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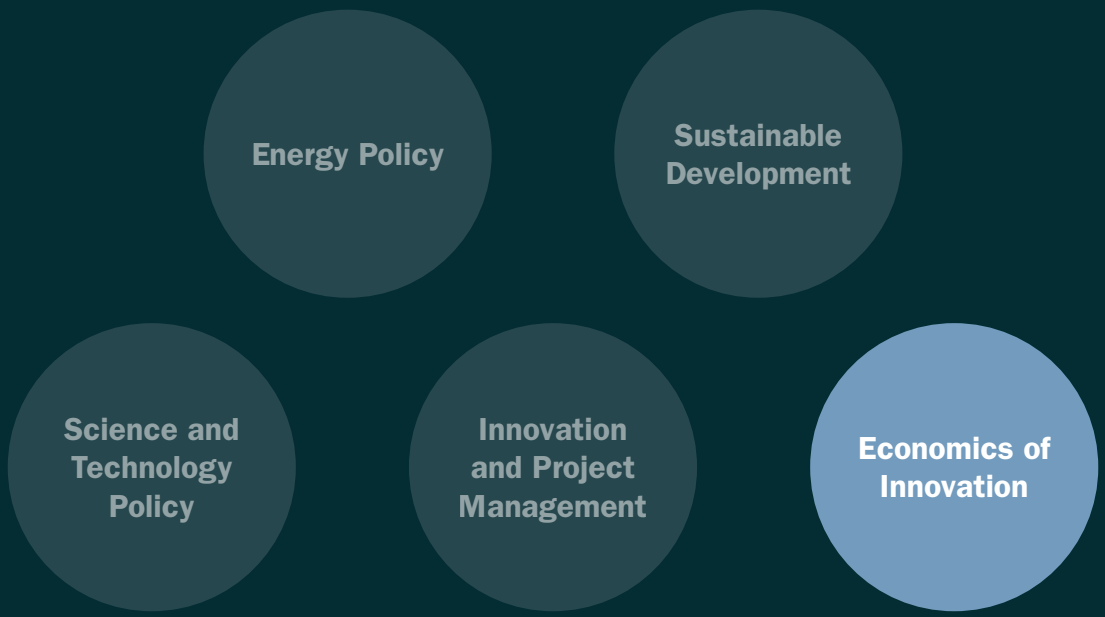

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Integration in Global Value Chains and Employment in Europe[1]

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Abstract[2]

This chapter 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 specialization of the patterns of international fragmentation, whether high technology manufacturing or knowledge intensive services (KIBS); (ii) the occupational categories that have benefited or been penalized by these trends. A rich empirical mapping of these trends in the European countries is provided, based on OECD ICIO and EU ISCO 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 a 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 chapter shows that, overall, integration in GVC seems to reproduce and perhaps exacerbate the initial asymmetries in the sectoral and employment structure, with manual workers occupation reducing overall and knowledge intensive occupations concentrating in western Europe.

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

JEL codes: F66, J24

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1. Introduction

Global Value Chains (GVCs) are long recognized as the dominant form of (intermediate) trade, affecting the international structure and organization of production activities (see recent compendium in OECD, 2017). These processes have relevant effects on the dynamics and qualitative content of jobs, as a result of the level of involvement and the specific positioning of firms, regions and countries within global production networks (Marcolin et al., 2016; OECD, 2017).

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

The aim of this chapter is to attempt a bridge of the literatures that have looked at the new international division of labour in Europe, in particular those with a more fine grained interest in the sectoral specificities of these processes and those focusing on the effects of offshoring on the labour markets. The study provides a first empirical mapping of the intersections of these elements that adds to the (very few) similar attempts in the literature (e.g. Taglioni and Winkler, 2016; Marcolin et al., 2016). It does so by looking at the processes of integration in knowledge intensive sectors such as high tech manufacturing and knowledge intensive business services (KIBS), that are indicative of general trends of sectoral upgrading within GVCs and that articulates the technological aspects considered in Marcolin et al. (2016). The 'quality' of upgrading within GVCs in Europe is then disentangled with respect to two key occupational categories, managers and manual workers. This choice is motivated by the aim of going beyond the skill intensity of the work force and examining broader processes of employment change and upgrading that might be linked to the quality of sectoral GVC integration.

While the analysis does not aim at inferring causal relationships between processes of integration in GVCs and employment, it nonetheless offers a rich picture of the general trends and countries' position.

This shows, overall, that integration in GVC of macro-regions in Europe seems to reproduce and perhaps exacerbate the initial asymmetries in the sectoral and employment structure. There seems to be a dual-speed and qualitatively different integration pattern in Europe, with eastern countries (EE) rapidly integrating in high tech manufacturing, and western countries (WE) strengthening their mutual integration in KIBS. Despite the relatively "good quality" of integration of EE countries, a mirroring upgrading of employment structures is not detected. Manual workers occupations have reduced overall across all European countries, but seem to have been compensated by an increase in knowledge intensive occupations only in western Europe. This suggests that advanced countries, while delocalizing in emerging European countries high-tech manufacturing activities, maintain the managerial and knowledge functions of GVCs.

These results are particularly interesting also for the literature that has looked at the determinants of participation in business services GVC (Miroudot and Cadestin, 2017; Lopez-Gonzalez et al., 2019) as it qualifies its potential effects in terms of employment creation and upgrading. What seems to emerge and will be discusses below is the occurrence of what Lopez-Gonzalez et al. (2019) have labelled as a 'third globalization unbundling' that involves services. The chapter discusses, on the basis of 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).

The remaining of the chapter is structured as follows: next section revisits the literatures mentioned above and introduces the aims of the chapter. The following one briefly describes the data and the indicators employed to map the sectoral and employment levels and trends of GVC integration in Europe. It 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 GVC, which distinguishes 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.

2. Background Literature

2.1. Asymmetries in the new international division of labour and GVCs

The changing nature of trade and the increasing fragmentation of production within and across national borders over the last decades has span interests from several disciplines. Baldwin (2011) has argued that

a ‘first globalization 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*. A ‘second unbundling’ started in 1985, mainly led by *Information and Communication Technologies* (ICTs) costs, which strengthened the virtuous effects of lower transport costs and 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 specialize in the low-tech phases of production chains, around the ‘headquarter’ centres, i.e. industrialized/developed countries such as the US, Japan and Germany. Importantly, it is argued that closeness to ‘headquarters’ mattered particularly as it favoured the industrialization 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 industrializing for the first time at virtually a fraction of the time-span that developed countries took to take off. For instance, countries such as Mexico, close to the US; China, close to Japan; Poland and Turkey, close to Germany, have all increased their participation in GVCs thanks to their closeness to headquarters. Baldwin and López-Gonzalez (2015) show that in the 'Factory North America', the US sources intermediates from a diversity of suppliers but that neighbouring Mexico predominantly buys from the US. So the pattern of specialisation driven by GVCs is that Mexico buys intermediates from the US, assembles them into final products and then exports them to American consumers. Interestingly, the same occurs in ‘Factory Europe’, with Germany leading the GVC around ‘factories’ such as Poland and Czech Republic.

The new 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 questions that remain open within trade theory is whether and under which conditions factory economies manage to upgrade their specialisation to higher value added segments of the value chains, to and benefit from upgrading within GVC integration.

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

A first stream, for instance, points to the sources of inequality linked to the spatial distribution of production activities between core and peripheral economies (Kaplinsky 2000). Despite being left out by GVCs might represent a losing proposition, it is argued that the countries that are most likely to lose from the globalisation process are also those that keep joining and participating in GVCs at costly conditions, for instance reaping low shares of profits or remaining trapped in low tech segments of the GVC. 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), that 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 stem directly from which segment of the GVCs countries enter.

A second stream of literature adopts a political economy perspective and looks more specifically at asymmetries in the model of integration in European GVCs, which is close to the interest in the present chapter. For instance, Milberg and Winkler (2011) argue that leading countries with better institutions, hosting large multinationals as leading firms in GVCs, have certainly a higher bargaining power when joining GVCs and influence the distribution of gains and losses from processes of international fragmentation of production. They show the negative effects of service and material offshoring on employment in the US, suggesting that the gains obtained from offshoring have not been translated into investment in new productive capacity but have rather been invested in financial assets.

Similarly, the work of Simonazzi et al. (2013) and Celi et al. (2018) is based on a structural approach to offshoring, developed within a geo-political economic framework. These studies interpret offshoring and changes in GVCs as the result of a broader process of hierarchical re-organization of production chains among firms, sectors and, more importantly, geographically identifiable areas. Focusing on Europe in particular, they emphasize the changes in the geo-economic structure of GVCs as a specific strategy implemented by the EU core – i.e. the German-led manufacturing network – to strengthen its productive capacity and enlarge its international market shares. Such a process occurs through both a cost channel – i.e. with the inflow of cheap intermediate inputs stemming from the East and feeding the German manufacturing VCs – and a technological one – i.e. using part of the accumulated surplus to strengthen the technological level of the core's industrial structure. On a similar ground, the works of Landesmann

and Stehrer (2000) and Altzinger and Landesmann (2008), by explicitly taking into account the role of technological specialization as influencing the patterns of international production, highlight important structural asymmetries in GVCs participation in the enlarged Europe.

2.2. GVC and technology

The empirical literature on growth and international competitiveness has shown since long ago that competitive advantage, at both the country and firm level, is based on the ability to accumulate distinctive sets of capabilities and competencies and to assimilate knowledge, rather or more than on price-cost factors (Dosi et al. 1988, 1990, 2015; Fagerberg 1994; Cohen 2010; Laursen and Meliciani 2010; Maggi 2017). In particular, the technology-gap approach to trade, dating back to the work of Posner (1961), challenges the traditional Ricardian notion of comparative advantage and highlights the importance of absolute advantages in shaping international competitiveness. In such a perspective, widespread technological asymmetries across countries due to the introduction of new products and processes drive export growth irrespective of cost advantages, also offering an explanation to Kaldor's paradox (Kaldor, 1978).

The neoclassical literature on GVCs, similarly to the neoclassical literature on trade specialization, neglects the role of technological absolute advantages by extending the Heckscher-Ohlin framework from trade in goods to trade in tasks (Grossman and Rossi-Hansberg, 2008; 2012). This literature highlights how the fragmentation of the production process linked to the progresses in ICTs allows countries to specialize in different tasks (according to comparative advantages) along a value chain. Offshoring increases productivity in the domestic country and, under some assumptions, generates gains for all domestic factors. Moreover, as mentioned earlier, participation in GVCs allows emerging countries to specialise in particular tasks along the value chain rather than having to set-up entire processes of production from scratch (see Kaplinsky 2013; De Backer and Miroudot 2013; Timmer et al. 2014; and Baldwin & López-Gonzalez 2015), leading to a faster industrialization process.

Knowledge-based or intangible capital (including not only R&D but also design, training, organizational capital and brand) affect countries' ability to appropriate gains from GVC participation (Jona and Meliciani, 2018; Durand and Milberg, 2018). Durand and Milberg (2018) claim that intangible assets such as standards, specifications, R&D achievements, as well as software and organizational know-how are typically scalable assets, imposing negligible marginal costs following the initial investment and resulting in infinite returns to scale. The difference in scale economies between tangible and intangible

assets implies that the firms controlling intangible-intensive parts of the chain will receive a disproportionate share of the gains from the network as output expands.

Firms participating in GVCs combine the comparative advantages of geographic locations with their own resources and competencies to maximize their competitive advantage (McCann and Mudambi 2005). In so doing they distribute tasks across space in a way that generates strong asymmetries in the distribution of the value added along the value chain and in the gains from GVC participation. The classical example of Apple's iPod shows that Apple keeps most of its product design, software development, product management, marketing and other high-wage functions in the US, while Asian firms like Toshiba from Japan and Samsung from South Korea manufacture high value components and firms from China are mainly specialized in assembling and testing activities (Dedrick et al. 2010). This distribution allows Apple to maintain the largest part of the value created in the GVC, while China specializing in the assembling activity retains only 1% of the total value.

This example is indicative of a more general evidence: a great part of the value added of a final product is created in the first and last stages of the value chain by firms involved in R&D, design, marketing and advertising, while firms involved in intermediate stages (such as the production of components and assembly) reap only a small part of the final value of the good or service produced (Mudambi 2007, 2008; Shin et al. 2009, 2012; Dedrick et al. 2010). The pattern of value-added along the value chain is represented by the 'smiling curve' (Everatt et al. 1999) or the 'smile of value creation' (Mudambi 2007): ranking activities on the x-axis along the value chain, with activities at the left or 'input' end are supported by R&D knowledge while activities at the right or 'output' end are supported by marketing knowledge. Mudambi (2008) also shows that advanced countries tend to specialise in the intangible intensive stages of the GVC while emerging countries specialise in the manufacturing and assembling activities.

However, there are technological trends that contribute to change this pattern of specialization in different directions. On the one hand, Information and Communication Technologies allow to standardize also high value added activities thus favouring a dynamic process by which advanced countries relocate to emerging economies also some of these activities (Mudambi, 2008). Belderbos et al. (2016) show that higher wages and the cost of human capital are a significant factor driving multinational enterprises to invest in R&D and innovation abroad. At the same time the increasing digitalisation of production processes is expected to allow lower-cost and high quality production in advanced economies, hence discouraging offshoring from and favouring reshoring to these countries (De Backer and Flaig, 2017).

The empirical evidence so far indicates that the use of industrial robots in developed economies appears to be slowing the offshoring rates, although it is not yet prompting firms to bring jobs back home (De Backer et al., 2018). These trends have also different implications for labour demand: R&D offshoring should lead emerging countries to upgrade in GVC and to increase the skill level of their workforce, while robotization would lead to a general drop in labour demand. De Backer and Flaig (2017) mention the examples of some modern factories, such as the almost fully robotic Philips shaver factory in Drachten in the Netherlands, or the fully automated shoe factory opened by Adidas in Germany, employing a tiny fraction of the number of people that were working in emerging economies in the production of the same goods.

2.3. GVC integration, offshoring and employment

While the sources of technological advantages in GVCs illustrated in the previous section are relatively recent, the evidence on the employment impact of offshoring is larger and relatively more consolidated. Despite the literature on offshoring deals with a somewhat narrower form of participation in GVCs, the findings produced are highly relevant also in relation to the analysis of the employment impact of GVCs and the topic investigated in the present chapter. Furthermore, many contributions dealing with GVCs end up measuring such phenomenon and assessing its impact looking at offshoring (i.e. at 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, with 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) found 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 found that material and service offshoring activities are detrimental for domestic industry employment (OECD, 2007).

The work of Feenstra and Hanson (1996; 1999) paved the way for a new branch of empirical research aiming at assessing the role played by offshoring in shifting the relative demand for skilled and un-skilled

labour. In particular, they found that offshoring drives up high-skilled workers' wage share. These results were 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). The destination of offshoring activities seems also to play a role, in this respect. Intermediate inputs imported from low-income countries have in fact been found to penalize medium- and low-qualified workers (Anderton and Brenton, 1999; Egger and Egger, 2003; Ekholm and Hakkala, 2006; Geishecker, 2006; Minondo and Rubert, 2006; Falk and Wolfmayr, 2008). Studies using the World Input Output Database have provided non-converging evidence on the existence of a skill-bias effect of offshoring (Foster-McGregor et al., 2013). Timmer et al. (2014) find an overall increase of the share of value added of high-skilled workers (and capital) and a reduction of value added accounted by less-skilled labor. This trend has been paralleled by a process of technological divergence across developed and developing countries, with the former increasingly specializing (within he GVCs) in activities carried out by high-skilled workers. Foster-McGregor et al. (2016) present evidences that partially contradict the results of Timmer et al. (2014), showing that in developed countries the negative effects of offshoring are unexpectedly larger for high-educated labour. The authors associate this result to the fact that firms located in developed countries are increasingly offshoring high-technology parts of the production processes – performed by high-skilled workers – beside low-skill intensive ones.

As already discussed, relevant for the assessment of the employment effects of offshoring and participation in GVCs is the recent emphasis put on tasks (rather than skills). In this case the empirical literature provides results more in line with theoretical expectations. Becker et al. (2013) found that offshoring is associated with a downward shift of labour demand towards less-routinized 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 organized. 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 involvement in activities intensive in 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 routinized/non-routinized 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., p.3). The policy implications of these results are also very insightful 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). This is consistent with the study of 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 the participation to GVCs.

3. 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 period 2001-14 with the aim of unveiling potential asymmetries across macro-regions, that are related to the dimensions illustrated above. First, the relative shares of different sectors in the indicators of integration described below are examined by looking at whether different macro-regions or countries within macro-regions have integrated more in high tech manufacturing or knowledge intensive services, with respect to their initial position in 2001. Second, the relationship between specific sectoral patterns of integration in GVCs and changes in the total employment and in the share of different occupational categories (managers, clerks, crafts and manual workers) is investigated. While trends in the four categories have been analysed, only results for managers and manual workers are reported since these are the categories where trends are more marked and better help qualifying the potential sources of asymmetries in processes of GVC integration.

3.1. Variables and Data sources

The analysis relies on two main sources of data.

First, 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 is available for the 28 EU members, European Economic Association (EEA) and Turkey. They

provide information on employment across ISCO categories as well as total employment for each country.

Second, the World Input-Output Database WIOD 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 2000 to 2014 is obtained.

The WIOD data provides information on value added flows. The literature on the issue of measurement of GVC participation is still evolving (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 is contributing to third countries' export (forward participation). The sum of the two measures can be referred to as total GVC participation, or GVC integration.

A detailed description of how these indicators are constructed, the countries included in the analysis, alongside summarising tables of the sectoral and occupational categories disaggregation are included in the Appendix to the paper.

3.2. Patterns of GVC integration

First a glance at the overall (initial) levels and trends of GVC integration across countries is provided, over the period 2000-2014. This adds to the empirical evidence seeking to identify patterns of international division of labour in Europe and to isolate whether a "headquarter" and "factory" dualism is being reinforcing or 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 (some small countries such as Malta and Cyprus have been excluded from the analysis while Bulgaria does not appear in Figure 2 being an outlier with very high increases in GVC participation) the "forward" and "backward" participation in GVCs standardised by value added. In particular, the indicators of forward and backward linkages of the

whole economy in each year described above have been divided by the country's total value added in the same year. This allows to get rid of a pure "size" effect.

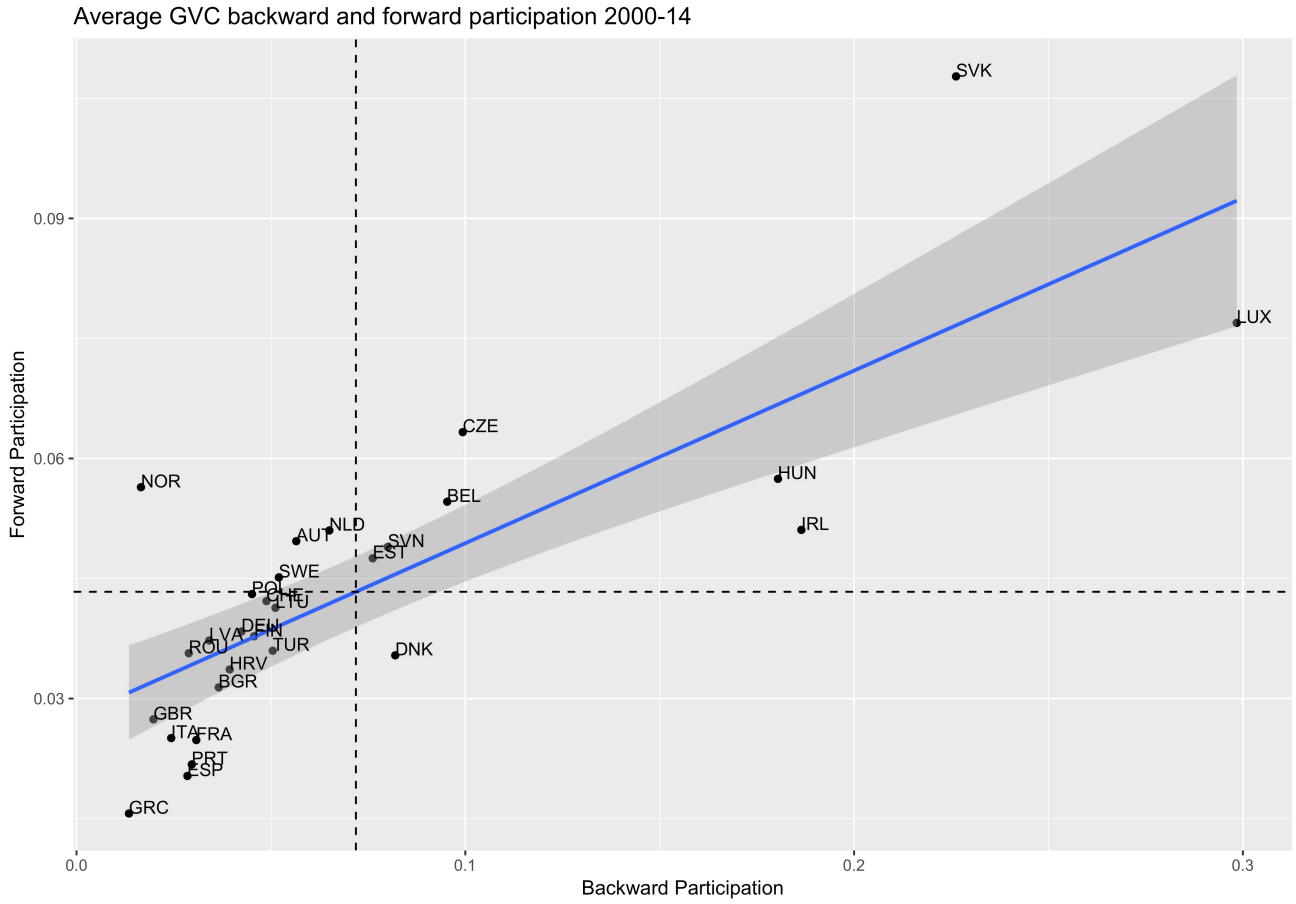


Figure 1.

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.

Source: authors' own calculations on WIOD.

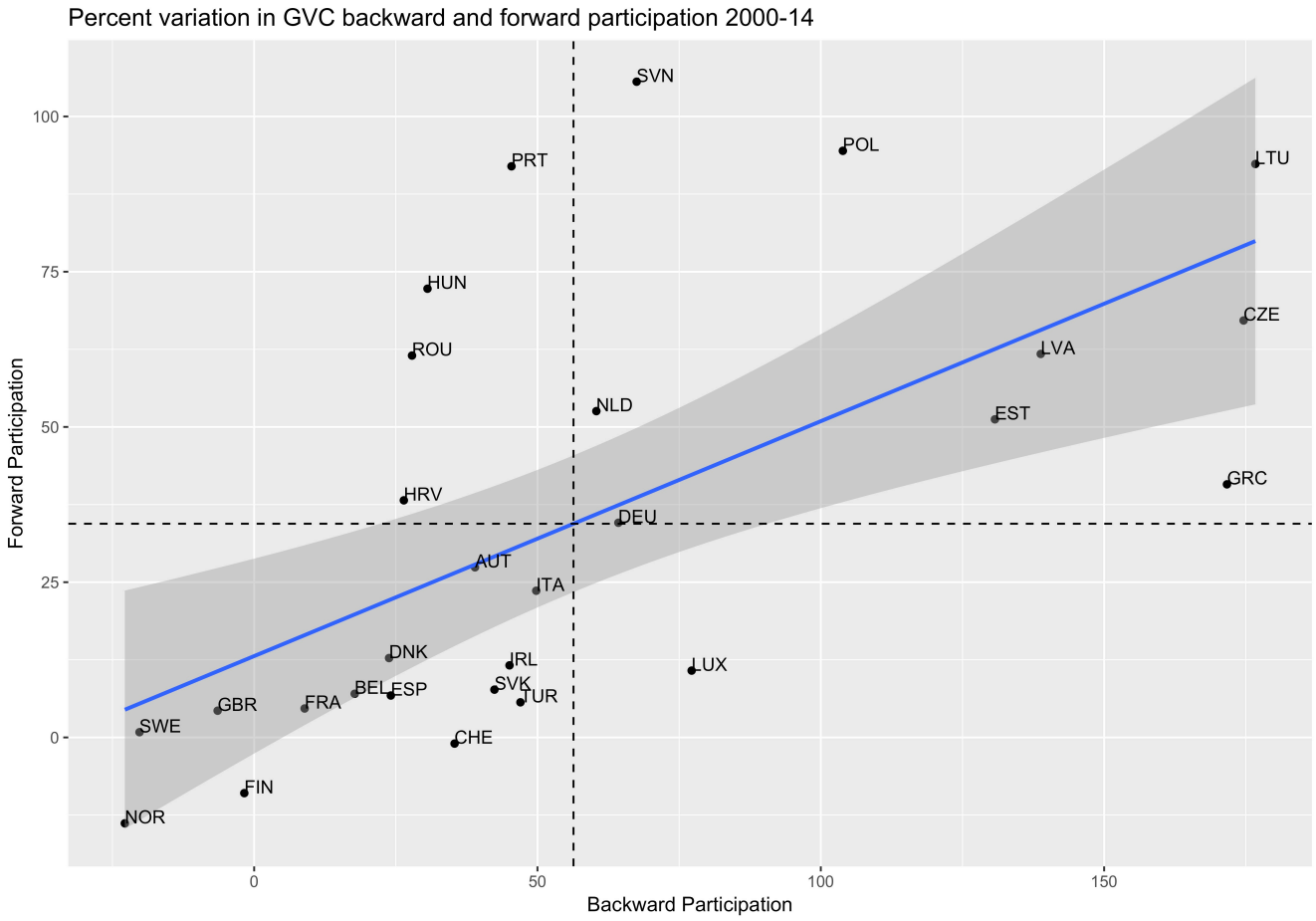


Figure 2.

Note: the figure plots percentage changes in backward and forward participation in GVCs as a share of total value added produced by countries over the 2000-14 period. The blue line is the line of best fit with the interval of confidence.

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 EU 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 EU countries are characterized by different levels of integration in GVCs even if most of them show levels of the two indexes above the mean. The largest Eastern EU member, Poland, shows a level of integration similar to the German one 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 exporting 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 dynamics in forward participation – i.e. their intermediate inputs are further exported by third countries, including Poland, Slovenia, Hungary, 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 Czech Republic are among those countries showing a higher than average dynamics 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 experienced by most Eastern European countries and in particular by Bulgaria (not shown in the figure being an extreme outlier), the Baltic republics, Czech Republic, Slovenia and Poland. Some of them have shown a more "forward" dynamic pattern of integration (Slovenia and Poland), others have pursued a pattern of integration intensifying the backward linkages much more than the forward ones. The five largest and more advanced EU countries have shown a much lower dynamics of the indexes with Germany (and the Netherlands) performing better 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.

3.3. Sectoral upgrading in GVCs

European countries show very heterogeneous patterns of integration in GVCs, which emerge when distinguishing between (total) integration in high tech manufacturing and KIBS GVCs. In particular, the shares, in domestic value added embodied in foreign exports (forward participation) and in foreign value

added embodied in domestic exports (backward participation), of High-technology manufacturing industries and Knowledge intensive business services and their changes over the 2000-14 period are examined.

Given the high correlation between the forward and backward linkages, two aggregate indexes of integration are computed, the first one referring to the overall high-tech manufacturing share in total participation in GVCs (HTSH), the second one measuring the KIBS share in total participation in GVCs (KIBSSH). The two indexes can be used as a proxy of 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 of upgrading and downgrading in GVCs, where an increase in the shares of KIBS or HTM in the total integration would indicate sectoral and functional upgrading in the processes of integration, regardless of whether this concerns backward or forward participation. They allow therefore 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 GVC. 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 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 and KIBS components in both forward and backward flows.

Figure 3 shows the average values and change of the HTSH index. Very large cross countries differences exist between the average levels of the index. These differences reflect to some extent differences in the overall technological profile of European economies and in their productive and technological specialization. It is nonetheless worth noting the very high level of the index in the case of Hungary, Czech Republic, Slovakia and Slovenia with values not far from the German one. This implies that the integration of these countries in manufacturing value chains has mainly involved the most qualified component of their production structure and this is in turn likely to be related to a process of integration within the German-wide production network. Processes of upgrading (signalled by a positive change of

the index) have been experienced mainly by Eastern European countries that have probably increased the level of their mutual integration and intensified their productive high tech linkages with Germany. The five largest EU economies (with the exception of Germany), as well as the Scandinavian countries, have on the contrary decreased the share of high tech manufacturing backward and forward flows. It is also worth observing the 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).

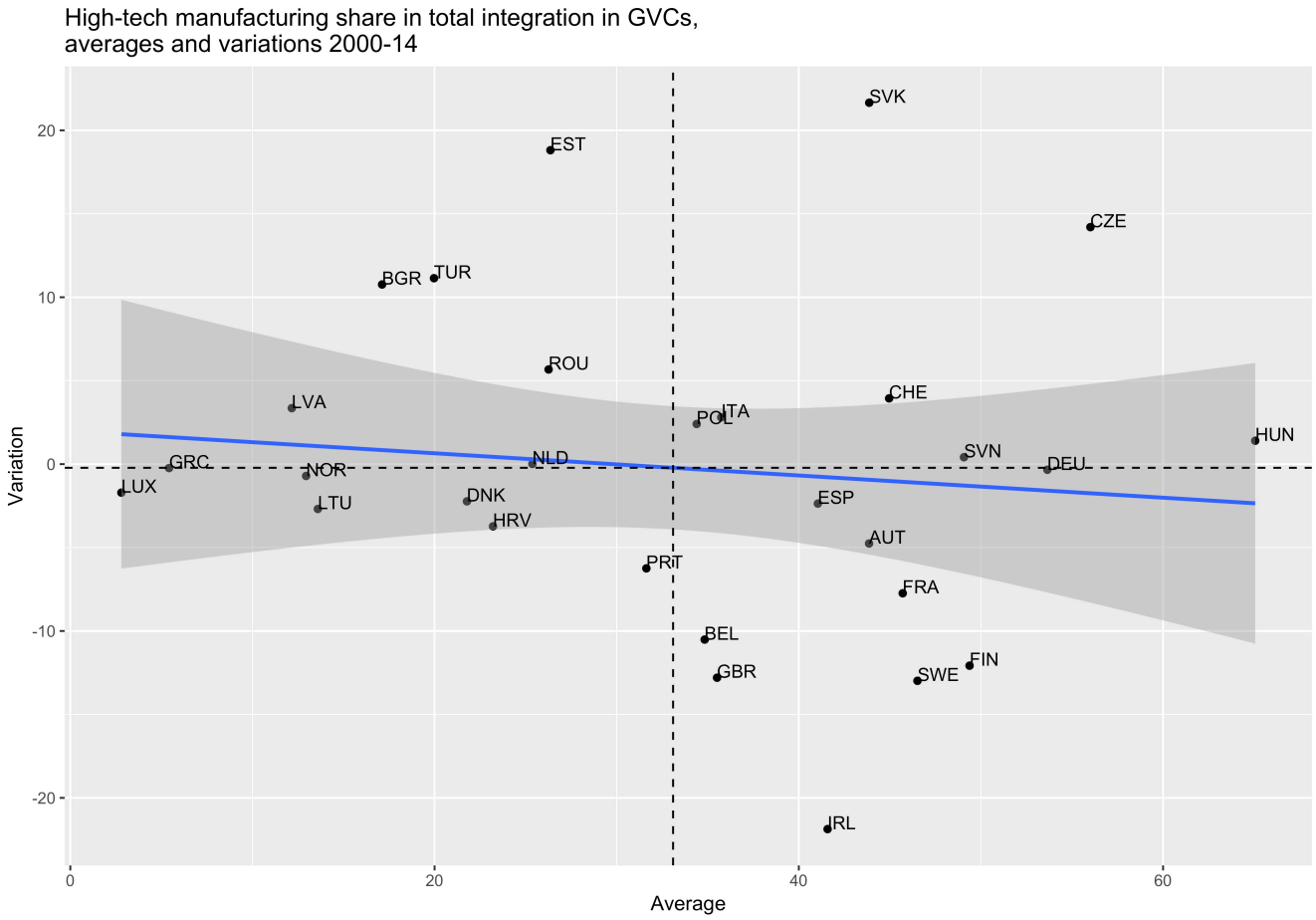


Figure 3.

Note: for high-tech manufacturing shares in GVC integration, the figure plots the average against the variations over the 2000-14 period. The blue line is the line of best fit with the interval of confidence.

Source: authors' own calculations based on WIOD.

Figure 4, referring to the relevance of KIBS in the patterns of integration in GVCs, provides a much more neat 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 tertiarization. Among the countries showing the lowest value of the index can be found most East European countries. In this

respect, it is worth observing that Hungary, Czech Republic, Slovakia and Slovenia, which show shares in high tech manufacturing integration that are close to the German one, have a much lower integration in knowledge intensive business services. What is more interesting is however the positive correlation between the two KIBSSH indexes (averages and changes). This signals a process of increasing divergence in Europe in the capacity of managing and participating in the most high value added and intangible stages of GVCs (R&D, intangible ICTs, Marketing, Post-sales, etc.).

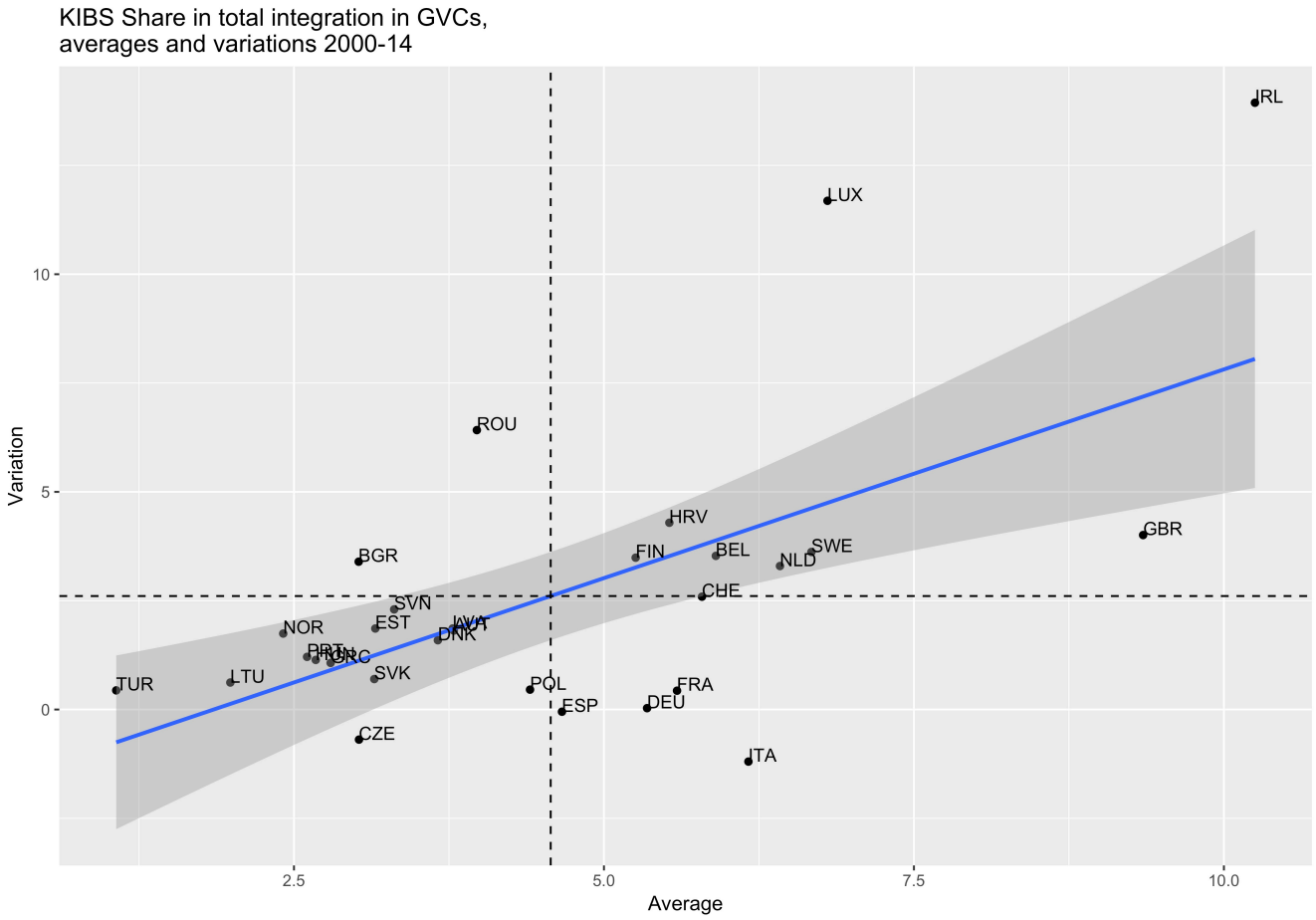


Figure 4.

Note: for KIBS shares in GVC integration, the figure plots the average against the variations over the 2000-14 period. The blue line is the line of best fit with the interval of confidence.

Source: authors' own calculations based 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.

3.4. Employment and sectoral upgrading within GVCs

Is there a relationship between the sectoral patterns of integration examined in the previous section and (changes in) the structural composition of employment? This question is investigated focussing on the two extreme ISCO occupational categories: manual workers and managers (results for clerks and crafts are available on request). The aim is to identify whether there is 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 in unveiling potential sources of employment and skill upgrading that might result from the sectoral upgrading linked to GVC participation and 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 period 2000-14) of the high tech manufacturing share in GVCs participation (HTSSH) and of the KIBS share in GVCs participation (KIBSSH).

The figure also shows for each country the share of managers in total employment (lighter colours corresponding to higher shares of this occupational category).

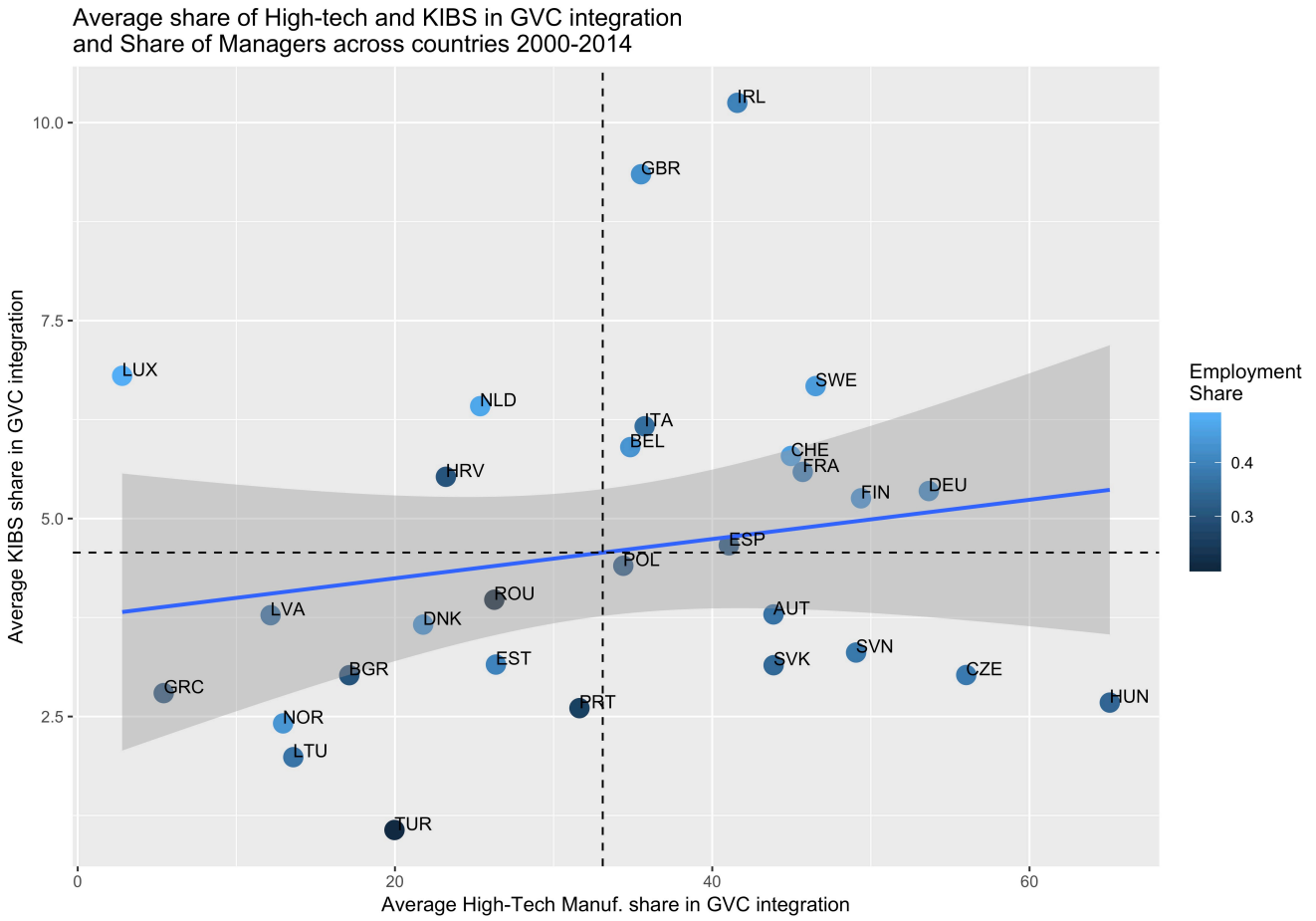


Figure 5.

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 countries going from lower to high and darker to lighter. The blue line is the line of best fit with the interval of confidence.

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 which are much more integrated in services than in manufacturing (Luxembourg, Ireland, the UK) and other countries with the opposite pattern (Hungary, the Check Republic, Slovakia, Slovenia). The figure also shows a positive association between the share of KIBS in total GVC integration and the share of managers in total employment. 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, Check Republic and Slovenia)

show below-average shares of managers in total employment. This suggests that it is possible to be integrated in GVCs producing 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 organizational arrangements 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 on an international scale knowledge intensive tasks for the most labour intensive ones.

The presence of different employment structures associated to 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 index HTSH and KIBSSH respectively and the variation of the share of managers. Figures 8 and 9 replicate the previous two figures taking into account the variation of the share of manual workers in total employment.

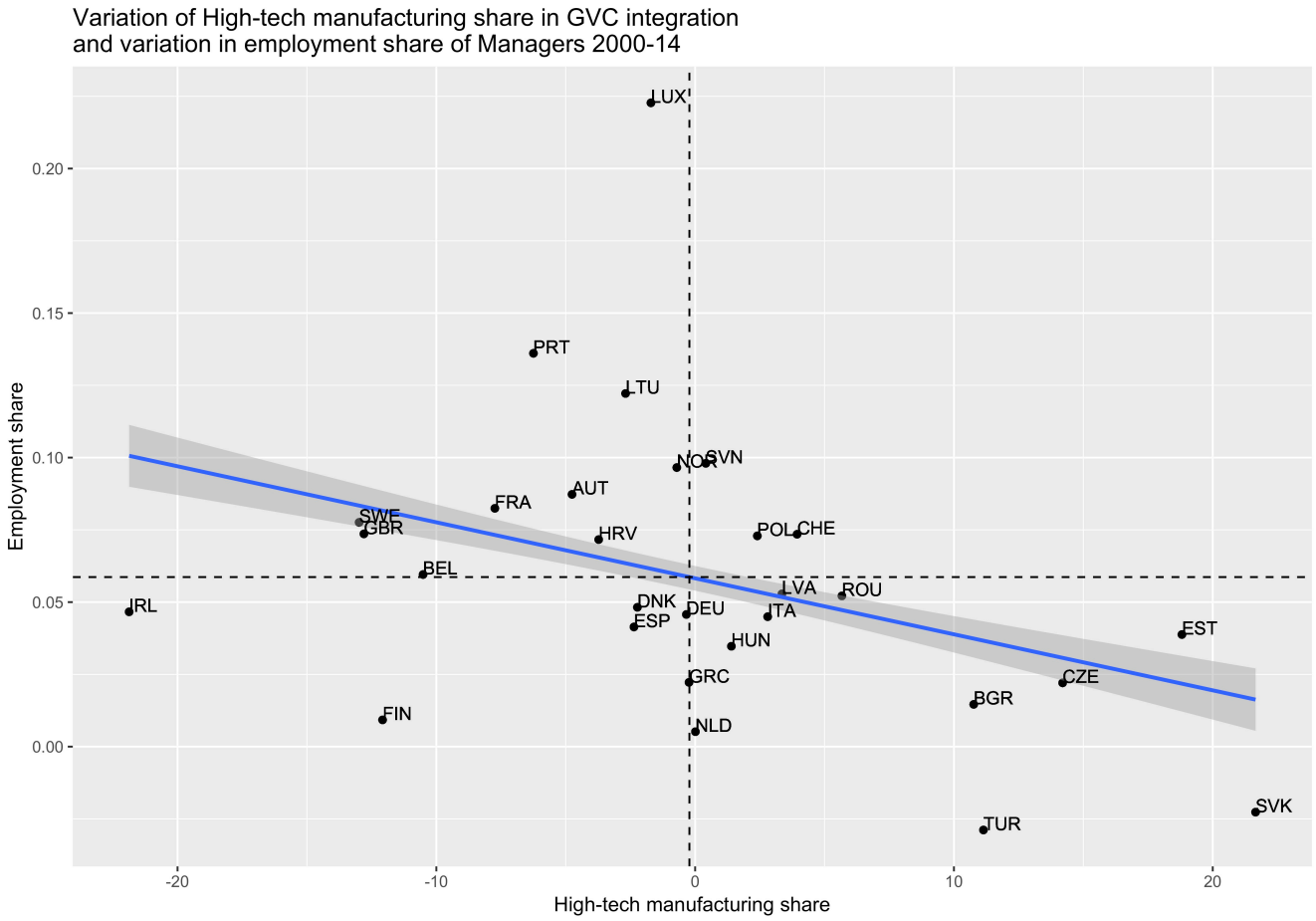


Figure 6.

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.

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

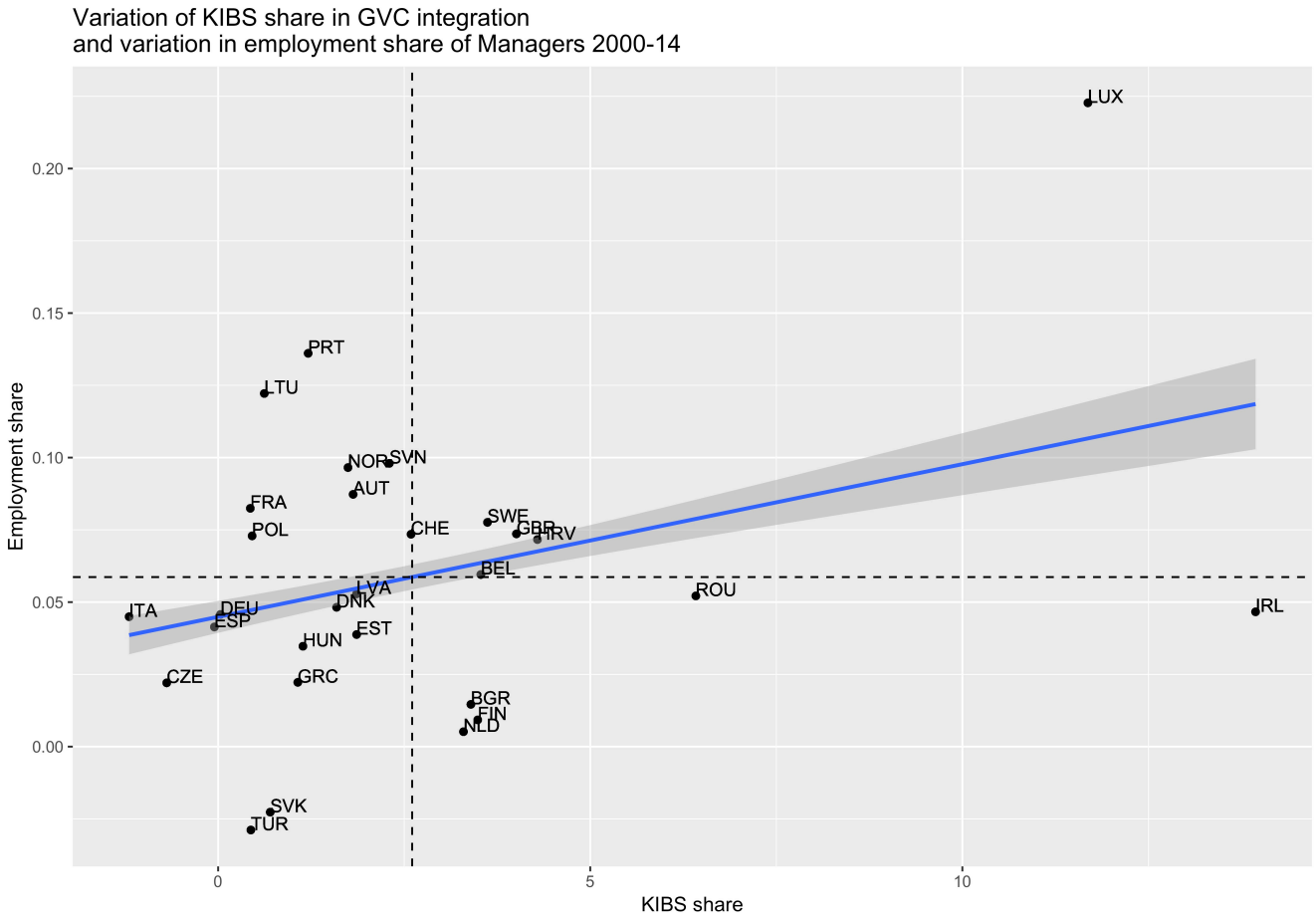


Figure 7.

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

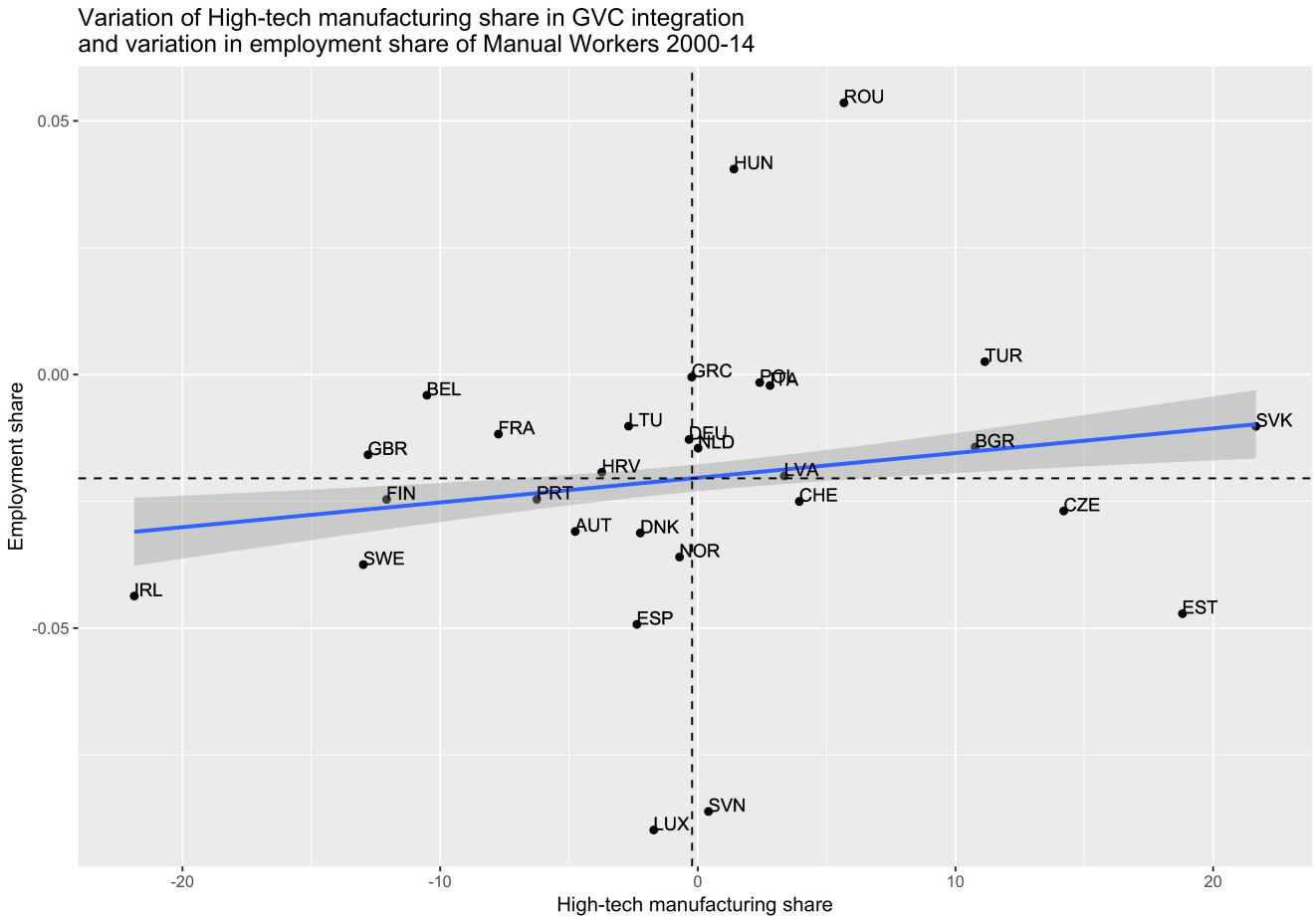


Figure 8.

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.

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

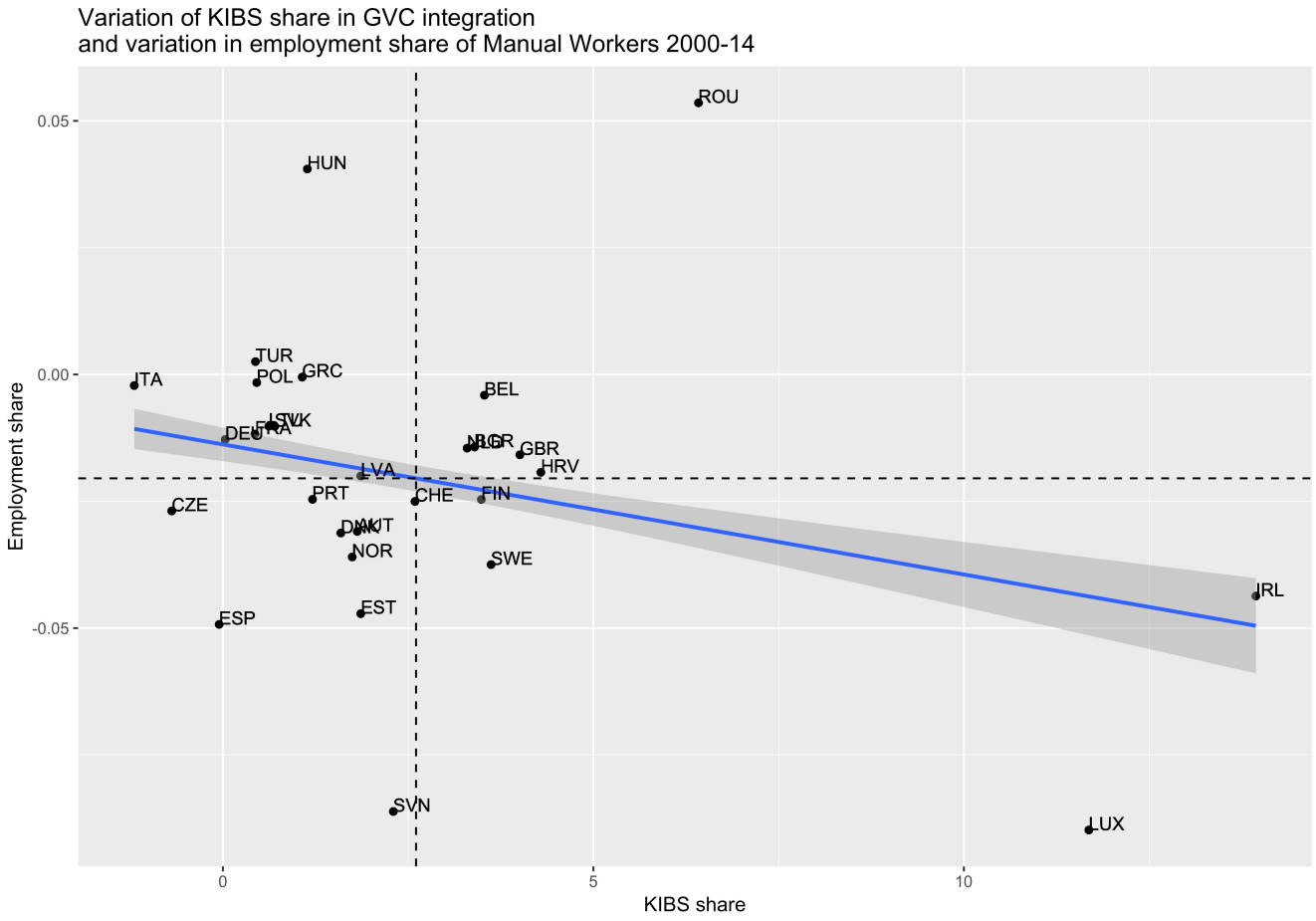


Figure 9.

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.

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 and reduce the share of manual workers to a lower pace with respect to the mean. 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).

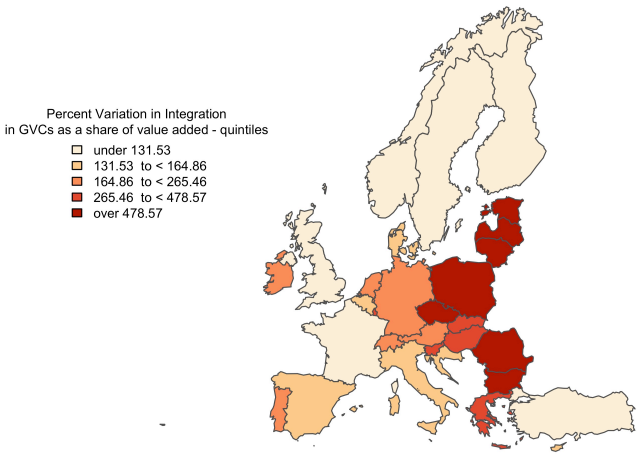
This seems to be a pattern of integration characterizing most Eastern European countries. This evidence hints once again at the possibility that the integration of these countries within the EU value chains has been the result of the delocalization of high-tech stages of production by firms located in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

advanced countries. Probably they have been the least value added and most labour intensive stages of production to be involved in such delocalization processes. These processes of delocalization (offshoring) have not been accompanied by a parallel delocalization or endogenous strengthening of managerial functions.

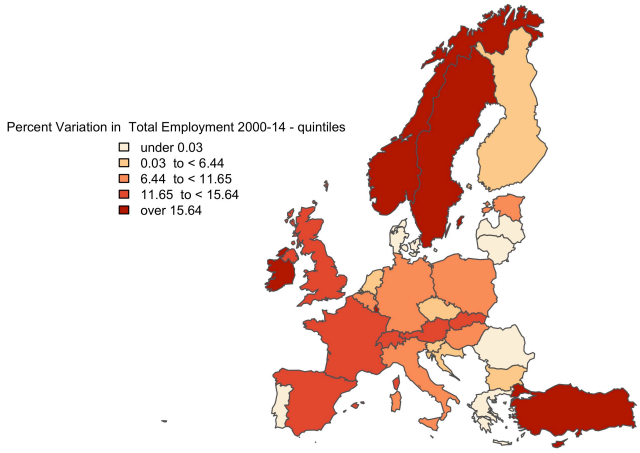
An opposite picture emerges from Figures 7 and 9 relating the dynamics of the processes of international integration in KIBS and changes in the shares respectively of managers (fig. 7) and manual workers (fig. 9). In this case the rate of change of the KIBSSH indicator is positively related to the change 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 specialization and international integration in KIBS require to upgrade the quality of the workforce and to strengthen the managerial and strategic functions associated to the production and delivery of these services, and to the ability of positioning in the high value added stages of global value chains. 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.

3.5. EU 27 dual integration and employment upgrading dynamics

The final issue addressed is the relationship between the dynamics of integration in GVC and the overall dynamics of employment. In particular, it is examined whether the group of countries that over the last fifteen years has increased more consistently its GVC participation (mainly Eastern European countries) has benefitted from such integration process in terms of employment growth or upgrading.



(A)



(B)

Figure 10. Maps A and B.

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

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

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 East European countries that over the period 2000-14 have increased the most the integration in the European manufacturing production network (along with missing a parallel upgrading in human capital has previously shown) have experienced a below the average rate of growth of 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 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-organization 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). Differences between manufacturing and services in the extent to which GVC upgrading is associated to upgrading in human capital is also suggestive of the presence of very different patterns of production fragmentation: firms/countries participating in GVCs controlling pre and post productions stages of GVCs (R&D, Marketing, Post-sales, etc.) and requiring a higher share of skilled labour and managerial functions and firms/countries specialising in manufacturing activities.

4. Concluding remarks

This chapter has looked at patterns of sectoral specialization in processes of GVC integration in Europe and their association to employment upgrading. The selected literature review has shown that, while contributions on the effects of offshoring on employment are relatively more numerous and established, most especially on developed countries, much less has been found on the link between employment and

sectoral/technological patterns of integration in GVCs. This is particularly the case even in relatively homogenous regional contexts such as the EU.

The aim of the empirical exploration was therefore to identify whether differences in the sectoral and technology/intangible capital intensity patterns of international fragmentation (i.e. whether high technology manufacturing or KIBS) are associated to differences in the occupational categories that have benefited or being penalized by these trends and whether this could have contributed to a potential, further source of unbalances in Europe over the last fifteen years.

Overall, the multidimensional nature of processes of GVC integration shows that 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 high tech share of manufacturing in GVC integration. This however has been accompanied by a decrease in the share of manual workers (and of overall employment), not compensated by an increase in the share of managers (although there is some sign of integration in high tech associated to an increase in the share of clerks). Instead, western European countries have increased integration in KIBS and this is associated to an increase in their share of managers. Overall integration has not favoured convergence in employment.

The take away message is that this dualistic integration and its consequences in terms of employment recomposition seem to be driven by the difference between integration in the (high tech) manufacturing stages 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 – where the new 'periphery' are indeed qualified 'factories' economies, that might have upgraded their trade specialization from low to high tech manufacturing, without necessarily experiencing a parallel upgrading in terms of employment.

While the study has not explicitly looked at micro-level evidence that highlights issues of asymmetries in governance, as pointed out by Kaplinsky in various contributions and recalled earlier, the results support the views that cautiously warn against GVC integration as a potential, further sources of growth divergence and employment polarization across developed and emerging countries globally. When it comes to Europe, the findings also support the claims that processes of hierarchical re-organization of production chains among geographically identifiable areas. A similar duality between the core countries that experience increases in high-skill employment as a consequence of the expansion of more complex activities, and peripheral countries rather 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 bear in mind that this empirical contribution does not attempt to identify causal relationships. Nonetheless, the descriptive picture provided in the chapter calls for some caution on the positive effect of integration in GVC in general. In the case of European countries, the focus here, it seems to reproduce and perhaps exacerbate the initial asymmetries in the sectoral and employment structure, with manual workers occupation reducing overall and knowledge intensive occupations concentrating in western Europe. It seems therefore that, despite the relatively "good quality" of integration of EE countries, the evidence presented does not seem to reveal a mirroring 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.

Anderton, R., Brenton, P. (1999) Outsourcing and low-skilled workers in the UK. *Bulletin of Economic Research*, 51(4), pp. 267–285.

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.

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.

Belderbos, R. et al. (2016) "Where to Locate Innovative Activities in Global Value Chains: Does Co-location Matter?", OECD Science, Technology and Industry Policy Papers, No. 30, OECD Publishing, Paris.http://dx.doi.org/10.1787/5jlv8zmp86jg-en

Bramucci, A., Cirillo, V., Evangelista, R., Guarascio, D. (2017) Offshoring, industry heterogeneity and employment, *Structural change and economic dynamics*, on-line: https://doi.org/10.1016/j.strueco.2017.09.002)

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

Cohen, W.M. (2010) Fifty Years of Empirical Studies of Innovative Activity and Performance, in Hall, B. H., Rosenberg N. (Eds.), Handbook of the Economics of Innovation, 129-213, North-Holland, Elsevier, Amsterdam.

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.

De Backer, K., Miroudot S. (2013) Mapping Global Value Chains, *OECD Trade Policy Papers*, 159, 1–46.

De Backer, K., Flaig, D. (2017) The Future of Global Value Chains: Business as usual or "a new normal ?", *OECD Science, Technology and Industry Policy Papers*, No. 41, OECD Publishing, Paris. http://dx.doi.org/10.1787/d8da8760-en

De Backer, K., DeStefano, T., Menon, C., Ran Suh, J. (2018) Industrial robotics and the global organisation of production, OECD Science Technology and Industry Working Papers 2018/03.

Dedrick, J., Kramer, K.L., Linden, G. (2010) Who Profits from Innovation in Global Value Chain? A Study of the iPod and Notebook PCs, *Industrial and Corporate Change*, 19, 81-116.

Dosi, G., Freeman, C., Nelson, R., Silverberg, G., Soete, L. (Eds.) (1988) Technical Change and Economic Theory, Pinter Publisher, London.

Dosi, G., Pavitt, K., Soete, L. (1990) *The Economics of Technical Change and International Trade*. New York University Press, New York.

Dosi, G., Grazzi, M., Moschella, D. (2015) Technology and costs in international competitiveness: From countries and sectors to firms. *Research Policy*, 44, 1795-1814.

Durand, C., Milberg, W. (2018) Intellectual Monopoly in Global Value Chains, The new school for social research, Working Paper 07.

Egger, H., Egger, P. (2003) Outsourcing and skill-specific employment in a small economy: Austria and the fall of the Iron Curtain. *Oxford Economic Papers*, 55, 625–643.

Ekholm, K. and Hakkala K. (2006) The effect of offshoring on labour demand: evidence from Sweden. CEPR Working Paper No. 5648.

Everatt, D., Tsai, T., Chang, B. (1999) The Acer Group's China manufacturing decision, Richard Ivey School of Business Case Series #9A99M009, University of Western Ontario.

Fagerberg, J. (1994) Technology and International Differences in Growth Rates. *Journal of Economic Literature*, 32, 1147-75.

Falk, M., Wolfmayr, Y. (2008) Services and materials outsourcing to low-wage countries and employment: empirical evidence from EU countries. *Structural Change and Economic Dynamics*, 19(1), 38–52.

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.

Foster-McGregor, N., Pöschl, J. and Stehrer, R. (2016) Offshoring and the elasticity of labour demand. *Open Economies Review*, 27(3), 515–540.

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.

Geishecker, I. (2006) Does outsourcing to central and Eastern Europe really threaten manual workers jobs in Germany? *World Economy*, 29(5), 559−583.

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

Grossman, G., Rossi-Hansberg, H. (2008) Trading tasks: a simple theory of offshoring. *American Economic Review*, 98(5), 1978–97.

Grossman, G. and Rossi-Hansberg, H. (2012) Trade Tasks between Similar Countries. *Econometrica* 80(2): 593–629.

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*.

Jona, C., Meliciani, V. (2018) "Productivity growth and international competitiveness: does intangible capital matter?". *Intereconomics*, 2, 58-62.

Kaldor, N. (I978) The effect of devaluations on trade in manufactures, In Further Essays on Applied Economics. London: Duckworth, 99-118.

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

Kaplinsky, R. (2013) *Global Value Chain, Where They Came From, Where They Are Going and Why This Is Important*. Innovation, Knowledge and Development Working Paper 68 (November).

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

Laursen, K., Meliciani, V. (2010) The Role of ICT Knowledge Flows for International Market Share Dynamics, *Research Policy*, 39, 687-697.

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* (forthcoming).

Maggi, B. (2017) A technology-based countries-interaction dynamic model for the study of European growth and stability: Were there the conditions for convergence? *Technological Forecasting and Social Change*, 125, 275-288.

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, OECD Publishing, Paris. http://dx.doi.org/10.1787/5jm5dcz2d26j-en.

McCann, P., Mudambi, R. (2005) Analytical differences in the economics of geography: the case of the multinational firm, *Environment and Planning A*, 37(10), 1857–1876.

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.

Minondo, A., Rubert, G. (2006) The effect of outsourcing on the demand for skills in the Spanish manufacturing industry. *Applied Economics Letters*, 13(9), 599−604.

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

Mudambi, R. (2007) Offshoring: economic geography and the multinational firm. *Journal of International Business Studies*, 38, p. 206-210.

Mudambi, R. (2008) Location, control and innovation in knowledge-intensive industries. *Journal of Economic Geography*, 8, 699–725.

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.

Posner, M.V. (1961) International trade and techical change. *Oxford Economic Papers*, 13, 323-341.

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. http://archivo.cepal.org/pdfs/cdPrebisch/002.pdf

Shin, N., Kraemer, K.L., Dedrick, J. (2009) R&D, value chain location and firm performance in the global electronics industry, *Industry and Innovation*, 16, 315–330.

Shin, N., Kraemer, K.L., Dedrick, J. (2012), Value Capture in the Global Electronics Industry: Empirical Evidence for the 'Smiling Curve' Concept. *Industry and Innovation*, 19, 89-107.

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

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. http://documents.worldbank.org/curated/en/450521467989506537/Making-global-value-chains-work-for-development.

Timmer, M.P., Los B., Stehrer, R., de Vries, G.J. (2014). Slicing Up Global Value Chains, *Journal of Economic Perspectives*, 28, 99-118.

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.

World Bank (2017), Measuring and analyzing the impact of GVCs on economic development, Global value chain development report 2017, International Bank for Reconstruction and Development/The World Bank, Washington DC

Appendix

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

$$V'BF$$

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 is used which is a vector with foreign final demand (i.e. export of finished products and services) for each country and sector. 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' it is obtained:

$$V'B_fF_x'$$

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 the equation:

$$V'B_fF_x'$$

Which, in a case with three countries A, B and C is equal to:

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

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

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

B_f is the off-diagonal block matrix, for clarity's sake in the equations above the full B matrix is reported but the elements that have been excluded from the B_f matrix are have 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 embodied again in electrical components, which are then assembled in a car in Croatia and finally sold onto the German domestic market for cars. 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 export in car (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 Chapter, 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 domestically produced (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, Check 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, Turkey – Malta and Cyprus are also available in the dataset but appear to be outliers and therefore omitted from the analysis to ensure graphics' readability.

The choice of the sectors follows a classification put forward by Eurostat on the division of sectors of the NACE rev.2 classification at the 2 digit level. In the analysis both high- and medium-high-tech services are considered, in order not to rely on the only two sectors (C21 and C26) 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. This study focuses only on the IT and computer based services and the M section (which is consistent with Eurostat definition of KIBS). The WIOD data have, generally speaking a 2 digit level of disaggregation, but in certain 2-digit NACE sectors are lumped together in the WIOD. When this is the case, it is pointed 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 following Cirillo et al. (2018)

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

Source: Cirillo et al. (2018)

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