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# Globalisation and unemployment in the EU: new insights on the role of global value chains and workforce composition

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Single Market Economics Papers

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# Globalization and unemployment in the EU: new insights on the role of global value chains and workforce composition\*

Mariam Camarero<sup>†</sup> Antonia López-Villavicencio<sup>‡</sup> and Cecilio Tamarit<sup>a§</sup>

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## Abstract

The participation of the European Union in Global Value Chains (GVCs) is significantly higher compared to North America and Asia and it has steadily increased with the creation of the Single Market and the launching of the euro. We provide empirical evidence on the consequences of GVC participation on aggregate unemployment. Using data for EU countries and impulse response functions derived from local projections, we show that a higher participation reduces the unemployment rate in less advanced EU economies while it increases it in core countries. Our results also show that unemployment is particularly sensitive to GVCs when the labour cost is low.

*JEL Classification:* F14; F15; F62; C32

*Keywords:* Global Value Chains, EU, local projections, unemployment.

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# 1 Motivation

There is ample consensus that economic globalization impacts the number of jobs available in the economy. Although the consequences of international trade on unemployment have been largely studied in the theoretical<sup>1</sup> and empirical<sup>2</sup> literature, there is much less evidence on the impact of global value chains (GVCs) on the unemployment rate. Indeed, at the aggregate level, the costs and benefits of GVCs are complex, as they increase the interconnections between countries and thereby the uncertainty.<sup>3</sup>

Over the past three decades, the world economy has witnessed an upsurge in the process of production fragmentation across borders. The facet of globalization that we study in this paper is, precisely, the so-called GVC organization. Three interconnected production hubs have been established around the world: North America (centered in the United States), Asia (with China playing a dominant role), and Europe (with Germany as the core). Overall, the participation of Europe in GVCs is significantly higher than the other two, and it has steadily increased with the creation of the Single Market and the launching of the euro (Huidrom et al., 2019). Indeed, euro area countries are more integrated into regional than into global supply chains, and thereby value chain participation at a regional level has significant economic implications for the euro area economy (ECB, 2019). As countries have increased their participation in GVCs, more and more firms have decided to relocate their production with clear consequences for employment across regions and countries (Amador and Cabral, 2016). Within the EU, the distribution of economic activity presents a core-periphery pattern, with the bulk of investments concentrated in core countries. Nonetheless, peripheral countries have gained prominence with the acceleration of the economic integration process in the EU. Since tariffs and non-tariff barriers were already eliminated in the 1990s, the accession of the Central and Eastern European Countries (CEECs) into the EU in 2004 provides a quasi-natural experimental setting that can be used to investigate the importance of behind-the-border barriers across integrated markets. In fact, most of the literature has been pessimistic, arguing that increased competition in an integrated

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<sup>1</sup>Some theoretical works show that the effect of globalization on unemployment can be either positive (Feenstra and Hanson, 1996; Helpman and Itskhoki, 2010), negative (Mitra and Ranjan, 2010; Heid and Larch, 2016; Farole et al., 2018; World-Bank, 2020) or uncertain (Moore and Ranjan, 2005; Şener, 2001; Szymczak and Wolszczak-Derlacz, 2022).

<sup>2</sup>In line with the Ricardian comparative advantage model, some authors find that trade openness creates employment for the home country and its trading partners (Dutt et al., 2009). Yet others show that trade liberalization may have a detrimental effect on employment in a labor-scarce economy that trades with a labor-abundant economy in accordance with the Heckscher–Ohlin model (Felbermayr et al., 2011; Heid and Larch, 2016).

<sup>3</sup>See, for a comprehensive revision of GVC, Antràs and Chor (2021).

area would force firms to trim their workforce and shift towards more capital intensive “advanced” technology, thereby restricting employment expansion along with a marked trend towards casualization of workforce (Mundle, 1993). More recently, the problem has been formulated as the seemingly paradoxical “pair of concerns”: more advanced countries worry about the potential loss of manufacturing jobs going to lower-cost countries, whereas the countries that host the new production worry about receiving the wrong type of jobs (as formulated by Baldwin and Ito, 2022). Motivated by these developments, it is increasingly important to understand the factors underlying the relation between GVCs and employment across European countries using robust statistical techniques.

However, this endeavor is a difficult task. The impact of GVCs on economies and societies is more diffuse and less controllable than that from the initial phase of globalization (Baldwin, 2016). The reason behind this difficulty is that intra-GVC transactions are hard to observe. Nevertheless, Shepherd (2013) elaborated an interesting revision of the effects of GVCs in employment in developing countries, and Shingal (2015) reviews the labor market effects and mechanisms of GVCs integration in a more general context. From an empirical point of view, one of the few examples of research in this area is Szymczak and Wolszczak-Derlacz (2022), who analyze the effects of GVC participation on employment between 2000 and 2014 for a group of 43 countries and 56 sectors.

We contribute to the debate on the macroeconomic effects of globalization by analyzing whether involvement in GVCs affects the unemployment rate across EU countries. We consider this issue empirically by estimating impulse response functions from local projections for the 28 EMU Member States over the period 1990-2015<sup>4</sup>. This straightforward methodology, proposed by Jordà (2005), allows us to focus attention on results rather than the estimation technique.

We make several novel contributions to the scarce existing literature. First, we focus on countries belonging to the European Union (EU). An analysis at the European level is interesting since the EU is the region with the most significant degree of participation in GVCs. Moreover, despite the global GVC slowdown since 2012, in the EU countries, this process has been much less pronounced (ECB, 2019).

Second, we adopt a global and a sectoral approach to value chain participation to provide a richer analysis. Indeed, we analyze not only the sectoral breakdown in manufacturing but also in services. Trade in services has been frequently ex-

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<sup>4</sup>Although at the moment of writing the paper, the UK is no longer an EU member, it was for the sample period. The sample ends in 2015, the last year available in the sectoral data breakdown.

cluded from GVC studies. However, services have increased in value-added as well as in sophistication. Therefore, production can be also divided into several stages in different locations. According to the OECD Statistics on International Trade in Services database, the EU leads the trade in services, as the joint exports of this sector amounted to more than one trillion dollars in 2020, and its imports also surpassed 900 billion. The corresponding figures for the US were 700 billion and 460, respectively.

Third, we linked the GVC-employment nexus with the workforce composition regarding the skill level and labor costs. This question is highly relevant given that the literature suggests that employment creation has been biased towards more skilled workers, at least in developing countries, which contrasts with the predictions of trade theory. The skill-biased nature of GVC trade is associated with the high complexity of global supply chains and increased use of skill-intensive inputs, notably services. Labor costs can also contribute to the global value chain by their impact on competitiveness and cost differentials vis-à-vis other countries.

Fourth, we pay special attention to possible endogeneity issues. Indeed, GVC participation can impact labor market outcomes by shaping the demand for labor and skills, but labor market outcomes also have a strong role in shaping the scale and nature of GVC participation. Thus, the direction of causality between GVC participation and jobs is often difficult to disentangle. We deal with this issue by relying on local projections and defining the causal effect on the unemployment rate on time  $t + h$  of a one-time shock at time  $t - 1$ . Considering both the shock and all explanatory variables at  $t - 1$  our analysis should provide some comfort in addressing endogeneity. However, we also implement an instrumental variable (IV) approach to mitigate such concerns completely. As an instrument, we use the average changes in the participation of the other countries in the sample.

Finally, we explore some of the possible mechanisms that can explain the impact of GVCs on the unemployment rate by revisiting the link between value added and employment for the subsectors in manufacturing.

Our results show that value chains affect the unemployment rate in different ways: while they have the potential to raise employment and, therefore, reduce the unemployment in less advanced EU countries, the impact of this characteristic of the globalization process can be detrimental for labour markets in core economies. In line with this result, we show that countries with low labour costs and skills benefit the more of GVC participation. Finally, our results indicate that subsectors with higher GVC participation growth in the manufacturing sector can generate

more employment in their sector, although the capacity to increase value added is more limited.

This paper is organized as follows. Section 2 relates the present research with previous literature. In Section 3 we describe the data and in Section 4 we present the methodology and the empirical results. Section 7 concludes.

## 2 Related literature

In a world where internal and external imbalances have been significant for extensive periods, the role of GVCs –that have predominated in trade since the 90s– deserves special attention. Indeed, firms’ and sectors’ participation in global value chains creates or strengthens cross-country linkages via trade in intermediate inputs with potentially significant macroeconomic consequences. Using local projections, Camarero et al. (2021) provides an in-depth analysis of how GVCs participation affects growth, productivity, unemployment, and the current account balance. However, from all the potential consequences of international involvement in GVCs, the labor market is probably crucial and deserves more attention. First, employment, productivity and growth are interlinked, both cyclically and in the short and long-term, with distinctive characteristics in each case. Second, from a socio-political point of view, the development of GVCs has been considered one of the causes of the increase in inequality in developed countries. Finally, the new wave of reshoring after the pandemic may also have consequences in the labor markets, something to be considered from an economic policy point of view. For these reasons, we review the theoretical and empirical literature on GVCs effects on the labor market in this section. Nevertheless, we do not consider the extensive literature on the concepts, nature and determinants of GVCs and refer to the recent review of Antràs and Chor (2021).

From a theoretical point of view, two approaches have converged toward similar conclusions about the relationship between globalization and the labor market. According to Shingal (2015), intra-industry trade in differentiated products models would conclude that labor market effects would also be intra-industry in nature. Through comparative advantage, Greenaway et al. (1999) link increases in imports with unemployment and more exports with more jobs. However, this may not happen in practice due to (among other arguments) the importance of firm-level heterogeneity. Melitz (2003) explicitly incorporates heterogeneity in his trade model. In this case, intra-industry trade is reallocated among firms responding to stronger foreign competition, causing changes in their relative performance.

The workhorse Ricardian trade model of Eaton and Kortum (2002) obtains similar results in a different setting. Using the same theoretical approach as Eaton and Kortum (2002), Caliendo and Parro (2015) provide a solid base to incorporate the role of GVCs and international linkages, as they introduce a greater level of detail with multiple sectors and countries, as well as intermediate goods. From a computational point of view, they can estimate the model country by country and obtain a formulation in the form of a gravity equation. However, they do not account for unemployment. Dix-Carneiro et al. (2021), starting from Caliendo and Parro (2015) approach, extend the model with inter-sectoral mobility costs, labor market frictions and trade imbalances. They study the effects of an increase in productivity in China on unemployment in the rest of the world, finding that this type of shock, even if not permanent, may have persistent long-run effects.

Carrère et al. (2020) have recently proposed a trade model about the effects of trade openness on employment in a multicountry and multisector framework, where workers are risk-averse, there is unemployment in equilibrium, and there are frictions in the labor market. Moreover, the workers worry about income and unemployment and have acquired skills for a specific sector. The model has a trade block and a labor market block (as well as the government budget constraint). In this context, trade affects unemployment through two channels: expansion and reallocation. The expansion effect occurs when a trade reform results in efficiency gains. These gains imply more jobs, higher welfare and less unemployment. However, once the resources are reallocated toward sectors with higher labor market efficiency than the average, employment increases in these sectors and decreases in others. The reallocation effect results from different degrees of friction across labor market subsectors. Thus, individual effects are heterogeneous and there are winners and losers in employment. Trade changes displace workers and adjustment takes time. Thus, it is possible to find simultaneous increments in real per capita income and unemployment.

Therefore, these recent theoretical and computational contributions to the literature on the relation between GVCs and the labor market constitute the background to our empirical approximation.

Concerning the mechanisms at work in this relationship, a number of papers have detected several “benefits” to increase participation in GVC. In general, the idea is that trade liberalization, within the framework of multilateral cooperation, has been a key factor driving global economic prosperity, especially in developing countries. In particular, it is suggested that GVCs trends have important implications for productivity, with potential gains through firms and countries specializing in their most productive tasks and utilizing new varieties and higher quality foreign

goods, services, and intangible inputs (see Kummritz, 2016). Moreover, the positive view on GVCs suggests that those productivity gains coincide with or even cause scale effects that further allow for fast job growth, at least in less developed countries (OECD, 2013).

On the other hand, there is a growing belief that rising trade fragmentation can lead to unemployment. Indeed, one of the main motivations for fragmenting the production process is the ability to procure inputs at a lower cost from abroad than at home. When production of these inputs moves to foreign countries, the fear at home is that jobs will be lost and unemployment will rise (see Dutt et al., 2009). Moreover, it is also argued that GVC participation is associated with reduced job growth because GVC trade fosters falling labor requirements in participating firms (i.e., fewer workers are needed per unit of production). Namely, trade in GVCs might require that participating firms adopt new technologies that are ultimately labor-saving (e.g. Rodrik, 2021). For example, producing for global markets might require more precision and adherence to strict global standards, which cannot be achieved by manual labor, so firms need to substitute away from (unskilled) labor. In other words, firms in GVCs import and learn production technologies that make them more productive and reduce the demand for unskilled labor. If true, firms participating in GVCs experience fast productivity growth but generate only a little employment.

In sum, even if firms with the strongest international linkages, i.e., firms that participate in a global value chain, create jobs, the relationship between GVC integration and unemployment is not necessarily positive at the aggregate level. Evidence and intuition suggest that GVC participation will have distributional implications with respect to where jobs go, the types of jobs there are, and who gets them. Of course, at the national level, the crucial question is whether there are spillovers that operate through labor markets leading to less unemployment at the aggregate level and if there are happening over time.

From an empirical point of view, according to World-Bank (2020), GVCs are supposed to deliver more and better jobs as production is more capital-intensive.<sup>5</sup> Although this may reduce employment, the overall effect is primarily positive due to the increase in exports. Participation in GVCs may affect employment through job destruction and job creation. Therefore, GVCs present both opportunities and challenges for countries. Indeed, GVCs allow workers to apply their skills worldwide without moving countries. At the same time, the demand for some skills drops as

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<sup>5</sup>More empirical evidence confirming these results can be found, among others, in Shepherd and Stone (2012).

activities are offshored, exposing workers to wage reductions or job losses in the short term. In the long term, however, offshoring enables firms to reorganize and achieve productivity gains that lead to job creation. Despite such complexity, an increasing number of studies have tried to measure the effects of GVCs on employment (Jiang and Milberg, 2013; ILO, 2015). Empirical evidence shows that, in general, participation in GVCs has a positive impact on employment, especially in developing countries, since it facilitates either structural transformation or generates new linkages in and around the value chain.

Nonetheless, it is still unclear if increasing participation in GVCs helps reduce the share of disadvantaged employees such as informal employees in the labor force (Artuc et al., 2019). Furthermore, the effects of trade liberalization and participation in GVCs on labor market outcomes are highly country-specific (Shingal, 2015). The latter suggests the necessity for additional studies on this issue. Moreover, as multiple channels explain how GVCs may affect labor markets, the implications of participation in GVCs for employment remain fully understood and can be diverse. For example, Taglioni and Winkler (2016) argue that GVCs can benefit labor markets through three channels: first, a demand effect, as multinationals (and other GVC participants) have a high demand for skilled labor; second, a training effect, as local firms participating in GVCs may receive training from either multinationals or their foreign buyers; third, a labor turnover effect, as knowledge embodied in the workforce of participating firms moves to other local companies. Moreover, according to OECD (2013) or ECB (2019), participation in GVCs can change the composition of the labor force. Low-skilled jobs would be affected, with downward pressure on wages. While recent studies show that import competition from low-cost countries such as China has led to a fall in employment, especially in the manufacturing sector (Autor et al., 2015), competition from low-cost countries is only one aspect of GVCs. OECD countries import intermediates from high-tech manufacturing industries and business services and export these products to other countries, creating new employment opportunities.

Evidence for Europe also shows employment shares of both high-skilled and low-skilled workers increasing at the expense of medium-skilled workers. According to Shepherd (2013), the available empirical evidence suggests that labor market outcomes are influenced by the type of activities undertaken by GVC participants. A priori, workers who perform manual or cognitive tasks that lend themselves to automation or codification (e.g., book-keeping, monitoring processes, processing information) are most likely to be affected by GVCs; many of these tasks can be offshored as services. However, such tasks may be complementary to those that cannot easily be digitalized or offshored due to high transaction costs or the need for contact with

customers. GVCs contribute to shifting demand for skills, but it is not easy to know how much is due to trade and how much to technology. High-skilled workers are less likely to be affected, as they tend to perform non-routine cognitive tasks that complement information technology; demand for such workers often increases with more significant investment in information technology. Low-skilled workers engage in non-routine tasks such as operating vehicles and assisting and caring for others, which may also be less affected by trade or technology. This change can now be measured with the availability of world input-output tables.

For the case of the EU, ECB (2019) suggests that participation in GVCs is likely to be essential for labor market outcomes and the impact of GVCs on labor market dynamics should be further analyzed from a sectoral perspective.

## 3 Data and descriptive statistics

### 3.1 Data and definitions

We collected data for the 28 EU members from 1990-2015. Within the EU, we consider not only the total area but also different groups: “Core” (Austria, Belgium, Denmark, Finland, Germany, France, Luxembourg, the Netherlands, Sweden, and the UK), “Periphery ” (Cyprus, Greece, Ireland, Italy, Malta, Portugal, and Spain), Euro (countries in the Eurozone) and Central European Economies or CEE (Bulgaria, Croatia, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Romania, the Slovak Republic, and Slovenia).

We use the UNTACD-Eora GVC database (2019) to obtain our measures of GVCs, given its larger geographical coverage (189 countries) and relatively recent input-output data. Measuring GVCs is far from a simple task due to the fragmentation of production across several countries. While trade data have been widely used to measure GVCs, this raises important concerns.<sup>6</sup> The most obvious drawback is that trade data are expressed in gross terms, meaning that the value of intermediate inputs traded along the supply chain is accounted for several times, distorting the measure. Key progress in GVC measurement has come from constructing multi-country input-output tables that link national input-output tables using bilateral trade flows (De Backer et al., 2018). Those tables allow quantifying the contributions of each production stage within the global supply chain to the value of the final product. Eora global supply chain database (UNCTAD) is particularly well

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<sup>6</sup>See, for instance, Feenstra and Hanson (1996), as well as Amador and Cabral (2016) and Haltmaier (2015) for a survey.

suiting for this purpose, as it consists of a multi-region input-output table covering a large set of economies, as mentioned above.

Based on this data and following Koopman et al. (2010), country  $i$ 's participation in GVC is defined as follows:

$$GVC_i = \frac{DVX_i + FVA_i}{VAX_i} \quad (1)$$

where  $DVX_i$  denotes domestic value added;  $FVA_i$  stands for foreign value added; and  $VAX_i$  is country  $i$ 's value added exports.

Similarly, a country  $i$ 's backward participation in GVC is defined as:

$$Backward_i = \frac{FVA_i}{VAX_i} \quad (2)$$

Thus, backward participation looks upward at the value chain at the imports used in the production of exports, such as raw materials or intangibles involved at the beginning of the production process (e.g., research, design).  $Backward_i$  then captures the “import to export” dimension and indicates that a country is positioned at a higher stage of the production process. Backward participation is supposed to be linked to better economic performance through productivity gains due to the increasing access to the highest-quality inputs to the production process. Note, however, that taken to the extreme, backward integration may crowd out local production and limit domestic value addition (Farole, 2016).

Forward participation, in turn, corresponds to domestic value added that is further exported by third countries:

$$Forward_i = \frac{DVX_i}{VAX_i} \quad (3)$$

That is, forward linkages imply producing and exporting intermediates, to which importing countries will then add further value and export as finished products or as intermediates to other production stages. Productivity spillovers from forward linkages in value chains are expected to come from the requirements to meet demanding standards and technical regulations imposed by buyers, with subsequent demands diffusing down through the domestic value chain (Farole, 2016).

Table 1: Global value chain participation, 1990 and 2015

Country	1990	2015
Austria	0,59	0,72
Belgium	0,71	0,79
Bulgaria	0,40	0,60
Croatia	0,51	0,63
Cyprus	0,42	0,51
Czech	0,53	0,74
Denmark	0,56	0,68
Estonia	0,67	0,75
Finland	0,54	0,67
France	0,53	0,62
Germany	0,51	0,60
Greece	0,49	0,60
Hungary	0,57	0,79
Ireland	0,61	0,71
Italy	0,41	0,54
Latvia	0,60	0,64
Lithuania	0,69	0,70
Luxembourg	0,79	0,85
Netherlands	0,67	0,78
Poland	0,49	0,71
Portugal	0,53	0,60
Romania	0,49	0,68
Slovakia	0,74	0,81
Slovenia	0,62	0,75
Spain	0,48	0,59
Sweden	0,54	0,67
UK	0,52	0,62
<b>Mean EU-28</b>	0,56	0,68

Source: own calculations, using UNCTAD Eora data.

### 3.2 Descriptive statistics and some stylized facts

In this section, we describe the participation of the EU countries in GVCs as defined above. In addition, we also present the three groups (core, periphery and CEE countries) of EU members that we later analyze.

Table 1 describes the evolution of the variables at the beginning of the sample (1990) and the end (2015). Some patterns can be inferred from them. First, the smaller EU countries need to source a more significant share of inputs from abroad, so their participation in GVCs is higher than that of the bigger economies. Second, Cyprus and Greece may have obtained their positions due to their specific domestic export structure: both countries are specialized in the tourism sector, located at the end of the supply chain, and are relatively less vertically fragmented. Also an exporter of services, but in the opposite extreme, Luxembourg appears to be involved in much supply chain trade, most probably due to its strong financial services sector that provides inputs to many other firms. Third, a couple of smaller economies, Denmark and Lithuania, specialize in production stages placed at the very end of the supply chain compared to other larger countries such as Italy, Spain, and the UK. Finally, Germany, having the largest market size in the EU and taking up a central position in Europe’s supply chains, exhibits a middle level of participation (between 50% and 60%).

The picture that emerges from the data is that the EU countries are active participants in value chains, reflecting the high level of openness and economic integration of the EU economies. Moreover, participation in backward and forward stages of production is relatively balanced. However, the relative position of the countries depends on their size and specialization.<sup>7</sup>

## 4 Empirical strategy and benchmark results

### 4.1 Methodology

In order to quantify the effects of GVC participation on the labor market, our strategy is based on the local projection (LP henceforth) method proposed by Jordà (2005) to flexibly document the dynamic response of unemployment to GVC participation. A local projection is a statistical framework that accounts for the rela-

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<sup>7</sup>The relative position of the countries is not homogeneous: smaller countries are placed more downstream (these are the cases of Belgium, Estonia, Ireland, Luxembourg, or Slovakia) than larger EU countries, which tend to lie more upstream. According to ECB (2019) compared with the world average, EU countries are placed relatively downstream, signaling that the foreign content of its production is larger compared to the inputs that EU countries supply to other countries. The United States is positioned more upstream than the EU mainly due to its specialization in natural resources, research and development, and financial services, all of which serve as intermediate inputs to other sectors. Within the EU, there are also pan-European production chains, where the larger countries produce intermediate goods and services, while the assembling process takes place in the smaller or CEE countries.

tionship between an exogenous and an endogenous variable, measured at different time points. Local projections are often applied in impulse response analyses. The local projections method, similar to a classical VAR model, allows for recovering the dynamics of the dependent variable after a shock. Local projections have become increasingly popular because of their robustness to misspecification and flexibility. More specifically, they have several advantages over the VAR models typically used in the literature. First, the local projections method generates estimates less vulnerable to misspecification of the data generating process because the impulse response is estimated separately for each horizon. Second, it allows controlling for a relatively large set of variables, which would be impractical in a standard VAR setting. Third, it allows for inference directly on the estimated impulse responses. Finally, they can easily accommodate non-linear specifications, which we use to uncover different patterns.

In sum, quoting the title of a recent paper by Plagborg-Møller and Wolf (2021) “local projections and VARs estimate the same impulse responses”: the only requirement to obtain this result is an unrestricted lag structure. The latter represents a critical outcome, as it supports the use of local projections as a suitable method for many empirical applications, with all the advantages enumerated above.

The local projection technique generates new estimates for each forecast horizon  $h = 0, 1, \dots, H$ , regressing the dependent variable at  $t+h$  on the available information set at time  $t$ . Impulse response functions (IRFs) are obtained as a subset of the estimated slope coefficients of the projections. The baseline specification for the panel model is the following:

$$\Delta y_{i,t+h} = \alpha_i + \gamma_t + \beta_h \Delta GVC_{i,t-k} + \nu X_{i,t-1} + \epsilon_{i,t+h} \quad (4)$$

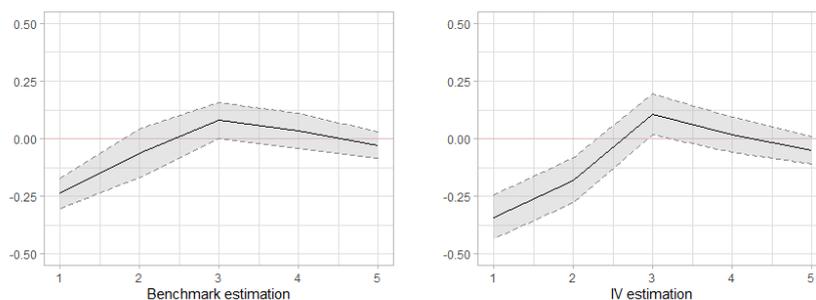
where  $y_{i,t}$  is the outcome variable of interest (the unemployment rate) for country  $i$  at time  $t$ ,  $\alpha_i$  are country fixed effects to control for unobserved cross-country heterogeneity,  $\gamma_t$  are time fixed effects to control for global shocks,  $\Delta GVC_{i,t}$  is the change in the GVC participation,  $\nu$  is a vector of nuisance coefficients,  $X_{i,t-1}$  is a vector of potentially endogenous controls lagged for one period to address endogeneity concerns arising from reverse causality. This vector includes: a) changes in the dependent variable, b) changes in the GVC participation score and c) in GDP and productivity growth.

Finally,  $\epsilon_{i,t}$  is the error term.<sup>8</sup> For robustness purposes and inspired by earlier

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<sup>8</sup>Another potential source of endogeneity is the correlation between the lags of the dependent variable and the unobserved country effect in the error term, which we control for using country fixed effects.

Figure 1: The effect of GVC participation’s shocks on aggregate unemployment



Note: Time is portrayed on the x-axes; the solid lines represent the average estimated cumulative response. We include its 90 percent confidence interval (computed using Driscoll-Kraay standard errors).

studies in the empirical trade literature we also address endogeneity concerns related to GVC participation by implementing an instrumental variable (IV) approach. As an instrument, we use the change in participation in the other countries of the group –core, periphery or EEC– over the same period. This instrument is meant to capture the variation in the participation that is driven by changes of conditions in foreign, but similar, countries that are not driven by domestic industry-specific shocks, which might be endogenous to GVCs.<sup>9</sup>

The coefficients on the variations of participation,  $\beta_h$ , trace out the effect of an increase in participation at time  $t$  on labor market outcomes at time  $t + h$ , i.e., the impulse response of the outcome variable. Given that GVC is measured as a fraction of gross exports, GDP in logarithms, and productivity in changes, the estimated coefficients on GVC quantify the percentage change in unemployment at time  $t + h$  in response to a one percentage point of gross exports increase in participation at time  $t$ .

## 4.2 Aggregated Results

The aggregated results of both the benchmark and the IV equations are presented in Figure 1. The shock consists of a one-standard deviation rise in the participation, which corresponds to an increase of about 1.66 percentage points, well within the standard range of the data. In all our LP results, we present the cumulative response

<sup>9</sup>See, among others, Autor et al. (2013); Dauth et al. (2014); Hummels et al. (2014); Bloom et al. (2016).

after a shock with a time horizon of 5 periods. As shown in 1, the response of the unemployment rate is significant in both specifications. In particular, the first two periods show a negative response signaling the macroeconomic relevance of changes in GVC participation.

### 4.3 Heterogeneity

The source of final demand strongly influences the organization of value chains. Gains/losses associated with value chain trade do not accrue to countries uniformly. Therefore, in order to gather richer results, we examine heterogeneity among EU countries by distinguishing between core, periphery, and Central and Eastern European (CEEs) Countries.<sup>10</sup>

The results, presented on Figure 2, show a significant negative response for peripheral and CEE countries. This response is large and long-lasting, notably in CEEs countries. Surprisingly, perhaps, there is a significant increase in unemployment in core EU countries. This result can be linked to the Stolper-Samuelson trade theorem (1941), which postulates that more trade implies gains for the factor in abundance, i.e., a country engaging in international trade enjoys a comparative advantage in the abundant factor. Given that labor is an abundant factor in most emerging economies such as the CEECs, higher exports should lead to higher employment. This result (more unemployment in richer countries and less in emerging economies) would correspond to one part, at least, of the “concern” as formulated by Baldwin and Ito (2022), as the production of labor-intensive processes is displaced toward CEECs countries in regional value chains.

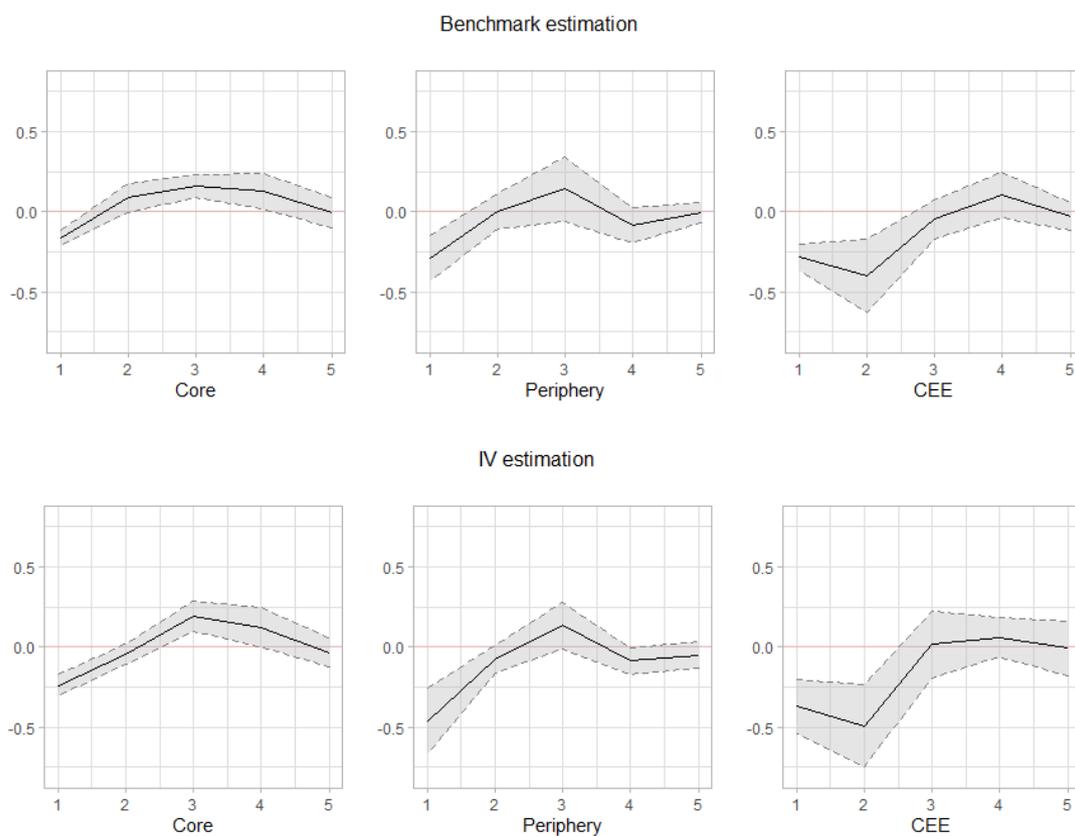
A logical step forward regarding heterogeneity is the sectoral breakdown analysis. This point is essential since, due to the characteristics of the production process, some sectors are closer to the final stages. Therefore, we can gain a richer analysis by distinguishing: i) Agriculture, forestry, and fishing, ii) Mining and quarrying, iii) Manufacturing, and iv) Services. Our breakdown includes eight sub-sectors in manufacturing and services and represents the main economic activities.

Table 2 shows sectoral GVCs participation during 1990 and 2015. In all cases, GCV participation has increased by around 20% on average during the period, the

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<sup>10</sup>The groups and countries included in each group are: “Core” (Austria, Belgium, Denmark, Germany, Finland, France, Luxembourg, the Netherlands, Sweden, and the UK), “Periphery” (Cyprus, Greece, Ireland, Italy, Malta, Portugal, and Spain), and CEEs economies (Bulgaria, Croatia, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Romania, the Slovak Republic, and Slovenia).

Figure 2: The effect of GVC participation's shocks on unemployment, by group of countries



Notes: Time is portrayed on the x-axes; the solid lines portray the average estimated response, and we include its 90% confidence interval (computed using Driscoll-Kraay standard errors).

increase being stronger in agriculture and the service sector. Regarding manufacturing, the highest levels of participation are found in sectors strongly linked to raw materials (chemicals, petroleum, metal products), which are located upstream and provide primary inputs. In services (some in upstream locations, others downstream), wholesale and transport are the sub-sectors with the highest participation. This ranking has changed little over time.

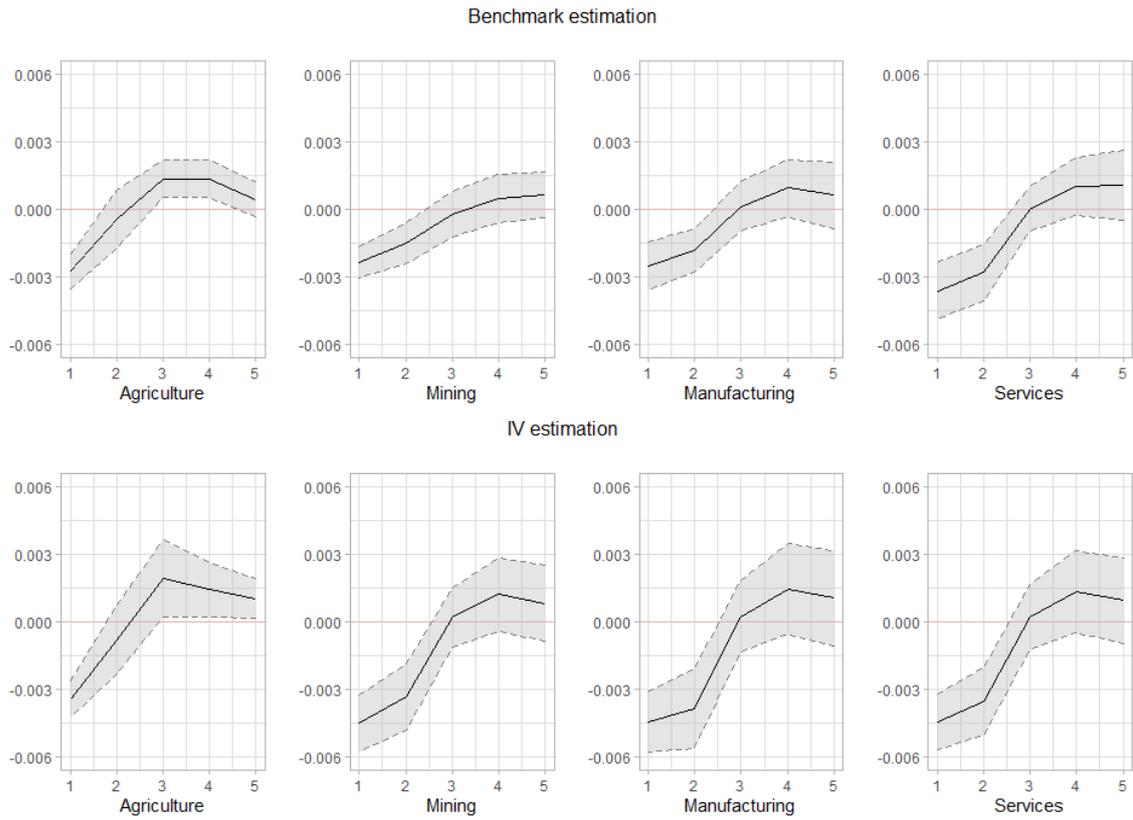
Table 2: Global value chain participation by sectors, 1990 and 2015

Sector	1990	2015	% Change
<b>Agriculture, forestry and fishing</b>	<b>36.25</b>	<b>46.03</b>	<b>27.0%</b>
<b>Mining and quarrying</b>	<b>52.85</b>	<b>62.45</b>	<b>18.2%</b>
<b>Manufacturing</b>	<b>51.03</b>	<b>59.69</b>	<b>17.0%</b>
Food and beverages	31.73	40.84	28.7%
Textiles and wearing apparel	45.29	54.24	19.8%
Wood and paper	51.00	60.65	18.9%
Petroleum, chemicals and non metallic mineral prods.	57.19	66.22	15.8%
Metal products	61.94	71.56	15.5%
Electrical and machinery	48.84	57.17	17.1%
Transport equipment	54.43	60.94	12.0%
Other Manufacturing	37.97	45.04	18.6%
<b>Services</b>	<b>35.34</b>	<b>43.07</b>	<b>22.0%</b>
Maintenance and repair	37.89	45.47	20.0%
Wholesale trade	46.08	58.21	26.3%
Retail trade	20.89	28.30	35.5%
Transport	40.83	48.98	20.0%
Post and communication	34.56	43.19	25.0%
Financial intermediation	34.10	41.44	21.5%
Public administration	16.53	20.28	22.7%
Education, health and and other services	20.76	25.68	23.7%

Notes: Based on data from the EORA database.

Several questions can be explored about the role of sectoral GVC participation and unemployment. The first is whether the response to an increase in participation differs depending on which sector is affected. In Figure 3 we present the response to an increase in total GVC participation in the four larger sectors (Agriculture, Mining, Manufacturing, and Services). The answer to our question is negative: the response is relatively homogeneous, although services are the sector whose integration in GVC affects the EU country's macro-unemployment rate and shows more persistence. We should remember that even if the EU constitutes the most prominent trade bloc globally, the present leadership is more in services than in manufacturing. As some services are provided upstream but others are closer to

Figure 3: The effect of GVC participation's shocks on unemployment, by sectors



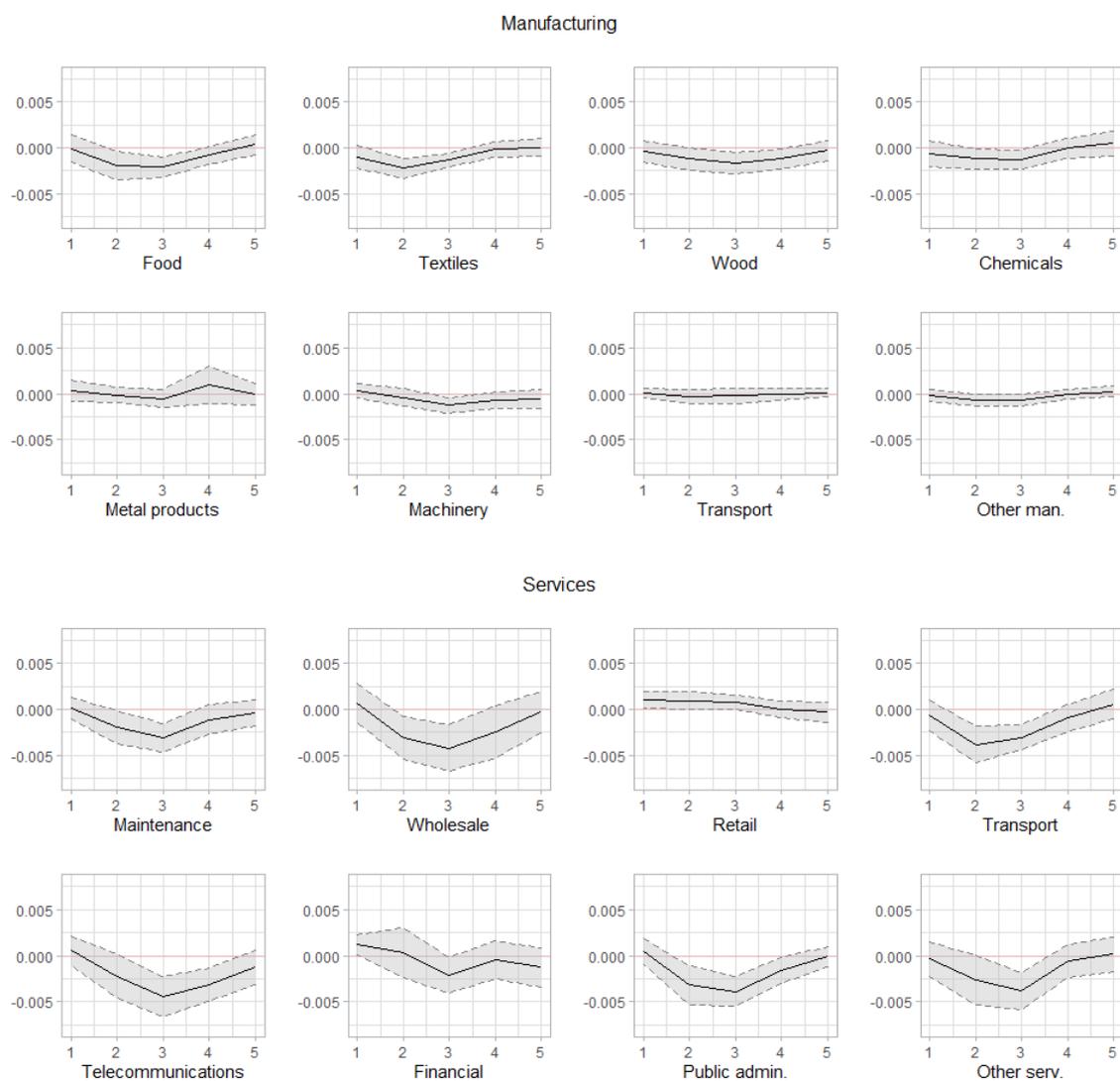
Notes: Time is portrayed on the x-axes; the solid lines portray the average estimated response, and we include its 90% percent confidence interval (computed using Driscoll-Kraay standard errors).

the consumer, a further breakdown of services into sub-sectors provides additional insights.

At a higher degree of decomposition, we distinguish eight sub-sector breakdowns of manufactures and services and concentrate on the response of unemployment. The response to an increase in total GVC participation from the different sub-sectors is shown in Figure 4. The first two rows of the graph are devoted to manufacturing's sub-sectors. Increased GVC participation in Food and beverages and Textiles and apparel generates a negative and relatively long-lasting response in unemployment. Note that these are sectors which are characterised by low labour skills. Later absorbed, a short negative impact is captured for Wood, paper, and Chemicals. The remaining manufactures are mostly unaffected. The response of unemployment to GVC participation in services is depicted in the two lower rows of Figure 4. As seen, the rise of global services value chains and, particularly, Maintenance, Wholesale (placed upstream), Transport (in a downstream position), Communications (which comprises publishing, audiovisual and broadcasting activities, telecommunications and IT and other information services), Public Administration and Other services have a strong impact on unemployment. Only Financial services and Retail (mostly non-tradable) do not show a significant impact. Taglioni and Winkler (2016) find (for a group of developed and developing countries) that with GVCs employment has grown more in services than in manufactures, with some exceptions, such as China and Turkey. In particular, in Germany, Italy, and Spain the increase of GVCs' related jobs in services is found to be larger than the losses of jobs in manufactures and agriculture. For other developed countries, this is not the case.

The former result is relevant as it stresses the relatively modest role of manufacturing subsectors in GVCs for employment. However, neglecting other sectors from the discussion, mainly services, would be a mistake. Indeed, the past few decades have witnessed an unprecedented shift of employment and output shares toward services. Moreover, services increasingly set up their value chains. The "production process" of certain services allows for fragmentation similar to that of goods. Delivering software, for instance, involves many discrete steps, most of which can be performed remotely. This fact enables countries to join services GVCs just as they joined goods GVCs (see Asian Development Bank, 2021). As a result, more value-added has also shifted from manufactures to services (Baldwin and Ito, 2022).

Figure 4: The effect of GVC participation's shocks on unemployment, by sub-sectors



Notes: Time is portrayed on the x-axes; the solid lines portray the average estimated response, and we include its 90% percent confidence interval (computed using Driscoll-Kraay standard errors).

## 5 What makes unemployment more sensitive to GVCs?

Our results show a link between GVC participation and unemployment. Moreover, this relationship is characterized by significant heterogeneity, particularly at the country level. A relevant question immediately arises: Which country-level characteristics shape the impact of the GVCs on unemployment?.

In this section, we aim to shed light on the drivers of such heterogeneity. From the potential factors, we focus on two characteristics of the workforce composition: skills and costs. Indeed, our first intuition is that the mix of skilled and unskilled jobs in the economy can affect the link between economic globalization and unemployment. There is a general view that, in developed countries, low-skilled workers have been most affected by increasing unemployment due to competition from developing countries' workers and also as a result of technological progress (see Meng et al., 2020; Szymczak and Wolszczak-Derlacz, 2022). However, the workforce in developing countries is becoming better qualified and increasingly engaging in more sophisticated, service-oriented activities. As such, skilled workers in developed countries increasingly feel the competition of their counterparts in developing countries (Farole et al., 2018).

Labor costs might also be a mechanism amplifying the impact of value chains on the unemployment rate. Indeed, factors that allowed globally “footloose” firms (i.e., firms that are not tied to any particular location or country) to locate in the host economy also will enable them just as easy to shift out to a lower-cost area, and governments may be locked into a “race to the bottom” on costs, which will most likely result in suppression of employments (Shingal, 2015; Farole, 2016).

This section aims to draw attention to the general relevance of these interactions as complementing factors, designed at the country level, that can magnify the impact of participation on unemployment. To capture these mechanisms, our specifications are similar to those presented before with the following modifications:

$$\begin{aligned} \Delta y_{i,t+h} = & \alpha_i + \gamma_t + \beta_h^{r1}(\Delta GVC_{i,t-k} \times F(z_{i,t-1})) + \beta_h^{r2}(\Delta GVC_{i,t-k} \times (1 - F(z_{i,t-1}))) \\ & + \nu X_{i,t-1} + \epsilon_{i,t+h} \end{aligned} \quad (5)$$

where, as in Eq. (4), the  $X$  vector contains changes in the GVC participation score, GDP, and productivity growth. In addition, we include skills and labor costs. In

Eq. (5), we also added a logistic function,  $F(z_{i,t-1})$ , that governs the transition between high and low regime,  $z_{i,t-1}$  being the scalar state variable at time  $t - 1$ . This switching variable is the measure representing the workforce composition, i.e., skills and labor costs. As standard, the transition function is the logistic transformation of the original  $z_t$ :

$$F(z_t) = \frac{1}{1 + \exp\left(-\theta\left(\frac{z_t - c}{\sigma^2 x}\right)\right)} \quad (6)$$

Therefore, we obtain two impulse response functions corresponding to two regimes characterized by low and high values of the switching variables. Our proxy for skills is the labor force with advanced education (% of the total working-age population with advanced education, source: EU Labor Force Survey, Eurostat). Labor costs correspond to unit labor costs, which measure the average cost per unit of output and are calculated as the ratio of total labor costs to real output (source: OECD).

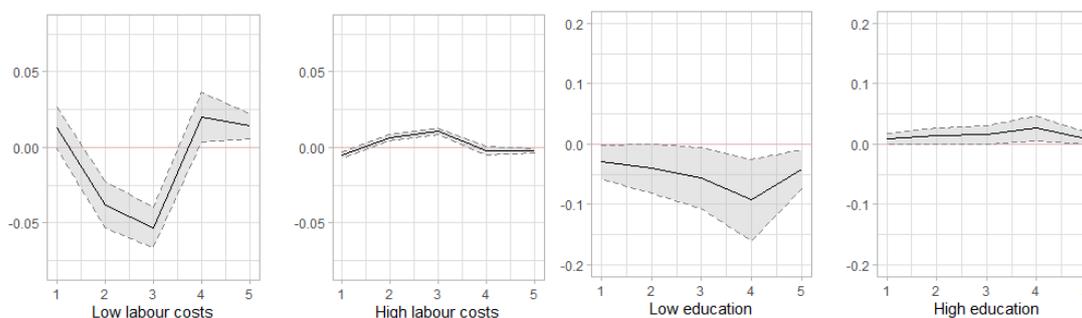
The results, presented in Figure 5, indicate the complex interactions between GVC and market composition in shaping aggregate unemployment. In both cases, the results indicate that the negative effect is magnified in countries with lower-educated workers or cheaper workforce. The LP show that not only lower costs or less skilled workforce are those affected by participation (unemployment decreases and the effect is persistent). Moreover, unemployment increases in higher-skilled workers. Nevertheless, we should bear in mind that all the countries in the sample are EU members and both labor costs and education are relative to the European level. In addition, the EU countries are involved not only in regional (intra-EU) GVCs but also in global chains as hubs or as participants in some particular stages or tasks. This result, combined with previous evidence about country-group heterogeneity, implies that CEECs and peripheral countries are those where these relatively fewer skills stages are concentrated. At this level of aggregation, and taking into account that around 70% of EU value added is in services, this may be the sector that accumulates most of the activity.

## 6 Mechanisms

After showing the workforce composition's effect on shaping GVC participation's impact on unemployment, we explore the mechanisms at play.

Numerous studies on the impact of trade on unemployment lack consensus, and the topic remains open to empirical investigation. As evidenced in the literature,

Figure 5: The effect of GVC participation's shocks on unemployment according to: labour costs and skill level



trade can impact unemployment through two broad channels: the substitution effect and the scale effect. In a simple framework, the substitution effect, or direct effect, implies that there is a direct negative substitution effect of import competition on employment. On the other hand, there are other, often positive, indirect effects. In particular, the scale effect refers to using cheaper imported inputs. When these inputs become cheaper, domestic firms can increase production, export, and hire more workers. Higher exports and production then create more employment opportunities under the scale effect of trade (Sen, 2008). Empirically, a large, mainly micro-oriented literature finds that exporters, as well as import firms, tend to employ more workers than firms that do not internationalize at all (World-Bank, 2020).

An indirect way to check these two opposite hypotheses is to analyze if GVCs have the potential to create employment through their influence on promoting domestic value-added creation. Even though empirical estimates of these effects would require working on firms individually, we rely instead on subsectors of the manufacturing industry for which data on value-added, at constant prices, and employment are provided by the EU KLEMS database and can be matched with our GVC related trade data. In Figure 6 we present the results of the impact of an increase in participation on real value-added growth (left-hand side column) and employment growth (right-hand side column) in the manufacturing subsectors. The countries are grouped using the core-periphery-CEECs criterion. In none of the groups, there is a significant response of real value added<sup>11</sup>. In contrast, employment grows in

<sup>11</sup>We have also repeated the analysis with nominal value-added, finding significant responses.

peripheral and CEE countries, with more persistence in the latter.

Although it may seem paradoxical that employment responds positively to participation (at least in the short-run), we should consider that these results correspond only to manufacturing sectors. As most of the European value added is now concentrated in services, what we have found does not mean that aggregated value-added does not grow with more participation in GVCs. Recent empirical results by Meng et al. (2020) obtain the smile curves for GVCs using input-output data with the expected V-shape. They confirm that value added (and jobs and better salaries) is mostly generated at both sides of the smile, whereas the production process is disadvantaged. Baldwin and Ito (2022) also analyze the sources of value added in manufacturing and conclude that value-added has shifted towards services. Some decades ago these services were provided within the production process in the firms, but now they are externalized and, very frequently, produced elsewhere in the value chain. If we complement these results with our findings concerning the subsectors in services, we can conclude that manufacturing jobs are more concentrated in peripheral and CEECs, but their contributions to value added are modest. Services are currently the main source of employment in European countries through their participation in GVCs.

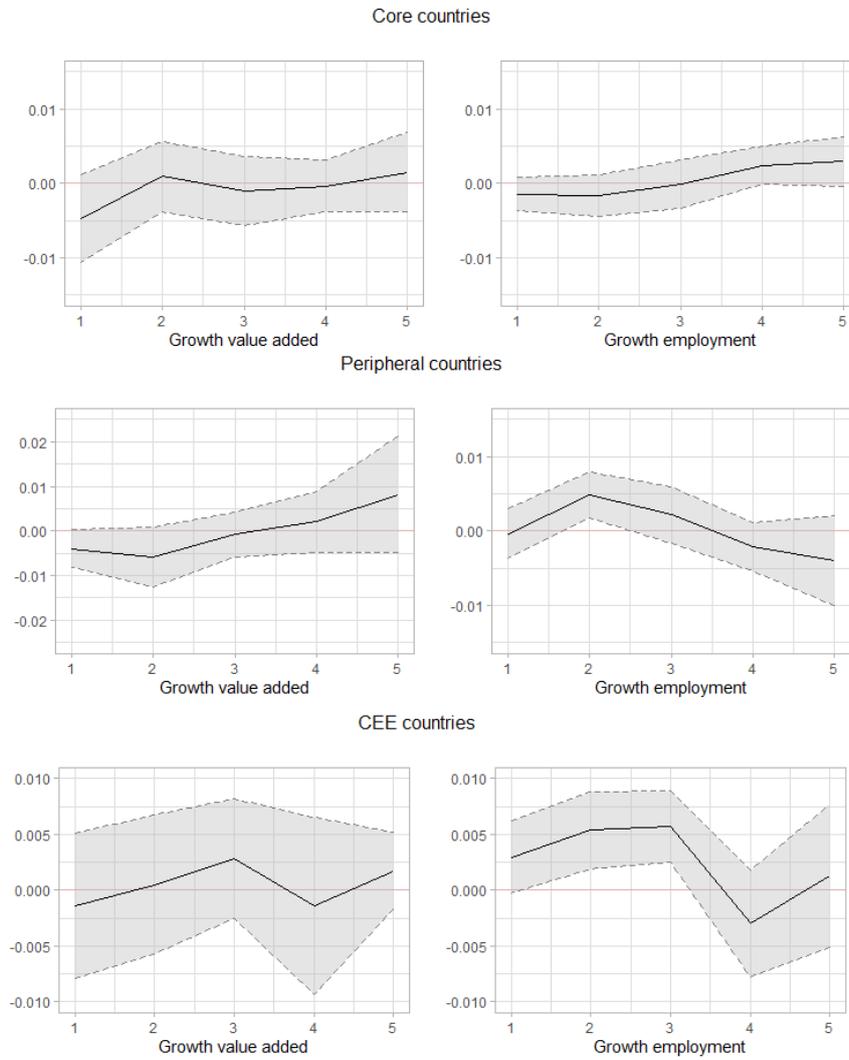
## 7 Summary and discussion

This paper revisits the nexus between globalization and unemployment by focusing on GVCs, the most prominent characteristic of the process of globalization in recent years. Furthermore, our study provides the first empirical investigation of the impact of interactions between the workforce composition and GVC-type trade on unemployment for the 28 EU Member States over the period 1990-2015.

Globalization may increase jobs. Indeed, at the firm level, there is strong evidence that trade can lead to the creation of better jobs as the participating economy seeks to comply with global standards. However, positive outcomes in the labor market are not always clear-cut. Indeed, globalization can also result in job losses and may lead to potential tradeoffs between the number of jobs and better and more productive jobs.

We make several contributions to the relatively scarce existing literature. First, we focus on the European Union (EU) countries, a region with the highest participation percentage in GVCs. Second, we allow for heterogeneity in two dimensions: first, by defining groups of countries with similar characteristics (core, periphery, and

Figure 6: The effect of sectoral GVC participation's shocks on sectoral value added and employment. Manufacturing



Note: Time is portrayed on the x-axes; the solid lines represent the average estimated cumulative response. We include its 90 percent confidence interval (computed using Driscoll-Kraay standard errors).

CEE countries) and, second, by decomposing the data into sectors and subsectors. Third, we account for a potential nonlinearity related to the workforce composition. Finally, since caution is required concerning the direction of causality between trade and labor market outcomes, we rely on impulse response functions obtained from local projections, where we also introduced instrumental variables to overcome any endogeneity issues.

Our results show that the effects of GVC participation on unemployment are not homogenous: higher participation reduces the unemployment rate in less advanced EU economies, but it slightly increases it in Core countries. Moreover, the negative impact on unemployment is reinforced in countries with lower labor costs and a higher proportion of low-skill workers. This result can be linked to the literature on “offshoring”, where firms in advanced economies outsource parts of the value chain (goods production and/or services) to third countries. While many debates remain to be settled in the offshoring literature, what is becoming increasingly clear is that GVC integration for advanced economies has reinforced the effects of skills-biased technical change. That is, offshoring will involve the most labor-intensive processes in the value chain. This fact will result in a reduction in employment in the short and medium term for advanced economies. On the contrary, lower-income EU countries that have been successful in attracting GVC investment, experience a significant increase in formal manufacturing jobs.

By sectors, we find that GVC participation has a significant negative response impact on aggregate unemployment. In particular, the manufacturing sector includes food and beverages, textiles and apparel, and Wood products. A larger response of GDP is found in services, notably Wholesale (placed upstream), Transport (in a downstream position), and Telecommunications (which comprises publishing, audiovisual and broadcasting activities, telecommunications and IT, and other information services). This result is important since the past few decades have witnessed an unprecedented shift of employment and output shares toward services, which can increasingly set up their value chains. Moreover, the production of many services allows for fragmentation due to the declining costs of services trade, thanks to digitalization. This fact has opened an avenue for the less developed countries in the EU. As services sectors are subject to barriers rooted in regulations, lifting these barriers in the EU Single Market seems paramount to facilitating services-led economic growth. Policies that ensure a fair distribution of benefits across countries, like the EU structural and cohesion funds (education attainment and R&D policies) or the Recovery and Resilience program, can be crucial to achieving these benefits.

We also show that subsectors with higher GVC participation growth in the manu-

facturing sector can generate more employment in their sector, although the capacity to increase value added is more limited.

Our results are in line with the proposition that, as with conventional trade, GVCs can create jobs. However, there are no guarantees that the GVCs will benefit all countries equally. For instance, GVCs may drive local companies out of business if it becomes cheaper for local firms to unbundle production into tasks performed at other locations to take advantage of lower factor costs. In our case, due to comparative advantages, while rich EU core countries may tend to engage in high-end and intangible production activities (R&D, design and brand building in the upstream stages and after-sales services and marketing in the downstream stages), low-technology, low-wage peripheral EU countries may tend to focus on tangible production activities (such as manufacturing and assembly) being locked into GVCs at the bottom (low end) of the so-called “smile curve”.

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