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Inward Foreign Direct Investment, Superstar Firms and Wage Inequality Between Firms: Evidence from European Regions

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Abstract

Theoretical models and international evidence have established that foreign direct investment is associated with new technologies, productivity gains, higher wages, and wage inequality in the host countries. While most existing studies on foreign direct investment and wage inequality have examined relative wages across skills, occupations and sectors, recent contributions to the theoretical and empirical literature highlight the role of wage dispersion between firms as an important driver of overall income inequality. Against this background, this paper examines wage dispersion between firms across European regions and the role played by multinational firms with dominant market shares, the so-called "superstar firms". Firstly, we document the evolution of wage dispersion between firms and the regional presence of foreign affiliates across European regions. Second, we empirically investigate the role of inward foreign direct investment as a driver of wage dispersion between firms across European regions. The analysis uses firm-level data from the ORBIS Europe data set over 2012-2021 combined with a range of data for European regions. Using a shift-share instrumental variables approach, we find that foreign direct investment, particularly international superstar firms, contributed to increased wage inequality between firms across European regions.

Keywords— Foreign direct investment; Market power; Economic, social, and spatial inequalities.

JEL Codes— F23, R12, R15

I. Introduction

The economic literature has long studied the effects of foreign direct investment (FDI) flows in host countries in terms of productivity gains (Fons-Rosen et al., 2021; Newman et al., 2015), adoption of new technologies, and wage differentials (Chen et al., 2011; Taylor & Driffield, 2005; Feenstra & Hanson, 1995). To what extent FDI has a significant effect on wage inequality is ultimately an empirical question since the impact can theoretically go in both directions. On the one hand, there is evidence of the productivity advantages that foreign-owned firms must exhibit to thrive in international markets (Driffield & Taylor, 2000; Tomiura, 2007), which translate into wage differentials relative to domestic firms and increased wage dispersion. On the other hand, there is evidence of the existence of FDI productivity spillovers that positively affect domestic firms (Amiti et al., 2023; Newman et al., 2015), which can level out the wage differentials depending on the extent to which these externalities affect domestic producers.

In this paper, we use micro-aggregated data at the regional level in Europe from the Bureau van Dijk's Orbis and the Competitiveness Research Network (CompNet) databases to examine wage dispersion between firms across European regions and the role played by multinational firms with dominant market shares (i.e., market power), the so-called "superstar firms". Our research is underpinned by recent theoretical and empirical contributions at the intersection of international trade with heterogeneous firms and labour market imperfections, market power and wage inequality. A small but growing theoretical and empirical literature strand focusing on international trade and firm heterogeneity has put forward between-firms wage inequality as a new channel through which trade affects wage inequality (Helpman et al., 2016, 2010). Recent research on earnings inequality in the US by Song et al. (2019) has pointed to the rising dispersion of earnings between firms as the main driver of rising overall earnings inequality. Further, the evidence indicates that rising within-firm earnings inequality is driven mainly by very large firms. In the case of Sweden, Akerman et al. (2013) find that two-thirds of overall wage inequality is explained by within-sector firm heterogeneity. De Loecker et al. (2022) provide evidence from the UK on rising between-firm inequality in firm productivity, wages, mark ups and size.

We start by documenting two empirical trends between 2012 and 2021: i) that between-firm wage dispersion has increased and has been driven by average wages in the top 90th and 95th percentiles; ii) an upward trend in the regional presence of foreign-owned companies, which is stronger for the top performing foreign affiliates, both in terms of labour and turnover shares. We then study the relationship between the regional presence of foreign-owned companies across regions, defined using the Nomenclature of Territorial Units for Statistics at the second level (NUTS2), and regional measurements of between-firm wage dispersion such as Gini coefficients and wage percentile ratios.

To the best of our knowledge, this is the first empirical analysis of between-firms wage inequality across European regions and the role of FDI and international superstar firms play. The novelties of our contribution to the literature are twofold. First, following recent research pointing to the rising dispersion of earnings between firms as the main driver of rising overall earnings inequality (Song et al., 2019; Akerman et al., 2013; Helpman et al., 2016, 2010), we examine the relationship between regional FDI presence and mean wage dispersion across firms instead of across individuals. Further, by exploiting firm-level data, we are also able to distinguish foreign-owned firms with dominant market shares to determine whether the effects are stronger for these top-performing foreign affiliates and to what extent the heterogeneity in the effects comes from observable firm characteristics such as size or age.

Our second contribution lies in our focus on the aggregate outcomes at the regional level, which allows us to go beyond the analysis at the industry-level. The analysis at the regional level also allows us to borrow from the literature on local labour demand shocks (Jaeger et al., 2018; T. J. Bartik, 1991) and use an instrumental variable strategy by exploiting the regional variation in pre-sample industry labour shares interacted with the aggregate change in FDI inward flows in the Euro Area to construct regional FDI shocks. Moreover, we can control for region-specific proxies for alternative determinants of wage dispersion identified in the literature such as technological change or employment in high-technology sectors.

We find that increases in the regional presence of foreign-owned firms significantly rises between-firm wage dispersion. On average, all else fixed, and based on our inequality measurements for residual wages, a 10 percent increase in inward FDI employment share increases the Gini coefficient of between firms residualized wage inequality by 1.79 percent, nearly twice the median Gini coefficient annual growth. Similarly, a ten percent increase in inward FDI employment shares leads to a 5.71 percent increase in the 90/10 ratio and a 3.64 percent increase in the 90/50 ratio. These findings are robust to using turnover shares as alternative measures of foreign ownership and further controlling by regional differences in average mark-downs.

Importantly, we also find that the effects increase in magnitude when comparing the overall presence of foreign owned companies to the presence of top performing foreign owned companies as measured by top 1%, 5%, and 10% performers in terms of revenue. For instance, a one standard deviation in the regional labour share of the top 1% international performers (around 1.8 percent) increases the Gini coefficient by 0.58 percent, the 90/10 wage percentile ratio by 1.71 percent, and the 90/50 wage percentile ratio by 1.21 percent.

The remainder of this paper is organised as follows. Section II. describes the data and measures used for the analysis and discusses trends of between-firm wage inequality and of foreign affiliates and international superstar firms across European regions. Next, in Section III. we present our

empirical approach. Section Section IV. discusses our empirical results. Section V. summarises the key findings and policy implications.

II. Data and Descriptive Statistics

For this research, we use highly detailed firm-level data from the Orbis Europe data set over 2012-2021 on firms' ownership, employees, wage bills, turnover, total assets, and year of incorporation for all active firms in 26 EEA countries, the UK and Switzerland between 2012-2021.[1] We then aggregate individual data at the NUTS2 regional level to construct our main explanatory and outcome variables, resulting in a dataset comprising 246 regions.

Our main explanatory variable is the regional presence of foreign-owned firms. For the baseline results, we define foreign-owned firms as those with at least 10 percent of foreign ownership and use labour shares in regional employment excluding health, education, and government as a measurement of local presence. Following Amiti et al. (2023) and D. Autor et al. (2020), we also measure the presence of superstar firms by identifying the top performing foreign owned firms as the top 1%, 5%, and 10% firms by turnover per year and region.

Our outcome variable of interest is the regional dispersion of mean wages (i.e. wage bills per employee) which we measure using Gini coefficients, 90/10, and 90/50 wage percentile ratios. Borrowing from the literature on individual wage inequality and housing values (Albouy, 2016; Shapiro, 2006), we construct these regional dispersion measurements using residual wages after adjusting for firms' observable characteristics as age and size. More precisely, we adjust wages per employee by estimating the residuals of a firm-level regression using the following model specification:

$$W_{ijt} = F_{ijt}\gamma + e_{ijt} \tag{1}$$

where F_{ijt} is a vector of individual characteristics of firm i located in region j and year t, including size, age, and age squared and e_{ijt} is the residual term we use to construct alternative measures of wage dispersion across firms[2].

As a robustness check, we later construct wage dispersion indices using CompNet data on wages as average labour costs per employee aggregated at the NUTS2 level. CompNet provides indicators computed based on firm-level data by national data providers for 22 European countries. We

[1] Table A2 in the Appendix presents the country coverage of each dataset.
[2] The estimation results of this regression are shown in Table A4 in the Appendix.

use the 10, 50, and 90 percentiles to construct comparable 90/10 and 90/50 wage percentile ratios. Additionally, CompNet allows us to control for additional regional controls such as labour markdowns to proxy for employer market power.

Our regional controls variables come from different datasets. We obtain mean productivity (GDP per worker), share of employment in high technology sectors, and the number of employees in Human Resources in Science & Technology per inhabitant from the Eurostat Regional database.[3] Detailed definitions of variables and data sources are given in Table A1 in Appendix A.

In Table 1, we report summary statistics for individual firm characteristics by distinguishing between domestic and foreign owned firms, and those top 10% performers among those foreign owned. On average, foreign owned firms are larger than domestic firms, both in number of employees and assets, and pay about 4 percent higher wages even after adjusting for age and size. Among these foreign affiliates, the top 10% performers are 3 times larger and pay 34 percent higher wages on average than the average foreign owned firms.

Table 1: Firm-level Summary Statistics

	(1)		(2)		(3)	
	Domestic		Foreign Affiliates		Top int. performers	
	mean	sd	mean	sd	mean	sd
Employees	34.37	785.15	34.85	636.06	575.97	4,988.84
Assets (euro mn)	7.36	179.79	8.38	433.11	270.28	3,345.06
Log wage residual	4.30	0.86	4.17	0.92	4.65	0.83
Turnover (euro mn)	5.88	134.30	7.60	558.13	223.83	4,173.32
Observations	971199		789993		10482	

Monetary values are in constant 2018 prices calculated using the Eurostat harmonised CPIs.

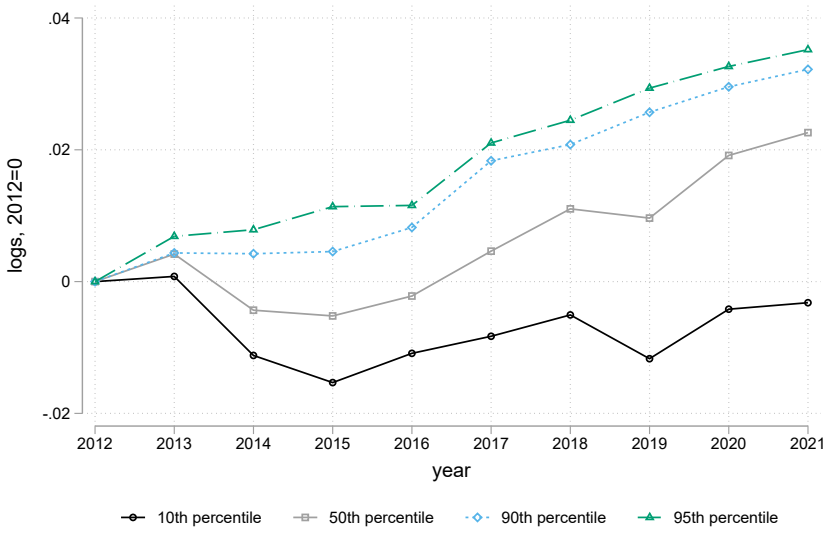
We then document trends in between-firm wage dispersion and inward FDI presence across regions over time. Figure 1 plots the average of different wage percentiles across NUTS2 regions weighted by regional employment and shows that wage dispersion across firms has increased over the analysed period. Mean wages in the 90th and 95th percentiles have persistently increased, while those in the 50th percentile have remained stagnant after 2013. This increase in wage inequality between firms is also captured by increasing trends in mean regional Gini coefficients and the mean 90/10 wage percentile ratio (Figure 2).

Finally, we report the trends in the employment shares of foreign owned firms and top inter-

[3]Productivity data for the UK comes from the Office of National Statistics.

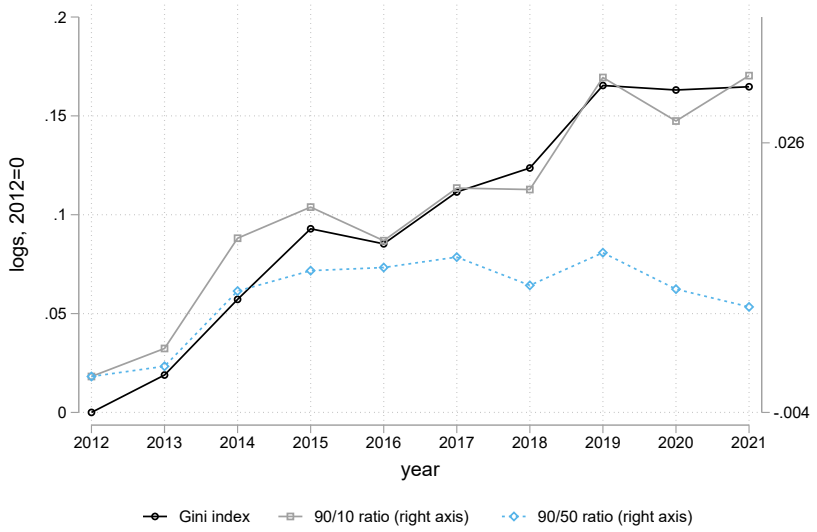
national performers in Figure 3. The mean regional employment share of top performing foreign affiliates has consistently increased during our studied period. The overall employment share of foreign affiliates also exhibits an increasing trend, although it is more volatile and less pronounced than the top-performing ones.

Figure 1: Wage Percentiles across Regions, 2012-2021



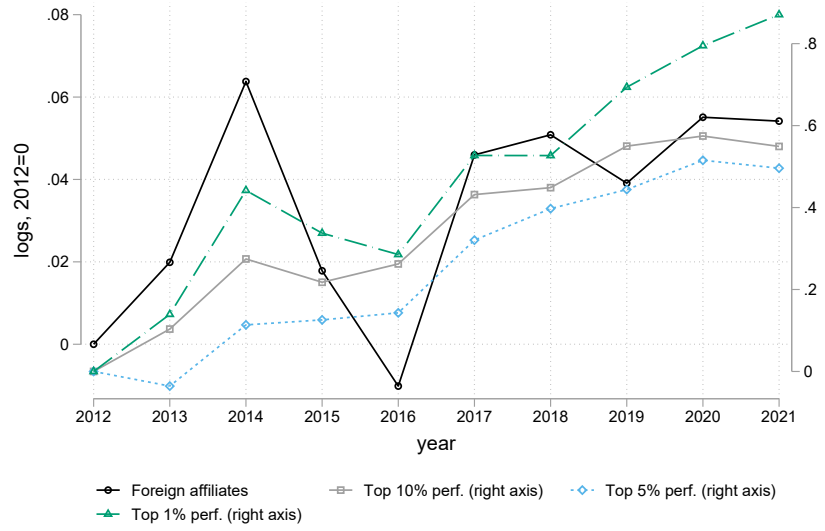
Source: Authors' calculations using data from the Orbis Europe.
Weighted average firm wages across NUTS2 regions in 26 EEA countries, the UK and Switzerland. Series are winsorized at the 5th and 95th percentiles by year.

Figure 2: Between-firm Wage Dispersion across Regions, 2012-2021



Source: Authors' calculations using data from the Orbis Europe.
Weighted average firm wages across NUTS2 regions in 26 EEA countries, the UK and Switzerland. Series are winsorized at the 5th and 95th percentiles by year.

Figure 3: Share of Foreign Affiliates and International Superstar Firms in Regional Employment



Notes: Weighted average firm wages across NUTS2 regions in 26 EEA countries, the UK and Switzerland. Series are winsorized at the 5th and 99th percentiles by year. Foreign affiliates: $>$ 10% international direct ownership
Top performers are defined given revenue shares by region and year.
Source: Authors' calculations using data from the Orbis Europe and Eurostat.

III. Empirical Approach

To quantify the relationship between the presence of FDI and regional wage inequality, we use the following specification:

$$Inq_{jt} = \beta FDI_{jt} + \Gamma \mathbf{X}_{jct} + \alpha_t + \epsilon_{jt}, \tag{2}$$

where Inq_{jt} is a measure of wage inequality across firms in region j and year t; FDI_{jt} is a measure of foreign direct investment in region j at time t; X_{jt} is a vector of regional characteristics that control for other potential determinants of local wage inequality; α_t denote year fixed-effects; and ϵ_{jt} is an error term. [4] Our coefficient of interest is β and with it we aim to quantify the contemporary effect of the presence of FDI on regional wage inequality once we account for other determinants of wage inequality.

We estimate the model in Eq. 2 using a fixed-effects regression model as a preliminary approach where our outcomes of interest are measured with Gini coefficients, 90/10, and 90/50 wage percentile ratios. To measure FDI_{jt} we use regional labour shares of all foreign-owned firms and the regional labour shares of the top 1%, 5%, and 10% performers by revenue. The vector of regional characteristics aims to control for different groups of wage inequality determinants identified in the literature and include third-level education attainment (as a share of the population aged 25-64), the employment share in knowledge-intensive sectors, productivity proxied as the regional GDP per worker, and employees in Human Resources in Science & Technology per inhabitant. The relationship between skill shares, productivity, and wage inequality has been typically explored under the lens of wage inequality between occupations (e.g. skill premiums) and can reflect changes in the relative supply of skills, the industrial composition, or skill-biased technological change (Acemoglu, 1998; Topel, 1994). Because we focus on between-firm wage inequality, our goal is to control for other determinants of wage dispersion across firms such as the rise of knowledge-intensive business services (Berkes & Gaetani, 2023) and technical change and innovation (Leiponen, 2005).

An identification concern for β to recover the causal effect of FDI on regional wage inequality across firms is that the regional presence of foreign affiliates might be correlated with unobserved determinants of wage dispersion. To address this concern, we use a shift-share instrument for FDI that interacts the changes in FDI across industries at the EU level with the regional industry labour shares. More precisely, the shift-share instrument is defined as follows:

$$\tilde{FDI}_{jt} = \sum_k \eta_{kjt^0} \cdot \Delta FDI_{kt} \tag{3}$$

[4] We omit country or NUTS1 fixed effects since we are interested in comparing regions across countries given the strong clustering of inward FDI at that level.

where η_{kjt^0} is the employment share of industry k in region j at a reference year t^0; and ΔFDI_{kt} is the log change of FDI in the EEA in industry k between the reference year t^0 and year t. We set t^0 as 2008 and source the local employment structure by industry from Eurostat's Structural Business Statistics and the FDI flows from the OECD's International Direct Investment Statistics. Intuitively, the instrument in Eq. 3 predicts regional FDI by exploiting variation in FDI flows at the European level (selected EEA countries and the UK) with each regions' industry mix at baseline, thus isolating any local characteristics potentially related to regional wage dispersion across firms that could have determined the presence of foreign affiliates. Our approach follows a growing literature using shift-share instrument to identify causal effects in different settings as migration (Jaeger et al., 2018), trade competition (Dell et al., 2019; D. H. Autor et al., 2013), and labour demand (T. Bartik, 1991). As pointed out by Goldsmith-Pinkham et al. (2020), the identification assumption when using this shift-share instrument is that the region-industry shares are uncorrelated with the error term in Eq. 2, which implies that the regions' industry mix is in turn uncorrelated with unobserved factors explaining wage dispersion across firms given the vector of controls. We find this assumption convincing since our controls include local conditions such as education, labour market participation, productivity, and the importance of knowledge-intensive sectors. With our shift-share instrument in hand, we estimate the regression model described in Eq. 2 using the instrumental variables generalized method of moments (IV-GMM) estimator.

IV. Estimation Results

We start by presenting the results when measuring regional between-firm wage dispersion using the Orbis database. In all regression models we include year fixed effects, use robust standard errors, and weigh by regional employment from Eurostat.

Table 2 presents the results when the explanatory variable of interest is the regional labour share of foreign owned firms. The outcome variable is the regional Gini coefficient in models (1) and (2), the 90/10 wage percentile ratio in models (3) and (4), and the 90/50 wage percentile ratio in models (5) and (6). For each outcome variable, we report the estimation results with and without our vector of controls. OLS estimates in Panel A imply that there is a statistically significant relationship between regional wage dispersion and inward FDI employment shares. IV estimates in Panel B show that our shift-share instrument is relevant to explain the variation in regional FDI labour shares as confirmed by the Cragg-Donald F statistic above 23. The relevance of the instrument is also confirmed in Panel C where we present the first stage estimation results. In all cases, the shift-share coefficient is statistically significant at the 5% level. Interestingly, the sign of the estimates in the first stage change when we add the vector of controls. These results suggest that the initial

employment structure predicts inward FDI into the region, but this relationship reverses when conditioning for education, innovation, and productivity, possibly signalling that foreign affiliates decide to locate away from markets with established and highly productive competitors.

Table 2: Inward FDI and Between-firm Wage Inequality across Regions

	Panel A. Ordinary Least Squares					
Outcome variable:	Gini index		90/10 ratio		90/50 ratio	
	(1)	(2)	(3)	(4)	(5)	(6)
Foreign aff. eployment share	0.055***	0.036***	0.155***	0.132***	0.055***	0.027***
	(0.0048)	(0.0047)	(0.0157)	(0.0217)	(0.0103)	(0.0094)
Region-year obs.	2,201	2,201	2,201	2,201	2,201	2,201
R-squared	0.100	0.208	0.023	0.034	0.037	0.144
Controls	No	Yes	No	Yes	No	Yes
	Panel B. Instrumental Variables					
Outcome variable:	Gini index		90/10 ratio		90/50 ratio	
	(1)	(2)	(3)	(4)	(5)	(6)
Foreign aff. eployment share	0.069***	0.179***	0.010	0.571*	0.019	0.364***
	(0.0243)	(0.0642)	(0.1497)	(0.3249)	(0.0426)	(0.1156)
Third level education		0.058***		0.090		0.160***
		(0.0199)		(0.0662)		(0.0418)
High tech employment		0.018***		0.024		0.018*
		(0.0046)		(0.0245)		(0.0092)
HR in sciene and technology per capita		-0.073		0.201		-0.025
		(0.0708)		(0.3599)		(0.1424)
GDP per worker		-0.013		-0.010		-0.010
		(0.0127)		(0.0663)		(0.0235)
Region-year obs.	2,201	2,201	2,201	2,201	2,201	2,201
Cragg-Donald F stat	84.898	22.990	84.898	22.990	84.898	22.990
Cumby-Huizinga test p-val.	0.000	0.000	0.000	0.000	0.000	0.000
Controls	No	Yes	No	Yes	No	Yes
	Panel C. First Stage					
Outcome variable:	Foreign Affiliates Employment Share					
	(1)	(2)	(3)	(4)	(5)	(6)
Shift-share	0.690***	-0.474***	0.690***	-0.474***	0.690***	-0.474***
	(0.0938)	(0.1194)	(0.0938)	(0.1194)	(0.0938)	(0.1194)
Region-year obs.	2,201	2,201	2,201	2,201	2,201	2,201
R-squared	0.040	0.180	0.040	0.180	0.040	0.180
Controls	No	Yes	No	Yes	No	Yes

Notes: All variables are transformed to logs. All models include year fixed effects and are weighted by regional employment. Mean residual wages are first adjusted using Equation 1.* p<0.1, ** p<0.05, *** p<0.01. Robust standard errors are shown in parentheses. Cumby-Huizinga tests for the existence of autocorrelation of order 2.

Using the shift-share as an instrument, Panel B of Table 2 reports that increases in inward FDI

labour shares rise local between-firm wage inequality. According to these IV estimates, over and above other factors, and based on our inequality measurements for residual wages, a 10 percent increase in inward FDI employment share increases the Gini coefficient of between firms residualized wage inequality by 1.79 percent, nearly twice the median Gini coefficient annual growth. Similarly, a ten percent increase in inward FDI employment shares leads to a 5.71 percent increase in the 90/10 ratio and a 3.64 percent increase in the 90/50 ratio.

The previous results correspond to our dispersion measures constructed with residualized wages. In Table 3, we explore the role of firm observable characteristics by comparing our estimation results reported in Table 2 to non-residualized measures of between-firm wage dispersion. Table 3 documents that the regional presence of foreign-owned firms significantly rises between-firm wage dispersion even when firm-level wages are adjusted by size and age. Hence, the effect of inward FDI on regional wage dispersion is not purely driven by gaps in size or experience. For instance, results in column 2 imply that a ten percent increase in inward FDI employment share increases the Gini coefficient constructed with non-adjusted wages by 6.23 percent, an effect about three times larger in magnitude. than that in the Gini coefficient constructed with non-adjusted wages (column 1).

Table 3: Inward FDI and Between-firm Wage Inequality across Regions - The Role of Observable Firm Characteristics

	Panel A. Ordinary Least Squares					
Outcome variable:	Gini index		90/10 ratio		90/50 ratio	
	(1)	(2)	(3)	(4)	(5)	(6)
Foreign aff. eployment share	0.036***	0.112***	0.132***	0.682***	0.027***	0.146***
	(0.0047)	(0.0181)	(0.0217)	(0.0954)	(0.0094)	(0.0441)
Region-year obs.	2,201	2,201	2,201	2,201	2,201	2,201
R-squared	0.208	0.192	0.034	0.059	0.144	0.117
Residualized wages	Yes	No	Yes	No	Yes	No
	Panel B. Instrumental Variables					
Outcome variable:	Gini index		90/10 ratio		90/50 ratio	
	(1)	(2)	(3)	(4)	(5)	(6)
Foreign aff. eployment share	0.179***	0.623***	0.571*	1.610	0.364***	1.442***
	(0.0642)	(0.2160)	(0.3249)	(1.0854)	(0.1156)	(0.5069)
Third level education	0.058***	0.447***	0.090	0.540*	0.160***	0.959***
	(0.0199)	(0.0805)	(0.0662)	(0.3154)	(0.0418)	(0.2057)
High tech employment	0.018***	0.082***	0.024	0.305***	0.018*	0.126***
	(0.0046)	(0.0143)	(0.0245)	(0.0782)	(0.0092)	(0.0348)
HR in sciene and technology per capita	-0.073	-0.532**	0.201	-1.318	-0.025	-0.479
	(0.0708)	(0.2319)	(0.3599)	(1.1479)	(0.1424)	(0.5794)
GDP per worker	-0.013	-0.023	-0.010	0.020	-0.010	-0.072
	(0.0127)	(0.0429)	(0.0663)	(0.2227)	(0.0235)	(0.1022)
Region-year obs.	2,201	2,201	2,201	2,201	2,201	2,201
Cragg-Donald F stat	22.990	22.990	22.990	22.990	22.990	22.990
Cumby-Huizinga test p-val.	0.000	0.000	0.000	0.000	0.000	0.000
Residualized wages	Yes	No	Yes	No	Yes	No
	Panel C. First Stage					
Outcome variable:	Foreign Affiliates Employment Share					
	(1)	(2)	(3)	(4)	(5)	(6)
Shift-share	-0.474***	-0.474***	-0.474***	-0.474***	-0.474***	-0.474***
	(0.1194)	(0.1194)	(0.1194)	(0.1194)	(0.1194)	(0.1194)
Region-year obs.	2,201	2,201	2,201	2,201	2,201	2,201
R-squared	0.180	0.180	0.180	0.180	0.180	0.180
Residualized wages	Yes	No	Yes	No	Yes	No

Notes: All variables are transformed to logs. All models include the full set of control variables and year fixed effects. Mean residual wages are first adjusted using Equation 1.* p<0.1, ** p<0.05, *** p<0.01. Robust standard errors are shown in parentheses. Cumby-Huizinga tests for the existence of autocorrelation of order 2.

We next investigate whether the effects differ when considering the presence of foreign owned firms with dominant market shares. Table 4 presents the results when we focus on the labour

shares of the foreign owned firms within the top 1%, 5%, and 10% revenues by year and region. The estimated effects in the second stage (Panel B) are larger than the ones obtained with the overall labour share of foreign owned firms. Namely, a ten percent increase in the regional labour share of the top 1% international performers increases the Gini coefficient by 3.09 percent, the 90/10 wage percentile ratio by 9.88 percent, and the 90/50 wage percentile ratio by 6.3 percent.

Table 4: Inward FDI and Between-firm Wage Inequality across Regions - Top Performers

	Panel A. Ordinary Least Squares								
Outcome variable:	Gini index			90/10 ratio			90/50 ratio		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Top 1% foreign affiliates	0.063***			0.093**			0.097***		
	(0.0134)			(0.0451)			(0.0164)		
Top 5% foreign affiliates		0.036***			0.006			0.056***	
		(0.0071)			(0.0428)			(0.0114)	
Top 10% foreign affiliates			0.027***			-0.006			0.033***
			(0.0062)			(0.0397)			(0.0100)
Region-year obs.	2,201	2,201	2,201	2,201	2,201	2,201	2,201	2,201	2,201
R-squared	0.191	0.187	0.185	0.023	0.022	0.022	0.150	0.146	0.142
	Panel B. Instrumental Variables								
Outcome variable:	Gini index			90/10 ratio			90/50 ratio		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Top 1% foreign affiliates	0.309**			0.988*			0.630***		
	(0.1222)			(0.5913)			(0.2033)		
Top 5% foreign affiliates		0.215***			0.687*			0.438***	
		(0.0752)			(0.3920)			(0.1224)	
Top 10% foreign affiliates			0.151***			0.482*			0.308***
			(0.0512)			(0.2721)			(0.0839)
Region-year obs.	2,201	2,201	2,201	2,201	2,201	2,201	2,201	2,201	2,201
Cragg-Donald F stat	54.543	52.721	71.559	54.543	52.721	71.559	54.543	52.721	71.559

Notes: All variables are transformed to logs. All models include the full set of control variables and year fixed effects. Mean residual wages are first adjusted using Equation 1.* p<0.1, ** p<0.05, *** p<0.01. Robust standard errors are shown in parentheses. Cumby-Huizinga tests for the existence of autocorrelation of order 2.

Further, we conduct several robustness analyses. We first use the CompNet database to obtain wage percentile ratios instead of aggregating firm-level wages from the Orbis dataset. CompNet provides micro-aggregated indicators computed on the basis of firm-level data by national data providers for 22 European countries. Although the sample size is smaller, CompNet indicators

are constructed using national firm-level databases and allows us to further control for additional regional determinants of between-firm wage dispersion. In our case, we use the 10, 50, and 90 percentiles to construct comparable 90/10 and 90/50 wage percentile ratios, and further control for average regional labour markdowns to proxy for employer market power defined as the ratio between firms' marginal revenue product of labour and its wage (Yeh et al., 2022). Results in Table 5 imply that there is a positive and significant effect of the regional presence of superstar international firms and between-firm wage dispersion. Interestingly, the coefficient of the regional markdown variable is positive and significant, implying that regions with higher relative employer market power also display larger between-firm wage dispersion.

Moreover, we also perform additional robustness checks presented in the Appendix by: i) reproducing our results using 50% foreign ownership instead of 10% as a threshold to define inward FDI (Tables A5 to A7); ii) reproducing our baseline results for Orbis using turnover regional shares instead of labour shares (Table A8).

Table 5: Inward FDI and Between-firm Wage Inequality across Regions - CompNet Data

Outcome variable:	90/10 ratio				90/50 ratio			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Foreign aff. eployment share	1.001***				0.163*			
	(0.2780)				(0.0840)			
Top 1% foreign affiliates		1.568***				0.255*		
		(0.5705)				(0.1347)		
Top 5% foreign affiliates			1.490***				0.242*	
			(0.5111)				(0.1276)	
Top 10% foreign affiliates				1.340***				0.218*
				(0.4300)				(0.1136)
Third level education	-0.022	-0.792***	-0.717***	-0.541***	0.394***	0.269***	0.281***	0.310***
	(0.1887)	(0.2302)	(0.2291)	(0.2013)	(0.0640)	(0.0715)	(0.0701)	(0.0643)
High tech employment	0.151***	0.116***	0.130***	0.134***	0.045***	0.039***	0.042***	0.042***
	(0.0207)	(0.0204)	(0.0200)	(0.0195)	(0.0078)	(0.0075)	(0.0074)	(0.0074)
HR in sciene and technology per capita	0.112	0.621	0.550	0.367	-0.512***	-0.429***	-0.441***	-0.471***
	(0.3548)	(0.4393)	(0.4433)	(0.3977)	(0.1278)	(0.1373)	(0.1380)	(0.1320)
GDP per worker	-0.221***	-0.447***	-0.373***	-0.324***	-0.134***	-0.171***	-0.159***	-0.151***
	(0.0548)	(0.0672)	(0.0497)	(0.0437)	(0.0185)	(0.0147)	(0.0130)	(0.0134)
Regional mark-down	0.253***	0.256***	0.289***	0.263***	0.077***	0.077***	0.083***	0.078***
	(0.0666)	(0.0730)	(0.0831)	(0.0721)	(0.0203)	(0.0202)	(0.0230)	(0.0209)
Region-year obs.	1,123	1,123	1,123	1,123	1,123	1,123	1,123	1,123
Cragg-Donald F stat	50.853	82.344	60.967	64.044	50.853	82.344	60.967	64.044
Cumby-Huizinga test p-val.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Notes: All variables are transformed to logs. All models include the full set of control variables and year fixed effects. * p<0.1, ** p<0.05, *** p<0.01. Robust standard errors are shown in parentheses. Cumby-Huizinga tests for the existence of autocorrelation of order 2.

V. Summary of Findings and Policy Implications

In this paper, we examined between-firms wage inequality across European regions, with a particular focus on the role of foreign direct investment and international top firms with dominant market shares within their industry. For this purpose, we used firm-level data from the Orbis Europe and CompNet datasets combined with economic and social data for European regions over 2012-2021.

In terms of empirical methodology, to identify causal effects, we use a shift-share instrumental variables empirical approach.

We document that between-firm wage dispersion has increased over the analysed period and it has been driven by average wages in the top 90th and 95th percentiles. Consequently, we observe increased wage inequality between firms as shown by upward trends in the 90/10 wage percentiles ratio and Gini coefficients across regions. Furthermore, we document that mean regional employment shares of foreign owned companies have consistently increased between 2012 and 2021.

Our estimates indicate that on average, over and above other factors, and based on our inequality measures for residual wages, a 10 percent increase in inward FDI employment share increases the Gini coefficient of between firms residualized wage inequality by 1.79 percent, nearly twice the median Gini coefficient annual growth. The effects increase in magnitude when considering the regional presence of superstar firms among those with foreign ownership and these effects are not purely driven by gaps in size or experience between domestic and international firms.

Taken together, the key findings of this paper suggest that FDI, and international superstar firms in particular, have contributed to increased wage inequality between firms across European regions over the period 2012-2021. While increased wage inequality between firms might appear to be less of a concern (see for example, De Loecker et al. 2022), as discussed in the Introduction, international evidence indicates that it can lead to increased overall income inequality (see for example, Song et al. 2019). As documented in a large literature, overall income inequality is negatively correlated with health outcomes and life expectancy, access to education and equal opportunities and it can also adversely affect economic performance, social cohesion and political stability (OECD, 2015a,b). To mitigate such potential unfavourable economic, social and political effects associated with increased between-firm wage inequality, we suggest that policy measures aimed at enhancing spillovers from highly innovative and productive international superstar firms to domestic markets could foster the productivity and wages of local firms and thus help achieve a more equal income distribution across firms.

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Appendix

Table A1: Variables Definitions and Data Sources

Variable	Description	Data Source
Region units	Nomenclature of Territorial Units at the second level (NUTS2).	Eurostat
Wage per employee	Cost of employees over number of employees. The top and bottom 0.5 percentiles are trimmed in each region.	CompNet and own calculations based on ORBIS Europe.
Firms' age	Number of years between the date of incorporation and the reference year.	Own calculations based on ORBIS Europe
Firms' size	Total assets in constant 2015 prices.	Own calculations based on ORBIS Europe
Foreign affiliates	Firms with 50% or higher direct ownership.	ORBIS Europe
Top performers	Foreign owned companies with the top x revenues in each year and region	Own calculations based on ORBIS Europe
Third-level education attainment	Share of population aged 25-64	Eurostat regions database
Knowledge-intensive share	Share of workers in knowledge-intensive sectors	Eurostat regions database
Productivity	Gross Domestic Product per capita	Eurostat regions database, Office of National Statistics
HR in Science & Technology	Employees in Human Resources in Science & Technology per inhabitant	Eurostat regions database

Table A2: Data Coverage by Country

Country	Orbis	CompNet	Eurostat
Austria	✓		✓
Belgium	✓	✓	✓
Bulgaria	✓		✓
Czechia	✓	✓	✓
Germany	✓	✓	✓
Denmark	✓	✓	✓
Estonia	✓		✓
Spain	✓	✓	✓
Finland	✓	✓	✓
France	✓	✓	✓
United Kingdom	✓		✓
Croatia	✓	✓	✓
Hungary	✓	✓	✓
Ireland	✓		✓
Iceland	✓		✓
Italy	✓	✓	✓
Luxembourg	✓		✓
Latvia	✓	✓	✓
Malta	✓	✓	✓
Netherlands	✓		✓
Norway	✓		✓
Poland	✓	✓	✓
Portugal	✓	✓	✓
Romania	✓	✓	✓
Sweden	✓	✓	✓
Slovenia	✓	✓	✓
Slovakia	✓	✓	✓
Switzerland	✓		✓

Notes: Orbis data on cost of employees is not available for Cyprus, Greece, Lithuania, and Liechtenstein.

Table A3: Region-level Summary Statistics

	(1)		
	Mean	SD	Obs.
Gini coefficient - residual wages	0.053	0.03	2,639
90-10 ratio - residual wages	1.315	0.70	2,639
90-10 ratio - CompNet	1.755	0.43	1,554
90-50 ratio - residual wages	1.120	0.10	2,639
90-50 ratio - CompNet	1.208	0.14	1,554
Inward FDI eployment share	0.331	0.20	2,676
Top 1% foreign affiliates	0.022	0.05	2,676
Top 5% foreign affiliates	0.065	0.09	2,676
Top 10% foreign affiliates	0.102	0.11	2,676
Third level education	0.311	0.10	2,552
High techecnology sectors employment share	0.039	0.02	2,399
HR in sciene and technology per capita	0.247	0.07	2,532

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Table A4: Individual Wage Estimations

Outcome variable: firm wage per employee	
	(1)
Size (total assets)	0.209***
	(0.0004)
Age	-0.046***
	(0.0014)
Age squared	0.090***
	(0.0023)
Constant	1.476***
	(0.0029)
Obs.	2,436,926
R-squared	0.299

Notes: * p<0.1, ** p<0.05, *** p<0.01. Standard errors clustered at the region level are shown in parentheses.

Table A5: Inward FDI and Between-firm Wage Inequality across Regions - 50% Foreign Ownership Threshold

	Panel A. Ordinary Least Squares					
Outcome variable:	Gini index		90/10 ratio		90/50 ratio	
	(1)	(2)	(3)	(4)	(5)	(6)
Foreign aff. eployment share	0.055***	0.036***	0.155***	0.133***	0.055***	0.027***
	(0.0048)	(0.0047)	(0.0157)	(0.0219)	(0.0102)	(0.0093)
Region-year obs.	2,201	2,201	2,201	2,201	2,201	2,201
R-squared	0.100	0.208	0.023	0.034	0.037	0.144
Controls	No	Yes	No	Yes	No	Yes
	Panel B. Instrumental Variables					
Outcome variable:	Gini index		90/10 ratio		90/50 ratio	
	(1)	(2)	(3)	(4)	(5)	(6)
Foreign aff. eployment share	0.069***	0.179***	0.010	0.572*	0.019	0.365***
	(0.0243)	(0.0643)	(0.1498)	(0.3253)	(0.0427)	(0.1159)
Third level education		0.057***		0.086		0.158***
		(0.0199)		(0.0659)		(0.0417)
High tech employment		0.018***		0.024		0.017*
		(0.0047)		(0.0247)		(0.0093)
HR in sciene and technology per capita		-0.072		0.206		-0.021
		(0.0714)		(0.3629)		(0.1436)
GDP per worker		-0.013		-0.010		-0.010
		(0.0128)		(0.0668)		(0.0237)
Region-year obs.	2,201	2,201	2,201	2,201	2,201	2,201
Cragg-Donald F stat	84.772	22.940	84.772	22.940	84.772	22.940
Cumby-Huizinga test p-val.	0.000	0.000	0.000	0.000	0.000	0.000
Controls	No	Yes	No	Yes	No	Yes
	Panel C. First Stage					
Outcome variable:	Foregin Affiliates Employment Share					
	(1)	(2)	(3)	(4)	(5)	(6)
Shift-share	0.690***	-0.473***	0.690***	-0.473***	0.690***	-0.473***
	(0.0938)	(0.1195)	(0.0938)	(0.1195)	(0.0938)	(0.1195)
Region-year obs.	2,201	2,201	2,201	2,201	2,201	2,201
R-squared	0.040	0.181	0.040	0.181	0.040	0.181
Controls	No	Yes	No	Yes	No	Yes

Notes: All variables are transformed to logs. All models include year fixed effects and are weighted by regional employment. Mean residual wages are first adjusted using Equation 1.* p<0.1, ** p<0.05, *** p<0.01. Robust standard errors are shown in parentheses. Cumby-Huizinga tests for the existence of autocorrelation of order 2.

Table A6: Inward FDI and Between-firm Wage Inequality across Regions - Top Performers, 50% Foreign Ownership Threshold

	Panel A. Ordinary Least Squares								
Outcome variable:	Gini index			90/10 ratio			90/50 ratio		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Top 1% foreign affiliates	0.063***			0.093**			0.097***		
	(0.0134)			(0.0451)			(0.0164)		
Top 5% foreign affiliates		0.036***			0.005			0.056***	
		(0.0071)			(0.0429)			(0.0114)	
Top 10% foreign affiliates			0.027***			-0.006			0.032***
			(0.0062)			(0.0397)			(0.0100)
Region-year obs.	2,201	2,201	2,201	2,201	2,201	2,201	2,201	2,201	2,201
R-squared	0.191	0.187	0.185	0.023	0.022	0.022	0.150	0.146	0.142
	Panel B. Instrumental Variables								
Outcome variable:	Gini index			90/10 ratio			90/50 ratio		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Top 1% foreign affiliates	0.309**			0.987*			0.629***		
	(0.1219)			(0.5904)			(0.2029)		
Top 5% foreign affiliates		0.215***			0.688*			0.439***	
		(0.0754)			(0.3930)			(0.1228)	
Top 10% foreign affiliates			0.152***			0.485*			0.309***
			(0.0516)			(0.2738)			(0.0846)
Region-year obs.	2,201	2,201	2,201	2,201	2,201	2,201	2,201	2,201	2,201
Cragg-Donald F stat	54.717	52.592	70.797	54.717	52.592	70.797	54.717	52.592	70.797

Notes: All variables are transformed to logs. All models include the full set of control variables and year fixed effects. Mean residual wages are first adjusted using Equation 1.* p<0.1, ** p<0.05, *** p<0.01. Robust standard errors are shown in parentheses. Cumby-Huizinga tests for the existence of autocorrelation of order 2.

Table A7: Inward FDI and Between-firm Wage Inequality across Regions - CompNet Data, 50% Foreign Ownership Threshold

Outcome variable:	90/10 ratio				90/50 ratio			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Foreign aff. eployment share	0.998***				0.162*			
	(0.2764)				(0.0836)			
Top 1% foreign affiliates		1.568***				0.255*		
		(0.5704)				(0.1347)		
Top 5% foreign affiliates			1.491***				0.242*	
			(0.5121)				(0.1277)	
Top 10% foreign affiliates				1.346***				0.219*
				(0.4332)				(0.1142)
Third level education	-0.021	-0.793***	-0.719***	-0.536***	0.394***	0.269***	0.281***	0.311***
	(0.1883)	(0.2305)	(0.2296)	(0.2012)	(0.0640)	(0.0716)	(0.0703)	(0.0642)
High tech employment	0.151***	0.116***	0.129***	0.135***	0.045***	0.039***	0.041***	0.042***
	(0.0206)	(0.0204)	(0.0201)	(0.0195)	(0.0078)	(0.0075)	(0.0074)	(0.0074)
HR in sciene and technology per capita	0.101	0.624	0.560	0.356	-0.514***	-0.429***	-0.439***	-0.472***
	(0.3529)	(0.4400)	(0.4459)	(0.3962)	(0.1275)	(0.1374)	(0.1386)	(0.1316)
GDP per worker	-0.219***	-0.447***	-0.373***	-0.322***	-0.134***	-0.171***	-0.159***	-0.150***
	(0.0549)	(0.0672)	(0.0498)	(0.0438)	(0.0185)	(0.0147)	(0.0130)	(0.0135)
Regional mark-down	0.253***	0.255***	0.287***	0.264***	0.077***	0.077***	0.082***	0.079***
	(0.0664)	(0.0729)	(0.0826)	(0.0723)	(0.0203)	(0.0202)	(0.0229)	(0.0209)
Region-year obs.	1,123	1,123	1,123	1,123	1,123	1,123	1,123	1,123
Cragg-Donald F stat	51.149	82.383	60.893	63.615	51.149	82.383	60.893	63.615
Cumby-Huizinga test p-val.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Notes: All variables are transformed to logs. All models include the full set of control variables and year fixed effects. * p<0.1, ** p<0.05, *** p<0.01. Robust standard errors are shown in parentheses. Cumby-Huizinga tests for the existence of autocorrelation of order 2.

Table A8: Inward FDI and Between-firm Wage Inequality across Regions - Turnover Shares

	Panel A. Ordinary Least Squares					
Outcome variable:	Gini index		90/10 ratio		90/50 ratio	
	(1)	(2)	(3)	(4)	(5)	(6)
Foreign aff. turnover share	0.022***	0.009**	0.041**	0.019	0.025***	0.009
	(0.0040)	(0.0035)	(0.0174)	(0.0144)	(0.0075)	(0.0067)
Region-year obs.	2,201	2,201	2,201	2,201	2,201	2,201
R-squared	0.033	0.180	0.006	0.022	0.015	0.138
Controls	No	Yes	No	Yes	No	Yes
	Panel B. Instrumental Variables					
Outcome variable:	Gini index		90/10 ratio		90/50 ratio	
	(1)	(2)	(3)	(4)	(5)	(6)
Foreign aff. turnover share	0.062***	0.132***	0.009	0.422*	0.017	0.269***
	(0.0239)	(0.0484)	(0.1351)	(0.2442)	(0.0390)	(0.0854)
Third level education		0.067***		0.120		0.179***
		(0.0226)		(0.0760)		(0.0454)
High tech employment		0.026***		0.052***		0.035***
		(0.0028)		(0.0140)		(0.0056)
HR in sciene and technology per capita		-0.152***		-0.050		-0.184*
		(0.0539)		(0.2544)		(0.1074)
GDP per worker		-0.020*		-0.033		-0.025
		(0.0110)		(0.0560)		(0.0199)
Region-year obs.	2,201	2,201	2,201	2,201	2,201	2,201
Cragg-Donald F stat	63.698	24.473	63.698	24.473	63.698	24.473
Cumby-Huizinga test p-val.	0.000	0.000	0.000	0.000	0.000	0.000
Controls	No	Yes	No	Yes	No	Yes
	Panel C. First Stage					
Outcome variable:	Foreign Affiliates Employment Share					
	(1)	(2)	(3)	(4)	(5)	(6)
Shift-share	0.766***	-0.641***	0.766***	-0.641***	0.766***	-0.641***
	(0.1137)	(0.1479)	(0.1137)	(0.1479)	(0.1137)	(0.1479)
Region-year obs.	2,201	2,201	2,201	2,201	2,201	2,201
R-squared	0.032	0.134	0.032	0.134	0.032	0.134
Controls	No	Yes	No	Yes	No	Yes

Notes: All variables are transformed to logs. All models include year fixed effects and are weighted by regional employment. Mean residual wages are first adjusted using Equation 1.* p<0.1, ** p<0.05, *** p<0.01. Robust standard errors are shown in parentheses. Cumby-Huizinga tests for the existence of autocorrelation of order 2.