Luiss
School of European Political Economy

Patterns of integration in global value chains and the changing structure of employment in Europe

F. Bontadini, R. Evangelista,
V. Meliciani and M. Savona

Working Paper 12/2021

LUISS

September 1, 2021

Patterns of integration in global value chains and the changing structure of employment in Europe

Filippo Bontadini
(Corresponding author: University LUISS Guido Carli, Department of Management; Sciences Po – OFCE/ SPRU, University of Sussex, email: fbontadini@luiss.it)

Rinaldo Evangelista
(University of Camerino, email: rinaldo.evangelista@unicam.it)

Valentina Meliciani
(University LUISS Guido Carli, Department of Management, email: vmeliciani@luiss.it)

Maria Savona
(SPRU, University of Sussex and University LUISS Guido Carli, Department of Economics, email: M.Savona@sussex.ac.uk)

Abstract

This paper aims at revisiting the empirical evidence on the recent trends of countries' integration in global value chains in Europe. It investigates two potential sources of unbalances that these processes might relate to: (i) the sectoral specialisation of the patterns of international fragmentation, whether high-technology manufacturing or knowledge intensive business services (KIBS); (ii) the occupational categories that have benefited or been penalised by these trends. A rich empirical mapping of these trends in the European countries is provided, based on World Input-Output Database (WIOD) and EU LFS data. The results on the overall and sectoral-specific trends of integration in GVCs, and the associated changes in the shares of managers and manual workers, show dual-speed and qualitatively different integration patterns in Europe, with Eastern European (EE) countries rapidly integrating in high-tech manufacturing, and the core of Western countries strengthening their mutual integration in the KIBS area. Despite the relatively "good quality" integration of EE countries, the evidence does not seem to reveal a mirroring upgrading of employment structures. While this empirical contribution does not attempt to identify causal relationships, the picture provided in the paper shows that, overall, integration in GVCs seems to reproduce and perhaps exacerbate the initial asymmetries in the sectoral and employment structure, with employment shares of manual workers reducing on the whole and knowledge intensive occupations concentrating in Western Europe.

Keywords: Global value chains, offshoring, KIBS, High-tech manufacturing, employment, skills

JEL codes: F66, J24

Introduction

Global Value Chains (GVCs) have long been recognised as the main form of (intermediate) trade, affecting the international structure and organization of production activities (OECD (2017). Processes of integration in GVCs have relevant effects on the dynamics, composition and quality of jobs that are connected to the specific positioning of firms, regions and countries within global production networks (Marcolin et al., 2016; OECD, 2017).

Despite the large interest in and policy concern with the role of GVCs for countries' development, systematic and robust empirical evidence is still limited, due to data constraints. In addition, it is difficult to conceptualise complex organizational structures such as GVCs, detect the positioning and functional role of countries and assess the gains and losses associated with being part of a GVC. This is especially true for the late industrialised and developing countries. The literature dealing with "upgrading" (downgrading) processes along the GVCs has not gone much beyond the provision of some definitional categories and the identification of possible drivers of such processes (Milberg and Winkler, 2011, 2013; Taglioni and Winkler, 2016; World Bank, 2017).

The main aim of this paper is to contribute to the literature that has looked at the new international division of labour in Europe, with a focus on the sectoral specificities of integration and those focusing on the effects of offshoring on the labour markets. To do so, the paper provides a rich descriptive empirical mapping of the intersections of these elements, which aims to add to the (very few) similar attempts in the literature (e.g. Taglioni and Winkler, 2016; Marcolin et al., 2016). While such an empirical endeavour is not designed to show causal relationships, it nonetheless offers an insightful picture of the general trends of integration in GVCs and employment in Europe.

We look at European countries' GVC integration in knowledge intensive sectors such as high-tech manufacturing and knowledge intensive business services (KIBS) over the 2000-2014 period that point to general trends of sectoral upgrading within GVCs, i.e. long-term changes in the qualitative profile of the pattern of integration and in the functional positioning within GVCs. Importantly, the quality of upgrading within GVCs in Europe is then disentangled with respect to two key occupational categories: managers and manual workers. In so doing we can go beyond the skill intensity of the workforce and examine broader processes of employment change and upgrading that might be linked to the technological quality of sectoral GVC integration.

The results show, overall, that integration in GVCs seems to reproduce and perhaps exacerbate the initial asymmetries in the sectoral and employment structure within macro-regions in Europe. A dual-speed integration pattern seems to emerge in Europe, with Eastern European countries (EE) rapidly integrating in high-tech manufacturing, and Western European countries (WE) strengthening their mutual integration in KIBS. Despite the relatively 'good quality' of integration of EE countries in high-tech manufacturing activities, a mirroring upgrading of employment structures is not detected. Employment in manual work occupations has reduced overall across all European countries, but this seems to have led to an increase in knowledge intensive occupations only in Western Europe. This suggests that advanced countries, while delocalising high-tech manufacturing activities, maintain the managerial and knowledge functions of GVCs.

These results add to the literature that has looked at the determinants of participation in business services (BS) GVC (Miroudot and Cadestin, 2017; Lopez-Gonzalez et al., 2019) as they qualify their potential effects in terms of employment creation and upgrading. What seems to emerge is the occurrence of what Lopez-Gonzalez et al. (2019) have labelled as 'globalization's third unbundling' that involves services. The paper discusses, through articulated evidence, whether this 'unbundling' might be leading to a new 'core-periphery' structure in Europe, supporting the conjectures put forward by Milberg and Winkler (2011), Simonazzi et al. (2013) and Celi at al. (2018).

The remainder of the paper is structured as follows: the next section revisits the literature mentioned above and introduces the aims of the paper. Next, we briefly describe the data and the indicators employed to map the sectoral and employment trends of GVC integration in Europe. The paper then moves to discuss four sets of results: (i) general patterns of backward and forward GVC integration; (ii) trends of sectoral specificities and upgrading within GVCs, which distinguish between high-tech manufacturing and knowledge intensive business services (excluding finance); (iii) trends of employment upgrading within GVC integration; (iv) overall dynamics of employment and GVC integration in Europe. The final section summarises the main results.

Background Literature

Asymmetries and technology gaps within GVCs

The changing nature of trade and the increasing fragmentation of production within and across national borders over the last decades have spurred interest from several disciplines. Baldwin (2011) has argued that 'globalization's first unbundling', up until the mid-1980s, was mainly determined by plummeting transportation costs and involved competition in sectors, though the whole of the supply chain remained within national borders. The 'second unbundling' started in 1985, mainly led by Information and Communication Technologies (ICTs), which fuelled offshoring.

This second unbundling shifted international competition towards stages of production rather than final products, followed by a spatial concentration of 'factory economies', i.e. developing countries that specialise in the low-tech phases of production chains, around the 'headquarter' countries, such as the US, Japan and Germany. Closeness to 'headquarters' mattered as it favoured the industrialisation of developing countries in the form of *participation* in existing GVCs (rather than "*building* (GVCs) from scratch") (Baldwin & López-Gonzalez 2015, p.4). For emerging countries – in any part of the globe, i.e. Asian and Latin American countries as well as Eastern European and Middle East countries – being inserted in a GVC might mean industrialising in a fraction of the time span that developed countries employed to take off.

The narrative around 'headquarters and factory economies' seems to be revamping, in the context of GVCs, the traditional 'core-periphery' model (Prebisch, 1950; Fujita, Krugman and Venables, 1999) to the (loose) extent that countries' insertion in GVCs will very much depend on their initial location, sectoral structure and stage of development (see also Baldwin et al., 2005). One of the relevant questions is whether and under which conditions factory economies will manage to upgrade their specialisation to higher value added segments of the value chains, and benefit from GVC integration.

Different streams of literature have indeed been cautious in recognising the automatic benefits for emerging (and developing) countries from joining GVCs, most especially as the distribution of these benefits might differ along the GVC.

The first stream points to the sources of inequality linked to the spatial distribution of production activities between core and peripheral economies (Kaplinsky 2000). Although being left out of GVCs might represent a loss, it is argued that the countries that are most likely to lose from the globalisation process are also those that integrate in GVCs at costly conditions, reaping low shares of profits or remaining trapped in low-tech segments of the GVC, with little opportunity to upgrade. Many of the cross-country asymmetries in the distribution of the gains of being part of a GVC are attributable to issues of governance (Kaplinsky 2000; Gereffi, Humphrey, and Sturgeon 2005), which is "the role of coordination and the complementary role of identifying dynamic rent opportunities and apportioning roles to key players" (Kaplinsky 2000), p. 124). Such issues of governance depend on the segment of the GVCs that countries enter.

The second growing body of literature takes a political economy perspective to look at asymmetries in GVC integration, which is very relevant for the purpose of the present paper. Milberg and Winkler (2011) link the bargaining power of countries that join GVCs to the quality of their institutions, which, they argue, play a significant role in shaping how gains associated with GVC participation are distributed. Simonazzi et al. (2013) and Celi et al. (2018) take a geo-political approach to the driving forces that have shaped the European production landscape in the last two decades. They argue that the core of the European economy – i.e. the manufacturing network in which Germany is at the centre – has deployed a geo-economic strategy, offshoring the low value added production stages to EE countries while retaining and strengthening the in-house productive and technological capabilities.

In line with this evidence, Grodzicki and Geodecki (2016) show that the rapid integration of Central and Eastern Europe into the GVCs has led to an increasing dependency of these countries on foreign capital and technologies. Stöllinger (2016) confirms this evidence, highlighting the emergence of a new "manufacturing divide" in Europe: "members of the manufacturing core benefit from participation in GVCs in terms of structural change towards manufacturing, whereas in other EU Member States GVC participation, if anything, accelerates the deindustrialisation process" (Stöllinger, 2016, p. 801).

While the contributions above discuss at length the geo-political asymmetries, they rarely explicitly consider the role that technology has in furthering these asymmetries. An exception is the recent contribution by Gräbner et al. (2020), which relates the divergent growth trajectories in the Eurozone to the presence of marked differences in the technological capabilities across European countries. They also argue in favour of coordinated fiscal, wage and industrial policies to counteract these on-going structural polarisation processes (Gräbner et al., 2020, p. 648). In a similar vein, the works of Landesmann and Stehrer (2000) and Altzinger and Landesmann (2008) have highlighted important structural asymmetries in GVC participation in the enlarged Europe by explicitly taking into account the role of technological specialisation in affecting the patterns of international production.

Overall, both technology and geo-political factors might be the source of the substantial asymmetries that affect the initial conditions of joining a GVC for a country and the opportunity to upgrade its positions along the GVCs, which both have bearing on employment outcomes.

GVC integration, offshoring and employment

The literature on the employment impact of offshoring is larger and relatively more consolidated. Despite the research on offshoring dealing with a somewhat narrower form of participation in GVCs, the findings produced are highly relevant also to the analysis of the employment outcomes of GVCs and to the topic investigated in the present paper. Furthermore, many contributions dealing with GVCs end up measuring such phenomenon, and assessing its impact, by looking at offshoring (i.e. the backward linkages side of GVCs) (see for instance Marcolin et al., 2016).

A stream of empirical evidence looks at the effect of the international fragmentation of production on total labour demand and on the relative skill structure of the domestic workforce, finding mixed results. Amiti and Wei (2005; 2009) find no evidence of a negative impact on labour demand of service offshoring in the United Kingdom and the US, where service and material offshoring are responsible for an increase in productivity. In line with these findings, Hijzen and Swaim (2007) find that in 17 high-income OECD countries, broad offshoring, or "inter-industry offshoring", does not affect labour-intensity but has a positive effect on overall industry employment. Other studies have reached different conclusions. An OECD study on a group of 12 countries finds that material and service offshoring activities are detrimental to domestic industry employment (OECD, 2007).

Going beyond the relationship between offshoring and total labour demand, the work of Feenstra and Hanson (1996; 1999) has paved the way for a new branch of empirical research aimed at assessing the role played by offshoring in shifting the relative demand for skilled and un-skilled labour. In particular, they find that offshoring drives up high-skilled workers' wage share. These results are confirmed by other contributions providing converging evidence on the existence of a sort of skill-bias effect of offshoring (Strauss-Kahn, 2003; Hijzen et al., 2005; Falzoni and Tajoli, 2012 and Crinò, 2012; Foster-McGregor et al, 2013).

Relevant to the assessment of the employment effects of offshoring and participation in GVCs is the more recent emphasis put on tasks (rather than skills) and the existence of a routine, rather than skill, bias. This stream of literature is particularly relevant to our research as tasks can be assimilated to different occupations, such as managerial and manual tasks, which we focus on in our empirical analysis. Becker et al. (2013) find that offshoring is associated with a downward shift of labour demand towards less-routinised and interactive tasks, and with an upward shift towards highly qualified workers. Similar results have been found by Hogrefe (2013), showing that offshoring has shifted domestic labour demand towards complex tasks, in particular when offshoring is directed towards non-OECD countries. Different results are however found by Akcomak et al. (2013), showing that offshoring changes the level of employment without affecting the way in which tasks are organised. Baumgarten et al. (2013)'s analysis confirms that a higher degree of interaction and non-routine jobs protect low-skilled workers from the negative effects of offshoring on their wage level. Ottaviano (2015) has shown that non-routine abstract tasks, as well as non-routine manual tasks, are less likely to be offshored due to the workers' involvement in activities dealing with problem solving or in-person interactions.

Marcolin et al. (2016) provide a more complex picture of the relationship between the composition of the workforce (in terms of the shares of routinised/non-routinised and skill/unskilled tasks) and the level of participation in GVCs. This is the result of the existence of "complex interactions between the routine content of occupations, skills, technology, industry structure and trade, which do not allow for a neat identification of "winners" and "losers" in a GVC context" (Marcolin et al., 2016, p. 3). The policy implications of these results are also very nuanced, calling for caution "when interpreting policies promoting the participation in GVCs as having a clear negative or positive general impact on specific categories of workers" (Marcolin et al. 2016, p. 6). This is consistent with the study by Fernandez-Macias (2012) that, in relation to the EU context, shows very different occupational dynamics, unlikely to be determined by single specific drivers such as participation in GVCs.

Overall, there seems to be convergence in the literature on the idea that offshoring countries tend to maintain core functions and highly capable jobs 'in-house', raising the demand for cheap (and unskilled) labour coming from peripheral countries. In the following section we aim to enrich the literature on the offshoring-employment relationships reviewed above by exploring the sectoral patterns of participation in GVCs and their reflections on the employment structure (shares of managers and manual workers) of EU countries.

Mapping processes of GVC integration and sectoral and employment dynamics in Europe

This section offers an empirical mapping of the European trends of international integration over the 2000-14 period with the aim of unveiling potential asymmetries across macro-regions that are related to the dimensions illustrated above. First, we examine the relative shares of different sectors in the indicators of integration described below by looking at whether different macro-regions or countries within macro-regions have integrated more in high-tech manufacturing or KIBS compared to their initial position in 2000. Second, the relationship between sectoral patterns of integration in GVCs and changes in the total employment and in the share of different occupational categories (managers, clerks, craftsmen and manual workers) is investigated.[1]

Variables and Data sources

The analysis relies on two main sources of data. The first is country level data from Eurostat on employment (i.e. employees) across ISCO categories, which are used to identify the share of different occupational categories in total employment in each country. The data are available for the 28 EU members, European Economic Association (EEA) and Turkey. They provide information on employment across ISCO categories as well as on total employment for each country.

[1] While trends in the four categories have been analysed, only results for managers and manual workers are reported since these are the categories in which trends are more marked and which better help qualify the potential sources of asymmetries in processes of GVC integration. Results for the other two occupational categories are available upon request.

The second is the World Input-Output Database WIOD, which is used to construct indexes of GVC participation. This dataset includes in its 2016 release 43 countries and 56 sectors, which are aggregated to construct shares of knowledge intensive business services (KIBS) and high-tech manufacturing in countries' GVC participation.

After matching WIOD data with the Eurostat information on employment across ISCO categories, a panel of 31 countries spanning the 2000-14 period is obtained.

The WIOD data provide information on value added flows. Literature on the issue of measurement of GVC participation is still evolving (Borin and Mancini 2020; Johnson 2017; Wang et al. 2017). The common goal of the different measures put forward in the literature is to capture the extent to which a country's export contains value added originated in foreign countries (backward participation) and the extent to which a country's own value added contributes to third countries' export (forward participation). The sum of the two measures can be referred to as total GVC participation, or GVC integration.

An input-output table connects value added from the sector and country where it originated to the sector and country where it is consumed; for this reason it is the most apt tool to measure countries' GVC participation. The usual formula for looking at value added in production is the following:

$$V'BF \tag{1}$$

Where V' is a diagonalised vector of value added shares, B is the usual Leontief inverse that reallocates value added based on the sector of production and F is a vector of final demand.

To compute backward and forward participation instead of F, Fx, which is a vector with foreign final demand (i.e. export of finished products and services) for each country and sector, is used. The interest lies in the cross-country inter-sectoral linkages (i.e. backward and forward participation), so the off-diagonal block matrix B_f, is considered, excluding all the input-output linkages within the same country. Using the diagonalised form of Fx, Fx', we obtain:

$$V'B_fF_x' \tag{2}$$

This yields a square matrix that for a sample of n countries and k sectors will have dimensions *nk x nk*; from this a vector of backward GVC participation at the country-sector level can be obtained by post-multiplying this matrix by a column vector of 1 of dimensions *nk x 1*; conversely, pre-multiplying by a row vector of same dimensions, country-sector forward GVC participation is obtained. These measures are then aggregated by country to obtain the measure of GVC participation, the sum of which yields GVC integration.

Since the measures are disaggregated at the country-sector level, it is possible to also compute shares of KIBS and high-tech manufacturing in GVC integration, which will be used in the analysis to qualify the way in which countries join GVCs.

To better explain how GVC measures are computed, it is useful to start from Equation 2 above, which, in a case with three countries A, B and C is equal to:

$$\begin{pmatrix} v_a & 0 & 0 \\ 0 & v_b & 0 \\ 0 & 0 & v_c \end{pmatrix} * \begin{pmatrix} \cancel{b_{aa}} & b_{ab} & b_{ac} \\ b_{ba} & \cancel{b_{bb}} & b_{bc} \\ b_{ca} & b_{cb} & \cancel{b_{cc}} \end{pmatrix} * \begin{pmatrix} f_{xa} = f_{ab} + f_{ac} & 0 & 0 \\ 0 & f_{xb} = f_{ba} + f_{bc} & 0 \\ 0 & 0 & f_{xc} = f_{ca} + f_{cb} \end{pmatrix} =$$

$$= \begin{pmatrix} \cancel{v_a b_{aa}} & v_a b_{ab} & v_a b_{ac} \\ v_b b_{ba} & \cancel{v_b b_{bb}} & v_b b_{bc} \\ v_c b_{ca} & v_c b_{cb} & \cancel{v_c b_{cc}} \end{pmatrix} * \begin{pmatrix} f_{xa} & 0 & 0 \\ 0 & f_{xb} & 0 \\ 0 & 0 & f_{xc} \end{pmatrix} =$$

$$= \begin{pmatrix} \cancel{v_a b_{aa} * f_{xa}} & v_a b_{ab} * f_{xb} & v_a b_{ac} * f_{xc} \\ v_b b_{ba} * f_{xa} & \cancel{v_b b_{bb} * f_{xb}} & v_b b_{bc} * f_{xc} \\ v_c b_{ca} * f_{xa} & v_c b_{cb} * f_{xb} & \cancel{v_c b_{cc} * f_{xc}} \end{pmatrix} \quad (3)$$

B_f is the off-diagonal block matrix. For clarity's sake, in Equation 3 above the full B matrix is reported but the elements that have been excluded from the B_f matrix have been barred off. The letters in subscript refer to countries; when there are two of them it means that value added is flowing from the former to the latter.

In this example, f_{xa} is A's total export of finished goods, i.e. the sum of the export of final goods from A to B and to C, i.e. f_{ab} and f_{ac} respectively.

From the final matrix obtained above, it is straightforward to compute backward linkages, which are the column sums and the forward linkages, the row sums. For example, for country A these correspond to:

- Backward linkages of A: $v_b b_{ba} * f_{xa}$ and $v_c b_{ca} * f_{xa}$, i.e. the value added that goes from B into the export of finished products of A and the value added from C embodied in the export of A, respectively.
- Forward linkages of B: $v_a b_{ab} * f_{xb}$ and $v_a b_{ac} * f_{xc}$, i.e. the value added provided by A to the export of finished products of B and C, respectively.

It is important to note that *final* foreign demand is used, rather than gross export, which includes both final and intermediate foreign demand.

This is because the global Leontieff inverse is used, which already takes intermediate foreign demand into account and is designed to quantify how much production in a given country-sector increases as a result of a one unit increase in the *final* demand of any other country-sector.

As an example, let us think of copper exported by Chile to, say, China, where it will be used again in electrical components, which are then assembled in a car in Croatia and finally sold in the German domestic car market. China's export to Croatia will contain some Chilean value added from the copper sector, but because the final product is sold by Croatia, the global Leontieff inverse records Chile's copper value added as the outcome of an increase in final demand for cars in Germany, met by Croatia's car exports (the final product).

Backward and forward participation in absolute terms (i.e. measured in US dollars) are obviously related to the size of the countries. To take this into account, a straightforward approach would be to compute these measures in per capita terms dividing them by countries' population. This, in turn, would present the problem of conflating measures of participation in GVCs with measures of productivity, especially for the forward participation. One, in fact, could argue that the most productive countries will also have larger GVC participation per capita. An alternative approach, followed in this study, is to net out both size and productivity effects from the measures by dividing them by countries' total value added, which corresponds to countries' output minus their input and is provided by the WIOD. This measure will therefore capture how much of countries total value added is produced in the context of GVC participation (forward participation) and how large is the value added imported from abroad compared to the value added produced domestically (backward participation).

After the calculation and the merging between the WIOD data on GVC participation and the Eurostat data on employment, the following list of countries is obtained: Austria, Belgium, Bulgaria, the Czech Republic, Switzerland, Germany, Denmark, Spain, Estonia, Finland, France, Great Britain, Greece, Croatia, Hungary, Ireland, Italy, Lithuania, Luxemburg, Latvia, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Sweden, and Turkey. Malta and Cyprus are also available in the dataset but they appear to be outliers and are therefore omitted from the analysis to ensure graphics' readability.

We consider sectors as high-tech manufacturing and KIBS following the EUROSTAT classification (NACE rev.2 classification at the 2-digit level) reported in Table 1. However, we consider both high- and medium-high-tech services to avoid relying on the only two sectors (C21 and C26) that Eurostat considers as high-tech manufacturing. In contrast, a more conservative approach is followed when identifying KIBS. Eurostat suggests including the whole J section of the NACE rev.2 classification, which also includes publishing activities. In contrast, this study focuses only on the IT and computer-based services and the M section (which is consistent with the Eurostat definition of KIBS). The WIOD data are disaggregated at a 2-digit level, but some 2-digit NACE sectors are lumped together in the WIOD. When this is the case, it is flagged out in Table 1.

Table 1 – Sectoral Disaggregation of the analysis

NACE rev.2	Description
High- and medium-high-tech manufacturing	
C21 and C26	High-tech manufacturing: Manufacture of basic pharmaceutical products and pharmaceutical preparations C21; Manufacture of computer, electronic and optical products C26.
C20 and C27 to C30	Medium-High tech manufacturing: Manufacture of chemicals and chemical products C20; manufacture of electrical equipment C27; manufacture of machinery and equipment n.e.c. C28; manufacture of motor vehicles, trailers and semi-trailers C29; manufacture of other transport equipment C30.
Knowledge Intensive Business Services	
J62 to J63	Computer programming, consultancy and related activities J62; Information service activities J63
M69 to M75	Legal and accounting activities; Activities of head offices, management consultancy activities M69-70 (aggregated in the WIOD); architectural and engineering activities, technical testing and analysis M71; Scientific research and development M72; Advertising and market research M73; Other professional, scientific and technical activities; Veterinary activities M74-75 (aggregated in the WIOD)

Source: Eurostat and WIOD; the latter to identify sectors that are aggregated in the GVC data.

The ISCO 1-digit categories encompass 9 activities, plus military activities. Table 2 lists the activities that have been used to construct the shares of employment for managers and manual workers, following the methodology put forward by Cirillo et al. (2018).

Table 2 – ISCO categories based on Cirillo et al. (2018)

ISCO category	Aggregated category
Managers Professionals Technicians and associate professionals	Managers
Clerical support workers Service and sale workers	Clerks
Skilled agricultural, forestry and fishery workers Craftsmen and related trade workers	Craftsmen
Plant and machine operators and assemblers Elementary occupations	Manual workers

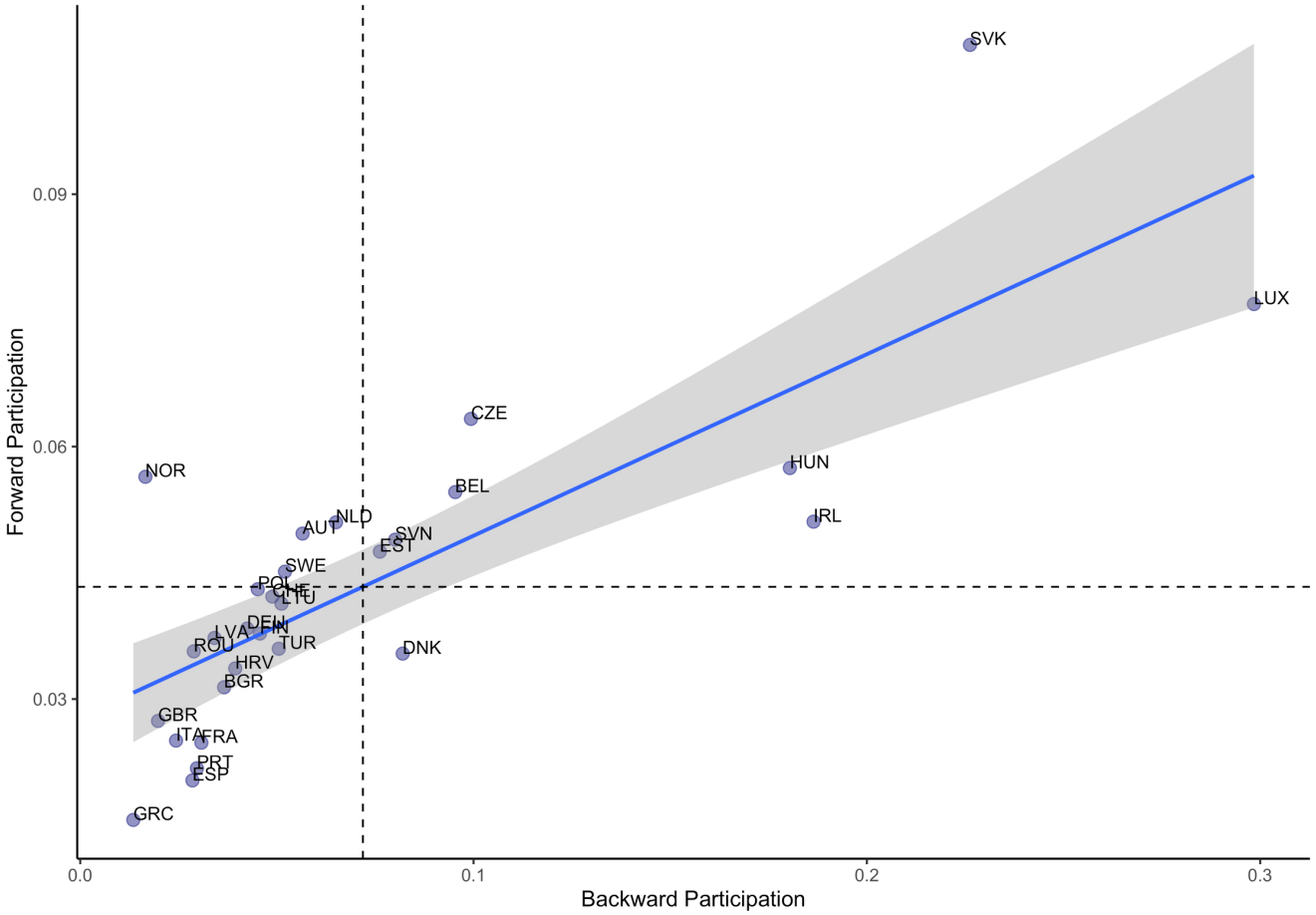
Source: Cirillo et al. (2018)

Patterns of GVC integration

We begin by taking a first glance at the overall (initial) levels and trends of GVC integration across countries, over the 2000-14 period. This adds to the empirical evidence seeking to identify patterns of international division of labour in Europe and to determine whether a 'headquarter' and 'factory' dualism is being reinforced or is levelling out. In the sections below, this picture is qualified in terms of sectoral integration and employment dynamics.

Figures 1 and 2 show for most of the countries included in the sample[2] the forward and backward participation in GVCs standardised by value added. As discussed, we divide the indicators of forward and backward GVC linkages by the country's total value added in the same year, to deal with size effects.

Figure 1 - Average GVC backward and forward participation 2000-14

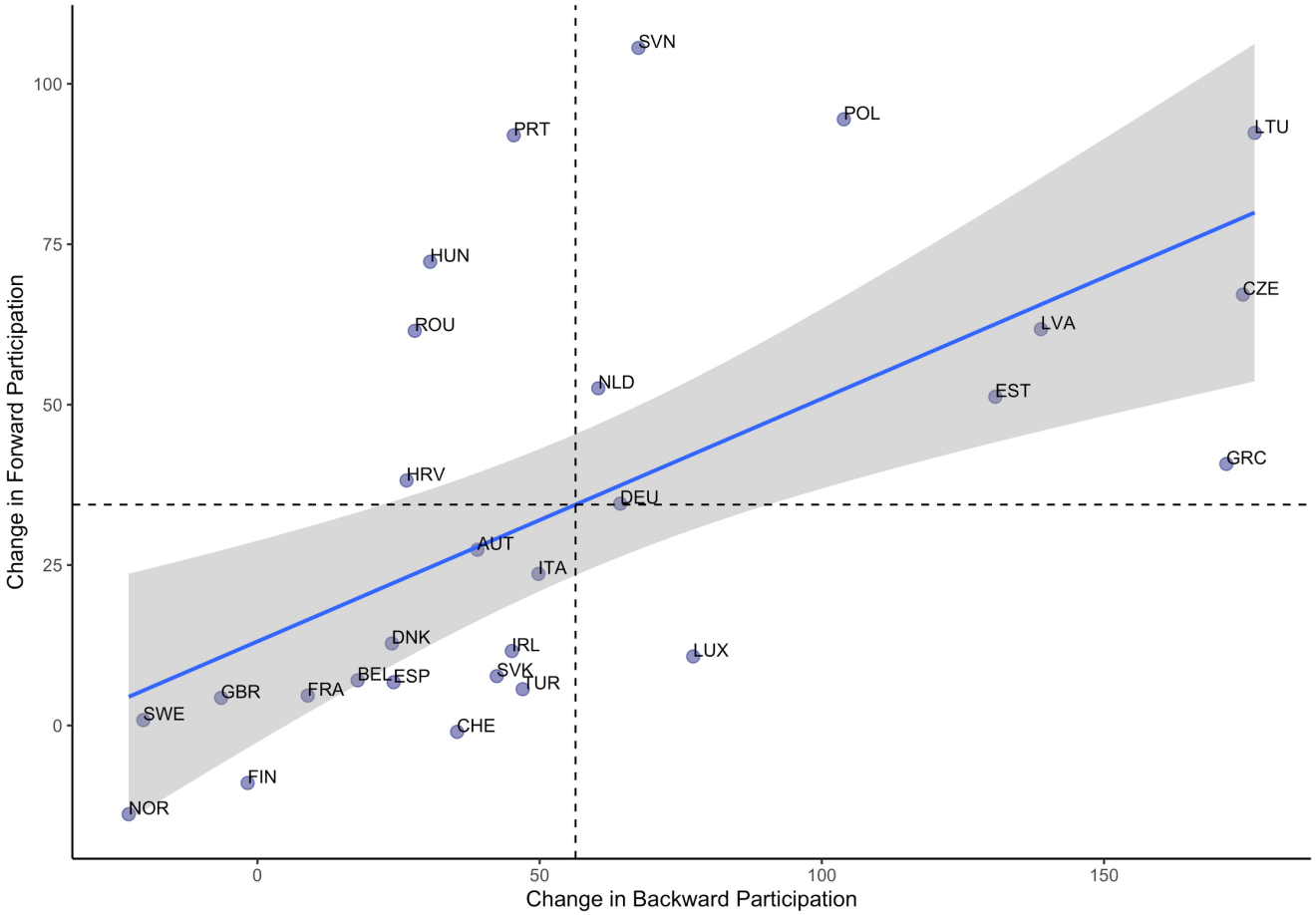


Note: the figure plots the average values over the 2000-14 period of backward and forward participation in GVCs as a share of total value added produced by countries. The blue line is the line of best fit with the interval of confidence, the dashed lines correspond to the sample average. Country names corresponding to the ISO codes used in the Figure can be found in Table A.1 in the Appendix.

Source: authors' own calculations on WIOD.

[2] As mentioned above, Malta and Cyprus have been excluded from the analysis, while Bulgaria does not appear in Figure 2 since it is an outlier with very high increases in GVC participation.

Figure 2 - Percent variation in GVC backward and forward participation 2000-14



Note: the figure plots the percentage change in backward and forward participation in GVCs as a share of total value added produced by countries. The blue line is the line of best fit with the interval of confidence, the dashed lines correspond to the sample average. Country names corresponding to the ISO codes used in the Figure can be found in Table A.1 in the Appendix.

Source: authors' own calculations on WIOD.

Both figures show a clear positive correlation between the two indexes, meaning that backward and forward integration in GVCs are highly symmetric processes. The average levels of the two indexes (Figure 1) – as in the case of trade flows - are affected by the size of the country. Usually small countries are more integrated, due to their production systems being less self-sufficient, constrained by a small domestic market and a limited (in scale and scope) supply of intermediate inputs. Reversely, all the largest European economies (Germany, France, Italy, Spain and UK) show moderate (below the average) levels of integration. However, it is worth observing that there are some notable differences in the level of integration among small countries: particularly high levels are found in the case of Luxembourg, Slovakia and Hungary, while Greece and Portugal lag behind. Eastern European countries have different levels of integration in GVCs, although most of them show levels of both indexes above

the mean. The largest Eastern EU member, Poland, has a level of integration similar to that of Germany and to the European mean.

Figure 2 shows the dynamics of the processes of integration of the same group of countries. The two axes of the figure measure the rate of change of the forward and backward participation indexes. The figure confirms the positive correlation between the two indexes providing further support to the fact that the participation in GVCs proceeds (by and large) in parallel with the acquisition of intermediate inputs from upstream industries and the export of intermediate goods that are further processed by third countries. The figure also shows a strong increase in the average level of integration in GVCs of European economies. However, within this general trend, a group of countries shows a higher than average dynamic in forward participation (i.e. their intermediate inputs are further exported by third countries), including Poland, Slovenia, Hungary and Romania, among the Eastern European countries, Portugal from the Southern group and the Netherlands and Germany from the core. On the contrary, Estonia, Lithuania, Greece and the Czech Republic are among those countries showing a higher than average dynamic of backward participation.

Overall, a main macro pattern can be identified: the highest rates of change of participation in GVCs (both forward and backward) have been mostly experienced by Eastern European countries and in particular by Bulgaria (not shown in the figure because it is an extreme outlier), the Czech Republic, Slovenia and Poland, and by the Baltic republics. Some of them have shown a pattern of GVC integration (Slovenia and Poland) characterised by forward participation, others have pursued a pattern of integration intensifying the backward linkages much more than the forward ones. The five largest EU countries have shown a much lower dynamic of the indexes with the exception of Germany and the Netherlands, which have increased their level of GVC integration more than the others. Scandinavian countries have remained relatively stationary. Overall, the evidence presented in Figure 2 confirms a process of rapid integration of the Eastern EU countries within the EU production area and a likely pivotal role played by Germany in such a process.

The Figures discussed above focus on the mean levels and the changes occurred over the entire observed period in our data. It should, however, be borne in mind that the 2000-14 period was characterised by significant turbulence, notably due to the financial crisis and the slowdown of international trade that ensued (Timmer et al., 2016). While the financial crisis has certainly had considerable effects on both employment and GVC integration, it should be noted that our analysis mainly looks at the structure and composition (i.e. using variables in terms of shares rather than absolute values) of employment and GVC participation, which are less likely to be affected by the exogenous shock of the crisis. Furthermore, our analysis focuses on the long-term dynamics in the sectoral structure of GVC participation and employment shares. In Appendix A we put forward evidence in support of this by looking at the year-by-year evolution of our key variables: we find that while the financial crisis is noticeable in the 2008-09 period, it does not alter the long-term trends in either GVC integration, its sectoral structure or the employment structure of European countries and macro-regions.

Sectoral upgrading in GVCs

European countries show very heterogeneous patterns of integration in GVCs, also in terms of the sectors in which they integrate. To show this we distinguish in particular between (total) integration in high-tech manufacturing

and KIBS GVCs. We focus on forward participation (shares in domestic value added embodied in foreign exports) and backward participation (shares in foreign value added embodied in domestic exports) of high-tech manufacturing industries and KIBS and their changes over the 2000-14 period. Given the high correlation between the forward and backward linkages, two aggregate indexes of integration are computed by summing up backward and forward GVC participation, which we refer to as GVC integration. The first one refers to the overall high-tech manufacturing share in GVC integration (HTSH), the second one measuring the KIBS share in GVC integration (KIBSSH). Formally, we compute for country *i* and industry *j*:

$$HTSH_i = \frac{Backward_{ij}^{h} + Forward_{ij}^{h}}{\sum_j Backward_{ij} + \sum_j Forward_{ij}} \qquad with\ h \in high-tech\ manufacturing \tag{4}$$

$$KIBSSH_i = \frac{Backward_{ij}^{k} + Forward_{ij}^{k}}{\sum_j Backward_{ij} + \sum_j Forward_{ij}} \qquad with\ k \in\ KIBS \tag{5}$$

Broadly speaking, the two indexes can be used as a proxy for interdependent aspects such as the technological and innovation content of the backward and forward linkages, the qualitative profile of the pattern of integration, and the functional positioning of the country within the GVCs. The dynamics of the indexes is a well-suited proxy for upgrading and downgrading in GVCs, where an increase in the shares of KIBS or high-tech manufacturing in the total integration would indicate sectoral and functional upgrading in the processes of integration, regardless of whether this concerns backward or forward participation. In principle, the data would allow for computing backward and forward participation at the industry level. However, we prefer to use aggregated indexes at the country level since they reflect, for manufacturing and services, the general level of skills and tasks that a country performs as it integrates in GVCs. It should in fact be noted that, while these measures are broad and descriptive in nature, their interpretation is more meaningful at the country, rather than the country-industry, level. This is because they capture structural changes in countries' GVC integration that are informative of the kind of functions and tasks in which each *country* specialises as an economy.

Therefore, they allow us to assess the existence and strengths of processes of upgrading in the GVC integration of European countries, that is, movements along the so-called smiling curve as well as the presence of technological convergence and divergence processes in the sectoral patterns of participation in GVCs. Processes of upgrading can take place either by strengthening the presence of countries in the high-tech manufacturing stages of GVCs or upgrading the value chains towards the more intangible highly valued added stages of GVCs or doing both. Also, in the cases of HTSH and KIBSSH, a positive and statistically significant correlation exists between the dynamics of the forward and backward components of these two indicators (correlation coefficients between the rates of change of the backward and forward components of the HTSH and KIBSSH indicators are respectively 0.707 and 0.597). This implies that processes of upgrading take place, (and require) increasing the share of high-tech manufacturing and KIBS components in both forward and backward flows.

Figure 3 shows the average values and change of the HTSH index. Based on this evidence, there is a lack of any process of either convergence or divergence in the share of high-tech manufacturing in integration (changes in the share are not correlated with average levels). Nevertheless, very large cross-country differences exist between

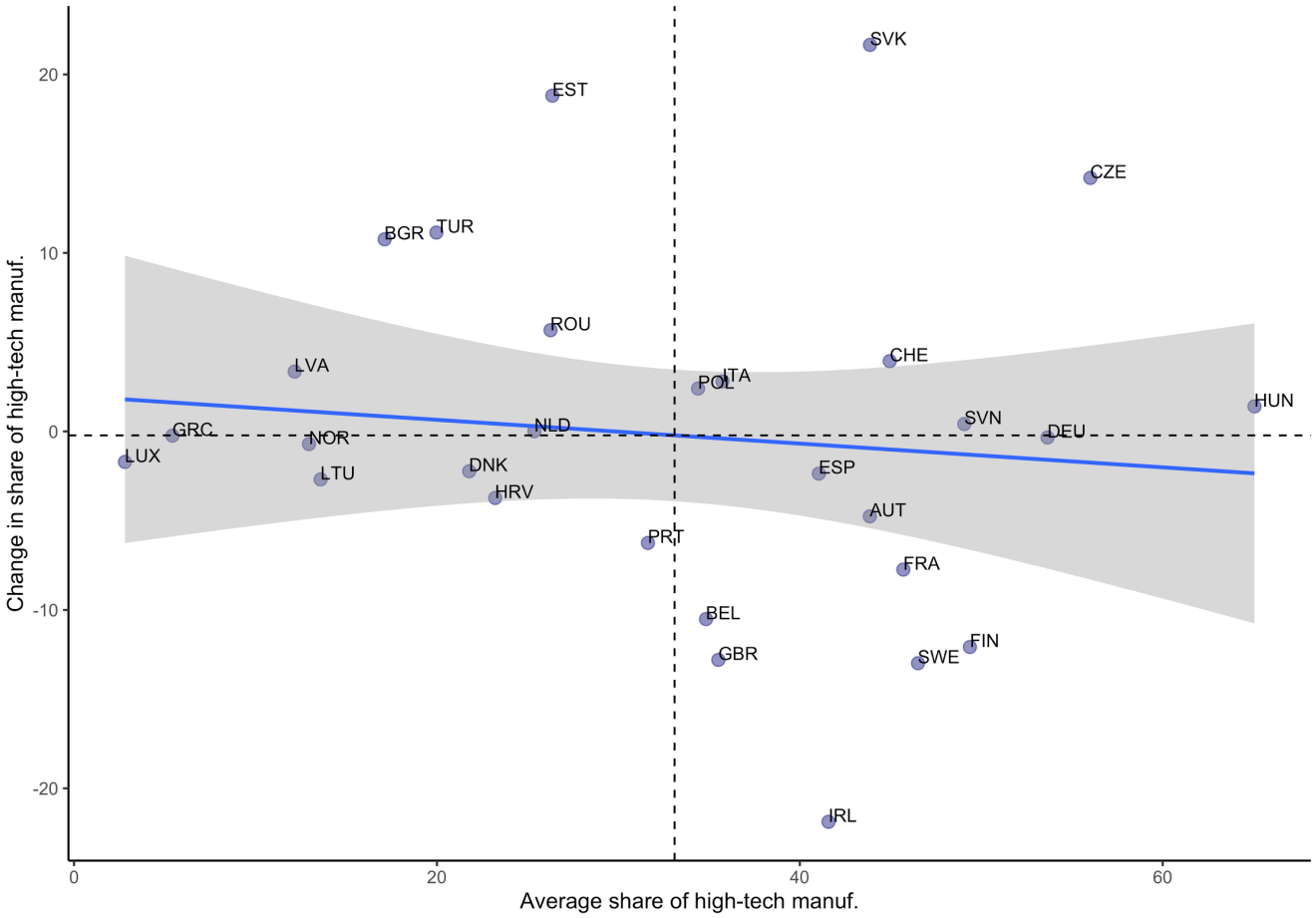
the average levels of the index. These reflect, to some extent, the differences in the overall technological profile of European economies and in their productive and technological specialisation. It is nonetheless important to note the very high level of the index in the case of Hungary, the Czech Republic, Slovakia and Slovenia with values not far from those of Germany. This implies that the integration of these countries in manufacturing value chains has mainly involved the most qualified component of their production structure. Therefore, processes of upgrading (signalled by a positive change of the index) have taken place mainly in the Eastern European countries that have probably increased the level of their mutual integration and intensified their productive high-tech linkages with Germany.

By contrast, the five largest EU economies (with the exception of Germany), as well as the Scandinavian countries, show a higher than average mean share of high-tech manufacturing in GVC integration, but, unlike the Eastern EU countries, have experienced a decrease in this index. This reflects, in part, the fact that the productive structure of most Western European Economies has undergone a considerable shift towards services, something that decreases the share of manufacturing – as a whole, not just the high-tech component – in the total economy. To take this into account we can recompute Equation 4 (and 5) by replacing the denominator with a country's total GVC integration within the manufacturing sector (for Equation 4, while we use services for Equation 5). This amounts to looking at the share of high-tech manufacturing in a country's GVC integration *within* the manufacturing sector.

We present these results and the corresponding equations in Appendix B.[3] Figure B.1 reports the relationship between the mean and the change in the share of high-tech manufacturing within GVC participation in the manufacturing sector. As expected, the reduction in the share of high-tech manufacturing in Western and Northern countries is now much smaller,[4] though overall this evidence confirms the absence of either convergence or divergence in the share of high-tech manufacturing in GVC integration.

[3] We also replicate the results by looking at GVC integration of KIBS as a share of services. These results are available upon request.
[4] It is important to point out that the dashed lines in all figures correspond to the average values of the variables on the axes. As a result, when looking at changes, they do not indicate whether there has been an increase or a decrease but whether changes are above or below the sample's average. For example, in Figure B.1 Germany's share of high-tech manufacturing in its GVC integration within the manufacturing sector has increased by 0.81, which is above 0 but below the sample's mean, which is why Germany is positioned slightly below the horizontal dashed line in the graph.

Figure 3 - High-tech manufacturing share in total integration in GVCs, averages and variations 2000-14



Note: For high-tech manufacturing shares in GVC integration, the figure plots the average against the variation over the 2000-14 period.The blue line is the line of best fir the interval of confidence, the dashed lines correspond to the sample average. Country names corresponding to the ISO codes used in the Figure can be found in Table A.1 in the Appendix.

Source: authors' own calculations on WIOD.

The evidence reported in Figure 3 and B.1 reports GVC integration, which is the sum of backward and forward GVC participation. When we unpack these two measures in figure B.2 in the Appendix, we detect two distinct patterns.

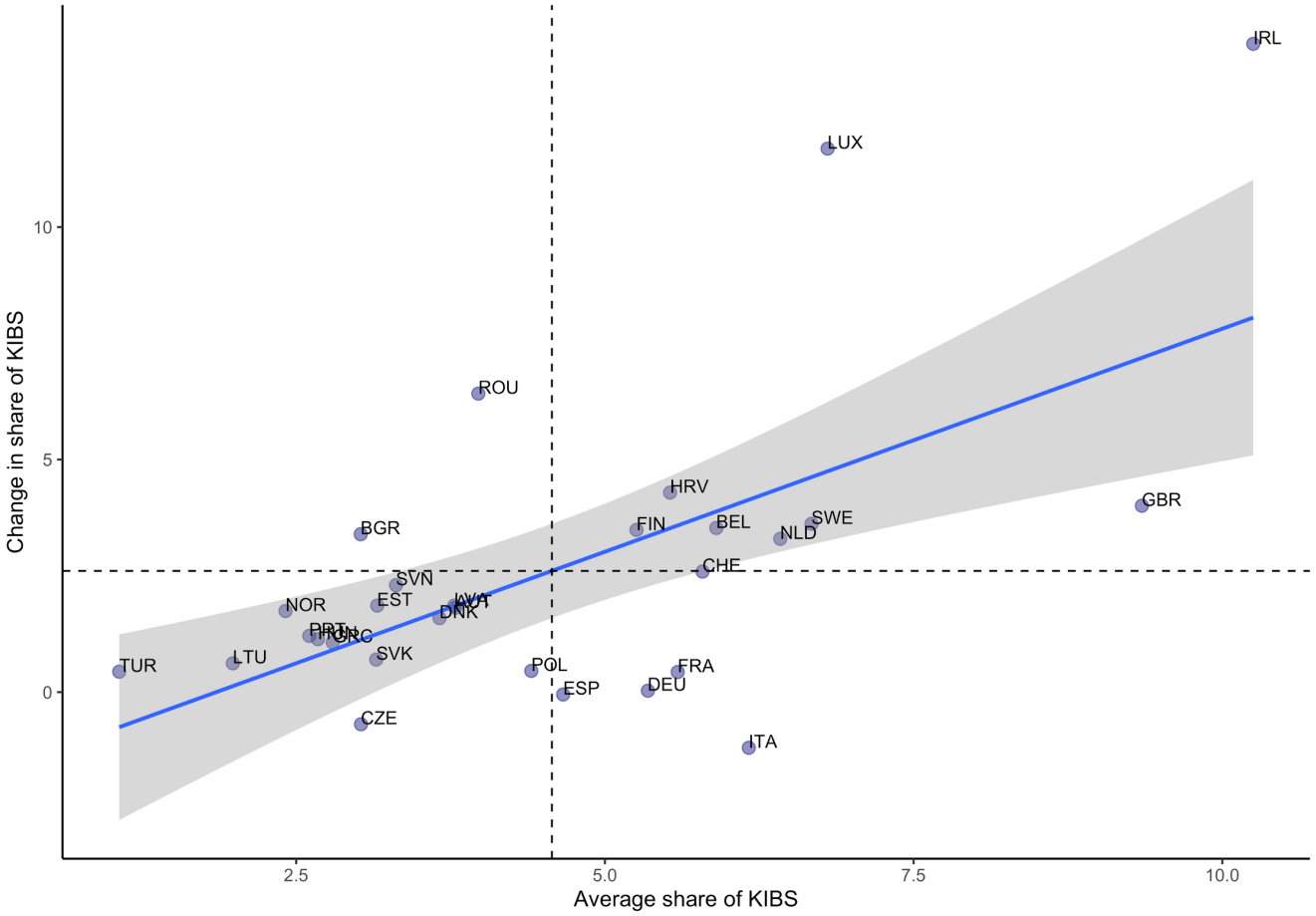
On the one hand, Eastern European countries experience increases in the share of high-tech manufacturing both in backward and forward GVC participation. This suggests that while they export a larger share of high-tech manufacturing value added, they also remain dependent on import from foreign high-tech sectors. This is consistent with the evidence from the literature suggesting that GVC integration of Eastern Europe is driven by foreign, rather than domestic, final demand for high-tech products, with likely little effects on the countries' domestic technological capabilities (Leitner and Stehrer (2014), Grodzicki and Geodecki (2016).

On the other hand, countries from Western and Northern Europe have experienced a sharp decrease in the share of high-tech manufacturing within their backward GVC participation in manufacturing industries, while this share has either increased or remained roughly the same in their forward GVC participation.[5] These patterns therefore suggest that while North-Western countries have increased the share of high-tech manufacturing in their export of value added, they have reduced their share of import. This means that a higher share of their domestic productive structure has shifted towards high-tech components while they have imported higher shares of low-tech value added from abroad. It therefore appears that these countries have reinforced their position as technological leaders within manufacturing GVCs.

Figure 4, referring to the relevance of KIBS in the patterns of integration in GVCs, provides a much neater picture. The ranking of European countries with respect to the average values of the index clearly reflects the overall technological level of the economies and their overall level of tertiarisation. Among the countries showing the lowest value of the index we find most of the Eastern European countries. In this respect, it is worth observing that Hungary, the Czech Republic, Slovakia and Slovenia, which show shares in high-tech manufacturing integration that are close to those of Germany, have a much lower integration in KIBS. What is even more interesting, however, is the positive correlation between the two KIBSSH indexes (averages and changes). This signals a process of increasing divergence in Europe based on an increasing concentration in the core EU countries of the capacity of managing and participating in the highest value added and intangible stages of GVCs (R&D, intangible ICTs, Marketing, Post-sales, etc.).

[5] This pattern might reveal the presence of the process of "reshoring" of some high value added and innovative stages of production by firms located in the core EU countries. This hypothesis has recently drawn significant interest, also in the light of how the pandemic has affected global supply chains (see in particular the two contributions by Javorcik and Miroudot in Baldwin and Evenett (2020)), although its investigation is well beyond the scope of this paper.

Figure 4 - KIBS Share in total integration in GVCs, averages and variations 2000-14



Note: For KIBS shares in GVC integration the figure plots the average against the variation over the 2000- 14 period. The blue line is the line of best fir the interval of confidence, the dashed lines correspond to the sample average. Country names corresponding to ISO codes used in the Figure can be found in Table A.1 in the Appendix.

Source: authors' own calculations on WIOD.

Taken together, the main message provided by Figures 3 and 4 is that while some countries have experienced a process of upgrading (and convergence) in their pattern of integration in the (high tech) manufacturing stages of GVCs (mainly Eastern EU countries), the same countries have not been able to increase significantly in the most strategic activities of GVCs, KIBS and related intangible capital.

Employment and sectoral upgrading within GVCs

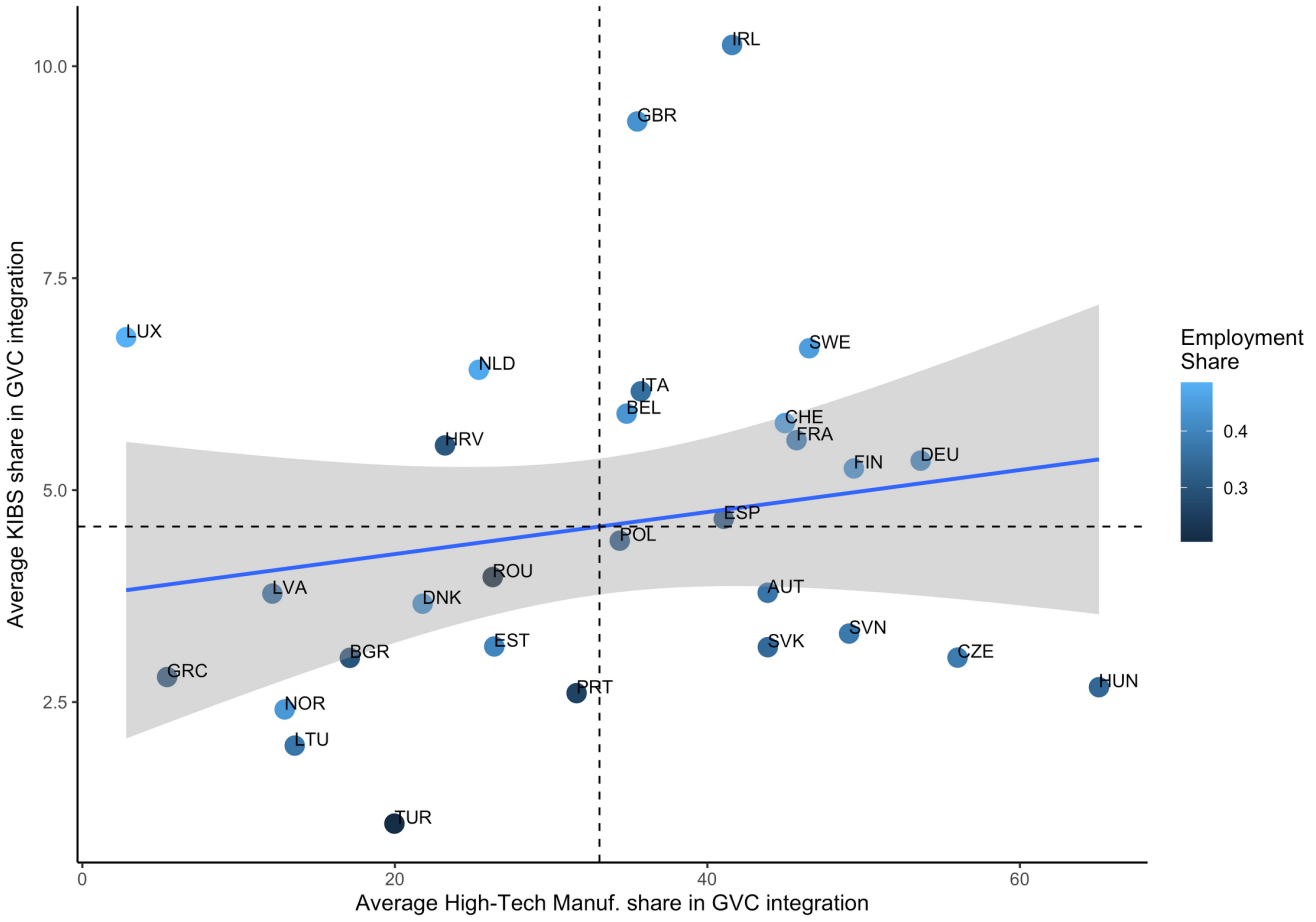
Is there a relationship between the sectoral patterns of integration examined in the previous section and (the changes in) the structural composition of employment? This question is investigated by focussing on the two extreme ISCO occupational categories: manual workers and managers.[6] The aim is to determine whether there is

[6] Results for clerks and crafts are available on request.

a relationship between the sectoral pattern of integration in GVCs and the share of managers and manual workers in the total labour force. Particular attention is devoted to unveiling potential sources of employment and skill upgrading that might result from sectoral upgrading linked to GVC participation described in the previous section. The correlation between the HTSH and KIBSSH indicators with the shares accounted for by managers and manual workers in total employment is, therefore, examined.

Figure 5 shows the position of EU countries along the two axes measuring the average values (over the 2000-14 period) of the high-tech manufacturing share in GVC participation (HTSSH) and of the KIBS share in GVC participation (KIBSSH). The figure also shows for each country the share of managers in total employment (lighter colours correspond to higher shares of this occupational category).

Figure 5 - Average KIBS and High-tech Manuf. shares in GVC integration and Managers Employment Shares



Note: The figure plots average values of high-tech manufacturing and KIBS shares in countries GVC integration over the 2000-14 period. The colour of the dots refers to employment shares of managers in each country, going from lower to high and darker to lighter. The blue line is the line of best fit with the interval of confidence, the dashed lines correspond to the sample average. Country names corresponding to the ISO codes used in the Figure can be found in Table A.1 in the Appendix.

Source: authors' own calculations on WIOD.

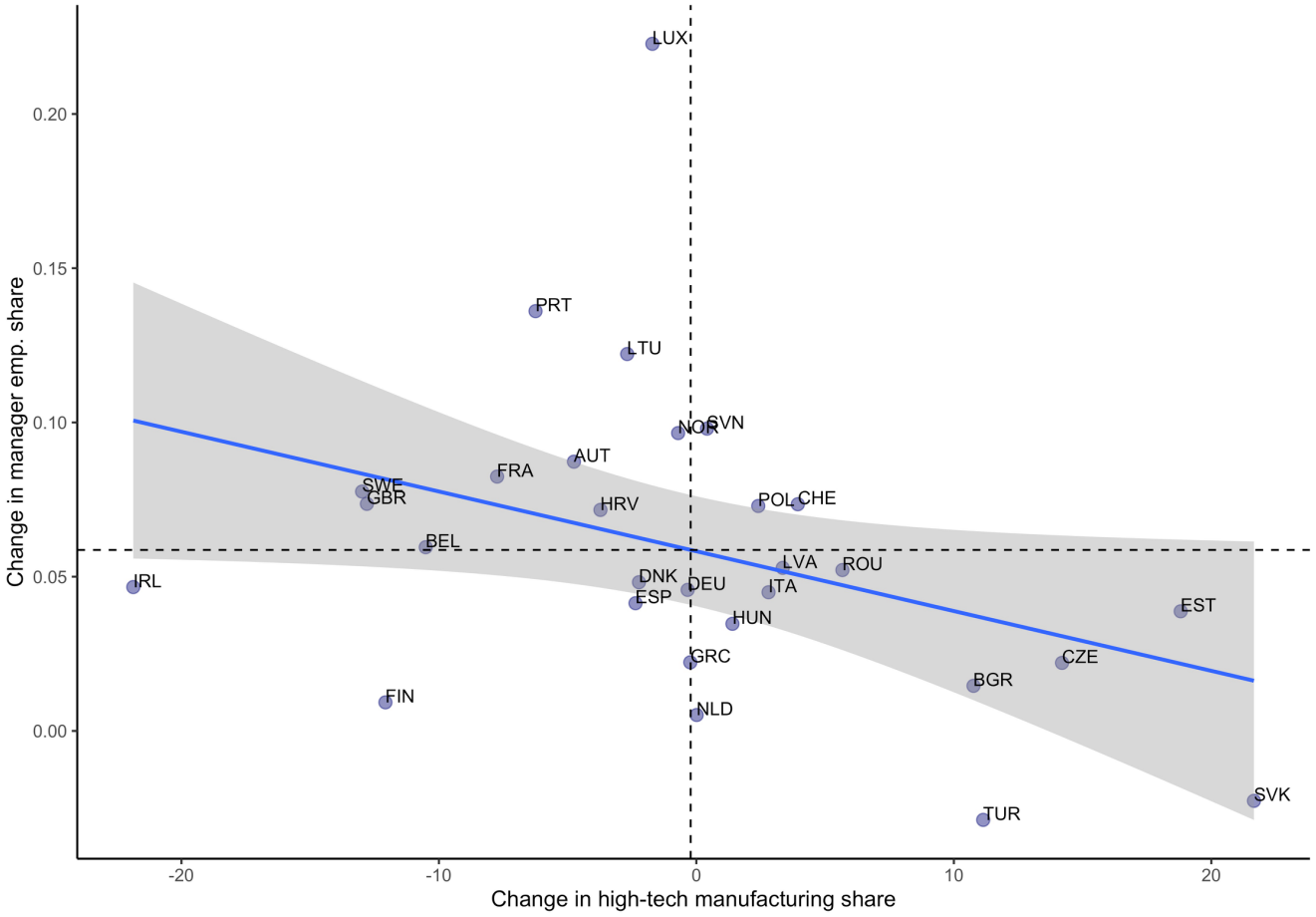
First, a positive relationship between the two shares can be observed, which confirms the complementarity between high-tech manufacturing and knowledge intensive business services (Guerrieri and Meliciani, 2005; Meliciani and Savona, 2015; Castellani et al., 2016; Lòpez Gonzalez et al., 2019). However, there are also countries that are much more integrated in knowledge intensive business services than in high-tech manufacturing (Luxembourg, Ireland, the UK) and there are countries with the opposite pattern (Hungary, the Czech Republic, Slovakia, Slovenia).

Figure 5 also shows a positive association between the share of KIBS in total GVC integration and the share of managers in total employment: countries with above average KIBS shares in GVC integration are coloured in lighter blues, indicating a higher share of managers. Instead, the figure shows no clear relationship between the share of high-tech manufacturing in GVC integration and the share of managers in total employment. In particular, the group of Eastern European countries with above average shares of GVC integration in high-tech manufacturing (Hungary, Slovakia, the Czech Republic and Slovenia) shows low shares of managers in total employment. This suggests that it is possible to be integrated in GVCs manufacturing high-tech intermediate inputs also with a limited domestic managerial control of production processes. This can occur in all cases in which technologically advanced firms located in advanced countries offshore some stages of their production processes maintaining (and often enlarging) in the home country the most strategic and managerial functions. The viability of this organisational arrangement increases with the physical proximity of the offshoring firms (country) and the firm (country) where the activity is offshored (Gamberoni et al., 2010; Baldwin and López- González 2013).

The different integration patterns in the case of services and manufacturing might be due to the relevance that managerial functions have in the KIBS and probably to the greater difficulty (in comparison to manufacturing) of fragmenting across borders the knowledge-intensive tasks from the most labour-intensive ones.

The presence of different employment structures associated with different patterns of integration, in the case of manufacturing (high-tech) sectors and KIBS, is confirmed when we turn from a structural reading of these patterns and relationships to a dynamic one. Figures 6 and 7 show the variation of the HTSH and KIBSSH indexes, respectively, and the variation of the share of managers. Figures 8 and 9 replicate the previous two figures by looking at the variation of the share of manual workers in total employment.

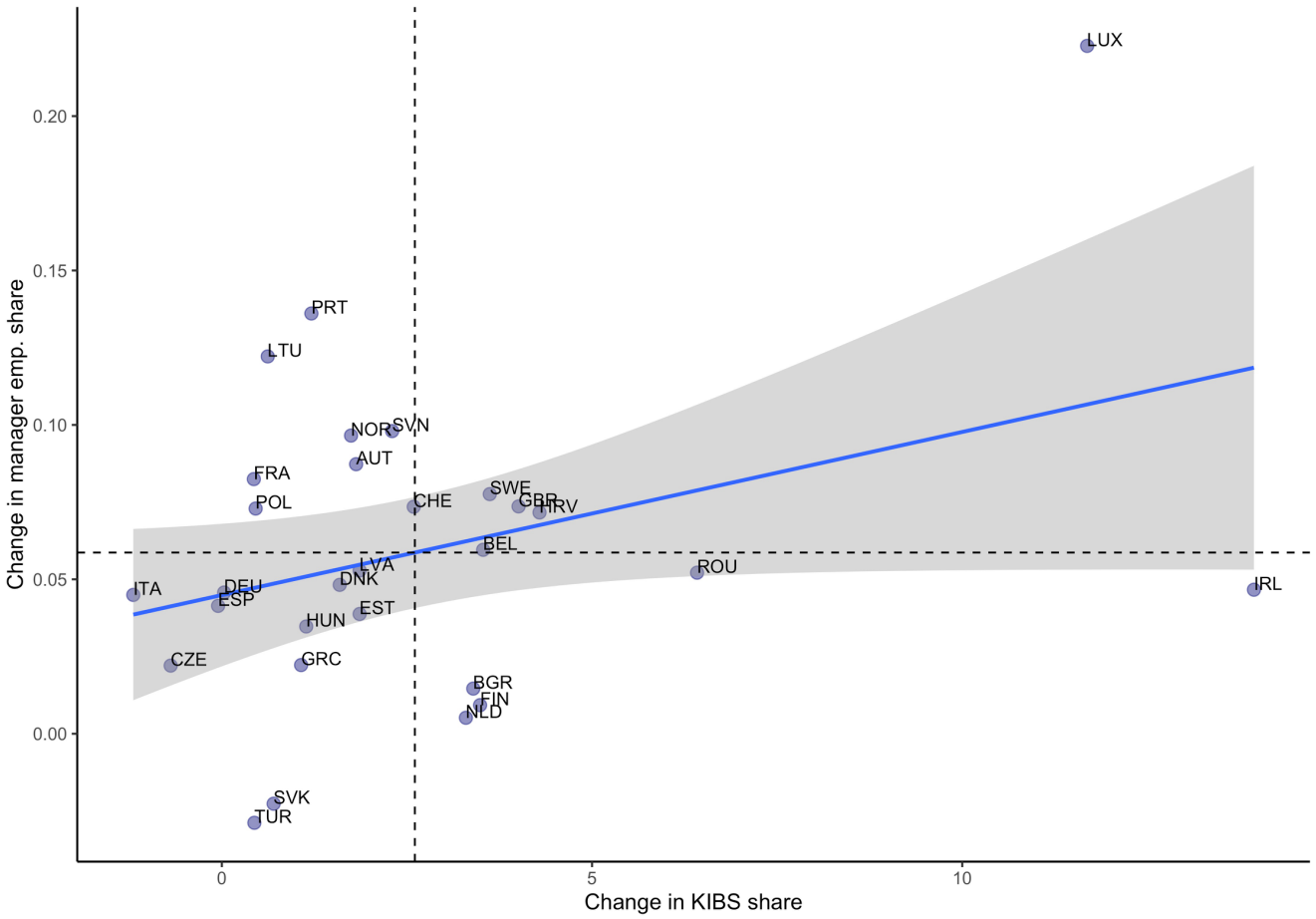
Figure 6 - Variation of High-tech manufacturing share in GVC integration and variation in employment share of Managers 2000-14



Note: the figure plots the variation of high-tech manufacturing shares in GVC integration against the variation in employment shares of managers over the 2000-14 period. The blue line is the line of best fit with its interval of confidence, the dashed lines correspond to the sample average. Country names corresponding to the ISO codes used in the Figure can be found in Table A.1 in the Appendix.

Source: authors' own calculations on WIOD.

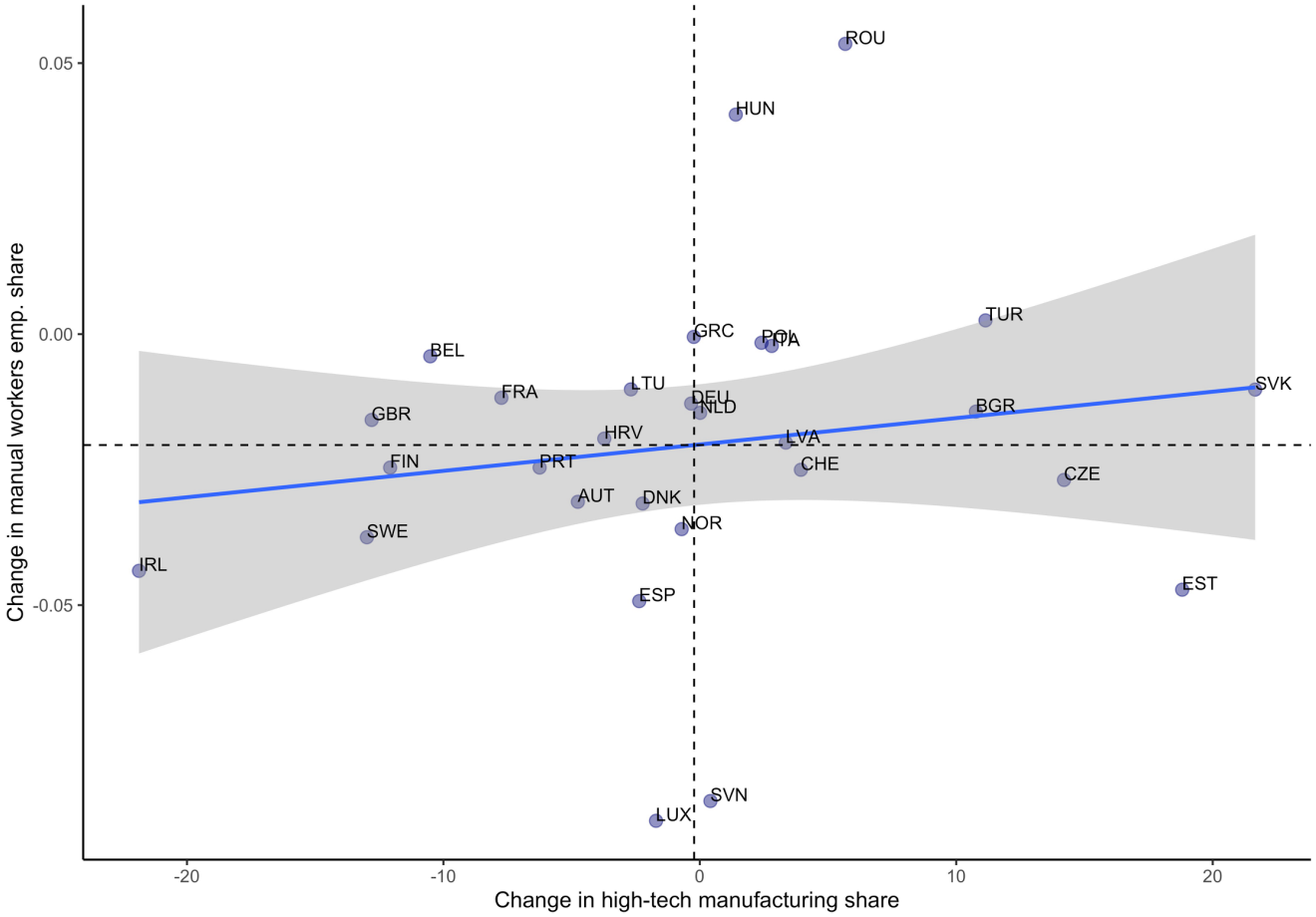
Figure 7 - Variation of KIBS share in GVC integration and variation in employment share of Managers 2000-14



Note: the figure plots the variation of KIBS shares in GVC integration against the variation in employment shares of managers over the 2000-14 period. The blue line is the line of best fit with its interval of confidence, the dashed lines correspond to the sample average. Country names corresponding to the ISO codes used in the Figure can be found in Table A.1 in the Appendix.

Source: authors' own calculation on WIOD and Eurostat data on employment.

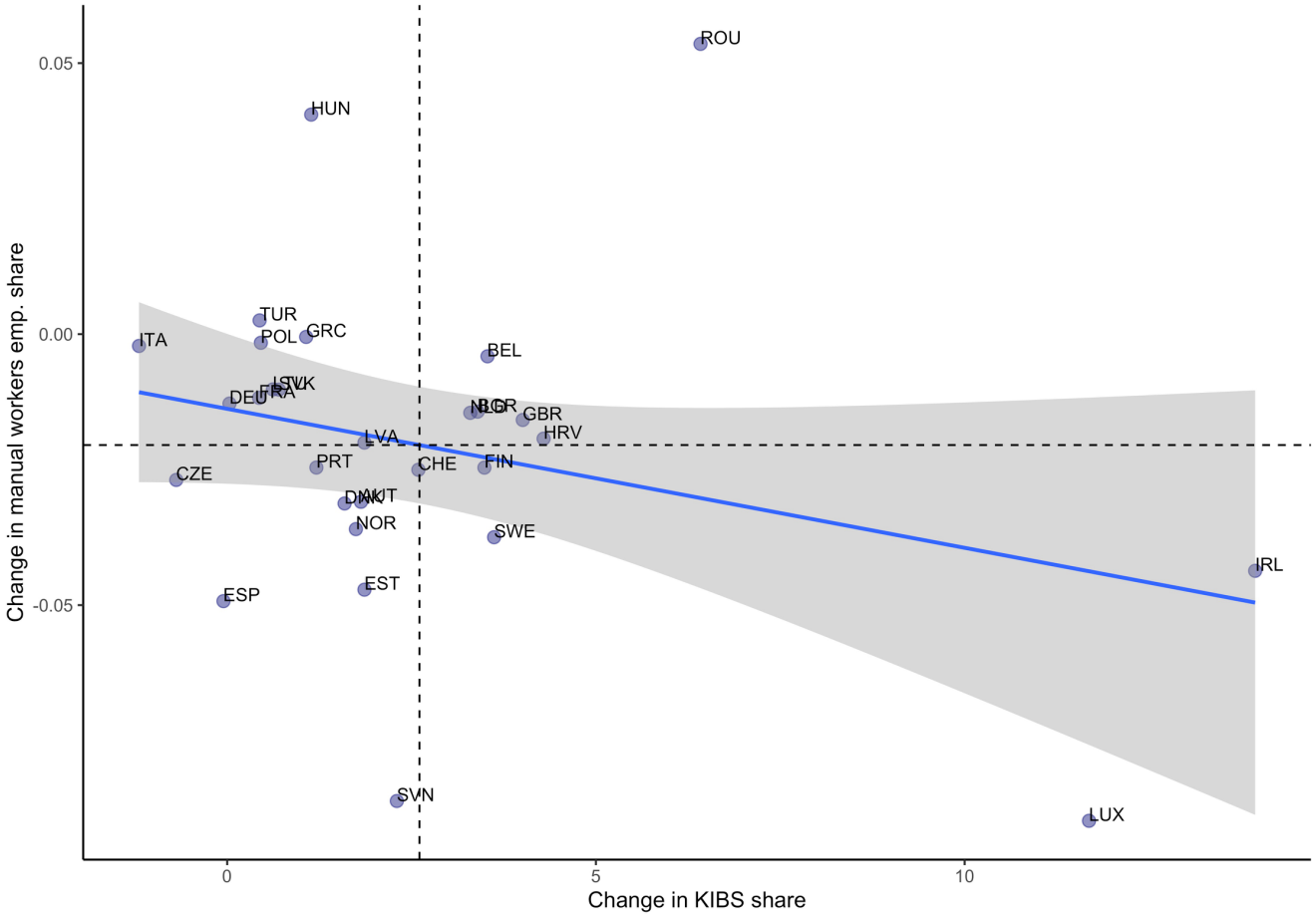
Figure 8 - Variation of High-tech manufacturing share in GVC integration and variation in employment share of Manual Workers 2000-14



Note: the figure plots the variation of high-tech manufacturing shares in GVC integration against the variation in employment shares of manual workers over the 2000-14 period. The blue line is the line of best fit with its interval of confidence, the dashed lines correspond to the sample average. Country names corresponding to the ISO codes used in the Figure can be found in Table A.1 in the Appendix.

Source: authors' own calculation on WIOD and Eurostat data on employment.

Figure 9 - Variation of KIBS share in GVC integration and variation in employment share of Manual Workers 2000-14.



Note: the figure plots the variation of KIBS shares in GVC integration against the variation in employment shares of manual workers over the 2000-14 period. The blue line is the line of best fit with its interval of confidence, the dashed lines correspond to the sample average. Country names corresponding to the ISO codes used in the Figure can be found in Table A.1 in the Appendix.

Source: authors' own calculation on WIOD and Eurostat data on employment.

Figures 6 and 8 show a rather surprising pattern. Countries that upgrade their patterns of integration in GVCs by increasing the share of high-tech manufacturing in forward and backward linkages show below average increases in the shares of managers (Figure 6) and reduce the share of manual workers to a lower pace with respect to the mean (Figure 8).[7]

This seems to be a pattern of integration characterising most Eastern European countries. This evidence once again alludes to the possibility that the integration of these countries within the EU value chains has been the result of the delocalisation of high-tech stages of production by firms located in the most advanced countries. It

[7] There is also a positive correlation between increases in the share of high-tech manufacturing and increases in the share of clerks (results are available on request).

has probably been the least value added and most labour-intensive stages of production (within the hi-tech supply chain) to be involved in such delocalisation processes, although our data do not allow us to explore this directly. However, such processes of delocalisation (offshoring) have not been accompanied by a parallel delocalisation or endogenous strengthening of managerial functions.

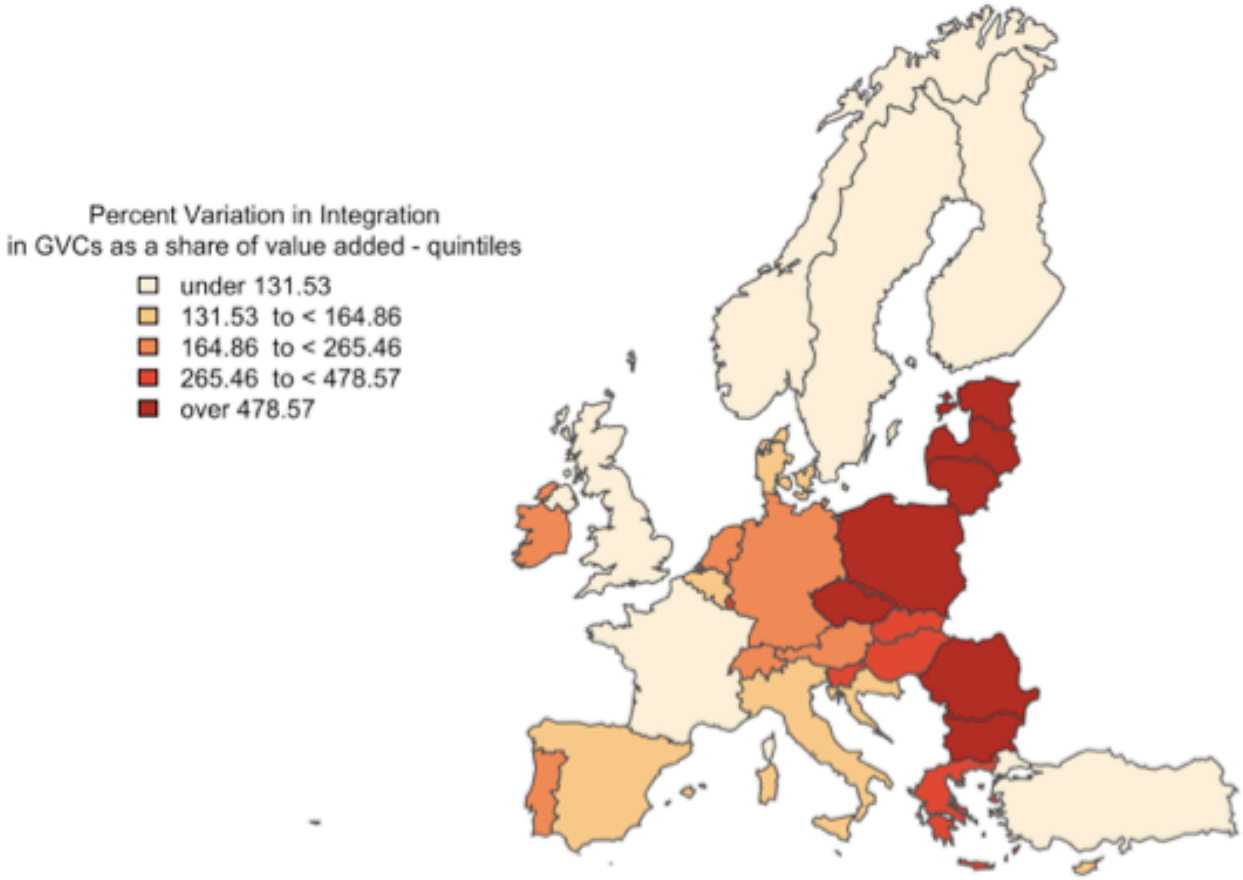
An opposite picture emerges from Figures 7 and 9, which relate the dynamics of the processes of international integration in KIBS and the changes in the shares, respectively, of managers (Figure 7) and manual workers (Figure 9). In this case, the rate of change of the KIBSSH indicator is positively related to the change in the share of managers, whereas a negative relationship is found in the case of the dynamics of the share of manual workers. This pattern seems to suggest that increasing the international integration in KIBS requires the upgrading of the quality of the workforce and the strengthening of the managerial and strategic functions associated with the production and delivery of these services. A specificity of the processes of KIBS-related-upgrading, compared to the high-tech manufacturing one, is that in this case it is more difficult to identify clear macro-regional patterns.

EU 27 GVC integration and employment upgrading dynamics

The final issue addressed here is the relationship between the dynamics of integration in GVC and the overall dynamics of employment. In particular, we examine whether the group of countries that over the 2000-14 period more consistently increased its GVC participation (mainly Eastern European countries) has benefitted from such integration processes in terms of employment growth.

Figure 10 shows a map with countries classified in quintiles on the basis of their rates of changes of GVC integration (Map A) and of employment (Map B). The map clearly shows that a large part of the Eastern European countries that over the 2000-14 period integrated the most in the European manufacturing production network have experienced a below average rate of employment growth.

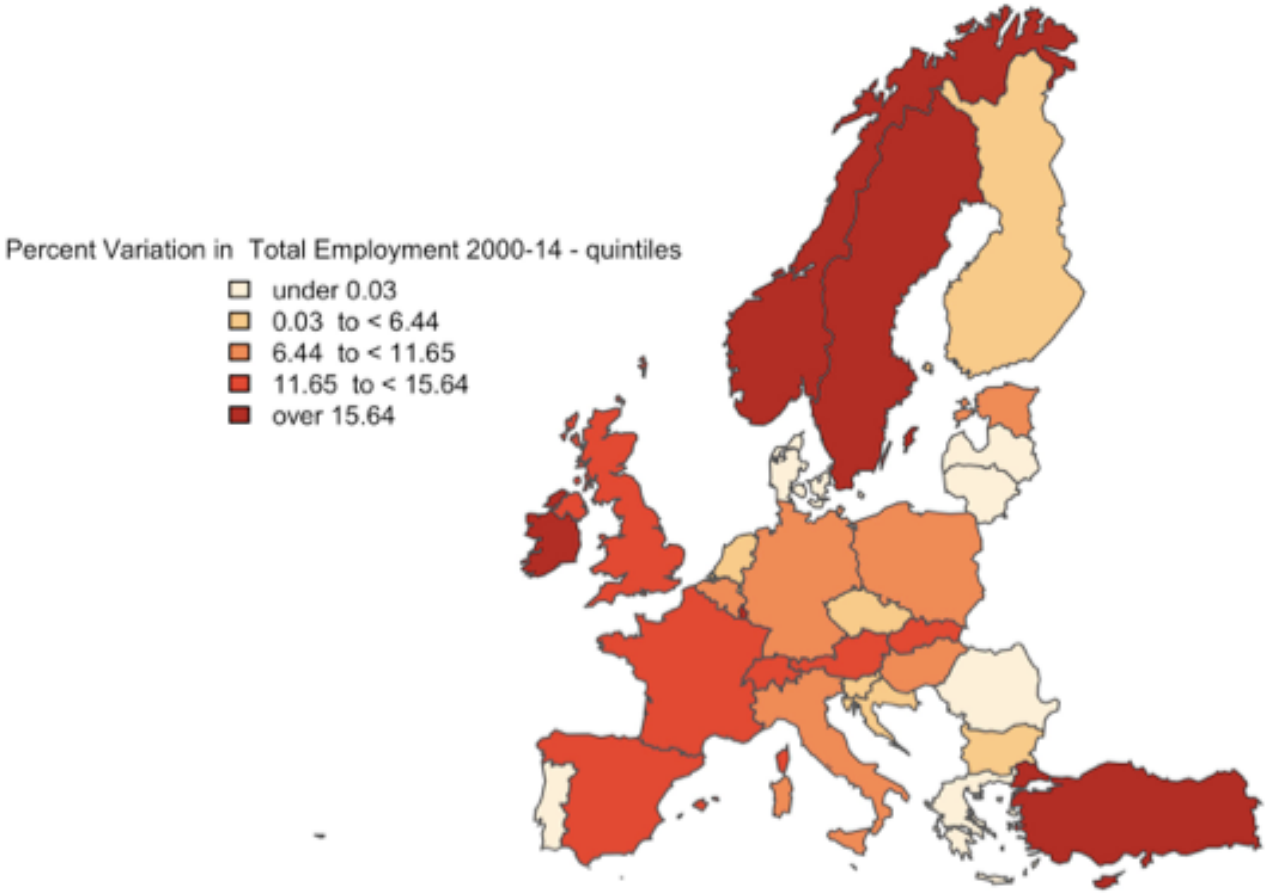
Figure 10.A – Countries by quintile of variation of GVC integration 2000-14



Note: the map represents percent variations in GVC integration over the 2000-14 period. The colours are based on the quintile in which each countries falls.

Source: authors' own calculations on WIOD and Eurostat data on employment.

Figure 10.B – Countries by quintile of variation of total employment 2000-14



Note: the maps represent percent variations in total employment, over the 2000-14 period. The colours are based on the quintile in which each countries falls.

Source: authors' own calculations on WIOD and Eurostat data on employment.

The overall reading of the GVC integration patterns in Europe suggests that peripheral countries that have increased their level of integration, and that in some cases have also upgraded their position in manufacturing in GVCs, have not increased the share of managers, professionals and technicians in the workforce. Moreover, they have also shown a weak dynamic of total employment. On the contrary, Western European economies, which were initially endowed with a highly qualified employment structure, have mainly increased their integration in KIBS and in some cases have further strengthened the qualification of their workforce. This trend has been accompanied by a more favourable dynamic of total employment.

This evidence, although only at a descriptive level, is supportive of the existence in Europe of a process of hierarchical re-organisation of production chains among geographically identifiable areas, with the core countries experiencing increases in high-skill employment and occupational categories with a high share of non-routinised

tasks as a consequence of the expansion of more complex activities, and peripheral countries experiencing a decrease in overall employment (Simonazzi et al. 2013; Cirillo and Guarascio, 2015; Celi et al., 2018).

Concluding remarks

This paper has looked at patterns of sectoral specialisation in GVC integration in Europe and their association with employment upgrading. The selected literature review has shown that, while contributions on the effects of offshoring on employment are relatively more numerous and established, much less has been found on the link between employment and sectoral/technological patterns of integration in GVCs. This is the case even in relatively homogenous macro-regional contexts such as the EU.

The aim of our empirical exploration was therefore to identify whether differences in the technology-related sectoral patterns of international fragmentation (i.e. whether high-tech manufacturing or KIBS) are associated with differences in the trends of occupational categories and whether this might have contributed to a potential further source of unbalances in Europe over the last fifteen years.

Overall, Eastern European countries have experienced a particularly strong dynamic of GVC integration (as a share of value added). Some of these countries have increased the share of high-tech manufacturing in GVC integration. However, this has been accompanied by a decrease in the share of manual workers (and of overall employment) that has not been compensated by an increase in the share of managers (although there are some signs of integration in high-tech manufacturing associated with an increase in the share of clerks). Instead, Western European countries have increased integration in KIBS and this is associated with an increase in the share of managers. Overall, in the case of Europe, integration in GVCs has not favoured convergence in employment.

The takeaway message is that this dualistic integration and its consequences in terms of employment composition seem to be associated with the difference between integration in the (high-tech) manufacturing segments of GVCs and integration in the KIBS functions. It seems that the new international division of labour in Europe sees the new 'core', or 'headquarters', moving towards a trade-specialisation in KIBS, whereas the new 'periphery', including qualified 'factories' economies, might have upgraded their trade specialisation from low to high tech manufacturing without it being paralleled by upgrading in terms of employment.

While the study has not explicitly looked at micro-level evidence that highlights issues of asymmetries in GVC governance, the results support a view that cautiously warns of GVC integration as a potential and further source of growth divergence and employment polarisation across developed and emerging countries. When it comes to Europe, the findings also support the claims that processes of hierarchical re-organisation of production chains among geographically identifiable areas have occurred. A similar duality between core and peripheral countries experiencing a decrease in overall employment (as shown in Simonazzi et al. 2013; Cirillo and Guarascio, 2015; Celi et al., 2018) can be detected together with an unexpected lack of increase in managerial occupations.

It is important to reiterate that the empirical contribution offered here does not attempt to identify causal relationships. Nonetheless, the descriptive picture provided in the paper calls for some caution on the positive effect of integration in GVC in general. In the case of the European countries, GVC integration seems to reproduce and perhaps exacerbate the initial asymmetries in the sectoral and employment structure, with manual work occupation reducing overall and knowledge-intensive occupations being concentrated in Western Europe (see also Wirkierman et al., 2021). It therefore seems that, despite the relatively "good quality" of the integration of EE countries, the evidence presented does not reveal an equal upgrading of employment composition.

References

Akcomak, S., Kok, S., Rojas-Romagosa, H. (2013) The effects of technology and offshoring on changes in employment and task-content of occupations. CPB Discussion Paper 233, Netherlands Bureau for Economic Policy Analysis.

Altzinger, W., Landesmann, M. A. (2008) Special issue: relocation of production and jobs to Central and Eastern Europe – who gains and who loses? *Structural Change and Economic Dynamics*, 19(1), 1–3.

Amiti, M., Wei, S. J. (2005) Fear of service outsourcing: is it justified? *Economic Policy*, 20(42), 308–347.

Amiti, M., Wei, S. J. (2009) Service offshoring, productivity and employment: evidence from the United States. *The World Economy*, 32(2), pp. 203–220.

Baldwin, R., Forslid, R., Martin, P., Ottaviano, G. Robert-Nicoud, F. (2005) *Economic Geography and Public Policy*. Princeton University Press.

Baldwin, R. (2011) Trade and Industrialization after Globalization's 2nd Unbundling: How Building and Joining a Supply Chain Are Different and Why It Matters, in Feenstra, R.C., Taylors, A.M. (Eds.) *Globalization in an Age of Crisis: Multilateral Economic Cooperation in the Twenty-First Century.* University of Chicago Press.

Baldwin, R., Lopez-Gonzalez, J. (2013) Supply-Chain Trade: A Portrait of Global Patterns and Several Testable Hypotheses. National Bureau of Economic Research (NBER) Working Paper No. 18957, NBER, Cambridge, MA.

Baldwin, R., J. López-Gonzalez (2015) Supply-Chain Trade: A Portrait of Global Patterns and Several Testable Hypotheses, *The World Economy*, 38, 1682-1721.

Baldwin, R., Evenett, S. J. (2020). *COVID-19 and trade policy: Why turning inward won't work*. CEPR Press, London, UK.

Baumgarten, D., Geishecker, I., Görg, H. (2013). Offshoring, tasks, and the skill-wage pattern. *European Economic Review*, 61, 132–152.

Becker, S. O., Ekholm, K., Muendler, M. A. (2013) Offshoring and the onshore composition of tasks and skills. *Journal of International Economics*, 90(1), 91–106.

Borin, A., & Mancini, M. (2020) Measuring What Matters in Global Value Chains and Value- Added Trade. In *World Development Report 2020*, The World Bank, Washington, D.C.

Bramucci, A., Cirillo, V., Evangelista, R., Guarascio, D. (2017) Offshoring, industry heterogeneity and employment, *Structural change and economic dynamics*.

Castellani, D., Meliciani, V., Mirra, L. (2016). The determinants of inward foreign direct investment in business services across European regions, *Regional Studies*, vol. 50(4), 671-691.

Celi, G., Ginzburg, A., Guarascio, D., Simonazzi, A. (2018) *Northern and southern Europe in the long European crisis: a core-periphery perspective*. Routledge, London.

Cirillo, V., Guarascio, D. (2015) Jobs and competitiveness in a polarised Europe. *Intereconomics*, 50(3), 156-160.

Cirillo, V., Pianta, M., Nascia, L. (2018) Technology and occupations in business cycles. *Sustainability* 10 (2) 463

Crinò, R. (2009) Offshoring, multinationals and labour market: a review of the empirical literature. *Journal of Economic Surveys*, 23(2), 197–249.

Crinò, R. (2012) Service offshoring and the skill composition of labour demand. *Oxford Bulletin of Economics and Statistics*, 74(1), 20–57.

Falzoni, A. M., Tajoli, L. (2012) The effects of offshoring on the composition of employment in Italy. In: Stern, R. (Eds.), *Quantitative Analysis Of Newly Evolving Patterns Of International Trade Fragmentation, Offshoring of Activities, and Vertical Intra-Industry Trade*. World Scientific Publishing Co. Pte. Ltd, 195-236.

Feenstra, R. C., Hanson, G.H. (1996) Globalization, outsourcing, and wage inequality. *American Economic Review*, 86(2), 240–245.

Feenstra, R. C., Hanson, G. H. (1999) The impact of outsourcing and high-technology capital on wages: estimates for the United States, 1979–1990. *Quarterly Journal of Economics*, 114(3), 907–940.

Fernandez–Macias, E. (2012) Job polarisation in Europe? Changes in the employment structure and job quality, 1995–2007, *Work and Occupations*, (39)2 (May), 157–182.

Foster-McGregor, N., Stehrer, R., De Vries, G.J. (2013) Offshoring and the skill structure of labour demand. *Review of World Economics*, 149(4), 631–662.

Fujita, M., Krugman, P., Venables, A. (1999) *The Spatial Economy. Cities, Regions and International Trade.* MIT Press.

Gamberoni E., Lanz, R., Piermartini, R. (2010) Timeliness and Contract Enforceability in Intermediate Goods Trade, World Trade Organization, Staff Working Paper ERSD-2010-14.

Gereffi, G., J. Humphrey, Sturgeon, T. (2005) The Governance of Global Value Chains. *Review of International Political Economy*, 12, 78-104.

Gräbner, c., Heimberger, P., Kapeller, J., Schütz, B. (2020) Is the Eurozone disintegrating? Macroeconomic divergence, structural polarisation, trade and fragility, *Cambridge Journal of Economics*, 44(3), 647–669.

Grodzicki, M.J., Geodecki, T. (2016) New Dimensions of Core-Periphery Relations in an Economically Integrated Europe: The Role of Global Value Chains, *Eastern European Economics*, 54(5), 377-404.

Guerrieri, P., Meliciani V. (2005) Technology and international competitiveness: The interdependence between manufacturing and producer services, *Structural Change and Economic Dynamics*, 16, 489-502.

Hijzen, A., Swaim, P. (2007) Does offshoring reduce industry employment? *National Institute Economic Review*, 201(1), 86–96.

Hijzen, A., Görg, H., Hine, R. C. (2005) International outsourcing and the skill structure of labour demand in the UK. *The Economic Journal*, 506(115), 860–878.

Hogrefe, J. (2013) Offshoring and relative labour demand from a task perspective. ZEW – Centre for European Economic Research Discussion Paper No. 13–067.

Johnson, R.C. (2017) Measuring global value chains. *NBER Working Paper Series*.

Kaplinsky, R. (2000) Globalisation and Unequalisation: What Can Be Learned from Value Chain Analysis? *The Journal of Development Studies* 37(2), 117–46.

Landesmann, M. A., Stehrer, R. (2000) Industrial specialisation, catching-up and labour market dynamics. *Metroeconomica*, 51(1), 67–101.

Leitner, S., and R. Stehrer. 2014, November. "Trade Integration, Production Fragmentation and Performance in Europe– Blessing or Curse? A Comparative Analysis of the new member-states and the EU-15." Research Report 397, Vienna Institute for International Economic Studies, Vienna, Austria.

Lopez Gonzalez, J., Meliciani, V., Savona, M. (2019) When Linder meets Hirschman. Inter-Industry linkages and Global Value Chains in Business Services, *Industrial and Corporate Change, 28(6), 1555-1586.*

Marcolin, L., Miroudot, S., Squicciarini, M. (2016) Routine jobs, employment and technological innovation in global value chains, *OECD Science, Technology and Industry Working Papers*, 2016/01, Paris: OECD publishing.

Meliciani, V., Savona, M. (2015) The determinants of regional specialisation in business services: agglomeration economies, vertical linkages and innovation, *Journal of Economic Geography*, 15 (2), 387-416.

Milberg, W., Winkler, D. (2011) Economic and social upgrading in global production network: Problems of theory and measurement. *International Labour Review,* 150(3-4), 341-365.

Milberg, W., Winkler, D. (2013) *Outsourcing economics. Global value chains in capitalist development*. Cambridge University Press, New York.

Miroudot, S., Cadestin, C. (2017) Services In Global Value Chains: From Inputs to Value Creating Activities, *OECD Trade Policy Papers*, 197, Paris: OECD Publishing

OECD (2007) *Offshoring and employment: trends and impact*. Paris: OECD Publishing.

Ottaviano, G. (2015). Offshoring and the migration of jobs. IZA World of Labor, 170.

Prebisch, R. (1950) The Economic Development of Latin America and Its Principal Problems, United Nations Department of Economic Affairs, Economic Commission for Latin America (ECLA), New York.

Simonazzi, A., Ginzburg, A., Nocella, G. (2013) Economic relations between Germany and Southern Europe. *Cambridge Journal of Economics*, 37(3), 653–675.

Stöllinger, R. (2016) Structural change and global value chains in the EU. *Empirica,* 43, 801–829.

Strauss-Kahn, V. (2003) The role of globalization in the within-industry shift away from unskilled workers in France. In: Baldwin, R., Winters, A. (eds.) *Challenges to Globalization: Analyzing the Economics NBER Economic Research Conference Report series*. University of Chicago Press, Chicago and London.

Taglioni, D., Winkler, D.E. (2016) *Making global value chains work for development. Trade and Development*. Washington, D.C. : World Bank Group.

Timmer, M., Los, B., Stehrer, R., & De Vries, G. (2016). An anatomy of the global trade slowdown based on the WIOD 2016 release. GGDC Research Memorandum GD-162, Groningen Growth and Development Centre, University of Groningen.

Wang, Z., Wei, S., Yu, X., Zhu, K. 2017. *Measures of Participation in Global Value Chains and Global Business Cycles*, Available at: http://www.nber.org/papers/w23222.pdf.

Wirkierman, A.L, Ciarli., T. and Savona, M. 2021. A Taxonomy of European Innovation Clubs. Luiss School of European Political Economy Working Paper 9/21. https://sep.luiss.it/research/working-papers/2021/05/18/l-wirkierman-t-ciarli-m-savona-taxonomy-european-innovation-clubs.

World Bank (2017), *Measuring and analyzing the impact of GVCs on economic development, Global value chain development report 2017,* Washington, D.C. : World Bank Group.

Appendix – A. Evolution of key variables of interest

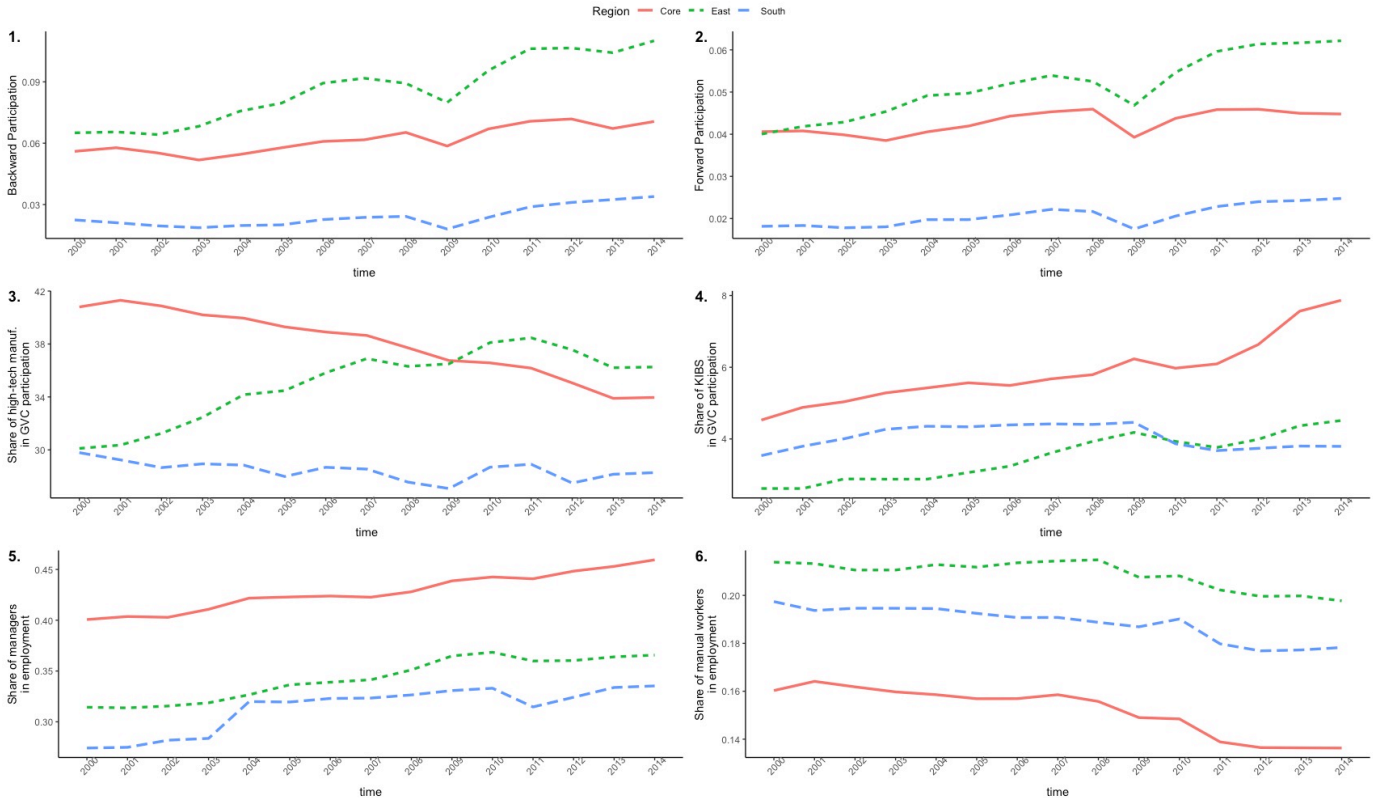
The descriptive evidence offered so far has looked at long-term dynamics in three key respects, namely GVC participation, the share of high-tech manufacturing and KIBS in GVC participation and the share of managers and manual workers in countries' total employment. Our observed period of analysis however includes the financial crisis that has had significant impacts on all our variables of interest. For this reason, we complement our evidence with a more detailed study of the evolution in each year of our variables of interest. We do this in two ways. First, we have grouped countries in three macro regions based on their position both in geographical and geopolitical terms, i.e. Core, South and East, as shown in Table A1, leaving Turkey out of this categorisation.

Table A1 – Macro regions

Region	Countries
Core	Austria (AUT); Belgium (BEL); Denmark (DNK); Finland (FIN); France (FRA); Germany (DEU); Ireland (IRL); Luxembourg (LUX); the Netherlands (NLD); Norway (NOR); Sweden (SWE); Switzerland (CHE); United Kingdom (GBR).
South	Italy (ITA); Spain (ESP); Greece (GRC); Portugal (PRT).
East	Bulgaria (BGR); Croatia (HRV); the Czech Republic (CZE); Estonia (EST); Hungary (HUN); Latvia (LVA); Lithuania (LTU); Poland (POL); Romania (ROU); Slovakia (SVK); Slovenia (SVN).
Unclassified	Turkey (TUR)

Based on the classification above, Figure A1 plots the evolution, over our observed 2000-14 period, of the average of six key variables: (i) backward GVC participation, (ii) forward GVC participation, (iii) the share of high-tech manufacturing in GVC participation (Equation 4), (iv) the share of KIBS in GVC participation (Equation 5), (v) the share of managers in total employment and (vi) the share of manual workers in total employment.

Figure A.1 - Key variables evolution across macro regions - Excluding BGR and TUR



Note: the figure reports the evolution of key variables over time. The variables have been averaged across countries in order to be aggregated in three regions as described in Table A.1. Out of all countries only Bulgaria and Turkey have been excluded given their extreme values – as it is the case for Bulgaria's GVC participation – or difficulty to be clearly grouped in one of the three regions.

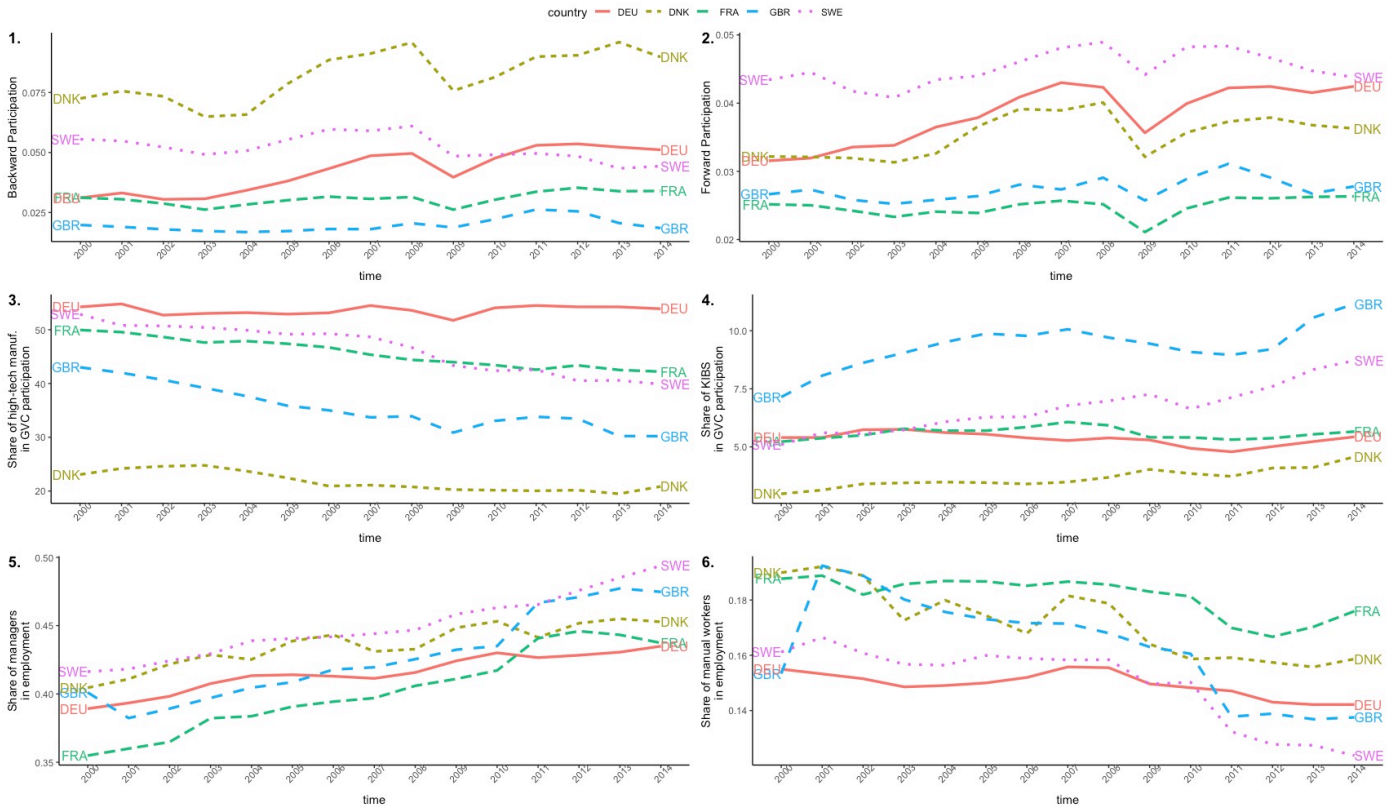
Source: authors' own calculations on WIOD.

Panel 1 and 2 look at the evolution of GVC participation (backward and forward, respectively) across our three regions. We can clearly observe a dip in both these measures as a consequence of the crisis, as expected. Eastern Europe has by far the largest average in both measures of GVC participation and it also bounces back much more strongly than the other two regions, which instead plateau. This confirms the evidence discussed in the main text that for Eastern Europe GVCs play the most important role. Panels 3 and 4 depict the share of high-tech manufacturing and KIBS in GVC participation (respectively). Comparing Eastern Europe and the core countries, we observe a striking pattern: the former significantly increases its share of high-tech manufacturing, while this decreases rather sharply for the core countries. Concerning KIBS, we observe an opposite pattern: the core countries increase significantly their share of KIBS in GVC participation, while Southern Europe sees a rather sharp decline after the years of crisis. Eastern Europe catches up, in terms of the share of KIBS, with Southern Europe but remains at much lower levels than the core countries.

Finally, when we look at the employment structure across our three regions in Panels 5 and 6, we observe a common increasing trend in the share of managers and a decreasing one in the share of manual workers. However, ranking in both these variables remains rather stable with the core countries maintaining the highest share of managers and the lowest of manual workers. Interestingly, Southern Europe ranks last in terms of the share of managers also compared to Eastern Europe.

Naturally, these results remain quite aggregate and hide significant country-level heterogeneity. To try to shed further light on this, while ensuring readability of our figures, we also replicate Figure A.1 for three subsets from each region, in Figures A.2-A.4.

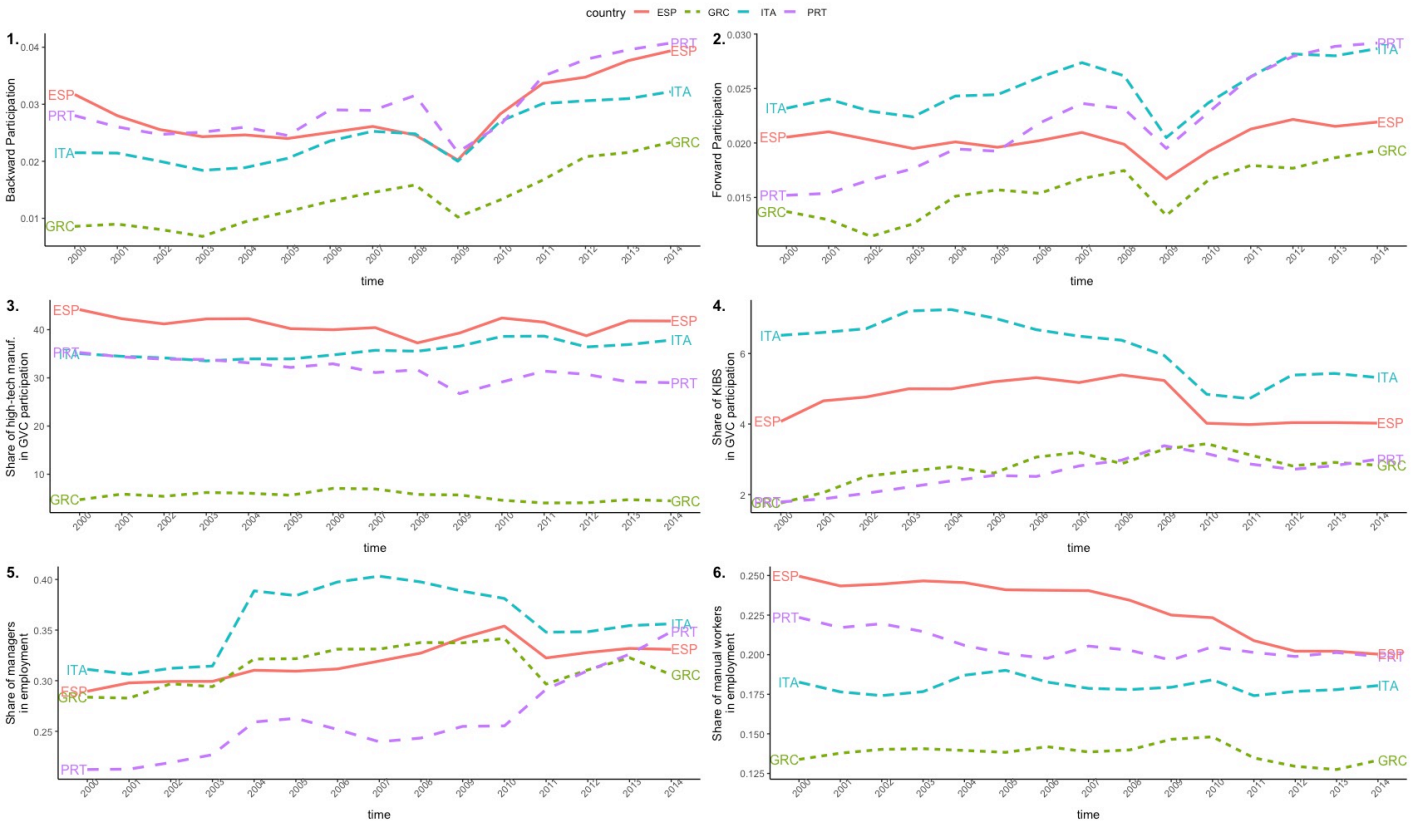
Figure A.2 - Key variables evolution for Core countries



Note: the figure reports the evolution of key variables over time for selected countries from those belonging to the Core group. Country names corresponding to the ISO codes used in the Figure can be found in Table A.1 in the Appendix.

Source: authors' own calculations on WIOD and Eurostat data on employment.

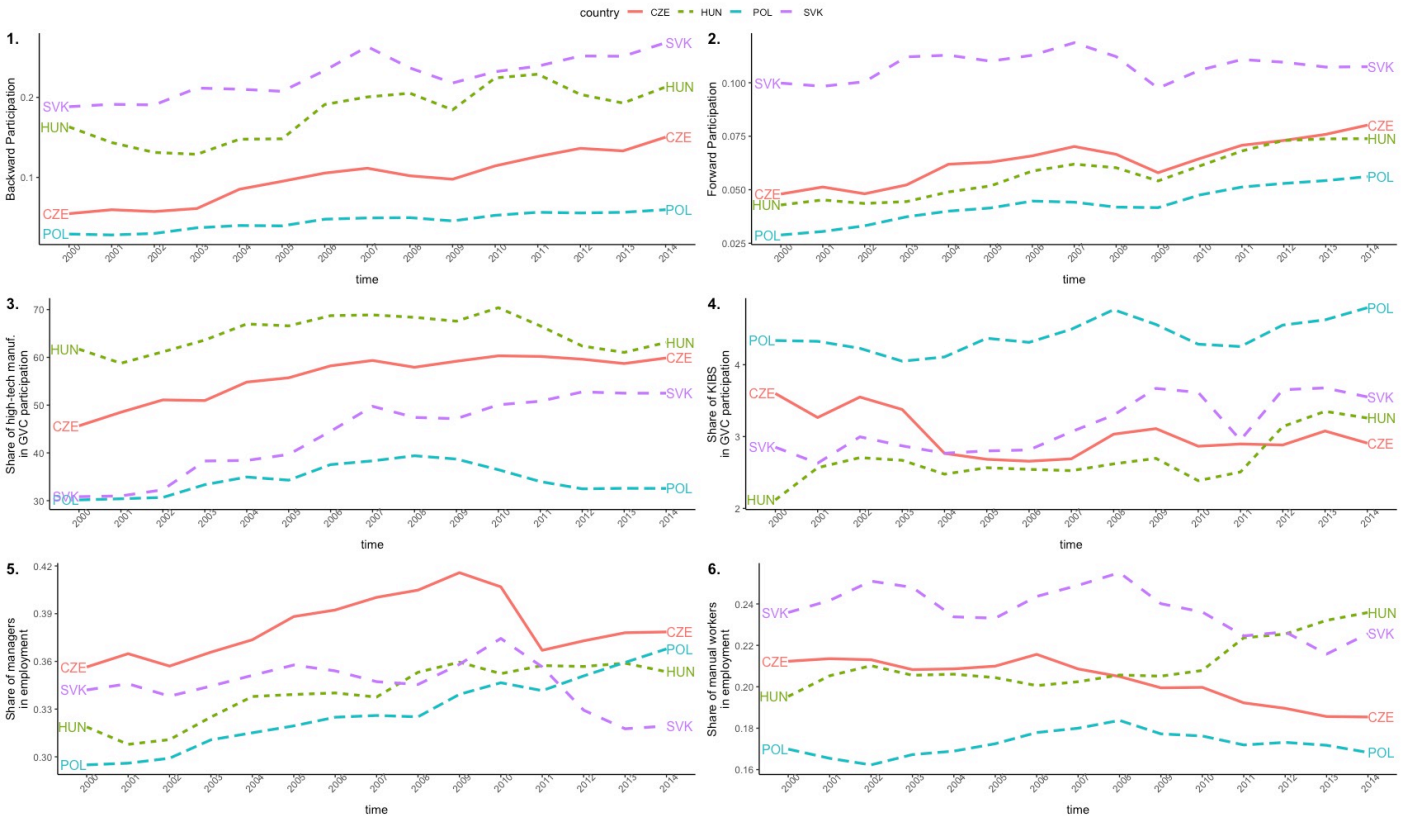
Figure A.3 - Key variables evolution for Southern countries



Note: the figure reports the evolution of key variables over time for selected countries from those belonging to the Southern Europe. Country names corresponding to the ISO codes used in the Figure can be found in Table A.1 in the Appendix.

Source: authors' own calculations on WIOD and Eurostat data on employment.

Figure A.4 - Key variables evolution for Eastern countries



Note: the figure reports the evolution of key variables over time for selected countries from those belonging to the Eastern Europe. Country names corresponding to the ISO codes used in the Figure can be found in Table A.1 in the Appendix.

Source: authors' own calculations on WIOD and Eurostat data on employment.

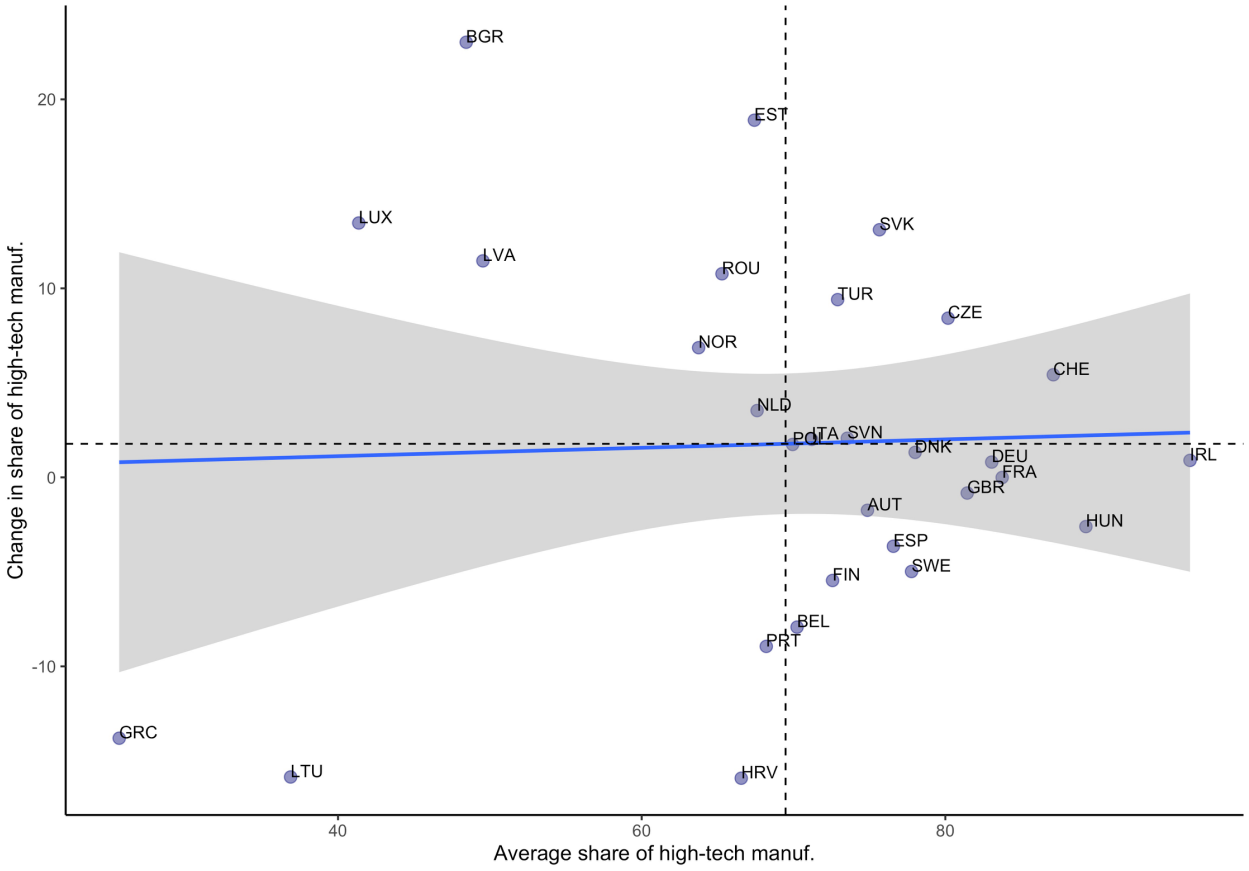
Appendix – B. Shares of high-tech manufacturing and KIBS in GVC participation within manufacturing and service industries

In this section we report the figures, already discussed in the main text, that use an alternative measure to HTSH, which we compute as follows:

$$HTSH_i = \frac{Backward_{ij}^{h} + Forward_{ij}^{h}}{\sum_j Backward_{ij}^{m} + \sum_j Forward_{ij}^{m}} \qquad with\ h \in high-tech\ manuf.;\ \ m \in manuf. \quad (6)$$

As previously discussed, the key difference between these measures and Equation 4 is that the denominator of the ratio only considers GVC participation in the manufacturing sector. In this way these measures are not affected by changes in countries' structures concerning either services or manufacturing, but focus on the role that the most knowledge intensive segments of each sector play in countries' GVC participation.

Figure B.1 - High-tech manufacturing share in total integration in GVCs, in manufacturing, averages and variations 2000-14



Note: For high-tech manufacturing shares in GVC integration within the manufacturing industry, the figure plots the average against the variation over the 2000-14 period. The blue line is the line of best fit with the interval of confidence, the dashed lines correspond to the sample average. Country names corresponding to the ISO codes used in the Figure can be found in Table A.1 in the Appendix.

Source: authors' own calculations on WIOD.

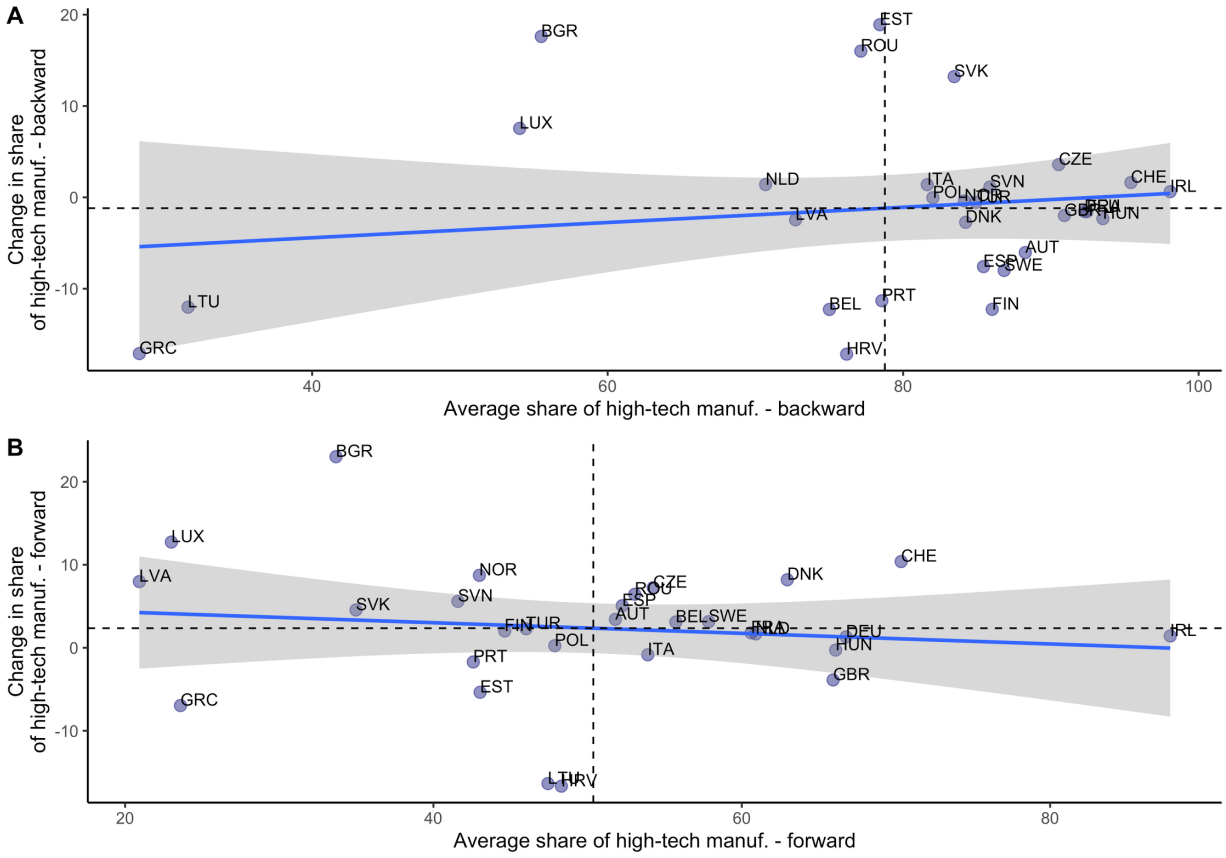
In order to shed further light on the dynamics at play concerning high-tech manufacturing as a share of the participation in manufacturing GVCs, we further decompose Equation 6 above, by looking at backward and forward GVC participation separately:

$$HTSH_i = \frac{Backward_{ij}^{h}}{\sum_j Backward_{ij}^{m}} \qquad with\ h \in high-tech\ manuf.;\ \ m \in manuf. \quad (7)$$

$$HTSH_i = \frac{Forward_{ij}^{h}}{\sum_j Forward_{ij}^{m}} \qquad with\ h \in high-tech\ manuf.;\ \ m \in manuf. \quad (8)$$

We then plot the average level and the change of these two measures in Figure B.2, which we discuss in the main text.

Figure B.2 - High-tech manufacturing share in backward and forward GVC participation, in manufacturing, averages and variations 2000-14



Note: The figure plots the average against the variation over the 2000-14 period for high-tech manufacturing shares in GVC participation within the manufacturing industry, panel A looks at backward participation while panel B looks at forward participation. The blue line is the line of best fit with the interval of confidence, the dashed lines correspond to the sample average. Country names corresponding to the ISO codes used in the Figure can be found in Table A.1 in the Appendix.

Source: author's own calculations on WIOD