Gauging the Vertical Specialization in EU Trade[1]

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Abstract: - The purpose of this paper is threefold. First, we review the mechanisms and determinants of vertical specialization (VS), as this has gradually become the dominant characteristic of international trade. Second, we underline that there is a rich literature regarding VS in EU trade, at aggregate and individual levels and research is advancing together with the instruments used to measure trade in value added. Third, our investigation brings to the forefront a classification of EU countries according to their GVC participation index, taking into consideration both upstream and downstream links. As a conclusion, the VS analyses help us better understand the interconnectedness among countries and industries by means of foreign direct investment, trade, labour migration and technology transfer.

Key-Words: - international trade, vertical specialization (VS), foreign direct investment (FDI), global value chains (GVC), global production networks, trade in value-added (TiVA), participation index, upstream links, downstream links.

JEL Classification: - E20, F14, F15, F60, F62, O14.

1. Vertical specialization – concept, mechanisms and determinants

The concept of vertical specialization (VS) was suggested for the first time by Balassa in 1967 in relationship with the process of joint fragmentation and globalization of production (Leitner, Stehrer, 2014). Nonetheless it became an established notion in the economic literature only in the 1990s with the meaning of foreign value added content of gross exports. Fragmentation or vertical disintegration (Krugman, 1995, p. 334, Feenstra, 1998, p. 35) or "production staging" (Fally, 2012) is linked to imported inputs embodied in goods (either final or unfinished) that are exported, which underlines the "multiple-border-crossing" inherent feature of trade (Hummels *et al.*, 2001, p. 77). Otherwise stated, VS means "slicing up the value chain" in order to "produce a good in a number of stages in a number of locations, adding a little bit of value at each stage" (Krugman, 1995, p. 334). Box 1 offers an overview of the VS and its main forms.

[1] The present paper is based on the author's researches included in the study "EU: Reconfiguring the Trade Policy after the Treaty of Lisbon. Romania's Position", IWE, Romanian Academy. It will also be presented at the international conference organized by the IWE in December 2014.

Box 1: Principles of VS

1. *Goods are produced in two or more successive stages;*
2. *At least two countries provide value-added during the production process;*
3. *At least one country uses imported inputs in its stage of production;*
4. *A part of the resulting output or the complete production is exported.*

(Sources: Hummels *et al.*, 2001, p. 77, Araujo, 2009, p. 6).

International fragmentation of production takes many forms but all of them belong to one of the following categories:

1. Snakes – sequences of multiple production stages: repeated incorporation of intermediate goods in different countries, until they reach the final stage of production;
2. Spiders – hubs where components from various subcontractors are collected and assembled;
3. A combination of "spiders" and "snakes".

(Sources: Baldwin, Venables, 2013, Los, Timmer, de Vries, 2013, p. 8, Timmer *et al.*, 2014, p. 101).

The VS takes the shape of global value chains (GVC) which are mainly coordinated by transnational corporations (TNCs) – through their networks of affiliates, contractual partners, arm's length suppliers – and account for circa 80% of international trade (UNCTAD, 2013, p. 135). It results that *outsourcing, foreign direct investment (FDI) and trade (especially intra-industry trade) are the main components of VS*. According to Lopez-González, Holmes (2011) and Banga (2013), the VS can be decomposed into backward and forward linkages, which nature varies in line with a country's position in the value chain. GVCs include various countries, according to their specialization in particular stages of production (Yi, 2001).

The change of trade nature by means of VS has been one of the dominant characteristics of the international trade since the 1990s and it gradually accentuated during the recent years. Repetitive border crossing of intermediate products has caused and continues to spur the expansion/drop of trade value due to statistics, differing considerably from the effective trade (i.e. trade in value added). Economic actors' participation at global production networks determines both expansion of trade (at a faster pace than global GDP) in normal states of the world economy and leads to trade collapse during crises periods (such as the 2007-2009 one) (Godart, Görg, Görlich, 2009, p. 5).

International organizations, statistical bodies as well as independent research institutions and scholars have been trying to develop methods to capture the value added in each production stage in order to solve the *double counting issue* of supply-chain trade. Researchers' interest for VS has increased anew since the database on trade in value added (TiVA) and the World Input-Output Database (WIOD)[2] were launched in 2013.

As a matter of fact, VS can be analyzed from a twofold standpoint. One is the microeconomic perspective, namely the viewpoint of individual consumers and companies in order to understand their decision-making processes, interactions and choices. The other one is the macroeconomic perspective, related to the economy-wide phenomena.[3] In this paper we resort to the macroeconomic approach.

The VS propensity varies among product groups and is linked to factors such as: differences in factor endowments across countries, the 3T features of services (technology, transportability, tradability) (Anand *et al.*, 2012, p. 8), advances in technology and the overall reduction in transaction costs worldwide (Box 2). Trade in intermediate goods is one channel leading to a deeper global integration (Foster, Stehrer, Timmer, 2013), alongside trade in final goods, foreign direct investment (FDI) and other financial flows, labour migration and technology transfer.

[2] The first one is a joint initiative of the Organisation for Economic Co-operation and Development (OECD) and World Trade Organization (WTO), while the second one is the outcome of a project financed by the European Commission under the 7th Framework Programme.

[3] According to Investopedia definitions.

Box 2: Determinants of vertical specialization

Perspectives of Transaction Cost Economics (set up by Coase and Williamson):
search of efficiency, i.e. companies keeping the cost of organizing production below market transaction cost, correlated with the overall reduction in transaction costs worldwide / vertical integration as a result of market failure;
Attitude and strategy towards risk, as vertical integration is considered a high-risk activity;
Nature of goods and services traded;
Results estimated by means of return on investment;
Differences in factor endowments across countries;
Trade liberalization;
Protectionist stances;
Evolution of wages and productivity;
Evolution of coordination costs;
Incentives for re-shoring (the reversal of fragmentation trend);
Macroeconomic policies;
Information flows;
Advances in technology – number of production stages increased due to the technological progress and this gave impetus to VS and trade.

(Sources: Own representation based on Nugent and Hamblin, 1996, pp. 16-18, Yi, 2001, p. 3, Lopez-González and Holmes, 2011, Anand *et al.*, 2012, Guan, Rehme, 2012, p. 198, Los, Timmer, de Vries, 2013, Timmer *et al.*, 2014).

Economic literature, though rich, does not offer enough evidence to what extent the vertical specialization is mainly regional or global (Los, Timmer, de Vries, 2013, p. 3). For instance, Timmer *et al.* (2014, p. 106) underscore that, in contrast to the 1990s, when the fragmentation took place mainly regionally (North America, Asia, Europe),[4] starting with the 2000s, this process became global, as developing economies emerged as important sources of intermediate products. These countries, especially the Asian ones, have increased their role both as hosts of offshoring activities and markets absorbing the final goods exports of developed countries (Foster *et al.*, 2013). On the contrary, Baldwin and Lopez-González (2013, pp. 18-20) consider that supply chain trade is regional and the three main regions involved in such a trade continue to be Factory Asia, Factory North America and Factory Europe.

Nevertheless, according to Timmer *et al.* (2014, pp. 106-112) the main features of vertical specialization worldwide are as follows:

(1) Foreign value-added content of production has rapidly increased since the early 1990s when it was first identified on a global scale;

(2) Fragmentation process slowed down in 2008-2009 but it gained momentum starting with 2010;

(3) Different product categories, countries and regions have distinct foreign value-added shares and trends;

(4) Due to technological progress, in most GVCs there is a firm shift towards value added by capital and high-skilled labour, to the detriment of low-skilled labour;

(5) Developed countries increasingly specialize in activities involving high-skilled workers, while emerging countries specialize more and more in capital-intensive activities.

And moreover:

(6) Supply-chain trade has shifted towards Factory Asia and away from Factories North America and Europe (Baldwin, Lopez-González, 2013);

(7) Factories Europe and North America tend to be more inward oriented, while Factory Asia is still extremely dependent on European and North American demand (Lopez-González and Holmes, 2011).

The main objective of this paper is to gauge the VS at the level of EU trade by means of literature review and TiVA database and stress the similarities and differences among the EU member states.

[4] Geographical regions such as South America, Africa, Middle East, Commonwealth of Independent States export mainly commodities and their participation at GVCs is limited.

2. Measuring the VS in EU Trade by means of TiVA database

2.1. Relevant literature concerning VS in EU Trade

There is a vast literature regarding VS. This can be classified in five main categories: (1) conceptual and analytical papers; (2) theoretical methods used to gauge the VS; (3) empirical research focused on one or more countries, regions (especially Asia) and groups of countries; (4) empirical research concentrated on sector-level analyses; (5) a combination of them.

As regards the VS in the EU and its member states, there is a significant literature yet not as large as that regarding Asian Factory. We enumerate below several relevant research papers focused on or linked to VS in EU and EU member states:

- ✓ Foster, Stehrer, Timmer (2013) – complex analysis of VS in the EU countries in a comparative manner, based on WIOD;
- ✓ Timmer *et al.* (2014) – several conclusions regarding EU as a whole and some EU member states;
- ✓ Ţurlea *et al.* (2014) – Romania case study; authors conclude that, in contrast with other parts of the world, the degree of vertical specialization in Romania declined between 2001 and 2011 and it remains below the average of other economies of the same size as regards VS;
- ✓ van Ark *et al.* (2012 and 2013) – interesting from the combination of demand-side and supply-side perspectives of GVC performance at EU level;
- ✓ Banga (2013) – evaluating participation in GVCs by forward and backward linkages in different countries, including the "big four" EU member states: Germany, France, Great Britain and Italy;
- ✓ Amador, Cabral (2008) – Portugal case study and also literature review including Minondo and Rubert (2002) for Spain, Breda *et al.* (2007) for Italy and other six EU countries, Cadarso *et al.* (2007) for nine EU countries;
- ✓ Breda, Cappariello, Zizza (2007) – VS in Germany (explaining the concept of "bazaar economy" coined by Sinn in 2004), France, Belgium, Italy, Netherlands, Spain and Great Britain;
- ✓ Fouquin, Nayman, Wagner (2007) – evidence from France: authors conclude that even if the production process in vertical, the number of stages in low, because French companies are more concentrated in sectors whose production processes are less separable, such as cars, basic chemicals and non-mineral products, while industries requiring a high fragmentation degree are minor industries in France.

2.2. TiVA database: a factsheet

In order to develop a statistical instrument to measure trade in value added terms, OECD and WTO launched in January 2013 the TiVA database (OECD-WTO, 2013). This is integrated into the larger framework of initiatives meant to better understand interconnectedness among countries and industries by means of trade. In this regard, OECD and WTO cooperate with other stakeholders, for example: WIOD group, Eurostat, United States International Trade Commission, Institute of Developing Economies-Japan External Trade Organization (IDE-JETRO).[5]

Although TiVA data are only estimates, they provide a clear image of international trade and the specific positions of different countries in GVCs. The database differentiates between the use of foreign inputs in exports and of domestic intermediates in exports to third countries (backward and forward participation, respectively) (De Backer, Miroudot, 2013, p. 5). Furthermore, TiVA is considered useful for various policy areas, such as trade policy, growth, development, employment, innovation, competitiveness and systemic risks (OECD, 2013).

TiVA includes 57 countries accounting for more than 95% of world output (including all G-20 member countries, EU-27 as a whole and its member states), 37 industries (18 manufactures and 15 services) and 5

[5] A detailed analysis regarding the international input-output datasets is presented in Sturgeon (2013).

years (1995, 2000, 2005, 2008 and 2009). The main indicators are as follows (De Backer and Miroudot, 2013, pp. 11-16):

- *Countries' participation in GVCs* (participation index developed by Koopman *et al.*, 2011) – VS share as import content of exports (value of imported inputs in the overall exports, i.e. backward participation or upstream links) and VS share as percentage of exported goods and services used as imported inputs by other countries (i.e. forward participation or downstream links). Most research papers refer to upstream links.
- *GVCs length or "average propagation length"* – estimated through an index taking value of 1 if there is a single production stage and incremental values according to the number of inputs from the same industry or other industries, weighted with the average of the sectoral production length. The highest fragmentation degree was identified in manufactures (television and communication equipment; motor vehicles; basic metals; textiles, leather and footwear; electrical machinery), while services sectors have generally shorter value chains (the sectors with the longest GVCs being: construction; hotels and restaurants; research and development; transport and storage). Obviously, countries specialized in such sectors obtain higher scores as regards participation in GVCs, as underlined in the next section of our paper.
- *Distance to final demand, i.e. a country's position in GVC or "upstreamness"* (Fally, 2012) – depending on specialization, countries may produce mainly inputs used at the beginning of the production process (including commodities but also design, research and development services and in this case they are situated upstream) or are for the most part involved in assembling activities or customer services (and consequently they are situated downstream).

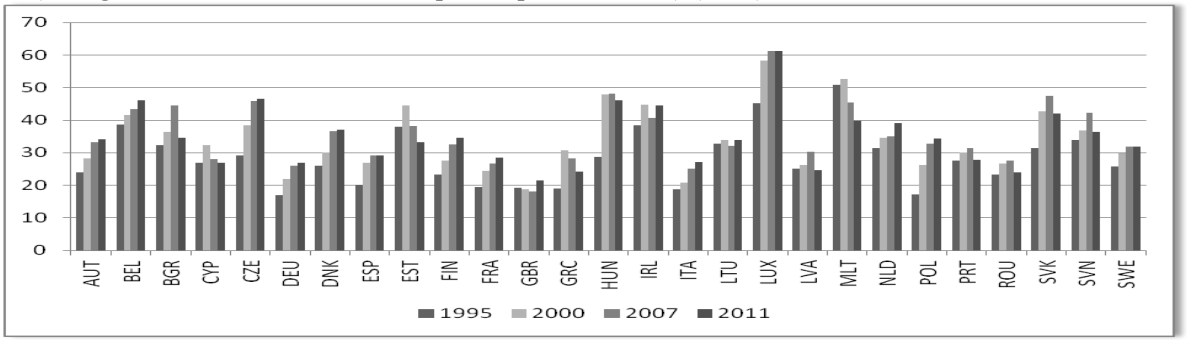
2.3. VS in EU trade

Di Mauro, Plamper and Stehrer (2013) consider that EU global value chains "are thriving", due to the following considerations: (1) The vast majority of EU member states recorded an increase of their participation index between 2000 and 2008; (2) The world financial and economic crisis interrupted only temporarily the VS of production and trade; (3) The importance of services (including those categories related to manufactures) has grown in terms of value added and job creation.

During 1995-2011, at the level of EU, foreign value-added was to a major extent sourced from other EU countries (Di Mauro, Plamper and Stehrer, 2013). Nevertheless, the share of non-EU sourcing has increased over the whole period, particularly during the crisis, reaching almost the level of intra-EU sourcing (Foster, Stehrer, Timmer, 2013, p. 27). Consequently, Factory Europe might soon become more outward oriented, as the importance of farshoring is increasing, to the detriment of nearshoring (Foster, Stehrer, Timmer, 2013, p. 27). In 2007 there were only 7 EU countries depending more on farshoring than nearshoring: Greece, Lithuania, Netherlands, Finland, Great Britain, Italy and Spain. In 2011, their number was double: Lithuania, Greece, Netherlands, Bulgaria, Finland, Italy, Great Britain, Spain, Ireland, Sweden, Germany, Cyprus, Denmark, Estonia (Foster, Stehrer, Timmer, 2013, p. 25).

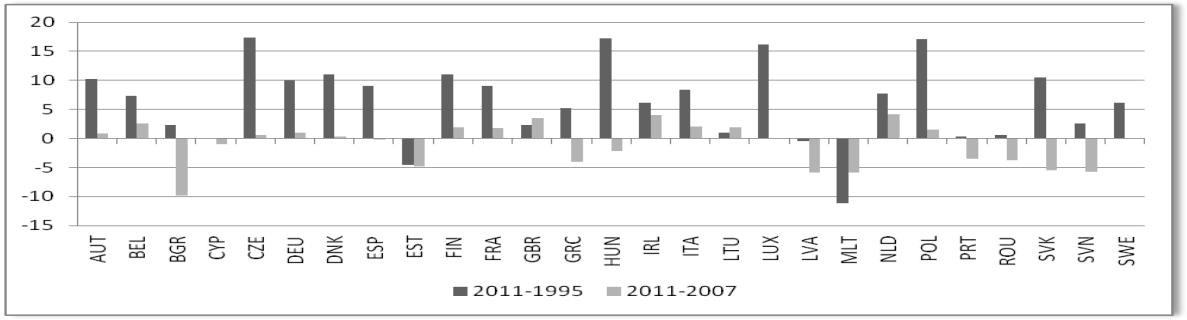
Resorting to data based on WIOD and included in Foster, Stehrer, Timmer (2013, p. 22), we may classify the EU countries in *eight main categories taking into consideration their backward participation at GVCs*: (1) high and increasing VS: Luxembourg; (2) medium and increasing VS: Czech Republic, Belgium, Netherlands, Denmark, Finland, Poland, Austria and Sweden; (3) medium and decreasing VS, especially due to the world financial and economic crisis: Hungary, Slovak Republic, Estonia, Malta, Slovenia and Bulgaria; (4) medium and increasing VS after the crisis: Great Britain; (5) medium VS but with ups and downs: Ireland; (6) low but increasing VS: Germany, France, Italy; (7) low VS with ups and downs: Lithuania, Spain and Cyprus; (8) low VS and decreasing after the crisis: Portugal, Latvia, Greece and Romania (Charts 1 and 2).

Chart 1: VS in EU countries in 1995, 2000, 2007 and 2011
(foreign value added content of exports/upstream links) (in %)



Source: Own representation based on Foster, Stehrer, Timmer (2013, p. 22).

Chart 2: VS in EU countries in 2011 as compared with 1995 and 2011 as compared with 2007 (in %)



Source: Own representation based on Foster, Stehrer, Timmer (2013, p. 22).

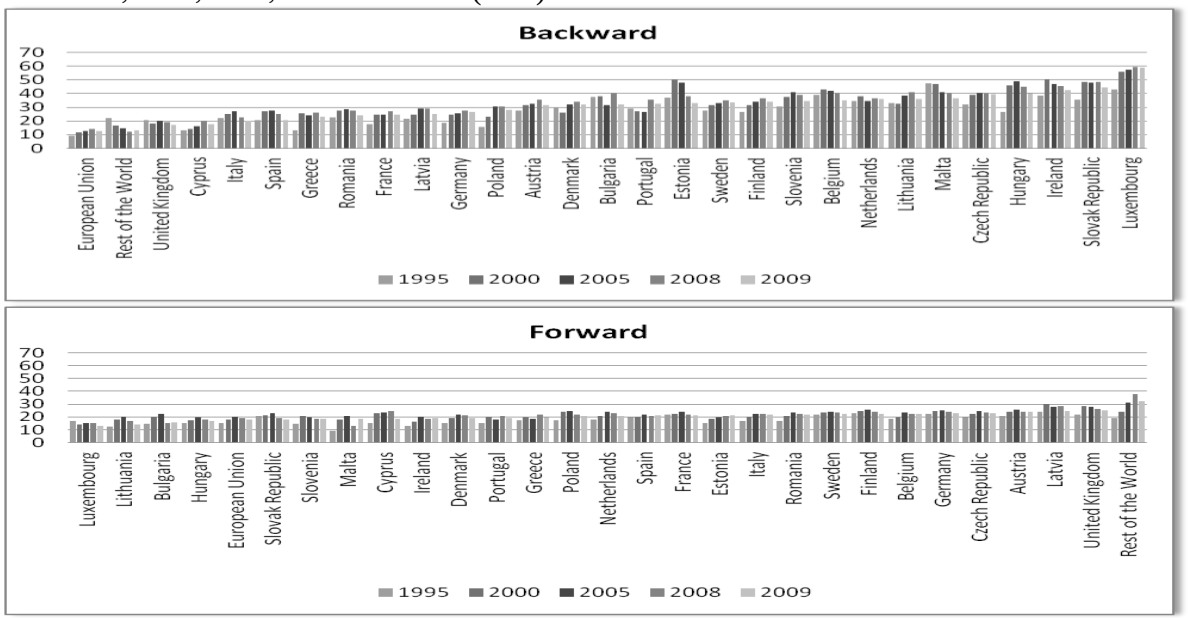
Van Ark *et al.* (2013) identify three groups of countries active in VS: (1) the Germany-led supply chain block (including Austria and Central and Eastern European countries); (2) a Mediterranean-France block, more inwardly focused and strongly dependent of the dynamics of domestic demand and (3) a Nordic/Benelux/UK/Ireland block with competitive export sectors, including services. From the viewpoint of employment linked to VS, van Ark *et al.* estimate its share at 20-30% of total employment, which is larger in the EU-12 as compared to EU-15 as regards trade in goods (especially in Bulgaria, Czech Republic, Slovakia and Slovenia, shares higher than 20%, also in Poland 17%) but larger in the EU-15 than in EU-12 as regards trade in services (p. 8). The same authors consider that EU-12 most countries have less employment dedicated to foreign market services demand, with a few exceptions (including Slovakia and Lithuania which have strong transportation industries).

Due to its own large production sector, Germany is less vertically specialized than other EU countries. Nevertheless, owing to high wages and rigid labour market, German companies resort to exporting intermediaries to foreign affiliates in lower-wage countries, where products are assembled and afterwards re-imported for final retouches and sold under the own brand on domestic and foreign markets. It explains why it was labelled as a "bazaar economy" (Breda, Cappariello, Zizza, 2007, p. 7). Nonetheless, other countries like France or Italy may be tagged with the same label.

The analysis presented above takes into consideration mainly the backward participation at GVCs. As already mentioned, TiVA offers a double perspective of countries' external links: upstream and downstream for 1995, 2000, 2005, 2008 and 2009. Although results are not identical with those offered by WIOD (partially due to the periods taken into consideration), we assume that the following conclusions are relevant at EU level: (1) Backward integration is much stronger than forward integration; (2) Smaller countries have higher backward GVCs participation rates than larger ones, while larger countries source less inputs from abroad than smaller countries (depending on the size of the economy, a larger or a smaller share of the value chain is domestic – De Backer, Miroudot, 2013). On the contrary, size of the economy is not necessarily a rule for higher or lower forward participation rates, which depends on sectors involved; (3) The "champion" in upstream links is Luxembourg (result attributable to financial intermediation), while the leader in downstream links is Great Britain (due to financial intermediation and chemicals and non-metallic minerals); (4) As of 2009, following Luxembourg, Slovak Republic, Ireland, Hungary, Czech Republic, Malta, Lithuania, Netherlands, Belgium,

Slovenia, Finland, Sweden, Estonia, Portugal, Bulgaria, Denmark and Austria (sorted in descending order) recorded higher *backward GVCs participation rates* than the others: Poland, Germany, Latvia, France, Romania, Greece, Spain, Italy, Cyprus and United Kingdom. (5) As of 2009, following United Kingdom, Latvia, Austria, Czech Republic, Germany, Belgium, Finland, Sweden, Romania, Italy, Estonia, France, Spain and Netherlands (enumerated in descending order) registered higher *forward GVCs participation rates* than: Poland, Greece, Portugal, Denmark, Ireland, Cyprus, Malta, Slovenia, Slovak Republic, Hungary, Bulgaria, Lithuania and Luxembourg (Chart 3).

Chart 3: Backward and forward participation index at the level of EU countries in 1995, 2000, 2005, 2008 and 2009 (in %)



Notes: According to TiVA definitions, backward participation index represents the contribution of foreign industries to the exports of a country by looking at the foreign value added embodied in the gross exports. Forward participation index provides the share of exported goods and services used as imported inputs to produce other countries' exports.

Source: Own representation based on OECD-WTO (2013).

Explanations for such hierarchies reside in: the nature of dominant industries (whose production processes are less separable or, on the contrary, highly fragmented)[6], specialization patterns and trade linkages.

3. Conclusion

This paper represents a basis for further researches on VS in EU trade. We consider necessary deeper analyses regarding sources of foreign value added in the EU member states (EU versus non-EU), trends in backward and forward GVCs participation and also their sectoral distribution.

Resorting to data presented by Foster, Stehrer and Timmer (2013, p. 22) regarding backward participation, we classified the EU countries in eight main categories: (1) high and increasing VS: Luxembourg; (2) medium and increasing VS: Czech Republic, Belgium, Netherlands, Denmark, Finland, Poland, Austria and Sweden; (3) medium and decreasing VS, especially due to the world financial and economic crisis: Hungary, Slovak Republic, Estonia, Malta, Slovenia and Bulgaria; (4) medium and increasing after the crisis: Great Britain; (5) medium VS but with ups and downs: Ireland; (6) low but increasing VS: Germany, France, Italy; (7) low VS with ups and downs: Lithuania, Spain and Cyprus; (8) low VS and decreasing after the crisis: Portugal, Latvia, Greece and Romania. The same source revealed that in 2011 there were 14 EU countries more depending on farshoring than nearshoring (as compared to only 7 in 2007): Lithuania, Greece, Netherlands, Bulgaria, Finland, Italy, Great Britain, Spain, Ireland, Sweden, Germany, Cyprus, Denmark, Estonia. In the

[6] As suggested by Fouquin, Nayman, Wagner (2007) for instance.

near future, Factory Europe might become more outward oriented, as the importance of farshoring is increasing, to the detriment of nearshoring.

Under these circumstances it might be relevant to determine the main factors leading to this result. At the same time, it is of interest to conduct an investigation in order to find out whether countries more depending on farshoring are becoming more rapidly integrated into the GVCs than those focused on nearshoring.

As statistical instruments used to measure trade in value added terms are evolving, researches regarding VS in trade will become more accurate. Future dynamics at the level of VS in EU trade will continue to be determined by factors such as: perspectives of Transaction Cost Economics, attitude and strategies towards risk, changes at the level of factor endowments across countries, strongly linked to the evolution of wages and productivity as well as advances in technology.

In spite of its inherent limitations, TiVA database underscores that the level of backward integration is much higher than in the case of forward integration. That is the main reason why it is easier to classify the EU countries taking into consideration their backward participation at GVCs rather than their forward participation.

VS analyses will further help us better understand the interconnectedness among countries and industries by means of foreign direct investment, trade, labour migration and technology transfer.

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