

Trade in Value Added and Global Value Chains: Comparative Analysis of Statistical Indicators*

Radmila Dragutinović Mitrović¹

Abstract

The measurement of international trade flows through trade in value-added (TiVA) statistical indicators is very important nowadays, since companies all over the world split their activities across other economies. More and more created products belong to international production chains, rather than to only one economy. In these circumstances, statistical bias is often mentioned as a problem of using data from traditional international trade statistics, instead of TiVA statistics. Therefore, the purpose of the paper is twofold: to give an overview and compare TiVA indicators from two different sources - OECD TiVA Inter-Country Input-Output (ICIO) tables and UNCTAD-Eora Multi-Region Input-Output (MRIO) tables, and to conduct comparative analysis of actual trends in European economies based on the newest TiVA data with intention to perceive differences in value added in the process of increasing vertical integration.

Keywords: Trade in value added, global value chains, OECD TiVA statistics, Eora Multi-Region Input-Output tables, European Union

1. Introduction

Global value chain (GVC) refers to the series of stages in production of goods or services, where each stage adds value and at least two stages of that process are in different economies (World Bank, 2020). Expansion of global value chains (GVCs) and the growth of international trade during the last three decades have had significant effects on employment and economic development. Due to increasing vertical integration and fragmentation of production process, that is splitted process across economies all over the world, products belong to international production chains rather than to only one economy. Such production fragmentation had effects particularly on developing countries with mostly labor-intensive activities, which have got benefits focusing on trade in intermediate goods. The whole process had positive macroeconomic implications since it has enabled economies to specialize in areas with their comparative advantages and thus to increase productivity and incomes, create new jobs and reduce poverty. As a consequence, the value of world trade in intermediate goods has significantly increased, particularly in the period before the global financial crisis. On the other side, gains from GVC participation are not shared equally across economies. Many developing countries produce and export intermediate goods for further processing, contrary to developed countries which offer more advanced products and services (World Bank, 2020). Furthermore, this process leads to increasing interconnections across countries and thus can accelerate transmission of shocks, which is confirmed by GVC trends in the period of global financial crisis onward and during the Covid-19 pandemic (Cigna, S. et al., 2022).

Mentioned changes in production fragmentation across countries imply that intermediate goods cross borders several times before final consumption along the GVC. In such conditions, data on gross trade flows used from conventional trade statistics are no longer appropriate because of statistical bias influenced by multiple counting of trade flows in intermediate goods. Hence, the measurement of international trade flows through TiVA statistical indicators in times of increasing vertical integration is very important since it gives better insights into global supply chains.

* The paper is a result of the project No. 179065, Ministry of Education, Science and Technological Development of the Republic of Serbia.

¹ University of Belgrade, Faculty of Economics and Business, radmila.dragutinovic@ekof.bg.ac.rs.

The paper reviews main indicators of trade in value-added (TiVA) statistics from different sources to measure GVCs, their properties, differences, as well as recent trends in GVC trade. After presentation of main trends in GVCs, a brief overview and comparison of trade indicators from different TiVA data sources and conventional trade statistics is presented. Final part of the paper deals with comparative analysis of main TiVA indicators across European economies in order to perceive main differences and trends in trade in value added based on the newest data ending with 2020.

2. Trends in World Exports and Impacts of GVCs on Trade Statistics

International trade in traditional sense implies the exports of products which are produced in one country to final consumers in another country. Nowadays, this kind of trade covers only around one third of all trade in goods and services, whereas the rest refers to growing trade in intermediate products and trade in services through GVCs. The growth of total world trade in goods and services has amounted to around 22 trillion US dollars in 2020 (WTO, 2021a). Within merchandise trade, trade in intermediate goods and processing trade have continuously increased due to specialization based on comparative advantages of countries in specific steps within GVCs. Total exports in intermediate goods have accounted for more than 60% of total world merchandise exports, thus determining the dynamics in total world exports. Furthermore, growing gap between gross exports in intermediate goods and gross exports in final goods is obvious in the period 1988-2021 (Figure 1). That was particularly visible in the period before global financial crisis, when the exports in intermediate goods grew by around 10% annually, compared to the slowing down period due to global crisis and Covid-19 when the annual growth was around 2%. Such trend was a consequence of expansion of GVCs during last three decades, that is due to increasing fragmentation of production process across countries and their involvement in GVCs.

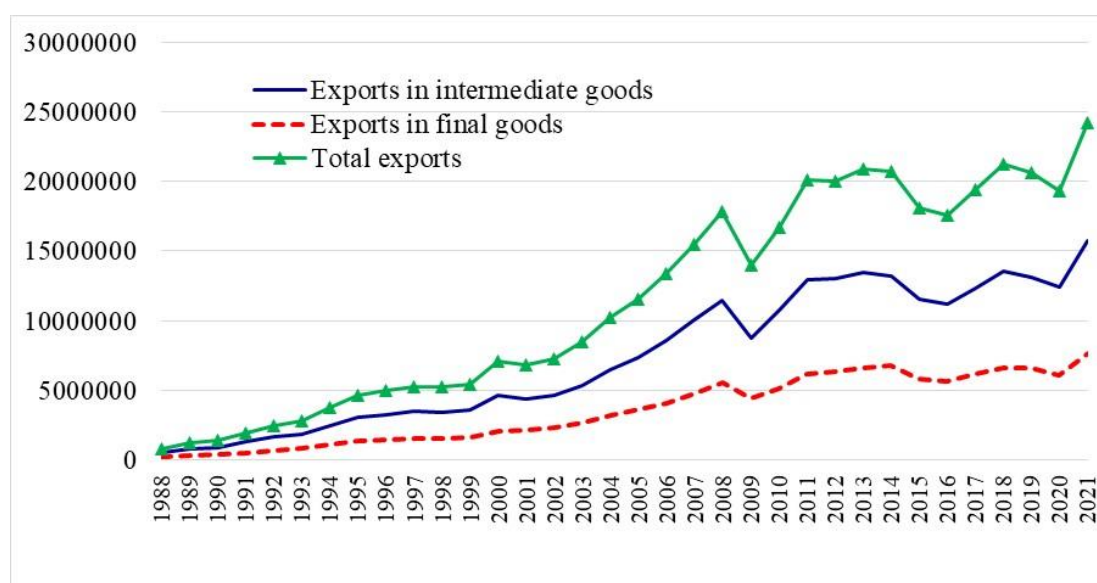


Figure 1: Gross exports in intermediate and final goods – world trend, 1988-2021 (in mill.USD)

Note: Intermediate and final goods definition is based on UNCTAD classification.

Source: World Integrated Trade Solution database.

In mentioned circumstances, intermediate goods or services cross borders many times along GVCs before their final destination. This leads to the problem of multiple counting of trade flows in intermediate goods and trade in services within GVCs, so that conventional trade statistics is no longer able to encompass international fragmentation and participation of each country in GVCs. Measures from traditional trade statistics over-estimate the exports of the last

exporter (country or sector) since they register flows each time the goods and services cross borders. They also cannot reveal value added contributed by countries within different stages of production process, implying distortion of the real trade value (Figure 2).

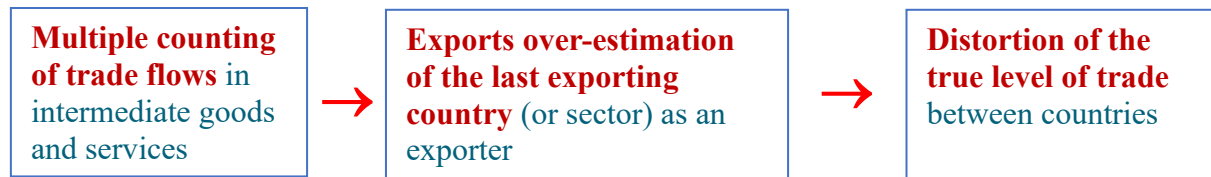


Figure 2: Bias in traditional trade statistics

Source: Author’s presentation.

Gross indicators in trade statistics also cannot cover exports in services of intangibles through GVCs, so that low shares of trade in services are presented in conventional statistics (WTO, 2021). By neglecting the producer aspect in favor of the exporter perspective, standard trade statistics is also biased since it either underestimates involvement of some countries and industries, particularly services, or overstates the level of backward GVC participation (Borin, A. et al., 2021). In order to avoid mentioned bias in conventional trade statistics and get real picture of each country contribution, other concept of measuring trade with new insights on GVCs has been developed. Contrary to conventional statistics, trade in value added (TiVA) statistics enable identifying multi-counting in gross trade, take the whole GVC into account indicating where that value is made and distinguish between domestic and foreign value added content which are created in GVCs. Indicators based on TiVA statistics decompose gross exports and final demand into the sources of value added, covering contribution of suppliers by country and industry of origin. In other words, the way of capturing multiple transactions (or production phases) can be observed as main difference between mentioned two concepts of measuring trade flows. Examples of differences between gross and value added measures of trade can be seen on the following Figure 3.

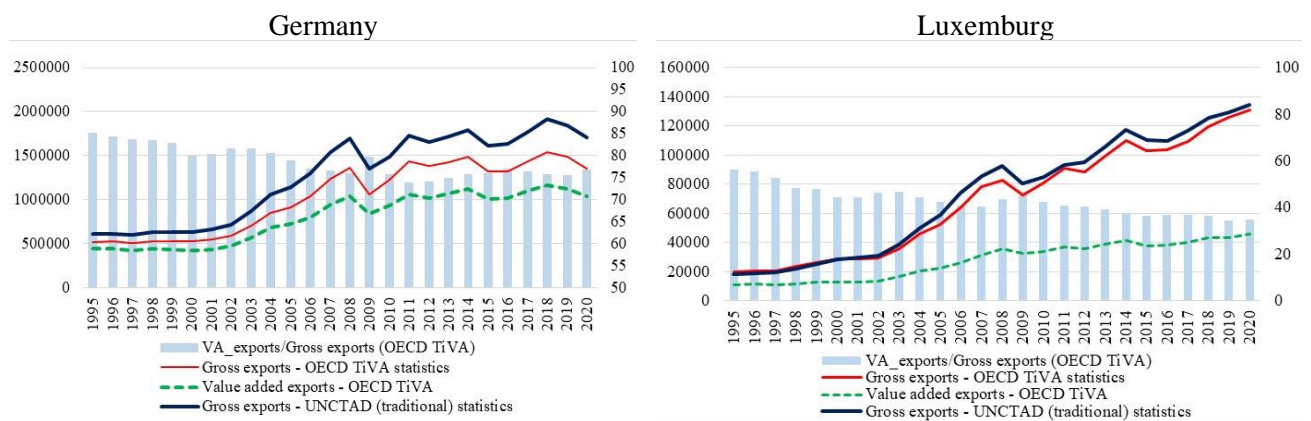


Figure 3 Example of differences between gross exports and exports in value added*

* *Left scale:* Gross exports in goods and services from traditional UNCTAD statistics; gross exports from OECD TiVA statistics adjusted for re-exports; value added exports in million USD; *Right scale:* share of value added in gross exports (in %).

Source: UNCTADstat and OECD TiVA database.

Many economies have benefited from their participation in GVCs. For many countries, value added to exports has moved from manufacturing sector to services. However, distribution of value-added gains between developed and developing economies is not uniform (WTO, 2021).

Developing countries have increased their share in global exports and imports, participating mostly in low-technology production activities, while developed countries have been more involved in high-technology activities generating higher value added. Moreover, contrary to developed countries, developing countries have decreased their own-sourcing of service value-added, filling the gap by service value-added from other countries (Baldwin, R. and T. Ito, 2021). Considered differences are notable even within the group of developed (or developing) economies. Small open economies like Luxemburg, have significantly lower share of domestic value added embodied in exports, implying the larger share of imported (foreign) components used to create goods and services for further exports, compared to some large economies like Germany (Figure 3).

3. Framework for Measuring TiVA Indicators

Different approaches to map GVCs and measure TiVA have been developed so far, such as those based on trade statistics focusing on trade in intermediate goods of sectors, or one of the most common used approaches based on input-output (IO) tables. The latter constructs world IO tables by combining national IO tables of different countries with bilateral trade statistics. In that way measurement of cross-border flows and decomposing of gross trade into domestic and foreign value added content are enabled. The most important sources of TiVA data which rely on IO tables include OECD TiVA database, UNCTAD Eora GVC database with the greatest level of geographical coverage, as well as World Input-Output database (WIOD), with the greatest level of sector details (last edition 2016). Other sources include region-focused projects, such as Asia-Pacific Economic Cooperation (APEC) TiVA, Asian Development Bank's Multiregional IO database, the North American TiVA initiatives (NA-TiVA), the EUROSTAT'S Full International and Global Accounts for Research in IO Analysis (FIGARO), South-American IO Table from the Economic Commission for Latin America and the Caribbean (ECLAC) (OECD, 2022; Lee, M. et al., 2020; Casella, B. et al., 2019).

OECD TiVA database contain indicators which can provide insights into GVCs which is not possible with conventional trade statistics. TiVA indicators follows the origins of value added in exports, imports and final demand. The last 2022 edition contains data for 76 economies in the period 1995-2020, covering 45 industries based on the International Standard Industrial Classification (ISIC) Revision 4. TiVA indicators are completely based on the OECD Inter-Country Input-Output (ICIO) tables.² Starting from the 2018 edition, the ICIO and TiVA databases are based on statistics compiled according to 2008 System of National Accounts (2008 SNA) from national and international sources instead of 1993 SNA (OECD, 2022).³ To define ICIO and TiVA indicators, two main assumptions are made (proportionality and production assumptions). These assumptions seem to be rather strong and hence the cause of potential bias in estimates of TiVA (Lee, M. et al., 2020).⁴

² ICIO tables are constructed by using national IO tables and supply and use tables (SUTs) combined with bilateral trade in goods and services statistics.

³ ICIO system contains annual symmetric industry-by-industry global IO tables for each observed year, so that by using several main matrices TiVA indicators can be calculated. More about that in OECD, 2022.

⁴ Production (homogeneity) assumption indicates that all firms allocated in observed sector use the same goods and services to produce the same outputs, while proportionality assumption means that the proportion of imported intermediates is equal to the ratio of imports to total domestic demand in that product.

Table 1: UNCTAD Eora and OECD TiVA databases - main differences

	UNCTAD-Eora MRIO	OECD TiVA ICIO
Accounting framework (Harmonization of data sources to)	Standards defined in 1993 SNA; ISIC Rev.3	2008 SNA standards; ISIC Rev.4
National IO tables	<ul style="list-style-type: none"> National IO (aprox.20% of countries); UN databases: National Accounts, UN Comtrade and UN Services trade. 	Completely used for all countries.
Country, time and sector coverage	<ul style="list-style-type: none"> 189 countries; 1990- 2018; 26 sectors - high level of disaggregation. 	New edition 2022: <ul style="list-style-type: none"> 76 economies* (OECD, EU, ASEAN, G20 countries); 1995-2020; 45 industries and aggregates (total services and total manufactures).

* 10 new countries in database compared to 2021 edition: Bangladesh, Belarus, Cameroon, Côte d’Ivoire, Egypt, Jordan, Nigeria, Pakistan, Senegal and Ukraine.

Sources: OECD (2022) and Eora GVC methodology (<https://worldmrio.com/>).

Contrary to OECD ICIO system, Eora Multi-Region Input-Output tables (MRIO) have considerably greater level of geographical coverage with data for 189 countries starting from 1990. Due to the problem of obtaining national IO tables from all observed countries (national IO tables from only around one-fifth of all countries are available), Eora also uses other sources, such as UN National Accounts Main Aggregates Database, UN National Accounts Official Data, UN Comtrade international trade database and UN Services trade (Lenzen, M. et al., 2013). Furthermore, Eora MRIO is based on 1993 SNA and uses ISIC Revision 3, which is different compared to OECD TiVA statistics (Table 1). Due to differences in coverage, used methodology in calculation of TiVA indicators and estimation methods in case of missing data, the results based on the OECD TiVA and Eora GVC databases cannot be directly comparable.

The following table show simplified example of MRIO structure in case of two countries and one industry. Key matrices of MRIO table are intermediate goods demand (*T* matrix in Eora), final demand (FD matrix) as well as value added (VA) matrix.

Table 2: Eora MRIO – example of two countries and one industry (sector)

		Intermediate use		Final demand		Gross output
		Country A	Country B	Country A	Country B	
		Industry	Industry	Industry	Industry	
Country A	Industry	Intermediate use of domestic output +	Intermediate use by B of exports from A +	Final use of domestic output	Final use by B of exports from A	X_A
Country B	Industry	Intermediate use by A of exports from B +	Intermediate use of domestic output +	Final use by A of exports from B	Final use of domestic output	X_B
Value added		V_A	V_B			
Gross input		X_A	X_B			

Exports from A to B of Intermediates (arrow from Country A Intermediate use to Country B Intermediate use)

Exports from A to B of Final Products (arrow from Country A Final demand to Country B Final demand)

Value added and Gross input are shown with minus signs (-) in the original diagram.

Source: UNCTAD (2013).

The rows in above presented MRIO table show how gross output produced in observed country can be used (e.g. whether it is used by country A as intermediate or final product, or exported and used by country B), while the columns refer to the amount of domestic and foreign intermediates needed to produce gross output of observed country. Value added in observed country can be calculated as the difference between its produced gross output and the sum of inputs used for production. Calculation of value added trade by using MRIO tables is based on Koopman et al. (2014) approach.

Table 3: Example of value added matrix

		DVX						
		Country 1	Country 2	Country 3	...	Country k	...	Country N
DVA	Country 1	T_v^{11}	T_v^{12}	T_v^{13}	...	T_v^{1k}	...	T_v^{1N}
	Country 2	T_v^{21}	T_v^{22}	T_v^{23}	...	T_v^{2k}	...	T_v^{2N}
FVA	Country 3	T_v^{31}	T_v^{32}	T_v^{33}	...	T_v^{3k}	...	T_v^{3N}

	Country k	T_v^{k1}	T_v^{k2}	T_v^{k3}	...	T_v^{kk}	...	T_v^{kN}

	Country N	T_v^{N1}	T_v^{N2}	T_v^{N3}	...	T_v^{Nk}	...	T_v^{NN}

Source: UNCTAD (2013).

Eora MRIO is the basis for Eora GVC database with relevant TiVA indicators (Table 3). Main indicators which can be calculated from VA matrix are foreign VA (FVA), domestic VA (DVA) and indirect VA (DVX). They indicate how VA contained in the exports of each country (and industry) is generated (by column) and distributed (by row) across countries. Main diagonal of matrix of VA refers to domestic value added content of exports of observed country (e.g. T_v^{11} denotes DVA content of exports of country 1).

4. A Short Review of Main TiVA Statistical Indicators

OECD TiVA indicators are classified into the following four groups: (1) structural indicators, based on values presented in ICIO; (2) indicators based on value added, gross exports and gross imports, that will be in the focus of this section; (3) indicators based on value added and final demand and (4) indicators with four dimensions, revealing the origins of value added in gross exports, gross imports and final demand (OECD, 2022). The second group of indicators are considered in this section only on aggregate (country) level, without presentation of TiVA indicators on sectoral level.

Data on gross exports (EXGR) calculated from the ICIO system in order to obtain main TiVA indicators are derived from the sum of the international trade flows (row sum in the ICIO tables). Namely, country's gross exports can be obtained by summing exports of intermediate goods and services and exports of final demand goods and services. In case of regions, EXGR

does not include intra-regional trade. These data are consistent with National Accounts estimates of total exports and imports of goods and services, but adjusted for re-exports.⁵

Main TiVA indicators are based on the origin of value added in gross exports and imports. The value of gross exports is the sum of domestic (DVA) and foreign value added (FVA). Furthermore, as a part of exports produced in home country, domestic value added content of that country gross exports can be splitted into direct DVA, indirect DVA and re-imported VA, as well. The first refers to the contribution made by industry *i* in home country to the production of goods and services exported by the same industry *i*, the second is also embodied in a country's exports of industry *i*, but originates from domestic industry different from industry *i*, while the third component is DVA content of exports, which is previously exported for production of intermediate goods and services abroad and then returned home, embodied in imports. Beside that, ICIO tables enable to calculate several other TiVA indicators (Table 4).

Table 4: Main TiVA statistical indicators

Indicator	Definition	Formula - aggregate level
DVA	Domestic VA content of home country's gross exports	$DVA = \text{Direct DVA} + \text{Indirect DVA} + \text{re-imported VA}$
FVA = Backward GVC participation	Foreign VA embodied in home country's gross exports	$\text{Backward GVC participation (in \%)} = \frac{FVA}{EXGR} \cdot 100$
DVAFX (or DVX in Eora)= Forward GVC participation	Domestic VA embodied in foreign country's gross exports	$\text{Forward GVC participation (in \%)} = \frac{DVAFX}{EXGR} \cdot 100$
GVC participation index	The extent to which a country-sector is involved in vertically fragmented production processes	$\text{GVC participation index} = \text{Backward GVC} + \text{Forward GVC}$
GVC position index	“upstreamness” - the “distance to final demand” – comparison of the forward and backward participation importance	$\text{GVC position index} = \frac{\ln\left(1 + \frac{DVAFX}{EXGR}\right)}{\ln\left(1 + \frac{FVA}{EXGR}\right)}$

Source: Author's presentation based on OECD (2022).

Foreign value added (FVA) is the value of imported intermediate goods and services embodied in home country's gross exports and corresponds to the backward GVC participation. It implies the extent to which home country's exports are dependent on imported inputs. Domestic value added embodied in foreign country's gross exports (DVAFX or DVX) corresponds to the forward GVC participation and refers to the dependence of foreign consumption and exports on home country's inputs (OECD, 2022). The sum of backward and forward participations (as the shares of gross exports) represents GVC participation rate and indicates the level of a country's involvement in vertically fragmented production processes. The division of this index into backward and forward components enables the analysis of main drivers of the involvement of each country into GVCs. Finally, GVC position index, as the log ratio of a country's intermediates used in other countries' exports and the imported intermediates in its own production, measures the distance of a country to final demand, i.e. the level of its relative

⁵ The difference is that National Accounts exports are expressed in purchasers' prices, while gross exports for TiVA indicators are in basic prices, like values in ICIO tables.

upstreamness (Table 4). Country with larger GVC position index contributes relatively more value added to other countries` exports than other countries contribute to its exports (Aslam A. et al., 2017; Koopman, R. et al., 2010).

In order to analyze GVCs, gross exports of one (home) country to another (partner) country can be decomposed by using source-based approach proposed in Borin, A. and M. Mancini (2019) and Koopman, R. et al. (2014). Three main categories of gross exports are domestic value added - DVA, foreign value added – FVA and pure double counting – PDC (Figure 4).⁶

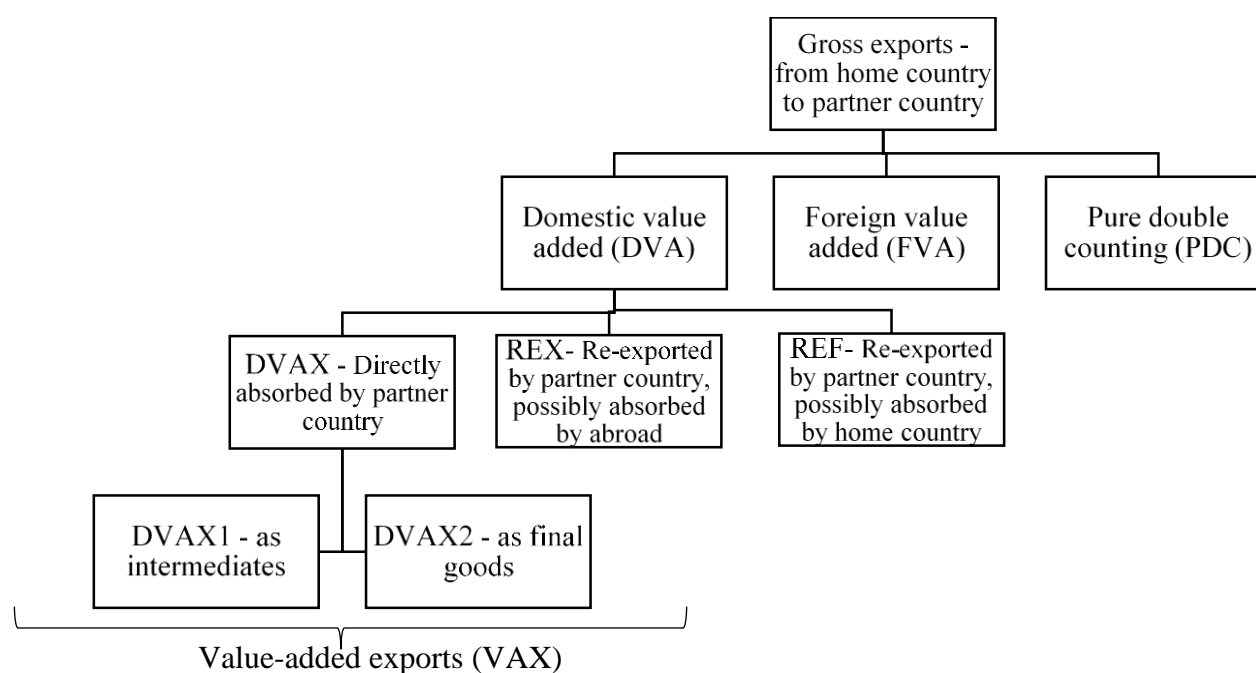


Figure 4: Decomposition of home country gross exports to partner country

Source: WTO (2021) according to Borin, A. and M. Mancini (2019) and Koopman, R. et al. (2014).

DVA can be (1) directly absorbed by importer (DVAX), that is used as intermediates for production and absorbed in that country (DVAX1), or as final goods (DVAX2), (2) sent to importer, re-exported and possibly absorbed by third countries (REX) or (3) sent to importer, re-exported to third economies and returned exporter, i.e. home country (REF). Finally, value-added exports (VAX) is the exports of DVA that are completely absorbed abroad (without reflection – REF). From these indicators, trade based approach of Borin, A. and M. Mancini (2019) implies GVC participation rate as the following ratio: $(REX + REF + FVA + PDC) / EXGR = \text{indirect trade} / EXGR$.⁷

5. Comparison of UNCTAD Eora and OECD TiVA Indicators

Generally, data on the same TiVA indicators defined in the same way and taken from two main observed sources should be similar. However, differences in coverage and methodology between two main TiVA data sources explained in Section 3 can reflect on the differences in the same TiVA indicators calculated from Eora and OECD IO tables. To illustrate this, the following scatterplots describe relationships between data for the same TiVA indicators taken from the two sources. Comparative analysis of the two datasets covers period for which

⁶ PDC covers cases when value added crosses the same border two or more times, leading to duplication in datasets.

⁷ Contrary to this, production based approach is defined in Wang et al. 2017: $GVC \text{ participation rate} = (DVAX1+REX+REF)/DVA = \text{unfinished exports} / DVA$.

indicators from both data sources are available (the last year 2018 and the whole period 1995-2018).

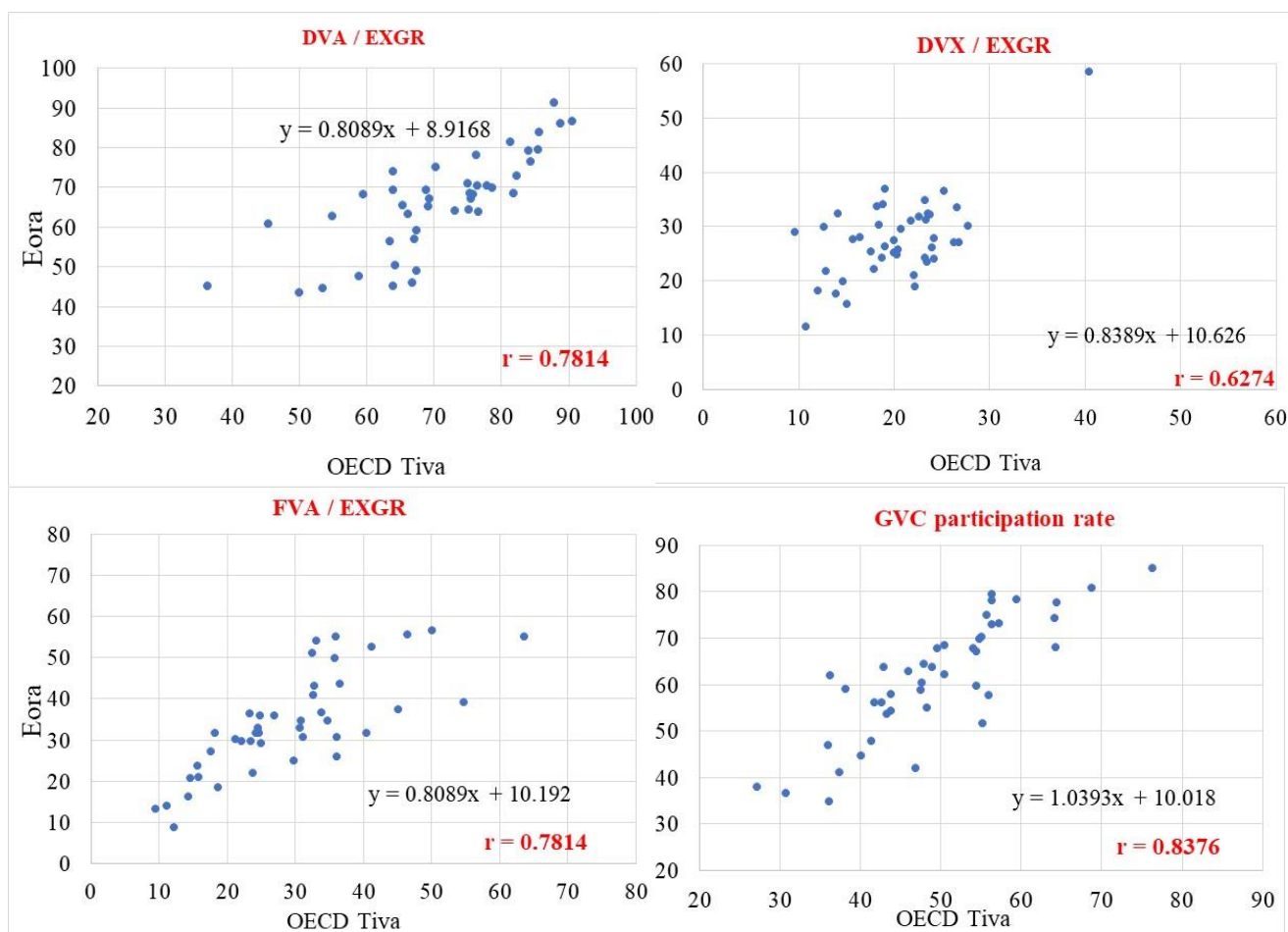


Figure 5: Comparison of Eora and OECD TiVA indicators – example of OECD countries, 2018

Note: Data on both x and y axis in %.

Sources: Author`s calculations and presentation based on OECD TiVA database and Eora GVC database.

Correlation coefficient between the most of TiVA indicators from UNCTAD-Eora and OECD TiVA in 2018 for OECD countries is relatively high (around 0.8), except that for domestic value added embodied in foreign country's gross exports (DVX/EXGR, i.e. backward participation; Figure 5). Moreover, if we observe GVC participation rate and its components in the whole period 1995-2018 for which data are available in both sources, significant correlation exists between Eora and OECD TiVA GVC indicator (Figure 6). According to correlation analysis, it seems that there is overall consistency between results based on the two data sources in observed period.⁸

⁸ Theoretically, for similar results for the most of countries scatterplot should lie close to the 45° line, meaning that there is no significant bias in one dataset or another (Aslam A. et al., 2017).

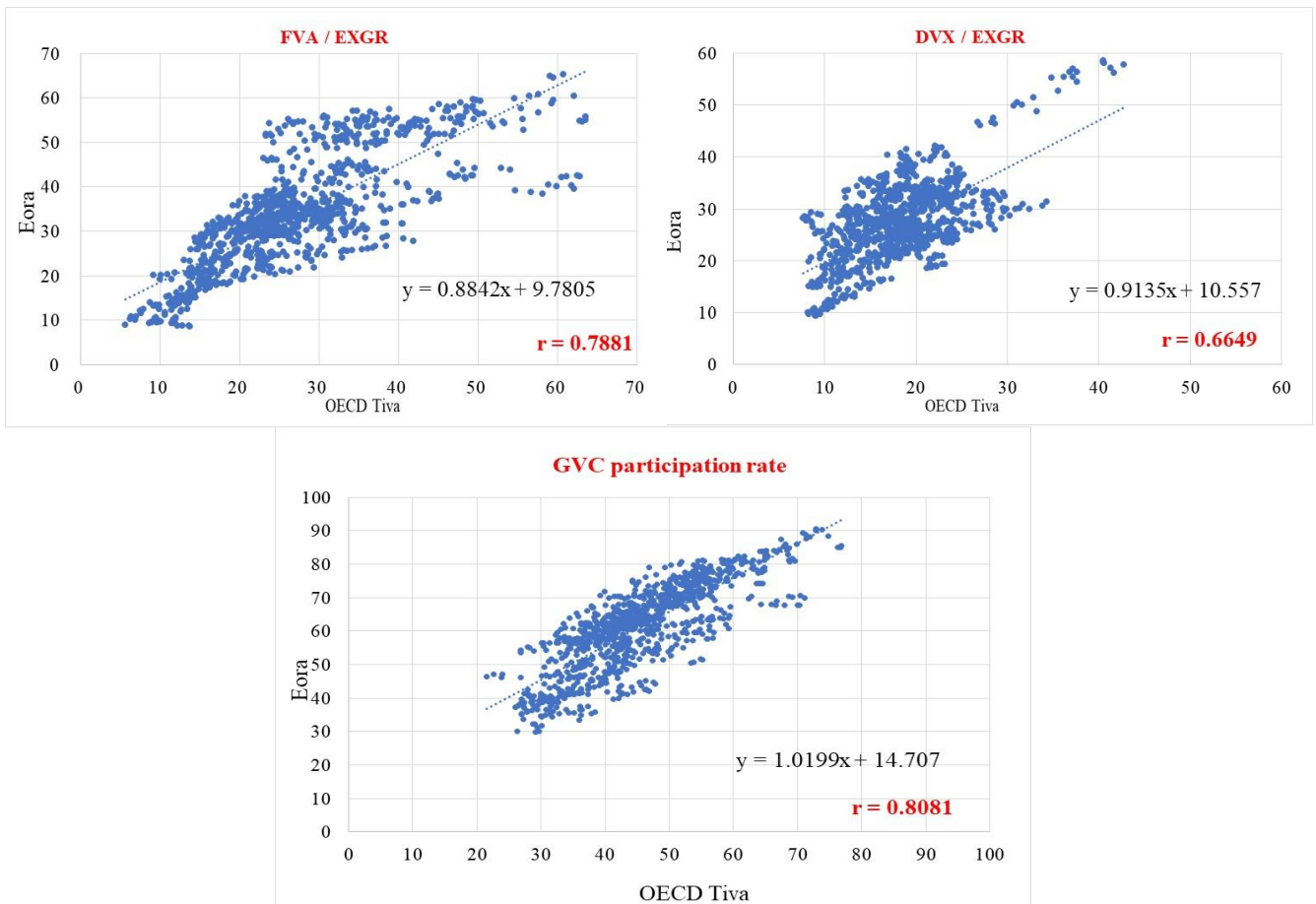


Figure 6: Comparison of Eora and OECD TiVA GVC participation rates – example of OECD countries, 1995-2018

Note: Data on both *x* and *y* axis in %.

Sources: Author’s calculations and presentation based on OECD TiVA database and Eora GVC database.

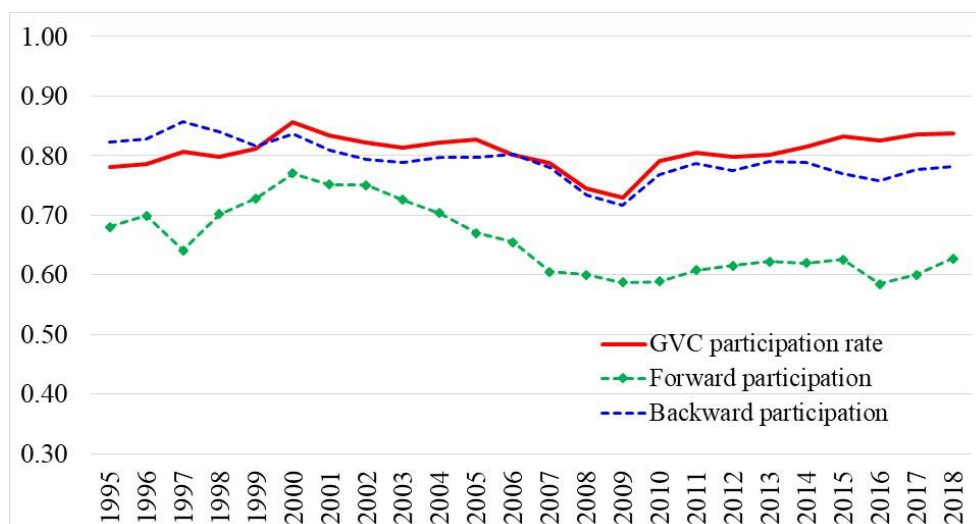


Figure 7: Linear correlation coefficient between Eora and OECD TiVA GVC participation rates in OECD, 1995-2018

Source: Author’s calculation based on OECD TiVA database and Eora GVC database.

Despite large differences in methodology framework and coverage, correlation coefficients for overall GVC participation rate and backward participation calculated for each observed are

rather high: the correlation coefficient between GVC participation data from two sources is consistently above 0.75 in almost all observed years, except in 2008 and 2009 as years of global financial crisis (Figure 7). Contrary to these two indicators, correlation coefficient for forward participation rate (DVX/EXGR) decreased from around 0.7 in the period before global crisis to 0.6 after that period, indicating larger discrepancies in that indicator between UNCTAD-Eora and OECD TiVA estimates. It is also obvious that Eora estimates are higher for the most of economies. That is possibly due to the fact that this database includes re-exports in gross exports contrary to OECD statistics which construct ICIO tables by adjusting for re-exports, i.e. by removing them from exports and imports. Removing re-exports from the data could further improve consistency between the two sources of TiVA data (Casella, B. et al., 2019; Lee, M. et al., 2020).

6. Actual Trends in Main TiVA GVC Indicators in European Countries

From the beginning of 1990s, more and more economies have been involved in GVCs. Rapid expansion in GVCs has been obvious particularly in the period before global financial crisis, when overall GVC participation rate (encompassing both forward and backward participation) grew significantly. This increase was driven by several factors, such as expansion in information and communication technology and hence cheaper telecommunications, lower transport costs, declining of tariffs and non-tariff barriers (World Bank, 2020). The period after the global crisis 2008 and collapse in trade was characterized by slowing down of GVC participation growth (period of “slowbalization”), so that the trade-based participation rate in 2020 was 44.4% which is similar rate as ten years earlier (Figure 8). Although GVC participation rates have stagnated in the period after the crisis, nominal values continued to grow (WTO, 2021).

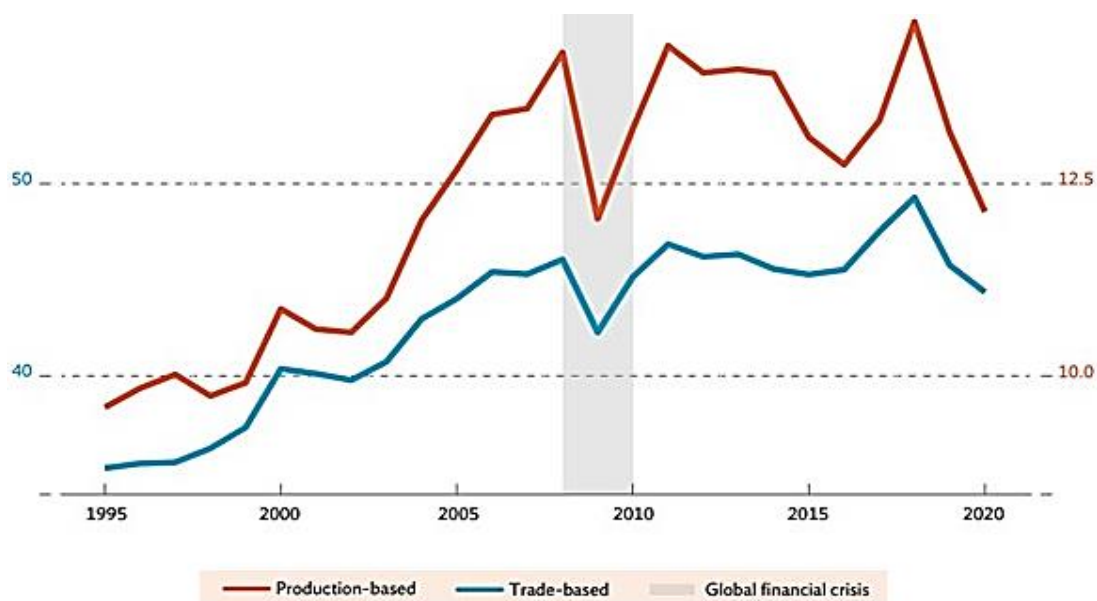


Figure 8: GVC participation rates - world trend, 1995–2020

* *Left scale:* trade based GVC participation rate (Borin A. and M. Mancini, 2019); *Right scale:* production-based GVC participation rate (Wang, Z. et al., 2017).

Source: WTO (2021).

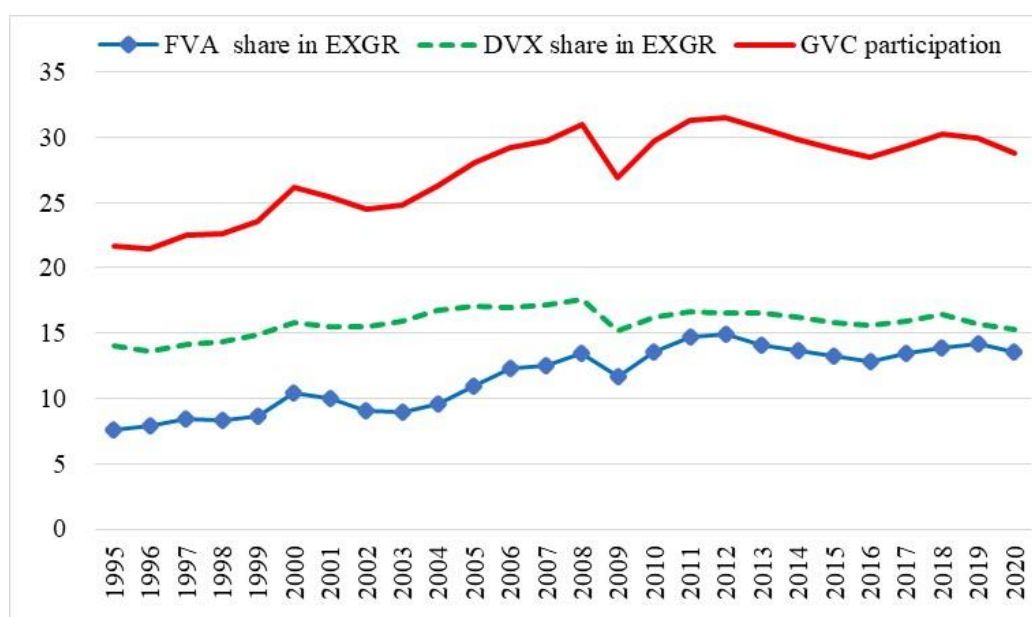
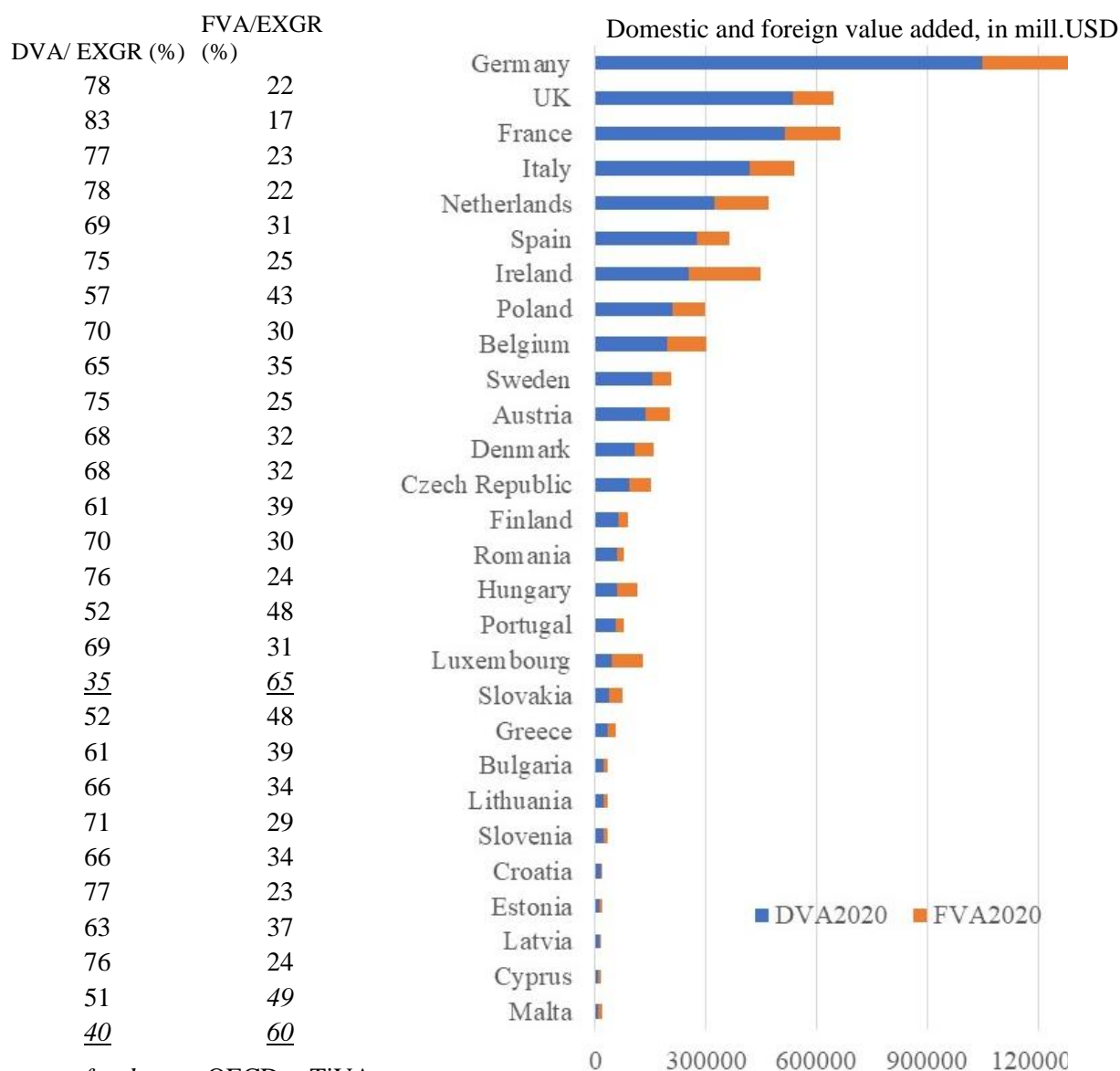


Figure 9: GVC participation rate and its components in EU28, 1995-2020 (in %)

Source: OECD TiVA database.

Comparing these world trends in GVCs with tendency in the EU28 as the most regionally integrated group of countries, GVC participation rate of this integration seems to be smaller than the world average (Figures 8 and 9). One of the reasons for that discrepancy could be the fact that OECD TiVA statistics for regions exclude intra-regional trade. This is also the case for the EU, so that all these indicators refer to the flows to non-EU28 only, i.e. intra-region value added flows (e.g. from France to Austria) are treated as domestic value added.

Regarding forward linkage (DVX/EXGR), it accounted for 14-18% in the EU28 over the period 1995-2020 (Figure 9). This component of GVC participation is larger than backward linkage during the whole observed period (FVA/EXGR varied from 8% to 15%), meaning that the EU is more integrated in supply chains of foreign (non-EU) exports than it is dependent on imported inputs. This relation between backward and forward linkage for the EU28 can also be due to the fact that these EU data refer to extra-regional flows. Namely, GVC participation of individual EU countries relies more on stronger supply linkages within EU region itself (regional contribution to GVC participation was around 75% in the whole period from 1995) than on other regions (extra-regional contribution around 25%). Contrary to some other advanced economies and emerging market economies, the EU has maintained relatively steady engagement in GVCs in the whole observed period 1995-2020 (Cigna, S. et al., 2022).



Source of data: OECD TiVA database.

Figure 10: Decomposition of gross exports in EU28, 2020

Due to the same mentioned reasons, the ranges of TiVA indicators for individual EU members are wider compared to the same indicators for the EU as a whole. The largest domestic value added share in gross exports was in Germany and the UK (78% and 83%, respectively), which is around twice larger than in Malta and Luxemburg (40% and 35%). Typically, countries with low forward linkages and high backward linkages are small open economies. Hence, the dependence of a country’s exports on imported inputs measured by FVA embodied in home country’s gross exports (backward linkage) was the highest in small EU economies such as Luxemburg (65%), Malta (60%) or Cyprus (49%), whereas the lowest was in the UK, Germany, Italy, France with the range of that share between 17-23% (Figure 10).

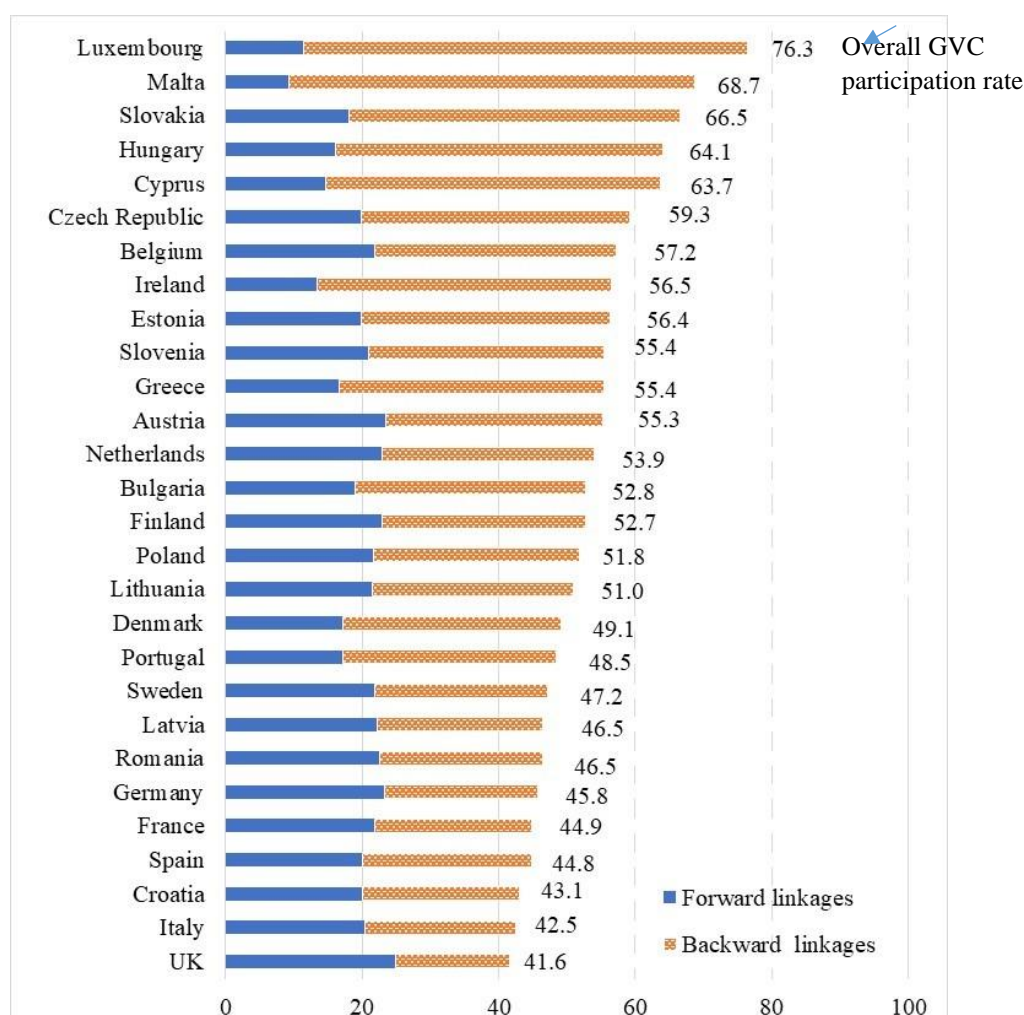


Figure 11: GVC participation rate and its components by individual EU countries, 2020 (in %)

Source: OECD TiVA database.

On the other side, forward linkage (DVX/EXGR) as indicator of the level of country’s integration in supply chains of foreign exports shows that countries like the UK, Germany, Netherlands or Austria were more integrated in supply chains of foreign exports, contrary to the lowest integrated EU economies, like Luxemburg or Malta. In addition to these results for small EU economies, it is also obvious that new EU member states, as more positioned in downstreams stages of GVCs compared to the old EU members, are more dependent on foreign inputs, i.e. their backward participation dominates over forward linkages. These results hold not only for 2020 as the year with the latest available OECD TiVA data (Figures 10 and 11), but also for the period before that year.

7. Concluding remarks

In this paper comparative analysis of TiVA indicators from two the most common used sources is conducted, as well as the analysis of recent trends across European economies based on the newest data. Although UNCTAD Eora and OECD TiVA statistics are different in methodology, accounting framework and assumptions in creating IO tables, as well as in country, time and sector coverage, the analysis shows that there is overall rather high consistency in main TiVA indicators between the two data sources. Both sources of TiVA statistics provide new insight in GVCs which is not available in conventional gross trade measures. Therefore, the use of data source for the investigation of GVCs depend on what groups of countries and period are in the focus of the analysis (for instance, Eora database should be used for countries for which OECD

TiVA data are not available). On the other hand, there are some limitations regarding estimation methods in construction IO tables which also affect the quality of TiVA estimates. In addition to this, limitations of TiVA statistics in sense of bias in estimates also arise from rather restrictive proportionality assumption and production assumptions. Finally, data from Eora and OECD TiVA statistics are not fully comparable, since the former is based on standards of 1993 SNA, whereas the later is based on 2008SNA starting from 2018. It means that interpretation of the results is affected by these changes and differences. All this also indicates that they should not be considered as substitutes, but as complementary to conventional gross trade statistics.

The second part of the analysis is based on OECD TiVA database since it contains the newest data. Two phases in GVCs dynamics (before and after global financial crisis 2008) are obvious both on global level as well as within developed European countries. The whole second sub-period, after global crisis, was characterized by slowing down and stagnation of world GVC participation rates. The latest data show that recovery in GVCs is not visible even in the recent period, that is up to 2020. In the same period, smaller GVC participation of the EU28 than world average has registered. This could be explained by the facts that indicators for the EU28 as a whole are based only on extra-regional flows (flows to non-EU28) and that individual EU member states are more integrated in GVCs by stronger supply linkages with other EU partners. The results indicate that rather high variability both in forward and backward GVC participation rates are obvious within the EU28 in the whole period 1995-2020, distinguishing between small open economies and new EU member states on one side, and core EU members on the other side. Many factors have determined the GVC participation dynamics, like the size of economy, trade openness, distance between economies, level of specialization within supply chains (at the beginning or the end of the chain) and so on. The latest researches give some additional insights in further slowing down in GVCs due to Covid-19, which has additionally caused slowing down in input demand, reduction in production of components by countries (except food sector, medical suppliers and IT sector where GVCs remained resistant). Since Covid 19 has deepened the question on the risk of GVCs, the debate about GVCs vs. growing protectionism has arisen in the post-Covid period, that is weather to save the costs and time or to reduce the risk of some new shocks and crisis. All this mentioned here requires additional and another kind of analysis of main driving forces of GVC participation, as well as careful interpretation of obtained results.

References

- Aslam A., Novta, N. and F. Rodrigues-Bastos (2017). Calculating Trade in Value Added. IMF Working Paper, WP 17/178, International Monetary Fund.
- Baldwin, R. and T. Ito (2021). The Smile Curve: Evolving Sources of Value-Added in Manufacturing. Canadian Journal of Economic/Revue Canadienne d'Economie, Volume 54, Issue 4, pp. 1455-1880.
- Borin, A. and M. Mancini (2019). Measuring What Matters in Global Value Chains and Value-Added Trade. Policy Research Working Paper, No. 8804. World Bank, Washington, DC.
- Borin, A., Mancini M. and D. Taglioni (2021). Measuring Exposure to Risk in Global Value Chains. Policy Research Working Paper, No. 9785. World Bank, Washington, DC.
- Casella, B., Bolwijn, R., Moran, D. and Kanemoto, K. (2019). Improving the analysis of global value chains: the UNCTAD-Eora Database. Transnational Corporations Journal, Volume 26, No. 3, pp. 115-142.
- Cigna, S., Gunnella, V. and L. Quaglietti (2022). Global value chains: measurement, trends and drivers, Occasional Paper Series, No 289, European Central Bank.

- Koopman, R., Powers, W., Wang, Z. and S. Wei (2010). Give credit where credit is due: tracing value added in global production chains. NBER Working Paper No. 16426.
- Koopman, R., Wang, Z. and S. Wei (2014). Tracing Value-Added and Double Counting in Gross Exports. *American Economic Review*, Volume 104, No. 2, pp. 459-494.
- Lee, M., Zagdanski, J., Spencer, J. and G. Hay (2020). Research on Trade in Value Added, Department for international trade, Research report, Cambridge UK.
- Lenzen, M., Moran, D., Kanemoto, K. and A. Geschke (2013). Building EORA: A global multi-region input-output database at high country and sector resolution, *Economic Systems Research*, Volume 25, Issue 1, pp. 20-49.
- OECD (2022). Guide to OECD Trade in Value Added (TiVA) Indicators, 2022 edition, OECD, Directorate for Science, Technology and Innovation.
- UNCTAD (2013). Global Value Chains and Development: Investment and Value Added Trade in the Global Economy. Advance Unedited Version.
- Wang, Z., Wei, S. and Zhu, K. (2017). Characterizing Global Value Chains: Production Length and Upstreamness. NBER Working Paper Series, 23261.
- World Bank (2020). Trading for Development in the Age of Global Value Chains. World Development Report 2020, International Bank for Reconstruction and Development / The World Bank.
- WTO (2021). Global value chain Development report 2021: Beyond Production, the World Trade Organization.
- WTO (2021a). World Trade Statistical Review 2021, the World Trade Organization.