers on unobserved and observed worker skills.

B.5.1. *Unobserved Skills*

In order to test whether and to what extent workers with higher unobserved ability sort into internationalising firms, I will employ the following empirical approach: First, the estimated individual fixed (see equation (2)), can be used as a measure of the unobserved ability of the worker. This may include a worker's productivity, language skills and other characteristics that are not available to the econometrician. Second, using the mean of these unobserved abilities on the firm-level, I will then employ the following OLS firm-level regression for the 2006 cross-section:

$$\phi_j = d_s + FTYPE_j'\beta_1 + FSIZE_j'\beta_2 + X_m'\beta_3 + \upsilon_j \tag{77}$$

where ϕ_j is the mean of the unobserved worker ability in firm j and the firm controls are as before, an industry fixed effect (d_s), firm size ($FSIZE$) and the firm type ($FTYPE$). The vector X_m aggregates several worker characteristics up to the firm level, i.e. the share of foreign and female workers and the average age and tenure of workers in the firm.

In a similar fashion to Table 4, Table 7 summarises the estimation results based on different types of wage regressions, which differ with respect to the controls included at the right hand side. The estimated coefficients in column 4, based on a specification including all firm controls, suggest that exporters and MNEs employ, on average, workers with higher unobserved characteristics than

[44] Previous research from the labour literature has already provided evidence for the importance of assortative matching, as measured by the correlation between individual and establishment effects, for sorting patterns wage inequality (see for example Shimer and Smith (2000), Rogerson, Shimer, and Wright (2005) and Chade, Eeckhout, and Smith (2017) for reviews of the search and matching literature). Here, I am interested in the correlation between the individual fixed effect and a specific firm characteristic, namely the firm type.

local firms. The coefficient for exporters takes a value of 0.0138 and for MNEs 0.0826, respectively. The estimated coefficients in all specifications are significant at the 1% and the exporter and MNE coefficient are significantly different from each other in all estimations. Furthermore, the positive coefficient for firm size (0.0667) indicates that larger firms have, on average better workers with respect to their unobserved component of skills.

Table 7: Sorting Patterns - Unobserved Ability and Firm Types (2006)

	(1) No Controls	(2) +Size	(3) +Industry	(4) +Obs
Exporter	0.0768***	-0.0056	0.0860***	0.0702***
	(0.0162)	(0.0160)	(0.0171)	(0.0156)
MNE	0.256***	0.0873***	0.170***	0.129***
	(0.0205)	(0.0211)	(0.0215)	(0.0199)
log *size*		0.0932***	0.0798***	0.0551***
		(0.00434)	(0.00436)	(0.00410)
Firms	4,779	4,779	4,779	4,779
R^2	0.033	0.188	0.194	0.340

Notes: Table presents regression results based on a firm-level sample, with the average unobserved skill per firm as dependent variable. I construct the measure of unobserved worker ability by backing out the individual fixed effects of a regression of log individual wages as in specification (2). I then take the average of the obtained worker fixed effect on the firm level. Firm controls include industry, firm size, and the firm type. Worker characteristics are averaged on the firm level, i.e. the share of foreign, female and high skilled workers and the average age and tenure of workers in the firm Standard errors in parentheses. Asterisks indicate significance at: * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

The estimation results confirm our inference from the previous section, namely that workers with higher unobserved ability sort into exporters and even more into MNEs. There are several potential explanations for the observed sorting pattern between firm types and unobserved worker skills. Intuitively, some skills and types of knowledge are going to be more valuable to firms that are internationally active, such as language skills, working in larger and more heterogeneous teams, leadership ability etc. To the extent that unobserved individual characteristics also matter for firm outcomes, the results from Table 7 suggest there is a 'skill-internationality' complementarity.

B.5.2. Observed Skills

In addition to providing evidence for positive assortative matching between firm type and unobserved worker ability, the Appendix includes further evidence for the sorting pattern with regard

[44] For example, we would think that communication and language skills are more valuable to firms, who are internationally active by developing relationships with customers and business partners abroad.

to observed worker skills in terms of educational level and the task content. Following Autor, Katz, and Kearney (2008), many empirical and theoretical contributions in the labour and trade literature, emphasise that distinguishing between educational level and tasks may be important when measuring the skills demanded by firms. A higher demand for skills, in turn, may capture underlying features of the production process, such as complementarities between firm productivity and worker ability.

The estimation results are presented in Table 11 and 12 in the Appendix. In line with the results regarding unobserved skills, I find that more skilled workers match with firms that participate in global markets. This observed sorting pattern provides further supportive evidence for the hypothesis regarding worker-firm-type complementarities. Furthermore, this finding is in line with theoretical and empirical predictions from the search and matching literature, where sorting arises due to complementarities in the production technology of the firm (e.g. Bagger and Lentz (2014) Eeckhout and Kircher (2018) and Lopes de Melo (2018)).

The estimation results provide corroborating evidence for the theoretical framework, suggesting that the proposed theoretical mechanism is a reasonable approximation of the observed patterns in the data.

B.6. Unemployment

In the model workers can be unemployed either because they are not matched with a firm or because their match-specific ability draw is below the screening threshold (a_c) of the firm with which they are matched. Both components of unemployment are frictional in the sense that workers cannot immediately achieve another match. The sectoral unemployment rate u includes both of these components and can be written as follows:

$$u = \frac{l-h}{l} = 1 - \frac{h}{n}\frac{n}{l} = 1 - \sigma x \tag{78}$$

where, H is the measure of hired workers, n is the measure of matched workers, and L is the measure of workers seeking employment in the sector. Then $\sigma = h/n$ captures the fraction of interviewed workers that are actually hired and $x = n/l$ denotes the number of interviews per job seeker.

In a next step, it is straight forward to derive the aggregate unemployment rate U in the economy. It can be expressed as a weighted average of the rates of unemployment in the homogeneous and differentiated sectors. With no unemployment in the homogeneous sector, the aggregate rate of unemployment is therefore equal to the unemployment rate in the differentiated sector times the share of the labor force in this sector:

$$U = \frac{l}{L}u \tag{79}$$