Where Global Value Chains go local: EU regions, global value chain creation and local upgrading

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ABSTRACT

This Report aims to support the development of a wider evidence base to help the EU Cohesion Policy in dealing with new opportunities and challenges associated with global connectivity and the (re)configuration of Foreign Direct Investment (FDI) networks and Global Value Chains (GVCs). The discussion will focus on the regional dimension of three "value-chain sensitive sectors": Electronics, Automotive, and Textile and Apparel (T&A).

The Report is organised around three main sections.

First the critical review of the existing scholarly and policy literature makes it possible to present in a systematic and critical manner the structure of these value chains and their organisation in more narrowly defined sub-chains with distinctive geographies. It also uncovers the role of different types of firms and regions with particular attention to their technological and employment footprint.

Second, the Report offers a quantitative description of the three GVC-sensitive sectors as a basis for the identification of the key actors/firms involved in the chains and their geography. The Report also explores the links between GVC indicators and regional indicators based on FDI, in order to unveil the heterogeneous subnational geography of various GVC functions.

Third, the Report sketches a set of conceptual, methodological, and operational requirements for future GVC-specific territorial studies, combining quantitative and qualitative insights, the best use of existing data and the collection of new information to offer solid foundations for new Cohesion Policy interventions in this area.

1. INTRODUCTION

The purpose of this Report is to support the development of a wider evidence base to help the EU Cohesion Policy in dealing with new opportunities and challenges associated with global connectivity and the (re)configuration of Foreign Direct Investment (FDI) networks and Global Value Chains (GVCs). The 2021-2027 Cohesion Policy includes new dedicated instruments specifically focused on GVCs to foster the ability of EU regions to build, embed and (ideally) reshape European value chains. However, the knowledgebase to support this new generation of "internationally open" regional policies remains limited. Detailed work on specific GVCs in Europe remains patchy and its regional and local dimension is often limited. Conversely, the scant literature with a local perspective is often based on limited case studies, lacking in generality and external validity. This makes it difficult to inform solid evidence-based public policies.

This Report leverages the insights offered by Comotti et al. (2020) (compiled for the European Commission) and aims to offer new insights and guidance on how to consolidate and expand the existing knowledge on the regional dimension of three "value-chain sensitive sectors" identified by the literature as Electronics, Automotive, and Textile and Apparel (T&A) (OECD, 2017; Sturgeon & Memedovic, 2010). For this purpose, the Report will take a three-pronged approach.

First, the Report offers a critical review of the existent scholarly and policy literature on a set of GVCs of special interest to the EU and its regions with reference to the "value-chain sensitive sectors" mentioned above. The discussion of the literature makes it possible to present in a systematic and critical manner the structure of these value chains and their organisation in more narrowly defined sub-chains with distinctive geographies. It also uncovers the role of different types of firms and regions with particular attention to their technological and employment footprint. Methods and data used for the analysis of GVCs are also reviewed and discussed, with special reference to different geographical scales.

Second, the Report offers a quantitative description of the three GVC-sensitive sectors as a basis for the identification of the key actors/firms involved in the chains and their geography. The Report also explores the links between GVC indicators and regional indicators based on FDI, in order to unveil the heterogeneous subnational geography of various GVC functions. The analysis is based on the combination of different data sources such as the OECD's FATS and AMNE databases, Eurostat's REGIO and FT fDiMarkets.

Third, considering the conceptual and empirical gaps identified in the qualitative and quantitative discussions, the Report sketches a set of conceptual, methodological, and

operational requirements for future GVC-specific territorial studies. The proposed approach to the design and implementation of these studies is theory-driven and aims to identify a full set of requirements for future GVC-specific mixed methods analyses able to combine quantitative and qualitative insights, the best use of existing data and the collection of new information to offer solid foundations for new Cohesion Policy interventions in this area.

The structure of the Report follows the logic outlined above. Section 2 includes the systematic review of the academic and policy literature on the selected GVC-sensitive sectors. Section 3 offers a critical discussion of the main quantitative indicators to describe these sectors in Europe and – with reference to FDI – its regions. Section 4 presents the logic and methodology for the future mixed methods studies. Section 5 concludes. A Compendium and an Appendix are also included and constitute important sources of reference material that underpins the present Report, forming relevant steppingstones for future GVC-specific mixed methods studies.

2. GVC-SENSITIVE SECTORS: A SYSTEMATIC REVIEW OF THE ACADEMIC AND POLICY LITERATURE

2.1. How to identify the key literature: the design of the systematic literature review

The first key step in the construction of a set of theory-driven case studies on GVC-sensitive sectors designed to inform regional development policies is a comprehensive and critical review of the existing academic and policy literature that has focused on the three sectors designated by the literature as "GVC-sensitive" (OECD, 2017; Sturgeon & Memedovic, 2010) and selected as the focus of this Report: Electronics, Automotive, and Textile and Apparel. The systematic literature review (SLR) will not only take stock of the current "state-of-the-art" knowledge on the three sectors but will also make it possible to highlight the extant limitations in the field for the identification of a future research agenda and the requirements for GVC-specific case studies at the regional level.

The rationale behind SLR is to gather, analyse, and synthesise a large body of literature in a systematic fashion (Denyer & Tranfield, 2009; Tranfield et al., 2003). This is based on an explicit and codified methodology to ensure that relevant literature is: 1) included in the review; 2) properly assessed for its "quality" (i.e., excluding non-relevant documents); and 3) examined with the purpose of extracting its key features (Khan et al., 2003). A SLR should be based on a replicable research protocol to collect, code, and analyse existing information

(Kupiainen et al., 2015). To capture the breadth of the GVC literature on three focal industries, both academic and policy work should be covered, as well as a sample of the most influential academic articles published on other industries organised in GVCs.

The search was conducted in three different steps. First, academic papers on the selected sectors were retrieved from the Scopus database, which has an extensive coverage of high-quality articles in top-tier journals by international and cross-disciplinary scholars. Additionally, Scopus has been used in recent academic research aimed at analysing the GVC literature (e.g., De Marchi et al., 2020). Target documents were first retrieved using a research query that included only journal articles (i.e., excluding books, conference proceedings and reviews) written in English as these can be accessible at international level and therefore be more influential in the academic literature. Following Tranfield et al. (2003), initial search terms were compiled based on prior scoping of the literature and consultation within the research team. Each query string included the terms "Global Value Chain" or "Global Commodity Chain (GCC)" (the most common terminology for academic papers published before 2005), in addition to synonymous words pertaining to each sector under investigation (e.g., automobile, automotive, auto; apparel, garment, textile, clothing, footwear, leather; electronics, electronical, electrical). The query strings were searched in the title, abstract or keywords of academic papers published from 1994 to 2021. The starting year was selected to focus on relevant publications on the GVC/GCC frameworks relevant for contemporary debates. The search was conducted in the spring and summer 2021.

The query initially produced a base sample of 423 journal articles. First, all abstracts were checked to ensure relevance with respect to the scope of the research. The final database of GVC papers on the three selected industries included 187 articles dated between 1994 and 2021 (34 on electronics; 47 on automotive; 106 on textile and apparel). Second, all policy works on the three GVC-sensitive sectors were retrieved from the Duke University Global Value Chains Initiative, which provides a repository of publications related to GVCs. This resulted in 20 additional works on the three GVC-sensitive sectors. Third, the most seminal and influential GVC academic works on other sectors has also been included in the sample in order to strengthen the SRL. To do this, the same search performed in the first step has been replicated by restricting the query string to the generic terms "Global Value Chain" OR "Global Commodity Chain", and only searching for papers with more than 30 citations. This new search yielded a sample of 300 journal articles. Only 43 papers focusing on specific sectors were kept in the analysis (see section C2 of the Compendium). This resulted in an overall final sample of 250 works to be included in the SLR: 187 academic papers and 20 policy works on the electronics, automotive, and textile and apparel industry, as well as 43 influential academic papers on other sectors.

The 250 works were manually coded. Each article/policy report was read in full, recording details of each work's theme, sub-sectoral scope, type of research methodology, and geographic focus. Whether each work was aimed at analysing a particular shock was also recorded. Reference to the Global Production Networks (GPNs) framework[1] (e.g., Coe et al., 2004; 2008) was also accounted for and coded. The GPN approach is widely used in the economic geography literature on the international division of labour and is particularly relevant in the case of the globalised electronic industry (e.g., Ernst, 1997). Bibliographic information for each work was gathered through the Scopus database to combine the results from the manual coding with data on the number of papers published over time, authors, and type of journals.

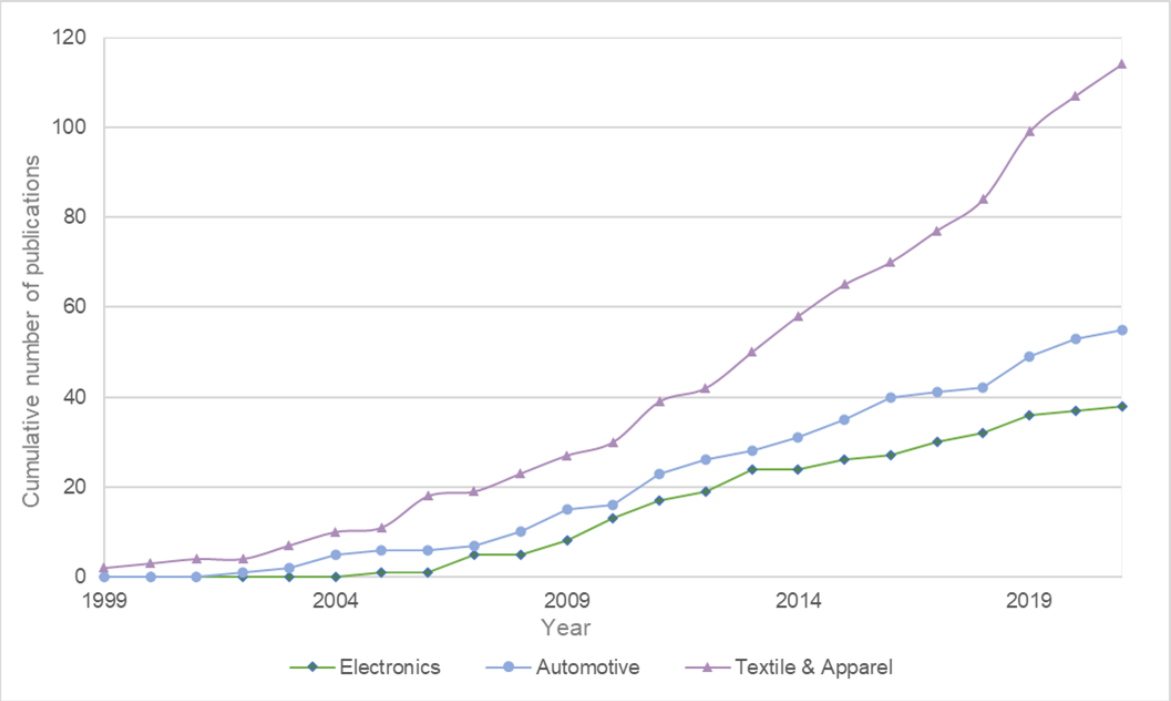
2.2. The existing literature: Objectives, research methods, and geographical coverage

Figure 1 shows the cumulative number of distinct works published over time on the three GVC-sensitive sectors. The first sectoral study in our sample was published by Gary Gereffi in 1999 in the Journal of International Economics. This was aimed at exploring the social and organizational dimensions of international trade networks, drawing upon a GCC perspective, and focusing on the apparel industry in Asia. Amongst the three sectors under investigation, T&A is the subject of the higher number of studies (N=114). Conversely, a relatively lower number of papers have investigated Electronics (N=38) within the GVC framework, possibly due to the wide coverage of this industry in the GPN literature since the late 1980s. However, the attention of GVC research for this industry has been growing over the last decade, when approximately 80% of total studies on this sector have been published. Similarly, the automotive industry – the focus of 55 GVC-related works – has grown in importance amongst researchers starting from the 2008/2009 economic and financial crisis, which has profoundly affected GVCs in all industries. Indeed, when studying the automotive GVC, significant attention has been devoted to the Great Recession, in addition to the impacts of market liberalisations, as well as the more recent UK Brexit and the implication of the transition to electric vehicles. The only type of shock explored in the electronics GVC was the economic crisis, accounting for 5% of works on this sector. The analysis of shocks in T&A, in addition to the economic recession, pointed to the consequences and GVC structural adjustments

[1] Compared to GVCs – that place more emphasis on the structure of industry-specific value chains and focus particularly on value creation, tasks, and the governance of inter-firm transactions – GPNs aim at incorporating all kinds of network configurations with a broad inter-industry view, by giving more relevance to the management of intra-firm relationships. Because of the type of data and analyses adopted in the empirical part of this Report, we decided to focus our systematic literature review on GVCs rather than GPNs, however highlighting the number of works adopting a combination of the two approaches.

following the abolition of the MFA quotas, while a few recent works looked at the implications of both Brexit and the Covid-19 pandemic.

Figure 1: Cumulative number of publications on GVC-sensitive sectors: Electronics, Automotive, and Textile & Apparel (by year of publication)



Source: Authors' elaboration on Scopus data.

Turning to the main topics addressed in the sample of studies under analysis, works on the electronics industry mostly looked at technological learning, upgrading and innovation along the GVC, with a focus on the relations between lead firms and suppliers, as well as their role and level of performance (e.g., Bae, 2011; Hobday & Rush, 2007; Kadarusman & Nadvi, 2013; Raj-Reichert, 2020). Some studies pointed out the complexity of this GVC by investigating its main characteristics, structure, governance, value-creation, organisational models, and spatial dynamics (e.g., Frederick & Gereffi, 2013; Shin et al., 2012; Sturgeon & Kawakami, 2011). Other works explored the participation of countries, regions, and firms in the GVC and the main implications (e.g., Ngoc & Binh, 2019; Plank & Startitz, 2013; Torsekar & Verwey, 2019). As concerns sub-sectors, most works focused on the electronics industry in general, while a few studies examined the consumer electronics industry, particularly computers.

Works on the automotive industry mostly addressed industrial upgrading, particularly of suppliers in developing countries, the role of industrial policies for the promotion of national automotive production, as well as innovation, technological capabilities and R&D activities and their role in GVC participation and upgrading (e.g., Bailey et al., 2019; Khan et al., 2015; Pavlínek et al. 2009; Pavlínek & Ženka, 2011; Sturgeon et al., 2009; Wad, 2008). Moreover,

some studies explored value chain governance, configuration, and value creation, as well as the effects of interactions between key GVC actors, in addition to strategies adopted by the main players in the industry (e.g., Castelli et al., 2011; Mohamad & Songthaveephol, 2020; Özatağan, 2011). Others investigated the role and position of developing and emerging countries in global production and consumption, as well as key features, challenges, and trends in the industry (e.g., Holweg et al., 2009; Sturgeon et al., 2008; Sturgeon & Van Biesebroeck, 2011). Several studies looked at regional development processes associated with automakers, the intersection between globalisation and regionalisation in the industry, and the way global, national, and regional value chains are nested for the creation of distinctive patterns of global integration (e.g., Colovic & Mayrhofer, 2011; Sturgeon et al., 2009).

Turning to T&A, many works focusing on this sector from a GVC perspective examined the evolution, configuration as well as economic and social upgrading of the industry in both developing and emerging economies, with a focus on competitiveness and governance structures, value creation, spatial dynamics, and trends, including the extent of backward and forward integration in the GVC (e.g., Azmeh & Nadvi, 2014; Crinis, 2012; Fernandez-Stark et al., 2011; Frederick & Gereffi, 2011; Frederick & Daly, 2019; Goger, 2013a; Hassler, 2004; Rahman & Sayeda, 2016). Some studies looked at the relation between economic upgrading and working conditions and rights, in addition to opportunities for environmental upgrading (e.g., Anner, 2020; Goger, 2013b; Khan et al., 2020; Khattak et al., 2015; Pasquali & Godfrey, 2021; Selwyn et al., 2020). The impact of technologies as well as of trade policy changes on firms' participation and upgrading into the GVC were the focus of several studies, while others investigated the geography of trade and production in the industry (e.g., Bair, 2006; Curran & Nadvi, 2015; Morris et al., 2016; Pickles et al., 2015). In terms of sub-sectoral focus, most works explored the apparel industry (73%), whereas 11% of studies also included the textile segment, which was however investigated alone by 5% of publications in the sample. A few studies analysed the footwear (8%) and leather goods (3%) sectors.

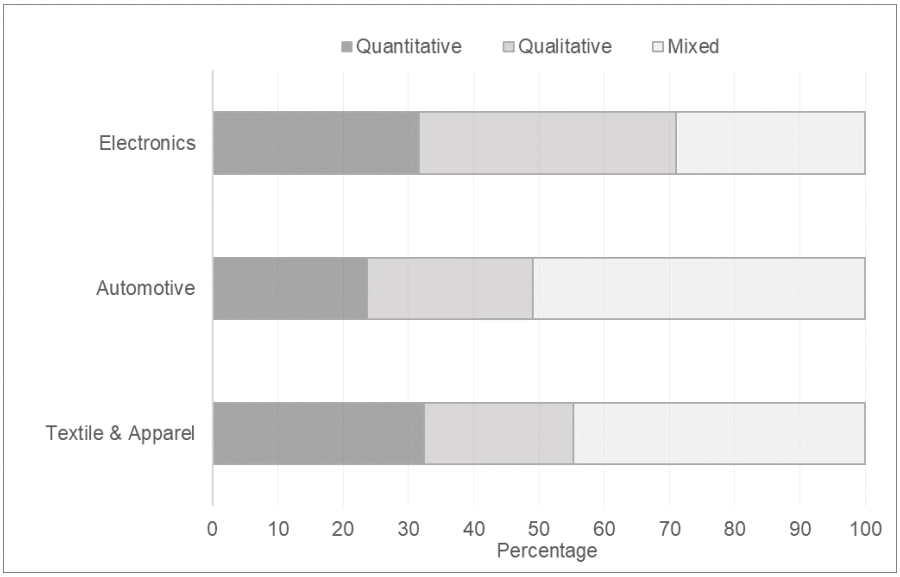
In terms of research methodologies (Figure 2), electronics, in comparison with the other industries, has a higher share of studies adopting a qualitative approach and a lower portion of works drawing upon mixed methods. For data collection methods (Figure 3), researchers focusing on this industry mostly drew upon interviews with key actors in the GVC (e.g., firms' managers or founders, government officials, representatives from public agencies, business associations or trade unions, sector experts) and secondary data such as official statistical sources (particularly trade statistics data), government data, business and commercial books, journals and newspapers, financial reports, companies' reports and websites. Approximately 19% of works relied upon the case study method, while 12% originally collected data from postal and electronic surveys. Official statistics sources mostly included the United Nations

Commodity Trade Statistics Database (UN COMTRADE), US International Trade Commission (USITC), OECD Trade in Value Added (TIVA), the CEPII Comptes Harmonisés sur les Echanges et L'Economie Mondiale (CHELEM) database, and the World Bank MC-GVC database.

Most works on the automotive sector relied upon mixed methodologies, while quantitative approaches accounted for the lowest share if compared to the other sectors. Again, secondary data (e.g., companies' documents, consultancy reports and books, archive documentation, research publications, press releases) and interviews (e.g., with firms' owners and managers, policy makers, trade associations, key informants, representatives of supporting institutions) were the most adopted methods for data collection, followed by the distribution of surveys to key actors in the GVC. The main official statistical sources included the World Input–Output Database (WIOD), UNIDO Industrial Statistics Database, UN COMTRADE, OECD TIVA, Eurofound, AMADEUS, EUROSTAT, fDiMarkets, and Automotive News: Market Data Books. Case study methodology accounted for 23% of works on the automotive GVC.

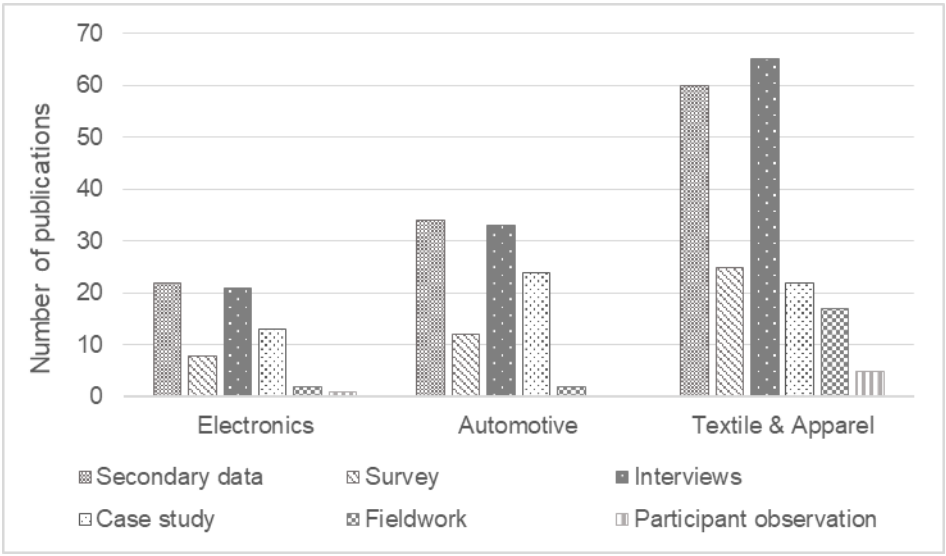
T&A has the lowest share of qualitative methodologies: indeed, most works drew upon mixed and quantitative approaches. Interviews (e.g., with factory owners and managers, buying offices, labour organisations, workers, labour activists, experts in the sector, central government officials, and key informants from relevant industry associations) were the most adopted method for collecting data, followed by reliance on secondary data (e.g., local newspaper, trade magazines, internal historical archives, firms' annual reports) and survey research. Most statistics (particularly trade, national industry, and labour market data) were retrieved from the UN COMTRADE, USITC, UNIDO Industrial Statistics Database, and EUROSTAT Comext. Among the three industries, this sector, accounted for a lower share of studies adopting case study techniques if compared to other methodologies.

Figure 2: Share of research methodologies by sector



Source: Authors' elaboration on Scopus data.

Figure 3: Number of publications by data collection method and sector

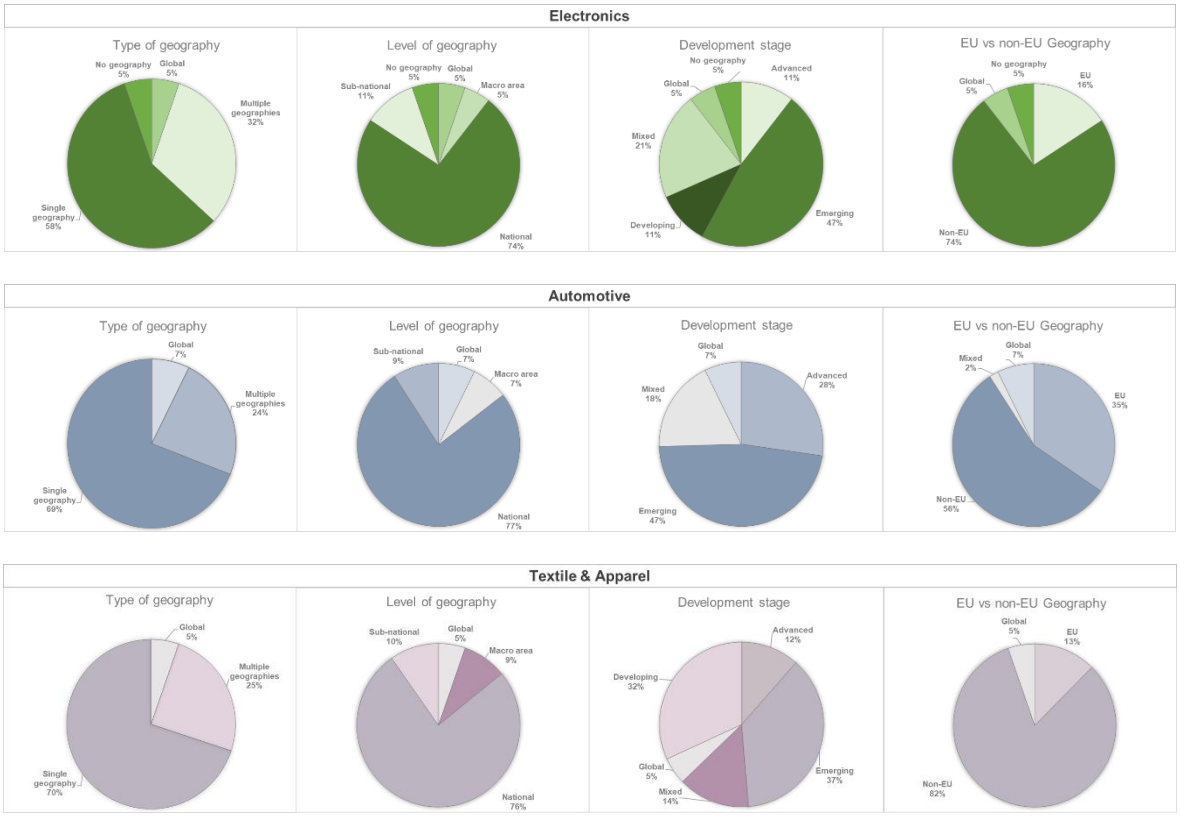


Source: Authors' elaboration on Scopus data.

Figure 4 shows the characteristics of the geographies included in the sample of studies. In the three sectors under investigation, most works examined a single geography, with multiple geographies accounting approximately for 25% of publications on automotive and T&A, and 32% of studies on the electronics industry. Amongst these geographies, most works carried out a country-level analysis, while around 10% of studies examined sub-national geographies, either regions or cities. T&A has the higher share of publications focusing on a macro geographical area such as Europe, Asia, North America, and Sub-Saharan Africa. As far as the development stage of these geographies is concerned, automotive has the highest share

of works exploring GVCs in advanced economies (28% versus 11% in electronics and 12% in textile and apparel), while T&A GVC studies show the highest portion of investigations in developing countries (32% versus 11% in electronics and no studies in automotive). The automotive sector features the highest share of studies focusing on geographies in the EU[2] (35% versus 16% in electronics and 13% in T&A).

Figure 4: The geographies of publications on GVC-sensitive sectors*



(*) The development stage of each geography was identified according to IMF (2020).

Source: Authors' elaboration on Scopus data.

The ten most studied countries are shown in Table 1. China is amongst the main geographical unit of analysis in all three industries. This is second only to Bangladesh for the T&A industry, while it is the first most explored country for both electronics and automotive. More specifically, China and Taiwan account for 42% of publications on the electronics sector, followed by some advanced (i.e., Singapore, South Korea), emerging (i.e., Malaysia, Poland, Mexico, Thailand) and developing countries (i.e., Vietnam). Both advanced (i.e., Czechia, Germany, Spain, United Kingdom, and Italy) and emerging economies (i.e., Malaysia, Mexico, Thailand, and Hungary) feature amongst the most studied in publications on the automotive industry. In addition to Bangladesh, another developing country (i.e., Vietnam) is in the top-ten list of works on T&A, which also includes other countries such as

[2] Throughout the analysis, we refer to the EU as the EU-27 plus the UK.

Indonesia, India, Sri Lanka, Pakistan, Turkey, and Mexico. Italy is the only advanced economy amongst the main studied geographies in the publications' sample for this sector.

Table 1 – Most studied countries by sector

Electronics		Automotive		Textile & Apparel	
Country	No. Publications	Country	No. Publications	Country	No. Publications
China	10	China	7	Bangladesh	13
Taiwan	6	Czechia	4	China	12
Malaysia	2	Germany	4	Indonesia	8
Vietnam	2	Malaysia	4	India	6
Hungary	2	Mexico	4	Sri Lanka	6
Poland	2	Thailand	4	Vietnam	5
Mexico	2	Spain	4	Pakistan	5
Singapore	2	Italy	3	Turkey	5
Korea	2	United Kingdom	3	Italy	5
Thailand	2	Hungary	3	Mexico	4

Source: Authors' elaboration on Scopus data.

Table 2 shows the sub-national geographical units of analysis examined. Only a few works on the electronics GVC focused on sub-national geographies: Chongqing municipality in western China, which is famous for its notebook manufacturing cluster; Guangdong province in Southern China, which in the 1990s became the focus of investments by Japanese electronics multinationals; the Bangladesh's capital Dhaka, an important site in the international "rubbish electronics" trade; and Ho Chi Minh City in Vietnam, which is specialised in segments of basic component electronics and serves as a location for the labour-intensive assembly of parts such as coils, cable assemblies and mini-motors for mobile phones and digital cameras. All these works relied on qualitative or mixed research, drawing upon interviews, participant observations, surveys, and secondary data including trade statistics, business press, and government reports. Interestingly, three of these four works combined the GVCs with the GPNs framework.

Several sub-national geographies were the focus of works on the automotive industry: the city of Bursa, an automotive component production node in Turkey; the Rayong province in Thailand and the Eastern Bavaria region in Germany, which both benefited from globalizing processes brought by the BMW's production networks and investments; Ningbo, a prominent hub for the Chinese magnet industry; the autonomous community of the Basque Country in north Spain, where the Mercedes-Benz-Vitoria GVC is located; and the Italian province of Turin, a historical hub and spoke district with a wide supply chain polarised around the lead company of the Fiat Group. These studies relied upon qualitative or mixed research methods,

particularly case studies (adopted by 5 out of the 6 studies) and using fieldworks, interviews, and survey data.

On the T&A GVC, the following sub-national geographies were targeted: again the city of Ningbo, which is also one of the biggest clothing industrial clusters in China; the Karnataka Indian state capital's Bengaluru, which accounts for around 30% of India's garment production; the Bareilly city situated in the Indian state Uttar Pradesh, an important centre of embellishment activity (e.g., embroidery) for the Indian garment industry; the Mewat region in India, which has been recently involved in an experiment aimed at ensuring safer and more transparent working conditions for the most vulnerable garment workers; the Kyrgyzstan's capital city Bishkek, home of a dynamic apparel manufacturing sector; Torreon in Mexico, known for its export-oriented blue jeans industry; the Denizli textile cluster in Turkey; the Transcarpathia region, a significant employer for clothing manufacturing in Western Ukraine; the Arzignano tannery district in Italy; the Italian region of Veneto specialised in the traditional sectors of clothing and footwear; and New York with its Garment District, which is internationally renowned for apparel manufacturing and fashion design. As for the other two industries, these works exclusively focused on qualitative or mixed methods, drawing upon interviews, participant observations, surveys, and secondary data. Almost half of these studies relied upon the case study method.

Table 2 – Sub-national geographies by sector

Electronics	
Region/City	No. Publications
Chongqing (China)	1
Guangdong (China)	1
Dhaka (Bangladesh)	1
Ho Chi Minh City (Vietnam)	1

Automotive	
Region/City	No. Publications
Bursa (Turkey)	2
Rayong (Thailand)	1
Ningbo (China)	1
Basque Country (Spain)	1
Eastern Bavaria (Germany)	1
Turin (Italy)	1

Textile & Apparel	
Region/City	No. Publications
Ningbo (China)	1
Bengaluru (India)	1
Bareilly (India)	1
Bishkek (Kyrgyzstan)	1
Mewat (India)	1
Torreón (Mexico)	1
Denizli (Turkey)	1
Transcarpathia (Ukraine)	1
Arzignano (Italy)	1
Veneto (Italy)	1
New York (US)	1

Source: Authors' elaboration on Scopus data.

2.3. Some insights from studies on the EU

This sub-section provides an overview of studies on the three industries under investigation, which focus on EU geographies. As far as electronics is concerned, 16% of works investigated these GVCs in the EU. Most studies were performed at the national level by including EU countries such as Germany, Italy, Hungary, and Poland. One study performed a comparative analysis between extra-EU and EU countries including Netherlands, Finland, and Sweden (Shin et al., 2012). Another research project was undertaken as a comparative analysis between Europe, US, and Malaysia (Nadvi et al., 2015). Studies mainly relied upon qualitative methods, particularly using interviews and secondary data, with two works performing a case study. The focus of these works was mainly on GVC structure, integration, upgrading, and value capturing, in addition to technological intensity and occupational health and safety along the value chain. For example, Endrődi-Kovács et al. (2018) drew upon semi-structured interviews, international and national statistics, as well as the WIOD to explore opportunities offered for the Visegrád Four (V4) region (i.e., Czechia, Hungary, Poland, Slovakia) by integration into the Samsung Electronics GVC over the past three decades. Samsung Electronics, with 169 subsidiaries worldwide and 31 sales affiliates in EU countries, is the flagship company of the South Korean Samsung Group. It was amongst the first companies which invested in Central and Eastern Europe (CEE) since the beginning of the 1990s. It has manufacturing plants in Hungary, Slovakia, and Poland (in Jászfényszaru, Galanta, Voderady and Wronki), an R&D Centre established in 2000 in Warsaw and an audio-visual equipment supplier sales unit for Czechia and Slovakia in Prague. The authors, however, concluded that the V4 region is now characterised by an inactive workforce with a very limited number of skilled technicians and professionals, and therefore needs to rely on foreign workers. They also showed limited opportunities for Slovakia and Hungary in productivity development, and proposed policy directions to foster their upgrading in the electronics GVCs. In a similar vein, Plank & Staritz (2013), drawing upon trade and national data and interviews, examined to what extent Hungary and Romania benefitted from integrating in the electronics GVCs. They showed that internal economic upgrading does not always automatically lead to external economic upgrading. Indeed, economic upgrading in electronics in Hungary and Romania has remained a highly precarious process, particularly due to the short-termism and insecurities in the industry.

Compared to electronics, the automotive industry is the focus of a higher share of works examining GVCs in the EU context (i.e., 35% of total studies on this sector). Czechia, Germany, Spain, Italy, UK, and Hungary were amongst the most studied countries. Some publications focused on sub-national geographies including the Italian province of Turin, Eastern Bavaria, and the Basque Country, while others referred to macro geographical areas

such as Western or Eastern Europe as well as Europe generically. Qualitative, quantitative, and mixed research methodologies were equally adopted. Secondary data and interviews were the most adopted sources of data collection, with half of the works relying upon the case study method. The main themes addressed by studies focusing on the EU were the impact of GVC participation on suppliers and complexity of products, the extent of globalisation and regionalisation in the sector, industrial upgrading, the effectiveness of industrial policies and the role of the state. For example, Castelli et al. (2011), by means of a case study and direct interviews, analysed the extent to which a group of selected suppliers based in the Italian province of Turin around the lead company of the Fiat Group were able to successfully participate into the GVC. Their findings showed how companies pursued different internationalisation strategies to take part in global networks and to become less dependent on the Fiat Group. Moreover, they engaged in innovative activities to upgrade in the GVC and raise entry barriers in the sector. Lampón et al. (2016), using data from the AMADEUS database and logistic regressions, explored changes experienced by Spain as a European peripheral region in the automotive components GVC. They emphasised how the Spanish sector – based on the development of a domestic skilled supply base and an industrial policy focused on technological development and improvement of production processes – encouraged investment on more complex and value-adding capital-intensive activities, thus becoming a location for activities associated with a more diverse knowledge base. Pavlínek et al. (2009) investigated industrial upgrading in the automotive industry of four Central European (CE) countries: Czechia, Hungary, Poland, and Slovakia. Their findings showed that the CE automotive industry upgraded mainly through large FDI inflows and over time achieved a high degree of integration withing European production networks and a relatively high degree of regional embeddedness, sophistication, and diversification.

Regarding the T&A industry, 13% of works focused on a geography within the EU. The most studied countries were Italy, France, Germany, and United Kingdom, followed by Bulgaria, Spain, and Netherlands. Amongst these, two studies explored sub-national geographies in Italy: the Veneto region specialised in the traditional sectors of clothing and footwear and the Arzignano tannery district. A few works explored more generically the macro areas of Central Eastern Europe as well Turkey, and North Africa (Bair, 2006). Scholars mostly relied upon mixed and quantitative research methodologies. Secondary data and interviews were the most common methods for data collection, while only three studies used the case study method. Some of the themes addressed were the regional dimension of trade and production, GVC configuration, sourcing patterns as well as industrial and environmental upgrading, in addition to factors and dynamics facilitating countries' integration into the GVC. For example, Crestanello & Tattara (2011), relying on interviews and trade data, analysed the governance of value chains in clothing and footwear, with a focus on production delocalisation from the

Italian region of Veneto to the nearby country of Romania. Their findings showed that Italian firms in footwear and clothing frequently produce directly in Romania, while retaining at home the high value-added design and marketing activities. Although since 2003 the cost of labour in Romania has more than tripled, many Italian firms prefer to work with established partners rather than seeking out lower prices. In addition to its geographic strategic position, Romania can take advantage of the completeness of the manufacturing process, as well as a high level of human capital and a favourable fiscal regime towards company taxation. De Marchi & Di Maria (2019) explored the role of suppliers in the process of environmental upgrading within GVCs, with a special focus on the Italian Arzignano tannery district. Their analysis emphasised how suppliers can autonomously develop sustainability strategies to maintain their competitiveness and achieve higher value in the GVC. Palpacuer et al. (2005) explored clothing import patterns and sourcing practices of major clothing retailers in the United Kingdom, France, and Scandinavia to identify differences between GVCs serving European clothing markets. Findings highlighted entry barriers for suppliers from developing economies into the sourcing networks of UK retailers by explaining these with corporate financialization in the United Kingdom. Moreover, they emphasised how the maturation of GVCs challenges classical ‘‘industrial upgrading’’ paradigms and the role of the clothing sector as a springboard in the industrialization of developing economies. In a similar vein, Palpacuer (2006) drew upon clothing import data and interviews to analyse the sourcing patterns of French clothing retailers and their determinants. Her findings showed dispersed, unstable, and informal supplier relations mainly due to the importance of small-specialised chains, the predominance of family ownership, and a low concentration level in French clothing retailing. However, since the late 1990s, the largest retailers operating in the standard-product segment have launched supply-chain rationalization policies aimed at reducing the number of suppliers, consolidating relations with preferred suppliers, and externalizing manufacturing.

Table 3 – Most studied EU countries by sector

Electronics		Automotive		Textile & Apparel	
Country	No. Publications	Country	No. Publications	Country	No. Publications
Hungary	2	Czechia	4	Italy	5
Poland	2	Germany	4	France	3
Germany	2	Spain	4	Germany	3
Italy	1	Italy	3	United Kingdom	3
Czechia	1	United Kingdom	3	Bulgaria	1
Slovakia	1	Hungary	3	Spain	1
Romania	1	Slovakia	2	Netherlands	1
Netherlands	1	Poland	1		
Finland	1	Romania	1		
Sweden	1	France	1		

Source: Authors' elaboration on Scopus data.

2.4. Research gaps

The systematic literature review of both academic and policy work on the electronic, automotive and T&A global value chains allowed us also to identify the main research gaps and suggest directions for future research.

Given the large and growing variety of market segments that characterise electronics, future studies should concentrate more on the specific GVC of different sub-sectors rather than the broader industry. The same applies to T&A, where the literature has mostly focused on the wider apparel industry rather than on smaller but highly relevant (in particular for Europe) segments of the sector. Overall, there is also need for new work investigating the impacts and implications of different types of shocks, such as the Covid-19 pandemic and new patterns of geo-political fragmentation. Also, the automotive industry is currently undergoing several pervasive technological changes ranging from the increasing adoption of electric vehicles to the advent of autonomous driving which need to be further investigated. More research is required to better understand the changing and evolving re-combination of global and local production networks, which have become particularly relevant both in automotive and T&A.

As far as methodological choices are concerned, as seen above, most works on automotive and T&A adopted a mix of qualitative and quantitative approaches, drawing upon interviews and secondary data. Qualitative methods are prevalent in research on the electronics sector. T&A was the sector with the lowest application of the case study method. The combination of quantitative and qualitative analysis, including the use of case studies, is deemed particularly

suitable for research on GVCs because it allows to better unveil their complex networks, structures, and geographies. On the latter, most studies explored a single geography by performing a country-level analysis. Indeed, only around 10% of publications focused on a sub-national geography, i.e., a region, district, or city, which was regarded as a key location for the specific GVC under investigation. Future research should offer more comparative analyses between different geographical contexts, while devoting more attention to sub-national analyses. This is particularly important in the context of the EU cohesion policy where smart specialisation and a place-based approaches require the identification of characteristics and relative position of subnational regions.

3. GVC-SENSITIVE SECTORS: A QUANTITATIVE DESCRIPTION

As discussed in the previous section, the systematic analysis of the existing literature has offered a number of key insights on the functioning, organisation and upgrading trajectories of the three GVC-sensitive industries. However, it has also made apparent the lack of coverage of the European Union as a whole and the limited evidence on most of its Member States (MS) and their regions. As a result, this section aims to leverage existing data sources in order to pilot the use of existing statistical data to complement the systematic review of the literature and offer a background for future GVC-specific studies. This section also highlights some key common trends deserving further investigation and potential data gaps to be addressed in order to support evidence-based policies.

3.1. EU country-level analysis

In order to better assess the importance of the three GVC-sensitive sectors in the EU economy and to identify the countries which play a more prominent role in their development, this part of the Report will draw upon the analysis of the Analytical AMNE database[3]. As discussed more in depth in Comotti et al. (2020), this database offers a useful tool to assess the contribution of domestic firms, Multinational Enterprises (MNEs) and their foreign affiliates to global trade and production. The first part of the analysis will present aggregate data for each country and sector. Subsequently, the specific role and contribution of foreign affiliates will be highlighted and discussed.

[3] https://www.oecd.org/industry/ind/analytical-amne-database.htm, OECD (2019).

Table 4 shows - for each country of the EU27 and the UK - the relative weight[4] of the three selected sectors in terms of gross value added (GVA), exports and imports in 2016, highlighting the countries in which the GVC-sensitive sectors play an important role in trade and production.

Although to different extents, Portugal, Italy and Romania[5] show a comparatively higher share of T&A trade and production on total manufacturing. In Portugal, for example, T&A had the largest share in total manufacturing among all European countries for GVA (14.5%), exports (16%), and imports (9%). Likewise, in Italy and Romania almost 10% of GVA in manufacturing was generated by T&A, while the average of European countries was just above 3.5%[6].Since the 1960s, when Portugal became a member of the European Free Trade Association, the T&A industry has thrived. Notwithstanding the challenges related to the integration of T&A into the General Agreement on Tariffs and Trade (GATT) in 2005 and the admission of relatively low-wage countries such as Bulgaria and Romania into the EU in 2007, the industry now remains important in Portugal, with high-quality niches such as cotton flannel and some synthetic fabrics (Truett & Truett, 2019). Despite globalising trends, Italy has been over time able to maintain a specialisation in T&A and is internationally renowned for many important brands (e.g., Armani, Ferragamo, Versace, Prada, just to mention a few), specialised industrial districts (e.g., textile in Prato, footwear in Montebelluna and Brenta, knitwear and clothing in Carpi, leather in Arzignano), and a strong Made-in-Italy tradition for quality, creativity, and craftsmanship (Dunford et al., 2013; Macchion et al., 2015). Romania is highly specialised in the footwear and clothing industry, which employs a large share of manufacturing workers and is mostly dedicated to the transformation of raw materials and semi-finished goods, mainly imported from Western Europe, and then re-exported as more sophisticated manufacturing products towards these countries (Crestanello & Tattara, 2011).

The electronics sector covered a large part of manufacturing exports (21%) and imports (26%) in Estonia, Hungary (13.5%; 17%), the Netherlands (13%; 24.5%), Finland (10.7%; 8.6%) and Ireland (11.2%; 12.8%). However, between 2005 and 2016, the importance of this sector significantly increased in Estonia (11.5%; 17%), while Hungary saw one of the largest drops, with over 15% points difference in both exports and imports. Nevertheless, in Hungary, 7% of manufacturing GVA is associated with electronics, with higher shares only in Finland (9%) and Ireland (8.4%). The electronics industry has been one of the fastest growing industries in Estonia: this is mostly concentrated in Tallinn and contributes nearly 2 billion euros annually to the country's exports. The industry, which is dominated by local branches of

[4] For each variable and sector, the relative weight is calculated as the share of total manufacturing in 2016. For further information on the evolution over time, Table A1 (in the *Appendix)* shows the percentage points difference between 2005 and 2016 for the same countries and sectors.

[5] If we compare values in 2005 and 2016, all countries experienced a decrease in the share of T&A exports, with Romania (-11.17%) recording the largest drop.

[6] The T&A sector plays an important role in these two countries also in terms of trade, as their shares in imports are almost double the others' countries average (5.99% Italy and 6.47% Romania).

MNEs that manage large-scale production for exports, is mainly specialised in manufacturing of computers, electronic and optical equipment. Most of the industry's output is exported, particularly to Sweden and Finland due to geographical proximity (Estonian Electronics Industries Association, 2019). More specifically, computer electronics is amongst Hungary's top exporting industries, with high shares of value added produced by foreign-owned firms and high import content in their exports, an indicator of GVC integration. However, like many European economies, Hungary's growth slowed after 2010 because of the global crisis (OECD, 2017). The Netherlands is among those countries that have recently increased their participation in value chains of the main EU electronics producers (Llados-Masllorens et al., 2021). As concerns Finland, the industry, which emerged in the 1990s and included internationally renowned MNEs such as Nokia, accounted in 2020 for a turnover of €18 billion (Palokangas, 2021). The electronics sector in Ireland is a vibrant and fast-moving segment with 20,000 expert jobs, €13.5 billion in export revenue and €450 million of R&D spending annually (Skillnet Ireland, 2021).

As expected by its historical tradition as one of the leaders in the automobile industry, the sector plays a key role in Germany, accounting for over 18% of manufacturing VA, 25% of exports, and 20% of imports. As for electronics, also the automotive sector is important in Hungary – with very high shares in total manufacturing GVA (21.82%), exports (34.2%), and imports (33%) – as well as in other Eastern European countries such as Czechia (19.5%; 34%; 31.5%) and Slovakia (21.5%, 38%, 37%). Contrary to the other two industries, between 2005 and 2016 GVA, exports, and imports in automotive in Hungary had the second largest increase in Europe (10%; 13.5%; 14.5% respectively for the three indicators) after Slovakia (11%; 16%; 14%). As discussed in previous parts of this Report, Germany is home to many of the most important automakers in the world including, for example, the Volkswagen group, Audi, BMW, and Mercedes-Benz. Compared to other EU countries such as France, Germany has retained domestically a larger share of assembly functions, while offshoring the manufacturing of intermediates to the neighbours. While the automotive sector has maintained its relative economic importance in Germany, those countries that have joined the EU since 2004, including Czechia, Hungary, and Slovakia, have increased their participation in the automotive GVC (Connell Garcia et al., 2020).

Table 4 – Relative weight of GVC-sensitive sectors on total manufacturing: GVA, exports, imports – 2016

	GVA by sector			EXP by sector			IMP by sector		
Countries	T&A	Electronics	Automotive	T&A	Electronics	Automotive	T&A	Electronics	Automotive
Austria	1.5%	4.5%	6.8%	2.0%	4.6%	12.3%	1.5%	3.6%	11.4%
Belgium	2.3%	2.0%	4.6%	2.7%	1.1%	11.3%	2.0%	1.5%	11.2%
Bulgaria	7.3%	1.9%	2.6%	8.8%	2.6%	3.4%	3.9%	1.8%	3.8%
Croatia	5.2%	2.8%	0.8%	7.9%	2.4%	1.3%	6.8%	2.4%	1.5%
Cyprus	1.0%	1.8%	0.2%	0.6%	3.4%	0.2%	1.3%	1.1%	0.5%
Czechia	2.0%	5.1%	19.5%	2.2%	8.7%	33.9%	1.7%	10.2%	31.4%
Denmark	1.0%	5.0%	0.9%	1.3%	5.1%	1.2%	1.3%	3.3%	1.4%
Estonia	5.8%	5.4%	4.1%	5.4%	20.7%	3.6%	4.6%	25.6%	4.8%
Finland	1.1%	9.0%	1.4%	0.9%	10.7%	1.8%	0.9%	8.6%	2.1%
France	2.0%	4.1%	5.6%	2.5%	5.4%	11.2%	2.1%	2.6%	9.5%
Germany	1.0%	5.3%	18.0%	1.1%	5.8%	24.9%	1.2%	4.5%	20.3%
Greece	2.0%	0.8%	0.3%	4.5%	1.6%	0.2%	1.9%	0.7%	0.3%
Hungary	2.0%	7.0%	21.8%	1.6%	13.5%	34.2%	1.1%	16.6%	32.9%
Ireland	0.3%	8.4%	0.4%	0.3%	11.2%	0.1%	0.3%	12.8%	0.6%
Italy	9.2%	2.9%	4.9%	10.8%	2.6%	9.4%	6.0%	2.5%	7.7%
Latvia	3.9%	3.9%	1.5%	4.1%	4.9%	2.2%	4.5%	4.5%	2.1%
Lithuania	6.0%	1.9%	1.3%	5.1%	2.1%	1.5%	2.7%	1.0%	1.2%
Luxembourg	6.7%	4.6%	5.3%	3.9%	3.3%	1.3%	3.0%	3.0%	4.3%
Malta	1.2%	17.4%	2.5%	1.1%	41.4%	0.3%	0.9%	35.5%	0.3%
Netherlands	1.2%	4.5%	3.4%	1.0%	13.3%	3.7%	0.8%	24.5%	4.3%
Poland	2.6%	1.8%	7.2%	2.9%	5.1%	15.0%	2.3%	6.0%	13.9%
Portugal	14.5%	1.5%	6.0%	15.8%	3.9%	14.0%	9.2%	2.5%	14.3%
Romania	8.0%	2.1%	10.4%	9.4%	5.0%	18.2%	6.5%	3.0%	17.7%
Slovakia	3.4%	3.1%	21.6%	2.3%	9.9%	38.0%	1.6%	11.6%	37.4%
Slovenia	3.1%	2.8%	7.7%	3.2%	2.5%	14.7%	2.9%	2.5%	14.3%
Spain	3.6%	1.6%	8.0%	5.0%	2.1%	22.5%	3.6%	1.3%	18.2%
Sweden	0.7%	3.5%	14.6%	0.6%	3.1%	19.2%	0.7%	2.4%	17.6%
United Kingdom	3.0%	3.5%	6.6%	2.5%	5.5%	15.2%	1.4%	3.7%	11.5%

Source: Authors' elaboration on Analytical AMNE database.

3.1.1. The role of MNE foreign affiliates: GVA, exports, and imports

The strong position of MNE affiliates as drivers of both exports and imports calls for a more in-depth sectoral analysis to shed light on their activities. Comotti et al. (2020) highlighted a positive relationship between GVA generated by foreign affiliates and their participation in exports and imports: "…European countries where foreign affiliates contribute more to value added creation tend also to experience a more pronounced presence of foreign affiliates in their trade flows" (p. 31).

With this backdrop, Figures 5 to 7 plot the percentage of GVA (against those of exports plus import[7]) generated by foreign affiliates for the three GVC-sensitive industries under investigation.

In general, in countries where foreign affiliates contribute more to domestic value-added creation, they also account for a large share of total trade flows. However, there are some exceptions, with some countries where foreign affiliates play a disproportionately significant role in shaping trade flows mostly through their international supply chain (compare for example the UK with Slovakia or Poland in Electronics: with similar shares of GVA in the latter the share of trade accounted for by FA is almost double). A group of CEE economies – Bulgaria, Czechia, Hungary, Poland, Romania, and Slovakia – have an above-EU average share of GVA, exports and imports accounted for by foreign affiliates in the three sectors under analysis. In the EU15, similar values are recorded only in the Netherlands: most of the remaining countries show relatively lower shares of foreign affiliates in GVA, exports and imports. Denmark, Greece, and Italy have values below the EU average for both trade and production in the three sectors, highlighting a less dominant role of foreign affiliates in these economies.

The role of foreign affiliates in the economy (and their internationalisation modes) is also driven by sector-specific patterns associated with technological intensity and institutional settings. Automotive shows the largest shares of foreign affiliates (on average: GVA, 64%; trade, 73%), followed by electronics (43%; 54%) and T&A (22%; 33%). This emphasises the importance of a sectoral approach in defining the relative contribution of foreign affiliates in an economy, as heterogeneous structural factors shape the overall picture. For example, Figure 7 shows that in three countries – France, Germany, and Italy – where the automotive sector is particularly developed domestically, foreign affiliates seem to play a relatively more limited role, with the lowest values in the sector among all EU economies. This reflects the role of domestic MNEs in GVA and trade in these countries that balances that of foreign affiliates.

Most European economies show a positive correlation over time between value added generated by foreign affiliates and share of total trade flows accounted for by foreign firms, with an increase in all the variables for the years under investigation (2005-2016) and regardless of the sector[8] (Figures A1, A2 and A3 in the *Appendix*). Most CEE countries discussed above with a significant activity of foreign affiliates also show its growth in the three sectors under analysis.

[7] In the Report, the percentage of exports plus imports will be identified with the term “trade”.

[8] This is in line with what was found at the aggregate sectoral level (Comotti et al., 2020), where the contribution of foreign affiliates tended to increase over time.

In T&A, Hungary (GVA, +25%; trade +26%) and Slovakia (+30%; +27%) saw the largest increases, followed by the Netherlands (+17%; +19%), while Bulgaria (both variables -8%), Croatia (-3%; -8%), and Sweden (both -3%) recorded a decrease over the same time span. CEE is internationally renewed for being an important regional supply base of T&A, which has overtime attracted a growing number of investments by other EU and extra-EU brands and producers mostly because of low-labour costs of production. Moreover, recently CEE has become the focus of some nearshoring projects aimed at bringing production closer to the final market (McKinsey & Company, 2019).

In electronics, the Netherlands show a growing role of foreign MNEs, with a significant increase (+70%) in both GVA and trade between 2005 and 2016[9] – a very significant change considering that the EU average percentage points difference over the period is +7% for GVA and +6% for trade. As discussed in the previous section, the Netherlands have recently increased participation in the value chain of the main European electronics producers (Llados-Masllorens et al., 2021). An increase in foreign subsidiary activity is also recorded in some Central and Eastern (Romania, Bulgaria, Hungary, Slovenia, Czechia, Poland) and Northern (Finland, Denmark, Sweden) European countries, with an above-average rise in foreign affiliates presence in both GVA and total exports and imports. Since the mid-1990s – in view of its accession to the EU – CEE has emerged as a new global location in the electronics industry, with FDI from European and Asian brand companies being the primary vehicle of integration of CEE countries in the GVC. These economies primarily serve as low-cost supply bases for assembly and export to the main European markets (De Backer & Miroudot, 2014). As for the T&A industry, the CEE have also been involved in some nearshoring projects of electronics firms interested in moving production closer to the home market (Llados-Masllorens et al., 2021). At the other end of the spectrum, some European economies show a decline in the relative share of foreign activity over time: Germany (-21%; -22%), United Kingdom (-11%; -17%), France (-12%; -15%), Italy (-10%; -8%)[10], together with Lithuania (-17%; -20%) and Latvia (-12%; -17%).

The automotive sector offers the clearest example of emerging internationalisation patterns in CEE, with several countries showing an expansion above or close to 50%: Bulgaria (82%; 73%), Romania (57%; 47%), and Slovenia (47%; 51%). In Eastern EU, the main automakers, attracted by low labour costs and local government policies aimed at enticing FDIs, determine the strategies concerning production location, investment, volume, and model allocations (Gaddi & Garbellini, 2021). In contrast to the other sectors, automotive foreign affiliates operating in the Netherlands (-15%; -9%), together with Croatia (-22%; -7%) and Slovakia (-13%; -7%), recorded the most significant drops.

[9] Figures A1 to A3 in the *Appendix* shows detailed information about the percentage points difference in the three sectors between 2005 and 2016.
[10] Two “outliers” are missing: Belgium (-52%; -35%) and Estonia (-84%; -60%).

Further insights are offered by Table 5[11] that shows the contribution to GVA and trade provided by domestic firms and MNEs for the three GVC-sensitive sectors in the pre-, during-, and post-Great Recession periods[12]. The sum of the shares of each firm typology (i.e., affiliates of foreign MNEs, domestic MNEs and domestic firms) for a given country-sector-year is equal to 100%, implying that countries with a higher dependence on foreign affiliates will automatically exhibit a lower involvement of their domestic firms and MNEs and in trade and production. The economies with the highest shares of nationally-owned MNE participation are predominantly the largest European economies and this applies irrespectively of the sector under analysis.

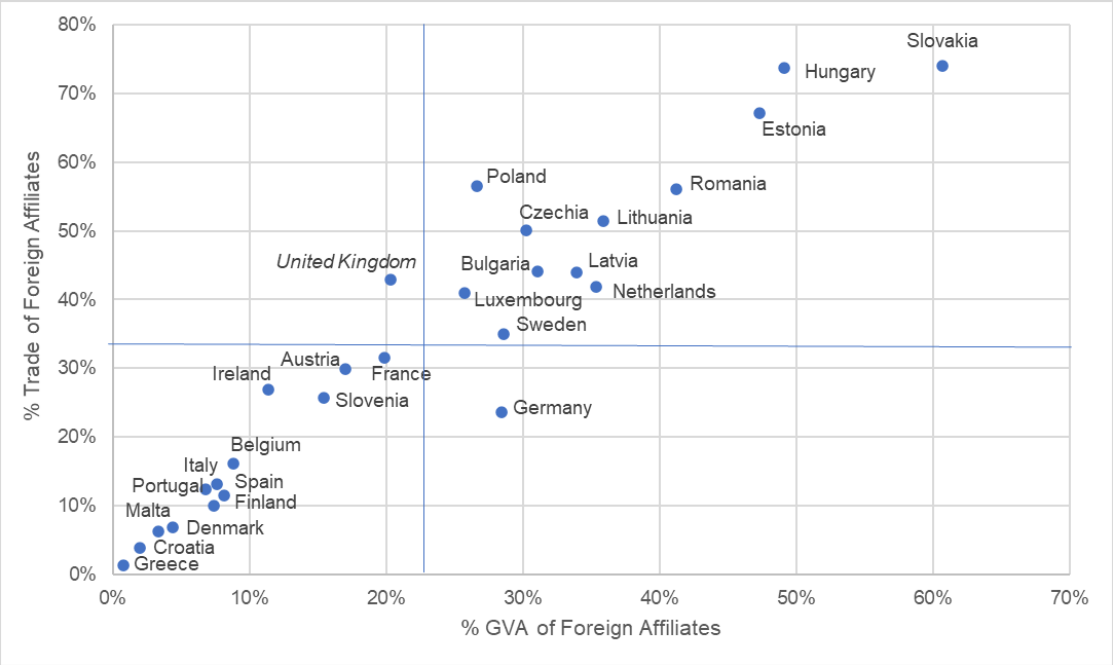
Domestic MNEs in T&A and automotive account for a large share of total production and trade in the most advanced economies of the Union as well as in some Eastern European members. In 2016 in the electronics sector, domestic MNEs have large shares in Estonia (GVA, 42%; trade, 27%), Lithuania (33%; 16%), and Latvia (33%; 29%). The Baltic countries have been indeed identified as growingly important hubs in electronics manufacturing, with an increasing number of domestic companies that are now competitive in the international arena (Estonian Electronics Industries Association, 2019; Investment and Development Agency of Latvia, 2021). In some countries, nationally-owned MNEs seems to be more significantly involved in GVA generation rather than trade. Some examples are Belgium (39%; 8%), Spain (40%; 21%), and Poland (35%; 3%). Domestic MNEs in the automotive sector show a relevant contribution to GVA generation and trade in Latvia (17%; 15%), Croatia (20%; 12%), Slovakia (18%; 11%), and Slovenia (21%; 17%). Automotive is an important manufacturing industry in Croatia, with local companies that managed to successfully integrate in the GVC of world's top automakers. However, some of these economies also recorded a significant drop in MNE participation between 2010 and 2016 (Slovakia: -16%; -12%; and Slovenia -8%; 6%).

The role of domestic firms varies to some extent depending on the country and sector under analysis. On average, they accounted for more than half of total trade and production occurring in the T&A sector (average GVA, 61%; average trade, 53%), followed by electronics (33%; 30%), and automotive (21%; 13%)[13]. As concerns T&A, domestic firms are still the main actors in countries such as Croatia (79%; 77%), Denmark (78%; 74%), Finland (73%; 67%), Greece (80%; 78%), and Portugal (90%; 80%)[14]. Indeed, the organisation of "buyer-driven" T&A global value chains implies a more limited role of direct operations by MNEs in production, which is often outsourced by these firms to global networks of overseas suppliers (Bair & Gereffi, 2001; Gereffi & Memedovic, 2003). However, on average, the role of purely

[11] On the right side of the table, for each country and sector a line chart illustrates the evolution of GVA of foreign affiliates over the years 2008-2016.
[12] The full Analytical AMNE database previously used covers the years from 2005 to 2016, while this section is related to domestic firms and MNEs and it has data restricted to the years from 2008 to 2016 only. For this reason, year 2008, 2010, and 2016 are used to identify pre-, during- and post-crisis periods.
[13] Values refer to 2016.
[14] This excludes very small countries such as Cyprus (90%; 100%) and Malta (87%; 84%).

domestic firms has decreased over time in all the three sectors[15], even if the percentage point changes between 2010 and 2015 are highly heterogeneous across European countries.

Figure 5: Percentage of foreign affiliates in total GVA and trade (exports plus imports) – Textile & Apparel, 2016*

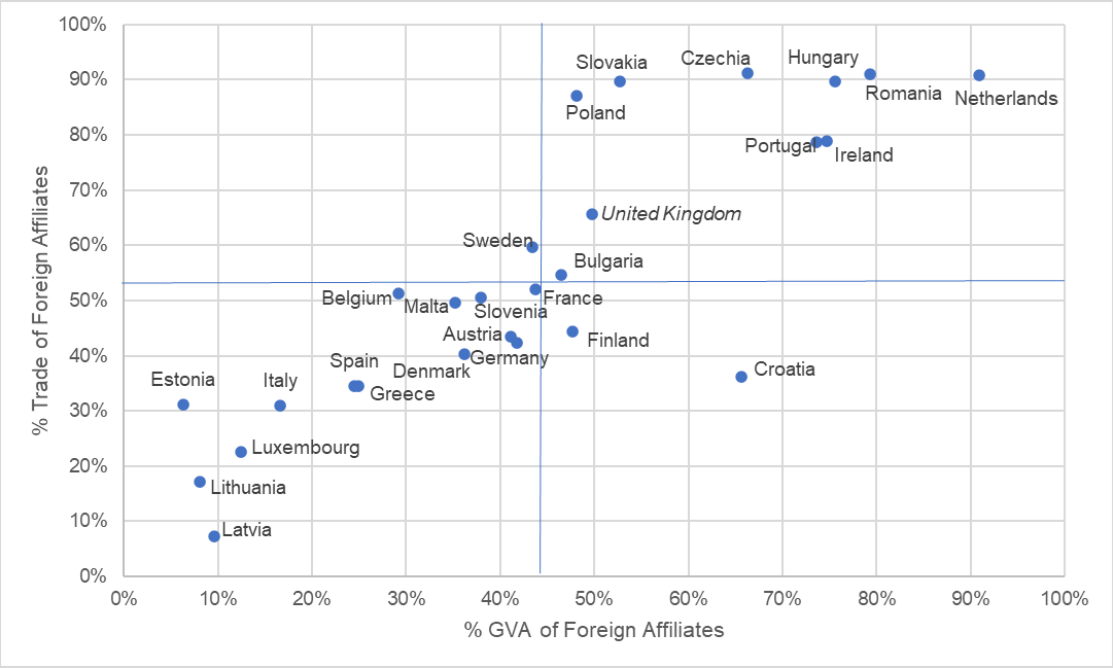


(*) Average values (blue lines) are for the EU27 plus the UK. Cyprus (0% GVA; 0% trade) is excluded from the chart and from the EU averages (blue lines) as outlier.

Source: Authors' elaboration on Analytical AMNE database.

[15] Average percentage points difference in the T&A GVA is -2% and for trade -1%; for electronics -3% and -2%; and for automotive -3% and -1%.

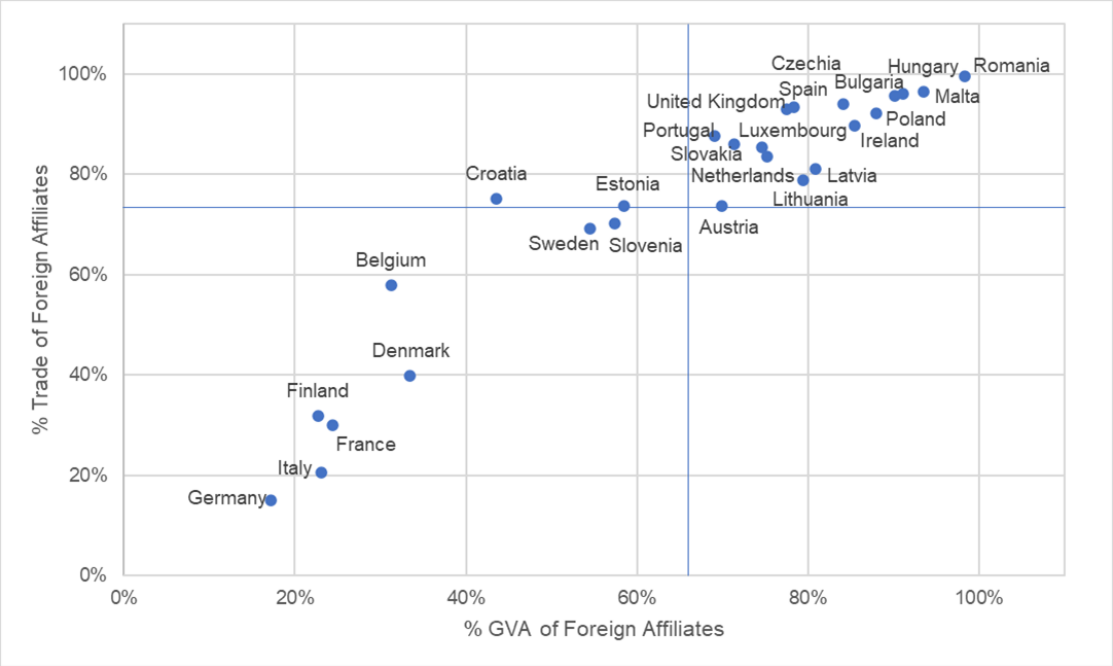
Figure 6: Percentage of foreign affiliates in total GVA and trade (exports plus imports) – Electronics, 2016*



(*) Average values (blue lines) are for the EU27 plus the UK. Cyprus (0% GVA; 0% trade) is excluded from the chart and from the EU averages (blue lines) as outlier.

Source: Authors' elaboration on Analytical AMNE database.

Figure 7: Percentage of foreign affiliates in total GVA and trade (exports plus imports) – Automotive, 2016*



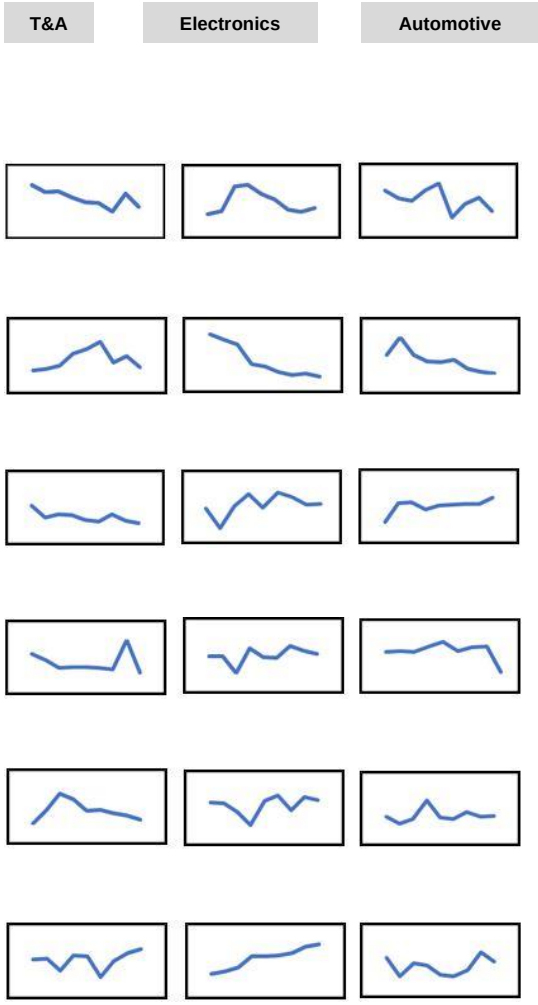
(*) Average values (blue lines) are for the EU27 plus the UK. Cyprus and Greece (both 0% GVA; 0% trade) are excluded from the chart and from the EU averages (blue lines) as outliers.

Source: Authors' elaboration on Analytical AMNE database

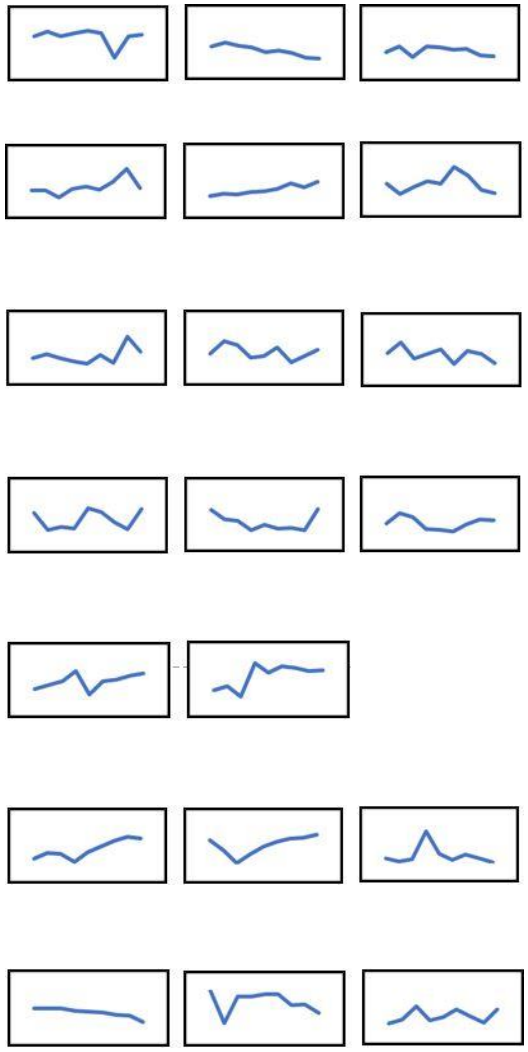
Table 5 – GVA and trade (exports plus imports) by sector and typology of firm, 2008-2016*

Countries	Pre Crisis - 2008						During Crisis - 2010						Post Crisis - 2016					
	T&A		Electronics		Automotive		T&A		Electronics		Automotive		T&A		Electronics		Automotive	
	GVA	Trade	GVA	Trade	GVA	Trade	GVA	Trade	GVA	Trade	GVA	Trade	GVA	Trade	GVA	Trade	GVA	Trade
	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%
Austria																		
FA	25	33	40	37	75	75	23	30	49	42	72	75	17	23	42	42	70	74
MNE	13	12	22	17	17	17	12	12	12	10	16	15	15	15	33	27	18	16
DF	62	55	38	46	7	8	65	58	39	48	11	11	68	62	25	31	12	11
Belgium																		
FA	7	13	86	91	66	93	9	17	50	69	50	76	9	16	29	53	31	58
MNE	34	33	7	3	24	6	23	23	27	7	30	17	23	22	39	8	41	30
DF	59	54	7	6	10	1	67	61	23	24	20	7	68	61	32	38	28	13
Bulgaria																		
FA	40	51	45	48	78	86	35	47	46	55	88	95	31	44	47	55	91	96
MNE	19	15	27	21	13	9	14	12	20	14	6	3	16	13	21	15	5	2
DF	41	34	29	31	10	5	50	41	34	31	6	3	53	43	32	30	4	2
Croatia																		
FA	9	17	62	33	64	89	4	8	39	16	64	89	2	4	66	36	44	75
MNE	25	24	20	31	17	7	18	19	24	29	13	5	19	20	13	21	20	12
DF	66	59	19	36	18	4	78	74	37	55	23	6	79	77	21	42	37	13
Czechia																		
FA	29	42	65	88	84	89	38	50	60	88	83	89	30	53	66	95	84	97
MNE	20	20	1	0	1	0	12	12	1	0	1	0	14	0	0	0	0	0
DF	50	38	35	12	16	11	50	38	40	11	16	11	56	47	34	5	16	3
Denmark																		
FA	4	6	19	19	36	42	3	5	23	22	32	34	4	7	36	38	33	37
MNE	26	28	43	46	36	41	18	20	32	36	29	39	18	19	26	35	29	41
DF	70	66	38	35	29	18	79	75	45	42	38	27	78	74	37	27	37	21

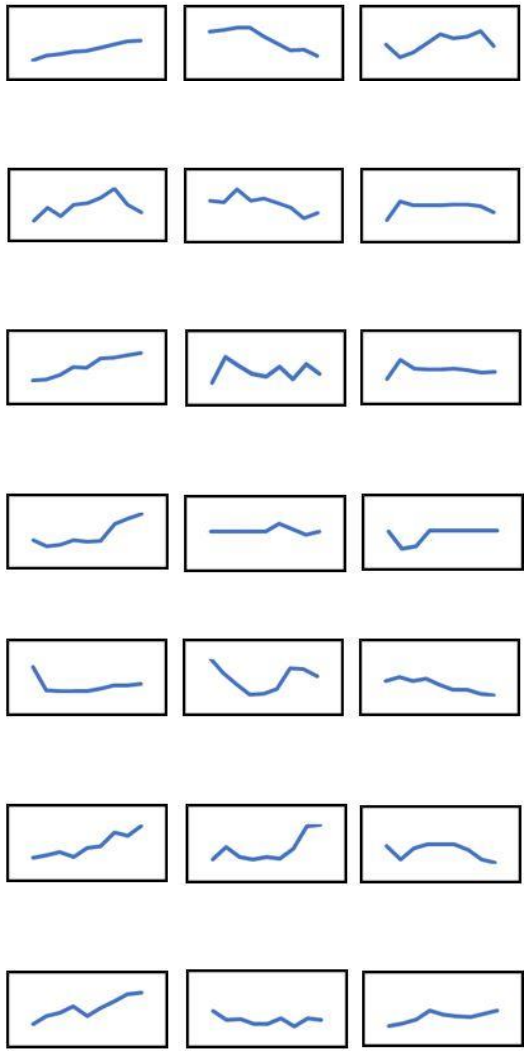
GVA by Sector of FA 2008-2016



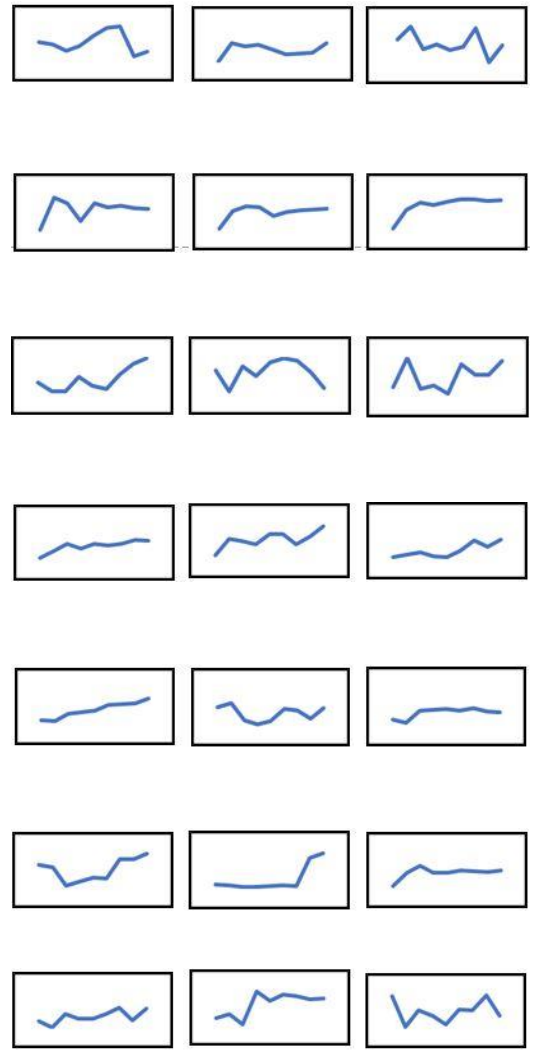
Estonia																		
FA	45	65	75	87	63	70	45	65	80	97	56	68	47	67	6	31	58	74
MNE	13	9	12	6	17	19	9	6	8	1	17	17	9	6	42	27	17	15
DF	42	26	13	7	19	11	46	29	12	2	27	16	44	27	52	42	25	12
Finland																		
FA	7	9	9	13	28	32	5	7	14	18	26	34	7	10	48	60	23	32
MNE	17	19	34	48	23	41	8	10	31	45	14	29	20	23	21	36	42	54
DF	77	72	57	39	49	27	87	84	56	37	60	38	73	67	32	5	35	14
France																		
FA	18	29	42	46	30	31	18	29	47	51	27	28	20	32	44	52	24	30
MNE	46	40	46	40	54	59	42	36	42	36	49	57	48	41	46	37	50	55
DF	36	31	12	14	16	10	40	35	12	13	24	15	32	27	10	11	25	15
Germany																		
FA	26	40	41	47	16	18	19	25	35	34	18	17	28	24	41	43	17	15
MNE	24	20	59	53	61	69	13	13	44	42	70	76	31	34	41	37	78	82
DF	50	40	0	0	23	14	68	62	22	24	11	7	41	42	18	19	5	3
Greece																		
FA	1	1	21	29	0	0	1	1	21	31	0	0	1	1	25	35	0	0
MNE	33	34	40	32	51	64	23	24	31	23	39	52	20	21	28	22	35	49
DF	67	65	39	39	49	36	76	75	48	46	61	48	80	78	47	44	65	51
Hungary																		
FA	38	63	67	90	91	96	40	64	35	78	91	94	49	74	76	90	90	96
MNE	18	11	22	7	6	3	12	7	38	12	5	4	10	6	13	5	6	3
DF	44	26	10	4	3	1	48	28	27	10	4	2	41	21	11	5	4	1
Ireland																		
FA	49	69	100	100	66	67	48	67	93	95	90	90	11	27	75	79	85	90
MNE	13	8	0	0	19	22	9	6	4	3	4	6	15	13	15	11	6	6
DF	38	23	0	0	15	10	44	27	3	2	6	4	73	60	10	10	8	4



Italy																		
FA	2	6	24	35	24	23	4	8	25	37	21	22	8	13	17	31	23	21
MNE	50	50	6	4	36	51	38	38	5	4	35	49	36	35	7	5	39	55
DF	48	44	70	60	41	27	58	54	70	59	44	28	57	52	76	64	38	25
Latvia																		
FA	27	36	14	12	70	81	31	40	19	12	90	90	34	44	10	7	81	81
MNE	17	15	35	33	13	11	11	10	25	24	3	4	10	9	33	29	7	9
DF	57	49	50	55	17	8	59	50	56	65	7	5	56	47	58	63	13	10
Lithuania																		
FA	28	41	3	9	69	77	29	44	13	15	83	88	36	46	8	14	79	73
MNE	15	15	44	37	14	14	13	14	31	28	6	6	15	13	33	16	8	0
DF	58	44	53	53	16	9	57	42	55	58	11	6	49	41	59	70	13	27
Luxembourg																		
FA	14	25	12	20	72	84	12	22	12	21	30	46	26	41	12	23	75	85
MNE	54	48	38	31	25	15	0	0	30	24	0	0	0	0	33	26	0	0
DF	32	27	50	49	3	1	88	78	57	55	70	54	74	59	55	52	25	15
Malta																		
FA	8	15	52	63	94	97	1	3	28	40	94	97	3	6	35	50	94	96
MNE	16	15	26	18	2	2	11	12	31	23	2	1	9	10	27	18	2	1
DF	76	70	22	19	4	2	87	86	41	38	4	2	87	84	38	32	5	2
Netherlands																		
FA	22	27	35	35	98	99	24	29	39	38	94	97	35	42	91	91	75	83
MNE	39	37	15	13	1	1	36	35	13	11	3	2	34	32	2	2	17	13
DF	40	36	50	53	1	0	40	36	47	51	3	1	31	26	7	7	8	3
Poland																		
FA	19	41	60	87	66	80	22	47	50	83	75	88	27	59	48	86	88	87
MNE	22	12	28	7	2	1	26	13	24	5	2	1	5	3	35	3	1	1
DF	59	48	12	6	32	19	52	40	26	12	23	11	68	38	17	10	11	12



Portugal																		
FA	7	13	49	39	70	82	7	12	69	75	68	80	7	14	74	81	69	94
MNE	2	5	16	24	2	2	2	5	9	10	2	2	3	6	9	8	3	2
DF	91	82	36	37	27	16	91	83	22	15	29	18	90	80	18	10	28	4
Romania																		
FA	28	29	24	33	41	31	45	62	85	96	94	97	41	39	79	87	98	99
MNE	26	27	41	36	43	54	15	11	7	2	4	2	16	3	9	0	1	1
DF	45	44	35	31	16	15	41	28	8	2	2	1	43	58	12	13	1	0
Slovakia																		
FA	51	67	74	94	44	73	48	67	79	95	43	69	61	74	53	90	71	86
MNE	14	10	17	4	39	22	10	7	11	3	34	23	8	6	24	5	18	11
DF	34	23	10	2	17	5	41	26	10	3	23	8	31	20	23	5	11	3
Slovenia																		
FA	11	19	19	30	37	55	15	25	28	43	43	61	15	26	38	46	57	76
MNE	24	23	42	33	39	30	16	14	29	20	29	22	15	14	25	12	21	17
DF	65	58	39	37	24	15	70	60	43	37	28	16	70	60	37	42	21	7
Spain																		
FA	5	9	25	52	68	87	6	11	18	34	80	93	8	17	25	53	78	94
MNE	41	41	50	30	24	11	30	30	45	33	13	5	29	25	40	21	15	3
DF	54	50	25	18	8	2	64	59	36	33	7	1	63	58	35	26	7	3
Sweden																		
FA	25	34	14	19	33	55	20	25	11	19	61	62	29	35	43	60	54	69
MNE	17	16	46	42	38	34	20	19	46	40	29	33	19	18	35	24	34	27
DF	57	51	40	39	29	11	61	56	43	40	9	5	52	47	22	16	11	4
UK																		
FA	17	38	42	71	83	95	19	39	40	69	79	95	20	43	50	66	78	93
MNE	33	26	41	19	13	4	24	19	36	17	14	4	24	18	30	19	15	6
DF	50	36	17	10	4	1	57	42	24	14	7	1	55	39	20	15	7	1



(*) For each country the table shows the shares of foreign affiliates (FA), domestic MNE (MNE), and domestic firms (DF). The values are calculated for gross value added (GVA) and the sum of import and export (trade) for the three GVC-sensitive sectors over the three periods of time (pre-, during-, and post-crisis).

Source: Authors' elaboration on Analytical AMNE database.

3.1.2. Sourcing of intermediate inputs

A detailed analysis of the sourcing structure of foreign MNE affiliates and domestic firms[16] offers an additional tool to understand the participation of EU economies into GVCs.

Tables 6 to 11 provide information about the sourcing structure of both foreign affiliates and all domestic firms for the three sectors under investigation in 2016. Foreign affiliates can source intermediate inputs from domestic firms in the host economy, from other foreign affiliates operating in the same economy, internationally from other EU countries, or internationally from outside the EU (extra-EU)[17] . Data show that on average in the T&A sector, foreign affiliates located in European countries tended to primarily source inputs from firms operating in other EU27 countries and the UK (29%), as well as firms in extra-EU countries (30%). This is shown by columns 4 and 6 in Table 6, where several countries display values over or around 40%[18] . On the other hand, T&A domestic firms, on average, sourced mostly from other domestic firms operating in the home country (36%)[19], reflecting the localised sourcing structure of this sector and the propensity to interact locally among domestic firms.

Domestic firms are relevant suppliers of intermediate inputs also in the electronics sector, although to a different extent for foreign affiliates and domestic firms. On average, foreign affiliates operating in European countries tend to source their inputs primarily from firms operating in countries outside the EU27 and the UK (32%), followed by domestic firms in the home country (18%)[20]. European domestic firms operating in the electronics sector instead equally source from other domestic firms operating in the home country (26%), as well as from firms operating in extra-EU27 countries (27%)[21] .

Turning to the automotive sector, the sourcing structure of intermediate inputs takes place mainly within the EU, but with some differences between foreign affiliates and domestic firms. For foreign affiliates located in the EU, on average, most of the inputs are sourced from other

[16] "Domestic firms" refers to domestic uni-national firms and nationally owned MNEs. More detailed information about the structure of the Analytical AMNE database is reported in the Compendium (C3).
[17] Also for firms that operate internationally, either inside the EU or extra-EU, it is possible to identify the typology of firm by differentiating between foreign affiliates or domestic firms.
[18] Countries with foreign affiliates sourcing largely from domestic firms operating in other EU27 countries and the UK are Austria (42%), Croatia (39%), Czechia (43%), Finland (39%), and Slovenia (46%); while countries with foreign affiliates sourcing primarily from domestic firms in extra-EU countries are France (44%), Greece (47%), Ireland (40%), Italy (45%, and Latvia (44%).
[19] Data from column 1 in Table 7 where several countries have values around or above 50%: Belgium (45%), Croatia (52%), France (44%), Italy (45%), Lithuania (43%), Netherlands (53%), Poland (52%), Romania (43%), and Spain (53%).
[20] Countries with foreign affiliates sourcing largely from domestic firms operating in the home countries are Croatia (66%), Italy (42%), Latvia (40%), and Spain (36%) – column 1 in Table 8. While foreign affiliates sourcing from domestic firms operating outside the EU27 are Bulgaria (41%), Denmark (46%), Estonia (55%), France (55%), Ireland (53%), Lithuania (44%), Portugal (59%) – column 6 in Table 8
[21] Domestic firms sourcing from other domestic firms in the home country are of particular importance in Belgium (57%), Finland (43%), Croatia (48%), Italy (51%), Spain (49%) and Sweden (41%). The largest part of intermediates' sourcing by domestic firms located within the Union takes place with other domestic firm located in countries outside the EU27 as shown by the values in the last column of Table 9. These counties are Austria (44%), Denmark (41%), Estonia (46%), France (45%), Ireland (55%), and Portugal (43%).

firms (equally foreign affiliates and domestic, 22%) operating in other EU27 countries and the UK, followed by domestic firms in the home country (20%)[22]. This is the sector where, on average, foreign affiliates tend to source the most from other foreign affiliates operating in the country, showing relevant linkages among foreign MNEs based in the EU. Domestic firms are mostly sourcing in the home economy, from other domestic companies (29%) as well as foreign affiliates (22%).

[22] Among the countries where foreign affiliates source from domestic companies in the home country, Germany (59%) and Italy (48%) show the largest shares – column 1 in Table 10. Similarly, foreign affiliates use domestic firms from EU27 countries and the UK such as Austria (32%), Belgium (30%), Croatia (34%), Denmark (42%), Hungary (33%), and Slovenia (40%) – column 4 in Table 10. Sourcing in other EU27 countries and the UK seems to be a common strategy also for foreign affiliates. Among the largest shares recorded there are those of Denmark (33%), France (41%) and Portugal (32%) – column 3 in Table 10.

Table 6 – Sourcing of intermediate inputs of foreign affiliates – Textile & Apparel, 2016*

	T&A - Foreign Affiliates					
	Home Country		EU		Extra-EU	
	Domestic	Other FA	Other FA	Others	Other FA	Others
Austria	1%	1%	21%	42%	8%	28%
Belgium	10%	1%	15%	32%	8%	35%
Bulgaria	25%	19%	8%	24%	3%	20%
Croatia	23%	2%	17%	39%	2%	17%
Cyprus						
Czechia	4%	1%	20%	43%	6%	27%
Denmark	5%	0%	18%	36%	6%	35%
Estonia	11%	6%	21%	39%	3%	20%
Finland	39%	4%	9%	17%	5%	27%
France	21%	4%	7%	17%	8%	44%
Germany	31%	5%	13%	21%	7%	23%
Greece	4%	0%	13%	30%	6%	47%
Hungary	5%	10%	21%	35%	5%	24%
Ireland	1%	0%	15%	31%	12%	40%
Italy	21%	2%	8%	18%	7%	45%
Latvia	24%	4%	11%	17%	3%	40%
Lithuania	22%	8%	12%	25%	4%	30%
Luxembourg	27%	22%	6%	14%	3%	28%
Malta	5%	1%	9%	34%	6%	44%
Netherlands	35%	9%	10%	24%	4%	18%
Poland	21%	9%	17%	30%	3%	20%
Portugal	13%	1%	13%	35%	6%	32%
Romania	34%	21%	7%	20%	3%	15%
Slovakia	12%	12%	22%	33%	3%	17%
Slovenia	2%	0%	23%	46%	3%	26%
Spain	21%	4%	8%	26%	5%	36%
Sweden	22%	9%	13%	24%	5%	27%
United Kingdom	*12%*	*4%*	*10%*	*23%*	*8%*	*43%*

(*) Minimum value is coloured red, median yellow, and maximum green. All other cells are coloured proportionally.

Source: Authors' elaboration on Analytical AMNE database.

Table 7 – Sourcing of intermediate inputs of domestic firms – Textile & Apparel, 2016*

	T&A - Domestic Firms					
	Home Country		EU		Extra-EU	
	Other Domestic	FA	FA	Others	FA	Others
Austria	24%	9%	16%	27%	6%	18%
Belgium	45%	10%	9%	15%	5%	17%
Bulgaria	31%	22%	7%	20%	3%	17%
Croatia	52%	6%	10%	21%	1%	9%
Cyprus		6%	2%	3%	1%	7%
Czechia	32%	23%	11%	19%	3%	12%
Denmark	29%	3%	14%	24%	5%	24%
Estonia	29%	18%	15%	23%	3%	12%
Finland	41%	5%	9%	16%	5%	26%
France	44%	9%	5%	10%	6%	27%
Germany	38%	7%	11%	17%	6%	20%
Greece	36%	2%	9%	19%	4%	29%
Hungary	15%	28%	16%	22%	4%	15%
Ireland	12%	6%	14%	25%	11%	33%
Italy	45%	5%	6%	11%	6%	28%
Latvia	48%	11%	7%	9%	2%	22%
Lithuania	43%	16%	8%	13%	3%	17%
Luxembourg	43%	30%	4%	7%	2%	15%
Malta	29%	4%	8%	23%	5%	31%
Netherlands	53%	17%	6%	12%	3%	9%
Poland	52%	25%	7%	9%	2%	6%
Portugal	27%	3%	12%	28%	5%	26%
Romania	43%	27%	5%	13%	2%	10%
Slovakia	19%	18%	19%	26%	3%	14%
Slovenia	24%	7%	18%	30%	3%	18%
Spain	53%	11%	5%	12%	3%	16%
Sweden	35%	15%	10%	16%	5%	19%
United Kingdom	*27%*	*9%*	*5%*	*9%*	*12%*	*39%*

(*) Minimum value is coloured red, median yellow, and maximum green. All other cells are coloured proportionally.

Source: Authors' elaboration on Analytical AMNE database.

Table 8 – Sourcing of intermediate inputs of foreign affiliates – Electronics, 2016*

	Electronics - Foreign Affiliates					
	Home Country		EU		Extra-EU	
	Domestic	Other FA	Other FA	Others	Other FA	Others
Austria	23%	8%	10%	9%	16%	35%
Belgium	23%	4%	10%	14%	13%	36%
Bulgaria	2%	2%	18%	20%	17%	41%
Croatia	66%	18%	5%	6%	2%	5%
Cyprus		23%	0%	0%	0%	0%
Czechia	12%	33%	13%	13%	8%	20%
Denmark	13%	3%	9%	11%	17%	46%
Estonia	5%	0%	11%	14%	16%	55%
Finland	12%	2%	14%	23%	10%	39%
France	7%	1%	8%	10%	19%	55%
Germany	23%	5%	9%	7%	16%	39%
Greece	13%	2%	14%	22%	11%	38%
Hungary	11%	16%	18%	18%	10%	27%
Ireland	2%	4%	10%	11%	19%	53%
Italy	42%	8%	6%	8%	9%	27%
Latvia	40%	9%	13%	17%	6%	15%
Lithuania	1%	0%	16%	27%	12%	44%
Luxembourg	19%	7%	17%	32%	6%	17%
Malta	3%	0%	5%	4%	26%	62%
Netherlands	25%	22%	12%	14%	8%	19%
Poland	11%	17%	20%	18%	9%	25%
Portugal	1%	1%	15%	16%	18%	49%
Romania	11%	8%	24%	19%	9%	28%
Slovakia	7%	21%	26%	20%	7%	19%
Slovenia	18%	6%	20%	25%	6%	25%
Spain	36%	9%	9%	15%	8%	24%
Sweden	30%	13%	10%	18%	7%	22%
United Kingdom	*22%*	*10%*	*4%*	*5%*	*17%*	*42%*

(*) Minimum value is coloured red, median yellow, and maximum green. All other cells are coloured proportionally.

Source: Authors' elaboration on Analytical AMNE database.

Table 9 – Sourcing of intermediate inputs of domestic firms – Electronics, 2016*

	Electronics - Domestic Firms					
	Home Country		EU		Extra-EU	
	Other Domestic	FA	FA	Others	FA	Others
Austria	12%	4%	11%	12%	17%	44%
Belgium	57%	16%	4%	5%	6%	12%
Bulgaria	17%	11%	15%	13%	14%	29%
Croatia	48%	12%	9%	15%	3%	13%
Cyprus	11%	2%	25%	30%	7%	25%
Czechia	13%	35%	13%	13%	8%	20%
Denmark	20%	5%	9%	10%	16%	41%
Estonia	16%	2%	10%	12%	14%	46%
Finland	43%	10%	8%	12%	7%	20%
France	18%	4%	7%	8%	18%	45%
Germany	27%	6%	8%	7%	15%	36%
Greece	35%	5%	11%	14%	9%	25%
Hungary	13%	22%	16%	16%	9%	24%
Ireland	1%	3%	10%	12%	19%	55%
Italy	51%	10%	5%	6%	8%	21%
Latvia	31%	7%	15%	21%	7%	19%
Lithuania	12%	3%	15%	22%	11%	37%
Luxembourg	40%	14%	12%	19%	5%	11%
Malta	17%	7%	4%	3%	22%	47%
Netherlands	28%	25%	11%	13%	7%	17%
Poland	24%	34%	13%	10%	6%	13%
Portugal	8%	5%	14%	14%	17%	43%
Romania	28%	24%	17%	9%	7%	15%
Slovakia	6%	17%	27%	22%	8%	21%
Slovenia	39%	15%	13%	14%	4%	14%
Spain	49%	12%	7%	10%	6%	16%
Sweden	41%	17%	8%	13%	6%	15%
United Kingdom	*27%*	*13%*	*2%*	*3%*	*17%*	*38%*

(*) Minimum value is coloured red, median yellow, and maximum green. All other cells are coloured proportionally.

Source: Authors' elaboration on Analytical AMNE database.

Table 10 – Sourcing of intermediate inputs of foreign affiliates – Automotive, 2016*

	Automotive - Foreign Affiliates					
	Home Country		EU		Extra-EU	
	Domestic	Other FA	Other FA	Others	Other FA	Others
Austria	10%	14%	25%	32%	8%	11%
Belgium	5%	0%	27%	30%	17%	22%
Bulgaria	25%	21%	25%	19%	4%	6%
Croatia	16%	4%	29%	34%	5%	12%
Cyprus						
Czechia	11%	29%	25%	25%	4%	6%
Denmark	3%	1%	33%	42%	7%	14%
Estonia	28%	8%	29%	27%	3%	5%
Finland	35%	9%	14%	21%	6%	15%
France	11%	3%	41%	27%	8%	10%
Germany	59%	12%	9%	4%	7%	8%
Greece						
Hungary	6%	15%	25%	33%	7%	14%
Ireland	17%	15%	15%	16%	17%	20%
Italy	48%	9%	13%	12%	7%	11%
Latvia	16%	12%	27%	29%	7%	9%
Lithuania	20%	7%	29%	26%	5%	12%
Luxembourg	23%	43%	15%	16%	1%	1%
Malta	52%	19%	8%	6%	9%	7%
Netherlands	20%	22%	20%	21%	6%	11%
Poland	17%	29%	23%	22%	4%	5%
Portugal	7%	19%	32%	20%	9%	13%
Romania	19%	46%	14%	15%	2%	3%
Slovakia	11%	32%	22%	19%	6%	10%
Slovenia	11%	7%	27%	40%	3%	10%
Spain	17%	22%	18%	24%	9%	10%
Sweden	26%	14%	17%	17%	8%	17%
United Kingdom	*16%*	*20%*	*7%*	*7%*	*25%*	*25%*

(*) Minimum value is coloured red, median yellow, and maximum green. All other cells are coloured proportionally.

Source: Authors' elaboration on Analytical AMNE database.

Table 11 – Sourcing of intermediate inputs of domestic firms – Automotive, 2016*

	Automotive - Domestic Firms					
	Home Country		EU		Extra-EU	
	Other Domestic	FA	FA	Others	FA	Others
Austria	1%	2%	30%	43%	9%	15%
Belgium	21%	4%	23%	22%	15%	16%
Bulgaria	45%	37%	10%	5%	2%	1%
Croatia	64%	16%	10%	6%	2%	2%
Cyprus	52%	7%	9%	9%	9%	14%
Czechia	19%	55%	13%	10%	2%	2%
Denmark	14%	4%	31%	33%	7%	11%
Estonia	39%	14%	23%	18%	3%	3%
Finland	36%	9%	13%	20%	6%	14%
France	13%	4%	41%	26%	8%	9%
Germany	44%	9%	14%	8%	10%	15%
Greece	53%	4%	8%	8%	6%	20%
Hungary	12%	37%	17%	20%	5%	8%
Ireland	21%	19%	14%	13%	16%	17%
Italy	54%	10%	11%	10%	6%	9%
Latvia	28%	22%	21%	19%	6%	5%
Lithuania	26%	10%	27%	22%	5%	10%
Luxembourg	27%	50%	12%	10%	1%	1%
Malta	59%	21%	6%	4%	7%	4%
Netherlands	29%	32%	15%	13%	5%	7%
Poland	19%	34%	20%	19%	4%	4%
Portugal	13%	31%	25%	15%	7%	10%
Romania	23%	55%	10%	9%	2%	2%
Slovakia	14%	43%	17%	14%	5%	7%
Slovenia	1%	0%	32%	50%	4%	13%
Spain	30%	41%	10%	10%	5%	4%
Sweden	34%	18%	14%	13%	7%	13%
United Kingdom	*20%*	*27%*	*2%*	*1%*	*28%*	*22%*

(*) Minimum value is coloured red, median yellow, and maximum green. All other cells are coloured proportionally.

Source: Authors' elaboration on Analytical AMNE database.

3.2. GVC-sensitive sectors at the regional level

3.2.1. Employment shares

To offer an initial overview of the sub-national geography of the GVC-sensitive sectors, this section provides a mapping exercise of their weight in regional (NUTS2[23] level) employment[24]. Mapping the distribution of employment helps identify the regions where each industry plays an important role in the local economy.

In T&A (Figure 8), the regions with the highest shares of employment are scattered in CEE countries and Western Europe, concentrated in very well-delimited hubs with a long-standing historical tradition of typical products. This is the case of some Southern European economies such as Italy (e.g., Abruzzo, Campania, Marche, Puglia, Toscana, Umbria, and Veneto) and Spain (e.g., Castilla-la Mancha, Comunidad Valenciana, Galicia, Illes Balears, and La Rioja), where the T&A industry has played a major role and continues to be significant in terms of employment shares. Tuscany, for example, is home to some worldwide renowned fashion districts, such as the one located in the province of Prato, one of the largest in Europe with a long historical tradition in the production of fabrics and yarns for international brands (Dei Ottati, 2009). Another example, in Spain, is the T&A industry in Galicia: relatively recent, its growth was strongly linked to the establishment of the Inditex company, which is amongst the largest fast fashion companies in the world (Revilla Bonnin, 2002). At the same time, also Bulgaria (7) and Romania (5) have several regions in the top decile of the regional employment share distribution, highlighting the importance of this sector for their national economy. Furthermore, Bulgaria and Romania have become the focus of many delocalisation production processes, originally directed towards other East EU members such as Hungary and Poland (Crestanello & Tattara, 2011).

Employment in the automotive sector is concentrated in the historical "automotive regions" in Western Europe as well as in major production areas in CEE (Figure 10). As highlighted in the map, in the first quintile of the distribution of employment shares (darkest shade of red), we find regions that have played a key role in the development of the automotive industry in Europe with historical national "champions". These are, for example, Baden-Württemberg, Bayern, Bremen, Hessen, Saarland, and Sachsen in Germany; Île de France in France; Stockholm, and Västsverige in Sweden; the North-East and West Midlands in the United Kingdom; as well as Abruzzo, Basilicata, Molise and Piemonte in Italy, and Aragón, Castilla y

[23] NUTS2 are used for all countries, except for Belgium, Germany, and the UK where NUTS1 is used. In some French regions, data for employment is missing due to the 2016 revision of the NUTS classification. In the maps, regions with missing data are in white.

[24] The share of employment of each sector is calculated as a percentage of total manufacturing employment in 2018. Data is extracted from Eurostat Regional Structural Business Statistics (SBS).

León, Comunidad Foral de Navarra in Spain for the South European countries. Baden-Württemberg, indeed, accounts for one in four jobs and a quarter of turnover in the German automotive sector, being home to production facilities of the automakers Daimler, Porsche, and Audi. The West Midlands in the UK are home to more than 430 specialist automotive firms and some of the leading brands such as Jaguar Land Rover, Aston Martin Lagonda, and the BMW Group Plant Hams Hall (Automotive Council UK, 2021). Italy and Spain are also home to many regions specialised in the automotive such as Piemonte, home to the Fiat Group in Turin (Castelli et al., 2011), or Castilla y León, which hosts the automotive manufacturing plants of Renault, Grupo Fiat-Iveco, and Nissan. At the same time, the delocalisation of MNE production facilities in CEE has supported automotive employment particularly in the Czech regions of Jihozápad, Moravskoslezsko, Severovýchod, Severozápad, Střední Cechy, and in areas of Hungary (Észak-Magyarország, Közép-Dunántúl, Nyugat-Dunántúl,), Romania (Centru, Nord-Vest, Sud – Muntenia, Sud-Vest Oltenia and Vest), and Slovakia (Bratislavský kraj, Stredné Slovensko and Západné Slovensko).

The geography of employment in electronics shows an even stronger divide between Western and Central and Eastern Europe. Higher knowledge and skill intensity of this sector have fostered concentration in consolidated hubs (Figure 9). Germany is by far the leading economy with seven regions in the first quintile of the distribution (Baden-Württemberg, Bayern, Berlin, Hessen, Sachsen, Schleswig-Holstein, Thüringen), followed by the UK (East of England, Northern Ireland, Scotland, South-East, South-West). As examples, Bayern is home to firms from a wide range of different fields of electrical engineering and electronics, while Scotland has a global reputation for excellence in the sector, with over 50 years of electronics manufacturing experience. Relatively high shares of employment in electronics also characterise selected regions in other countries: Austria (Kärnten, Salzburg, Steiermark, Tirol), Finland (Åland, Helsinki-Uusimaa, Pohjois- ja Itä-Suomi) and the Netherlands (Gelderland, Noord-Brabant). In Eastern Europe, the largest shares are found in two regions in Poland (Pomorskie and Warszawski stoleczny). Electronics production has deep roots in the Pomorskie region, being home to the company Radmor, the largest Polish manufacturer of mobile VHF/UHF radiocommunication equipment. Finally, Hungary is another key player with seven regions in the first quintile of the electronics employment share distribution (Budapest, Észak-Alföld, Észak-Magyarország, Dél-Dunántúl, Közép-Dunántúl, Nyugat-Dunántúl, Pest).

Figure 8: Employment shares on total manufacturing – Textile & Apparel, 2018*

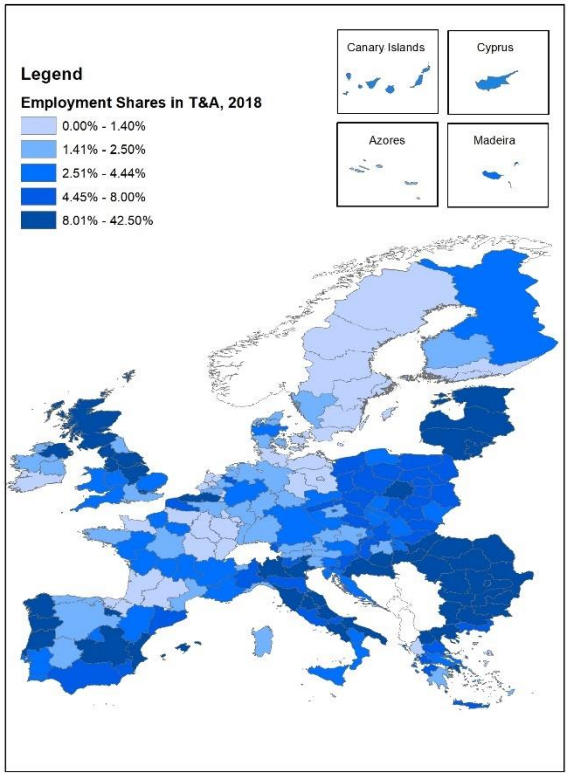
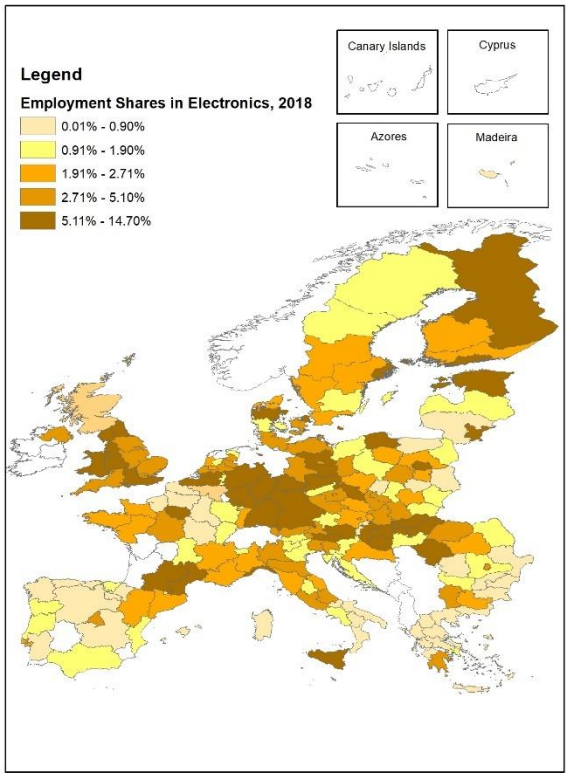


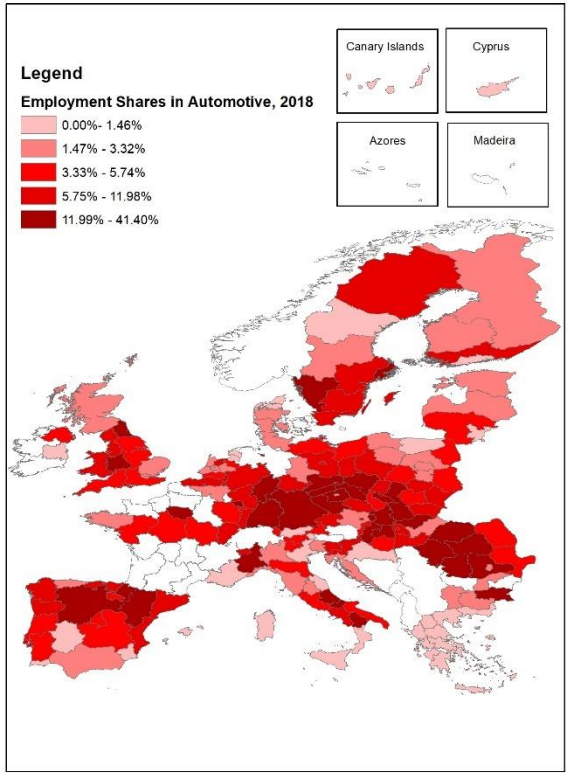
Figure 9: Employment shares on total manufacturing – Electronics, 2018*



(*) Classes are in quintiles of the employment distribution. Employment data for some French regions are missing due to the revision of the 2016 NUTS reclassification. In the maps, regions with missing data are in white. Employment shares are computed on total manufacturing only. This implies disproportionally large employment shares in some specific NUTS1&2 regions (2% of the total), as reflected in the upper limit of the fifth quintile of the distribution for T&A and automotive sector.

Source: Authors' elaboration on Eurostat Regional Structural Business Statistics (SBS).

Figure 10: Employment shares on total manufacturing – Automotive, 2018*



(*) Classes are in quintiles of the employment distribution. Employment data for some French regions are missing due to the revision of the 2016 NUTS reclassification. In the maps, regions with missing data are in white.

Source: Authors' elaboration on Eurostat Regional Structural Business Statistics (SBS).

3.2.2. Greenfield FDI in GVC-sensitive sectors: trends and geography

Foreign Direct Investment is crucial for the GVC upgrading and internationalisation of countries and regions (Crescenzi & Harman, 2018). The investing firm holds effective control of, or at least substantial influence over, the decision-making of new activities in the host economy. The focus on greenfield[25] investment allows to capture the capacity of internationalisation processes to bring to the home economy new activities. As extensively discussed in Comotti et al. (2020), GVCs and FDI are closely interlinked phenomena. FDI is a relevant mode of governance of GVCs, with MNEs often acting as lead firms in a variety of GVC configurations (Crescenzi et al. 2014). While FDI data might not capture the geography of production of the so-called "buyer-driven" GVCs – such as those of T&A, where the role of MNE production operations is relatively marginal – they can still offer key insights on the geography of power and value creation in GVCs. In addition, the analysis of the functional nature of FDI offers relevant insights on the GVC stage of both active and passive internationalisation patterns at the sub-national level. Therefore, the analysis of FDI flows remains central to a full picture of the internationalisation patterns of European economies and their position in GVCs. A full picture of global connectivity through FDI should cover both inward (i.e., investments made in the domestic economy by foreign firms) and outward (i.e., investments made by domestic companies in a foreign economy) flows to capture the nature, directionality, and functional profile of internationalisation processes (Crescenzi & Iammarino, 2017).

Key information on these dynamics comes from fDiMarkets, a database created and maintained by the Financial Times, covering cross-border greenfield investments for all countries and sectors worldwide between 2003 and 2017. The accuracy of fDiMarkets and its coherence with official statistical sources has been tested and confirmed by a consolidated literature (e.g., see Crescenzi et al., 2014). This data source offers a twofold advantage for the purpose of the present study. First, it makes it possible to monitor and trace individual investment projects down to the regional level, offering a coherent and integrated picture. Second, fDiMarkets offers detailed information on the business function pursued by each investment (e.g., it specifies whether a particular new investment project is a production site vis-à-vis, for example, a Research and Development unit or a regional Headquarter). Following Crescenzi et al. (2014) and linking the business functions in fDiMarkets with Sturgeon's (2008) identification of GVC stages (based on occupations), it is possible to

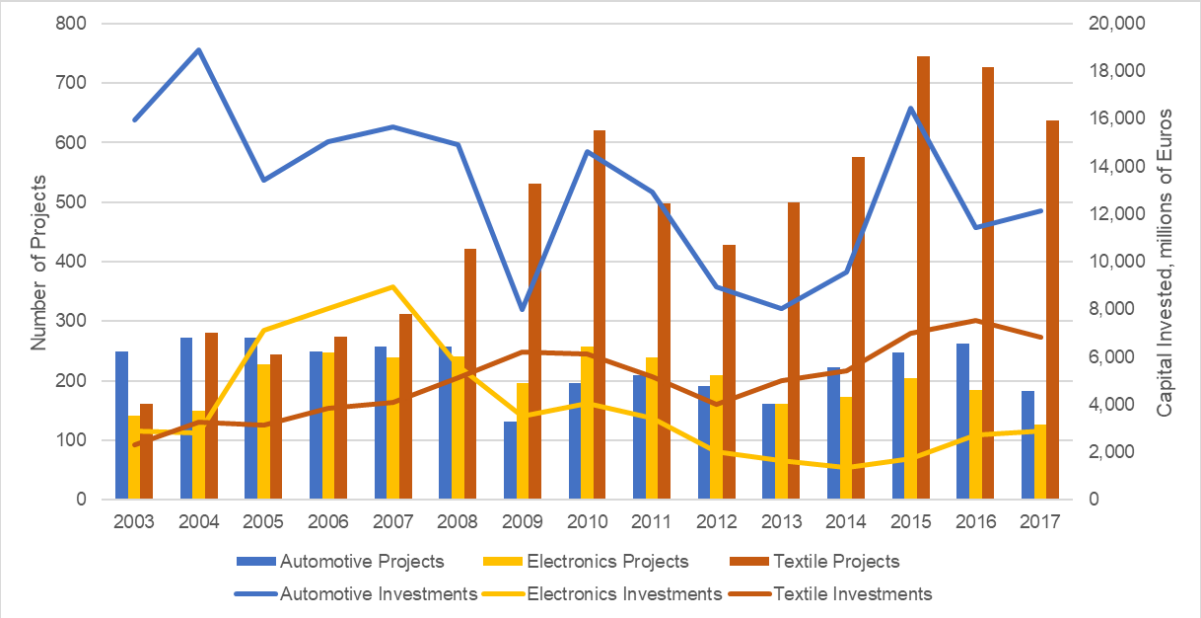
[25] "Greenfield FDI relates to investment projects that entail the establishment of new entities and the setting up of offices, buildings, plants and factories from scratch. (…) Greenfield FDI involves capital used for the purchase of fixed assets, materials, goods, and services, and to hire workers in the host country" (UNCTAD 2005, Training Manual on Statistics for FDI and the Operations of TNCs, p.98, unctad.org/en/docs/diaeia20091_en.pdf).

associate each investment project with a particular value chain stage. The functional classification of inward and outward FDI flows makes it possible to organically link the GVC analysis based on backward and forward linkages and value generation with FDI and their sub-national geography.

Figures 11 and 12 show the trend of total greenfield investment into (IFDI[26]) and from (OFDI) the EU27 and the UK between January 2003 and December 2017 for the three selected sectors, with the histograms showing the number of projects and the lines identifying the capital invested (expressed in million euros).

In this context, FDI trajectories over time are very sector-specific and distinct between inward and outward flows. As shown by the brown bars in both histograms below, the T&A sector saw the largest number of projects flowing into and from Europe among all sectors under analysis. Between 2003 to 2017, IFDI and OFDI increased marginally in both number of projects and capital invested, with a drop in both corresponding to the economic and financial crisis. Conversely, both IFDI and OFDI (in terms of project numbers and euro value) in electronics have been in decline since 2003, even if some signs of recovery emerged in the most recent years. Despite a more irregular pattern, a similar situation is recorded in IFDI into the EU27 and the UK in the automotive sector, with a decline during the financial years possibly reverted in an upward trend.

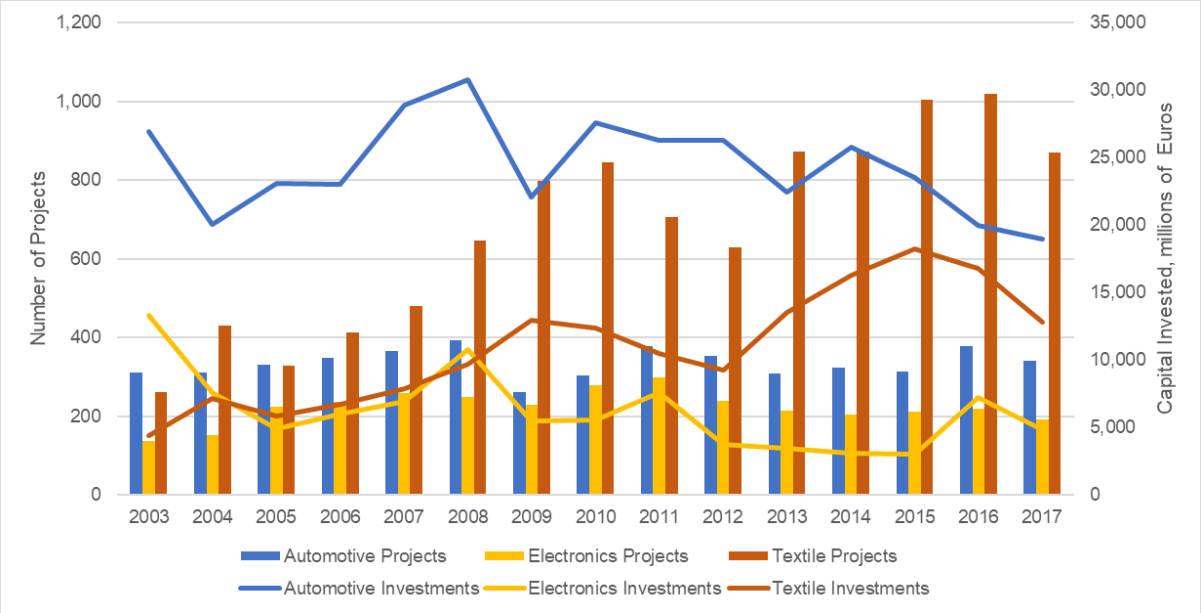
Figure 10: IFDI in the 3 GVC-sensitive sectors in the EU27 & UK, 2003-2017



Source: Authors' elaboration on fDiMarkets data.

[26] In the Report IFDI and OFDI will be used to identify inward and outward foreign direct investments respectively.

Figure 11: OFDI in the 3 GVC-sensitive sectors in the EU27 & UK, 2003-2017



Source: Authors' elaboration on fDiMarkets data.

In line with what has been explained above, fDiMarkets includes detailed information on the region where each investment project is located, as well as the location of the investing company. By geo-localising this information, it is possible to compute detailed regional-level statistics for both inward and outward FDI flows. NUTS1 and NUTS2 classifications are selected, depending on the most meaningful units in each country[27].

Figures 13 to 15 plot the cumulative value of inward (x-axis) and outward (y-axis) FDI for the EU and the UK regions for each GVC-sensitive sector. The blue dotted lines identify the averages for the EU27 and the UK for each variable, with the size of the dots proportional to the share of employment in the given sector for each region[28]. Considering the relative position of each NUTS region vis-à-vis the average it is possible – for each sector – to identify four broad regional groups:

1) **High FDI Integrated**: Higher Inward – Higher Outward (H-H)

2) **Low FDI Integrated**: Lower Inward – Lower Outward (L-L)

3) **IFDI Integrated**: Higher Inward- Lower Outward (H-L)

4) **OFDI Integrated**: Lower Inward – Higher Outward (L-H)

[27] NUTS2 are used for all countries for which data are available. NUTS1 are used for Belgium, Germany, and United Kingdom.
[28] To map the distribution of NUTS regions in Figure 13 to 15, all observations reporting a zero for either inward or outward (or both) were excluded. For each NUTS region, the FDI value is computed as the cumulative amount of FDI from 2003 to 2017, while the values for employment are computed as an average of the employment shares calculated over the years 2008 to 2017. In addition, the maps do not display values for all NUTS1 and NUTS2 where IFDI and/or OFDI were in the first quartile of the distribution of cumulative IFDI and/or OFDI.

To help interpretation, Table 12 lists the regions in each group (excluding Low FDI Integrated regions). Figures 15 to 18 map in colour the top 25% regions in the inward and outward distribution for each sector respectively.

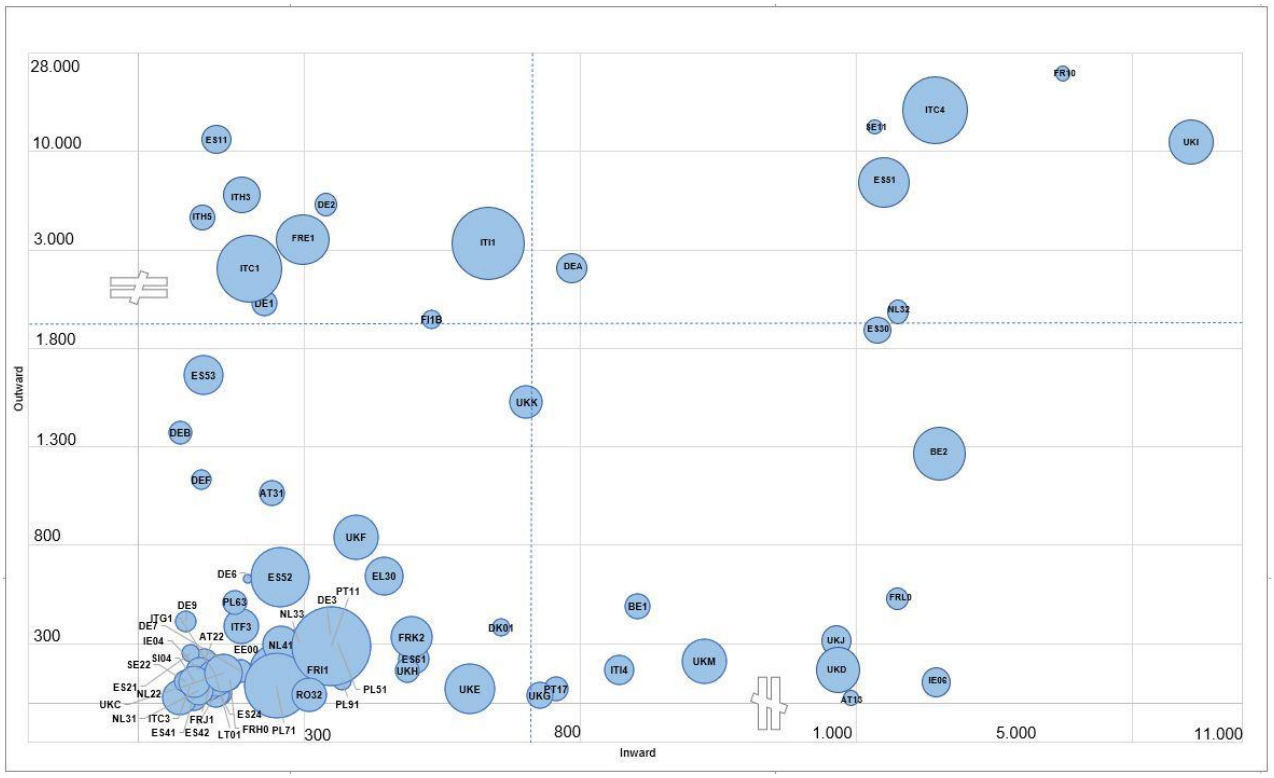
Over the period 2003-2017, Nordrhein-Westfalen in Germany played a crucial role as a sender and receiver of FDI, being in the high FDI integrated group for all three GVC-sensitive sectors. Similarly, the capital regions of Paris, Île de France, as well as London are both in the high FDI integrated groups for T&A and electronics, and in the outward FDI integrated in the automotive sector. Data show that most of the areas that fall in the high FDI integrated group for one sector tend to position themselves (at least) into the OFDI integrated class for the other sectors. This is for instance, in Germany, the case of Bayer and Baden-Württemberg, both in the high FDI integrated in electronics, and OFDI integrated in T&A and automotive. In Italy, Lombardy is instead in the high FDI integrated in T&A and electronics, while being in the low FDI integrated in automotive – showing how regional integration through the FDI flows can be sectoral dependent. This can also be noted in Piemonte which, as expected, is high FDI integrated in the automotive sector and outward exposed in T&A, while much less internationalised in electronics (in the lowest 25% for outward and automatically excluded from the scatterplot chart). Similarly, Noord-Holland (Netherlands) is high FDI integrated in T&A and OFDI integrated in electronics, but low integrated in the automotive sector. Cataluña (Spain) also plays a role in all three sectors, being in the high FDI integrated category in T&A, while attractive to IFDI in electronics and automotive but without participating as investor abroad. Stockholm (Sweden) is another key player in the EU being high FDI integrated in T&A and primarily a sender of FDI in electronics. Similar collocations are indeed found in the German regions of Sachsen and Hessen, both high FDI integrated in electronics and large receiver of FDI in automotive.

There are then regions which can be considered either only senders or receivers of FDI. This is the case of Helsinki-Uusimaa (Finland) in the OFDI integrated classes for both T&A and electronics sectors. On the other hand, Provence-Alpes-Côte d'Azur (France), Scotland (UK), Wien (Austria) and Vlaams Gewest (Belgium) are all regions very attractive to FDI in both T&A and electronics. Regions with inward investments above the EU average in more than one sectors are also found in the North-East of the UK for electronics and automotive, in West Midlands for T&A and automotive, or even in all the three industries in metropolitan areas such as Cumunidad de Madrid (Spain) and South-East of England.

It is then possible to identify a group of regions with a strong FDI presence in one single sector, while at the same time missing FDI links in other sectors. Examples are the Italian regions of Emilia Romagna, Toscana, and Veneto in the OFDI integrated class of T&A, together with Nord-Pas-de-Calais (France) and Galicia (Spain), all regions historically

specialised in the sector. The same applies to the East of England in electronics and Niedersachsen (Germany) in the automotive sector. A more diversified situation arises when looking at the remaining regions in IFDI integrated groups: there are many attracting investments only in one specific sector. In the T&A sector, this is mostly related to western European capital areas (Área Metropolitana de Lisboa in Portugal, Lazio in Italy, and Région de Bruxelles-Capitale in Belgium), as well as additional regions in the UK (such as North-West) and Ireland (Eastern and Midland). On the other hand, there is an interesting presence of Eastern and Southern European regions in the IFDI integrated group for electronics and automotive respectively. For the former, this is the case of Andalucía (Spain), Közép-Dunántúl (Hungary), Severen tsentralen (Bulgaria), Sicilia (Italy), and Wielkopolskie (Poland), together with areas in Central and Northern Europe like Brandenburg (Germany), and Noord-Brabant (Netherlands), and Sydsverige (Sweden). Similarly, in the automotive IFDI integrated classes, there are Bratislavský kraj and Západné Slovensko (both in Slovakia), as well as Jihozápad in Czechia, and several other Western European regions especially from Spain (Aragón, Castilla y León, Comunitat Valenciana, País Vasco).

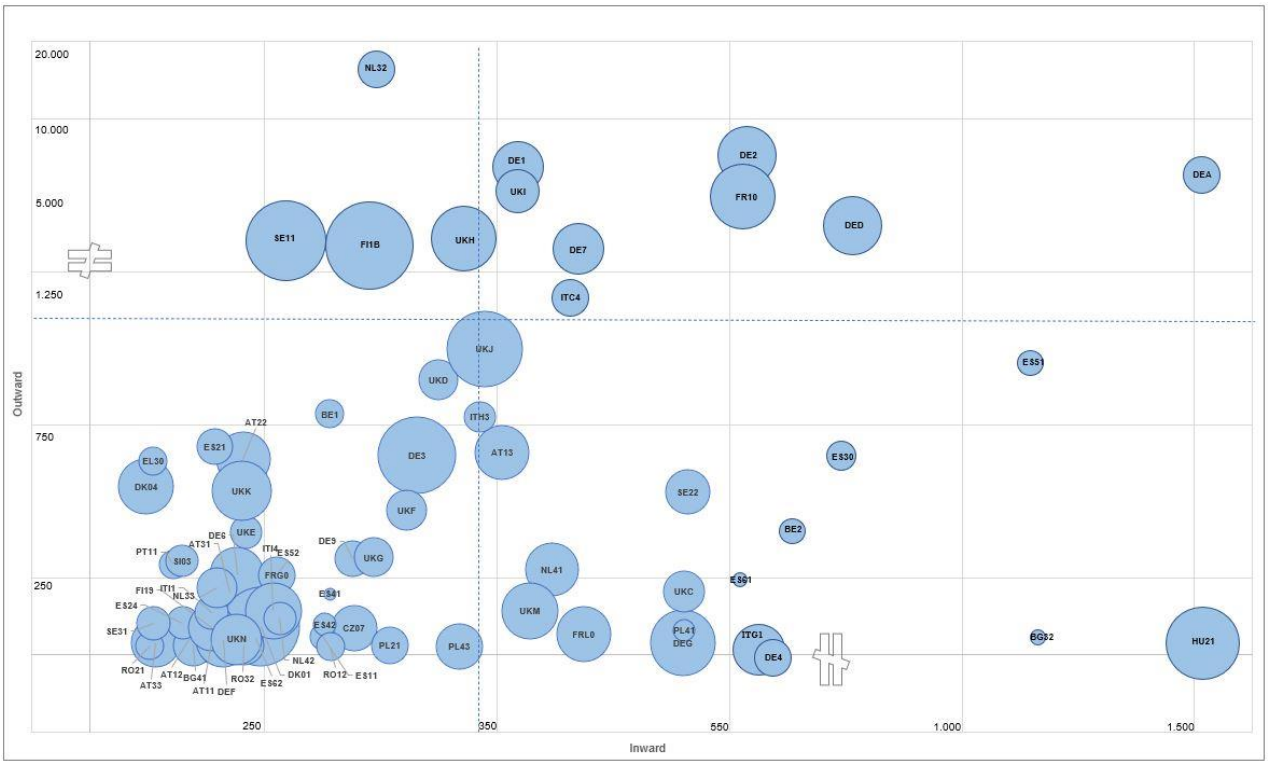
Figure 12: Cumulative IFDI and OFDI (in Euros, 2003-2017) + average employment share (2008-2017) – Textile & Apparel*



(*) Average values (blue lines) are for the EU27 plus the UK. The size of the dots is proportional to each NUTS1&2 average employment share in T&A over total manufacturing for the period 2008-2017.

Source: Authors' elaboration on fDiMarkets data and Eurostat SBS.

Figure 13: Cumulative IFDI and OFDI (in Euros, 2003-2017) + average employment share (2008-2017) – Electronics*



(*) Average values (blue lines) are for the EU27 plus the UK. The size of the dots is proportional to each NUTS1&2 average employment share in electronics over total manufacturing for the period 2008-2017

Source: Authors' elaboration on fDiMarkets data and Eurostat SBS.

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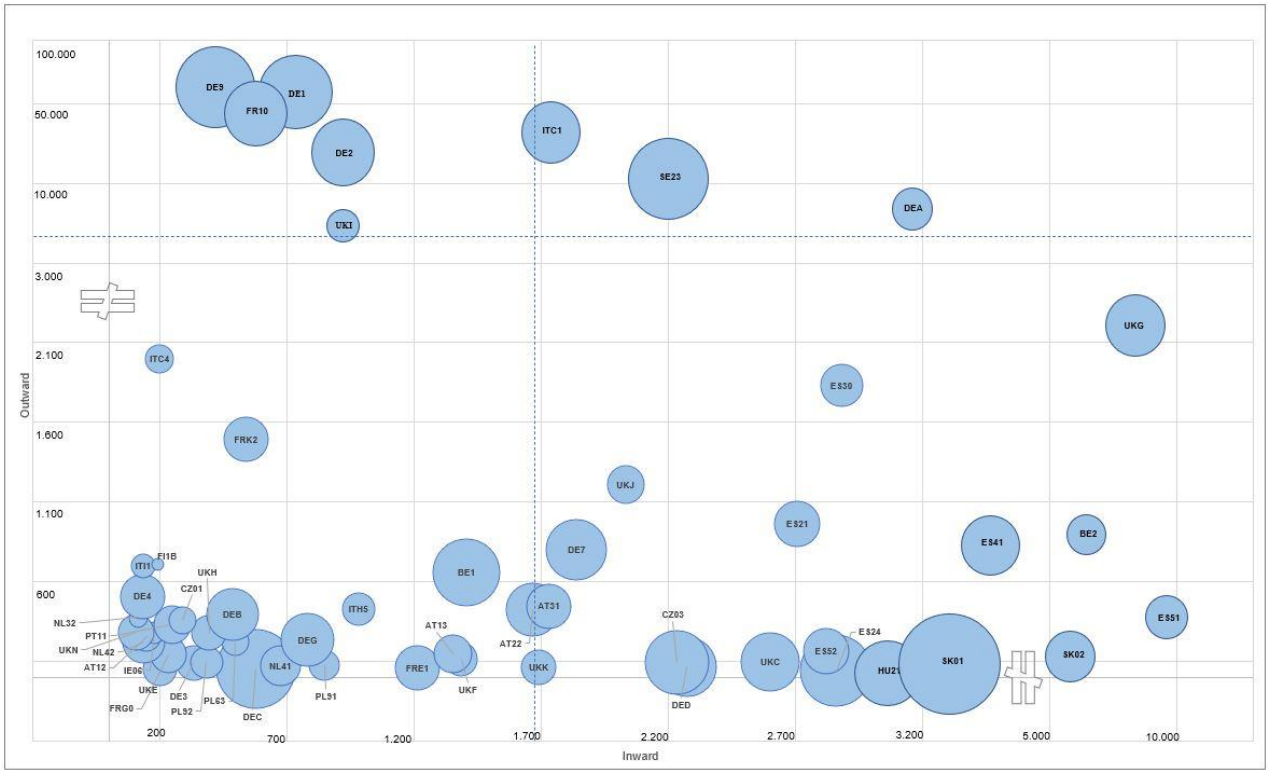
Figure 14: Cumulative IFDI and OFDI (in Euros, 2003-2017) + average employment share (2008-2017) – Automotive*



(*) Average values (blue lines) are for the EU27 plus the UK. The size of the dots is proportional to each NUTS1&2 average employment share in automotive over total manufacturing for the period 2008-2017.

Source: Authors' elaboration on fDiMarkets data and Eurostat SBS.

The importance of German regions as investors abroad in the automotive sector has increased in the years following the financial crisis[29], as shown by the regions Baden-Württemberg and Niedersachsen, which combined accounted for more than 50% of national OFDI in the industry. These regions have not only maintained their position over the years during the financial crisis, but also increased their shares by over 4%. These areas are followed by Île de France (13%), whose importance decreased over the years, but it is still accounting for more than 13% of total OFDI in automotive in 2016. Notably, the regions of Bayer and Piemonte seem to have been among the most affected by the financial crisis, with their shares significantly dropping over time[30].

[29] Tables showing the values and shares of the top 25% regions pre-, during- and post-crisis for all three sectors in terms of inward and outward FDI are reported in the *Appendix*. As the dataset covers the years 2003-2017, the period was broken down in 3 sub-periods: pre-crisis 2003 to 2007, during crisis 2008 to 2012, and post-crisis 2013 to 2017.

[30] Confronting the values during and after the crisis, there is a reduction of -2% in Bayern and -10% in Piemonte.

Table 12 – FDI integration groups, NUTS regions

	Sensitive Sectors		
	T&A	**Electronics**	**Automotive**
High FDI Integrated	Cataluña (Spain), Île de France (France), Lombardia (Italy), London (UK), Nordrhein-Westfalen (Germany), Stockholm (Sweden), Noord-Holland (the Netherlands)	Baden-Württemberg (Germany), Bayern (Germany), Hessen (Germany), Île de France (France), Lombardia (Italy), London (UK), Nordrhein-Westfalen (Germany), Sachsen (Germany)	Nordrhein-Westfalen (Germany), Piemonte (Italy), Västsverige (Sweden)
Outward FDI integrated	Baden-Württemberg (Germany), Bayer (Germany), Emilia Romagna (Italy), Galicia (Spain), Helsinki-Uusimaa (Finland), Nord-Pas-de-Calais (France), Piemonte (Italy), Toscana (Italy), Veneto (Italy)	East of England (UK), Helsinki-Uusimaa (Finland), Noord-Holland (the Netherlands), Stockholm (Sweden)	Baden-Württemberg (Germany), Bayern (Germany), Île de France (France), London (UK), Niedersachsen (Germany)
Inward FDI Integrated	Área Metropolitana de Lisboa (Portugal), Comunidad de Madrid (Spain), Eastern and Midland (Ireland), Lazio (Italy), North-West (UK), Provence-Alpes-Côte d'Azur (France), Région de Bruxelles-Capitale (Belgium), Scotland (UK), South-East (UK), Vlaams Gewest (Belgium), West Midlands (UK)	Andalucía (Spain), Brandenburg (Germany), Cataluña (Spain), Comunidad de Madrid (Spain), Közép-Dunántúl (Hungary), Noord-Brabant (the Netherlands), North-East (UK), Provence-Alpes-Côte d'Azur (France), Scotland (UK), Severen tsentralen (Bulgaria), Sicilia (Italy), South-East (UK), Sydsverige (Sweden), Vlaams Gewest (Belgium), Wielkopolskie (Poland), Wien (Austria)	Aragón (Spain), Bratislavský kraj (Slovakia), Castilla y León (Spain), Cataluña (Spain), Comunidad de Madrid (Spain), Comunitat Valenciana (Spain), Hessen (Germany), Jihozápad (Czechia), North-East (UK), Oberösterreich (Austria), País Vasco (Spain), Piemonte (Italy), Sachsen (Germany), South-East (UK), Vlaams Gewest (Belgium), West Midlands (UK), Západné Slovensko (Slovakia)

Source: Authors' elaboration on fDiMarkets data.

In terms of IFDI in automotive, the distribution among European regions is less concentrated compared to OFDI and it also became more dispersed over time. The South-East (UK), with 11.5%, is the largest recipient of FDI in automotive in the post-crisis period. Cataluña (Spain) has always been among the top recipients in automotive, and it is now the second largest attractor with over 8% of total investments in Europe. A similar attractive power in the sector is shown by Bratislavský kraj and Západné Slovensko in Slovakia, which are currently among the largest recipients in the EU. As for OFDI, Piemonte (Italy) faced a significant drop (-2.8%) also in the percentage of investments into the region in the post-crisis period, similarly to some other regions such as Nyugat-Dunántúl (Hungary, -3.7%), Sud-Muntenia (Romania, -2.7%), and Vlaams Gewest (Belgium, -2.9%).

Among the most advanced European regions there are the largest senders of FDI in electronics: London, with 21.5% of total investments in Europe, is by far the biggest player (moving from less than 3% in the pre-crisis years) and Bayern, which more than doubled its share over the years (from 6% to 13.5%.) These are followed by Baden-Württemberg (from 2 to over 9%) and Nordrhein-Westfalen (from 5% to 7.5%), and together with Île de France seemed to have been stimulated to offshore since the crisis.

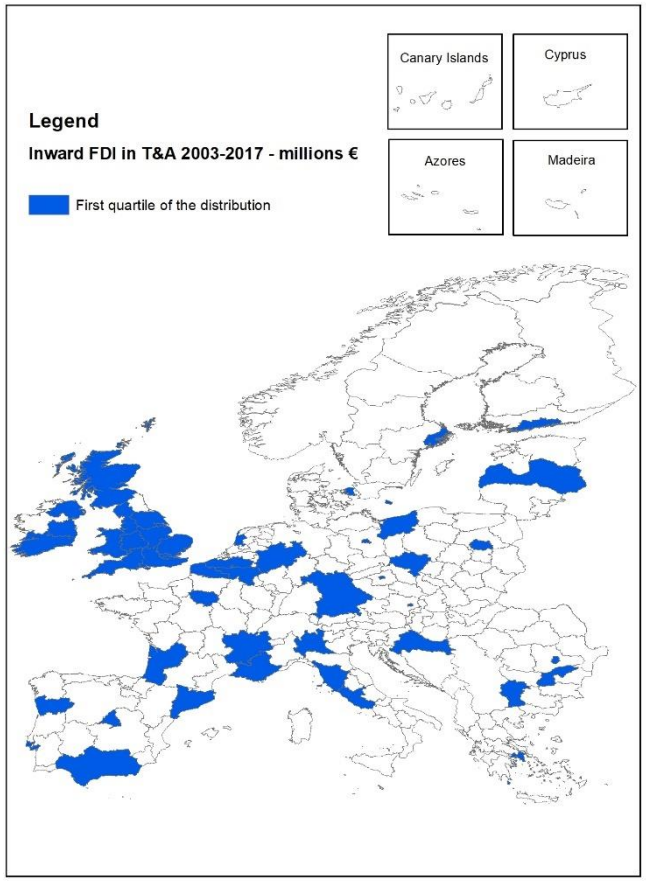
As previously outlined, a substantial portion of the largest recipients of FDI in electronics are in Eastern European countries, such as Hungary where Közép-Dunántúl has the largest share in the post-crisis period with over 8% of total investments in Europe, followed by Dolnoslaskie in Poland with almost 7%. Even if the latter has seen a reduction in IFDI compared to the pre-crisis values (16%), both regions have been able to attract industry capitals after the financial crisis. This is a trend seen in most regions in these two countries, with only a few exceptions[31]. Conversely, some regions located in CEE EU seem to have been negatively affected by the financial crisis, showing large decreases in FDI inflows: the largest drops have been in Campania (Italy, -5.5%), Nordrhein-Westfalen (Germany, -4%), Severen tsentralen (Bulgaria, -5%), and Západné Slovensko (Slovakia, -4%).

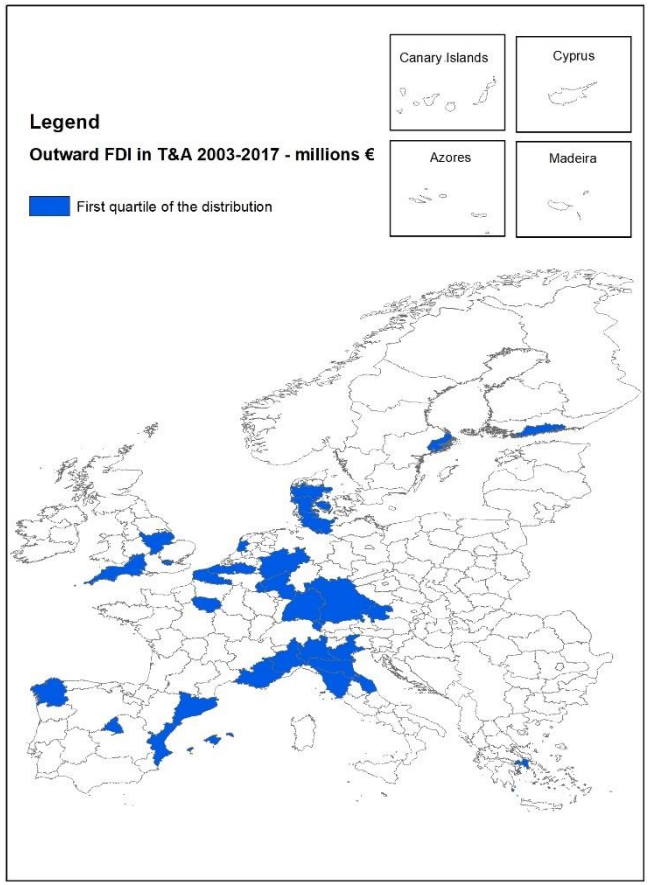
Île de France (France) over time has more than doubled its share as sender of investments in the T&A sector, accounting for over 20% of total investments from EU27 & the UK in the post-crisis period. This is followed by other metropolitan regions such as the Milan's region Lombardia (Italy, 11%), London (UK, 9.47%), and Stockholm (Sweden, 9.4%). Most of the major recipients in the industry do not show large variations in their shares in the years 2003-2017, with the largest drop affecting Cataluña (Spain, - 3%). In terms of inwards FDI in T&A, London is the largest recipient by far, with more than 15% of total investments in Europe, followed by the French regions of Île de France (9%) and Provence-Alpes-Côte d'Azur (4%).

[31] Exceptions are Kujawsko-Pomorskie in Poland and Nyugat-Dunántúl in Hungary, both with less than 1%.

Over time, such big players have been able to increase their position, securing even more investments compared to the other regions. On the other side, inward investments in the T&A sector have decreased in the regions of Eastern and Midland (Ireland) from more than 10% to 1.7% of total investments in Europe, as well as Northern Ireland (UK) dropping from 3% to 0.5%.

Figure 15: IFDI and OFDI – Textile & Apparel, 2003-2017*

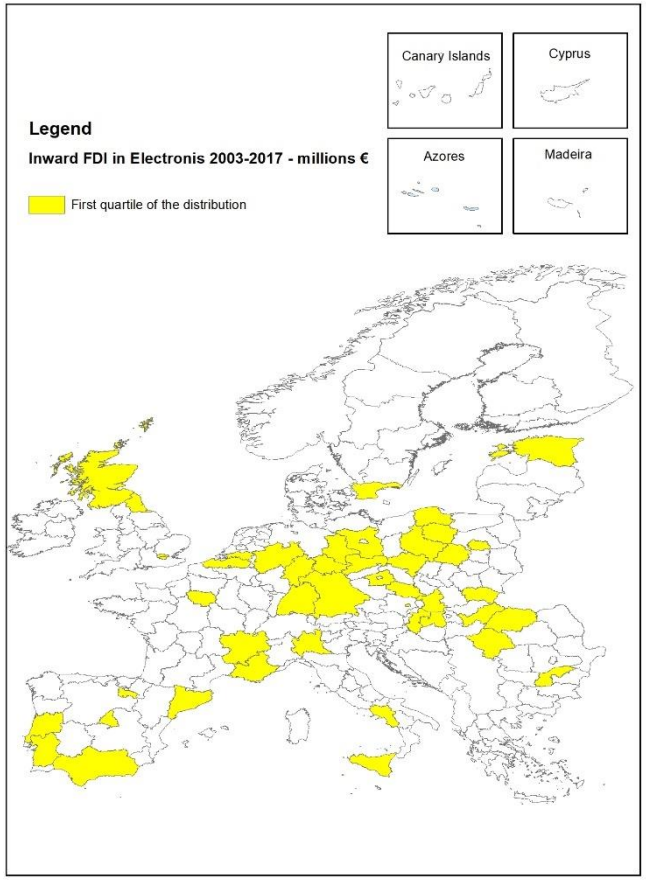


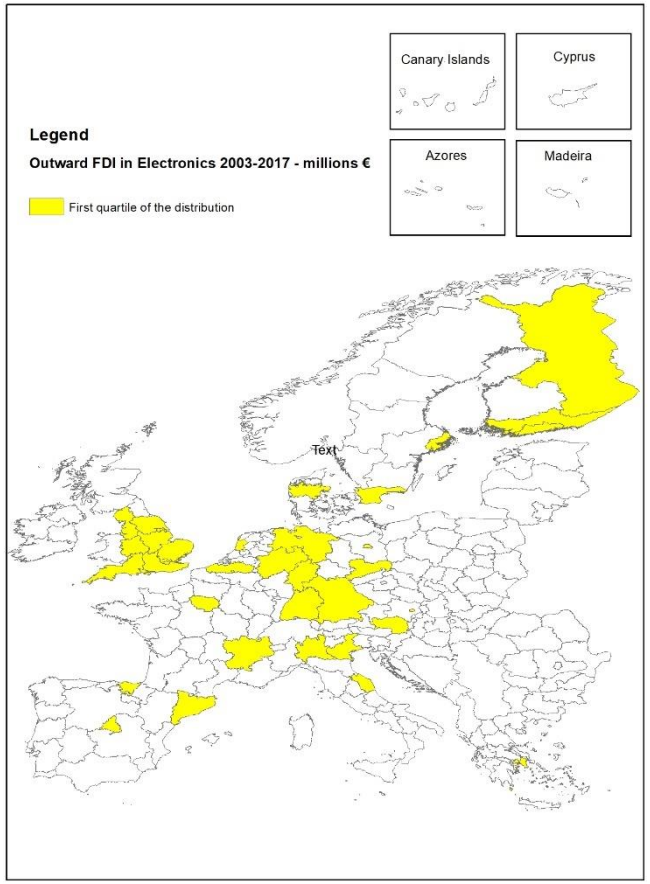


(*) in colours only NUTS in the first quartile of the distribution.

Source: Authors' elaboration on fDiMarkets data.

Figure 16: IFDI and OFDI – Electronics, 2003-2017*

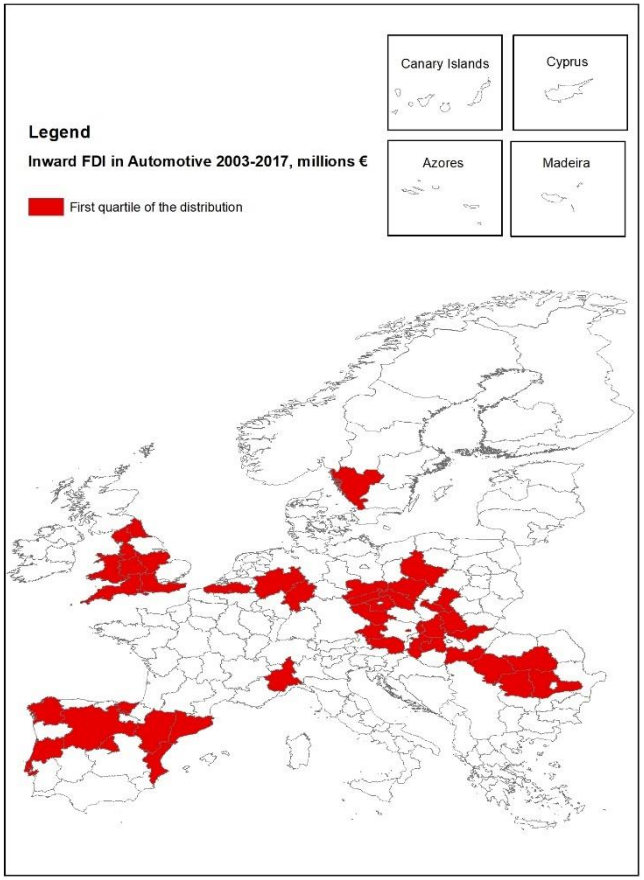


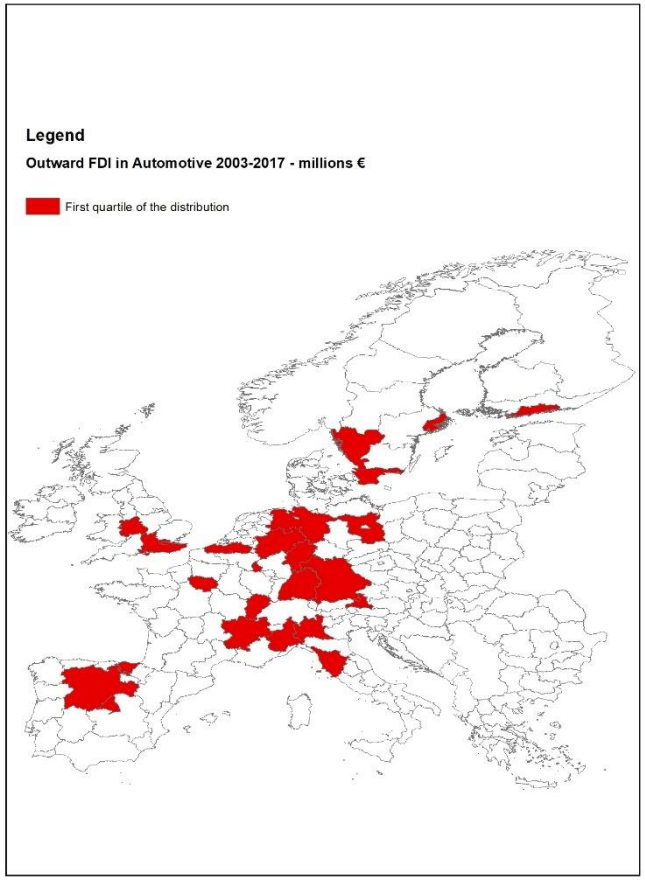


(*) in colours only NUTS in the first quartile of the distribution.

Source: Authors' elaboration on fDiMarkets data.

Figure 17: IFDI and OFDI – Automotive, 2003-2017*





(*) in colours only NUTS in the first quartile of the distribution.

Source: Authors' elaboration on fDiMarkets data.

As previously outlined, one of the main advantages of the fDiMarkets database is that it offers detailed information on the business function pursued by each investment. This allows to gain more information on the participation of regions in GVCs as it is possible to analyse the functional nature of FDI projects in each of the three sensitive industries. By looking at the business function, we can associate each investment project with a particular stage of the value chain. Greenfield FDI to and from European regions are subdivided according to the different stages of the value chain, or groups of functions, as classified by Crescenzi et al. (2014).

Figures 19-24 show IFDI and OFDI in and from European NUTS regions and the UK (from and to the World, including other Europe) in Innovation (R&D) and Production GVC stages for T&A, electronics, and automotive. In each figure, the left-hand-side map shows aggregate cumulative IFDI values over 2003-2017 (expressed in € millions) at the NUTS2[32] level, while the right-hand-side map identifies OFDI for the same period. Different colours identify the classes, defined in quartiles of the distribution. In the following, the focus of the analysis is primarily on the top 25% of the regional FDI distribution.

Given the limited number of R&D activities usually performed by the T&A sector, it is not surprising that only a few locations are involved in R&D FDI in this industry. As shown in Figure 19, Île de France turns out to be a strong hub of R&D for this sector being in the first quartile of both IFDI and OFDI: in the period under investigation, the region attracted R&D FDI for approximately 27 million euros from several firms including renowned luxury and fast fashion brands located in Italy, Spain, Switzerland, and Japan. Around 41 million R&D investments were made by Paris-based luxury and fashion design companies in Spain, Italy, Singapore, and US. The key areas of French expertise in research and innovation include technical yarns and textiles, machine solutions, 3D printing, smart solutions for e-commerce, industry 4.0 and medical textiles, as well as fashion tech research in new materials and smart textiles. In 2004, France launched a competitiveness cluster programme to encourage collaborative innovation and R&D in the T&A industry. The main technological innovation strategies of French major fashion and luxury brands include partnerships with technological companies, accelerators, incubators, labs, foundations, award and competitions, patent acquisitions, as well as high-tech accessories (Gras & Eliot, 2019). Other large recipients are found in Helsinki-Uusimaa (Denmark), Nordjylland (Denmark), and Praha (Czechia) while major senders are the regions of Attiki (Greece), Baden-Württemberg (Germany), and East Midlands (UK). More specifically, Praha received the largest single R&D investment (51.3 million), which was made in 2007 by a company in the sporting goods retail market headquartered in Greece (Attiki).

[32] NUTS2 are used for all the countries, except for Belgium, Germany, and the UK where NUTS1 is used. In the maps, regions with no observations are in white.

In line with what previously observed in the Report, investments in production-related activities in T&A are largely directed towards Eastern European regions, especially in Bulgaria (Severen Tsentralen, Yugoiztochen, Yuzhen tsentralen), Croatia (Kontinentalna Hrvatska), Czechia (Jihovýchod, Moravskoslezsko), Poland (Dolnoslaskie, Lódzkie, Lubuskie), Lithuania (Vidurio ir vakaru Lietuvos regionas), and Romania (Nord-Vest). These areas receive investment for production-related activities to similar extent to the T&A historical regions in Europe, such as Comunidad de Madrid (Spain)[33], Eastern and Midland (Ireland), or Toscana (Italy). For example, the largest investment (296 million) was made by a well-known Italian fashion group from Piemonte to Veliko Tarnovo, which is in the region Severen Tsentralen of Bulgaria. On the other hand, the major investors in T&A production activities are from regions in Central Europe such as the Austrian Oberösterreich, Steiermark, and Vorarlberg, Midtjylland and Nordjylland in Denmark, German Baden-Württemberg, Bayern, Nordrhein-Westfalen, Syddanmark, and Sachsen, Italian Lombardia, Piemonte and Veneto, and Finnish regions (Helsinki-Uusimaa, Etelä-Suomi)[34]. More specifically, the larger investments were made by firms located in Upper Austria and mostly in the city of Lenzing, which alone sent almost 1 billion OFDI to countries outside the EU including the US, India, Indonesia, and China, in addition to the UK. Indeed, this city is home to the Lenzing Group, an international producer of high-quality viscose fibres with manufacturing sites in all its key markets and supplying the global textile and nonwovens industry. Together with large metropolitan areas in London and Île de France, in most cases, these regions are mainly investing in production processes to relocate their activities abroad. As for the Ile-de-France in R&D activities, in T&A Cataluña is in the top quartile of the distribution for both IFDI and OFDI in production: as an example, a handful of textile firms located in Barcelona invested around 147 million in both EU (i.e., Poland, Finland, Germany) and non-EU (i.e., China, Morocco, Mexico, Vietnam, US) locations.

Overall, regions involved with OFDI in R&D in electronics are primarily in the most advanced areas in Europe (Bayern, Helsinki-Uusimaa, Noord-Holland, and Stockholm), while some recipients of IFDI in R&D are also located in Eastern Europe. These major attractors are Közép-Magyarország (Hungary), Vest (Romania) and the Polish regions of Lódzkie and Warszawski stoleczny, together with other regions in France (Basse-Normandie, Rhône-Alpes), Spain (Cataluña, Comunidad de Madrid), and the United Kingdom (North-West, Scotland, and West Midlands)[35]. Cataluña, over the period under investigation attracted the largest amount of R&D investments in the sector (459 million) from firms specialised in electrical equipment and components as well as audio and video equipment, and located in

[33] In the first quartile the distribution, there are also other regions in Germany (Brandenburg, Thüringen) and Netherland (Drenthe, Groningen).
[34] Other regions in the top 25% for inward FDI in T&A production are Luxembourg, Nord-Pas-de-Calais (France), and Vlaams Gewest (Belgium).
[35] Noord-Brabant (Netherlands) and Toscana (Italy) are also in the first quartile of the distribution.

France, Germany, US, and Japan. Île de France is again in the top 25% in R&D related activities for both IFDI and OFDI, together with the three German regions of Baden-Württemberg, Hessen, Nordrhein-Westfalen, as well as Lombardia and Stockholm. More specifically, firms located in Bayern – some of these renowned electronics companies – recorded the largest R&D OFDI (approximately 732 million), which were mostly directed towards Turkey, Spain, and the US.

Similarly to T&A, production-related FDI in electronics has a first quartile regional distribution predominantly located in Eastern Europe for IFDI and central Europe for OFDI[36]. For the first, the most attractive regions are Severen tsentralen (Bulgaria), Střední Cechy (Czechia), Észak-Alföld, Közép-Dunántúl, Nyugat-Dunántúl (Hungary), Dolnoslaskie, Lódzkie, Lubuskie, Pomorskie, Wielkopolskie (Poland), Nord-Vest, Vest (Romania), and Východné Slovensko, Západné, Slovensko (Slovakia). For example, Dolnoslaskie in Poland attracted alone almost 5 billion investments, most of these from renowned firms specialised in electronical equipment, components and household appliances and mostly located in South Korea and the Netherlands. Looking at Figure 22, however, it is possible to notice a strong presence of some Western regions as large attractors, especially in the French Lorraine, Poitou-Charentes, and Provence-Alpes-Côte d'Azur, in the German Brandenburg, Nordrhein-Westfalen, Sachsen-Anhalt, Thüringen, the two main Italian Southern poles in electronics, Campania and Sicilia, Alentejo and Centro in Portugal and Andalucía and La Rioja in Spain. On the other hand, major investors are located either in capital regions such as London, Wien, Bruxelles, Helsinki, Stockholm and Île de France, or in industrial regions of old tradition such as Baden-Württemberg, Bayern, Nordrhein-Westfalen, Hessen, Berlin in Germany, Attiki in Greece, Lombardia and Marche in Italy, Noord-Holland, País Vasco in Spain, Pohjois- ja Itä-Suomi in Sweden, and South-East, East and North-West of England. A handful of renowned firms located in Amsterdam (the Netherlands) and mostly specialised in electric lighting and audio and video equipment, in addition to electrical equipment and components, invested approximately 18 billion both in EU and extra-EU locations. However, South Korea attracted alone more than 13 billion of Europeans investments. Cataluña (Spain), again, reveals its ability to be at the same time both a major sender and recipient of large production investments, regardless of the sector. Similarly, other regions with contemporary large IFDI and OFDI are Comunidad de Madrid (Spain), Sachsen (Germany), Sydsverige (Sweden), Veneto (Italy), and Vlaams Gewest (Belgium).

Regions with the most significant inward and outward investments in automotive R&D are all located in the well-known automotive regions in central Europe, with some eastern EU regions also receiving large portion of R&D FDI. Regions in the first quartile of the distribution

[36] Table 9 provides a full list of the NUTS regions in the first quartile for IFDI and OFDI in each industry for both R&D and production GVCs.

for both IFDI and OFDI are Baden-Württemberg, Bayern, Niedersachsen, Nordrhein-Westfalen, and Steiermark in Germany, the Italian Piemonte and Västsverige in Sweden. The metropolitan hub of Paris and London are also very large investors. For example, firms located in Île de France (some of these worldwide renowned automakers) sent the largest amount of R&D investments (almost 5 billion), which were mostly directed towards Romania and China. In Eastern Europe, Romania has the highest number of attractor regions (Bucuresti – Ilfov, Centru, Sud – Muntenia, Sud-Vest Oltenia), followed by Poland (Zachodniopomorskie, Malopolskie), Hungary (Közép-Magyarország), and Czechia (Severozápad). In Western Europe several regions are involved as receivers: Oberösterreich (Austria), Vlaams Gewest (Belgium), Limousin (France), Hessen (Germany), Centro (Portugal), Cataluña (Spain), and West Midlands, East Midlands, South-East (UK). More specifically, Coimbra in the Centro Region of Portugal, attracted in 2007 1 billion R&D FDI made by a well-known automaker from Germany.

Investment in automotive production is by far one of the largest sectors in terms of capital invested and number of projects, as also shown by the values reported in the maps and the number of regions involved in the analysis. But this larger sample confirms the trend seen in the other sectors and GVCs. Eastern and some Southern regions are large recipients of FDI in this sector, while the role of senders is played by most advanced European regions in central Europe. Regions in the first quartile for both IFDI and OFDI are in the Spanish regions of Castilla y León, Comunidad de Madrid, País Vasco, together with Piemonte (Italy), Västsverige (Sweden), Vlaams Gewest (Belgium), and West Midlands (UK). It is interesting to note that Piemonte and Västsverige are among the largest recipients and senders of investments in both R&D and production in the automotive sector, highlighting the crucial importance of these two regions in the sector. IFDI in production activities in automotive is located mostly in Czechia (Jihozápad, Moravskoslezsko, Severovýchod, Střední Cechy), Hungary (Dél-Alföld, Észak-Magyarország, Közép-Dunántúl, Nyugat-Dunántúl), Poland (Dolnoslaskie, Slaskie, Wielkopolskie), Romania (Centru, Sud – Muntenia, Sud-Vest Oltenia, Vest), and Slovakia (Bratislavský kraj, Stredné Slovensko, Západné Slovensko). These are mostly areas where new investment projects have supported a re-localisation of automotive production within Europe. However, there are at the same time large recipients also in Western Europe regions, as Oberösterreich, Steiermark (Austria), Nordrhein-Westfalen, Sachsen (Germany), Cataluña, Comunitat Valenciana, Galicia (Spain) and South-East, South-West, North-East, North-West, Wales (UK). Cataluña alone attracted more than 10 billion production IFDI, which were mostly made by well-known German automakers. Major investors are located in the historical automotive regions of Baden-Württemberg, Bayern, Niedersachsen, Nordrhein-Westfalen, Hessen (Germany), Lombardia, Toscana (Italy), Stockholm, Sydsverige (Sweden), as well as in the capital regions of Île de France, Helsinki-

Uusimaa, London, Luxembourg, and Bruxelles[37]. For example, in the period under investigation, a group of prominent firms located in Niedersachsen (Germany), sent almost 84 billion investments in production mostly towards China, Spain, and India.

[37] Franche-Comté and Rhône-Alpes are also in the list.

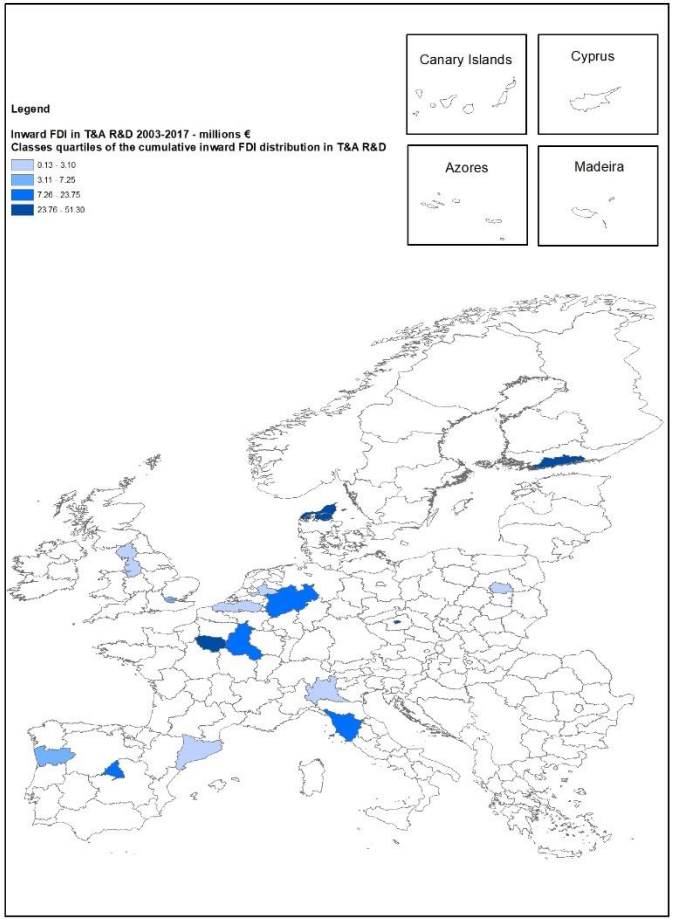
Table 13 – Regions in the first quartile for IFDI and OFDI in R&D and production GVCs

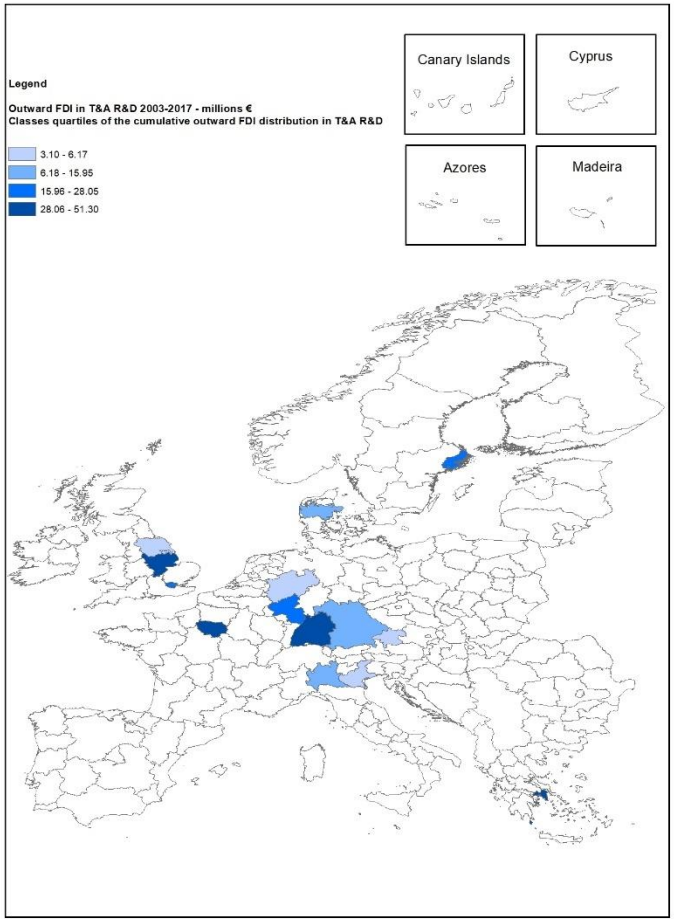
		Sensitive Sectors		
		Textile	**Electronics**	**Automotive**
R&D	Inward	Helsinki-Uusimaa (Finland), Île de France (France), Nordjylland (Denmark), Praha (Czechia)	Baden-Württemberg (Germany), Basse-Normandie (France), Cataluña (Spain), Comunidad de Madrid (Spain), East of England (UK), Hessen (Germany), Île de France (France), Közép-Magyarország (Hungary), Lódzkie (Poland), Lombardia (Italy), Noord-Brabant (Netherlands), Nordrhein-Westfalen (Germany), North-West (UK), Rhône-Alpes (France), Scotland (UK), Toscana (Italy), Vest (Romania), Warszawski stoleczny (Poland), West Midlands (UK)	Baden-Württemberg (Germany), Bayern (Germany), Bucuresti - Ilfov (Romania), Cataluña (Spain), Centro (Portugal), Centru (Romania), East Midlands (UK), Hessen (Germany), Közép-Magyarország (Hungary), Limousin (France), Malopolskie (Poland), Niedersachsen (Germany), Nordrhein-Westfalen (Germany), Oberösterreich (Austria), Piemonte (Italy), Severozápad (Czechia), South East (UK), Steiermark (Austria), Sud - Muntenia (Romania), Sud-Vest Oltenia (Romania), Västsverige (Sweden), Vlaams Gewest (Belgium), West Midlands (UK), Zachodniopomorskie (Poland)
	Outward	Attiki (Greece), Baden-Württemberg (Gemany), East Midlands (UK), Île de France (France)	Baden-Württemberg (Germany), Bayern (Germany), Helsinki-Uusimaa (Finland), Hessen (Germany), Île de France (France), Lombardia(Italy), London (UK), Noord-Holland (Netherlands), Nordrhein-Westfalen (Germany), South West (UK), Stockholm (Sweden)	Baden-Württemberg (Germany), Bayern (Germany), Île de France (France), London (UK), Niedersachsen (Germany), Nordrhein-Westfalen (Germany), Piemonte (Italy), Steiermark (Austria), Västsverige (Sweden)
Production	Inward	Brandenburg (Germany), Cataluña (Spain), Comunidad de Madrid (Spain), Dolnoslaskie (Poland), Drenthe (Netherlands), Eastern and Midland (Ireland), Eesti (Estonia), Groningen (Netherlands), Jihovýchod (Czehia), Kontinentalna Hrvatska (Croatia), Lódzkie (Poland), Lubuskie (Poland), Moravskoslezsko (Czechia), Nord-Vest (Romania), Severen tsentralen (Bulgaria), Thüringen (Germany), Toscana (Italy), Vidurio ir vakaru Lietuvos regionas (Lithuania), Yugoiztochen (Bulgaria), Yuzhen tsentralen (Bulgaria)	Andalucía (Spain), Brandenburg (Germany), Campania (Italy), Cataluña (Spain), Centro (Portugal), Comunidad de Madrid (Spain), Dolnoslaskie Západné (Poland), Eesti (Estonia), Észak-Alföld (Hungary), Közép-Dunántúl (Hungary), La Rioja (Spain), Lódzkie (Poland), Lorraine (France), Lubuskie (Poland), Nordrhein-Westfalen (Germany), Nord-Vest (Romania), North East (UK), Nyugat-Dunántúl (Hungary), Poitou-Charentes (France), Pomorskie (Poland), Provence-Alpes-Côte d'Azur (France), Sachsen (Germany), Sachsen-Anhalt (Germany), Severen tsentralen (Bulgaria), Sicilia (Italy), Slovensko (Slovakia), Strední Cechy (Czechia), Sydsverige (Sweden), Thüringen (Germany), Veneto (Italy), Vest (Romania), Vlaams Gewest (Belgium), Východné Slovensko (Slovakia), Wielkopolskie (Poland)	Aragón (Spain), Área Metropolitana de Lisboa (Portugal), Bratislavský kraj (Slovakia), Castilla y León (Spain), Cataluña (Spain), Centru (Romania), Comunidad de Madrid (Spain), Comunitat Valenciana, Dél-Alföld (Hungary), Dolnoslaskie (Poland), Észak-Magyarország (Hungary), Galicia (Spain), Jihozápad (Czechia), Közép-Dunántúl (Hungary), Moravskoslezsko (Czechia), Nordrhein-Westfalen (Germany), North East (UK), North West (UK), Nyugat-Dunántúl (Hungary), Oberösterreich (Austria), País Vasco (Spain), Piemonte (Italy), Sachsen (Germany), Severovýchod (Czechia), Slaskie (Poland), South East (UK), South West (UK), Steiermark (Austria), Stredné Slovensko (Slovakia), Strední Cechy (Czechia), Sud - Muntenia (Romania), Sud-Vest Oltenia (Romania), Västsverige (Sweden), Vest (Romania), Vlaams Gewest (Belgium), Wales (UK), West Midlands (UK), Wielkopolskie (Poland), Západné Slovensko (Slovakia)

	Outward	Baden-Württemberg (Germany), Bayern (Germany), Cataluña (Spain), Etelä-Suomi (Finland), Helsinki-Uusimaa (Finland), Île de France (France), Lombardia (Italy), London (UK), Luxembourg, Midtjylland (Denmark), Nordjylland (Denmark), Nord-Pas-de-Calais (France), Nordrhein-Westfalen (Germany), Oberösterreich (Austria), Piemonte (Italy), Sachsen (Germany), Steiermark (Austria), Syddanmark (Denmark), Sydsverige (Sweden), Veneto (Italy), Vlaams Gewest (Belgium), Vorarlberg (Austria)		Attiki (Greece), Baden-Württemberg (Germany), Bayern (Germany), Berlin (Germany), Cataluña (Spain), Comunidad de Madrid (Spain), East of England (UK), Helsinki-Uusimaa (Finland), Hessen (Germany), Île de France (France), Lombardia (Italy), London (UK), Marche (Italy), Noord-Holland (Netherlands), Nordrhein-Westfalen (Germany), North West (UK), País Vasco (Spain), Pohjois- ja Itä-Suomi (Finland), Région de Bruxelles-Capitale (Belgium), Rhône-Alpes (France), Sachsen (Germany), South East (UK), Steiermark (Austria), Stockholm (Sweden), Sydsverige (Sweden), Veneto (Italy), Vlaams Gewest (Belgium), Wien (Austria)		Baden-Württemberg (Germany), Bayern (Germany), Castilla y León (Spain), Comunidad de Madrid (Spain), Franche-Comté (France), Helsinki-Uusimaa (Finland), Hessen (Germany), Île de France (France), Lombardia (Italy), London (UK), Luxembourg, Niedersachsen (Germany), Nordrhein-Westfalen (Germany), País Vasco (Spain), Piemonte (Italy), Région de Bruxelles-Capitale (Belgium), Rhône-Alpes (France), South East (UK), Stockholm (Sweden), Sydsverige (Sweden), Toscana (Italy), Västsverige (Sweden), Vlaams Gewest (Belgium), West Midlands (UK)

Source: Authors' elaboration on fDiMarkets data.

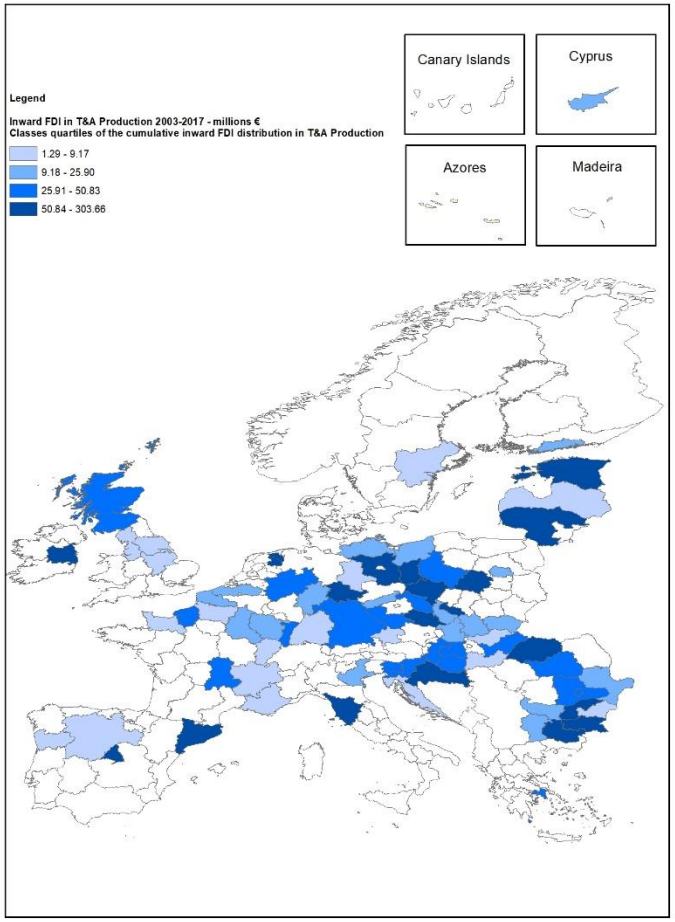
Figure 18: IFDI and OFDI in R&D – Textile & Apparel, 2003-2017

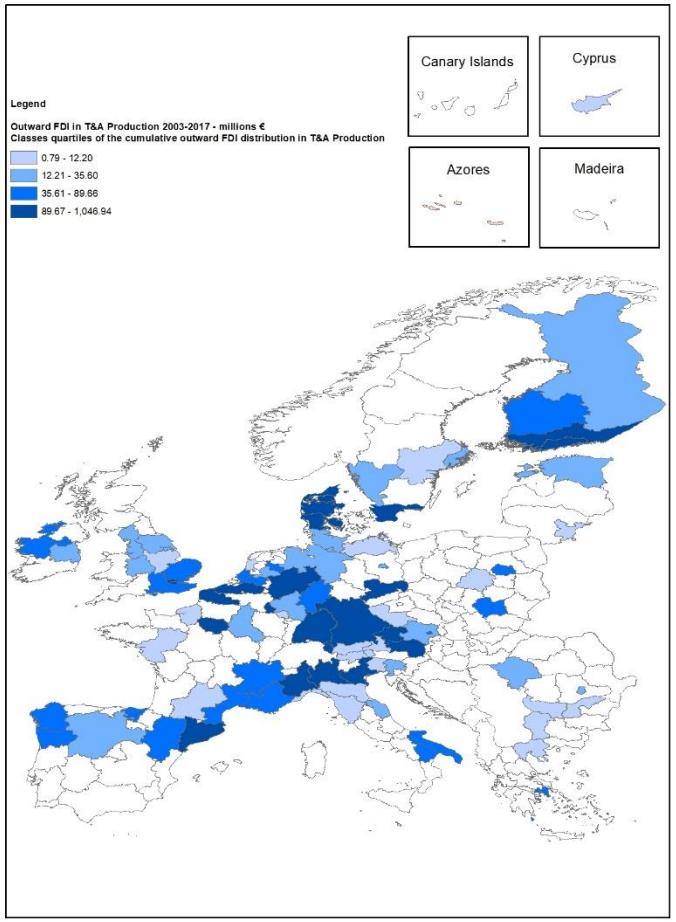




Source: Authors' elaboration on fDiMarkets data.

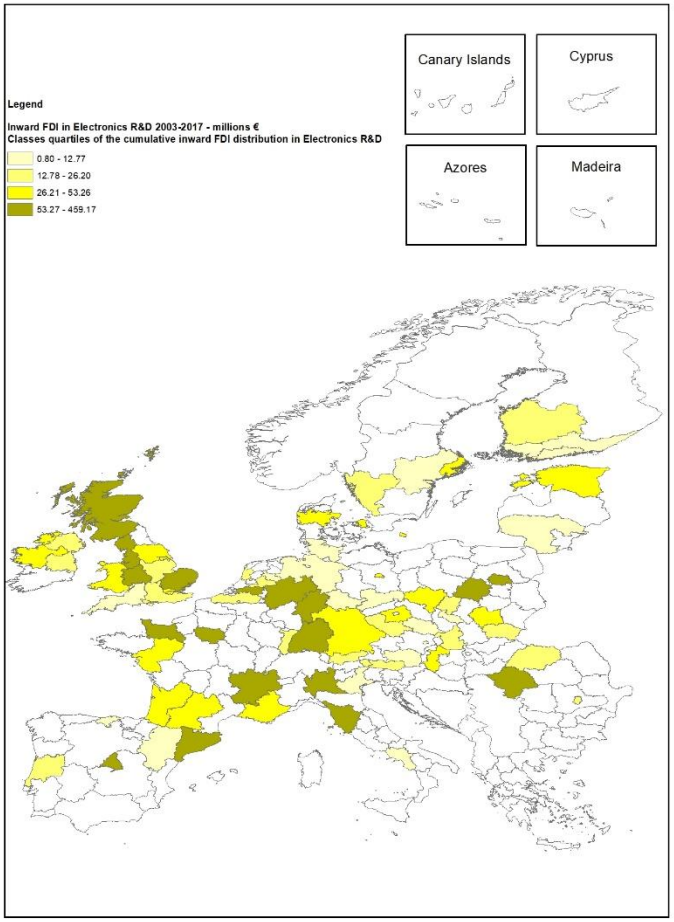
Figure 19: IFDI and OFDI in production – Textile & Apparel, 2003-2017

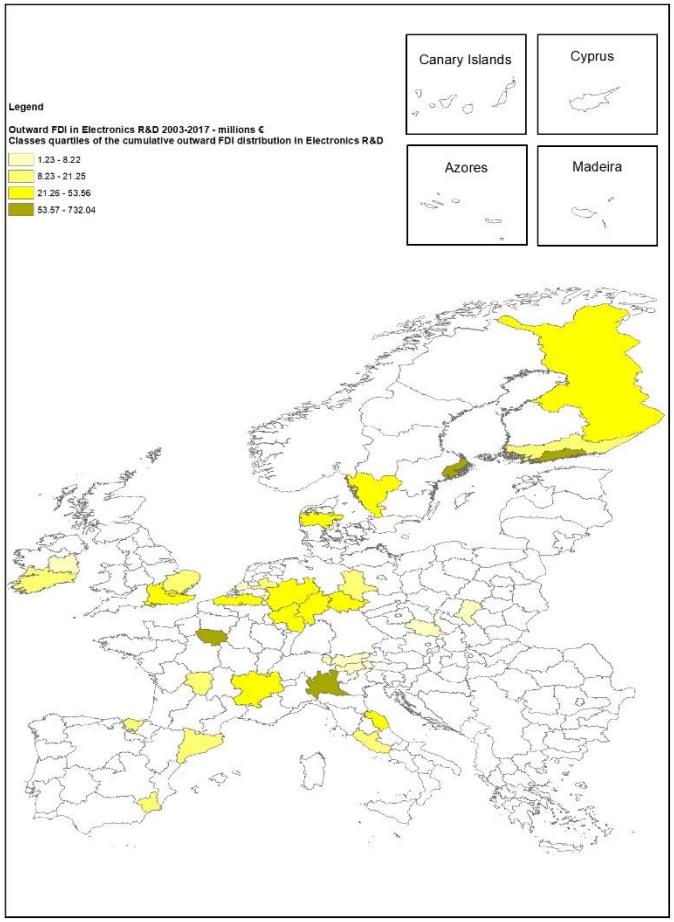




Source: Authors' elaboration on fDiMarkets data.

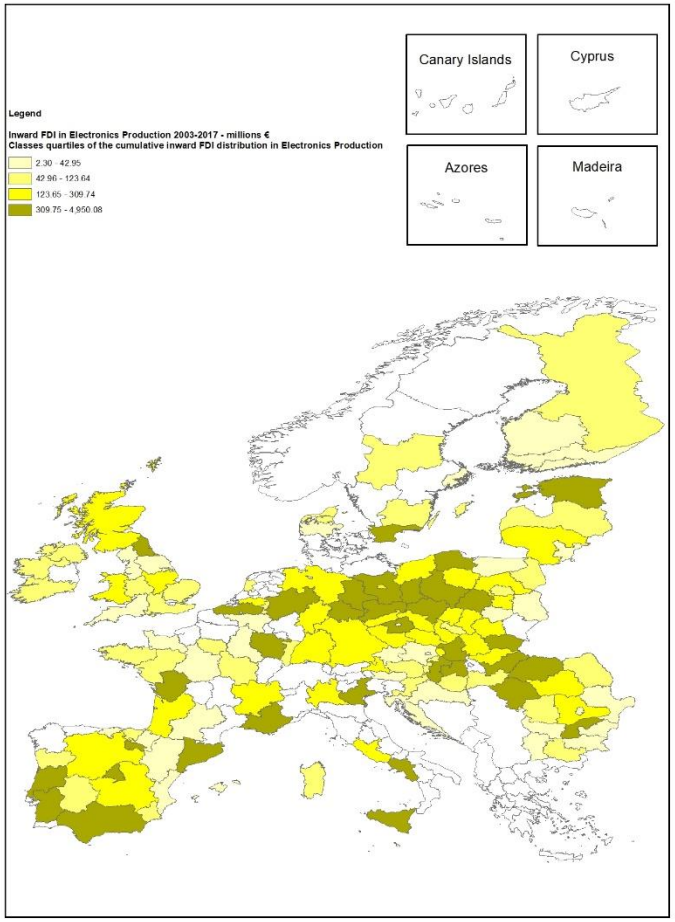
Figure 20: IFDI and OFDI in R&D – Electronics, 2003-2017

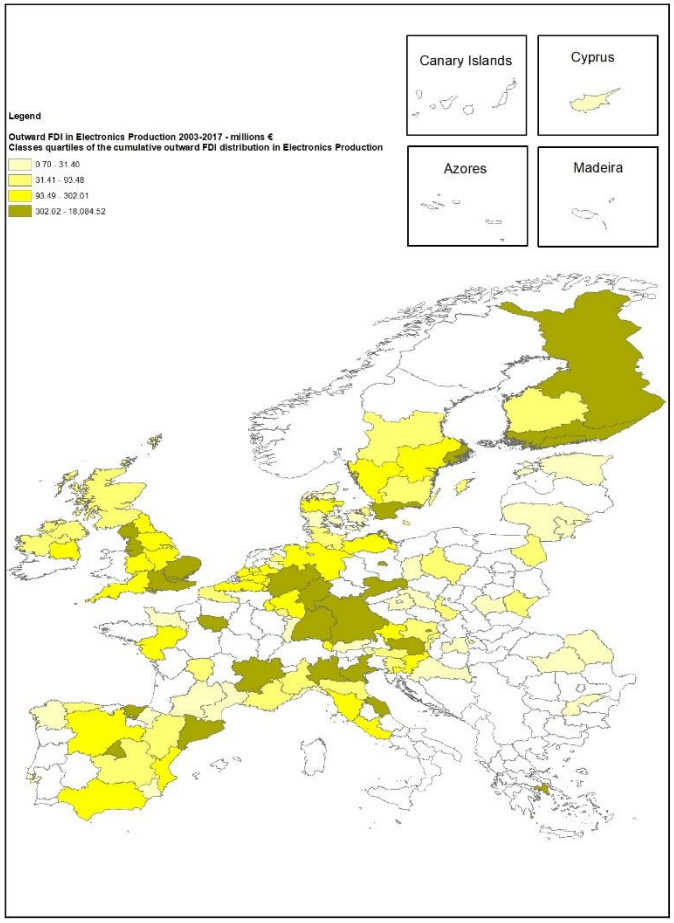




Source: Authors' elaboration on fDiMarkets data

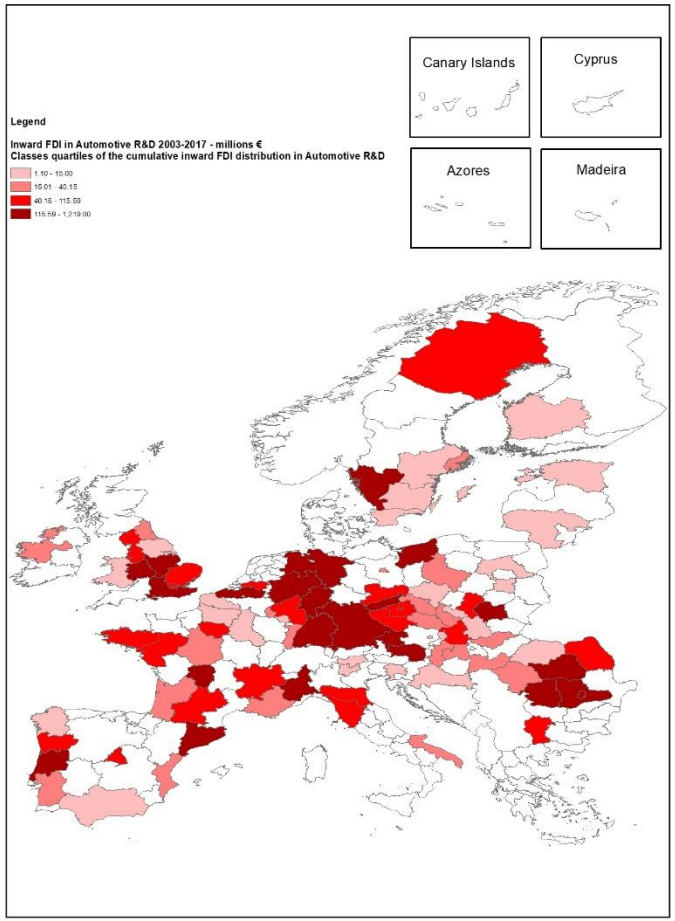
Figure 21: IFDI and OFDI in production – Electronics, 2003-2017

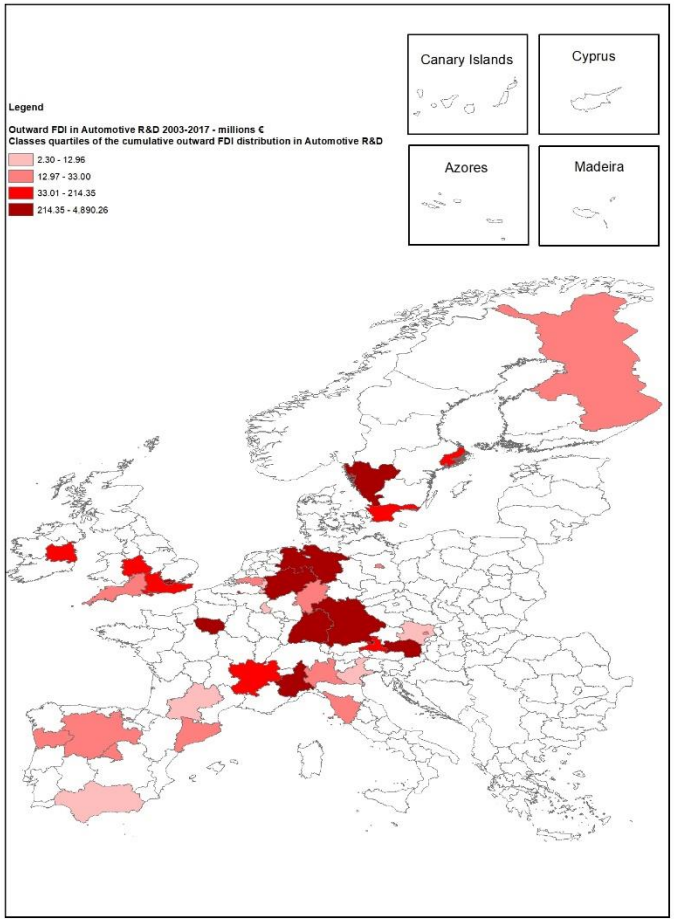




Source: Authors' elaboration on fDiMarkets data.

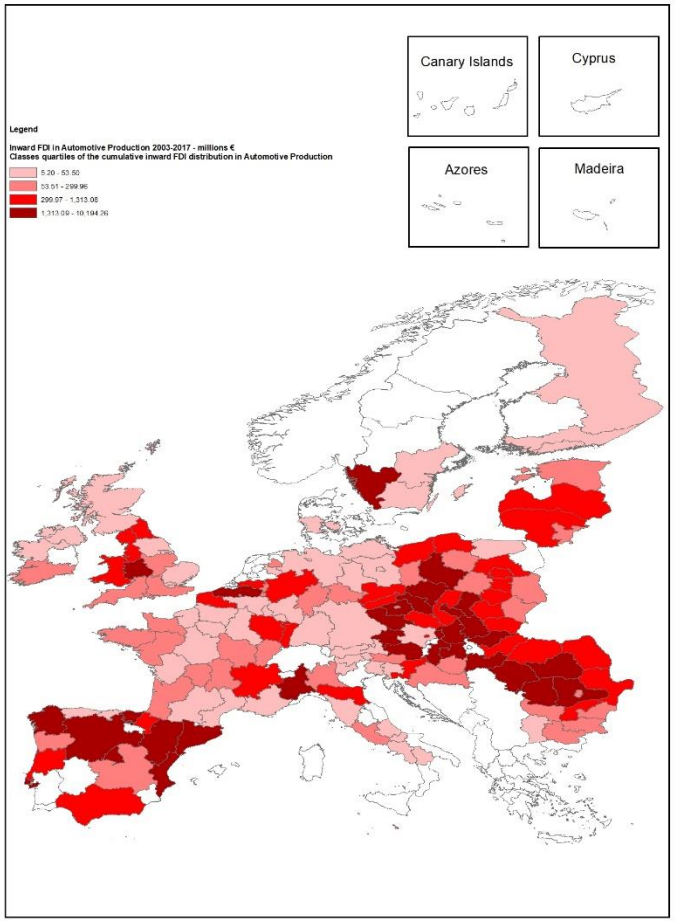
Figure 22: IFDI and OFDI in R&D – Automotive, 2003-2017

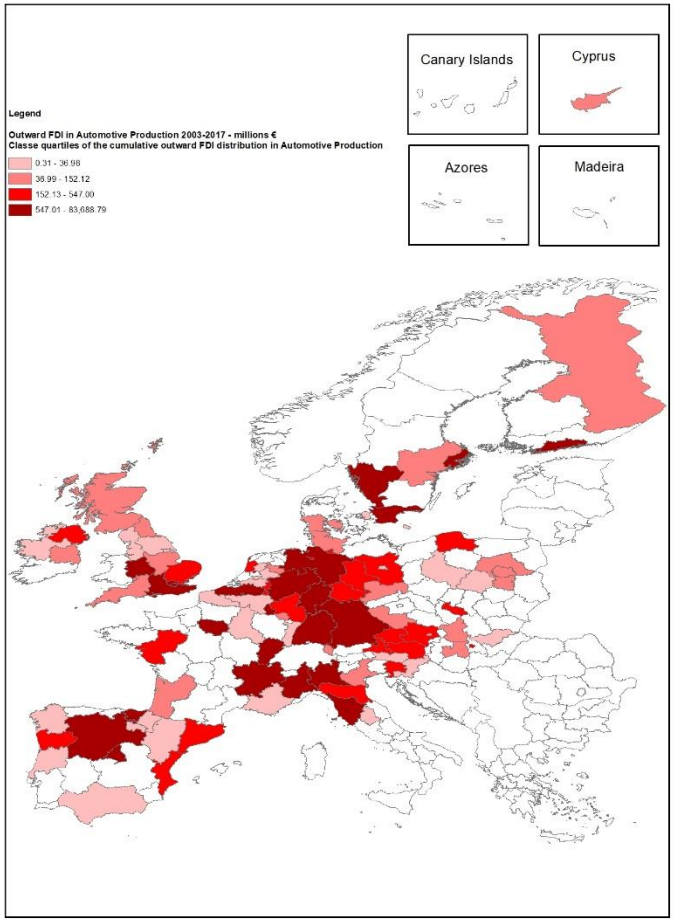




Source: Authors' elaboration on fDiMarkets data.

Figure 23: IFDI and OFDI in Production – Automotive, 2003-2017





Source: Authors' elaboration on fDiMarkets data.

3.2.3. Network Analysis of FDI connectivity

The analysis of inward and outward FDI at a fine-grained geographical scale makes it possible to gain some insights on the participation and position of sub-national regions in global investment flows and (indirectly) into GVCs. However, the picture offered in the previous section can be further enriched and qualified by capturing more fully the network properties of FDI flows. By analysing the relative position of each city/region in the network of IFDI and OFDI flows, we can shed new light on the centrality and dominance of specific regions, on the formation of (new) core-periphery patterns as well as on the connectivity relationships and hierarchies within the "core" of highly connected regions. For this purpose, network analysis techniques drawn from the world city network literature (e.g., Alderson & Beckfield, 2004; Derudder & Taylor, 2013; Friedmann, 1986) are leveraged and applied to fDiMarkets data. The general picture sketched in the previous sections of this Report is one dominated by a limited number of regional hubs with strong FDI connectivity in each of the selected GVC sectors, and some other regions integrated either as FDI recipients or senders. The analysis carried out here seeks to gain a finer-scaled appreciation of sectoral and functional connectivity of different European cities.

From a methodological standpoint the approach put forward in this Report departs from the traditional world city network literature either based on standard network centrality indexes (Alderson & Beckfield, 2004; Liu et al., 2013) or on the interlocking network model (Derudder & Taylor, 2013; Neal, 2013; Taylor, 2000). Conversely, the identification of topologically viable networks, as well as the identification of the position of each location within the hierarchy of locations comprising each network, is achieved through the analysis of the degeneracy of each network according to a method set out in Kitsak et al. (2010a, 2010b). This method centres on the calculation of the "k-shell decomposition" of each network according to the algorithm developed by Seidman (1983), which recognises that any network may be decomposed into several layers, numbered from the periphery to the core, each of which is herein called a "k-shell". The number k of any k-shell identifies the minimum number of connections to other locations within that k-shell accruing to every location within that same k-shell, regardless of the number of connections to peripheral locations outside that k-shell. The k-shell decomposition analysis is an extremely useful method for city network analysis for several reasons. First, as shown by the methodological literature (e.g., Kitsak et al., 2010a, 2010b), it identifies more accurately than other common node-level algorithms the group of cities that wields most influence over the network as a whole. Second, it captures very succinctly all other classes of cities in the network - that is, it efficiently and simultaneously identifies all classes of cities from the innermost core to the outermost periphery of the network. Third, it provides an

in-built test of significance, allowing us to discard networks where k < 3 by having demonstrated that they do not bear meaningful further analysis. Fourth, it offers a clear-cut distinction between the cores and the peripheries of any network, marking clearly as core any locations where k ≥ 3, and marking clearly as peripheral any locations where k = 1 or 2[38]. These features justify the choice of the k-shell decomposition method as a sound tool to perform an analysis of global cities connectivity. However, in this method all edges (linkages between nodes) are treated equally, without accounting for their magnitude (e.g., in the case of FDI the dollar value of each investment project). To overcome this limitation of the unweighted k-shell decomposition method, following Garas et al. (2012), a "weighted k–shell decomposition" is generated to account for both the connections a well as the magnitude of the links (proxied by the total value of capital invested) between the nodes. The results that follow are all based on the weighted k-shell decomposition.

In this section two main networks will be analysed: a "global" and an "intra-EU" network. The first network is generated by taking into account all FDI flows across the globe over the years 2003 to 2017; while the intra-EU network is based only on the sub-sample of investment projects pursued within the European Union and the UK during the same time period.

In this context, Table 14 shows the results of the network analysis for the three GVC-sensitive sectors under investigation, listing the EU27 and UK (left column) and the rest of world (right column) cities in the innermost core of the global network[39]. In Europe, the most "central" cities are all located in the EU15 and the UK, with a strong national primate city effect as mostly economic capitals are here represented. Within the "core" of the FDI networks it is possible to identify an additional layer with four leading capitals that are simultaneously at the centre of the networks of all industrial sectors: Barcelona, London, Munich, and Paris[40] . In these cities, the combination of density, absolute size, and connectivity through MNEs can sustain multiple specialisations, generating a cumulative virtuous circle with foreign investment. At the country level, Germany has the largest number of cities (3) in both automotive and electronics innermost core, while Italy (5) accounts for the highest number of central nodes in T&A followed by Germany (4) and Spain (4).

Turning to the functional nature of FDI, Tables 15 and 16 show some interesting results for the innermost core cities in both R&D and production global networks of the three GVC-sensitive

[38] The core vs periphery distinction is only possible when a network is analysed with an unweighted k-shell decomposition method. In a weighted k-shell decomposition the choice is instead arbitrary as the amount of capital invested (weights) plays an additional role in defining the structure of the network.

[39] Tables showing lower k-shell for each network are reported in the *Appendix* (only for EU27 and the UK cities).

[40] Cities in bold are in the innermost core of the network of all three sectors, while cities in italics are in the innermost core of two out of three sectors. Outside the EU27 and the UK only six other cities in the world are contemporaneously in the innermost core in all three sectors, namely: Beijing (China), Dubai (UAE), Hong Kong, Seoul (South Korea), Shanghai (China), Singapore, Tokyo (Japan).

industries. Overall, the number of cities in the innermost core is reduced due to the lower number of total observations when the FDI is subdivided by function. In terms of R&D investment, Paris is the only European city in the inner most core of all three sectors[41], with Stuttgart (automotive and electronics) and London (electronics and textile) with a presence in two out three sectors[42] . Moreover, there are some new cities in the innermost core of the R&D network that were not in the general global network: Berlin and Budapest in electronics, and Bonnigheim[43] in T&A. When looking at production networks, there is a reduced number of European cities in the innermost core compared to R&D, especially in electronics and T&A, where Lenzing is the only city in the innermost core of the network. This is related to the major role played by East & Southeast Asia cities in the production processes of goods[44].

[41] Outside Europe only Shanghai is also in the innermost core of the R&D global network in all three sectors.
[42] Similarly, outside of the EU27 and the UK, the cities of Bangalore (India), Dubai (UAE), Seoul (South Korea) and Tokyo (Japan) are all in the innermost core of the R&D network in both automotive and electronics sectors, while Hong Kong and New York (USA) are the core of the electronics and T&A sectors.
[43] Bonnigheim is in the innermost core of the R&D network for T&A thanks to the presence of the Hohenstein Institute which has 9 outward investment projects in the period under analysis for a total of 30.4 million US dollars.
[44] Guangzhou (China), Seoul (South Korea), Shanghai (China), and Tokyo (Japan) are all cities located outside of the EU27 and the UK in the innermost core of the global production networks of both automotive and electronic sectors. At the European level, only Munich has such a crucial role in both sectors.

Table 14 – EU27 & UK vs Rest of the World cities in the innermost core – Global networks*

T&A		Electronics		Automotive	
EU27 & the UK	**Rest of the World**	**EU27 & the UK**	**Rest of the World**	**EU27 & the UK**	**Rest of the World**
Amsterdam (Netherlands)	*Bangkok (Thailand)*	*Amsterdam (Netherlands)*	Bangalore (India)	**Barcelona (Spain)**	Aurora (Canada)
Antwerp (Belgium)	Beaverton (Or) (United States)	**Barcelona (Spain)**	**Beijing (China)**	**London (UK)**	*Bangkok (Thailand)*
Barcelona (Spain)	**Beijing (China)**	*Dusseldorf (Germany)*	Changzhou (China)	*Madrid (Spain)*	**Beijing (China)**
Berlin (Germany)	**Dubai (Uae)**	**London (UK)**	**Dubai (Uae)**	**Munich (Germany)**	Changchun (China)
Bologna (Italy)	Geneva (Switzerland)	**Munich (Germany)**	**Hongkong (Hongkong)**	**Paris (France)**	Chennai (India)
Brussels (Belgium)	Greensboro (Nc) (United States)	**Paris (France)**	Kadoma (Japan)	*Stuttgart (Germany)*	Chongqing (China)
Dusseldorf (Germany)	**Hongkong (Hongkong)**	*Stockholm (Sweden)*	Nanjing (China)	Turin (Italy)	Dearborn (Mi) (United States)
Florence (Italy)	Istanbul (Turkey)	*Stuttgart (Germany)*	Osaka (Japan)	Wolfsburg (Germany)	Detroit (Mi) (United States)
Herzogenaurach (Germany)	Kobe (Japan)		*San Francisco (Ca) (United States)*		**Dubai (Uae)**
La Coruna (Spain)	Los Angeles (Ca) (United States)		**Seoul (South Korea)**		Guangzhou (China)
London (UK)	*Melbourne (Australia)*		**Shanghai (China)**		**Hongkong (Hongkong)**
Madrid (Spain)	Mexico City (Mexico)		Shenzhen (China)		Kariya (Japan)
Milan (Italy)	*Moscow (Russia)*		**Singapore (Singapore)**		*Melbourne (Australia)*
Munich (Germany)	New Albany (Oh) (United States)		Suzhou (China)		*Moscow (Russia)*
Neuilly-Sur-Seine (France)	New Delhi (India)		*Sydney (Australia)*		Mumbai (India)
Palma de Mallorca (Spain)	*NYC (Ny) (United States)*		Taipei (Taiwan)		*NYC (Ny) (United States)*
Paris (France)	*San Francisco (Ca) (United States)*		**Tokyo (Japan)**		Palo Alto (Ca) (United States)
Stockholm (Sweden)	*Sao Paulo (Brazil)*		Wuxi (China)		Pune (India)
Trebaseleghe (Italy)	**Seoul (South Korea)**				Rayong (Thailand)
Trivero (Italy)	**Shanghai (China)**				*Sao Paulo (Brazil)*
Vienna (Austria)	**Singapore (Singapore)**				**Seoul (South Korea)**
	Sydney (Australia)				**Shanghai (China)**
	Tokyo (Japan)				Shenyang (China)

	Toronto (Canada)				**Singapore (Singapore)**
	Vancouver (Canada)				Southfield (Mi) (United States)
	Yamaguchi (Japan)				St Petersburg (Russia)
					Tianjin (China)
					Tokyo (Japan)
					Toyota (Japan)
					Troy (Mi) (United States)
					Yokohama (Japan)

(*) Cities in bold are in the innermost core of the network in all three sectors; cities in italics in the innermost core of the network in two sectors.

Source: Authors' elaboration on fDiMarkets data.

Table 15 – EU27 & UK vs Rest of the World cities in the innermost core – Global networks, R&D*

T&A		Electronics		Automotive	
EU27 & the UK	**Rest of the World**	**EU27 & the UK**	**Rest of the World**	**EU27 & the UK**	**Rest of the World**
Bonnigheim (Germany)	Ahmedabad (India)	Amsterdam (Netherlands)	*Bangalore (India)*	**Paris (France)**	*Bangalore (India)*
Herzogenaurach (Germany)	Hochiminh (Vietnam)	Barcelona (Spain)	*Dubai (Uae)*	*Stuttgart (Germany)*	Beijing (China)
London (UK)	*Hongkong (Hongkong)*	Berlin (Germany)	Fairfield (Ct) (United States)	Turin (Italy)	Detroit (Mi) (United States)
Milan (Italy)	*NYC (Ny) (United States)*	Budapest (Hungary)	Gurgaon (India)	Wolfsburg (Germany)	*Dubai (Uae)*
Paris (France)	**Shanghai (China)**	*London (UK)*	Hangzhou (China)		Mumbai (India)
	Yamaguchi (Japan)	Munich (Germany)	Hongkong (Hongkong)		Pune (India)
		Paris (France)	Hsinchu (Taiwan)		*Seoul (South Korea)*
		Stockholm (Sweden)	Kadoma (Japan)		**Shanghai (China)**
		Stuttgart (Germany)	Kyoto (Japan)		*Tokyo (Japan)*
			NYC (Ny) (United States)		Troy (Mi) (United States)
			Osaka (Japan)		Yokohama (Japan)
			Seoul (South Korea)		
			Shanghai (China)		
			Shenzhen (China)		
			Singapore (Singapore)		
			St Paul (Mn) (United States)		
			Sunnyvale (Ca) (United States)		
			Taipei (Taiwan)		
			Tokyo (Japan)		
			Wilmington (De) (United States)		
			Xiamen (China)		
			Zurich (Switzerland)		

(*) Cities in bold are in the innermost core of the network in all three sectors; cities in italics in the innermost core of the network in two sectors.

Source: Authors' elaboration on fDiMarkets data.

Table 16 – EU27 & UK vs Rest of the World cities in the innermost core – Global networks, production*

T&A		Electronics		Automotive	
EU27 & the UK	**Rest of the World**	**EU27 & the UK**	**Rest of the World**	**EU27 & the UK**	**Rest of the World**
Lenzing (Austria)	Mumbai (India)	Amsterdam (Netherlands)	Bayanlepas (Malaysia)	Hannover (Germany)	Aurora (Canada)
	Purwakarta (Indonesia)	*Munich (Germany)*	Dongguan (China)	*Munich (Germany)*	Beijing (China)
			Guangzhou (China)	*Paris (France)*	Changchun (China)
			Kadoma (Japan)	Stuttgart (Germany)	Chennai (India)
			Kyoto (Japan)	Turin (Italy)	Chongqing (China)
			Manaus (Brazil)	Wolfsburg (Germany)	Detroit (Mi) (United States)
			Nanjing (China)		*Guangzhou (China)*
			Osaka (Japan)		NYC (Ny) (United States)
			Seoul (South Korea)		Pune (India)
			Shanghai (China)		Rayong (Thailand)
			Shenzhen (China)		San Luispotosi (Mexico)
			Singapore (Singapore)		Sao Paulo (Brazil)
			Suzhou (China)		*Seoul (South Korea)*
			Taipei (Taiwan)		*Shanghai (China)*
			Tianjin (China)		Silao (Mexico)
			Tokyo (Japan)		St Petersburg (Russia)
			Wuxi (China)		Tianjin (China)
					Tokyo (Japan)
					Toledo (Oh) (United States)
					Toyota (Japan)
					Troy (Mi) (United States)
					Wuhan (China)
					Yokohama (Japan)

(*) Cities in bold are in the innermost core of the network in all three sectors; cities in italics in the innermost core of the network in two sectors.

Source: Authors' elaboration on fDiMarkets data.

Table 17 lists the cities in the innermost core of the intra-EU network for the three GVC-sensitive sectors. Given the structure of the two networks, it is then possible to identify the cities that are in the innermost core of the global network but not in the intra-EU network. This is the case of Barcelona and London present only in the innermost core of the automotive sector of the global network, and of Herzogenaurach and Trebaseleghe in T&A[45]. These cities show a strong dependency on FDI (inward and/or outward) from cities located outside the EU27 and the UK. Once the extra-European investments are excluded, the importance of these locations in the network is then reduced (i.e., these cities are therefore in lower k-sells in the intra-EU network).

Conversely, some cities in the innermost core of the intra-EU network are not part of the innermost core of the worldwide connectivity network, suggesting that their centrality if mostly driven by intra-EU flows. Several Eastern European cities are part of these intra-EU networks, with Bucharest and Prague in the innermost core of the network in all three sectors, together with Madrid, Munich, Paris, Stockholm, and Vienna. At the same time, Budapest is in the innermost core in electronics and T&A[46], while Warsaw is in automotive and T&A[47]. Other Eastern EU cities in the innermost core are Brasov and Bratislava in the automotive sector, and Brno and Lodz in electronics. Several Western European cities not in the innermost core of the global networks are also appearing in the intra-EU core: Boulogne-Billancourt (France) in automotive; Dornbrin (Austria), Dublin (Ireland), Eindhoven (Netherlands), Fabriano (Italy), Gothenburg (Sweden), Gutersloh (Germany), Hemel Hempstead (UK), Bueil-Malmaison (France), and Zaragoza (Spain) in electronics; and Athens (Greece), Brade (Denmark), Hamburg (Germany), Helsinki (Finland), Koln (Germany), Lisbon (Portugal), Manchester (UK) in T&A.

To complete the analysis, Tables 18 and 19 show the cities in the innermost core of the intra-EU networks at the sectoral level for the business functions related to R&D and production. First, as reported in the global network results, Stuttgart and Wolfsburg are in the innermost core for both R&D and production in the automotive sector. Barcelona, Brussels, Munich, and Hannover are also in the innermost core for both functions in the intra-EU automotive network; the Eastern European cities of Iasi and Budapest are found in the innermost core of the automotive R&D network. In electronics, Amsterdam and Munich are in the innermost core of both global and intra-EU R&D networks, while this is not the case for most cities listed in the global network - implying again a dependency on FDI to/from outside the Union. Smaller cities and towns are observed in the continental innermost core: Caen (France),

[45] Interestingly, all cities in the innermost core of the global network in electronics are also in the innermost core of the intra-EU network in the industry.
[46] Amsterdam, Berlin, Copenhagen, Düsseldorf, and London are all in the innermost core of the network of both electronics and T&A.
[47] Stuttgart is the innermost core of the network in automotive and electronics as in the global network.

Cambridge (UK), Espoo (Finland), and Getafe (Spain)[48]. Looking at the intra-EU networks for production activities, it is possible to notice a presence of Eastern European cities, especially in the automotive sector. As in the global network, Hannover, Munich, Paris, and Turin are all in the innermost core of this sector-function network, together with Jihlava, Mladaboleslav, Ostrava, Trutno (Czechia), Bielsko-biala, Walbrzych (Poland), Brasov, Pitesti, Timisoara (Romania) and Kecskemet (Hungary). Arad (Romania) and Wroclaw (Poland) are in the innermost core of the network in both automotive and electronics production, while Bulgaria has two cities (Silven and Yambol) in the innermost core of the T&A industry.

[48] The number of observations in the T&A R&D network is very low and this impacts the results of the network analysis, with the innermost core of the weighted k-shell decomposition only equal to 2 (therefore not commented here).

Table 17 – EU27 & UK cities in the innermost core – Intra-EU networks*

T&A	Electronics	Automotive
Amsterdam (Netherlands)	*Amsterdam (Netherlands)*	Boulogne-Billancourt (France)
Antwerp (Belgium)	*Barcelona (Spain)*	Brasov (Romania)
Athens (Greece)	*Berlin (Germany)*	Bratislava (Slovakia)
Barcelona (Spain)	Brno (Czech Republic)	**Bucharest (Romania)**
Berlin (Germany)	**Bucharest (Romania)**	**Madrid (Spain)**
Bologna (Italy)	*Budapest (Hungary)*	**Munich (Germany)**
Brande (Denmark)	*Copenhagen (Denmark)*	**Paris (France)**
Brussels (Belgium)	Dobrin (Austria)	**Prague (Czech Republic)**
Bucharest (Romania)	Dublin (Ireland)	**Stockholm (Sweden)**
Budapest (Hungary)	*Dusseldorf (Germany)*	*Stuttgart (Germany)*
Copenhagen (Denmark)	Eindhoven (Netherlands)	Turin (Italy)
Dusseldorf (Germany)	Fabriano (Italy)	**Vienna (Austria)**
Florence (Italy)	Gothenburg (Sweden)	*Warsaw (Poland)*
Hamburg (Germany)	Gutersloh (Germany)	Wolfsburg (Germany)
Helsinki (Finland)	Hemel Hempstead (UK)	
Herzogenaurach (Germany)	Lodz (Poland)	
Koln (Germany)	*London (UK)*	
Lac Coruna (Spain)	**Madrid (Spain)**	
Lisbon (Portugal)	**Munich (Germany)**	
London (UK)	**Paris (France)**	
Madrid (Spain)	**Prague (Czech Republic)**	
Manchester (UK)	Rueil-Malmaison (France)	
Milan (Italy)	**Stockholm (Sweden)**	
Munich (Germany)	*Stuttgart (Germany)*	
Palma de Mallorca (Spain)	**Vienna (Austria)**	
Paris (France)	Wroclaw (Poland)	
Prague (Czech Republic)	Zaragoza (Spain)	
Stockholm (Sweden)		
Trivero (Italy)		
Vienna (Austria)		
Warsaw (Poland)		

(*) Cities in bold are in the innermost core of the network in all three sectors; cities in italics in the innermost core of the network in two sectors.

Source: Authors' elaboration on fDiMarkets data.

Table 18 – EU27 & UK cities in the innermost core – Intra-EU networks, R&D*

T&A	Electronics	Automotive
Aalborg (Denmark)	Amsterdam (Netherlands)	Barcelona (Spain)
Athens (Greece)	Caen (France)	Brussels (Belgium)
Helsinki (Finland)	Cambridge (UK)	Budapest (Hungary)
Melton Mowbray (UK)	Espoo (Finland)	Hannover (Germany)
Prague (Czech Republic)	Getafe (Spain)	Iasi (Romania)
Stockholm (Sweden)	*Munich (Germany)*	*Munich (Germany)*
Struer (Denmark)		Stuttgart (Germany)
		Wolfsburg (Germany)

(*) Cities in bold are in the innermost core of the network in all three sectors; cities in italics in the innermost core of the network in two sectors.

Source: Authors' elaboration on fDiMarkets data.

Table 19 – EU27 & UK cities in the innermost core – Intra-EU networks, production*

T&A	Electronics	Automotive
Alba (Italy)	*Arad (Romania)*	*Arad (Romania)*
Sliven (Bulgaria)	Dornbrin (Austria)	Bamberg (Germany)
Vicenza (Italy)	Fabriano (Italy)	Barcelona (Spain)
Yambol (Bulgaria)	Lodz (Poland)	Bielsko-Biala (Poland)
	Nurnberg (Germany)	Boulogne-Billancourt (France)
	Spennymoor (UK)	Brasov (Romania)
	Stockholm (Sweden)	Brussels (Belgium)
	Wroclaw (Poland)	Burgos (Spain)
		Ghent (Belgium)
		Gothenburg (Sweden)
		Hannover (Germany)
		Jihlava (Czechrepublic)
		Kecskemet (Hungary)
		Lippstadt (Germany)
		Madrid (Spain)
		Mladaboleslav (Czechrepublic)
		Munich (Germany)
		Ostrava (Czechrepublic)
		Paris (France)
		Pitesti (Romania)
		Stuttgart (Germany)
		Timisoara (Romania)
		Trutnov (Czechrepublic)
		Turin (Italy)
		Valladolid (Spain)
		Vilsbiburg (Germany)
		Walbrzych (Poland)
		Wolfsburg (Germany)
		Wroclaw (Poland)

(*) Cities in bold are in the innermost core of the network in all three sectors; cities in italics in the innermost core of the network in two sectors.

Source: Authors' elaboration on fDiMarkets data.

4. A METHODOLOGICAL PROPOSAL FOR FUTURE GVC-SPECIFIC MIXED-METHODS STUDIES

4.1. Data gaps and challenges for the study of GVCs

Section 2 of this Report has highlighted the main research methodologies that have been adopted by scholars for the study of GVCs specifically in the three sectors under investigation.

Overall, except for electronics, quantitative methods have been leveraged mostly in combination with qualitative tools rather than as a stand-alone method. This is mainly explained by data limitations that make it difficult to track the complex configuration and geographies of specific GVCs and only allow for a high-level representation of the distribution of GVC stages globally. The databases UN COMTRADE, World Input-Output database, OECD TiVA and fDiMarkets (for greenfield FDI) are widely used in the GVC-focused literature under analysis. Data constraints become even more binding when comparing multiple countries or narrowing down the geographical focus to sub-national areas such as regions or cities. These considerations can explain why most GVC-specific studies have explored a single geography by performing country-level analyses, with very few works focusing on sub-national geographies. Studies on the EU, which, except for automotive, still represent a low share of world studies on GVCs, were also mostly performed at the national level, with limited research able to capture comparisons among countries or studying GVCs by tracking them cross border at a spatially detailed level.

For example, both at the national and regional scale, FDI and foreign affiliates data need to be interpreted in a careful manner when it comes to the analysis of "buyer-driven" GVCs such as T&A in particular – where direct operations of MNEs and FDI play a different and (often) more limited role in explaining the geography of production[49]. Furthermore, the position of countries (or regions) in a specific GVC can be only indirectly captured by looking at establishment-level employment data when it is possible to access information on firm (or ideally establishment) level data on skill composition proxied – for example – through the distribution of employees across wage brackets. Additionally, the analysis of IFDI and OFDI flows across business function "re-organised" in GVC stages (as in section 3) still cannot

[49] Although FDI data might not fully grasp the geography of production for buyer-driven chains, they still capture the geography of lead firms (with its subsidiaries) and, as a result, offer key insights on the geography of both value addition and power in GVCs. In addition, the analysis of FDI by GVC-stage makes it possible to go beyond the geography of production, and understand location and co-location patterns of both core and support functions that matter for all types of GVCs (see Crescenzi et al. 2014).

capture the degree of sophistication of products (or services) processed in a particular foreign establishment. For example, when looking at production-oriented FDI, the geographical distribution of the production of high-end products differs from those of mass-produced goods. However, to the best of our knowledge, there are no systematic data that link product-level information with firm ownership/internationalisation, making it impossible to address this important limitation for the analysis of the labour market impacts of GVC participation.

More generally, the measurement of GVCs is still an open issue and significant effort is needed to develop a coherent empirical portrait of global value chains, in particular when it comes to their sub-national geographies and the understanding of their wider impacts (Johnson, 2018). While the economic literature in this area is progressing significantly, a sound basis to inform regional and urban development policies remains limited. The problem is particularly acute for the EU Cohesion Policy, given the limited coverage of Europe in existing studies extensively discussed in section 2.

Promising improvements come from the use of inter-country input-output (ICIO) tables that link production processes within and across countries to measure trade in value-added (TiVA) and participation in GVCs (as illustrated in section 3). They avoid the double-counting problem associated with standard gross trade data by capturing both direct and indirect linkages between countries and industries. More specifically, for a given country, they record the countries and industries from which inputs are sourced to produce output, and the destination of these goods. In so doing, I/O indicators allow for the measurement of the foreign content of national exports and the value truly generated by each country and industry. However, the degree of sectoral aggregation and the limited availability of internationally comparable I/O data (both over time and across countries) still in part constrain the accuracy of these data for the measurement of production fragmentation (World Bank, 2019).

The turning point for quantitative analyses capable of informing regional development policies is constituted by the availability of firm-level datasets containing information on the import and export transactions of firms that make it possible to compute indexes of GVC participation in line with those based on global Input-Output tables. Transaction-level customs datasets (such as the Export Dynamics Database by the World Bank) make it possible to identify firms that are active in international trade by importing and/or exporting. Participation in GVCs is approximated by the simultaneous engagement in both import and export activities by the same firm. Further information at the product level would make it possible to further qualify firm-level participation in GVCs by distinguishing firms that do import intermediate goods (to be used as input for their own exports) from imports of final goods. Integration of custom data

across countries would allow to further track the products of the focal firms into the destination country, capturing the various GVC stages in full.

Where the geo-location of firms/establishments is possible, this type of firm-level datasets paves the way to a complete understanding of regional (with regions ideally defined with functional rather than administrative boundaries) GVC participation and, crucially, impacts in terms of labour markets, productivity, inequalities, and innovation. It is well-established in the national-level and firm-level quantitative literature – see for example work by Taglioni in Gould (2018) – that participation in GVCs is highly selective and that it only involves a limited number of frontier firms. It is also well-documented that the upgrading induced by GVC participation tends to reinforce capital intensity at the expenses of lower-skilled workers. As a result, the overall impact of GVC participation on the regions involved remains to be explored and assessed given the heterogeneity of forces that are at play beyond the firm boundaries explored in the existing analyses.

An interesting practical example of analyses that leverage firm-level data that could potentially be extended for regional-level studies is offered by the seminal work by Alfaro et al. (2019) that combines Input-Output data with detailed establishment-level data to analyse firms' propensity to integrate upstream versus downstream inputs in more than 100 countries. They capture the heterogeneity of GVC linkages across firms, thus allowing for a finer understanding of firms' input sourcing decisions, the way import and export participation are linked, and how MNEs organise their production networks (World Bank, 2019).

As far as the EU is concerned, firm-level trade data are available in France, where customs data have been already used to explore the participation of individual firms to international markets (e.g., Eaton et al., 2011). Indeed, in France, the Customs administration collects information about trade in goods under the two distinct legal frameworks of the "Déclaration d'Echange de Biens" for the intra-EU trade flows and the Document Administratif Unique" concerning trade between France and non-EU countries (Bergounhon et al., 2018). The National Bank of Belgium Business-to-Business transactions database records VAT-ID to VAT-ID yearly transactions of Belgian firms in the private non-financial sector. It is constructed from three sources of raw data: the VAT listings to the Belgian tax administration, the VAT declarations to the Belgian tax administration, and the NBB balance sheet database. These data can be merged with other firm-level datasets that identify enterprises by their VAT number and have therefore numerous potential applications (e.g., Bems & Kikkawa, 2021). A firm-level dataset on the universe of Italian exporters is also provided by the Italian National Institute of Statistics (Bugamelli et al., 2017). In sum, firm-level data able to help GVC analysis are diversely collected across EU countries, with little harmonisation or coordination

at the Union level. Therefore, the first step in such a statistical integration would be the identification of which EU countries currently collect these data and the type of information available, generating a meta-database model.

The more extensive use of firm-level data in a recent body of literature offers the possibility to develop more sophisticated and nuanced analyses of GVCs by establishing the links between firms in different countries and different stages of the production process (Ahmad et al., 2017) and creates the conditions to bridge the case study approach to the analysis of GVCs (see the seminal work by Geri Gereffi and co-authors) with quantitative work on GVCs covering multiple sectors and countries simultaneously (see the work by Pol Antras, Paola Conconi and others). The geo-localisation of these datasets and their integration in regional statistics will offer the possibility of further bridging these two streams of research with the economic geography literature interested in the local and regional economic consequences of these same fundamental processes and in their implications for regional policies (see Crescenzi & Harman, 2018 for the OECD). Examples of regional empirical applications are still limited due to the data limitations discussed above with some noticeable exceptions. A practical example of a regional application of the "macro" approach to GVC operationalization is offered by Ijtsma & Los (2020), who leverage regionalized world input-output tables from the EUREGIO-database (2000 and 2010 only) in order to proxy the linkages between regions and countries regarding the sourcing of raw materials, parts, components and (business) services. By linking regional data on employment by industry to these tables they can quantify differences in the extent to which UK regions contribute to GVCs. Conversely, Crescenzi et al. (2021a) leverage firm-level survey data for Italy and Spain to develop firm-level measures of GVC participation and explore the regional-level heterogeneity of FDI impacts depending on the GVC positioning of domestic local firms.

Existing studies in this area of economic geography and regional economics are mostly tentative and still at an infant stage. Further work is definitely needed – as will be discussed in the following section – in order to extend the bridging supported by the World Development Report 2021 between case-studies and quantitative analysis of GVCs to embrace a geo-spatial approach needed to inform a new generation of "open economy" regional policies.

4.2. A new generation of GVC-sensitive studies for the territorial analysis of European value chains

The design, implementation and evaluation of regional policies aiming at leveraging GVCs to the enhancement of the local economy need solid frameworks of understanding and an

equally solid knowledge base. This Report has shown with a detailed analysis of the existing literature and with the exploration of existing quantitative indicators that a lot can be learnt and understood to inform regional policies by taking stock and looking critically at what has been done already on three GVC-sensitive sectors. However, this Report has also highlighted that much needs to be investigated urgently in order to support the new international focus of Cohesion Policy (as well as other regional development policies in the Member States and some key actions funded by the Resilience and Recovery Fund for example).

How to advance existing GVC knowledge in support of evidence-based territorial policies? The analysis developed in this Report suggests that renewed energies and resources should be targeted at extending the bridge between GVC case studies and GVC quantitative analysis supported by the World Bank to cover regional dynamics. This does not mean the replication of existing studies at the sub-national level or the multiplication of case studies to cover multiple regions. On the contrary, the starting point of a regional approach to GVC analysis should be based on two key pillars: a) a sound conceptualization of the territorial drivers and implications of GVCs (see Crescenzi & Harman, 2018 for systematic re-conceptualization of the literature for this purpose); b) a careful integration of both quantitative and qualitative methods not only as a shortcut around current quantitative data limitations (see Comotti et al. 2020 for structured discussion).

Based on these principles, the integration of quantitative and qualitative methods will make it possible to reach the appropriate balance between internal and external validity of the key results. While case studies offer rich insights into a particular regional context, they lack in external validity (how and to what extent the same findings apply to other regions/territories?). Conversely quantitative studies with insufficiently detailed data (as discussed above) might lack in internal validity as they fail to capture the mechanics of the key regional processes. Self-reported information from surveys inevitably suffers from significant bias by the respondents in particular when targeted towards public policies (and expenditure). Small sample of interviewees are inevitably affected by selection bias. The convergent, coordinate and theory-driven use of various methods will make it possible not to cancel, but to balance these distortions and offer a more realistic picture to guide public policy.

Following this logic, a set of in-depth studies on the territorial dimension of the three GVC-sensitive sectors discussed in the present Report would look at the way different stages of the production process are geographically distributed across EU countries and firms at the regional level, with a focus on the role played by different GVC key actors (identified in section C1 of the Compendium for each industry), as well as their characteristics, structure, and main relationships. This will then be used to analyse how these actors and their relations

shape regional trajectories in terms of productivity, innovation, employment, and resilience beyond firm boundaries. In a final step the positive analytical part will be linked with normative implications for public policies at the local level to discuss the tools that work.

The proposed industry-specific studies would take the present Report as a **preliminary stage**, leveraging both its stock-taking of the literature and its quantitative description of the role of EU countries and their regions into the GVC of interest (as well as the detailed Compendium). This would be updated and extended to cover all GVC functions/locations for the selected industry using data sources available from individual national statistical offices in order to develop a complete descriptive picture of the European geography of the GVC of interest. This initial mapping will unveil a selected number of Member States and regions (or possibly cross-border clusters) to be targeted in the following steps of the study.

The **first step** will involve the search, collection, and validation of firm-level data for the selected Member States from various commercial (e.g., Orbis, Compustat, etc.) and national public micro-data. For the Member States where this is possible the approach followed by Antras et al. (discussed above) would be followed to identify firms involved in the specific GVC of interest. Access to custom data would reinforce the accuracy of this preliminary firm-level exercise. The geo-coding of firm-level data will make it possible to reconstruct a detailed firm-level geography of the value chains and combine firm-level data with other territorial level indicators (for example on employment, FDI presence, etc.), ideally at the level of the functional administrative units responsible for regional policies. The **second step** will involve the design of a dedicated survey in order to collect additional detailed information on the GVC position of the key firms (target population) identified in step 1 to unveil: a) their linkages with suppliers and other local actors; b) their exposure to public policies with special reference to Cohesion Policy projects and Smart Specialisation (for example through the integration with programme-level expenditure data as in Crescenzi et al. (2020) with the firm-level analysis of the impact of Smart Specialisation programmes in Italy).

As highlighted in recent research (e.g., Johnson, 2018), firm-level survey data is currently highly valuable in the GVC research field. For example, Sinkovics et at. (2021) drew upon survey data from 160 firms in the Taiwanese electronics and hardware industry to investigate the role of knowledge connectivity in suppliers' new product innovation capabilities and GVC status. Pavlínek & Žížalová (2016), based on unique data collected through a questionnaire completed by 317 foreign and domestic firms, analysed the linkages between and spillovers from foreign to domestic firms in the Czech automotive industry, as well as their implications for GVC upgrading. Casadei & Iammarino (2021) relied upon an original survey carried out

with 688 firms amongst lead firms and suppliers operating in the UK T&A industry to explore how trade policy uncertainty linked to Brexit affected firms' behaviours along the GVC.

In addition, the most common data collection methods used in social network analysis are surveys and interviews. As shown also by our preliminary exercise in section 3.2.3, network analysis would particularly contribute to highlighting the importance of GVC stages across regional boundaries.

The design and distribution of a harmonised firm-level survey for the firms involved in GVCs identified in step 1 would entail the following additional tasks: a) the development of survey instruments, and b) the selection of the administration procedure and of a strategy for increasing response rates and handling non-response bias.

The survey would be distributed to both the entire target population of firms active in GVCs identified in step 1 (in this case with the support of the EC or offices of national statistics) and to a sample, which might be selected through non-probabilistic (e.g., convenience or snowball sampling, the latter most used for data collection in network analysis) or probabilistic sampling. For example, with a good accessibility to companies' information, stratified random sampling, a type of probabilistic approach that involves the division of the population into strata identified based on meaningful criteria (e.g., firms' size, performance, or location), allows to draw more precise conclusions by ensuring that every sub-group is properly represented in the sample (Forza, 2002). Additionally, this type of sampling is particularly useful in cross-country survey research to ensure external validity and the generalisability of the results. The support of a network of dedicated research units/contractors in the regions of interest would be a necessary condition for the collection of a representative sample (Tsui et al., 2007). In addition, precisely in order to reduce sample selection and respondent bias, the survey will need to offer some sort of remuneration to the respondent (on-line shopping vouchers being the most common incentive being used in this area of research).

The survey would be designed in accordance with the methodological guidelines of survey research (Forza, 2002). Following an ex-ante input harmonisation process, the same questionnaire items would be used for all regions under analysis to maximise standardisation and comparability (Wolf et al., 2016). Therefore, the questionnaire would be first designed in English and then translated into other languages using back translation (i.e., original version of the survey translated into the target language and subsequently translated back into the source language) to ensure concept equivalence. It would draw upon the existing GVC literature – with a particular focus on sectorial survey research explored in this Report – to identify and ensure a high level of validity of the survey questions (Harzing et al., 2013).

The survey would particularly focus on the configuration of the GVC across EU regions. Firms would be first asked about their type of products, organization, phases and models of production, main customers and suppliers, competitiveness strategies, workforce, technological capacities, and innovation activities. Questions tailored to the type and structure of the GVC under analysis would be asked in the second part of questionnaire. These would include the extent of sales and purchases of firms through relational linkage with other local and non-local actors in the GVC, as well as the nature of these relationships. More specifically, supply chain relationships, including outsourcing and offshoring strategies, with a particular focus on the geography and characteristics of buyers or suppliers of intermediate inputs, would be investigated. Through Likert-scale questions, respondents would be asked to rate the importance of a variety of factors – identified following a review of the existing literature – driving their decision of operating in the specific region as well as of offshoring or investing in a different geography. A set questions would be aimed at collecting social network data on the relations between firms involved in GVCs across the main EU regions (for the collection of survey-based network information see Agneessens & Labianca, 2022). For example, lead firms in each region under investigation could be asked to name their main suppliers and customers, as well as their geographical location.

Box 1 – In the literature: Small-scale surveys on firm linkages

Contreras at al. (2012) conducted a survey with 166 small and medium-sized enterprises to gather evidence from new local knowledge-intensive firms within the supplier network in the automotive cluster led by Ford Motor Company of Hermosillo, Mexico. The survey included questions about the origin of the company, main products and production processes, main customers, competitiveness strategies, links with multinational businesses, staff preparation and training, technological capacities, and links with local institutions. Özatağan (2011) relied upon survey data with 103 component suppliers to examine shifts in value chain governance and upgrading in the automotive component production node of Bursa in Turkey. The survey included questions on firms' innovation activities associated with product, process, and functional upgrading, as well as the nature of interactions with the most important customers (e.g., their involvement in product and process development as well as technology upgrading). Hussain et al. (2019), using survey data of 234 garment firms across the major garment clusters in Pakistan, analysed the positioning of the Pakistan's garment sector in the GVC by examining parameters such as firms' strategies, type of contracting, nature of clientele, and average export price. Rahman & Sayeda (2016) conducted a firm-level survey with 120 apparel manufacturing firms to estimate the effect of GVC integration in the Bangladesh apparel sector. A particular emphasis was given to the extent of forward and backward linkages of a firm with global buyers of finished garments and with suppliers of intermediate inputs and to their effect on firm performance.

As said, the aim is also to ask different sets of questions to different actors in the GVC. For example, in line with recent research on the T&A GVC (e.g., Casadei & Iammarino, 2021), lead firms, including designers, retailers and brand manufacturers, and suppliers would be asked different questions related to the nature and type of their supply chain relationships. Different themes could be explored depending on the industry investigated. The study of the geographical distribution of fashion weeks and trade fairs, for instance, could help shed light on the characteristics of the T&A GVC. The survey would be then piloted with several industry experts and a sample of target respondents by means of interviews in each region of interest, to ensure the quality and accuracy of the questions, and explicitly cater for possible cultural differences in the perception of survey design.

The survey would be distributed electronically with invitations sent by emails. This type of distribution usually entails low cost as well as higher transmission and response speed (Dillman, 2006). Indeed, in the case of large-scale cross-country survey research, interviews

are usually less feasible in terms of language difficulties and the costs involved. Sponsorship and the presence of local collaborators (e.g., local professional organisations, universities, industry representatives) in the regions of interest would serve not only as a means to gain access to local companies but also to facilitate the cross-regional data collection process, particularly for the subsequent network and relational analysis. Also, direct interactions among local stakeholders would provide additional credibility to the research project in the local context, thus helping increase the response rate. Sponsorship often takes the form of an explicit letter of endorsement that can be attached to the actual cover letter, expressing support for the study, and asking for participation. The survey would be distributed electronically to randomised sub-samples from the population/sample of interest in different periods of time, and non-respondents would be solicited with reminders. This procedure, which allows to accurately monitor the response rate, would consider different ideal times for distributing the survey in each region. Based on the availability of funds, specialised survey companies to collect data in each region using computer-assisted telephone interviewing could be envisaged.

In the **third step**, secondary and survey data would be triangulated with both interviews and focus group discussions. First, semi-structured interviews with directors, managers or owners of firms included in the survey sample and belonging to different regions would be carried out to contextualise the findings from the questionnaire and gain a deeper understanding of key aspects of the GVC micro-interactions emerged from the survey. Second, focus group sessions with cross-regional panels of industry or trade associations, policy makers and government officials would be conducted to gather information on perceived sector-specific strengths and weaknesses as well as on policies already in place or to be implemented in the future to support the industry/regions in the GVC integration and upgrading. This third step will also allow the collection of additional information on EU-level, national and local policies that have influenced the activities and choices of the actors involved (with different roles) in the value chain of interest. At this stage a dedicated smaller-scale survey might also target public bodies involved in various ways in supporting active and passive internationalisation, firm development, or local impacts (see Crescenzi et al. 2021b on Regional Investment Promotion Agencies in Europe for an example of the use of survey methods in combination with advanced quantitative policy evaluation tools).

5. CONCLUSIONS & IMPLICATIONS FOR REGIONAL DEVELOPMENT POLICIES

This Report has offered an overview of key dimensions for the study of three GVC-sensitive sectors, and a methodological and operational approach for future GVC-specific and territorial analyses able to provide a solid knowledge base for regional development policies in a global economy. In the last few years shocks of various nature – from financial and economic crises to pandemic emergencies and wars – have contributed to unprecedented economic downturns and growing uncertainty on a global scale. These shocks have severely affected supply and demand of goods and services, putting under pressure all stages in the functional and geographical distribution of production along value chains across industries. As also maintained in Comotti et al. (2020), if a re-configuration of GVCs across the globe is already ongoing – eventually, from a geographical perspective, with a higher concentration of such chains and networks within macro-regions – GVCs are all the more urgent key policy targets for policy makers. This calls for rigorous research able to assess the effects of the participation of cities and regions into global and continental value chains, and the implications of global shocks for the vulnerability and resilience of local economic and innovation systems.

Here below we provide a summary of the main take-aways of the Report for policy reflection and design, starting with answers to two main questions.

What have we learnt from the present Report that is helpful for regional development policies in general, and Cohesion Policy in particular? The key lessons from the Report can be summarised as follows:

- First, the Report has offered a unique and **original stock-taking and critical presentation of quantitative and qualitative material on three key GVC-sensitive sectors**. This is a rather rare exercise that forms a helpful stepping-stone for additional research, at the same time providing a compass for policy makers that want to embark in national and regional policies linked with these sectors and GVCs.
- Second, the Report has unveiled several **fundamental knowledge gaps with special reference to the European Union and the demand for evidence of its Cohesion Policy**. Not only the existing literature on the three GVCs of interest has significantly overlooked EU countries, but existing studies have mostly taken a one-country approach, with limited attention devoted to the regional/subnational dimension. The identification of these gaps is critical for policy makers at various level of governance that want to embark in policies oriented to GVCs and upgrading.

- Third, the Report offers comprehensive guidance on the requirements, research methods and procedure, as well as possible outcomes, for one or more in-depth mixed-methods territorial studies on European Value Chains. The **development of a comprehensive research protocol that takes stocks and builds upon frontier research** on the topic is an original contribution of this Report. The proposed research protocol for the GVC studies can offer helpful guidance for the collection and generation of new data by Eurostat and National Statistical Offices. It can also serve as guidance for the actual implementation of one or more studies commissioned to support the development of an appropriate evidence-base for Cohesion Policy.

What guidance and insights can policy makers gain from the knowledge collected and organised in this Report and on the additional insights offered by the proposed GVC studies? The Report points to some key findings relevant to the new international focus of regional policies in the European Union. The most relevant are summarize here below:

- Generally, the role of domestic firms as suppliers of intermediate inputs has decreased over time in all observed industries. However, **the industry dimension still shapes the GVC geography**: the T&A GVC shows the most localised sourcing structure, whilst that of electronics is the most globally dispersed, with the automotive sector in an intermediate position with a sourcing structure less local but mainly EU-based. These insights have very important implications for supporting domestic firms in their internationalisation strategies depending on the industry they operate in.
- Despite the limitations highlighted over the Report, FDI flows can offer key insights on the geography of value creation in GVCs, particularly in terms of the analysis and insights on the **FDI function/GVC stage** of both active and passive internationalisation patterns at the sub-national level. The nexus sector-function in FDI and GVCs indicates that understanding the detailed structure and evolution of local-global networks must become a central reflection for future development policies (e.g., Crescenzi & Iammarino, 2017; Crescenzi & Harman 2018; De Marchi et al., 2018; Iammarino, 2018; Bailey et al. 2021 with reference to Covid-19 and recovery patterns).
- Over the last decades some regions of the **EU eastern periphery have emerged as new global and/or continental hubs** in electronics, T&A and, even more, automotive industry. This aligns with the recent relational conceptualisation of peripheral regions placing emphasis on international and interregional connectivity as a main strategy for local economic development.
- The FDI-based worldwide network analysis confirms once more the **major role played by European capitals and economic prime cities**: London, Munich and

Paris are at the centre of the global networks of all observed sectors. Geographical concentration is as usual less prominent in the case of Germany, which displays the largest number of cities in the networks in both automotive and electronics, like Italy shows the same in T&A.

- Looking at global networks in R&D functions, Paris is the only European city in the inner most core for all three industries, followed by Stuttgart (automotive and electronics) and London (electronics and T&A). However, the crucial role of the **GVC stage/FDI function shows its geographical specificity**: cities that do not appear in the core of the overall global network do emerge as crucial nodes in R&D global networks, e.g., Berlin and Budapest in electronics, and Bonnigheim in T&A.
- The network analysis also confirms the **continental/macro-regional nature of some GVCs** European cities that are in the innermost core of the global networks are not necessarily in that of intra-EU networks: when the extra-European investments are factored out, the importance of such locations decreases, as they act as the gatekeepers for European connections with the rest of the world. On the contrary, cities in the innermost core of intra-EU networks may not show up as part of the core of global networks, suggesting that their centrality and networks embeddedness are mostly driven by intra-EU flows. These insights are critical for regional development agencies and policy makers in their choice to select or incentivise FDI and linkages in their region/sector.
- Several **Eastern European cities are part of these intra-EU networks**, with Bucharest and Prague as central nodes in all three sectors, together with other EU15 prime cities such as Madrid, Munich, Paris, Stockholm, and Vienna; Budapest is in the intra-EU core for electronics and T&A, while Warsaw is for automotive and T&A. Several **Western European cities not in the innermost core of the global networks are also appearing in the intra-EU core**: for example, Amsterdam and Munich are in the innermost core of both global and intra-EU R&D networks in electronics, whereas also small cities are observed in the industry continental innermost core.
- More generally, the application of methods such as network analysis – possibly using better and diversified data – may add **critical information on the nature and impact of GVC participation in peripheral regions.** It may make it possible to uncover **new and additional geographical/sectoral/functional layer**s, with seemingly peripheral places occupying different positions and roles in continental cores,or showing growing inter-periphery connections at the global level. In addition, the analysis of **the**

evolution of these networks over time can be linked to global and local shocks as well as to the influence of public policies.

- Finally, the use of more refined data can allow to disentangle the **differences in nature and drivers of inter-regional networks vis-à-vis purely corporate networks**.

To conclude, from the analysis carried out in this Report policy makers can learn some key general lessons:

- First, when territorial policies aim to target (and possibly leverage) GVCs, they need to rely on **new frameworks of understanding and information bases**, as shown by the evidence and the network analysis summarised above. The complex and subtle fragmentation of global production is not fully reflected in aggregate data (e.g., data on trade flows) or in patents: policy makers need insight to facilitate the positioning of their region vis-à-vis others in the same country and cross-border, integrating and extending the current EU Territorial cooperation policy.
- Second, the identification and discussion of methodological and data collection issues offers guidance for policy makers to require new data and information from the competent offices and, ideally, contribute to a **European public and integrated information base** by incorporating relevant data collection routines, for example, in their own strategies (e.g., where fund recipients are mandated to respond). A dedicated effort for compiling such metadatabase and related datasets is needed to bring firms and their heterogeneous channels of interactions – carried out at various spatial scale, i.e., global, macro-regional, national, regional, and local – at the core of economic analysis. This will allow the strategies of economic actors and policy makers to be more effective with regards to:
    - **upgrading/renewing the regional GVC continental and global position** in one or more sectors on the basis of the actual relative positioning of the own region in the networks;
    - **selecting collaboration networks** with other (primarily EU, but also non-EU) cities and regions that carry out complementary activities and operations within the same value chain;
    - shifting from being net receivers (e.g., mostly Eastern and some Southern EU regions) to a **more balanced network position** becoming also senders of investment flows and value added (e.g., most advanced European regions in central Europe)

- Third, these **policies require a new evidence-based approach to targeting inter-regional and cross-border coordination**. In-depth analyses of the relations across actors and their various categories (business, government, and education/research organisations) and their governance would support the identification of potential targets within the region as well as of relevant partners in other EU regions.
- Fourth, policy makers should take a **holistic approach to the regional eco-system**. Firms and their linkages are only one part of the story. The role of the public sector needs to be analysed and assessed in order to identify the tools that work in practice with an evidence-based and experimental approach in mind. Knowledge-base development triggered and shaped by the proposed study-protocol should become part and parcel of the policy learning cycle.

6. References

Agneessens, F. & Labianca, G. (2022). Collecting survey-based social network information in work organizations. *Social Networks*, 68: 31-47.

Ahmad, N., Bohn, T., Mulder, N., Vaillant, M. & Zaclicever, D. (2017). Indicators on global value chains: a guide for empirical work. OECD Statistics Working Papers 2017/2018, OECD Publishing, Paris.

Alderson, A. S. & Beckfield, J. (2004). Power and position in the world city system. *American Journal of Sociology*, 109(4): 811-851.

Alfaro, L., Chor, D., Antràs, P. & Conconi, P. (2019). Internalizing global value chains: A firm-level analysis. *Journal of Political Economy*, 127(2): 509-559.

Anner, M. (2020). Squeezing workers' rights in global supply chains: purchasing practices in the Bangladesh garment export sector in comparative perspective. *Review of International Political Economy,* 27(2): 320-347.

Azmeh, S. & Nadvi, K. (2014). Asian firms and the restructuring of global value chains. *International Business Review,* 23(4): 708-717.

Bae, Y. (2011). Global value chains, industry structure, and technology upgrading of local firms: The personal computer industry in Korea and Taiwan during the 1980s. *Asian Journal of Technology Innovation*, 19(2): 249-262.

Bailey, D., Crescenzi, R., Roller, E. Anguelovski, I., Datta, A. & Harrison, J. (2021). Regions in Covid-19 recovery, *Regional Studies*, 55(12): 1955-1965.

Bailey, D., Driffield, N. & Kispeter, E. (2019). Brexit, foreign investment and employment: some implications for industrial policy?. *Contemporary Social Science,* 14(2): 174-188.

Bair, J. (2006). Regional trade and production blocs in a global industry: Towards a comparative framework for research. *Environment and Planning A,* 38(12): 2233-2252.

Bair, J., & Gereffi, G. (2001). Local clusters in global chains: The causes and consequences of export dynamism in Torreon's blue jeans industry. *World Development*, 29 (11): 1885-1903.

Balconi, M. (2002). Tacitness, Codification of Technological Knowledge and the Organisation of Industry. *Research Policy,* 31(3): 357–79.

Bems, R. & Kikkawa, A.K. (2021). Measuring trade in value added with firm-level data. *Journal of International Economics*, 129: 103434.

Bergounhon, F., Lenoir, C. & Mejean, I. (2018). A guideline to French firm-level trade data. https://www.isabellemejean.com/BergounhonLenoirMejean_2018.pdf. Accessed 22 May 2021.

Bugamelli, M., Fabiani, S., Federico, S., Felettigh, A., Giordano, C. & Linarello, A. (2017). Back on track? A macro-micro narrative of Italian exports. Bank of Italy Occasional Paper No. 399.

Cadestin, C., De Backer, K., Desnoyers-James, I., Miroudot, S., Ye, M., & Rigo, D. (2019). Multinational enterprises and global value chains: New Insights on the trade-investment nexus. OECD Science, Technology and Industry Working Papers, 2018(5), 1-36.

Casadei, P. & Iammarino, S. (2021). Trade policy shocks in the UK textile and apparel value chain: Firm perceptions of Brexit uncertainty. *Journal of International Business Policy*, 4(2): 262-285.

Castelli, C., Florio, M. & Giunta, A. (2011). How to cope with the global value chain: Lessons from Italian automotive suppliers. *International Journal of Automotive Technology and Management,* 11(3): 236-253.

Chuang, Y. (2016). Electronics and Global Value Chains. In: J. Weiss & M. Tribe, *Routledge Handbook of Industry and Development.* Abingdon: Routledge, pp. 204-221.

Coe, N.M., Dicken, P. & Hess, M. (2008). Global production networks: Realizing the potential. *Journal of Economic Geography*, 8(3): 271-295.

Coe, N.M., Hess, M., Yeaung, H.W.C., Dicken, P. & Henderson, J. (2004). Globalizing regional development: A global production networks perspective. *Transactions of the Institute of British Geographers*, 29(4): 468-484.

Colovic, A. & Mayrhofer, U. (2011). Optimizing the location of R&D and production activities: Trends in the automotive industry. *European Planning Studies,* 19(8): 1481-1498.

Comotti, S., Crescenzi, R., & Iammarino, S. (2020). Foreign direct investment, global value chains and regional economic development in Europe. European Commission, Contract Number: 2018CE160AT082.

Connell Garcia, W., Kizior, M. & Simons, W. (2020). Analysing automobile industry supply chains. European Commission. Discussion Paper 13, November 2020.

Contreras O.F., Carrillo J. & Alonso J. (2012). Local Entrepreneurship within Global Value Chains: A Case Study in the Mexican Automotive Industry. *World Development,* 40(5): 1013-1023.

Crescenzi, R. & Iammarino, S. (2017) Global investments and regional development trajectories: the missing links. *Regional Studies*, 51(1): 97-115.

Crescenzi R., De Blasio, G. & Giua, M. (2020). Cohesion Policy Incentives for Collaborative Industrial Research. The Evaluation of a Smart Specialisation Forerunner Programme. *Regional Studies*, 54(10), 1341–1353

Crescenzi, R., Ganau, R. & Giunta, A. (2021a). Foreign investment, global value chains, and labour productivity: firm-level evidence from Italy and Spain paper presented at the *RSA Conference Regions in Recovery*, June 2nd, 2021.

Crescenzi, R., Di Cataldo, M., Giua, M. (2021b). FDI inflows in Europe: Does investment promotion work?, *Journal of International Economics*, Volume 132, September 2021, 103497.

Crescenzi, R. & Harman O. with D. Arnold (2018). "Move On Up! Building, Embedding and Reshaping Global Value Chains Through Investment Flows: Insights for Regional Innovation Policies", Background paper for an OECD/EC Workshop on 21 September 2018 within the workshop series "Broadening innovation policy: New insights for regions and cities", Paris [https://www.oecd.org/cfe/regional-policy/CrescenziHarman(2018)MoveOnUp.pdf].

Crescenzi, R., Pietrobelli, C., & Rabellotti, R. (2014). Innovation drivers, value chains and the geography of multinational corporations in Europe. *Journal of Economic Geography,* 14(6): 1053-1086.

Crestanello, P. & Tattara G. (2011). Industrial clusters and the governance of the global value chain: The Romania-Veneto network in footwear and clothing. *Regional Studies*, 45(2): 187-203.

Crinis, V. (2012). Global commodity chains in crisis: The garment industry in Malaysia. *Institutions and Economies,* 4(3): 61-82.

Curran, L. & Nadvi, K. (2015). Shifting trade preferences and value chain impacts in the Bangladesh textiles and garment industry. *Cambridge Journal of Regions, Economy and Society,* 8(3): 459-474.

De Backer, K. & Miroudot, S. (2014). Mapping Global Value Chains, ECB Working Paper Series, No. 1677. Frankfurt am Main: European Central Bank.

De Marchi, V. & Di Maria, E. (2019). Environmental upgrading and suppliers' agency in the leather global value chain*. Sustainability,* 11(23): 6530.

De Marchi, V., Di Maria, E., Golini, R. & Perri, A. (2020). Nurturing international business research through Global Value Chain literature: A review and discussion of future research opportunities. *International Business Review*, 29(5): 101708.

De Marchi, V., Giuliani, E. & Rabellotti, R. (2018). Do Global Value Chains Offer Developing Countries Learning and Innovation Opportunities?. *The European Journal of Development Research*, 30: 389-407.

Dedrick, J., Kraemer, K. L. & Linden, G. (2008). Who profits from innovation in global value chains? A study of the iPod and notebook PCs. Sloan Industry Studies Working Papers, No. WP-2008-15.

Dei Ottatti, G. (2009). An industrial district facing the challenges of globalisation: Prato today. *European Planning Studies*, 17(12): 1817-1835.

Denyer, D. & Tranfield, D. (2009). Producing a systematic review. In: D. Bunchan & A. Bryman (Eds), *The Sage Handbook of Organizational Research Methods.* Sage Publications Ltd, London, pp. 671-689.

Derudder, B., & Taylor, P. J. (2017). Central flow theory: comparative connectivities in the world-city network. *Regional Studies*, 3404: 1-14.

Dillman, D. A. (2006) Mail and Internet Surveys: The Tailored Design Method, 2nd ed., 2007 update, New York: Wiley.

Di Mauro, C., Fratocchi, L., Orzes, G., & Sartor, M. (2018). Offshoring and backshoring: A multiple case study analysis. *Journal of Purchasing and Supply Management*, 24(2): 108-134.

Dicken, P. (2005). *Tangled webs: transnational production networks and regional integration*. SPACES 2005-04, Phillips-University of Marburg: Germany.

Dicken, P. (2007). *Global Shift: Reshaping the Global Economic Map in the 21st Century.* 5th ed., Sage Publications: London.

Diemer, A., Iammarino, S., Perkins, R. & Gros, A. (2021). Technology and geography in a paradigm shift: the case of Critical & Conflict Materials in ICT. Paper No. 29 LSE Geography & Environment Discussion Paper Series.

Dunford, M., Dunford, R., Barbu, M. & Liu, W. (2013). Globalisation, cost competitiveness and international trade: The evolution of the Italian textile and clothing industries and the growth of trade with China. *European Urban and Regional Studies*, 0(0): 1-25.

Eaton, J., Kortum, S., & Kramarz, F. (2011). An anatomy of international trade: Evidence from French firms*. Econometrica*, 79(5):1453-1498.

Endrődi-Kovács, V., Kutasi, G. & Magasházi, A. (2018). Visegrad group expertise and position in the Samsung global value chain: a case study of Samsung electronics in the V4 countries. *Central European Business Review*, 7(1): 14-36.

Ernst, D. (1997). From partial to systemic globalization: international production networks in the electronics industry. UC Berkeley BRIE Working Paper 98.

Ernst, D. (2002). The Economics of Electronics Industry: Competitive Dynamics and Industrial Organization. In: M. Warner & W. Lazonick (Eds.), The International Encyclopedia of Business and Management (IEBM), International Thomson Business Press, London, in press.

Ernst, D. (2005). Limits to modularity: reflections on recent developments in chip design. *Industry and Innovation*, 12(3), 303-335.

Estonian Electronics Industries Association. (2019). Electronics industry in Estonia. https://www.estonianelectronics.eu/electronics-industry-in-estonia. Accessed 27 September 2021.

Euratex. (2020). Facts and key figures of the European textile and clothing industry. https://euratex.eu/wp-content/uploads/EURATEX-Facts-Key-Figures-2020-LQ.pdf.

European Automobile Manufacturers Association. (2020). Economic and Market Report. EU Automotive Industry Full-year 2020.https://www.acea.auto/files/Economic_and_Market_Report_full-year_2020.pdf. Accessed 25 September 2020.

Fernandez-Stark, K., Frederick, S., & Gereffi, G. (2011). The apparel global value chain. Economic upgrading and workforce development. Duke University Centre on Globalization, Governance and Competitiveness.

Forza, C. (2002). Survey research in operations management: a process-based perspective. *International Journal of Operations & Production Management*, 22(2): 152-194.

Fratocchi, L., & Di Stefano, C. (2019). Manufacturing reshoring in the fashion industry: a literature review. *World Review of Intermodal Transportation Research*, 8(4): 338-365.

Frederick, S. & Gereffi, G. (2011). Upgrading and restructuring in the global apparel value chain: why China and Asia are outperforming Mexico and Central America. *International Journal of Technological Learning, Innovation and Development*, 4(1): 67-95.

Frederick, S. & Gereffi, G. (2013). Costa Rica in the electronics global value chain. Duke Center on Globalisation, Governance and Competitiveness.

Frederick, S. & Daly, J. (2019). Pakistan in the apparel global value chain. Duke Global Value Chains Center, Duke University.

Friedmann, J. (1986). The world city hypothesis. *Development and Change*, 17(1): 69–83.

Frigant., V & Layan J.B. (2009). Modular Production and the New Division of Labour Within Europe: The Perspective of French Automotive Parts Suppliers. *European Urban and Regional Studies*, 16(1): 11-25.

Frigant, V. & Lung Y. (2002). Geographical proximity and supplying relationships in modular production. *International Journal of Urban and Regional Research*, 26(4): 742-755.

Gaddi, M. & Garbellini, N. (2021). Automotive global value chains in Europe. WP No. 160, Institute for New Economic Thinking.

Garas, A., Schweitzer, F., & Havlin, S. (2012). A k-shell decomposition method for weighted networks. *New Journal of Physics*, 14(8): 083030.

Gereffi, G. (1994). The organization of buyer-driven global commodity chains: How US retailers shape overseas production networks. In: G. Gereffi, M. Korzeniewicz (Eds.), *Commodity Chains and Global Capitalism*, Praeger, Westport, CT: 95-122.

Gereffi, G. (1999). International trade and industrial upgrading in the apparel commodity chain. *Journal of International Economics*, 48(1): 37-70.

Gereffi, G. (2019). Global value chains and international development policy: Bringing firms, networks, and policy-engaged scholarship back in. *Journal of International Business Policy*, 2(3): 195-210.

Gereffi, G. & Frederick, S. (2010). The global apparel value chain, trade, and the crisis: Challenges and opportunities for developing countries. Policy Research Working Paper No. 5281, World Bank.

Gereffi, G. & Lee, J. (2016). Economic and Social Upgrading in Global Value Chains and Industrial Clusters: Why Governance Matters. *Journal of Business Ethics*, 133(1): 25-38.

Gereffi, G. & Memedovic, O. (2003). The global apparel value chain: What prospects for upgrading by developing countries? Sectorial studies series Vienna: United Nations Industrial Development Organization (UNIDO). http://www.ids.ac.uk/ids/global/pdfs/AppareF1.pdf. Accessed 24th June 2021.

Gereffi, G., Humphrey, J. & Sturgeon, T. (2005). The governance of global value chains. *Review of International Political Economy*, 12(1): 78-104.

Giuliani, E., Pietrobelli, C. & Rabellotti, R. (2005). Upgrading in global value chains: lessons from Latin American clusters. *World development*, 33(4): 549-573.

Glückler, J., Shearmur, R. & Martinus, K. (2022). From liability to opportunity: Reconceptualising the role of periphery in innovation. SPACES online, 17, 2022-02.

Goger, A. (2013a). From disposable to empowered: Rearticulating labour in Sri Lankan apparel factories. *Environment and Planning A,* 45(11): 2628-2645.

Goger, A. (2013b). The making of a 'business case' for environmental upgrading: Sri Lanka's eco-factories. *Geoforum,* 47: 73-83.

Gould, D.M. (2018). *Critical Connections: Promoting Economic Growth and Resilience in Europe and Central Asia*. Europe and Central Asia Studies. Washington, DC: World Bank. doi:10.1596/978-1-4648-1157-9.

Grappi, S., Romani, S., & Bagozzi, R.P. (2018). Reshoring from a demand-side perspective: Consumer reshoring sentiment and its market effects. *Journal of World Business*, 53(2): 194-208.

Gras, A. & Eliot, C. (2019). Innovation and sustainability in French fashion tech outlook and opportunities. Netherlands enterprise agency and the innovation department of the embassy kingdom of the Netherlands in France.

Guerrieri, P., Iammarino, S. & Pietrobelli, C. (2001). *(eds.), The Global Challenge to Industrial Districts: SMEs in Italy and Taiwan*. Edward Elgar: Cheltenham UK and Northampton (MA) USA.

Harzing, A-W., Reiche, B. & Pudelko, M. (2013). Challenges in international survey research: A review with illustrations and suggested solutions for best practice. *European Journal of International Management*, 7(1): 112-134.

Hassler, M. (2004). Raw material procurement, industrial upgrading and labor recruitment: Intermediaries in Indonesia's clothing industry. *Geoforum,* 35(4): 441-451.

Hobday, M. & Rush, K. (2007). Upgrading the technological capabilities of foreign transnational subsidiaries in developing countries: The case of electronics in Thailand. *Research Policy,* 36(9): 1335-1356.

Holweg, M., Luo J. & Oliver N. (2009). The past, present and future of China's automotive industry: A value chain perspective. *International Journal of Technological Learning, Innovation and Development,* 2(1): 76-118.

Humphrey, J. & Memodovic, O. (2003). The global automotive industry value chain: what prospects for upgrading by developing countries? Sectoral Studies Series, United Nations Industrial Development Organization, Vienna.

Hussain S.T., Malik K.Z., Faheem A. & Khan U. (2019). An analysis of the garment sector of Pakistan within a global value chain framework. *International Journal of Supply Chain Management,* 8(2): 505-522.

Imai, K. & Shiu J.M. (2011). Value Chain Creation and Reorganization: The Growth Path of China's Mobile Phone Handset Industry. In: M. Kawakami & T.J. Sturgeon (Eds), *The Dynamics of Local Learning in Global Value Chains: Experiences from East Asia*. Basingstoke: Palgrave Macmillan, pp. 43-67.

Iammarino, S. (2018). FDI and regional development policy. *Journal of International Business Policy*, 1: 157-183

International Electrotechnical Commission (IEC). (2021). https://www.electropedia.org. Accessed 24 August 2021.

International Energy Agency. (2021). Global EV Outlook 2021. https://www.iea.org/reports/global-ev-outlook-2021. Accessed 12 August 2021.

International Monetary Fund (IMF). (2020). Fiscal Monitor. Policies to support people during the COVID-19 pandemic. https://www.imf.org/en/Publications/FM/Issues/2020/04/17/Fiscal-Monitor-April-2020-Policies-to-Support-People-During-the-COVID-19-Pandemic-49278. Accessed 15 August 2021.

Ijtsma, P. & Los, B. (2020). UK regions in global value chains. Economic Statistics Centre of Excellence Discussion Papers 2020-08.

Johnson, R.C. (2018). Measuring global value chains. *Annual Economic Review,* 10(1): 207-236.

Kadarusman, Y. & Nadvi, K. (2013). Competitiveness and Technological Upgrading in Global Value Chains: Evidence from the Indonesian Electronics and Garment Sectors. *European Planning Studies,* 21(7): 1007-1028.

Khan, K. S., Kunz, R., Kleijnen, J., & Antes, G. (2003). Five steps to conducting a systematic review. *Journal of the Royal Society of Medicine*, 96(3): 118–121.

Khan Z., Lew Y.K. & Sinkovics R.R. (2015). The mirage of upgrading local automotive parts suppliers through the creation of vertical linkages with MNEs in developing economies. *Critical Perspectives on International Business,* 11(3/4): 301-318.

Khan M.J., Ponte S. & Lund-Thomsen P. (2020). The 'factory manager dilemma': Purchasing practices and environmental upgrading in apparel global value chains. *Environment and Planning A,* 52(4): 766-789.

Khattak A., Stringer C., Benson-Rea M. & Haworth N. (2015). Environmental upgrading of apparel firms in global value chains: Evidence from Sri Lanka. *Competition and Change,* 19(4): 235-251.

Kitsak, M., Gallos, L. K., Havlin, S., Liljeros, F., Muchnik, L., Stanley, H. E., & Makse, H. A. (2010a). Identification of influential spreaders in complex networks. *Nature Physics*, 6: 888-893.

Kitsak, M., Riccaboni, M., Havlin, S., Pamolli F. & Stanley, H.E. (2010b). Scale-free models for the structure of business firm networks, *Physical Review,* 81(3): 036117.

Kupiainen, E., Mäntylä, M. V., & Itkonen, J. (2015). Using metrics in Agile and Lean software development - A systematic literature review of industrial studies. *Information and Software Technology*, 62(1): 143-163.

Lampón, J.F., Lago-Peñas, S. & Cabanelas, P. (2016). Can the periphery achieve core? The case of the automobile components industry in Spain. *Papers in Regional Science*, 95(3): 596-612.

Langlois, R. (2003). The Vanishing Hand: The Changing Dynamics of Industrial Capitalism. *Industrial and Corporate Change,* 12(2): 351–85.

Langlois, R. & Robertson, P. (1995). *Firms, Markets and Economic Change*. London: Routledge.

Leslie, D., Brail, S., & Hunt, A.M. (2014). Crafting an antidote to fast fashion: The case of Toronto's independent fashion design sector*. Growth and Change*, 45(2): 222-239.

Liu, X., Derudder, B., Liu, Y., Witlox, F., & Shen, W. (2013). A stochastic actor-based modelling of the evolution of an intercity corporate network. *Environment and Planning A*, 45(4): 947–966.

Llados-Masllorens, Meseguer-Artola, A. & Vilaseca-Requena, J. (2021). Upskilling and distributional changes in the electronics global value chain. *International Labour Review,* 160(1): 113-142.

Lung, Y., Van Tulder, R. & Carillo, J. (2004). *Cars, Carriers of Regionalism?.* Palgrave Macmillan: New York.

Macchion, L., Moretto, A., Caniato, F., Caridi, M., Danese, P., & Vinelli, A. (2015). Production and supply network strategies within the fashion industry. *International Journal of Production Economics*, 163(1): 173-188.

Mann, C. & Kirkegaard, J. (2006). *Accelerating the Globalization of America: The Next Wave of Information Technology.* Washington, DC: Institute for International Economics.

McKinsey & Company. (2016). Automotive revolution – perspective towards 2030. How the convergence of disruptive technology-driven trends could transform the auto industry. https://www.mckinsey.com/~/media/mckinsey/industries/automotive%20and%20assembly/our%20insights/disruptive%20trends%20that%20will%20transform%20the%20auto%20industry/auto%202030%20report%20jan%202016.pdf. Accessed 24 September 2021.

McKinsey & Company. (2019). Is apparel manufacturing coming home? Nearshoring, automation, and sustainability - establishing a demand-focused apparel value chain. https://www.mckinsey.com/industries/retail/our-insights/is-apparel-manufacturing-coming-home. Accessed 28 July 2021.

Mohamad, M. & Songthaveephol, V. (2020). Clash of titans: The challenges of socio-technical transitions in the electrical vehicle technologies – the case study of Thai automotive industry. *Technological Forecasting & Social Change,* 153(1): 119772.

Morris M., Plank L. & Staritz C. (2016). Regionalism, end markets and ownership matter: Shifting dynamics in the apparel export industry in Sub Saharan Africa. *Environment and Planning A,* 48(7): 1244-1265.

Nadvi, K. & Raj-Reichert, G. (2015). Governing health and safety at lower tiers of the computer industry global value chain. *Regulation & Governance*, 9(3): 243-258.

Natsuda, K., Otsuka K & Thoburn J. (2015). Dawn of Industrialisation? The Indonesian Automotive Industry. *Bulletin of Indonesian Economic Studies*, 51(1): 47-68.

Natsuda, K., Thoburn, J., Blažek, J. & Otsuka, K. (2020). Industrial policy and automotive development: a comparative study of Thailand and Czechia. *Eurasian Geography and Economics*, 63(2): 212-238.

Neal, Z. (2013). Brute Force and Sorting Processes: Two Perspectives on World City Network Formation. *Urban Studies*, 50(6): 1277–1291.

Ngoc, T.T.B. & Binh, D.T. (2019). Vietnam's electronics industry: The rise and problems of further development. *Humanities and Social Sciences Reviews,* 7(4): 1-12.

OECD (2016). Upgrading pathways in the automotive value chain. https://www.oecd.org/dev/Upgrading-pathways-in-the-automotive-value-chain.pdf. Accessed 22 May 2021.

OECD (2017). International trade, foreign direct investments, and global value chains. Accessed 27 September 2021.

Özatağan, G. (2011). Shifts in value chain governance and upgrading in the European periphery of automotive production: evidence from Bursa, Turkey*. Environment and Planning A*, 43(4): 885-903.

Padilla-Perez, R. & Hernandez, R.A. (2010). Upgrading and Competitiveness Within the Export Manufacturing Industry in Central America, Mexico, and the Dominican Republic. *Latin American Business Review,* 11(1): 19-44.

Pal, R., Harper, S., & Vellesalu, A. (2018). Competitive manufacturing for reshoring textile and clothing supply chains to high-cost environment. *The International Journal of Logistics Management*, 29(4): 1147-1170.

Palokangas, J. (2021). Technology industry / Finnish economic outlook. https://teknologiateolisuus.fi/sites/default/files/inlinefiles/FinnishTechnologyIndustry_December%202021.pdf. Accessed 15 January 2022.

Palpacuer F. (2006). The global sourcing patterns of French clothing retailers. *Environment and Planning A,* 38(12): 2271-2283.

Palpacuer F., Gibbon P. & Thomsen L. (2005). New challenges for developing country suppliers in global clothing chains: A comparative European perspective. *World Development,* 33(3): 409-430.

Pasquali G. & Godfrey S. (2021). Governance of Eswatini Apparel Regional Value Chains and the Implications of Covid-19. *European Journal of Development Research, DOI:* 10.1057/s41287-021-00383-3.

Pavlínek P. & Ženka J. (2011). Upgrading in the automotive industry: Firm-level evidence from Central Europe. *Journal of Economic Geography,* 11(3): 559-586.

Pavlínek P. & Žížalová P. (2016). Linkages and spillovers in global production networks: Firm-level analysis of the Czech automotive industry. *Journal of Economic Geography,* 16(2): 331-363.

Pavlínek P., Domański B. & Guzik R. (2009). Industrial upgrading through foreign direct investment in Central European automotive manufacturing. *European Urban and Regional Studies,* 16(1): 43-63.

Pickles, J. & Godfrey, S. (2013). Economic and social upgrading in global apparel production networks. Capturing the Gains, Revised Summit Briefing No 6.2. http://www.capturingthegains.org/pdf/ctg_briefing_note_6.2.pdf. Accessed 12th May 2021.

Pickles, J., Plank, L., Staritz, C., & Glasmeier, A. (2015). Trade policy and regionalisms in global clothing production networks. *Cambridge Journal of Regions, Economy, and Society*, 8(3): 381-402.

Plank, L. & Staritz, C. (2013). 'Precarious upgrading' in electronics global production networks in Central and Eastern Europe: the cases of Hungary and Romania. Working Paper 31, Manchester, Capturing the Gains.

Rahman, M. & Sayeda, T. (2016). The Effect of Integration with Global Apparel Value Chain: The Case of Bangladesh Apparel Industry. *South Asia Economic Journal,* 17(2): 1-23.

Raj-Reichert, G. (2018). The Changing Landscape of Contract Manufacturers in the Electronics Industry Global Value Chain. In: N. Dev, Tewari, M. & S. Sandip (Eds), *Development with Global Value Chains: Upgrading and Innovation in Asia*, Cambridge: Cambridge University Press, pp. 20-62.

Raj-Reichert, G. (2020). Global Value Chains, Contract Manufacturers, and the Middle-Income Trap: The Electronics Industry in Malaysia. *Journal of Development Studies*, 56(1): 1-19.

Revilla Bonnin, A. (2002). The fashion industry in Galicia: Understanding the Zara phenomenon. *European Planning Studies*, 10(4): 519-527.

Robinson, P.K., & Hsieh, L. (2016). Reshoring: a strategic renewal of luxury clothing supply chains. *Operations Management Research*, 9(3-4): 89-101.

Rugman, A. M. (2005). *The regional multinationals: MNEs and 'global' strategic management*. Cambridge University Press.

Seidman, S. B. (1983). Network structure and minimum degree. *Social Networks*, 5(3): 269-287.

Selwyn B., Musiolek B. & Ijarja A. (2020). Making a global poverty chain: export footwear production and gendered labour exploitation in Eastern and Central Europe. *Review of International Political Economy*, 27(1): 1-27.

Shin, N., Kraemer, K.L. & Dedrick, J. (2012). Value Capture in the Global Electronics Industry: Empirical Evidence for the "Smiling Curve" Concept. *Industry & Innovation,* 19(2): 89-107.

Sinkovics N., Liu, C.L.E., Sinkovics R.R. & Mudambi R. (2021). The dark side of trust in global value chains: Taiwan's electronics and IT hardware industries. J*ournal of World Business,* 56(4): 101195.

Skillnet Ireland. (2021). Electronics sector resources & skills needs. https://www.skillnetireland.ie/wp-content/uploads/2021/01/MIDAS-Electronics-Sector-Resources-Skills-Needs.pdf. Accessed 15 January 2022.

Sturgeon, T. (2002). Modular production networks. a new American model of industrial organization. *Industrial and Corporate Change*, 11(3): 451-496.

Sturgeon, T. (2008). Mapping integrative trade: conceptualising and measuring global value chains. *International Journal of Technological Learning, Innovation and Development*, (1): 237-257.

Sturgeon, T. & Florida, R. (2004). Globalization, deverticalization, and employment in the motor vehicle industry, in Kenny, M. and Florida, R. (Eds.): Locating Global Advantage; Industry Dynamics in a Globalizing Economy, Stanford University Press, Palo Alto, CA.

Sturgeon, T. & Lee, J. (2005). Industry co-evolution: a comparison of Taiwan and North American electronics contract manufacturers. In: S. Berger & R. K. Lester (Eds.), *Global Taiwan: Building Competitive Strengths in a New International Economy*, M.E. Sharpe, Armonk, NY.

Sturgeon, T. & Kawakami, M. (2010). Global value chains in the electronics industry. Was the crisis a window of opportunity for developing countries. The World Bank.

Sturgeon, T. & Kawakami, M. (2011). Global value chains in the electronics industry: Characteristics, crisis, and upgrading opportunities for firms from developing countries. *International Journal of Technological Learning, Innovation and Development*, 4(1): 120-147.

Sturgeon, T. & Lester, R. (2004). The new global supply-base: new challenges for local suppliers in East Asia. In: S. Yusuf, Altaf, A. & Nabeshima, K. (Eds.): Global Production Networking and Technological Change in East Asia, The World Bank and Oxford University Press, Washington, DC, pp. 35-87.

Sturgeon, T. & Memedovic, O. (2010). *Mapping global value chains: Intermediate goods trade and structural change in the world economy*. United Nations Industrial Development Organization.

Sturgeon, T. & Van Biesebroeck, J. (2010). Effects of the Crisis on the Automotive Industry in Developing Countries. A global value chain perspective. The World Bank, Policy Research Working Paper 5330.

Sturgeon, T. & Van Biesebroeck, J. (2011). Global value chains in the automotive industry: an enhanced role for developing countries? *International Journal of Technological Learning, Innovation and Development*, 4(1): 181-205.

Sturgeon, T. & Zylberberg, E. (2016). The Global Information and Communications Technology Industry: Where Vietnam Fits in Global Value Chains, Policy Research Working Paper No. 7916. Washington, DC: World Bank Group.

Sturgeon, T., Daly, J., Frederick, S., Bamber, P. & Gereffi G. (2016). The Philippines in the automotive global value chain. Duke University Centre on Globalization, Governance and Competitiveness.

Sturgeon, T., Memedovic, O., Van Biesebroeck, J. & Gereffi, G. (2009). Globalisation of the automotive industry: main features and trends. *International Journal of Technological Learning, Innovation and Development*, 2(1): 7-24.

Sturgeon, T., Van Biesebroeck, J. & Gereffi, G. (2007). Prospects for Canada in the NAFTA automotive industry: A global value chain analysis. Duke University Centre on Globalization, Governance and Competitiveness.

Sturgeon, T., Van Biesebroeck, J. & Gereffi, G. (2008). Value chains, networks, and clusters: reframing the global automotive industry, *Journal of Economic Geography*, 8(3): 297-321.

Taylor, P.J. (2000). Specification of the World City Network. *Geographical Analysis*, *33*(2): 181-194.

Torsekar, M. & Verway, J. (2019). East Asia-Pacific's Participation in the Global Value Chain for Electronic Products. Journal of International Commerce and Economics, March 2019.

Tranfield, D., Denyer, D. & Smart, P. (2003). Towards a Methodology for Developing Evidence-Informed Management Knowledge by Means of Systematic Review. *British Journal of Management,* 14(3): 207-222.

Truett, L.J. & Truett, D.B. (2019). Challenges in the Portuguese textile and clothing industry: a fight for survival. *Applied Economics,* 51(26): 2842-2854.

Tsui, A. S., Nifadkar, S. S., and Ou, A. Y. (2007). 'Cross-national, cross-cultural organizational behavior research: Advances, gaps, and recommendations', *Journal of Management*, 33(3): 426-478.

UNCTAD. (2005). Training Manual on Statistics for FDI and the Operations of TNCs. unctad.org/en/docs/diaeia20091_en.pdf. Accessed 10 July 2021.

United Nations Industrial Development Organizations (UNIDO). (2018). Global value chains and industrial development: Lessons from China, South-East and South Asia.

Van Liemt, G. (2007). Subcontracting in electronics: From contract manufacturers to providers of Electronic Manufacturing Services (EMS). Working Paper 249. International Labour Organization. Geneva, Switzerland.

Wad, P. (2008). The development of automotive parts suppliers in Korea and Malaysia: A global value chain perspective. *Asia Pacific Business Review*, 14(1): 47-64.

Waterman, J. (2021). Circuit board & electronic component manufacturing in the US. https://www.ibisworld.com/united-states/market-research-reports/circuit-board-electronic-component-manufacturing-industry/. Accessed 12th May 2021.

Wolf, C., Joye, D., Smith, T.W. & Fu, Y.C. (2016). The SAGE handbook of survey methodology. Los Angeles: Sage references.

World Bank. (2019). The new face of trade. World Development Report 2020: Trading for development in the age of global value chains. https://elibrary.worldbank.org/doi/10.1596/978-1-4648-1457-0_ch1. Accessed 22 November 2021.

Zino, A. (2011). *Industry Surveys: Semiconductors.* New York, NY.

Compendium

C1. GVC structure, organization, and spatial dimension: evolution, current trends, and expected future developments

C1.1. The electronics industry

The electronics industry is among the largest and fastest-growing manufacturing industries in the world. It is a high-tech, capital-intensive, and highly innovative industry, which includes a vast array of different market segments such as computers, consumer electronics, communications, and networking. The sector is usually defined as "propulsive" because its products enhance productivity in other sectors and encourage innovation across the entire economy (Mann & Kirkegaard, 2006). Indeed, computers and information technology are heavily used in other sectors, including among others retail and wholesale trade, transportation, finance, real estate, education, professional services, and industrial production (Sturgeon & Kawakami, 2011).

GVCs in the electronics industry are more geographically extensive and dynamic than in any other goods-producing sector. The electronics segment is characterised by rapid technological change and significant investment in Research and Development (R&D) (Frederick & Gereffi, 2013). Manufacturing processes are highly automated and there is a high level of standardization in the industry. Assembly operations can be easily separated from technology development and basic high-volume components can be substituted with relative ease (Sturgeon & Kawakami, 2010). The combination of automation and standardization in the sector has created a recipe for "value chain modularity"[50], in which multiple firms can contribute to the realization of final products (Ernst, 2005). More specifically, the modularity of this value chain allows for a technical division of labour between design and manufacturing operations at multiple points in the value chain. On the one hand, the key business phases of product design, production planning, inventory, and logistic control, as well as various aspects of the production process itself, have been over time formalised, codified, standardised, and computerised. On the other hand, the Internet has provided an ideal vehicle for sharing the data generated and used by these systems: Information and Communication Technologies (ICTs) and practices have created a connection point in the flow of knowledge that allows data to be transmitted across long

[50] In electronics, the nature of products and of value chain architecture is usually regarded as highly "modular". Over time, the advent of computer-aided design (CAD) technologies and the transition towards digital systems have enhanced the ability to codify electronic systems and system elements. While digitalisation enlarges the scope of what can be achieved with electronics and information technology, codification and standardisation allow components and other systems to be substituted without the need of entirely redesigning products. This "product modularity" has enabled high levels of "value chain modularity", which allows firms and workers to collaborate at distance on complex projects and to establish cross-border collaborations (Sturgeon & Kawakami, 2010).

distances and to other firms. Additionally, the high value-to-weight ratio of electronic parts and most final products makes long-distance shipping relatively inexpensive. For example, air shipment is highly common for several high-value components and some final products, such as notebook computers and mobile phone handsets. Factories can also be easily relocated and produce a large variety of end products. All these factors have played a critical role in enabling the industry to spread geographically by fostering a high degree of outsourcing and offshoring throughout the value chain (Balconi 2002; Langlois & Robertson 1995; Langlois, 2003; Van Liemt, 2007). This has over time provided significant growth opportunities for developing countries, both as production locations for multinational enterprises (MNEs) and for local firms seeking to participate in the industry as component suppliers or contract manufacturers. Rapid product innovation and short product life cycles in the sector allow local suppliers that gain a role in the GVC to quickly learn and industrially upgrade (Frederick & Gereffi, 2013).

As a result, many companies of different sizes and from different locations are part of the electronics GVC, which is regarded as highly complex and "producer-driven". The main actors of this global value chain are lead firms, component suppliers, platform leaders, and contract manufacturers. Here below we discuss the role played by each of these actors along different stages of the value chain.

Lead firms control product and technology development and sell branded products and systems in final markets to individual consumers, businesses, or government agencies. These firms, often referred to as Original Equipment Manufacturers (OEMs), are responsible for the highest value-adding stages in the value chain including research, product and process development, design, branding, marketing, and after-sales services. More specifically, the main activities that cut across several sectors include new product development, circuitry and semiconductor design, software integration, and overall product architecture development (see Figure C1 below). These activities, the least likely to be performed in offshore locations or outsourced to other facilities, are the most profitable in the value chain. Most lead firms have however little production capacities in their domestic markets by often relying on the support of suppliers. The key lead firms in the electronics industry are mostly based in advanced economies, especially the US (e.g., IBM, Dell, Apple, Microsoft), Western Europe (e.g., Philips, Siemens), Japan (e.g., Fujitsu, Toshiba, Sony) and South Korea (e.g., Samsung, LG). Over time, an increasing number of such firms have been also established in emerging economies, including for example the Chinese lead firms Huawei and Lenovo (Frederick & Gereffi, 2013).

In addition to high value-adding activities, the electronics industry is composed of inputs and raw materials, electronic components, sub-assemblies, and final product assembly for a

variety of end market segments. The first step in the GVC is sourcing the inputs and raw materials required to make electronic components: the mining, refining, combination and use of critical raw materials is essential for many advanced electronic products, such as smart phones and computers, and their components including for example lithium-ion batteries and semiconductors (e.g., Diemer et al., 2021). The first stage of raw material inputting is followed by numerous other steps in the component manufacturing process: moulding, stamping, precision machining and finishing. Electronic components are basic electronic elements with two or more connecting leads or metallic pads that need to be connected to create an electronic integrated circuit. These can be active components (or semiconductors[51]) and passives. While the former amplify voltage and control the flow of electric current in a circuit, the latter are usually configured together in an electronic sub-system for incorporation into a complete electronic system[52] (Frederick & Gereffi, 2013). While the world's largest electronic **component suppliers** are usually headquartered in advanced economies such as the US, Japan, and the EU, most of their manufacturing is usually located in low-wage countries (UNIDO, 2018).

Platform leaders, which often deal directly with lead firms, are component suppliers that have been particularly successful in including their products or implanting their technology (i.e., software, hardware, or a combination) in other firms' products. Some platform leaders are more profitable than lead firms in the value chain, with higher innovation and technological capabilities as well as market power. Moreover, they have the capacity to decide the location of critical nodes of the GVC (Imai & Shiu, 2011). Personal computers and mobile phone handsets are two industries in which platform leaders now dominate (Sturgeon & Kawakami, 2011; Sturgeon & Zylberberg, 2016). The most notable example of a platform leader is Intel, which is a dominant force in the microprocessor business[53]. Apple is an interesting case of a lead firm that is also a platform leader. Indeed, the system architecture of Apple products is proprietary, although most parts and sub-systems are purchased from external companies. More recently, there has been a growth of demand for less sophisticated products in emerging economies, which has allowed several domestic platform leaders to enter the smartphone business. Here, a large share of value along the GVC is created through the supply of chipsets and complementary services (Chuang, 2016). For example, chipsets from MediaTEK, a Taiwanese semiconductor company, have played a central role in supporting the development of low-cost phones suitable for the Chinese market (Sturgeon &

[51] Semiconductors, including discrete components, integrated circuits, and optoelectronics, are among the most technologically advanced and expensive components in electronic products (Zino, 2011).

[52] Other passive components include electrical cables and other devices that cannot create an electrical current and are used on circuit boards or as part of electrical sub-assemblies such as electrical panels, switchgear equipment, and power transmission devices (IEC, 2021; Waterman, 2021).

[53] Many branded PC producers such as IBM have tried to develop substitutes for Intel chipsets to enhance their profitability and replace its leadership.

Kawakami, 2011). The emergence of platform leaders, suppliers, and local brands in domestic-market-oriented production networks is currently challenging the dominance of global brands (Llados-Masllorens et al., 2021).

Since the late 1980s, lead firms and key platform leaders have relied upon **contract manufacturers** (or sub-contractors) to assemble electronics using their brand names and sell final products through one or more distribution channels (e.g., consumer, institutional, industrial), depending on the type of end market segment (Ernst, 2002; Sturgeon & Kawakami, 2010). The popularity of contract manufacturing is a direct result of the value chain modularity previously discussed. Contract manufacturers usually purchase the bulk of the world's electronic components and establish their own global production networks to manufacture products and/or provide design services on behalf of global buyers. Sub-assemblies include the main components that make up final parts such as circuit boards and displays. However, purchase contracts for the more expensive components, such as microprocessors and other key integrated circuits, are negotiated directly by the lead firms or key platform leaders.

Contractors are divided in two types of firms. **Electronics Manufacturing Services (EMSs)** include activities such as component purchasing, circuit board assembly, final product assembly, and testing. The EMS industry is highly geographically concentrated, with many of the large EMS companies originated in the US and Canada and several other companies emerged from Asia, particularly Taiwan[54] and Singapore. Being most EMS businesses at the circuit board assembly level, these providers can serve lead firms in a variety of end market sectors. Contractors that provide both manufacturing and product design services are known as **Original Design Manufacturers (ODMs)**. Most large ODM contract manufacturers (e.g., Quanta Computer, Compal Electronics, Wistron, Inventec) are based in Taiwan, with manufacturing concentrated in lower-cost countries in mainland China and the Southeast of Asia (Guerrieri et al., 2001; Sturgeon & Kawakami, 2011; UNIDO, 2018). Design expertise is much more sector-specific, which limits the potential for end market upgrading. Indeed, ODM contract manufacturers have been traditionally confined to the PC industry (Sturgeon & Lee, 2005). However, both the EMS and ODM contract manufacturing segments have been characterised by rapid growth and geographic expansion, becoming key actors in the electronics GVC (Frederick & Gereffi, 2013).

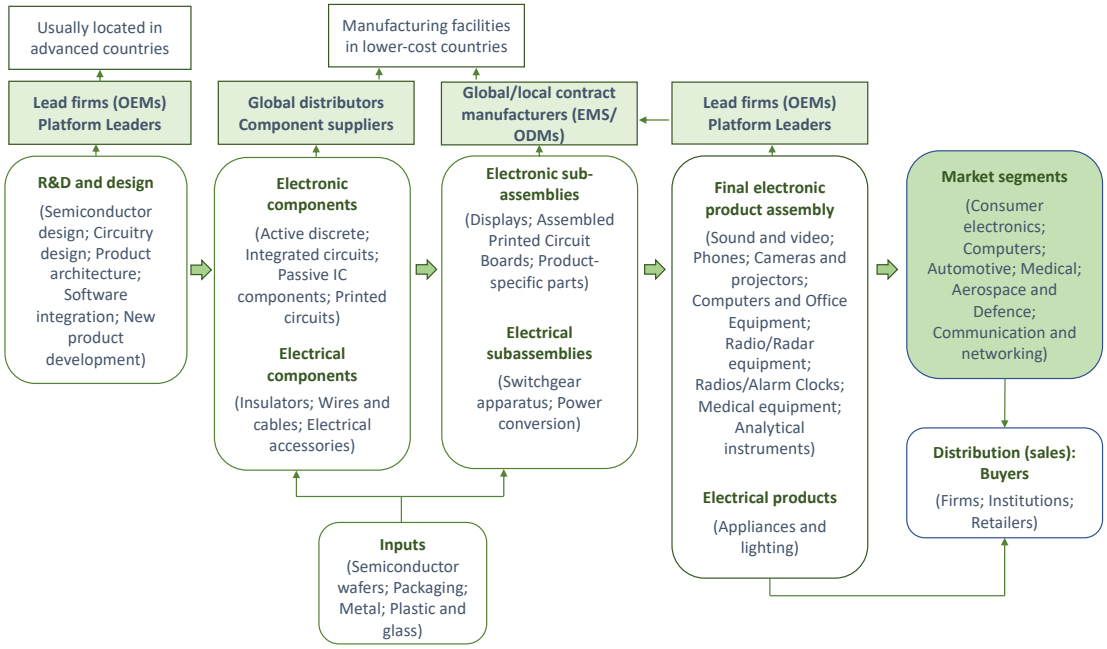
Over time, the largest contract manufacturers have set up facilities throughout the world by influencing industry trends in both emerging and developing countries such as Malaysia, Philippines, Thailand, Vietnam, and Mexico. The economic and financial crisis post-2008 has

[54] For example, Foxconn, based in Taiwan and with production facilities in other countries such as Vietnam and China, is amongst the largest industry's players because of the large orders received from Apple to produce iPhones, iPad tablets and MacBook laptops.

encouraged lead firms to rationalise and consolidate their supplier base. As a result, contract manufacturers have further upgraded and gained new capabilities by providing lead firms with increasing design, engineering, and prototyping services, as well as technological development (Gereffi & Lee, 2016; Raj-Reichert, 2018). China has emerged as the main source of value generation, by reinforcing its regional ties and expanding production links with Latin American and Eastern European economies. FDI from EU and Asian brand companies in Eastern European countries has become an important vehicle of integration in the electronics GVC. Indeed, these economies growingly serve as low-cost supply bases for assembling and exporting to the main EU markets (Llados-Masllorens et al., 2021). However, compared to other actors in the GVC, the market power and profitability of contract manufacturers has generally remained low because these firms are highly substitutable (Sturgeon & Kawakami, 2011).

Distribution and sales vary by different stages in the value chain. For example, passive electronic and electrical component manufacturers sell their products to distributors and to end-users, mainly electronic product manufacturers. Semiconductor, display, and printed circuit board companies tend to sell most of their products to OEMs and their contract manufacturers (Frederick & Gereffi, 2013). Overall, distribution is mostly decentralised amongst many small national or local distributors, although there are a few large distributors operating internationally such as Arrow, Techdata, and IngramMicro. Sales are by large retail chains, general retailers, and smaller local dealers (Dedrick et al., 2008). The continuous growth and influence of the electronics sector on new industries makes it difficult to classify all its final products and end markets (Padilla-Perez & Hernandez, 2010). Opportunities for electronics stem particularly from the growth of hybrid electric and battery electric vehicles. The use of electronic components is also increasing in household appliances, as well as in electricity products such as smart meters and in industrial products including automation and control. The fastest growing segments for semiconductors include medical equipment, process controls, and military and aerospace applications (Zino, 2011). These new markets provide significant opportunities for smaller, flexible, and highly customised suppliers (UNIDO, 2018).

Figure C1. The electronics global value chain



Source: Authors' elaboration adapted from Frederick & Gereffi (2013).

C1.2. The automotive industry

The automotive industry – another example of "producer-driven" global value chain (Gereffi et al., 2005) – is typically coordinated by a handful of large and very powerful **automakers** with global recognition (i.e., lead firms or OEMs) (Sturgeon et al., 2009). The organization and geography of this GVC is highly complex and has been experiencing a profound transition over the last decades. Here we will first discuss the evolution, configuration, and type of governance of this GVC, then move to its geography with a focus on its macro-regional/continental structure, as well as the recent trends that have affected the industry.

Since the late 1980s, in a context of increasing trade liberalisation and cheaper ICTs, the sector has been exposed to growing opportunities for FDI, global production and cross-border trade, which have accelerated dramatically (Sturgeon et al., 2007, 2008). Over time, the industry has organised itself into a multi-tiered supplier structure with a high degree of outsourcing and a growingly globalised supply base, including firms from many developing economies (Sturgeon & Van Biesebroeck, 2011). The largest suppliers, also through the acquisition of firms with complementary assets and geographies, have expanded their global presence and increased their technological, innovation and design competences, with an ability to provide goods and services to a wider range of lead firms (Sturgeon & Lester, 2004). In doing so, they have gained control over their own upstream suppliers. Accordingly, automakers have been able to source more critical systems and modules ready to be

assembled (instead of individual parts) from "**first-tier suppliers**", which then sub-contract more basic and labour-intensive manufacturing activities to "**lower-tier suppliers**" (Frigant & Lung, 2002; Humphrey & Memedovic, 2003; Natsuda et al., 2015; Sturgeon, 2002; Sturgeon & Florida, 2004). In other words, first-tier suppliers have become responsible not only for producing components according to the lead firms' specifications, but also for designing solutions, adapting basic designs to customers' specific requirements, developing complex systems using their own technologies, and supplying these in globally dispersed geographies. This has required more sophisticated forms of coordination between lead firms and first-tier suppliers, which have gradually switched from captive to more relational connections for the exchange of tacit knowledge (Sturgeon et al., 2008).

Final assembly has become growingly dispersed because of market saturation, high levels of motorisation and the tendency for automakers to locate close to the final markets, often encouraged by government policies (Sturgeon et al., 2007, 2009). A wave of new final assembly plants has been established in new locations, including regions in many of the largest emerging market countries such as Brazil, India, and China (Dicken, 2007; Humphrey & Memedovic, 2003; Lung et al., 2004; Sturgeon, 2002). While the production of lighter and more standardised parts and components (e.g., tyres, batteries, wire harnesses) can take place at distance because of scale economies and labour cost reductions, suppliers of bulky, heavy, and model-specific parts (e.g., engines, transmissions, seats, body panels) have tended to cluster around automaker's assembly plants to facilitate collaboration and assure timely delivery (Sturgeon & Van Biesebroeck, 2010). This has triggered the creation of different regional/sub-national industrial systems, where design and manufacturing are typically co-located. Detroit, Cologne, Stuttgart, Paris, and Tokyo are amongst the clusters around lead firms' headquarters, where designs are translated into the parts that need to be assembled into a final vehicle (Sturgeon et al., 2008, 2009). Such agglomerations at the sub-national level– given also the industry high capital-intensity – are strongly connected particularly within national economies and macro-regions (e.g., Giuliani et al., 2005; Sturgeon et al., 2008). As described by Sturgeon & Van Biesebroeck (2011), "local, national, and regional value chains in the automotive industry are 'nested' within the global organisational structures and business relationships of the largest firms".

While the industry has remained concentrated in some regions in Japan, Germany, and US (Sturgeon & Florida, 2004), which between 2013 and 2015 accounted together for more than 60% of total FDI in the industry, emerging economies have rapidly expanded and are now amongst the most rapidly growingly geographies in terms of vehicle output (Natsuda et al., 2020). In recent years, among the top 20 world's producers of vehicles, China, India, Thailand, Czechia, and Slovakia have increased their share over total production (OECD,

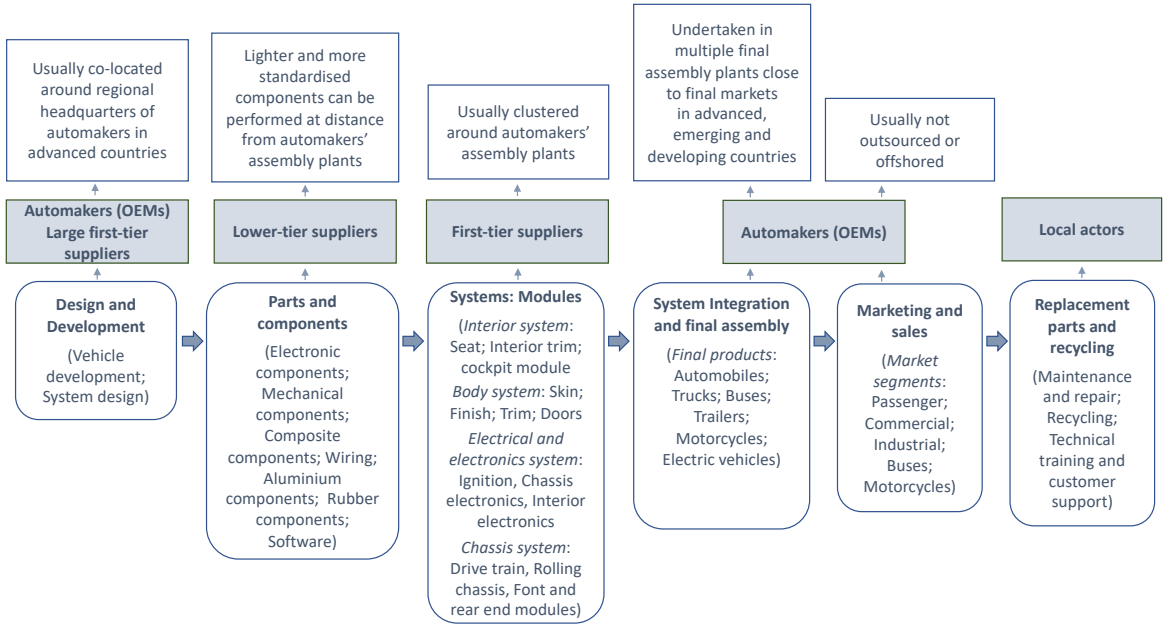
2016). China now leads vehicles production and employment by accounting for more than one fourth worldwide. Europe, between 2013 and 2015, was the first exporting region for vehicles, accounting for 54% of total world exports. The European automotive sector is internationally renowned for the high number of car manufacturers known for their quality, innovative technologies, as well as marketing and design. The Volkswagen Group, including twelve brands (i.e., Volkswagen Passenger Cars, Audi, SEAT, ŠKODA, Bentley, Bugatti, Lamborghini, Porsche, Ducati, Volkswagen Commercial Vehicles, Scania, and MAN) with 69 sites in 20 European countries and headquartered in Wolfsburg in Germany, is Europe's largest automaker. This brand alone accounted for 11% of newly registered passenger cars in Europe in 2019. In 2020, EU automotive accounted for 6.7% of EU total jobs and 11.5% of EU manufacturing jobs, generating a turnover of over 7% of EU GDP. In the same year, despite a decline in the number of cars produced due to the Covid-19 pandemic, Germany, Spain, Czechia, Slovakia and France, followed by Italy, Romania, and Hungary, were still amongst the top passenger car producing countries in the EU (European Automobile Manufacturers Association, 2020). Overall, except Hungary, those countries that joined the EU in 2004/2007, such as Slovakia, Czechia, and Romania, have particularly increased their participation in the automotive GVC (Connell Garcia et al., 2020).

As mentioned above, despite the fast-globalizing pace evident in the 1990s and compared to other consumer-oriented manufacturing industries such as electronics and apparel, this sector has never fully developed global-scale patterns of integration but has retained a strong and durable macro-regional/continental structure (Dicken, 2005, 2007; Lung et al., 2004; Sturgeon et al., 2008, 2009). The political dimension is amongst the most important factors contributing to the relevance of relatively more geographically-bounded production in the automotive industry. Indeed, the high cost and visibility of automotive products amongst the general population can create risks of political backlash in some markets if imported vehicles become too large a share of total vehicles sold. Thus, assemblers usually choose to prevent this reaction by restricting exports and setting up local production (Sturgeon & Van Biesebroeck, 2010, 2011).

Proximity to final markets is particularly relevant in this type of industry also because of the high transport costs of motor vehicles and their main parts and due to the industry-wide adoption of lean production techniques, which imply timely delivery and just-in-time organisation (Castelli et al., 2011; Frigant & Layan, 2009; Humphrey & Memedovic, 2003; Sturgeon & Florida, 2004). Moreover, in the automotive industry, there are few standardised parts that can be used in a wide variety of end products without extensive customization. This further raises the costs for suppliers that serve multiple customers and the need for close collaboration with automakers. For example, consumers in high-income countries are more

demanding and require certain specific features[55]. Roads and fuel are frequently of poorer quality in developing economies, and thus vehicles need to be adapted to local conditions, for example by strengthening the body, suspension, or steering (Sturgeon et al., 2009). Moreover, each market – as for example in the case of the EU Single Market[56] – has its own set of regulations (e.g., water regulations, air emissions, waste management, noise control) with which automakers must comply. Within countries or macro-regions, automotive production, development, and employment are typically clustered in one or a few industrial regions, with clusters specialised in aspects of the business that share a common characteristic such as electronic content or labour intensity (Sturgeon et al., 2016). Because of huge investments in capital equipment and skills, regional automotive clusters tend to be very long-lived (Sturgeon & Van Biesebroeck, 2011). A more detailed structure of this GVC is shown in Figure C2.

Figure C2. The automotive global value chain



Source: Authors' elaboration adapted from Sturgeon et al. (2016).

Because of the co-location of assembly plants in national and regional production systems, the effects of the 2008 economic and financial crisis on the industry have been largely contained within each country or region (Sturgeon & Van Biesebroeck, 2010). As in other industries, several trends such as the development in emerging markets, the accelerated rise of new technologies, sustainability policies, and changing consumer preferences around

[55] Intensified global competition has given rise to a "build-to-order" approach, in which consumers are able to define the characteristics of the vehicles before they are produced.

[56] As for other industries, the EU has very strict regulations for the automotive sector. Indeed, vehicles must meet all EU safety rules (e.g., installation of lights, braking performance, stability control, crash tests with dummies), noise and emissions limits, as well as production requirements (of individual parts and components) before being placed on the EU market (EC, 2021).

ownership have been revolutionising the automotive sector. Together with autonomous driving, which is still being tested and surrounded by high levels of uncertainty concerning its safety as well as the required infrastructure and regulations, the move toward electric vehicles is one of the biggest technological changes currently under way in the sector (McKinsey & Company, 2016). Despite the worldwide downturn in car sales due to the pandemic, electric car registrations increased by 41% in 2020. The growing number of electric vehicle sales, up to 10 million in 2020 (International Energy Agency, 2021), has resulted in some significant transformations in the automotive industry. There are various new systems in electric vehicles that are not compatible with conventional vehicles, including new gear boxes, electric power steering, and water pumps to cool the electric engine. This has led to a shift in the creation of value-added activities in the automotive value chain. Moreover, 60% of the total electric vehicles cost are due to the battery, compared to 30% vehicle cost of power train system in normal cars. The production of electric drivetrains requires new know-how, which has not yet been developed by either suppliers or automakers. Hence, these new components and systems will create opportunities for battery makers, cell component makers, and their suppliers, while reducing the role of traditional component suppliers (Mohamad & Songthaveephol, 2020). This could lead to a new era of "modular" vehicle design and industry standards, capable of breaking the dominance of the largest automakers, as well as of creating opportunities for entry into the GVC in both design and production (Sturgeon et al., 2016)[57].

C1.3. The textile & apparel industry

Textile and Apparel (T&A) is one of the oldest, most globalised, and leading export industries in the world, as well as a significant engine for economic growth (Gereffi, 1994, 1999). It is considered a typical starter industry for economies engaged in export-oriented industrialization (Fernandez-Stark et al., 2011; Frederick & Gereffi, 2011; Gereffi & Memedovic, 2003). Due to its low fixed costs and technology-intensity, and high labour-intensive manufacturing, it has been deeply affected by the global slicing up of production stages, a long-term steady increase in offshore production, a serious loss of manufacturing jobs in advanced economies, and a consolidation at the retail end of the value chain (Macchion et al., 2015). Production and trade in the sector are largely organised within GVCs, which are characterised by a high degree of involvement of developing economies' producers. The economic model involving the relocation of production overseas and the retention of high-value activities locally (e.g., design, innovation, marketing, branding) has over time become dominant in this type of industry and has gradually redrawn the boundaries

[57] Recent multi-disciplinary literature has also pointed to various challenges arising from the electrification of the automotive industry (see, for a review, Mohamad & Songthaveephol, 2020).

of traditional industrial districts focused on textile and apparel and typically located in advanced economies (Gereffi & Frederick, 2010; Leslie et al., 2014). Here below we will focus on the configuration and geography of this GVC, the impact of trade regimes on global sourcing dynamics, in addition to the more recent dynamics which are leading to a new reconfiguration of the value chain.

The global apparel value chain is organised around the following main segments: design; supply of raw materials such as fibres; provision of component textile products such as yarns and fabrics; production networks made up of garment factories including their domestic and overseas sub-contractors; export channels established by trade intermediaries; and marketing networks at the retail level[58] (Gereffi & Memedovic, 2003). The most important value-adding stages are the services that occur before and after the apparel production process such as research, design, marketing, branding, and retailing (Fernandez-Stark et al., 2011). Compared to apparel, textile production is more capital and scale intensive, demands higher skills and retains a large presence in advanced and middle-income countries.

The GVC of the textile and apparel industry is highly complex, geographically fragmented and characterised by large power asymmetries. It is a classic example of the "buyer-driven" value chain, where **lead firms**, such as private label retailers, designers, and brand manufacturers, play a key role in the organization of global production, by often outsourcing the manufacturing process to a global network of overseas **suppliers** (Bair & Gereffi, 2001; Gereffi & Memedovic, 2003; Pickles et al., 2015). Lead firms, which are usually located in leading markets in advanced economies, perform the most valuable activities in the value chain (e.g., research, design, sales, branding, marketing) (Gereffi & Memedovic, 2003). These firms are not necessarily the traditional vertically integrated manufacturers, nor are they necessarily involved in making finished products. Indeed, suppliers, typically located in low-cost developing economies, usually carry out various phases of the production process in accordance to lead firms' specification (Gereffi, 2019; Pickles et al., 2015). However, lead firms may have different formulations of global and domestic sourcing, as well as of production and supply network configurations. For example, the retention of production in specialised industrial districts with high-skilled workers and long-standing tradition in T&A, which are mostly located in European countries such as Italy or Spain, is still a widespread business model particularly for luxury fashion firms, which want to link brand reputation to consumers' perception of product quality, or for those innovative products that require quick style variations to meet consumers' needs on a timely basis (Macchion et al., 2015). More generally, T&A remains an important sector of the European manufacturing industry,

[58] While the re-use and recycling of all materials and products employed in the production process has become growingly important and is now often featured as the last stage of this GVC, this topic will not be discussed in the present Report.

accounting in 2019 for around 160,000 firms, €162 billion in turnover, €5 billion in investments and €61 billion in exports (Euratex, 2020).

Over time, different trade regimes have generated major shifts in global sourcing dynamics and governance of these GVCs. Between 1974 and 2004, the ability of developing economies to enter the T&A industry was limited by a complex system of quantitative limits (i.e., quotas) on the volume of exported items. These trade restrictions, part of the Multi-Fibre Arrangement (MFA), were aimed at protecting the domestic industries in Europe and the US from highly competitive low-cost suppliers such as China (Pickles & Godfrey, 2013). Nevertheless, the MFA prompted the rise of value-chain intermediaries, the establishment of factories in places with available quotas, and the entry of developing players in the export market sheltered from leading low-cost competitors, thus fuelling the spread of global production networks (Frederick & Gereffi, 2011; Gereffi, 1999). Indeed, trade policies had the effect of dispersing production globally by shifting orders across a range of countries according to quota availability (Frederick et al., 2014). Bangladesh, for example, was able to improve its competitiveness and become the second largest source of apparel after China in 2016 (Frederick & Daly, 2019).

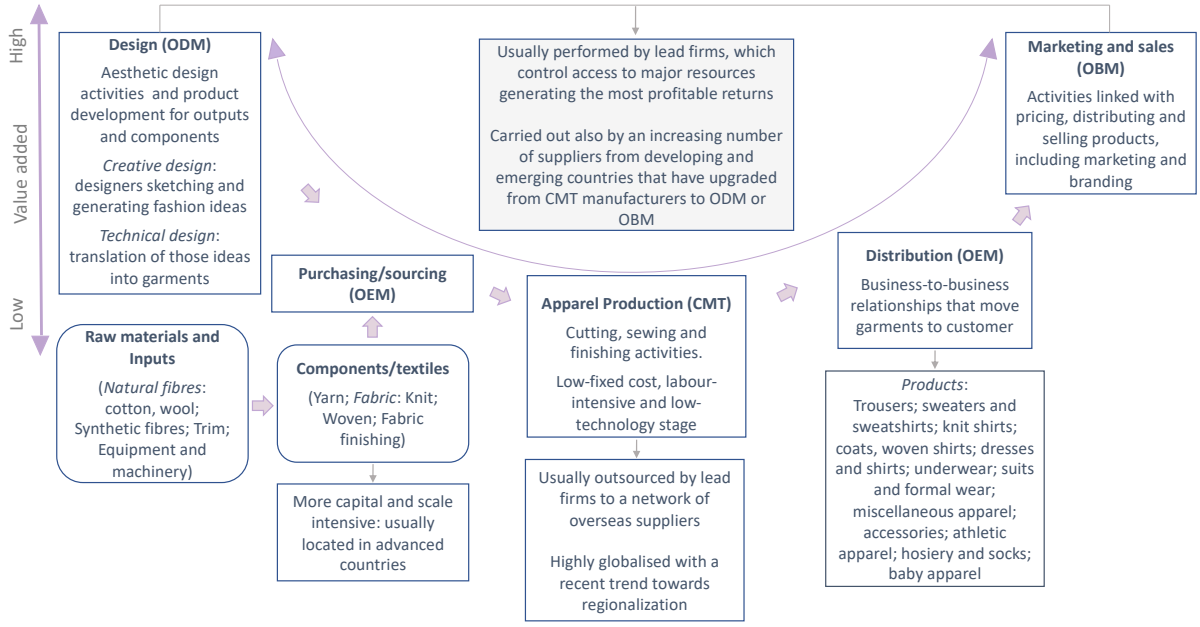
Later, the removal of quota-constrained trade under the WTO's Agreement on Textile and Clothing (over the period 1995-2005) led to a considerable flux in the global geography of production and trade, as well as to a rethinking of firms' strategies seeking to realign with new economic and political realities (Gereffi & Frederick, 2010). This has resulted in a gradual rationalization and consolidation of the value chain (Fernandez-Stark et al., 2011). On the one hand, lead firms, also spurred by the development of fast fashion systems and the growing specialization of T&A products, have enacted a profound process of restructuring of their sourcing networks by developing longer-term relationships with a restricted number of more efficient and strategically located suppliers. In so doing, they have increasingly favoured not only labour costs but also productivity, flexibility, capabilities, proximity to main markets and compliance with specific social and environmental standards (Pickles et al., 2015). On the other hand, suppliers from developing countries have benefited from an organizational learning process arising from these longer and stable relationships with lead firms, by upgrading[59] into higher value activities and improving their position in the value chain. While low-cost countries such as Bangladesh, China, and India have emerged as leaders in the lower-value assembly segments of the value chain, other countries, such as Sri Lanka and

[59] Industrial upgrading is usually associated with the shift from the mere assembly of products (i.e., CMT - Cut, Make, Trim) to full production models (i.e., OEMs or FPP – Full Package Production), and more domestically integrated forms of manufacturing involving design (i.e., ODMs) and branding activities (i.e., OBMs - Original Branding Manufacturing). This process can take many forms ranging from the acquisition of new capabilities (i.e., functional upgrading), product innovation (i.e., product upgrading), the integration of more sophisticated technologies (i.e., process upgrading) and the entrance in new industries (i.e., intersectoral upgrading) (Fernandez-Stark et al., 2011; Giuliani et al., 2005).

Turkey, have upgraded into higher-value segments, such as branding and design. During this phase-out period, several small countries such as Nicaragua and Lesotho continued to compete in the industry thanks to additional unilateral trade agreements and preference schemes launched to ease the impact of the removal of quota-constrained trade on the least developed economies (Fernandez-Stark et al., 2011). As a result of these changes, the T&A value chain has gradually shifted from a "captive" model, characterised by a high degree of monitoring and control by lead firms on suppliers, to a "relational" model where the power balance between these types of firms is more symmetrical. The 2008 economic and financial crisis further accelerated the reconfiguration and restructuring of the global apparel sector leading to production slowdowns and plant closures in most apparel-exporting economies (Frederick & Gereffi, 2011).

More recently, several trends such as the growing importance of proximity to consumers, production control, flexibility, shorter lead times and skilled workers, together with the increased automation of low-value processes and the rising concern for environmental and ethical standards, have further challenged the competitive advantage enjoyed by low-cost manufacturing suppliers, triggering a new reconfiguration of the textile and apparel value chain (Di Mauro et al., 2018; Grappi et al., 2018). Domestic production in original home countries has become increasingly appealing and a growing number of firms have started returning some of their manufacturing activities back home (Fratocchi & Di Stefano, 2019; Macchion et al., 2015; McKinsey & Company, 2019). In this type of industry, "backshoring" has been particularly intensified by the need for meeting a growingly sophisticated consumers' demand, which looks for higher-quality and innovative, customised, and crafted products, thus requiring more flexible, agile, and responsive production networks (Casadei & Iammarino, 2021; Pal et al., 2018; Robinson & Hsieh, 2016). The "country of origin" and "made-in" effect have become growingly important drivers for firms' competitiveness. Furthermore, the complexity of this value chain makes negotiation and coordination costs higher than in other industries, favouring shorter distances between design and manufacturing activities. Investments in manufacturing-integrated technologies (i.e., computer-aided design, modular systems) have also encouraged backshoring strategies in the industry (Macchion et al., 2015). Figure C3 shows the structure of the T&A global value chain.

Figure C3. The textile & apparel global value chain



Source: Authors' elaboration adapted from Fernandez-Stark et al. (2011) and Frederick & Daly (2019).

C2. GVC scholarly literature on other sectors

To strengthen the SLR on the three GVC-sensitive sectors, we included in the analysis the most influential works on GVCs in other sectors. A sample of 43 academic articles with at least 30 citations was retrieved from Scopus by first searching generically for the strings "Global Value Chain" OR "Global Commodity Chain" and then selecting those articles with a sectoral scope other than electronics, automotive and T&A. The aim of this section is to provide a quick overview of the main works on other GVCs, which is useful for supporting findings from the previous analysis. While this sample is not representative of the entire body of sectoral GVC literature, it serves however as a reference for a rough comparison with the main trends highlighted in the GVC-sensitive sectors literature.

Most works in this sample examined the horticulture, agriculture, and food GVCs, with a focus on cut flowers, coffee and cocoa chocolate, fish, fruit, vegetables, palm oil, and wine. Others explored the furniture, music, pharmaceutical, biotechnology, photovoltaic, football and toys industries. As with electronics, automotive and T&A, the most influential literature started to grow from 2008 onwards. As far as the main topics are concerned, researchers mostly investigated the geography, structural configuration, governance, and changing dynamics of GVCs. In this regard, a few papers looked at the effect of domestic and regional value chains on upgrading opportunities. Others investigated learning and innovation processes, the relationship between key GVC actors, the integration of firms into the GVC, as well as

opportunities for more socially and environmentally sustainable global value chains. Approximately 14% of studies combined the GVCs and GPNs frameworks, while no studies examined a shock affecting global value chains.

Most works drew upon mixed methodologies, followed by qualitative research approaches. Only two studies adopted quantitative methods. Interviews with key GVC actors (e.g., companies, producer organizations, representatives of non-governmental organizations, intermediaries, exporters, public officials) was the most adopted methodology for collecting data, followed by secondary data and fieldworks. Surveys and participant observations were the least adopted strategies for data collection. Most studies examined a single national geography, particularly within emerging and developing economies. Only 4 studies focussed on the EU. The most studied countries were China, Indonesia, South Africa, and India. Only two sub-national geographies were examined: the ceramic tile district of Castellon in Spain, which plays a prominent position in the glazing industry; and the Java Island in Indonesia, where teak plantations provide wood for many teak furniture manufacturers and retailers in Indonesia and other parts of the world. While the former drew upon qualitative interviews for examining the process of knowledge exchange between clusters through external ties, the latter used quantitative system dynamics modelling for the study of governance scenarios of fair trade and vertical integration as well as their impacts on sustainability.

C3. Information about the Analytical AMNE Database

The OECD Analytical AMNE database provides information about the role of multinational enterprises in the global economy (Cadestin et al., 2019). Combining official AMNE statistics with information from the OECD TiVA database, it breaks down production, value-added and trade according to ownership (domestic versus foreign ownership). More in details, the full matrix of the Analytical AMNE database is composed by the intermediate consumption matrix, the final demand matrix, the value-added vector, and the gross output vector. Cells across columns correspond to a country-sector's inputs, while cells across lines correspond to the output of a country-sector. To account for firms' ownership, the intermediate consumption matrix is divided by distinguishing between the inputs used by domestic-owned and foreign-owned firms. The final demand matrix is split only across rows to reflect the final demand of products from domestic-owned and foreign-owned firms. The value-added and gross output vectors are split across columns to indicate the value-added and gross output of domestic-owned and foreign-owned firms in each country and sector. The dataset's structure provides the instruments to analyse the input requirements of foreign affiliates and domestic firms operating in a given country and sector. The dataset is structured in a way that, given a

country of analysis, is always possible to distinguish between inputs coming from all domestic firms (including nationally-owned MNEs) or foreign affiliates in that specific sector, covering the period 2005-2016. In fact, for each country and sector in the EU27 and the UK, the inputs used by foreign affiliates and domestic firms respectively were computed distinguishing between inputs obtained from firms operating in the country where the foreign affiliate/domestic firm is operating (home country), internationally in other EU27 countries plus the UK, or in other extra-EU countries.

Appendix

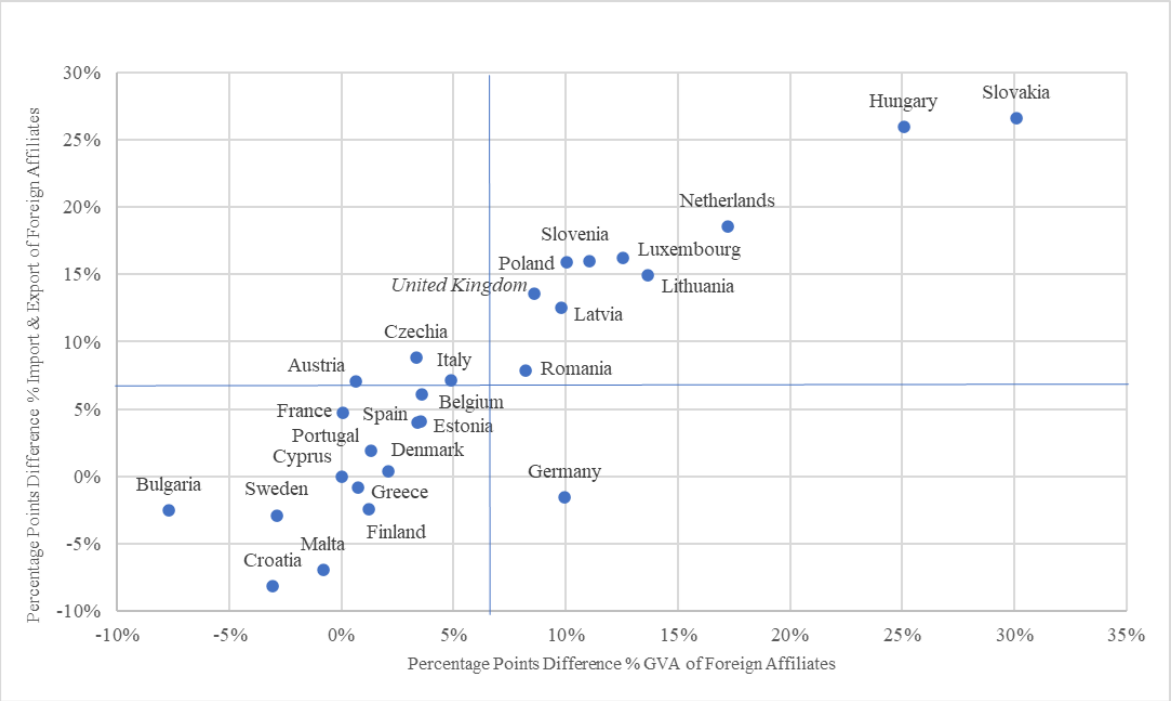
Table A1. Percentage point change of relative weight of GVC-sensitive sectors on total manufacturing: GVA, exports, imports – 2005 vs 2016*

	GVA % change			Exports % change			Import % change		
	T&A	Electronics	Automotive	T&A	Electronics	Automotive	T&A	Electronics	Automotive
Austria	-1.1%	-1.6%	-0.7%	-0.8%	-1.2%	-4.5%	-0.7%	-1.0%	-5.5%
Belgium	-1.4%	-0.7%	-1.8%	-1.7%	-1.1%	-4.9%	-1.2%	-0.5%	-5.8%
Bulgaria	-3.5%	0.3%	1.8%	-6.6%	0.7%	3.0%	-0.9%	-0.1%	2.9%
Croatia	-0.9%	-0.3%	-0.3%	-1.6%	0.2%	0.2%	2.2%	0.6%	0.0%
Cyprus	-1.9%	1.4%	-0.2%	-3.3%	0.6%	0.1%	-1.7%	0.0%	0.0%
Czechia	-1.0%	1.0%	5.6%	-1.2%	-2.4%	9.2%	-0.7%	-0.6%	12.3%
Denmark	-0.3%	0.2%	-0.3%	-0.7%	-0.9%	0.3%	-0.6%	-1.3%	-0.2%
Estonia	-2.3%	1.5%	2.3%	-5.6%	11.5%	0.2%	-3.2%	16.6%	2.1%
Finland	-0.5%	-13.8%	0.0%	0.0%	-16.1%	0.4%	-0.1%	-13.4%	0.5%
France	-0.8%	-0.8%	-1.4%	-0.9%	-3.0%	-5.6%	-1.0%	-1.7%	-1.5%
Germany	-0.5%	-0.2%	5.3%	-0.4%	1.5%	0.1%	-0.5%	0.4%	1.8%
Greece	-4.2%	-0.6%	-0.4%	-8.3%	-0.6%	-0.3%	-3.1%	-0.1%	-0.1%
Hungary	-1.0%	-4.3%	9.7%	-1.3%	-18.2%	13.5%	-0.9%	-15.3%	14.6%
Ireland	-0.4%	-6.6%	-0.3%	-0.3%	-18.5%	0.0%	-0.3%	-24.2%	-0.3%
Italy	0.3%	-0.1%	0.9%	-2.1%	-1.9%	1.5%	-0.5%	-1.4%	1.5%
Latvia	-4.7%	2.3%	0.9%	-9.0%	3.1%	0.7%	-3.2%	3.2%	1.0%
Lithuania	-3.2%	-1.4%	-0.3%	-4.1%	-3.3%	0.1%	-0.8%	-1.8%	0.4%
Luxembourg	-1.0%	1.2%	1.1%	-3.2%	-1.3%	0.5%	-3.6%	0.0%	0.5%
Malta	-5.1%	-1.8%	1.7%	-5.3%	-13.8%	0.0%	-3.6%	-15.7%	0.2%
Netherlands	0.0%	-0.8%	0.8%	-0.1%	1.6%	-0.4%	-0.2%	10.8%	0.7%
Poland	-0.8%	-0.3%	1.2%	-1.8%	0.2%	-2.1%	-0.5%	1.4%	0.6%
Portugal	0.9%	-1.4%	-1.0%	-2.5%	-4.2%	-0.8%	-0.2%	-3.6%	2.3%
Romania	-0.9%	-0.4%	4.0%	-11.2%	2.6%	12.3%	-5.5%	-0.5%	13.4%
Slovakia	-1.4%	-0.1%	11.4%	-2.2%	1.1%	15.8%	-1.4%	2.6%	14.0%
Slovenia	-3.0%	-0.8%	1.7%	-3.9%	-1.8%	-0.3%	-4.5%	-0.7%	-2.2%
Spain	-0.9%	-0.2%	0.6%	-0.7%	-1.9%	-0.8%	-0.5%	-1.7%	1.9%
Sweden	-0.2%	-7.3%	5.0%	-0.1%	-9.1%	1.5%	0.1%	-5.6%	-1.9%
United Kingdom	0.8%	-0.3%	2.3%	-0.1%	-3.0%	3.3%	-0.7%	-2.9%	0.3%

(*) Minimum value is coloured red, median yellow, and maximum green. All other cells are coloured proportionally.

Source: Authors' elaboration on Analytical AMNE database.

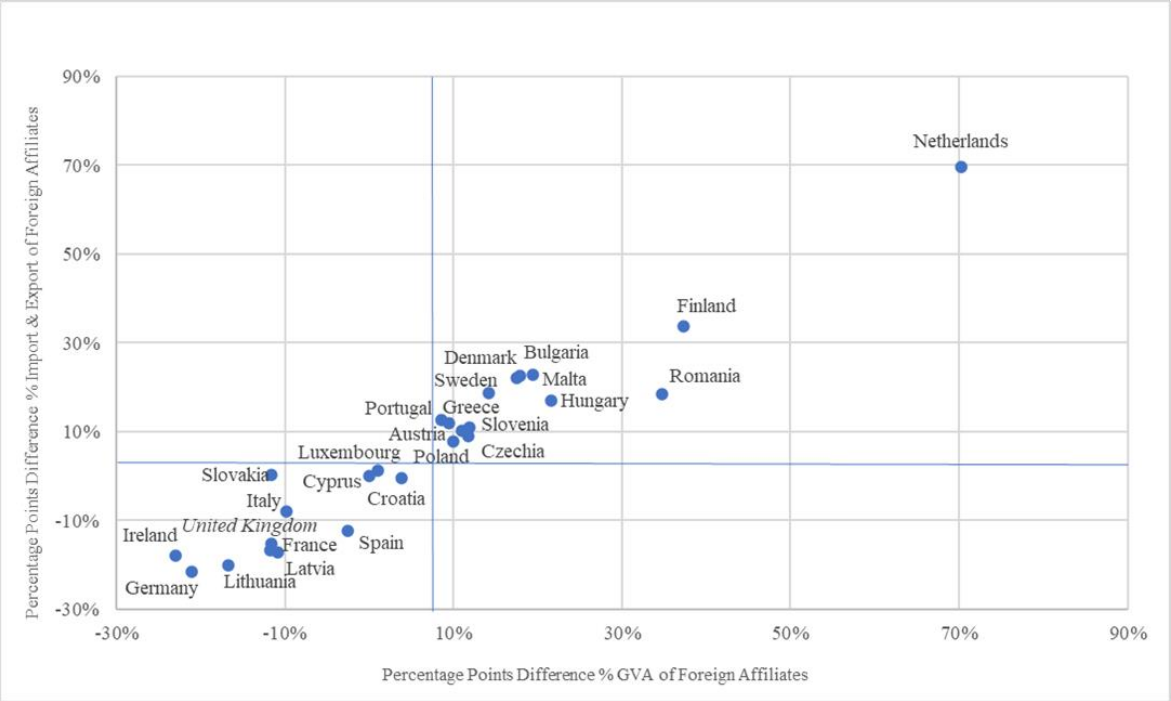
Figure A1. Percentage point change in the contribution of foreign affiliates to total GVA, trade – Textile & Apparel, 2005-2016*



(*) Average values (blue lines) are for the EU27 plus the UK. Ireland (-53% GVA, -45% Export & Import) is excluded from the chart and from the EU averages (blue lines) as an outlier.

Source: Authors' elaboration on fDiMarkets data and Eurostat SBS.

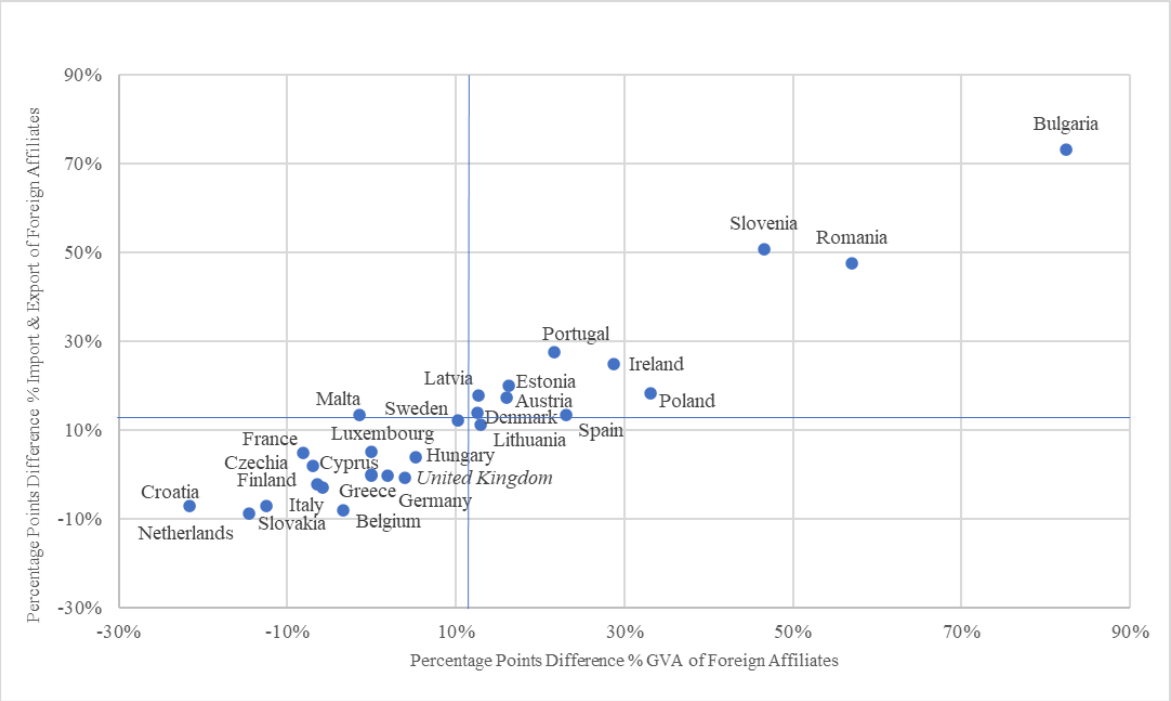
Figure A2. Percentage point change in the contribution of foreign affiliates in total GVA, trade – Electronics, 2005-2016*



(*) Average values (blue lines) are for the EU27 and the UK. Belgium (-52% GVA, -35% trade) and Estonia (-84% GVA, -60% trade) is excluded from the chart and from the EU averages (blue lines) as outliers.

Source: Authors' elaboration on fDiMarkets data and Eurostat SBS.

Figure A3. Percentage point change in the contribution of foreign affiliates in total GVA, trade – Automotive, 2005-2016*



(*) Values (blue lines) are for the EU27 and the UK.

Source: Authors' elaboration on fDiMarkets data and Eurostat SBS.

Table A2. Top 25% regions for IFDI in Textile & Apparel – Pre-, during- and post-crisis*

NUTS		Values			Shares		
Name	Code	Pre	During	Post	Pre	During	Post
Andalucía	ES61	68.70	178.97	251.17	0.5%	0.8%	0.9%
Aquitaine	FRI1	55.50	109.60	159.80	0.4%	0.5%	0.6%
Área Metropolitana de Lisboa	PT17	179.00	270.31	306.40	1.2%	1.2%	1.1%
Attiki	EL30	150.00	294.50	-	1.0%	1.4%	0.0%
Bayern	DE2	44.70	86.00	222.10	0.3%	0.4%	0.8%
Berlin	DE3	37.40	105.52	203.50	0.3%	0.5%	0.7%
Brussels	BE1	124.60	222.80	556.80	0.8%	1.0%	2.0%
Bucuresti - Ilfov	RO32	57.65	92.68	158.76	0.4%	0.4%	0.6%
Cataluña	ES51	161.87	411.74	565.32	1.1%	1.9%	2.0%
Comunidad de Madrid	ES30	164.20	464.78	717.28	1.1%	2.1%	2.6%
Dolnoslaskie	PL51	135.34	130.19	95.09	0.9%	0.6%	0.3%
East Midlands	UKF	106.70	102.93	184.20	0.7%	0.5%	0.7%
East Of England	UKH	77.20	225.90	183.80	0.5%	1.0%	0.7%
Eastern and Midland	IE06	1,496.68	797.50	463.85	10.1%	3.7%	1.7%
Flanders	BE2	437.15	262.25	1,117.16	3.0%	1.2%	4.0%
Helsinki-Uusimaa	FI1B	108.50	155.00	267.10	0.7%	0.7%	1.0%
Hovedstaden	DK01	124.60	219.50	312.70	0.8%	1.0%	1.1%
Île de France	FR10	935.20	2,443.51	2,569.78	6.3%	11.3%	9.3%
Kontinentalna Hrvatska	HR04	64.86	141.40	155.49	0.4%	0.7%	0.6%
Közép-Magyarország	HU10	147.57	185.37	64.70	1.0%	0.9%	0.2%
Latvija	LV00	135.39	99.29	72.10	0.9%	0.5%	0.3%
Lazio	ITI4	256.90	264.10	349.40	1.7%	1.2%	1.3%
Lombardia	ITC4	494.30	669.00	1,097.10	3.3%	3.1%	4.0%
London	UKI	1,774.70	4,261.90	4,365.20	12.0%	19.7%	15.8%
Noord-Holland	NL32	166.50	511.50	789.33	1.1%	2.4%	2.9%
Nord-Pas-de-Calais	FRE1	82.00	48.90	168.21	0.6%	0.2%	0.6%
Nordrhein-Westfalen	DEA	53.47	201.88	535.68	0.4%	0.9%	1.9%
Norte	PT11	77.50	130.55	140.40	0.5%	0.6%	0.5%
North West	UKD	336.89	395.30	332.09	2.3%	1.8%	1.2%
Northern Ireland	UKN	436.95	57.40	157.10	3.0%	0.3%	0.6%
Praha	CZ01	117.40	118.05	150.80	0.8%	0.5%	0.5%
Provence-Alpes-Côte d'Azur	FRL0	145.80	348.60	1,026.55	1.0%	1.6%	3.7%
Rhône-Alpes	FRK2	157.60	193.50	143.20	1.1%	0.9%	0.5%
Scotland	UKM	136.87	357.52	530.08	0.9%	1.7%	1.9%
Severen tsentralen	BG32	309.46	5.80	5.80	2.1%	0.0%	0.0%
South East	UKJ	239.80	280.70	549.95	1.6%	1.3%	2.0%
South West	UKK	254.40	275.10	171.66	1.7%	1.3%	0.6%
Southern	IE05	186.80	207.30	67.02	1.3%	1.0%	0.2%
Stockholm	SE11	248.00	263.50	691.20	1.7%	1.2%	2.5%
Toscana	ITI1	108.50	31.00	506.40	0.7%	0.1%	1.8%
Wales	UKL	38.60	217.00	102.20	0.3%	1.0%	0.4%
Wallonia	BE3	59.44	103.12	195.06	0.4%	0.5%	0.7%
Warszawski stoleczny	PL91	70.40	93.73	204.80	0.5%	0.4%	0.7%
West Midlands	UKG	193.90	291.10	241.50	1.3%	1.3%	0.9%
Wien	AT13	202.10	449.50	519.19	1.4%	2.1%	1.9%
Yorkshire And The Humber	UKE	27.70	193.60	378.60	0.2%	0.9%	1.4%
Yugozapaden	BG41	69.80	219.80	77.51	0.5%	1.0%	0.3%
Zachodniopomorskie	PL42	10.70	63.80	359.95	0.1%	0.3%	1.3%

(*) Minimum value is coloured in red, median in yellow, and maximum in green. All other cells are coloured proportionally.

Source: Authors' elaboration on fDiMarkets data.

Table A3. Top 25% regions for OFDI in Textile & Apparel – Pre-, during- and post-crisis*

NUTS		Values			Shares		
Name	Code	Pre	During	Post	Pre	During	Post
Attiki	EL30	281.78	152.17	284.69	0.7%	0.3%	0.4%
Baden-Württemberg	DE1	364.17	772.20	955.83	0.9%	1.5%	1.3%
Bayern	DE2	1,668.06	1,682.75	2,390.13	4.3%	3.2%	3.2%
Cataluña	ES51	2,783.70	3,153.96	2,950.97	7.3%	6.1%	4.0%
Comunidad de Madrid	ES30	492.60	828.70	893.35	1.3%	1.6%	1.2%
Comunidad Valenciana	ES52	74.25	304.95	313.30	0.2%	0.6%	0.4%
East Midlands	UKF	349.22	359.80	185.20	0.9%	0.7%	0.3%
Emilia-Romagna	ITH5	1,291.80	933.40	2,743.40	3.4%	1.8%	3.7%
Flanders	BE2	798.50	147.70	313.90	2.1%	0.3%	0.4%
Galicia	ES11	2,673.60	3,703.50	4,580.58	7.0%	7.1%	6.2%
Hamburg	DE6	99.00	141.70	393.47	0.3%	0.3%	0.5%
Helsinki-Uusimaa	FI1B	450.12	535.02	1,015.40	1.2%	1.0%	1.4%
Île de France	FR10	4,071.76	9,212.58	15,712.02	10.6%	17.7%	21.3%
Illes Balears	ES53	235.50	769.00	724.30	0.6%	1.5%	1.0%
Lombardia	ITC4	3,629.91	4,778.27	8,045.96	9.5%	9.2%	10.9%
London	UKI	4,606.63	6,173.18	6,972.86	12.0%	11.9%	9.5%
Luxembourg	LU00	1.20	298.46	360.00	0.0%	0.6%	0.5%
Marche	ITI3	512.80	225.70	661.40	1.3%	0.4%	0.9%
Midtjylland	DK04	121.10	556.75	1,089.52	0.3%	1.1%	1.5%
Noord-Holland	NL32	306.20	689.50	1,188.26	0.8%	1.3%	1.6%
Nord-Pas-de-Calais	FRE1	571.22	1,400.52	1,686.32	1.5%	2.7%	2.3%
Nordrhein-Westfalen	DEA	498.40	1,073.83	1,237.04	1.3%	2.1%	1.7%
Oberösterreich	AT31	507.64	255.90	301.40	1.3%	0.5%	0.4%
Piemonte	ITC1	1,140.16	556.40	822.48	3.0%	1.1%	1.1%
Provence-Alpes-Côte d'Azur	FRL0	15.50	168.50	337.90	0.0%	0.3%	0.5%
Rheinland-Pfalz	DEB	36.80	374.31	997.60	0.1%	0.7%	1.4%
Schleswig-Holstein	DEF	497.50	425.80	251.30	1.3%	0.8%	0.3%
South West	UKK	282.70	624.50	699.60	0.7%	1.2%	1.0%
Stockholm	SE11	3,122.77	4,687.00	6,846.55	8.1%	9.0%	9.3%
Syddanmark	DK03	414.67	216.00	284.49	1.1%	0.4%	0.4%
Toscana	ITI1	631.64	1,175.34	1,205.60	1.6%	2.3%	1.6%
Veneto	ITH3	2,133.58	1,823.30	2,287.70	5.6%	3.5%	3.1%
Vorarlberg	AT34	93.20	152.60	312.21	0.2%	0.3%	0.4%

(*) Minimum value is coloured in red, median in yellow, and maximum in green. All other cells are coloured proportionally.

Source: Authors' elaboration on fDiMarkets data.

Table A4. Top 25% regions for IFDI in Electronics – Pre-, during- and post-crisis*

NUTS		Values			Shares		
Name	Code	Pre	During	Post	Pre	During	Post
Alentejo	PT18	89.76	326.60	-	0.4%	2.0%	0.0%
Andalucía	ES61	396.71	174.98	7.10	1.6%	1.1%	0.1%
Baden-Württemberg	DE1	61.00	227.64	103.72	0.2%	1.4%	1.1%
Bayern	DE2	167.92	226.10	235.65	0.7%	1.4%	2.5%
Brandenburg	DE4	333.54	280.73	17.39	1.3%	1.7%	0.2%
Campania	ITF3	1,599.60	-	38.86	6.4%	0.0%	0.4%
Cataluña	ES51	455.09	663.09	154.56	1.8%	4.1%	1.7%
Centro (PT)	PT16	91.50	290.26	4.27	0.4%	1.8%	0.0%
Comunidad de Madrid	ES30	495.50	214.80	95.66	2.0%	1.3%	1.0%
Dolnoslaskie	PL51	4,024.39	385.50	634.10	16.2%	2.4%	6.8%
Eesti	EE00	166.13	189.17	49.40	0.7%	1.2%	0.5%
Észak-Alföld	HU32	444.50	67.12	39.28	1.8%	0.4%	0.4%
Flanders	BE2	369.84	204.72	78.60	1.5%	1.3%	0.8%
Hessen	DE7	133.00	189.70	166.13	0.5%	1.2%	1.8%
Île de France	FR10	156.30	211.50	210.35	0.6%	1.3%	2.3%
Jihovýchod	CZ06	268.20	98.71	-	1.1%	0.6%	0.0%
Közép-Dunántúl	HU21	723.10	66.59	753.01	2.9%	0.4%	8.1%
Közép-Magyarország	HU10	242.31	85.37	107.67	1.0%	0.5%	1.2%
Kujawsko-Pomorskie	PL61	248.80	148.20	-	1.0%	0.9%	0.0%
La Rioja	ES23	633.00	-	-	2.5%	0.0%	0.0%
Lódzkie	PL71	563.76	171.33	332.10	2.3%	1.1%	3.6%
Lombardia	ITC4	244.30	76.50	109.70	1.0%	0.5%	1.2%
London	UKI	76.20	163.10	150.89	0.3%	1.0%	1.6%
Noord-Brabant	NL41	127.32	146.60	123.60	0.5%	0.9%	1.3%
Nordrhein-Westfalen	DEA	1,036.50	417.71	108.50	4.2%	2.6%	1.2%
Nord-Vest	RO11	455.05	290.49	85.81	1.8%	1.8%	0.9%
North East	UKC	77.19	417.75	16.10	0.3%	2.6%	0.2%
Nyugat-Dunántúl	HU22	108.25	289.68	127.68	0.4%	1.8%	1.4%
Pomorskie	PL63	10.60	288.12	229.78	0.0%	1.8%	2.5%
Provence-Alpes-Côte d'Azur	FRL0	344.98	42.60	37.17	1.4%	0.3%	0.4%
Rhône-Alpes	FRK2	147.90	196.70	52.45	0.6%	1.2%	0.6%
Sachsen	DED	332.25	497.14	44.41	1.3%	3.1%	0.5%
Sachsen-Anhalt	DEE	186.63	71.00	84.00	0.8%	0.4%	0.9%
Scotland	UKM	94.26	190.91	93.44	0.4%	1.2%	1.0%
Severen tsentralen	BG32	1,272.37	13.60	-	5.1%	0.1%	0.0%
Sicilia	ITG1	-	580.65	-	0.0%	3.6%	0.0%
Střední Cechy	CZ02	197.60	124.10	77.90	0.8%	0.8%	0.8%
Sydsverige	SE22	65.20	404.60	44.30	0.3%	2.5%	0.5%
Thüringen	DEG	0.70	471.37	38.08	0.0%	2.9%	0.4%
Vest	RO42	442.00	192.20	216.97	1.8%	1.2%	2.3%
Východné Slovensko	SK04	230.40	72.70	115.45	0.9%	0.5%	1.2%
Warszawski stoleczny	PL91	168.50	47.80	125.60	0.7%	0.3%	1.4%
Wielkopolskie	PL41	87.46	226.09	197.80	0.4%	1.4%	2.1%
Wien	AT13	61.10	275.83	17.90	0.2%	1.7%	0.2%
Západné Slovensko	SK02	1,183.73	1,261.09	97.47	4.8%	7.8%	1.0%

(*) Minimum value is coloured in red, median in yellow, and maximum in green. All other cells are coloured proportionally.

Source: Authors' elaboration on fDiMarkets data.

Table A5. Top 25% regions for OFDI in Electronics – Pre-, during- and post-crisis*

NUTS		Values			Shares		
Name	Code	Pre	During	Post	Pre	During	Post
Attiki	EL30	65.70	522.30	44.30	0.2%	1.7%	0.2%
Baden-Württemberg	DE1	754.77	4,169.85	1,863.34	2.0%	13.3%	9.4%
Bayern	DE2	2,479.26	2,963.08	2,686.75	6.6%	9.5%	13.6%
Berlin	DE3	457.30	114.86	79.45	1.2%	0.4%	0.4%
Brussels	BE1	1.40	688.70	95.60	0.0%	2.2%	0.5%
Cataluña	ES51	48.54	732.31	162.14	0.1%	2.3%	0.8%
Comunidad de Madrid	ES30	227.50	242.52	163.00	0.6%	0.8%	0.8%
East Midlands	UKF	19.10	446.50	6.10	0.1%	1.4%	0.0%
East Of England	UKH	936.31	543.59	155.77	2.5%	1.7%	0.8%
Etelä-Suomi	FI1C	93.27	19.10	256.19	0.2%	0.1%	1.3%
Flanders	BE2	66.15	205.50	106.50	0.2%	0.7%	0.5%
Helsinki-Uusimaa	FI1B	663.82	186.20	468.80	1.8%	0.6%	2.4%
Hessen	DE7	728.90	381.54	188.99	1.9%	1.2%	1.0%
Île de France	FR10	1,327.76	2,268.75	1,533.63	3.5%	7.2%	7.7%
Lombardia	ITC4	442.30	153.48	564.05	1.2%	0.5%	2.8%
London	UKI	1,099.69	589.60	4,247.81	2.9%	1.9%	21.4%
Marche	ITI3	1,182.88	397.13	93.00	3.2%	1.3%	0.5%
Midtjylland	DK04	259.90	165.88	123.81	0.7%	0.5%	0.6%
Niedersachsen	DE9	76.70	156.84	79.61	0.2%	0.5%	0.4%
Noord-Holland	NL32	17,627.84	1,459.69	725.70	47.0%	4.7%	3.7%
Nordrhein-Westfalen	DEA	1,871.65	3,148.96	1,480.80	5.0%	10.1%	7.5%
North West	UKD	149.50	647.60	100.40	0.4%	2.1%	0.5%
País Vasco	ES21	265.20	321.20	92.70	0.7%	1.0%	0.5%
Pohjois- ja Itä-Suomi	FI1D	114.07	68.50	247.98	0.3%	0.2%	1.3%
Rhône-Alpes	FRK2	74.10	353.56	210.18	0.2%	1.1%	1.1%
Sachsen	DED	44.90	3,747.50	-	0.1%	12.0%	0.0%
South East	UKJ	579.54	250.10	169.00	1.5%	0.8%	0.9%
South West	UKK	1.50	86.50	446.66	0.0%	0.3%	2.3%
Steiermark	AT22	291.37	347.18	-	0.8%	1.1%	0.0%
Stockholm	SE11	1,534.61	1,945.47	472.07	4.1%	6.2%	2.4%
Sydsverige	SE22	258.04	194.61	79.85	0.7%	0.6%	0.4%
Veneto	ITH3	24.70	501.64	250.40	0.1%	1.6%	1.3%
West Midlands	UKG	42.30	106.00	169.78	0.1%	0.3%	0.9%
Wien	AT13	288.00	210.20	163.22	0.8%	0.7%	0.8%
Yorkshire And The Humber	UKE	246.30	3.30	150.90	0.7%	0.0%	0.8%

(*) Minimum value is coloured in red, median in yellow, and maximum in green. All other cells are coloured proportionally.

Source: Authors' elaboration on fDiMarkets data.

Table A6. Top 25% regions for IFDI in Automotive – Pre-, during- and post-crisis*

NUTS		Values			Shares		
Name	Code	Pre	During	Post	Pre	During	Post
Aragón	ES24	1,204.30	345.33	1,309.35	1.7%	0.7%	2.4%
Área Metropolitana de Lisboa	PT17	2,450.59	262.22	3.70	3.5%	0.5%	0.0%
Bratislavský kraj	SK01	913.34	794.59	2,060.03	1.3%	1.5%	3.7%
Brussels	BE1	543.30	827.50	35.20	0.8%	1.6%	0.1%
Castilla y León	ES41	1,600.10	1,504.25	745.65	2.3%	2.9%	1.4%
Cataluña	ES51	3,737.32	2,358.36	4,688.19	5.3%	4.6%	8.5%
Centro (PT)	PT16	1,569.30	413.19	33.90	2.2%	0.8%	0.1%
Centru	RO12	495.09	283.17	1,211.27	0.7%	0.6%	2.2%
Comunidad de Madrid	ES30	1,579.75	976.57	323.37	2.2%	1.9%	0.6%
Comunidad Valenciana	ES52	1,088.01	723.94	1,007.08	1.5%	1.4%	1.8%
Dél-Alföld	HU33	78.35	1,186.96	2,122.36	0.1%	2.3%	3.9%
Dolnoslaskie	PL51	1,289.83	877.21	1,809.54	1.8%	1.7%	3.3%
East Midlands	UKF	574.21	614.47	196.04	0.8%	1.2%	0.4%
Észak-Magyarország	HU31	356.41	661.25	609.02	0.5%	1.3%	1.1%
Flanders	BE2	3,494.52	1,974.35	515.98	5.0%	3.8%	0.9%
Galicia	ES11	1,397.27	90.09	1,282.52	2.0%	0.2%	2.3%
Hessen	DE7	728.72	688.01	422.76	1.0%	1.3%	0.8%
Jihozápad	CZ03	1,401.28	463.60	369.83	2.0%	0.9%	0.7%
Közép-Dunántúl	HU21	2,019.93	277.95	636.87	2.9%	0.5%	1.2%
Moravskoslezsko	CZ08	2,140.75	654.87	460.25	3.0%	1.3%	0.8%
Nordrhein-Westfalen	DEA	779.56	1,571.07	853.37	1.1%	3.1%	1.6%
North East	UKC	809.42	977.96	813.58	1.1%	1.9%	1.5%
North West	UKD	650.60	2,309.45	765.10	0.9%	4.5%	1.4%
Nyugat-Dunántúl	HU22	883.48	2,499.50	670.46	1.3%	4.9%	1.2%
Oberösterreich	AT31	1,462.99	101.65	165.54	2.1%	0.2%	0.3%
País Vasco	ES21	752.02	1,344.39	610.33	1.1%	2.6%	1.1%
Piemonte	ITC1	301.10	1,470.82	21.70	0.4%	2.9%	0.0%
Sachsen	DED	318.50	498.64	1,455.21	0.5%	1.0%	2.6%
Severovýchod	CZ05	938.27	833.31	235.46	1.3%	1.6%	0.4%
Severozápad	CZ04	770.40	219.22	731.69	1.1%	0.4%	1.3%
Slaskie	PL22	3,806.87	1,557.28	1,241.34	5.4%	3.0%	2.3%
South East	UKJ	572.42	909.32	549.92	0.8%	1.8%	1.0%
South West	UKK	639.20	795.57	255.81	0.9%	1.6%	0.5%
Steiermark	AT22	752.56	327.24	586.40	1.1%	0.6%	1.1%
Stredné Slovensko	SK03	3,436.39	1,142.85	256.54	4.9%	2.2%	0.5%
Střední Cechy	CZ02	627.78	320.09	532.99	0.9%	0.6%	1.0%
Sud - Muntenia	RO31	1,536.59	1,671.35	334.75	2.2%	3.3%	0.6%
Sud-Vest Oltenia	RO41	1,003.57	701.68	749.26	1.4%	1.4%	1.4%
Västsverige	SE23	1,176.60	27.00	1,070.70	1.7%	0.1%	1.9%
Vest	RO42	841.97	401.54	194.50	1.2%	0.8%	0.4%
Wales	UKL	989.45	743.49	420.98	1.4%	1.4%	0.8%
West Midlands	UKG	440.30	2,295.55	6,303.72	0.6%	4.5%	11.5%
Wielkopolskie	PL41	100.95	895.56	1,892.91	0.1%	1.7%	3.4%
Západné Slovensko	SK02	2,064.29	601.60	2,706.27	2.9%	1.2%	4.9%

(*) Minimum value is coloured in red, median in yellow, and maximum in green. All other cells are coloured proportionally.

Source: Authors' elaboration on fDiMarkets data.

Table A7. Top 25% regions for OFDI in Automotive – Pre-, during- and post-crisis*

NUTS		Values			Shares		
Name	Code	Pre	During	Post	Pre	During	Post
Baden-Württemberg	DE1	27,756.35	26,176.75	27,793.82	23.2%	20.0%	25.6%
Bayern	DE2	12,874.14	12,064.47	7,963.60	10.8%	9.2%	7.3%
Brandenburg	DE4	265.80	116.68	125.00	0.2%	0.1%	0.1%
Brussels	BE1	187.21	392.68	122.54	0.2%	0.3%	0.1%
Castilla y León	ES41	257.36	222.70	460.07	0.2%	0.2%	0.4%
Comunidad de Madrid	ES30	21.80	938.26	886.15	0.0%	0.7%	0.8%
Flanders	BE2	316.60	318.61	463.83	0.3%	0.2%	0.4%
Franche-Comté	FRC2	236.08	783.20	300.20	0.2%	0.6%	0.3%
Helsinki-Uusimaa	FI1B	595.32	85.50	29.50	0.5%	0.1%	0.0%
Hessen	DE7	183.80	300.40	322.35	0.2%	0.2%	0.3%
Île de France	FR10	18,543.96	21,695.57	14,159.75	15.5%	16.6%	13.1%
Lombardia	ITC4	495.10	861.67	654.25	0.4%	0.7%	0.6%
London	UKI	793.21	2,077.54	4,627.49	0.7%	1.6%	4.3%
Luxembourg	LU00	138.50	557.88	755.47	0.1%	0.4%	0.7%
Niedersachsen	DE9	29,369.18	30,527.09	29,719.30	24.6%	23.3%	27.4%
Nordrhein-Westfalen	DEA	3,031.62	2,963.25	3,416.53	2.5%	2.3%	3.2%
País Vasco	ES21	132.18	319.52	512.59	0.1%	0.2%	0.5%
Piemonte	ITC1	11,766.54	19,887.12	5,424.05	9.8%	15.2%	5.0%
Rhône-Alpes	FRK2	349.43	449.52	800.76	0.3%	0.3%	0.7%
Salzburg	AT32	3.60	340.50	412.09	0.0%	0.3%	0.4%
Stockholm	SE11	2,281.83	408.34	418.47	1.9%	0.3%	0.4%
Sydsverige	SE22	192.80	243.96	279.10	0.2%	0.2%	0.3%
Toscana	ITI1	79.00	621.30	-	0.1%	0.5%	0.0%
Västsverige	SE23	5,264.64	4,749.40	2,618.97	4.4%	3.6%	2.4%
West Midlands	UKG	619.92	566.46	1,337.54	0.5%	0.4%	1.2%

(*) Minimum value is coloured in red, median in yellow, and maximum in green. All other cells are coloured proportionally.

Source: Authors' elaboration on fDiMarkets data.

Table A8. Textile & Apparel – Global Network*

Textile Global Network, innermost core kshell=55			
K	EU14	UK	EU13
55	*Amsterdam*, Antwerp, **Barcelona**, Berlin, Bologna,Brussels, *Dusseldorf*, Florence, Herzogenaurach, La Coruna, *Madrid*, Milan, **Munich**, Neuilly-sur-Seine, Palma de Mallorca, **Paris**, *Stockholm*, Trebaseleghe Triverio, Vienna	**London**	
54	Copenhagen, Helsinki, Hamburg	Manchester	
53	Croix		
52	Koln, Ludwigshafen, Metzingen		
50	Athens, Montevelluna, Rome, Sant'Elpidio a Mare		Bucharest, Prague, Warsaw
48	Reggio nell'Emilia, Frankfurtammain, Rimini, Vicenza	Nottingham	
47	Dublin		
46	Brande, Lisbon, Menorca	Edinburgh	Budapest
45		Leeds	Sofiya
44			
43	Bredebro	Glasgow	Gdansk
40	Capri, Essen, Pontevedra, Valencia, Villeneuve-d'Ascq	Birmingham	Belgrade, Bratislava, Zagreb
38	Elche, El Prat del Lobregat		
36	Breenz, Flensburg, Gothenburg, Luxembourg, Lyon, Marseille, Monza, Verona		
35			Riga, Tallinn, Vilnius
34	Cheltenham, Malaga, Monchengladbach		Szczecin
33	Mantova, Seville, Zaragoza		
32	Toulon, Zalaegerszeg		Lodz
31	Bilbao, Miramas, Varese		Gliwice, Ploiesti
30	Cavriago, Nice	Liverpool	
29	Graz, Marbella, Ponte di Piave, Vigo		Krakow
28	Roissy		
27	Hannover, Napoli, St-Tropez, Turin	Bristol	Ljubljana
26	Orense, Viladecans		Arad, Katowice
24	Arhus, Civitanovamarche, Cork, Den Haag, Kunzelsau, Lille, Modena, Molvena	Banbridge, Cardiff, Greenhithe, Leicester, Weymouth	
23	Bonnigheim Breda, Leganes, Maia, Oberhausen, Rotterdam, Stephanskirchen, Swords, Toulose, Venezia, Vilroorde		
22	Porto		Brasov, Timisoara
21	Cannes, Kilare, Muster, Palermo, Parabiago	Maidstone	
20	Bielefeld, Bordeaux, Caivano, Clichy	Southhields	Poznan, Slupsk

(*) Cities in bold are in the innermost core of the network in all three GVC-sensitive sectors; cities in italics in the innermost core of the network in two out of three sectors.

Source: Authors' elaboration on fDiMarkets data.

Table A9. Electronics – Global Network

Electronics Global Network, innermost core kshell=28			
K	EU14	UK	EU13
28	*Amsterdam*, **Barcelona**, *Dusseldorf*, **Munich**, **Paris**, *Stockholm*, *Stuttgart*	**London**	
27	Berlin, Madrid		Budapest
24	Copenhagen, Dublin, Gutersloh, Rueil-Malmaison, Vienna		Bucharest
23	Helsinki		Prague
22	Brussels, Hamburg, Milan, Valencia		
21	Frankfurtammain, Gothenburg, Nurnberg, Solms	Hemelhempstead	Brno, Wroclaw
20	Dornbrin, Eindhoven, Fabriano, Struer, Zamudio	Oxford	Lodz, Warsaw
19	Espelkamp, Espoo	Cambridge, Leatherhead	Plzen
18	Lyon, Neckarsulm, Zaragoza		
17	Bremen, Koln, Malmo, Vantaa, Wels		
15	Athens, Dresden, Hemmingen, Limoges, Niestetal, Wuppertal	Birmingham, Coventry, Edinburgh, Leeds, Newbury, Southampton	Krakow, Sofiya, Tallinn
14	Eschborn, Feldkirch, Getafe, Ispringen, Leoben, Terrassa	Glasgow	
13	Antwerp, Bonn, Darmstadt, Rotterdam, Salo, Tampere	Loughboroug	Bratislava, Kobierzyce
12	Aachen, Alicante, Deggendorf, Hoofssorp, Leuven, Rome, Santiago de Compostela, Wedemark		
11	Freiburg, Gouda, Kortrijk, Leonberg, Montpellier, Neuilly-sur-Seine, Oberkochen, Sulzemoos, Willich	Aberdeen, Livingston	

(*) Cities in bold are in the innermost core of the network in all three sectors; cities in italics in the innermost core of the network in two sectors.

Source: Authors' elaboration on fDiMarkets data.

Table A10. Automotive – Global Network*

Automotive Global Network, innermost core kshell=35			
K	EU14	UK	EU13
35	**Barcelona**, *Madrid* , **Munich**, **Paris**, *Stuttgart* , Turin, Wolfsburg	**London**	
33	Boulogne-Billancourt		
32	Brussels, Dusseldorf, Frankfurtammain, Friedrichshafen, Gothenburg, Hannover, Luxembourg		
31		Redditch	
30	Lyon		Bucharest, Prague
29	Burgos		
28	Salzburg	Coventry	Warsaw
27	Dublin	Oxford	Brasov
26	Ludwigsburg, Milan		Katowice
25	Koln, Lippstad		Walbrzych
24	Berlin		
23			Tychy
22	Anteuil, Bamberg, Esslingenamneckar, Graz, Trelleborg	Birmingham	Arad, Budapest, Gyr, Ostrava, Wroclaw
21	Amsterdam, Helskinki Velbert		Bielsko-Biala, Plzen, Sofiya, Timisoara
20	Grenoble, Herzogenaurach, Weinheim		Kecskeme
19	Aachen, Coburg, Sodertalje, Vienna		Bratislava, Craiova, Iasi, Trnava,
18	Mannheim, Vilsbiburg		Gliwice, Pitesti
16	Bergamo, Dettingen, Linz, Ludwigshafen, Lummen, Paderborn, Vigo, Zaragoza		Legnica
15	Amberg, Bruchsal, Hamburg, Rome		Cluj-Napoca, Dej, Kaunas, Mladaboleslav, Ploiesti
14	Ghent, Pontedera, Saarbrucken	Washington	Zatec
13	Antwerp, Denhaag, Haldensleben, Karlsruhe, Landskrona, Neu-Isenburg, Nurberg, Rehau, Russelsheim,	Daventry, Liverpool, Llanelli, Milton Keynes, Nuneaton, Pererlee, Solihul,Warwick	Miskolc, Novemestonadvahom, Szekesfehervar, Zilina
12	Athens, Bologna, Chezeryforens, Copenhagen, Einbeck, Fulda, Munster, Valenciennes	Northampton, Shoreham-by-sea	Czestochowa, Oradea, Riga, Vilnius
11	Almussafes, Clichy, Toulouse	Burtonupontrent, Gaydon, Sunderland	Ruse

(*) Cities in bold are in the innermost core of the network in all three sectors; cities in italics in the innermost core of the network in two sectors.

Source: Authors' elaboration on fDiMarkets data.

Table A11. Textile & Apparel – Global Network, R&D*

Textile Global Netork - R&D, innermost core kshell=3			
K	EU14	UK	EU13
3	Bonnigheim, Herzogenaurach, Milan, **Paris**	**London**	

(*) Cities in bold are in the innermost core of the network in all three sectors; cities in italics in the innermost core of the network in two sectors.

Source: Authors' elaboration on fDiMarkets data.

Table A12. Electronics – Global Network, R&D*

Electronics Global Netork - R&D, innermost core kshell=8			
K	EU14	UK	EU13
8	Amsterdam, Barcelona, Berlin, Munich, **Paris**, Stockholm, *Stuttgart*	*London*	Budapest
6	Leuven		
5	Blaubeuren, Copenhagen, Darmstadt, Eindhoven, Frankfurtammain, Grenoble, Lyon, Nurnberg, Rueil-Malmaison, Tampere, Willich	Belfast, Cambridge, Livingston,	Plzen, Warsaw, Wroclaw
4	Dublin, Dusseldorf, Langen	Glasgow	

(*) Cities in bold are in the innermost core of the network in all three sectors; cities in italics in the innermost core of the network in two sectors.

Source: Authors' elaboration on fDiMarkets data.

Table A13. Automotive – Global Network, R&D*

Automotive Global Netork - R&D, innermost core kshell=10			
K	EU14	UK	EU13
10	**Paris**, *Stuttgart* , Turin, Wolfsburg		
9	Barcelona, Brussels, Hhannover		
8	Arjeplog, Boulogne-Billancourt, Graz, Munich	Coventry, Nottingham	
7	Aachen, Berlin, Gothenburg, Stockholm	Shoreham-by-sea	Budapest, Iasi, Prague
6	Friedrichshafen		Sanluispotosi
5	Dublin, Dusseldorf, Herzogenaurach, Lommel, Lyon, Russelsheim, Salzburg, Toulouse, Trelleborg, Velbert, Veszprem	Gaydon, London, Uxbridge	Czestochowa, Veszprem
4	Coburg, Fulda, Lippstadt, Ludwigsburg, Lund, Saarbrucken, Vienna	Daventry, Nuneaton	Bucharest, Gyr, Miskolc

(*) Cities in bold are in the innermost core of the network in all three sectors; cities in italics in the innermost core of the network in two sectors.

Source: Authors' elaboration on fDiMarkets data.

Table A14. Textile & Apparel – Global Network, production*

Textile Global Netork - Production, innermost core kshell=6			
K	EU14	UK	EU13
6	Lenzing		
5	Alba, Barcelona, Helsinki, San Martino Buon Albergo, Silkeborg, Vicenza	London	Lodz, Silven, Yambol

(*) Cities in bold are in the innermost core of the network in all three sectors; cities in italics in the innermost core of the network in two sectors.

Source: Authors' elaboration on fDiMarkets data.

Table A15. Electronics – Global Network, production*

Electronics Global Netork - Production, innermost core kshell=13			
K	EU14	UK	EU13
13	Amsterdam, Munich		
12	Paris, Stuttgart		Plzen, Wroclaw
10	Barcelona, Fabriano, Nurnberg, Stockholm		
9	Luxembourg, Rueil-Malmaison		Budapest, Kobierzyce, Lodz,
8	Aachen, Berlin, Espoo, Leoben, Salo, Vantaa	London	Nitra, Szekesfehervar
7	Dornbrin, Dublin, Menden, Milan, Zaldibia		Arad, Gorzowwielkopolski, Miskolc, Szombathely
6			Nyiregyhaza, Oradea
5	Angers, Arhus, Aveiro, Bagnolet, Bitterfeld, Brussels, Danderyd, Dresden, Ecully, Espelkamp, Essen, Galway, Genk, Heerlen, Jaen, Leonberg, Levalloisperret, Lippstadt, Malmo, Metzingen, Niestetal, Pandrup, Taby, Valencia, Vienna, Zzamudio, Zandt, Zaragoza	Abingdon, Bingley, Birmingham, Spennymoor,Wrexham	Bratislava, Bucharest, Kadan, Komarom, Krakow, Lysomice, Mlawa, Nymburk, Sarvar, Satumare, Tczew, Torun, Trenin, Trnava, Zalaegerszeg
4	Erfurt, Hasselt, Jena, Limoges, Madrid, Mannheim, Nantes, Neuilly-sur-Seine, Remscheid, Rubi, Seville, Solna, Tessenderlo, Ulm	Eastkilbride, Newmarket, Weybridge	Botevgrad, Elva, Novezamky, Pecs, Plovdiv, Sibiu, Tallinn, Tatabanya, Timisoara, Veszprem

(*) Cities in bold are in the innermost core of the network in all three sectors; cities in italics in the innermost core of the network in two sectors.

Source: Authors' elaboration on fDiMarkets data.

Table A16. Automotive – Global Network, production*

Automotive Global Netork - Production, innermost core kshell=21			
K	EU14	UK	EU13
21	Hannover. Munich, Paris, Stuttgart, Turin, Wolfsurg		
20	Barcelona, Friedrichshafen	Redditch	
19	Boulogne-Billancourt, Burgos, Madrid	London, Oxford	Tychy
18	Dusseldorf, Gothenburg, Lippstadt, Luxembourg		Walbrzych
17	Stockholm		
16	Esslingenamnecka		Katowice, Ostrava
15	Anteuil, Lyon,		
14	Bamberg, Herzogenaurach, Salzburg, Weinheim	Birmingham	Arad, Bielsko-Biala, Brasov, Gliwice
13	Brussels, Coburg, Koln, Trelleborg	Coventry	Craiova, Kecskemet, Wroclaw
12	Dettingen, Linz, Mannheim,		Pitesti, Plzen, Timisoara
11	Bergamo, Ludwigsburg, Vigo, Zaragoza		Gyr, Mladaboleslav

(*) Cities in bold are in the innermost core of the network in all three sectors; cities in italics in the innermost core of the network in two sectors.

Source: Authors' elaboration on fDiMarkets data.

Table A17. Textile & Apparel – Intra-EU*

Textile Intra EU Network, innermost core kshell=26			
K	EU14	UK	EU13
26	*Amsterdam*, Antwerp, Athens, *Barcelona*, *Berlin*, Bologna, Brande, Brussels, *Copenhagen*, *Dusseldorf*, Florence, Hamburg, Helsinki, Herzogenaurach, Koln, La Coruna, Libon, **Madrid**, Milan, **Munich**, Palma de Mallorca, **Paris**, **Stockholm**, Triverio, **Vienna**	*London*, Manchester	**Bucharest**, *Budapest*, **Prague**, *Warsaw*
25	Metzingen, Montebelluna, Neuilly-sur-Seine		Sofiya
24	Rome		
23	Croix, Dublin, Essen, Villeneuve-d'Ascq		Bratislava, Gdansk, Zagreb
22	Reggio nell'Emilia, Flensburg, Frankfurtammain, Seville, Toulon, Trebaseleghe		Riga, Tallinn, Vilnius
21	Carpi, Hannover, Valencia	Glasgow, Leeds	
20	Den Haag, Graz, Lyon, Marseille, Verona, Vicenza		
19	Bredebro, El Prat de Llobregat, Gothenburg, Marbella, Stuttgart, Zaragoza		Krakow, Ljubljana
18	Ponte di Piave	Edingburgh, Mansfield	Burgas, Gliwice
17	Bregenz		
16	Luxembourg, Malaga	Cheltenham	Hradeckralove, Lodz, Ploiesti
15	Breda, Cannes, Cork, Lillie, Ludwigshafen, Miramas, Mons, Monza, Porto, St-Tropez, Swords, Turin	Leicester, Nottingham, Weymouth	Szczecin, Timisoara
14	Arhus, Bilbao, Monchengladbach, Stephanskirchen	Belfast, Southshields	Arad, Poznan, Split, Varna
13		Birmingham, Liverpool	
12	Bielefeld, Elche, Maia, Menorca, Munster, Palermo, Rimini, Roissy, Toulouse, Venezia, Vigo, Vilroorde		Dubrovnik, Katowice, Polowice, Torun
11	Kunzelsau, Leganes, Murcia, Oberhausen	Bristol	Brasov, Brno, Cluj-Napoca, Iasi, Ostrava

(*) Cities in bold are in the innermost core of the network in all three sectors; cities in italics in the innermost core of the network in two sectors.

Source: Authors' elaboration on fDiMarkets data.

Table A18. Electronics – Intra-EU*

Electronics Intra EU Network, innermost core kshell=10			
K	EU14	UK	EU13
10	*Amsterdam* , *Barcelona* , *Berlin* , *Copenhagen* , Dornbrin, Dublin, *Dusseldorf* , Eindhoven, Fabriano, Gothenburg, Gutersloh, **Madrid**, **Munich**, **Paris**, Reuil-Malmaison, **Stockholm**, *Stuttgart* , **Vienna**, Zaragoza	Hemelhempstead, *London*	Brno, **Bucharest**, *Budapest* , Lodz, **Prague**, Wroclaw
8	Athens, Brussels, Cluses, Espoo, Hamburg, Helsinki, Lyon, Malmo, Nurnberg	Cambridge	Plovdiv, Tallin, Tczew, Warsaw
7	Badstaffelstein, Milan, Sulzemoos, Valencia	Glasgow, Oxford	
6	Alicante, Antwerp, Den Haag, Freiburg, Gouda, Koln, Luxembourg, Santa Cruiz de Tenerife, Thessaloniki, Vantaa, Wels	Newbury, Spennymoor	Krakow, Timisoara
5	Aachen, Aschaffenburg, Brundby, Deggendorf, Dresden, Eschborn, Getafe, Ghent, Hasselt, Heerlen, Hoofddorp, Kortrijk, Leoben, Levalloisperret, Linz, Lunen, Maia, Malaga, Montpellier, Nantes, Neuilly-sur-Seine, Nicosia, Oiartzun, Palma de Mallorca, Pirkkala, Remscheid, Rimforsa, Rotterdam, Shannon, Struer, Toledo, Toulouse, Valladolid, Venissieux, Vigo, Wedem, Wuppertal, Zamudio		Arad, Botevgrad, Decin, Katowice, Naklo, Ostrava, Plzen, Satumare, Sofiya, Szczecin, Trenin, Wedemark, Wuppertal
4	Almere, Ancona, Bordeaux, Bremen, Cottbus, Detmold, Gualtieri, Hirschau, Ispringen, Karlsruhe, Monheim, Neckarsulm, Niestetal, Reutlingen, Rome, Turin, Wessling	Kettering, Milton Keynes, Nottingham	

(*) Cities in bold are in the innermost core of the network in all three sectors; cities in italics in the innermost core of the network in two sectors.

Source: Authors' elaboration on fDiMarkets data.

Table A19. Automotive – Intra-EU*

Automotive Intra EU Network, innermost core kshell=13			
K	EU14	UK	EU13
13	Boulogne-Billancourt, **Madrid**, **Munich**, **Paris**, **Stockholm**, *Stuttgart* , Turin, **Vienna**, Wolfsburg		Brasov, Bratislava, **Bucharest**, **Prague**, *Warsaw*
12			Budapest, Mladaboleslav, Sofiya
11	Gothenburg, Hannover, Helsinki, Lippstadt, Lyon	London	Cluj-Napoca, Gyr, Kaunas, Timisoara, Wroclaw
10	Berlin		Bielsko-Baiala
9	Burgos, Vilsbiburg		Kecskemet, Ostrava, Pitesti, Walbrzych
8	Athens, Bamberg, Bergamo, Dusseldorf, Frankfurtammain, Ghent, Lille, Luxembourg, Milan, Odense, Pamplona, Rome, Salzburg, Zaragoza	Coventry	Arad, Dabrowagornicza, Dej, Iasi, Legnica, Lozorno, Trutnov, Ustinadlabem
7	Valladolid		
6	Bietigheim-Bissingen, Clichy, Copenhagen, Dublin, Forst, Friedrichshafen, Graz, Hamburg, Herzogenaurach, Iserlohn, Kempele, Koln, Malmo, Mannheim, Mepel, Nurnberg, Opglabbeek, Paderborn, Pullach, Rubi, St-Priest, Trelleborg, Ulm, Velbert, Venissieux, Vigo	Llanelli, Northampton, Oxford	Craiova, Eger, Gliwice, Jihlava, Katowice, Kechnec, Koprivnice, Kosice, Logoj, Miskolc, Mor, Niepolomice, Novomesto, Nyiregyhaza, Panevezys, Plzen, Poznan, Ruse, Satumare, Sibiu, Skawina, Slupsk, Starachowice, Szczecin, Szombathely, Trnava, Veszprem, Wrzesnia, Zvolen
5	Aachen, Allmendingen, Amsterdam, Angers, Barberadelvalles, Barchfeld, Bologna, Bruchsal, Dettingen, Esslingenamneckar, Florence, Forbach, Hilversum, Hof, Horsching, Krefeld, Landskrona, Linz, Ludwigsburg, Osnabruck, Rehau, Schwabischgmund, Tondela, Toulouse, Utrecht, Zeewolde	Basildon, Coleshill, Liverpool, Milton Keynes, Newtonaycliffe, Nuneaton, Portchester, Shoreham-by-Sea, Solihull, Wolverhampton	
4	Martorell	Banbury, Washington	

(*) Cities in bold are in the innermost core of the network in all three sectors; cities in italics in the innermost core of the network in two sectors.

Source: Authors' elaboration on fDiMarkets data.

Table A20. Electronics – Intra-EU, R&D*

Electronics Intra EU Network - R&D, innermost core kshell=3			
K	EU14	UK	EU13
3	Amsterdam, Caen, Espoo, Getafe, *Munich*	Cambridge	

(*) Cities in bold are in the innermost core of the network in all three sectors; cities in italics in the innermost core of the network in two sectors.

Source: Authors' elaboration on fDiMarkets data.

Table A21. Automotive – Intra-EU, R&D*

Automotive Intra EU Network - R&D, innermost core kshell=5			
K	EU14	UK	EU13
5	Barcelona, Brussles, Hannover, *Munich*, Stuttgart, Wolfsbrug		Budapest, Iasi
4	Friedrichshafen, Salzburg	Coventry	Miskolc, Plzen
3	Boulogne-Billancourt, Dresden, Lagoas, Paris, Steyr, St-Priest, Vienna		Bucharest, Sibiu, Skawina, Sokolov, Szczecin, Titu, Veszprem

(*) Cities in bold are in the innermost core of the network in all three sectors; cities in italics in the innermost core of the network in two sectors.

Source: Authors' elaboration on fDiMarkets data.

Table A22. Textile & Apparel – Intra-EU, production*

Textile Intra EU Network - Production, innermost core kshell=4			
K	EU14	UK	EU13
4	Alba, Vicenza		Silven, Yambol
3	Bagno Aripoli, Dublin, Leipzig, Luxembourg, Paris	London	Legnica, Svishtov, Znojmo

(*) Cities in bold are in the innermost core of the network in all three sectors; cities in italics in the innermost core of the network in two sectors.

Source: Authors' elaboration on fDiMarkets data.

Table A23. Electronics – Intra-EU, production*

Electronics Intra EU Network - Production, innermost core kshell=4			
K	EU14	UK	EU13
4	Dornbrin, Fabriano, Nurnberg, Stockholm	Spennymoor	*Arad*, Lodz, *Wroclaw*
3	Aachen, Amsterdam, Berlin, Bitterfeld, Blomberg, Brudby, Dassow, Eindhoven, Ensheim, Genk, Gussing, Hamburg, Jaen, Kassel, Kempele, Koln, Madrid, Malmo, Munich, Oberkochen, Obernai, Paris, Puerto Llano, Ronneby, Sievi, Stuttgart, Susegana, Taby, Tienen, Tocksfors, Trescantos, Treviso, Turnhout, Uden, Vasteras, Venissieux, Vienna, Vilanovailageltru, Wuppertal, Zaldibia, Zaragoza	Abingdon, London, Petersfield, Worcester	Bucharest, Bydgoszcz, Gdansk, Gliwice, Goleniow, Jaszbereny, Jucu, Kobierzyce, Kuressaare, Malacky, Namestovo, Nitra, Nowytomysl, Nyiregyhaza, Olawa, Oradea, Pila, Prabuty, Radomsko, Sieradz, Siewierz, Simeria, Slatina, Strzelceopolskie, Swidnica, Szekesfehervar, Tczew, Valasskemezirici, Vrable, Zarow

(*) Cities in bold are in the innermost core of the network in all three sectors; cities in italics in the innermost core of the network in two sectors.

Source: Authors' elaboration on fDiMarkets data.

Table A24. Automotive – Intra-EU, production*

Automotive Intra EU Network - Production, innermost core kshell=6			
K	EU14	UK	EU13
6	Bamberg, Barcelona, Boulogne-Billancourt, Brussels, Burgos, Ghent, Gothenburg, Hannover, Lippstadt, Madrid, Munich, Paris, Stuttgart, Turin, Valladolid, Vilsbiburg, Wolfsburg		*Arad* , Bielsko-Biala, Brasov, Jihlava, Keckemet, Mladaboleslav, Ostrava, Pitesti, Timisoara, Trutnov, Walbrzych, *Wroclaw*
5	Allmendingen, Bergamo, Bruchsal, Clichy, Dettingen, Dusseldorf, Forbach, Forst, Friedrichshafen, Herzogenaurach, Iserlohn, Linz, Lyon, Mannheim, Meppel, Nurnberg, Pamplona, Rubi, Salzburg, Sodertalje, Stockholm, Velbert, Venissieux, Vienna, Vigo, Zaragoza	Coleshill, Llanelli, London, Oxford	Budapest, Cluj-Napoca, Dabrowagornicza, Dej, Gliwice, Gyr, Jelcz-laskowice, Karvina, Kaunas, Koprivnice, Legnica, Liberec, Lugoj, Miskolc, Niepolomice, Novomesto, Plzen, Ruse, Satumare, Sibiu, Slupsk, Starachowice, Szombathely, Trnava, Veszprem, Wrzesnia, Zvolen
4	Barbera del Valles, Barchfeld, Berlin, Esslingenamneckar, Florange, Tondela, Trelleborg		Craiova, Katowice, Oradea, Swosnowiec

(*) Cities in bold are in the innermost core of the network in all three sectors; cities in italics in the innermost core of the network in two sectors.

Source: Authors' elaboration on fDiMarkets data.

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