Unpacking the Polarizing Effects of Global Production Networks: Evidence from EU Regions

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Vieri Calogero
Università di Milano Bicocca

Simona Comi
Università di Milano Bicocca

Mara Grasseni
Università di Bergamo

Laura Resmini
Università di Milano Bicocca

Abstract: *This paper investigates the relationship between regional participation in Global Production Networks (GPNs) and labour market polarization across European regions. While existing literature has extensively examined the effects of technological change and trade on occupational structures, the territorial consequences of different modes of firm internationalization remain underexplored. We address this gap by constructing a novel panel dataset (2007–2022) that integrates regional employment data with firm-level information on multinational ownership structures from Orbis DataHub. We identify three main forms of GPN participation: the emergence of Global Ultimate Owners (GUOs), the expansion of foreign subsidiaries by domestic multinationals (SUBOUT), and the presence of foreign-owned firms (SUBIN). Using fixed effects and instrumental variable models, we find that all three forms of internationalization are significantly associated with higher levels of polarization, though outward FDI by local firms generates the strongest effects by displacing middle-skill occupations. Importantly, we show that national labour market institutions—such as employment protection legislation and collective bargaining centralization—can moderate these effects, in some cases reversing the direction of impact. Our findings suggest that policies supporting international integration should be accompanied by institutional and territorial strategies capable of addressing uneven impacts and fostering a more balanced distribution of their outcomes.*

1. Introduction

Over the past decade, labour market polarization has emerged as a defining trend across European economies, challenging the traditional narrative of continuous occupational upgrading. Employment dynamics have become increasingly characterized by the simultaneous growth of low-skilled/low-wage and high-skilled/high-wage jobs, coupled with the decline of middle-skill occupations. This phenomenon has been widely attributed to a combination of technological change (Autor, Levy, and Murnane, 2003; Autor and Dorn, 2010), consumption-driven spillovers (Manning, 2004; Mazzolari and Ragusa, 2013; Leonardi, 2010), and trade liberalization and task offshoring (Thoenig and Verdier, 2003; Feenstra and Hanson, 2003; Grossmann and Rossi-Hansberg, 2012). Together, these forces have intensified the task-based division of labour (Baldwin, 2014) and contributed to the erosion of routine-intensive jobs (Autor and Dorn, 2013; Goos et al., 2014; Reijnders and de Vries, 2018).

Despite growing attention to the role of task fragmentation in shaping employment, the territorial implications of Global Production Networks (GPNs) for labour market polarization remain understudied. This gap is particularly salient given the strong subnational heterogeneity observed in both GPN participation and polarization trajectories. Existing evidence suggests that regional patterns of polarization diverge significantly from national trends, often concentrating in a limited set of areas (Henning and Eriksson, 2020). Moreover, firms and territories differ markedly in how they engage with GPNs (Crescenzi et al., 2014), potentially giving rise to uneven impacts on regional employment structures.

An additional and underexplored dimension concerns the differential effects of distinct internationalization modes. While the expansion of multinational enterprises and the increasing complexity of GPNs are reshaping regional economies across Europe (Resmini et al., 2024), few studies have empirically examined how specific forms of firm-level participation influence occupational polarization. GPN integration has the potential to transform local labour markets by introducing advanced technologies, altering organizational practices, and redistributing tasks and capabilities across space (Yuan and Sun, 2024). Yet, its impacts may be ambivalent: while integration can enhance competitiveness and foster high-skill employment, it may also deepen labour market inequalities by displacing middle-skill jobs.

Against this background, this paper investigates whether, and to what extent, GPN participation contributes to labour market polarization at the regional level. We address three interrelated questions: (1) Does the internationalization of domestic firms exacerbate regional polarization? (2)

Do different modes of GPN integration produce heterogeneous effects on occupational structure? (3) Are these effects shaped by the institutional characteristics of local labour markets?

To address these questions, we focus on three distinct forms of GPN participation. First, we consider the case of domestic firms that become Global Ultimate Owners (GUOs), coordinating value chains and establishing strategic control abroad. Second, we examine the expansion of existing multinational enterprises through the creation of new foreign subsidiaries (SUBOUT), a process that can lead to task reallocation and offshoring. Third, we analyse the effects of inward FDI, measured as the presence of foreign-owned subsidiaries (SUBIN) within a region. These mechanisms capture different degrees and directions of GPN integration and allow us to disentangle their respective impacts on employment polarization. We construct a regional panel dataset covering 2007–2022 by integrating firm-level information from Orbis DataHub with employment data from the European Labour Force Survey and regional statistics from Eurostat. Our empirical strategy combines fixed effects models with instrumental variable techniques to address potential endogeneity concerns.

Our results show that GPN participation significantly contributes to occupational polarization at the regional level. The strongest effects are observed in relation to outward internationalization by local GUOs, particularly through the creation of subsidiaries abroad, which tend to shift middle-skill jobs to lower-cost countries. Inward FDI also contributes to polarization, primarily by increasing the demand for high-skilled labour. Crucially, our findings reveal a moderating role played by labour market institutions: higher levels of employment protection legislation, and centralized bargaining systems can mitigate the most adverse effects of internationalization.

This study advances the literature on globalization and regional development by offering new insights into the distributive consequences of GPN integration. Understanding how global production dynamics interact with local institutional contexts is essential to designing policies that promote both competitiveness and social cohesion. In doing so, the paper contributes to current debates on open strategic autonomy and the territorial rebalancing of Europe's economic geography.

2. Data and Methodology

In this paper, we use multiple datasets to examine the relationship between labour market polarization and globalization. We combine detailed occupational employment data with regional-level information derived from firm-level sources.

Polarization

We analyse the evolution of labour market polarization across European regions using employment share data across occupational groups from the EUROSTAT Labour Force Survey. To measure polarization, we rely on a specific index, calculated as follows:

$$\boldsymbol{Polarisation}_{i,t} = ln \frac{\sum \boldsymbol{E}_{i,t}^{\boldsymbol{high}} + \sum \boldsymbol{E}_{i,t}^{\boldsymbol{low}}}{\sum \boldsymbol{E}_{i,t}^{\boldsymbol{medium}}}$$

This index captures the relative decline of middle-skill occupations compared to both low- and high-skill jobs. We use harmonized data covering the period 2007–2022, which allows for consistent comparisons across regions and over time. A higher index value indicates a more pronounced level of polarization, reflecting the displacement or erosion of middle-skill employment. By leveraging EUROSTAT's harmonized and comparable data, we provide a comprehensive overview of the polarization dynamics affecting European labour markets. As shown in Figure 1, polarization is a widespread trend, although its intensity varies significantly across regions.

(Fig. 1 about here)

We also incorporate information on labour market institutions, drawing from the OECD and AIAS ICTWSS databases. In particular, we focus on these two indicators, measured in year 2007:

1. **Employment Protection Legislation (EPL)**: The OECD EPL indicators measure the strictness of regulations governing the dismissal of permanent workers and the hiring of temporary workers. They cover both individual and collective dismissal rules.
2. **Bargaining Centralization**: The degree of collective bargaining centralization refers to the level at which wage negotiations occur—national, sectoral, or firm level. In highly centralized systems, negotiations are typically conducted at the national or sectoral level, ensuring uniform conditions across industries. Conversely, decentralized systems allow firm-level bargaining, which may lead to more flexible but unequal employment conditions.

Regional Participation in Global Value Chains

In this paper, we propose a new analytical and measurement framework to investigate the participation of the EU regions in the global production system. A novelty relative to the existing literature is that we measure the participation in terms of outward and inward FDI rather than in terms of value added in gross exports. The basic idea is that MNEs often act as lead firms in GVCs, directing

the chain's value addition and distribution through their investment decisions. This firm-level perspective has the advantage of allowing us to trace each Global Production Network to the regional level and exploit this information to measure EU regions' participation in GVC. To this respect, we proceed in steps. First, we download from Orbis DataHub data on Global Ultimate Owners (GUOs), i.e. the independent companies at the top of the corporate ownership structure, and their subsidiaries abroad. Data are then aggregated at the NUTS2-level region/year level, based on the location of the GUOs, as reported in Orbis. The operational dataset covers an annual average of 270 thousand GUOs located in 189 NUTS2 regions across 27 EU countries controlling about 763.815 subsidiaries located in 109 destination countries.

Using these data, we then measure regional participation in GVC in two ways. First, we measure outward participation, and then we measure inward participation.

Outward participation

Our indicator of regions' participation in GPNs translates into the following formula:

$$GPN_{rt} = \sum_{rt} (GUO_{rt} + SUBOUT_{rt})$$

This variable reflects the dimension of outward FDI stocks, which depends on two separate entities, i.e. the number of local firms that become international (GUOs) as well as the number of subsidiaries abroad controlled by those firms. Indeed, when local firms take the role of the Global Ultimate Owner (GUO), they control the GPNs, deciding on strategies, supply chains, and investments abroad (SUBOUT). This can lead to improved capacity for innovation and high-skill job creation within the region, as well as enhanced competitiveness of local industries on the global stage. This may generate selective job growth, with high-skilled workers benefitting the most. Furthermore, when local GUOs establish subsidiaries abroad, it can result not only in growth opportunities for local firms, leading to higher revenues and potentially more jobs in headquarters and R&D, but also in job reallocation, with some high-skill jobs created locally and middle-skill jobs delocalised in lower-cost regions abroad. Lastly, an increase in outward FDI may bring diversification in activities and skills in the regions of origin, because of the development of new competencies in international management, logistics, supply chain optimization and innovation. Given the different effects that GUOs and subsidiaries abroad may exert on the skill composition of the labour force in the region of origin of the FDI activities, we decided to include in the regression analysis the aggregated variable (GPNs) as well as its two components separately.

Inward participation to GPN

To measure inward FDI stocks, we follow a similar approach. We downloaded from Orbis DataHub data on foreign-owned firms in the EU and aggregated them by NUTS2-level region/year level based on the location reported in Orbis. This variable (SUBIN) reflects that foreign investments bring capital, advanced technology, and new management practices into host locations. This can lead to job creation, knowledge spillovers, and potential polarization, given that foreign firms tend to hire a more skilled labour force and pay higher wages. Thus, as the number of foreign investments increases, the demand for high-skill jobs may increase, while middle-skill jobs could decline if automation occurs. Besides variables measuring regions' involvement in GPNs, we also consider other variables that may potentially explain variation in the polarisation of the labour force. They include the degree of urbanisation, the unemployment rate, the education attainment of the population, the share of women's employment, the average size of local firms and the average age of the labour force. Lastly, we include also the economic complexity of the regions as a proxy for their level of development broadly defined.

2.1 Methodology

In this paper, we investigate how regional participation in Global Value Chains (GVCs) affects labor market polarization. The empirical analysis is conducted at the regional level using a panel dataset that spans multiple European countries over time. The key explanatory variables are the degree of regional GVC participation, measured through firm-level indicators derived from Orbis data set and aggregate at the regional level.

We estimate the following baseline model:

$$Polarization_{i,t} = \alpha_i + \beta_1 Network_{i,t-1} + \beta_2 SubsIN_{i,t-1} + \theta X_{it} + \alpha_i + \gamma_t$$

where $Polarization_{i,t}$ is our outcome variable capturing the extent of labor market polarization in region i at time t, $Network_{i,t-1}$ and $SubsIN_{i,t-1}$ are the two measures of the intensity of regional participation in global production networks explained in section 2.2, lagged one year. The vector X_{it} includes region-level time-varying controls such as employment structure (average age of the workforce, female participation, share of tertiary educated workers, unemployment rate, average firm size). Time fixed effects γ_t and region fixed effects α_i control for unobserved temporal shocks and region-specific heterogeneity, respectively.

Our polarization indicator tracks the relative employment shares across low-, middle-, and high-skill occupations, with particular focus on the hollowing-out of middle-skill jobs—a pattern often linked to globalization and technological change.

The coefficient of interest in equation (1) are β_1 and β_2, which measure the relationship between labor market polarization and our measures of regional GVC participation, holding other factors constant. The main empirical challenge concerns the causal interpretation of the OLS estimates, which may be biased due to endogeneity. There are two main threats to the identification of unbiased coefficients in equation (1). First, GVC integration at the regional level may be driven by unobserved economic or institutional characteristics—such as industrial policy, labor market reforms, or regional competitiveness—leading to omitted variable bias. Although the inclusion of regional controls and fixed effects mitigates this issue to some extent, it does not fully eliminate it. Second, there is a risk of reverse causality: while we aim to study the effect of GVC participation on polarization, it is also plausible that regions with rising polarization patterns are more or less likely to integrate into GVCs.

To address these concerns, we implement a Bartik-style instrumental variable (IV) strategy (Goldsmith-Pinkham et al., 2020; Bartik, 1993). We construct shift-share instruments that combine two elements: (i) the initial sectoral composition of each region in terms of GVC exposure ("share" component), and (ii) the global growth of sector-specific GVC integration at the international level ("shift" component).

In the next section, we present the results from the estimation of the fixed-effect model described in equation (1), while additional results using 2SLS are reported in section 4 which is devoted to the robustness exercises. All regressions use clustered standard errors at the regional level.

3. Results

3.1 Benchmark results

The benchmark results are summarized in Table 1. We adopt the standard approach of demeaning variables using within transformation so that region-fixed effects are implicitly present in the model. We also add time effects to control for common time development effects. Furthermore, explanatory variables have been standardized to have a clearer interpretation of the estimated coefficients. Needless to say, these specifications do not identify any causal effect of GPN participation on polarization. More simply, they represent a first explorative analysis pointing to uncovering the nature

of the potential association between the two phenomena. Despite that, they are quite informative on where the effects of GVC participation concentrate the most. Endogeneity will be accounted for in Section 4 where causal links will be clearly identified through an IV approach.

In line with our hypotheses, the regression analysis delivers positive and statistically significant coefficients of the network variables, indicating that an increase in participation in GPN is associated with an increase in polarisation regardless of the way regions engage in GPNs (column 1). More specifically, our findings suggest that a one standard deviation increase in the size of the external connections created by local MNEs through their subsidiaries abroad generates a 0.04 increase in polarization. The magnitude of the coefficient does not seem to change substantially when only offshore activities are considered. These results support the idea that the expansion of foreign activities by local companies implies an increase in high-skill jobs in the regions of origin of MNEs. Polarisation is also associated positively with an increase in inward FDI projects, though the magnitude of this impact is lower than that exerted by offshoring activities. Overall, these results confirm the idea that GPN participation exert uneven effects on workers, since MNEs, both local and foreign, are more oriented to recruit high-skill workers.

However, headquarters and the subsidiaries abroad they control can be considered as two sides of the same coin. A region hosting a large number of MNEs' headquarters is a region controlling GPNs and the larger the number of headquarters and/or subsidiaries abroad, the stronger is region participation in GPNs. To avoid multicollinearity biases, we aggregate them in a variable proxying the total size of the external network created by MNEs headquartered in each EU region (column 2). Results do not change significantly. There is still evidence that participation in GPNs is positively associated with the polarisation of regional labour markets, and the impact of offshored activities remains higher than that of inward activities.

(Table 1 about here)

Most of the control variables are significant with the expected sign. In particular, polarisation is positively associated with the average size of firms operating in the regional labour market, the endowment of human capital and the unemployment rate, while it is negatively associated with the average age of the labour force, the relative participation of women in employment, and the degree of urbanisation of the regions, though the latter is not statistically significant. These results are in line with previous similar studies (Kalleberg and Van Buren, 1996; Autor & Dorn, 2013; Chauvin, 2018; Mukoyama et al., 2025). Overall, these preliminary findings provide an answer to research questions 1 and 2. Indeed, participation in GPNs has a positive effect on polarisation, all else equal, irrespective

of the way regions engage in GPNs. However, offshoring via outward FDI exerts a larger effect on polarization with respect to the inward FDI.

3.2 Heterogeneity: The Moderating Role of Labour Market Institutions

In this section, we investigate whether the relationship between regional participation in GPNs and labour market polarization is mediated by institutional characteristics of national labour markets. In particular, we focus on two key dimensions: employment protection legislation (EPL) and the degree of collective bargaining centralization.

EPL, as defined by the OECD, captures the stringency of regulations on individual and collective dismissals, as well as on the use of temporary contracts. We construct a binary variable equal to 1 for countries with an EPL index above the median value in 2007. These countries include Czech Republic, Germany, Greece, France, Italy, Latvia, Netherlands, Portugal, Sweden, and Slovakia. Similarly, we define a dummy variable for countries with high levels of collective bargaining centralization in 2007, coded as 4 or 5 in the ICTWSS dataset. This group comprises Belgium, Greece, Spain, Finland, Ireland, and Romania.

Results are reported in Table 2. We find that strong labour market institutions significantly moderate the effect of different modes of internationalization on polarization outcomes. In particular, the presence of either high bargaining centralization or stringent EPL reverses the sign of the coefficient on inward FDI from positive and statistically significant to negative and statistically significant. This suggests that institutional settings can mitigate the polarizing effects of foreign investment by shaping hiring practices and wage-setting mechanisms of incoming multinational firms.

(Table 2 about here)

A similar moderating effect emerges for outward FDI: in countries with stronger institutional frameworks, the increase in foreign subsidiaries by local GUOs is associated with a reduced polarization effect. Interestingly, we also find that bargaining centralization attenuates the polarization associated with the emergence of new internationalized firms, whereas a high level of EPL appears to amplify it. In particular, the coefficient increases from 0.0285 to 0.110 in high-EPL contexts. While the latter finding is somewhat unexpected, it may reflect an intensity effect: in more rigid labour markets, GUOs may restrict their domestic hiring to high-skilled functions (e.g. management and R&D), while shifting more easily and strongly replaceable middle-skill jobs to subsidiaries in more flexible labour markets abroad. This potential mechanism deserves further empirical investigation.

4. Robustness (tbd)

5. Discussion and Conclusions

This paper has explored how regional participation in Global Production Networks (GPNs) shapes labour market polarization across European regions. While the literature has long emphasized the role of technological change, consumption patterns, and trade liberalization in driving polarization, our study highlights the importance of firm internationalization modes as a distinct and regionally embedded driver. By combining firm-level data on multinational ownership structures with regional employment dynamics, we provide novel empirical evidence on the heterogeneous effects of outward and inward foreign direct investment (FDI) on the occupational structure of local labour markets.

Our results show that participation in GPNs is positively associated with labour market polarization. In particular, we find that outward FDI by local firms, especially through the establishment of foreign subsidiaries, is the most significant driver of polarization. This form of integration tends to displace middle-skill jobs while concentrating high-skilled functions—such as management, coordination, and R&D—within the region of origin. Inward FDI also contributes to polarization, though to a lesser extent, by reinforcing the demand for high-skilled labour in host regions. These findings underscore that different modes of internationalization are not neutral: they exert uneven effects on the geography of employment, favouring certain occupational segments over others.

We also find that labour market institutions moderate these effects. High levels of employment protection legislation (EPL) and greater bargaining centralization reduce the polarizing impact of foreign investment. In particular, stringent EPL and centralized wage-setting mechanisms reverse the effect of inward FDI on polarization, suggesting that robust institutional frameworks can buffer against the adverse consequences of international economic integration. However, the role of EPL is more ambiguous when it comes to outward FDI: in high-EPL contexts, GUOs may further specialize in high-end functions at home while offshoring mid-level tasks to less regulated environments. This may reflect a task-sorting mechanism intensified by regulatory constraints, and it invites further research on the interaction between institutional rigidity and functional upgrading within GPNs.

From a policy perspective, our findings imply that strategies aimed at promoting internationalization should not be pursued in isolation. First, they need to be accompanied by place-based cohesion policies to prevent the spatial concentration of benefits and the deepening of territorial inequalities. Second, policies that support the reconfiguration of production systems—through reshoring, nearshoring, or the development of strategic autonomy—may contribute to mitigating polarization in

key sectors. Third, reinforcing labour market institutions can act as a stabilizing force, especially in regions exposed to intense global competition. Strong employment protection and centralized bargaining can play a central role in ensuring that the gains from internationalization are more evenly distributed across occupational groups. Overall, this study contributes to the growing body of research on the territorial implications of globalization by unpacking how GPN integration interacts with local labour markets.

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Tables

Tab 1. The baseline results

VARIABLES	(1) polarisation	(2) polarisation
GUO	0.0430***	
	(0.00648)	0.0716***
SUBout	0.0660***	(0.00767)
	(0.00804)	
SUBin	0.0218***	0.0262***
	(0.00473)	(0.00472)
Degree urbanization	-0.0329**	-0.0324**
	(0.0153)	(0.0154)
Firm size	0.0263***	0.0229***
	(0.00840)	(0.00845)
Age	-0.0370***	-0.0349***
	(0.0111)	(0.0112)
Education	0.175*	0.181*
	(0.101)	(0.102)
Gender balance	-0.361***	-0.405***
	(0.0962)	(0.0968)
Unemployment rate	0.717***	0.826***
	(0.268)	(0.270)
ECI	0.000681***	0.000768***
	(0.000220)	(0.000222)
Constant	0.970***	0.961***
	(0.0632)	(0.0637)
Observations	2,273	2,273
Number of region	174	0.259
R-squared	0.272	174
Nuts2 FEs	YES	YES
Years FEs	YES	YES

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 2. Heterogeneous Effects by Institutional Labour Market Framework

VARIABLES	(1) EPL polarisation	(2) Centralization polarisation
Low LM Institutions * GUOs	0.0285***	0.108***
	(0.00684)	(0.0139)
High LM Institutions * GUOs	0.110***	-0.0709***
	(0.0154)	(0.0155)
Low LM Institutions * SUBout	0.120***	0.0486***
	(0.0139)	(0.00811)
High LM Institutions * SUBout	-0.106***	-0.0178
	(0.0169)	(0.0456)
Low LM Institutions * SUBin	0.0209***	0.0236***
	(0.00625)	(0.00473)
High LM Institutions * SUBin	-0.00669	-0.0334**
	(0.00887)	(0.0152)
Degree urbanization	-0.0275*	-0.0253*
	(0.0147)	(0.0148)
Firm size	0.0564***	0.0474***
	(0.00844)	(0.00827)
Age	-0.0562***	-0.0479***
	(0.0106)	(0.0106)
Education	0.900***	0.818***
	(0.0985)	(0.101)
Gender balance	-0.229**	-0.321***
	(0.0925)	(0.0920)
Unemployment rate	0.467*	0.746***
	(0.258)	(0.257)
ECI	0.000272	0.000487**
	(0.000211)	(0.000213)
Constant	0.849***	0.814***
	(0.0604)	(0.0605)
Observations	2,273	2,273
R-squared	0.334	0.323
Number of region	174	174
Nuts2 FEs	YES	YES
Years FEs	YES	YES

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Figures

Figure 1. Average Polarization in EU NUTS-2 Regions