TRADE SHIFTS WITHIN GLOBAL VALUE CHAINS EU-USA-ASIA

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Abstract

Nowadays international trade patterns are continually changing, that either creates or eliminates global imbalances and thereby affects the welfare of entire countries. The purpose of this study was to identify and assess, based on of theories of international trade (on the example of Heckscher-Ohlin theory), shifts in international trade between developed and developing countries, using the concept of value added in the triangle the EU-US-Asia (China-Vietnam). Specifically, in the research, we assessed the participation of these countries in the Global Value Chains (GVC) and analyzed influencing factors, which are in our opinion FDI and R&D spending. To find out, which countries actually benefit from an international trade we examined such indicator as Domestic Value Added (DVA) in exports. The result of this study has confirmed that the Heckscher-Ohlin theory is still applicable to modern trade international patterns. On the other hand, the result of our calculations did not identify any substantial shift in trade within EU-US-Asia triangle, although there were some minor changes in trade patterns of these countries. Moreover, according to the DVA in exports indicator, the USA and the EU benefited from trade more than China or Vietnam.

Keywords: Global value chains, shifts of international trade, Intra/Inter-industry trade, developed countries, developing countries

INTRODUCTION

The current formation of Global Value Chains (GVC) occurs under a number of factors, including technical progress, institutional complications, "spaghetti bowl", exhaustion of natural resources, the emergence of new productions, rules of origin and many others. Providers of structural shifts of international trade within the national economies are primarily the Multinational Enterprises (MNE). The presence of the MNE determines the country's participation in the GVC, and the associated offshore and onshore processes of goods and services produced as the result of current global trends. In the triangle of the EU-US-Asia(China, Vietnam) economic actors, the participation of countries in the GVC is different depending on their level of economic and technological development, participation in the division of labour, state economy, innovation policy, including taxes, and many other domains, so there will be different structural shifts in the trade in goods between them. In our opinion, the key indicators of participation are Research & Development (R&D) costs and participation in the division of labour, which was analysed through Foreign Direct Investment (FDI) indicators. A special role in these processes belongs to the political processes and the emergence of Industry 4.0. In fact, structural shifts in a trade reflect the qualitative changes in the GVC itself.

Our article based on works of Heckscher (1919), Cooper and Srinivasan (1995) with their analysis of the causes and consequences of shifts in international trade, Grubel and Lloyd (1971). The peculiarities of the formation of GVC were relatively recently reviewed by Miroudot, Rouzet and Spinelli (2013), modelling international firm migration was discussed by Baldwin and Okubo (2014) and mutual measurement value in GVC was made by Banga (2013).The relationship between trade and FDI can be found in scientific works of Liu and Greham (1998), Muresan (2011).

Structural shifts in intra-industry and inter-industry trade occur regularly; of particular interest is the change in the structure of value added (VA) trade between countries over a long period, for example 10 or more years, because this period is enough for shifts in trade to occur. As is known, international trade in terms of differentiation of the product range consists of two streams: inter-industry and intra-industry trade.

According to the Heckscher-Ohlin theory, inter-industry trade reflects the comparative advantages of countries in the production of goods, develops in conditions of varying availability of production factors, as a result of which incomes for relatively abundant production factors increase and decrease for relatively insufficient ones. Trade is carried out, as a rule, between developed countries and developing countries, mainly with finished products and homogeneous goods between large industries (Blaug, 1992). Our hypothesis about modern shifts in international trade is considered in the context of trade between developed and developing

countries, and we search for empirical evidence of the Heckscher-Ohlin theory in the triangle of the EU-US-Asia (China, Vietnam).

Intra-industry trade, on the contrary, is carried out, as a rule, between developed countries or countries of approximately the same size and level of economic development. Countries trade with parts, components of products, and differentiated industrial goods. It is believed that the more countries are similar in the provision of resources and technologies, the greater is the share of intra-industry trade between them (Heckscher, 1919). Our particular interest lies in the analyzing of the dynamics of economies for last 10 years since trade theories are not supposed to come into action in a short-run. In addition, it is known that intra-industry trade creates additional benefits for the country compared to inter-industry trade due to the growth of economies of scale, which contributes to improving of the efficiency of the country's economy. Grubel and Lloyd (1971) are considered to be pioneers in the development of the theory of intra-industry trade.

To assess the structural changes in trade in the EU-USA-ASIA (China, Vietnam) triangle, we analyzed inter-industry and intra-industry trade between the selected countries for the period 2006-2016. Such period was selected because it comprises all phases of economic cycle and so is reliable, although the ending point was determined by an insufficiency of data for latest 2017 and 2018 years. As Black, Hashimzade and Myles (2017) state, intra-industry trade can be described as trade, where goods of the same classification are both imported and exported; Inter-industry trade is, on the contrary, trade between countries where exports and imports consist of different types of goods. In addition, we will try to analyze the impact of R&D and FDI on shifts in international trade in the EU-USA-ASIA (China, Vietnam) triangle.

OECD (2015) notes that Research and Development spending can be defined as expenditures, either current or capital, on creative work undertaken regularly to increase some kind of knowledge (including knowledge of culture and society), and the use of knowledge for new possible applications. R&D covers basic research, applied research, and experimental development.

Since the development of innovative production increases the competitiveness of products, we believe that investment in research and development has a significant impact on the trade of any state. Innovative production (in particular Industry 4.0) not only leads to an increase in productivity, i.e. quantitative changes, but also to changes in the quality of production in general, which allows competing with foreign producers for value added in the GVC.

In general, it can be noticed that FDI enable TNC to expand all over the globe. FDI are defined by the UNCTAD (2001, p. 275) as "the investment which involve a long-term

relationship that reflects the interests of an entity resident in an entity resident in another country than its investor, the direct investor's role is to exert a significant degree of influence over the management of the enterprise resident in another economy". The minimum percentage of control accepted by most countries is 10-25% (10% U.S., 20% France and Britain, 25% Germany). Vice versa, TNCs are often a vehicle for FDI (Sârbu, 2014).

According to Muresan (2011), nowadays, foreign direct investments have a form of transfers of modern technology (including machinery and equipment) and precise technical documents, flows of know-how (technical and managerial assistance) as well as creating new work places, that applies especially for FDI of transnational companies. All the above-mentioned make the direct foreign investments advantageous for both investing countries and recipient countries.

According to Graham and Liu (1998), FDI can be an export substitute, which makes it possible to save on transportation and other expenses; FDI can be complementary to exports - when MNE production operations in the donor country are vertically linked to operations in the host country. Since the semi-finished products are part of the value added in the final product, it means that in the long term, FDI are a substitute for the export of the donor country, at least for the value added in its exports.

An analysis of the relationship between FDI and exports (namely, the value added in it) will be given below. As for FDI in the context of Global Value Chains, it worth answering the question how does the presence of MNEs affect countries' GVC participation. For example, UNCTAD is of the opinion that the involvement of MNEs in generating value added trade is confirmed by the statistical relationship between FDI stock in countries and their GVC participation rates. The correlation is strongly positive, and increasingly so over time, especially in the poorest countries, indicating that FDI may be an important avenue for developing countries to gain access to GVCs and grow their participation. The best development outcome may result from increasing GVC participation and upgrading along GVCs at the same time (UNCTAD, 2013). Thus, globalization motivates companies to restructure their operations at the international level through outsourcing and offshoring activities (OECD, 2017).

Following Banga (2013), a global value chain can be simply understood as the sequence of all functional activities required in the process of value creation involving more than one country. GVC for a particular product may therefore not only span over countries but also span across different industry.

The country's participation in the GVC directly determines the structure of its foreign trade, as well as the benefits that the country receives from trade with other countries. In addition, there are a number of reasons why issues of active participation in the GVC are of

great importance and thus discussed in this article: GVCs are the cause of the "double counting" in world trade figures. This creates a discrepancy in statistics and can be misleading for the researcher.

As calculated by UNCTAD, about 28% of gross exports consist of value added, which countries import only to make from it a part of their future exports. This way, almost 5 trillion US dollars out of 19 trillion US dollars of global gross exports (for example, in 2010) are actually counted twice (UNCTAD, 2013). To avoid this problem in assessing structural shifts in trade, we will use forward and backward indices, which will be discussed below.

Traditional trade data does not tell the whole story, as the OECD members Miroudot, Rouzet and Spinelli (2013) report. Economic growth and employment are also affected by GVC. Trade flows in the context of value added indicate where jobs are created and highlight the benefits of trade for all countries involved in the value chain. Understanding the interdependencies within the GVC framework is important for explaining the competitiveness of countries, so that productivity gains can be achieved.

Ignoring GVC creates global imbalances. The total trade balance of the country with the rest of the world is the same, regardless of whether they are measured by gross indicators or methods based on value added are used. However, the measurement of bilateral trade flows based on gross indices can create a misleading picture of who ultimately benefits from trade. In addition, this method exaggerates the importance of production in a country that is at the end of the value chain (OECD-WTO, 2012; Koopman, Powers, Wang, & Wei, 2010).

It is believed that exports have a positive effect on the economy of states, in particular, on their balance of payments, but the real benefits from exports can only be determined by studying it in the context of the domestic value added (DVA), since it shows how much of the export actually "belongs" to the state, and is not just a marginally processed import.

United Nations Conference on Trade and Development, (2013) in its World investment report defines domestic value added as the part of exports created in the country. It is the part of the country's exports that contributes to GDP of this country. The sum of foreign and domestic value added is equal to gross exports. As a share of GDP, domestic value added measures the extent to which trade contributes to the GDP of a country.

RESEARCH METHODS

Structural shifts, as mentioned above, must be observed through the prism of the division of trade into an intra-industry trade and inter-industry trade. To determine the level of intra-industry trade between selected countries, we used the Grubel-Lloyd index. Since, in our opinion, it

makes it possible to most accurately assess the intra-industry trade in a specific product and is calculated by the Grubel and Lloyd (1971) formula:

$$I_{G-L} = 1 - \frac{\sum_{i=1}^{n}|X_i - M_i|}{\sum_{i=1}^{n}(X_i + M_i)} \qquad (1)$$

Where,

Xi = export of goods *i; Mi* = import of goods *i.*

The closer the index value to 1, the greater the level of intra-industry trade in the analyzed goods item. Structural shifts in intra-industry trade were assessed using the arithmetic average indices of each goods item (we used the classification of goods according to the Harmonized System 4 digital level) as well as with the help of weighted average indices, which takes into account the specific weight of each goods item.

We used this index in order to assess the real extent of structural shifts in intra-industry trade. Neglecting of the specific weight would lead to the situation when the change in the goods item with insignificant volumes of trade would have the same effect as the most traded good. Consequently, this would distort the real picture of the structure of trade between the selected countries.

Our paper includes two groups of countries in framework concept core-periphery; according to the UN DESA (2014) and Fredriksson (2009), the major country groupings follow the next classification: *Developed countries* (the EU and the USA - developed economies with high-income level) and *Developing economies* (China - developing economy in Asia with upper-middle income and Vietnam - developing economy in Asia with lower-middle income).

EMPIRICAL EVALUATION

Our investigation covers more than 33 thousands observations and 10-year period. Considering, for the selected period from 2006 to 2016, factors affecting the formation of GVC, which are trade, FDI, R&D in the EU-USA-ASIA (China, Vietnam) triangle.

During 2017, the EU exported and imported almost 2.3 trillion dollars both which makes it world largest merchandise exporter and importer (European Commission, 2018). Though the data may vary from source to source, there is no doubt that the EU counts for a great deal of world trade.

China, being the largest exporter of goods to the EU (in 2016, it accounted for more than 20% of all EU imports, compared with 14% in 2006), has a positive trend in trade volumes except for the decline that occurred during the global economic crisis of 2008. In general, over

the selected period, the volume of imports from China increased more than 1.5 times, exceeding in 2017 the mark of 350 billion euros. However, due to a steady increase in exports to China, the total trade balance of the EU with China fluctuated around minus 150 billion euros (European Commission, 2018).

The United States, in turn, is the largest importer of the EU goods. Their share in total EU exports ranged from 23.2% to 16.7%. Both exports to the United States and imports from it tended to increase, with the exception of 2009. There was also a drop in trade between the US and the EU as a result of the suspension of negotiations on the Transatlantic Trade and Investment Partnership.

The most significant changes were observed in the EU trade with Vietnam. The share of Vietnam in the EU total imports over the selected period increased almost 4 times, while the share in total exports more than 2 times. The 2008 crisis did not significantly affect the trade of these two countries (European Commission, 2018).

As mentioned above, R&D investments have a significant impact on country trade. That is why they were chosen as a variable in the analysis of structural shifts in the EU trade. The EU has high spending on R&D and since 2006 it has increased by almost 100 billion euros from 216 to 301 billion figure in 2015, which was 2% of the EU GDP.

The United States spends more on R&D than any other country. In 2015, more than 450 billion euros were invested in R&D, which is almost 2.8% of GDP, with only 281 billion euros in 2006.

The most notable changes have undergone with indicators of spending on research and development in China. While in 2006 China's domestic spending on research and development amounted to 30 billion euros (1.37% of GDP), in 2015 it reached 203 billion euros, that is 2.07% of GDP. Moreover, China was already ahead of the EU by ratio of research and development spending to GDP in 2015.

Such a rapid increase in investment in R&D may have been influenced by the fact that China's Global Competitiveness Index in 2008 was 4.7 out of 7, and in 2017 it was already 5.0.

We had to deal with problem of collecting full data. Data for Vietnam is available only for 2011 and 2013, and for this period, R & D expenditures grew from 0.19% of GDP to 0.37%, that is, almost doubled (UNESCO, 2018).

Direct investments to the EU reached a maximum in the run-up to the global economic crisis and in 2007 amounted to almost 830 billion dollars. Then there was a sharp decline in the level of the EU FDI down to the USA level (by almost 60% in 1 year) and at the time of the crisis, their figures were approximately the same and equal to $ 318 billion. Subsequently, the FDI inflow to the EU was partially resumed and, until 2015, ranged from 340 to 430 without

drastic changes. Meanwhile, in the United States, FDI inflows fell to $ 150 billion after the crisis and did not rise above 240 billion until 2015 (OECD, 2018).

In 2015, there was a sharp increase in the inflow of FDI to developed countries, in particular, to the EU and the USA (from 253 to 520 billion dollars to the EU and from 212 to 477 to the USA, which means that it more than doubled). It was an absolute record of FDI inflows to the United States, while in the EU a similar level of FDI inflows was observed only before the global financial crisis. According to the WORLD INVESTMENT REPORT 2016 (UNCTAD, 2016), the main factors contributing to such a sharp increase in FDI inflows to developed countries were cross-border mergers and acquisitions (M&A).The same was in China, where was a steady increase in FDI inflows up to 2014, from 125 billion in 2006 to 290 billion dollars in 2013, i.e. more than 2.3 times. The global economic crisis did not adversely affect FDI inflows to China.

Actively developing country with a huge amount of cheap labor, China was a popular destination for the transfer of the production of large MNEs and for foreign investment. However, beginning from 2014, the volume of foreign investment to this country began to fall and declined to 170 billion dollars in 2016, which is more than by 40% in three years (UNCTAD, 2016).

One of the possible reasons for the above changes in global FDI flows in 2014 and later on was the so-called "onshore" process. The use of industry 4.0, lights-out manufacturing, rise of labour costs in China as well as in several other developing countries, and some other factors led to the fact that a part of production capacity is coming back from the recipient countries of capital to donor countries, i.e. to developed countries in particular the EU and the USA.

However, according to UNCTAD, China and other developing countries remain the most promising destinations for FDI inflows. This is facilitated, in particular, by the free trade zone, as well as by liberal economic reforms. For example, Boeing began construction of its new assembly plant in China in 2017, which is the first such project outside the United States.

On the other hand, there is an increase in FDI outflow from China to developed countries. Chinese MNEs make cross-border M&A choosing corporations from the US and the EU countries as "victims" (UNCTAD, 2016).

In Vietnam, which at this stage represents a kind of "former China," FDI inflows steadily increased throughout the given period - from 2.4 billion US dollars in 2006 to 12.6 billion US dollars in 2016. Due to the emergence of MNEs this country is becoming a major centre for electronics manufacturing in the Asian region. After creating a number of manufacturing facilities, Samsung already produces more mobile phones in Vietnam than in China(UNCTAD, 2016).

Moreover, UNCTAD (2013) in its Global Value Chains and Development report states, that there is a correlation between presence of MNEs in a particular country and its involvement in GVC. The confirmation of this lies in the relationship between FDI inflow and GVC participation rates of the country. This correlation is highly positive and tends to increase over time (particularly in less developed countries), so FDI is the possible way through which developing countries could get an access to GVC and expand their participation in world trade.
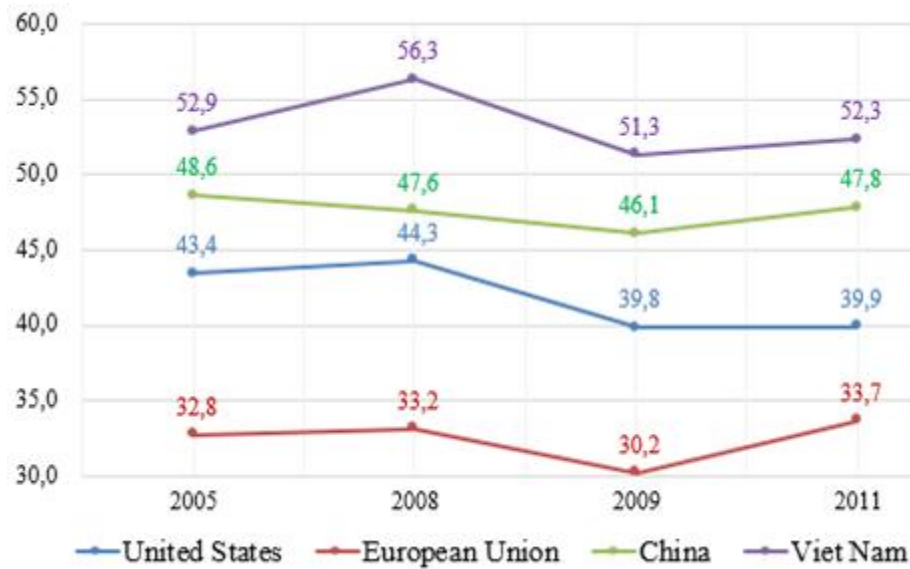

Figure 1. Global Value Chains indicators. Participation index, total (2005-2011).
Source: (OECD Stat, 2018)

Moving on to GVC, first of all general GVC participation should be examined. Differentiation of participation in GVCs by countries is illustrated in Figure 1.

The US forward participation index dropped significantly from 31.7 points to 24.9 in 2005 and 2011 respectively. That means that the value added of the United States in exports of the rest of the world fell by 20%. On the other hand, the United States backward participation index increased, reaching 15 points in 2011. This means that the share of foreign value added (FVA) increased in the US exports. The overall index of activity of participation in GVC decreased to 39.9 during the given period, while its qualitative characteristics slightly deteriorated - the share of the US value added in GVC decreased. However, the USA remains the country with the largest share of domestic value added in exports among the selected.

In the EU similar trends can be observed: the forward participation index declined over the selected period by 0.5 points, reaching 19.4, and the backward participation index grew from 12.6 to 14.3. As we can see, in general, the activity of the EU participation in GVC increased by almost 1 point, but only due to the growth in share of foreign value added in its imports, while the added value of the EU in exports of other countries fell.

Table 1. GVC Participation index: forward and backward (2005-2011)

Country\Year	Participationindex, forward				Participationindex, backward			
	United States	European Union	China	VietNam	United States	European Union	China	VietNam
2005	31,7	20,1	12,2	17,8	11,7	12,6	36,4	35,0
2008	29,7	19,1	14,4	16,5	14,6	14,1	33,3	39,8
2009	28,5	17,8	13,4	14,7	11,3	12,5	32,6	36,6
2011	24,9	19,4	15,6	16,0	15,0	14,3	32,2	36,3

Source: (OECD Stat, 2018)

China, in turn, increased its forward participation index from 12.2 in 2005 to 15.6 in 2011. In contrast to that, over the selected period, the share of foreign value added in China's exports (which is backward participation index) decreased by 4.2 points and reached 32.2. Nevertheless, such numbers are still quite high. The participation activity of China in the GVC did not change much, but its qualitative structure undergone significant changes in favor of China domestic value added.

In Vietnam the backward participation index was extremely high (within 35-40 points) during the selected period. Despite the decrease in the forward participation index from 17.8 to 16, Vietnam remains the most actively participating in the GVC country - its participation index was 52.3 points in 2011. We can assume that Vietnam was gradually turning to some kind of "assembly shop", which used to be a function of China, with a minimum domestic value added and a huge GVC participation index.

For a deeper analysis of GVC participation, we examined the value added in exports of countries (in particular, origin of value added).
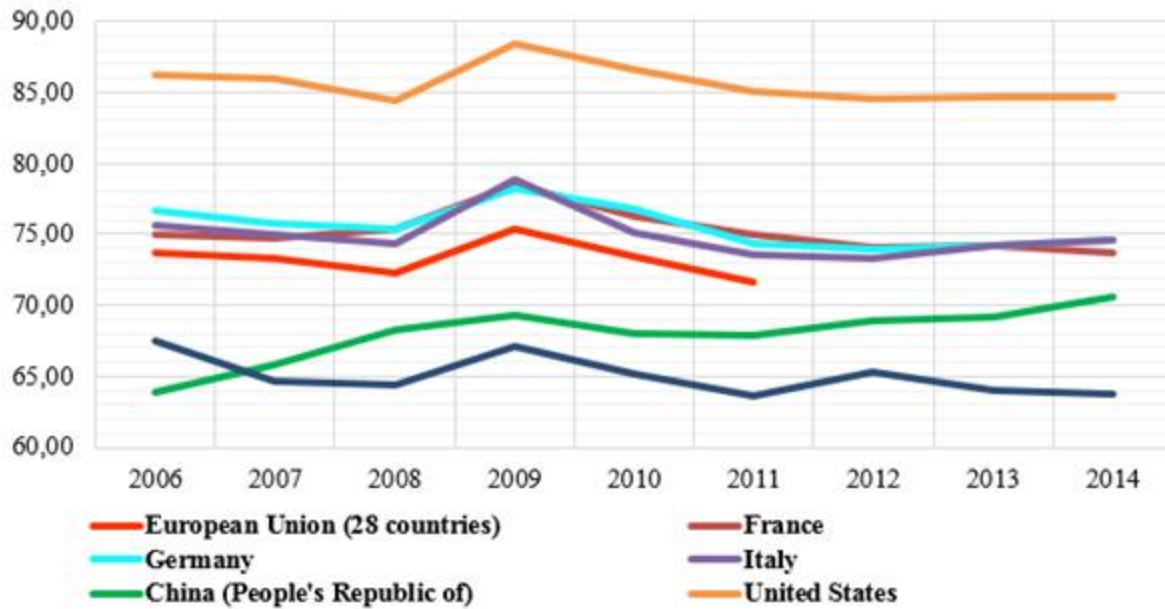
Figure 2. Domestic value added in gross exports 2006-2014, per cent

Source: (OECD Data, 2018)

It can be derived from the data presented in the Figure 2 (Appendix A) that there are certain general trends in the domestic value added in export rate of the selected countries for the period 2006-2014:

- The EU (in particular Germany, France and Italy as representative states) was gradually losing its value added in exports, just as the USA did. Nevertheless, it still had a fairly high level of domestic value added in exports (74-84%).

- Despite the fact that in 2006 Vietnam exports had a greater share of domestic value added (67.5%) than China, in 2014 Vietnam fell behind China by this indicator with a gap of almost 7%. Vietnam DVA in exports in 2014 was the lowest among the selected countries and did not have any upward trends.

- In China there was a stable uptrend - the share of domestic value added in exports grew even during the world crisis period. Over the given period and of time and among the selected countries this indicator increased only in China. With such trend being stable, the share of China domestic value added in exports will exceed the share of the EU DVA in exports soon (unless it has already exceeded it). Moreover, everything seems to suggest that this trend will continue and could even intensify more in the future.

In fact, Chinese domestic corporations are already capturing a growing market share and are moving up the value chain in such highly competitive manufacturing sectors as the chemical industry, electronics, the auto industry and aircraft manufacturing (UN DESA, 2014).

For a more detailed analysis of the domestic value added and participation in GVCs, it is necessary to refer to the data of summary table 2, reflecting the origin of foreign value added in the export of the selected countries.

Table 2. Origin of Value Added in gross exports of the EU - Foreign value added (2006-2011)

Country\ Year	US Dollar, Millions			Per cent of gross FVA in export		
	United States	China	VietNam	United States	China	VietNam
2006	50 106	16 985	409	20,21%	6,85%	0,17%
2007	58 254	23 838	534	19,94%	8,16%	0,18%
2008	65 547	31 355	654	18,21%	8,71%	0,18%
2009	56 392	22 962	571	22,18%	9,03%	0,22%
2010	63 079	31 266	680	19,60%	9,71%	0,21%
2011	74 203	38 235	982	18,24%	9,40%	0,24%

Source: Authors' calculations based on (European Commission, 2018; OECD Stat, 2018)

During 2006-2011 period, the share of the US value added in FVA of the EU exports fell by almost 2% (to 18.24% in 2011m), but still remains the largest among all other countries which contributed their VA to the EU exports. Conversely, the share of China's VA increased and in 2011 amounted to 9.4% of the EU FVA. Value added of Vietnam in the EU FVA increased by almost 40%, but still was very insignificant in absolute terms.

The United States, in turn, also replaced part of the VA from the EU in the US export structure by imports from other (possibly developing) countries, and the EU share in foreign value added of the USA fell from 23.9% in 2006 to 19.7% in 2011 (Table 3.). Despite such a downtrend, the EU remained the main source of VA in foreign VA in the US exports.

Table 3. The EU Value Added in gross export of countries (2006-2011)

	Year\Country	2006	2007	2008	2009	2010	2011
US Dollar, Millions	United States	44 629	51 657	58 065	39 647	46 824	56 369
	China	64 010	77 811	87 557	71 608	86 177	108 123
	VietNam	1 517	2 183	2 461	2 463	2 937	3 654
Per cent of gross FVA in export	United States	23,9%	23,9%	21,9%	23,5%	20,8%	19,7%
	China	17,3%	18,0%	18,4%	18,2%	16,4%	17,1%
	VietNam	10,60%	11,66%	10,44%	12,08%	11,26%	10,53%

Source: (European Commission, 2018; OECD Stat, 2018)

The share of the EU VA in China FVA remained approximately unchanged, fluctuating between 17 and 18% (Table 3.). That means that semi-finished goods from the EU constituted a significant part of China exports. In absolute terms, in 2006 China exported $ 64 billion of the EU value added, while in 2011 the figure was $ 108 billion, that is 70% more.

A similar situation occurred in Vietnam, where 1.5 billion USD of the EU value added was exported in 2006, and this figure increased 2.4 times in 2011. However, the EU share in Vietnam FVA fluctuated from 10.6% in 2006 to 12% in 2009, and then back to 10.5% in 2011.

Below, there is an analysis of the ratio between value added in exports and gross imports (Appendix B). We consider it important, as it shows what part of the import from a particular country goes to domestic consumption (it is the case for the final products), and what part is later processed and exported as FVA (semi-finished goods).

There was a downtrend in the EU using the US imports for a domestic consumption and the share of semi-finished goods used for further processing and export grew. Furthermore, the United States, which previously exported only 13.4% of imports from the EU, in 2011 increased this figure to 17.1%.

In addition to the finished products, China began to export semi-finished goods to the EU, and it is most likely these are complex products with a high value added. A growing number of Chinese consumers can afford to acquire and consume expensive and high-quality European goods and, on the other hand, there was an active import substitution of European semi-finished goods.

Vietnam also began to export more semi-finished products to the EU. In Vietnam the share of European import, which was further exported, fluctuated from 48% to 58%. In general, there was a downward tendency of domestic consumption of expensive European imports, which did not exceed 52% over the selected period.

DISCUSSION

All goods items were classified in accordance with the graduation based on change of their Grubel-Lloyd index in absolute value for the given period:

● If the index of intra-industry trade changed by more than 0.3 points, then the product falls under the "Big changes" group and there was a significant shift in bilateral trade;

● If the index changed by less 0.3 points, but more than 0.15, then the product falls under the group "Visible changes" and there was a partial shift in bilateral trade;

● If the index changed by less than 0.15 points, but by more than 0.05, then the product falls under the group "Minor changes" and there was insignificant shift in bilateral trade;

● If the index changed by less than 0.05 points, then the product falls under "No changes" group and the shift in bilateral trade did not happen.

All calculated data was summarized in the table 4 as followed:

Table 4. Ranking of all goods items based on change of their Grubel-Lloyd
Index in absolute value for the period 2006-2016

Index change	Number of goods items		
	USA	China	Vietnam
0,3-0,99	339	333	253
0,15-0,3	321	241	131
0,05-0,15	379	337	180
0-0,05	468	577	827

Source: Authors' calculations based on (European Commission, 2018; OECD Stat, 2018)

EU – US bilateral trade

It can be derived from the table that there is a relatively high level of intra-industry trade between the US and the EU. However, during the given period, inter-industry trade increased from 0.58 to 0.603 point. At the same time, for all goods items the Grubel-Lloyd index changed by 0.19 on average in absolute value for the selected period. Table 5 presents the result of our calculations.

Table 5. Grubel-Lloyd index of EU –US bilateral trade and its change
during 2006-2016 period calculated by two methods

Arithmetic mean method			Weighted average method		
2006	2016	Δ	2006	2016	Δ
0,420	0,397	0,190	0,621	0,602	0,146

Source: Authors' calculations based on (European Commission, 2018; OECD Stat, 2018)

If the specific weight of goods items in the total volume of exports and imports is taken into account, then the average index of intra-industry trade was 0.621 points in 2006 and 0.602 in 2016. That means that the real level of intra-industry trade between the US and the EU is much higher than the average indicators show. Moreover, if specific weights are considered, then the Grubel-Lloyd index changed in all commodity goods by 0.146 in absolute value for the selected period, which means the real shift in trade was less than the average one.

The highest weighted index of intra-industry trade was observed in goods item 3004 – Medicaments, with the Grubel-Lloyd index of 0.63 points and foreign trade turnover of almost 45 billion euros in 2016.

Approximately a third of all goods items, which is 468 units, did not change over the selected period from the perspective of industry trade. At the same time, 378 items underwent some minor changes, 321 items incurred noticeable changes and in 339 goods items the index of intra-industry trade changed by more than 0.3 in absolute value. A change in the non-weighted average index by more than 0.95 was observed in the following goods items:

● 5305 - Coconut;

● 0703 - Onions.

These non-weighted changes are extremely insignificant on the overall EU-US bilateral trade scale and so were given as an example. From now on, in order to reflect trends in trade more accurately, only changes in the weighted index will be considered, as they are less likely to be accidental and statistically unreliable.

With due consideration of the specific weight, the most significant changes in intra-industry trade occurred in the following goods items:

• 2710 - Petroleum oils and oils;

• 8802 - Powered aircraft vehicles;

• 8411 - Turbojets, turbo propeller turbines.

The intra-industry indicator of petroleum oils trade went up from 0.23 in 2006 to 0.78 in 2016 due to the dramatic increase in the EU import of that commodity while export to the US did not grow that much, which significantly levelled off excess of the EU export to the US over imports from it. For the remaining two goods items, there was a decrease in intra-industry trade, when the EU import from the US grew a lot while export was approximately the same. For example, value of import of 8411 item increased from 10 billion euros to 24 billion.

In general, it can be concluded that bilateral trade between such developed regions as the EU and the USA is primarily intra-industry, which corresponds to existing theories of intra-industry trade. However, over the selected period, the level of inter-industry trade had a tendency to increase, which can be explained by the partial refocusing of exports and imports of technology intensive goods to relatively new players in the global market - developing countries of Asia.

This example confirms the theory of intra-industry trade, however there are some exceptions and structural changes in trade between the US and the EU. The possible reasons for that will be discussed later.

EU – China bilateral trade

According to our calculations, there is a prevalence of inter-industry trade between the EU and China (during entire selected period it was 0.7 points or more on average). The index of intra-industry trade for all goods items accounted to 0.263 in 2006 and increased to 0.276 in 2016. There was a change by 0,179 points on average in absolute value, which is approximately the same as in the EU trade with the United States. Table 6 presents the result of our calculations.

Table 6. Grubel-Lloyd index of EU –China bilateral trade and its change

during 2006-2016 period calculated by two methods

Arithmetic mean method			Weighted average method		
2006	2016	Δ	2006	2016	Δ
0,263	0,276	0,179	0,257	0,274	0,123

Source: Authors' calculations based on (European Commission, 2018; OECD Stat, 2018)

If the specific weight of goods items in the total volume of exports and imports is taken into account, then the average index of intra-industry trade was 0.257 in 2006 and 0.274 in 2016.

The highest weighted index of intra-industry trade was observed in goods item 8708 - Automobiles; parts and accessories, with the Grubel-Lloyd index of 0.51 points and foreign trade turnover of almost 13 billion euro in 2016.

More than a third of all goods items - 577 out of 1486 units - did not change over the selected period from the perspective of industry trade. At the same time, 337 positions underwent some minor changes, 241 items incurred noticeable changes and in 333 goods items the index of intra-industry trade changed by more than 0.3 in absolute value.

Taking into account the specific weight, the most significant and significant changes in intra-industry trade occurred with the following commodity items:

- 8517 - Telephone sets;
- 8703 –Motor cars and other vehicles;
- 8543 - Electrical machines and apparatus.

For all three goods positions, the index of intra-industry trade declined during thegiven period. Export of telephones to China from the EU decreased almost three times, with consistently high import. On the contrary, import of cars from China declined, and export of cars to China was approximately constant high.

Imports of electrical machines and apparatuses from China to the EU rose almost 5.6 times over the given period and reached a peak at 2.7 billion euros in 2016. Exports to China also increased, but not that much(approximately two times). This led to a significant drop in intra-industry trade level for this goods item with its Grubel-Lloyd index plunged from 0.83 in 2006 to 0.35 in 2016, which is nearly 0.5 points.

In general, it can be concluded that bilateral trade between the developed EU and developing China is primarily inter-industry, which confirms the Heckscher-Ohlin theory. However, over the selected period, the level of inter-industry trade had a tendency to decrease and the possible of it can lie in China technological level, which is getting closer to developed countries. For example, exports from China to the EU of electrical machines and apparatus (technology intensive goods)grew few times.

EU – Vietnam bilateral trade

As can be seen from the table, there is an overwhelming dominance of inter-industry trade between the EU and Vietnam with more than 0.8 points on average during the entire given period. The index of intra-industry trade for all goods items accounted to 0,116 in 2006 and increased to 0,156 in 2016. There was a change by 0,145 points on average in absolute value that is less than in the EU trade with the United States or China. Table 7 presents the result of our calculations.

Table 7. Grubel-Lloyd index of EU –Vietnam bilateral trade and its change
during 2006-2016 period calculated by two methods

Arithmetic mean method			Weighted average method		
2006	2016	Δ	2006	2016	Δ
0,116	0,156	0,142	0,148	0,088	0,151

Source: Authors' calculations based on (European Commission, 2018; OECD Stat, 2018)

If the specific weight of goods items in the total volume of exports and imports is taken into account, then the average index of intra-industry trade was 0,148 in 2006 and 0,088 in 2016. Therefore, the actual level of intra-industry trade between Vietnam and the EU differs significantly from the arithmetic mean figures. It can be concluded that, even though there was an increase of intra-industry trade index in the majority of goods items, it was not the case for the items with the largest trade volumes. More than that, if specific weights are considered, then the Grubel-Lloyd index changed in all commodity items by 0.151 in absolute value for the selected period, which means the real shift in trade was slightly more than the average one.

The highest weighted index of intra-industry trade was observed in goods item 8517 - Telephone sets, with the Grubel-Lloyd index as little as 0,11 points but with foreign trade turnover of almost 11.3 billion euro in 2016. The second place (9018 - Instruments and appliances used in medical sciences) is more balanced and had the index of 0.8 and turnover of 220 million euro.

In general, while the EU trades with both China and the United States approximately the same number of goods items, in trade with Vietnam this figure is 100 items less. More than a half of all goods items - 827 out of 1391 units - did not change over the selected period from the perspective of industry trade. At the same time, 180 positions underwent some minor changes, 131 items incurred noticeable changes and in the 253 goods items the index of intra-industry trade changed by more than 0.3 in absolute value. It means that in the vast majority of goods items there were no changes, but in those where they occurred, the changes were significant. Taking into account the specific weight, the most significant and significant changes in intra-industry trade occurred with the following commodity items:

- 8473 – Machines, spare parts and accessories;
- 8517 - Telephone sets;
- 8541 - Diodes, transistors and similar semiconductor devices.

In all three positions, the intra-industry trade index declined, and in all cases, the reason was an increase of imports from Vietnam. Import of cars and their spare parts from Vietnam increased dramatically from 2.6 million euros in 2006 to 1.7 billion euros in 2016, while export of this item from the EU to Vietnam was insignificant. The same way, there was a rapid increase (from 4.4 million euros in 2006 to 11.3 billion euros in 2016) of the import of telephone sets from Vietnam, mainly due to the establishment of Samsung production facilities in this country. Imports of diodes and transistors to the EU from Vietnam also increased manifold, from 502 thousand euros in 2006 to 567 million in 2016.

In general, it can be concluded that trade between the developed EU and developing Vietnam is almost completely inter-industry, which confirms the Heckscher-Ohlin theory. Moreover, during the selected period, the level of inter-industry trade had upward trend for majority of goods items on average. However, according to weighted average indicators, the level of intra-industry trade significantly fell.

The decrease in intra-industry trade was mainly due to the establishment of high-tech manufacturing by multinational corporations in Vietnam, which led to a dramatic increase in the export of some goods items to the EU.

CONCLUSIONS

Summarizing the research above, the following conclusions can be drawn:

As the result of the active policy of raising VA, China was progressively replacing European semi-finished products with domestic ones, which led to an increase in its domestic value added in exports. This fact, in turn, consequences in a higher level of China population welfare. For example, a growing number of Chinese consumers can afford to buy and consume expensive and high-quality European goods.

The bilateral trade between the developed EU and developing China is mainly inter-industry, which confirms the Heckscher-Ohlin theory. However, over the selected period, the level of inter-industry trade had a tendency to decrease and the possible of it can lie in China technological level, which is getting closer to developed countries. For example, exports from China to the EU of electrical machines and apparatus (technology intensive goods)grew few times.

Crises have different influence on developed and developing economies. For instance, owing to world global crisis of 2007–2008, the economic situation in the EU and the USA deteriorated most severely among the analyzed countries. In particular, in these developed regions, FDI as well as import capacity experienced a rapid decline. On the other hand, as an effect of such situation, there was a partial import substitution and so DVA in export grew.

Participation in global value chains was becoming less beneficial for developed countries as their forward index fell and the backward increased, while in developing countries, such as China, there were opposite trends. In less developed countries such as Vietnam, cheap labor encouraged huge capital inflows and increased participation in the GVC. However, there were no qualitative changes so far.

Export from developing countries to developed was more often processed and exported further than consumed domestically. By contrast, there was a reverse situation in developing countries. It can be also concluded, that R&D expenses directly contribute to improving competitiveness of countries and increasing their DVA in exports. This can be illustrated by the example of China, in which higher R&D expenses were accompanied by value added growth, and the USA, which had the highest R&D expenses and the highest DVA in export rate;

As it was proven, FDI reflect the activity of multinational corporations. However, they do not necessarily create additional jobs or increase exports because often times FDI are simply mergers and acquisitions. Typically, it is the case for FDI in the developed economies.

All in all, basing on all mentioned above, we could conclude that, despite there were some changes in trade patterns between selected countries, any substantial shift in international trade in EU-US-Asia triangle (China-Vietnam) did not occurred.

Further research should focus on the study of new approaches in the formation of vertical value chains in the framework of the so-called "colonial system" on the example of Tesla.

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APPENDICES

Appendix A

Domestic value added in gross exports 2006-2014, in per cent.

	2006	2007	2008	2009	2010	2011	2012	2013	2014
European Union (28 countries)	73,64	73,27	72,33	75,34	73,40	71,62			
France	75,03	74,71	75,32	78,46	76,33	74,99	74,10	74,19	73,73
Germany	76,69	75,82	75,33	78,22	76,75	74,38	73,97	74,22	74,64
Italy	75,65	74,92	74,32	78,88	75,15	73,59	73,36	74,23	74,64
China (People's Republic of)	63,82	65,83	68,33	69,25	68,06	67,89	68,85	69,15	70,65
United States	86,24	85,98	84,46	88,46	86,62	85,03	84,48	84,73	84,72
Viet Nam	67,46	64,69	64,41	67,06	65,21	63,67	65,26	63,97	63,69

Source: (OECD Data, 2018).

Appendix B

Value Added of foreign country in export of EU as per cent of import from a given country (2006-2011)

	2006	2007	2008	2009	2010	2011
United States	20,21%	19,94%	18,21%	22,18%	19,60%	18,24%
China	6,85%	8,16%	8,71%	9,03%	9,71%	9,40%
Viet Nam	0,17%	0,18%	0,18%	0,22%	0,21%	0,24%

Source: (European Commission, 2018; OECD Stat, 2018).

EU Value Added in export of foreign country as per cent of import from EU (2006-2011)

	2006	2007	2008	2009	2010	2011
United States	13,37%	15,92%	18,73%	15,53%	15,39%	17,07%
China	80,39%	86,67%	89,46%	69,50%	60,77%	63,41%
Viet Nam	50,96%	48,57%	58,20%	52,34%	50,18%	56,29%

Source: (European Commission, 2018; OECD Stat, 2018).