

<sup>21</sup> K. Shin, Y. Wang, *Trade integration and business cycle synchronization in East Asia*, "Discussion Paper", The Institute of Social and Economic Research, No. 574, 2003.

<sup>22</sup> C. Cortinhas, *Intra-industry trade and business cycles in ASEAN*, "Applied Economics", Vol. 39, Issue 7, 2007.

<sup>23</sup> U. Böwer, C. Guillemineau, *Determinants of Business Cycle...*, op. cit.

<sup>24</sup> J. Frankel, *Real Convergence and Euro Adoption in Central and Eastern Europe: Trade and Business Cycle Correlations as Endogenous Criteria for Joining EMU*, Harvard University, John F. Kennedy School of Government, "Working Paper Series", No. 04-039, 2004.

<sup>25</sup> J. Fidrmuc, *Migration and Regional Adjustment to Asymmetric Shocks in Transition Economies*, "CEPR Discussion Paper", No. 3798, 2003.

<sup>26</sup> I. Babetskii, *Trade integration and synchronization of shocks. Implications for EU enlargement*, "Economics of Transition", No. 1, Vol. 13, 2005.

<sup>27</sup> A. Zervoyianni, A. Anastasiou, *Convergence of shocks and trade in the enlarged European Union*, "The Journal of International Trade & Economic Development: An International and Comparative Review", Vol. 18, Issue 1, 2009.

<sup>28</sup> J. Fidrmuc, I. Korhonen, *Meta-analysis of the business cycle correlation between the euro area and the CEECs*, "CESIFO Working Paper", No. 1693, 2006.

<sup>29</sup> The meta-analysis is a research tool applied in economics (most notably in monetary economics) which basically summarises published results on particular topics. Meta-analyses 'provide an aggregate overview of a subject and allow analysis of factors that may influence the results such as data definition, time period, or author characteristics' (J. Fidrmuc, I. Korhonen, *Meta-analysis ...*, op. cit.).

<sup>30</sup> M. Maurel, *On the way of EMU enlargement towards CEECs: What is the appropriate exchange rate regime?*, CEPR, "Discussion Paper", No. 3409, 2002.

<sup>31</sup> P. Misztal, *International trade and business cycle synchronization in Poland, the European Union and the Euro Zone*, "Contemporary Economics", Vol. 7, Issue 13, 2013.

<sup>32</sup> J. Borowski, *Podatność Polski na szoki...*, op. cit.

<sup>33</sup> M. Camacho, G. Perez-Quiros, L. Saiz, *Are European business cycles close enough to be just one?*, "Journal of Economics Dynamics and Control", Vol. 30, No. 9, 2006.

<sup>34</sup> J. V. Blanes-Cristóbal, *Agglomeration versus dispersion...*, op. cit.

<sup>35</sup> H.G. Grubel, P.J. Lloyd, *Intra-Industry Trade: The Theory and the Measurement of International Trade in Differentiated Products*, Macmillan, London 1975, pp. 21-36.

<sup>36</sup> See more: Ł. Ambroziak, *FDI and intra-industry trade: theory and empirical evidence from the Visegrad Countries*, "International Journal of Economics and Business Research", Vol. 4, No. 1-2, 2012.

<sup>37</sup> Those comparisons exclude Malta and Cyprus which adopted the euro in 2008, due to different conditions of their development before and after EU accession.

<sup>38</sup> J. Fidrmuc, I. Korhonen, *Meta-analysis...*, op. cit.

<sup>39</sup> Ibidem.

## THE COMPARATIVE ANALYSIS OF MID-TECH AND HIGH-TECH TRADE OF THE VISEGRAD COUNTRIES AND THE GERMAN IMPACT<sup>1</sup>

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The collapse of the Soviet bloc, internal multidimensional problems typical for political and economic transition as well as the globalisation of the world economy induced many challenges for Central European countries and their economic systems. Deep structural reforms, often politically rationalised by the growing obsession of competitiveness, as Paul Krugman put it<sup>2</sup>, were aimed at keeping pace with most significant tendencies in the world economy, transferred and accelerated through the channels of international capital flows and foreign trade.

Embarking on the issue from the perspective of current knowledge may shed light on the lack of key competences of political and economic decision-makers in the 1990s, which resulted in the false identification of crucial challenges, opportunities and threats. One of them was the changing nature of the geoeconomic and geopolitical rivalry, where multinational companies (MNCs) expanding their international businesses and lessening the power of states<sup>3</sup> play an essential role. Offering attractive locational incentives for foreign direct investments (FDIs) was believed to be the most efficient way to get access to up-to-date knowledge and skills and create optimal circumstances for a kind of leapfrogging development.

However, to be a creator of rules of the game, one has to have sufficient resources generating non-easily imitable competitive advantages in the world trading system. That is why competitiveness of contemporary economic systems is usually brought about by the institutional environment<sup>4</sup> which accelerates processes of creation and enforcement of advanced technologies. If this fails, the only alternative seems to be the growing openness to trade and foreign investments. They are supposed to pave the way for transferring necessary mid-tech and high-tech skills, embodied both in goods as well as in the investors' know-how, while the competition is increasing because other emerging economies (especially so-called Factory Asia) strive to do the same. If so, there appears an essential doubt whether it is possible to reduce the structural and technological gap and how to address new developmental burdens.

Having said that, the analysis conveyed in this paper relates to the theoretical paradigm of the middle-income trap<sup>5</sup> which offers a promising explanatory potential to zero in on problems characteristic for the Visegrad countries (V4): the Czech Republic (CZ), Hungary (HU), Poland (PL), and Slovakia (SK). A certain emphasis is put on the

structure of their foreign trade in mid-tech and high-tech goods. The general context relates to growing risks for these countries of becoming just passive receivers of technologies and producers of intermediates under the framework of corporate added-value chains (CVCs), exerting ongoing pressure on lowering costs, increasing productivity, possible delocalisation and moving selected processes offshore.

If national innovation systems cannot balance these tensions, and they are not capable of accelerating growth and development by making more efficient use of domestic advantages, the political temptation to aggressively attract new foreign investments becomes more rationalised. It happens by putting aside though strategic choices as long as economic growth and development remain satisfactory. If there are neither incentives nor attempts to launch complex programs aimed at modernising the domestic economy and its structure of foreign trade, this creates a real threat of sustaining dependency on decisions made by non-state actors (MNCs and international economic organisations), rarely taking into account what needs to be done. Hence, this forms subtly a structural developmental glass ceiling easy to hit, but difficult to break through. As a consequence, domestic small and medium-sized companies usually experience a lot of regulatory, capital or market burdens ("sticky floor"), in contrast to preferences foreign firms enjoy. That is why they may dominate value creation process making internalisation of knowledge and skills less and less likely by accumulating industrial human capital<sup>6</sup>.

What one should bear in mind is that one of the most important political and economic motives supporting the membership in the European Union (EU) was the reduction of existing differences. However, the EU's financial framework does not necessarily reflect essential interests of less developed countries and their regions. If a strategic priority defined at the European decision-makers' level is to build a globally competitive economic system, this may mean for (semi-)peripheral member states the necessity of imperfect institutional imitation concentrating around national centres of growth and development and thus ineffectively addressing their specific challenges.

### **Purpose of the research and methodological remarks**

The main goal is to conduct a comparative study of the Czech, Hungarian, Polish and Slovak total exports and imports in the period 2001–2015 taking into particular consideration their technological intensity. The author remains aware that research covering similar issues has been thoroughly undertaken so far by numerous scholars<sup>7</sup>. However, the author's ambition is to offer a complimentary study which would shed light on slightly different developments in the foreign trade of the V4 countries and provide their

interpretation from the standpoint of international political economy.

Another relevant aim of the analysis is also to check whether the membership of the V4 in the EU may have induced positive developments as far as the technological intensity of their exports is concerned. Particular attention will be paid to their relations with Germany (their largest trading partner in the EU).

Against this backdrop, the author has formulated the following research hypothesis: the beneficial transformation of the technological intensity of the Czech, Hungarian, Polish and Slovak trade after the accession to the European Union is represented by growing shares of mid-tech and high-tech goods, but it fosters economic dependency on the German economy. This situation brings about challenges typical for the middle-income trap. In the author's opinion, conferred as a proposal for academic debate, this particular phenomenon may be coined as a bane of German geographical proximity. Hence, a spin-off hypothesis may also relate to the paradigm of corporate neo-colonialism which means the sequential creation of optimally defragmented production structures<sup>8</sup>. They are dispersed geographically through selective direct investment projects, but no further than 1–2 days required for a truck to reach a downstream producer elsewhere in the region (here: Central Europe and Germany).

The first part of the analysis covers all commodity clusters at the 4-digit disaggregation level of the Harmonised System (HS) data classified as primary products, labour- and resource-intensive, low-tech, mid-tech and high-tech, according to the methodological approach of UNCTAD<sup>9</sup>. An indication of exports and imports' market concentration of each country relies on the concept of the Herfindahl-Hirschmann Index (HHI). Commonly accepted in antitrust and anticompetitive merger cases<sup>10</sup> may find here its alternative implementation as the HHI is calculated by squaring the market share of each foreign market and then summing the resulting numbers. Then a special focus concentrates on trade relations of the V4 with Germany. This part of the study covers following chapters: HS 39 (plastics and articles thereof), HS 84 (machinery), HS 85 (electrical, electronic equipment) and HS 87 (road transport vehicles). The reason behind is that they dominate in the Czech, Hungarian, Polish and Slovak trade with Germany (see Tables 1 and 2).

The primary data being the subject of the author's calculations were downloaded from the database of the International Trade Centre (ITC)<sup>11</sup> at the 2-, 4- and 6-digit disaggregation level covering the period 2001–2015. Because the methodology of UNCTAD measuring technological intensity is founded on the Standardised International Trade Classification (SITC; at the 3-digit disaggregation level of trade data), the author has converted this approach into the one consistent with the Harmonised System (at the 4-digit disaggregation level).

**Table 1****Average shares (%) of mid-tech and high-tech goods and dominant HS chapters in the total exports of the Czech Republic, Hungary, Poland and Slovakia, 2001-2015**

Country	2001-2003		2004-2008		2009-2015	
	mid-tech	high-tech	mid-tech	high-tech	mid-tech	high-tech
CZ	41.7	18.4	41.7	21.1	42.3	23.8
	HS 84 - 11.7	HS 39 - 1.7	HS 84 - 12.7	HS 39 - 2.0	HS 84 - 11.5	HS 39 - 2.1
	HS 85 - 9.8	HS 84 - 5.8	HS 85 - 9.2	HS 84 - 7.0	HS 85 - 9.3	HS 84 - 7.7
	HS 87 - 16.1	HS 85 - 4.2	HS 87 - 15.8	HS 85 - 6.3	HS 87 - 17.6	HS 85 - 7.6
HU	36.3	31.6	36.3	34.3	38.9	31.6
	HS 84 - 15.4	HS 39 - 2.0	HS 84 - 15.9	HS 39 - 2.3	HS 84 - 14.0	HS 39 - 2.2
	HS 85 - 10.9	HS 84 - 7.4	HS 85 - 9.3	HS 84 - 6.0	HS 85 - 10.7	HS 84 - 3.9
	HS 87 - 8.0	HS 85 - 16.1	HS 87 - 8.8	HS 85 - 18.3	HS 87 - 11.0	HS 85 - 14.4
PL	29.3	11.9	34.2	13.3	32.0	18.6
	HS 84 - 10.4	HS 39 - 1.5	HS 84 - 12.6	HS 39 - 2.0	HS 84 - 10.4	HS 39 - 2.3
	HS 85 - 6.6	HS 84 - 0.3	HS 85 - 6.6	HS 84 - 0.6%	HS 85 - 5.9	HS 84 - 2.2
	HS 87 - 8.9	HS 85 - 4.3	HS 87 - 11.2	HS 85 - 4.7%	HS 87 - 11.5	HS 85 - 6.1
SK	39.7	10.9	39.0	17.8	41.1	23.8
	HS 84 - 8.2	HS 39 - 2.2	HS 84 - 8.3	HS 39 - 2.1	HS 84 - 8.7	HS 39 - 1.7
	HS 85 - 6.5	HS 84 - 0.9	HS 85 - 6.5	HS 84 - 1.9	HS 85 - 5.7	HS 84 - 1.7
	HS 87 - 21.5	HS 85 - 2.7	HS 87 - 20.8	HS 85 - 10.0	HS 87 - 22.9	HS 85 - 16.4

Source: Author's calculations based on <http://www.trademap.org> (3.10.2016).

**Table 2****Average shares (%) of mid-tech and high-tech goods and dominant HS chapters in the total imports of the Czech Republic, Hungary, Poland and Slovakia, 2001-2015**

Country	2001-2003		2004-2008		2009-2015	
	mid-tech	high-tech	mid-tech	high-tech	mid-tech	high-tech
CZ	31.6	25.9	31.0	27.1	29.2	29.7
	HS 84 - 11.7	HS 39 - 3.5	HS 84 - 11.1	HS 39 - 3.7	HS 84 - 10.0	HS 39 - 3.6
	HS 85 - 8.3	HS 84 - 5.0	HS 85 - 8.2	HS 84 - 6.0	HS 85 - 7.9	HS 84 - 7.4
	HS 87 - 8.0	HS 85 - 6.4	HS 87 - 8.4	HS 85 - 7.6	HS 87 - 8.1	HS 85 - 8.6
HU	34.7	30.2	32.3	28.9	30.3	28.8
	HS 84 - 13.8	HS 39 - 2.4	HS 84 - 12.5	HS 39 - 2.3	HS 84 - 11.4	HS 39 - 2.5
	HS 85 - 10.5	HS 84 - 5.3	HS 85 - 9.9	HS 84 - 3.9	HS 85 - 9.6	HS 84 - 3.1
	HS 87 - 7.7	HS 85 - 13.5	HS 87 - 7.5	HS 85 - 14.4	HS 87 - 6.7	HS 85 - 13.3
PL	28.1	25.8	27.6	24.0	24.9	26.2
	HS 84 - 11.9	HS 39 - 4.3	HS 84 - 11.2	HS 39 - 4.3	HS 84 - 9.4	HS 39 - 4.3
	HS 85 - 4.9	HS 84 - 3.0	HS 85 - 4.9	HS 84 - 2.6	HS 85 - 5.2	HS 84 - 3.0
	HS 87 - 8.6	HS 85 - 5.6	HS 87 - 8.8	HS 85 - 5.7	HS 87 - 7.5	HS 85 - 6.2
SK	34.0	19.7	32.5	23.8	30.9	27.1
	HS 84 - 11.7	HS 39 - 2.5	HS 84 - 10.2	HS 39 - 2.4	HS 84 - 9.0	HS 39 - 2.5
	HS 85 - 7.0	HS 84 - 2.3	HS 85 - 6.8	HS 84 - 2.1	HS 85 - 7.0	HS 84 - 2.2
	HS 87 - 11.9	HS 85 - 4.3	HS 87 - 12.3	HS 85 - 8.1	HS 87 - 12.1	HS 85 - 12.3

Source: Author's calculations based on <http://www.trademap.org> (3.10.2016).

When embarking on the analysis of the intensity of the intra-industry trade of the Czech Republic, Hungary, Poland and Slovakia with Germany the author has made use of the classical concept of Grubel and Lloyd<sup>12</sup> calculating the values of GL-indices at the 6-digit disaggregation level of the Harmonised System. The reason was to identify the shares of horizontal intra-industry trade (HIIT), vertical-low quality intra-industry trade (VIIT-LQ) and vertical-high quality intra-

industry trade (VIIT-HQ). The condition to be fulfilled follows the method provided by Greenaway, Hine and Milner<sup>13</sup>, based on the assumption that the unit value reflects – or to be more precise, approximates – the quality of a given commodity. Hence, HIIT occurs when the difference between the unit value of a product being the subject both of exports and of imports does not exceed more than +/- 15%. Therefore, VIIT-LQ or VIIT-HQ streams are identi-

fied when the difference in unit values of respective goods is below or above 15%. However, an essential drawback of this approach results from the nature of trade statistics available in USD which does not capture the volatility (appreciation/depreciation) of national currencies (CZK, HUF, PLN, SKK, then EUR) in particular years covered in the research<sup>14</sup>.

### The technological intensity of the Czech, Hungarian, Polish and Slovak total exports and imports in the period 2001-2015. General outlook

The years 2001-2015 were the period of a steady growth of trade volume (see Chart 1) and the openness of all analysed economies. The only exceptions happened in 2009 and 2012 when the world economy suffered the consequences of global financial/economic crisis and these also hit economies of the V4 countries. In the long run in each case, the growth rate of foreign trade was higher than the one of GDP which was stimulating for the openness. Smaller economies (CZ, HU and SK) would be naturally stronger oriented towards comprehensive trade relations (openness as the ratio of GDP higher than 150%), whereas Polish economy, mainly due to the size of its domestic market<sup>15</sup> experienced the kind of growth resulting in the ratio of GDP exceeding 75%.

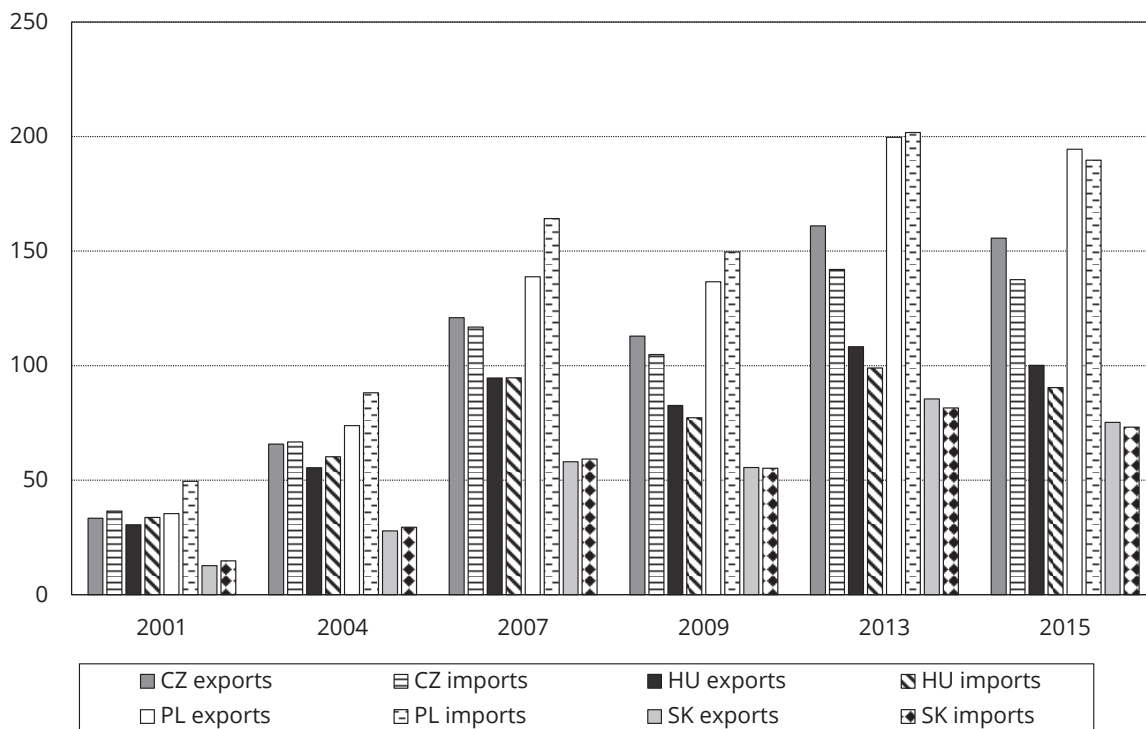
In the context of the above-indicated data, it is worth emphasising the fact that large companies owned by foreign

investors generate most of foreign trade of the V4 countries<sup>16</sup>. Small and medium-sized businesses remain rather local and thus hesitant about their internationalisation, also partly because of the lack of essential competencies for this critical decision. Foreign subsidiaries possess resources and capabilities that affect their survival in the long term, and because of this advantage, they can pose a threat to small and medium-sized firms<sup>17</sup>. Therefore it is justified to recognise MNCs and their supplier networks as a force changing the economic landscape of the Czech Republic, Hungary, Poland and Slovakia. The task is to assess their impact on certain developments like in this case on the technological intensity and the ability to generate trade surplus (see Tables 3. 4 and 5) as well as its further consequences for the role of these economies in the new international division of labour (NIDL).

What one can easily discern in the case of each economy is a dominating tendency of growing shares of mid-tech and high-tech goods in their total exports (for the latter also in imports). It is attributed to the activity of MNCs as domestic innovation systems and internal knowledge-intensive resources do not have enough power to determine a different path of economic development. Each economy covered by this study has been sustaining its trade surplus in the group of mid-tech goods, especially since they joined the EU, because of relatively cheaper local workforce mixed with foreign technology being the source of their advantage characteristic for the middle-income trap.

**Chart 1**

**Total exports and imports of the Czech Republic, Hungary, Poland and Slovakia (bn USD), selected years**



Source: Author's calculations based on <http://www.trademap.org> (3.10.2016).

**Table 3****Technological intensity (% shares) of the Czech, Hungarian, Polish and Slovak total exports, 2001-2015**

Country	Category	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
CZ	RL	17.6	15.2	15.7	14.3	13.7	12.5	12.2	11.0	11.4	10.8	10.5	10.2	10.7	10.9	11.0
	LT	13.6	10.9	13.0	13.7	13.1	13.1	13.2	12.9	10.8	10.8	11.7	11.3	11.3	10.5	10.2
	MT	41.8	41.2	42.1	42.0	41.7	42.1	42.4	40.3	40.0	40.3	41.4	42.0	43.3	44.2	45.2
	HT	15.9	20.8	18.4	19.8	19.2	20.6	22.6	23.2	24.4	24.8	25.2	24.1	22.9	23.2	22.2
	PP	11.0	11.8	10.8	10.2	12.3	11.7	9.5	12.6	13.3	13.3	11.3	12.4	11.9	11.1	11.4
HU	RL	13.9	13.8	11.3	9.8	8.6	7.4	6.8	6.4	7.0	6.6	6.7	6.4	6.6	6.9	6.8
	LT	6.7	6.3	6.2	6.5	6.4	6.6	6.3	6.2	5.1	5.5	6.1	6.1	6.2	6.2	6.1
	MT	36.0	35.9	37.2	35.8	36.1	37.3	36.9	35.7	33.3	33.9	35.8	37.1	39.9	44.5	47.3
	HT	30.0	31.5	33.4	37.2	35.0	33.9	32.5	32.9	37.4	37.4	34.2	30.8	29.1	26.5	25.6
	PP	13.5	12.5	11.9	10.8	13.8	14.8	17.6	18.8	17.1	16.6	17.2	19.6	18.1	15.9	14.3
PL	RL	25.1	24.4	23.7	20.6	18.6	17.0	16.5	15.2	15.5	15.3	15.2	14.5	14.7	15.4	15.7
	LT	18.4	18.4	17.5	17.5	16.2	16.9	16.8	16.2	13.6	14.0	15.4	14.8	14.7	14.3	13.9
	MT	28.0	29.2	31.0	33.1	33.7	34.7	35.3	34.4	33.8	32.8	32.7	31.4	31.2	30.9	31.3
	HT	11.8	12.1	11.9	11.5	11.8	13.1	14.2	16.0	18.5	19.9	17.6	18.0	18.1	18.8	19.2
	PP	16.7	15.9	15.9	17.4	19.8	18.3	17.3	18.3	18.5	18.0	19.2	21.3	21.3	20.6	19.9
SK	RL	21.0	21.5	18.5	16.5	15.0	12.6	11.4	10.8	12.0	10.6	10.3	9.2	9.0	9.5	9.3
	LT	17.7	16.4	15.5	16.9	16.9	16.4	15.8	15.1	13.4	14.5	13.7	13.2	12.2	12.1	11.5
	MT	35.7	38.1	45.2	41.4	37.1	37.7	40.0	38.7	36.0	37.8	39.9	41.1	42.4	43.4	46.9
	HT	11.8	11.1	9.9	12.1	15.6	18.6	20.4	22.3	26.8	25.2	22.4	22.3	23.5	23.7	22.3
	PP	13.8	12.8	10.9	13.1	15.4	14.8	12.3	13.1	11.9	12.0	13.7	14.1	12.9	11.3	10.0

RL: resource- and labour-intensive; LT: low-tech; MT: mid-tech; HT: high-tech; PP: primary products and others.

Source: Author's calculations based on <http://www.trademap.org> (3.10.2016).

**Table 4****Technological intensity (% shares) of the Czech, Hungarian, Polish and Slovak total imports, 2001-2015**

Country	Category	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
CZ	RL	12.0	11.9	11.9	11.7	11.2	10.4	10.2	9.7	10.4	9.1	9.4	9.2	9.5	9.9	9.9
	LT	11.8	9.9	11.8	13.2	13.2	13.9	14.8	14.0	11.2	11.6	12.8	12.5	12.5	12.2	12.0
	MT	33.0	29.4	32.6	32.8	30.2	29.9	30.2	28.4	27.0	26.0	28.3	29.1	29.7	31.4	32.7
	HT	24.8	26.4	26.5	25.8	24.7	25.9	28.2	27.6	30.4	31.6	30.0	29.1	28.2	28.8	29.5
	PP	18.5	22.4	17.2	16.6	20.6	19.9	16.5	20.3	21.0	21.7	19.5	20.2	20.0	17.6	15.9
HU	RL	11.9	11.9	11.7	10.5	9.0	7.9	7.6	6.9	7.4	6.7	6.6	6.2	6.6	7.1	7.2
	LT	8.5	8.6	8.6	9.3	8.2	9.2	9.4	9.1	7.4	8.0	8.8	8.6	9.1	9.3	9.5
	MT	34.3	34.8	35.1	34.6	33.0	31.4	32.0	30.4	27.1	27.3	28.5	27.7	30.4	34.4	36.3
	HT	30.5	30.2	30.0	31.1	28.2	28.1	28.9	27.9	31.7	32.1	29.5	28.3	27.3	25.4	26.9
	PP	14.8	14.5	14.6	14.5	21.7	23.3	22.1	25.8	26.6	25.9	26.5	29.2	26.6	23.8	20.1
PL	RL	14.5	14.6	14.0	12.9	11.8	11.0	10.7	10.1	11.2	10.7	10.5	10.0	10.2	11.2	11.9
	LT	11.0	12.3	13.3	14.4	13.2	14.0	14.7	13.4	11.7	12.7	13.3	13.0	13.4	13.5	13.8
	MT	27.1	27.9	29.3	29.1	27.1	27.2	27.7	26.8	25.7	24.7	24.6	23.4	24.2	24.8	26.5
	HT	26.6	25.9	24.8	24.4	24.2	24.0	23.6	24.0	26.9	27.7	24.9	25.2	25.8	25.9	26.7
	PP	20.9	19.3	18.6	19.2	23.7	23.9	23.2	25.7	24.4	24.1	26.7	28.5	26.5	24.6	21.2
SK	RL	13.3	13.5	13.1	12.1	10.9	10.1	9.9	9.3	10.7	9.2	9.4	9.0	9.1	9.6	9.9
	LT	9.7	10.1	10.3	11.4	11.1	11.0	11.8	12.0	9.7	10.7	11.1	10.8	10.3	10.9	10.8
	MT	32.3	33.2	36.6	34.5	31.8	31.7	33.0	31.4	29.5	29.6	30.4	30.5	30.2	31.8	34.3
	HT	19.5	20.1	19.4	20.2	22.3	24.7	25.9	25.7	28.4	27.5	24.2	26.1	27.5	27.9	28.2
	PP	25.3	23.1	20.6	21.8	23.8	22.4	19.4	21.7	21.7	23.0	25.0	23.5	22.9	19.8	16.9

RL: resource- and labour-intensive; LT: low-tech; MT: mid-tech; HT: high-tech; PP: primary products and others.

Source: Author's calculations based on <http://www.trademap.org> (3.10.2016).

Table 5

## Structure of the Czech, Hungarian, Polish and Slovak trade balance (bn USD), selected years

Country	Category	2001	2004	2007	2009	2013	2015
CZ	RL	1.52	1.60	2.89	1.97	3.62	3.41
	LT	0.22	0.19	-1.31	0.45	0.43	-0.59
	MT	1.94	5.76	15.93	16.87	27.42	25.40
	HT	-3.72	-4.14	-5.63	-4.35	-3.18	-5.97
	PP	-3.05	-4.35	-7.80	-6.91	-9.28	-4.06
HU	RL	0.21	-0.89	-0.76	0.10	0.65	0.32
	LT	-0.82	-1.96	-2.98	-1.50	-2.28	-2.50
	MT	-0.56	-1.04	4.56	6.63	13.20	14.52
	HT	-1.14	1.87	3.39	6.45	4.48	1.32
	PP	-0.87	-2.76	-4.28	-6.38	-6.69	-3.87
PL	RL	1.71	3.82	5.32	4.42	8.77	8.09
	LT	1.08	0.18	-0.84	1.17	2.34	0.99
	MT	-3.49	-1.24	3.47	7.69	13.50	10.51
	HT	-8.98	-13.04	-19.13	-14.88	-15.80	-13.33
	PP	-4.39	-4.08	-14.21	-11.33	-10.94	-1.49
SK	RL	0.70	1.04	0.78	0.76	0.20	-0.20
	LT	0.80	1.34	2.20	2.09	1.98	0.78
	MT	-0.26	1.38	3.67	3.72	11.67	10.19
	HT	-1.38	-2.58	-3.49	-0.80	-2.25	-3.84
	PP	-2.00	-2.78	-4.33	-5.38	-7.64	-4.82

RL: resource- and labour-intensive; LT: low-tech; MT: mid-tech; HT: high-tech; PP: primary products and others.

Source: Author's calculations based on <http://www.trademap.org> (3.10.2016).

Given the fact that competition in mid-tech product clusters usually undergoes price pressure, it makes keeping operational costs low a must. That is why the V4 countries have to face this kind of strategic concern how to reduce foreign dependence, which then would help raise the internal value and emerge as a dynamic exporter of high-quality manufactured products challenging more advanced competitors and reshaping the global industrial landscape<sup>18</sup>. However, being a technology taker determines strongly the structure of exports, which – having in mind the nature of corporate defragmentation of production – is dominated by parts and components<sup>19</sup>. They are the type of goods that do not create viable opportunities to internalise added value and in consequence sustain (semi-)peripheral character of an assembly production line in the NIDL.

As far as high-tech goods are concerned, only Hungarian economy was able to perform better than the rest<sup>20</sup>. What is also characteristic, smaller economies started to generate the overall trade surplus in the period of global economic crisis while Polish trade balance remained negative, although the prospects of cutting it down seemed promising. This change may be interpreted as a result of crisis-triggered, complex and multidirectional re-configuration within CVCs<sup>21</sup>.

Another remarkable tendency for the V4 countries as far as their international trade is concerned in the period

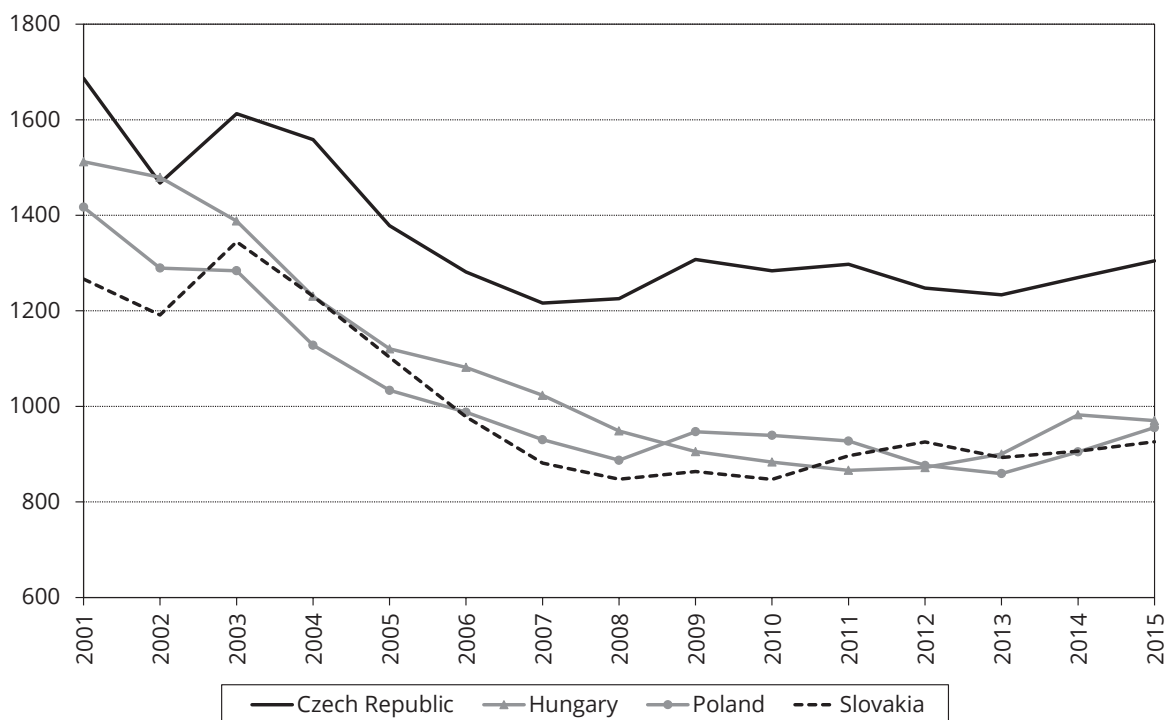
covered was significant progress in diversification of exporting and supplying markets (HHI; see Charts 2 and 3). It means that Germany, although it maintained its first position, started weighing less and less in their geographical structure of trade.

### The intra-industry trade of the Czech Republic, Hungary, Poland and Slovakia with Germany in the period 2001-2015. The case of chapters HS 39, 84, 85, and 87

Concentrating this part of the analysis on the intra-industry trade with Germany is based on the assumption that technology diffusion mimics the geographical pattern of the intra-industrial trade<sup>22</sup>. Relations with the main trading partner are thus crucial, especially in the product clusters with the highest shares of the total exports of countries covered (see again Table 1). That is why chapters 39, 84, 85, and 87 of the Harmonised System – consisting of mid-tech and high-tech commodities – were selected for this study. The purpose of a detailed examination of the intra-industry trade, especially its horizontal and vertical components, is to explore long-term tendencies and their consequences for the technological change in the foreign trade of the Czech Republic, Hungary, Poland and Slovakia brought about by the inflow of FDIs and the involvement in CVCs.

**Chart 2**

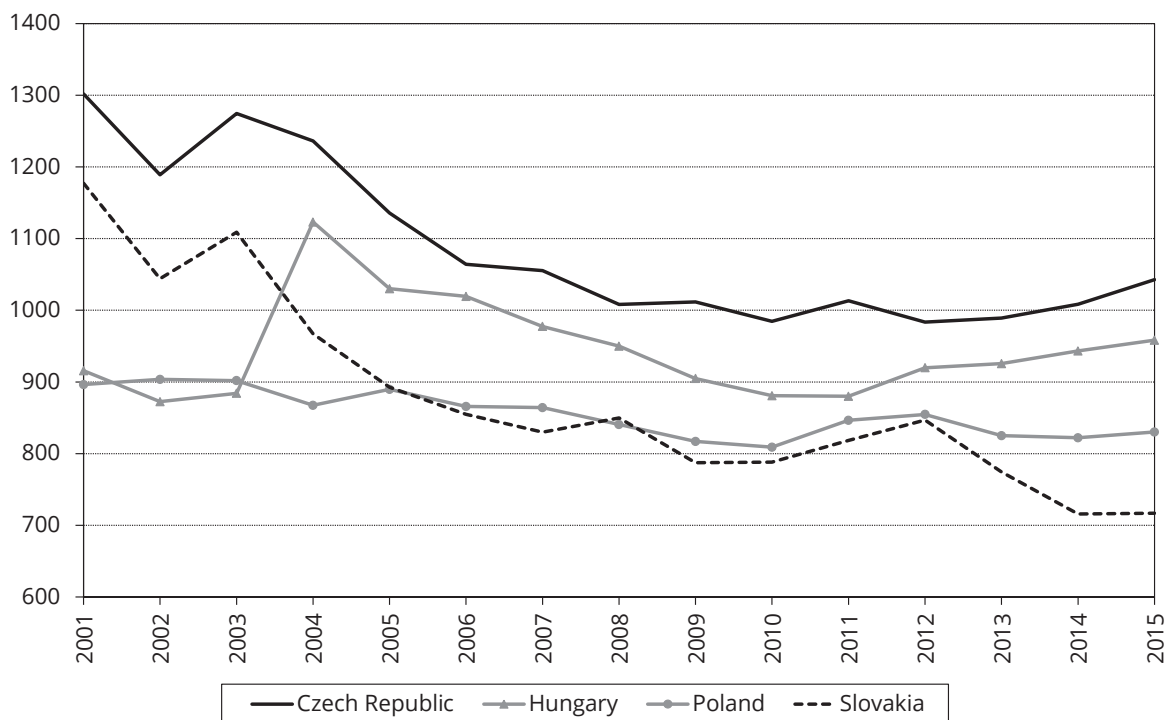
**Geographical concentration (HHI) of the Czech, Hungarian, Polish and Slovak exports, 2001-2015**



Source: Author's calculations based on <http://www.trademap.org> (3.10.2016).

**Chart 3**

**Geographical concentration (HHI) of the Czech, Hungarian, Polish and Slovak imports, 2001-2015**



Source: Author's calculations based on <http://www.trademap.org> (3.10.2016).

Table 6

Intensity of the intra-industry trade (GL-index) of the Czech Republic, Hungary, Poland and Slovakia with Germany (selected chapters, selected years)

	The Czech Republic					Hungary					Poland					Slovakia								
	2001	2004	2007	2009	2013	2015	2001	2004	2007	2009	2013	2015	2001	2004	2007	2009	2013	2015	2001	2004	2007	2009	2013	2015
<b>GL-index HS 39</b>	50.3	47.4	50.7	55.0	62.5	63.7	39.3	35.4	39.2	47.9	49.2	51.9	34.4	40.5	48.4	52.6	57.3	58.8	29.7	28.1	40.9	42.8	46.3	53.2
HIIT	8.4	5.3	11.2	28.8	14.3	23.9	13.5	14.4	6.2	9.1	21.2	22.5	9.7	12.7	25.0	19.6	21.9	28.3	8.0	8.2	14.9	5.6	4.8	5.4
VIIT-LQ	7.4	26.0	25.2	15.6	29.8	23.6	6.5	7.1	16.7	22.7	8.3	12.2	6.8	7.9	11.2	11.3	18.1	11.9	8.3	5.1	13.3	20.5	25.0	31.1
VIIT-HQ	34.6	16.1	14.3	10.6	18.4	16.1	19.4	13.9	16.3	16.2	19.7	17.2	17.8	20.0	12.3	21.7	17.3	18.6	13.4	14.8	12.7	16.7	16.6	16.7
<b>GL-index HS 84</b>	51.6	49.7	54.9	54.1	49.8	49.0	21.6	23.8	26.2	21.8	30.5	33.4	35.0	36.4	39.8	42.7	49.8	52.9	29.7	26.4	34.4	35.3	34.1	40.2
HIIT	7.4	7.9	10.6	11.1	5.5	7.3	1.5	10.5	11.0	6.1	6.4	8.6	8.6	7.5	13.1	10.7	16.3	14.7	6.0	6.2	2.6	9.6	5.8	4.9
VIIT-LQ	9.5	11.4	15.0	14.6	20.0	18.9	12.2	3.1	7.9	6.9	8.9	14.7	8.6	7.3	6.6	7.6	7.8	13.1	4.8	7.4	12.1	12.8	17.1	22.9
VIIT-HQ	34.7	30.5	29.2	28.4	24.2	22.8	7.9	10.2	7.3	8.8	15.2	10.1	17.8	21.6	20.1	24.3	25.7	25.2	18.9	12.8	19.8	12.9	11.2	12.4
<b>GL-index HS 85</b>	57.0	58.1	57.0	59.4	51.9	50.4	46.3	42.6	43.2	33.4	43.2	46.3	35.1	45.5	49.1	39.8	46.6	59.2	40.4	30.9	23.6	21.1	26.1	24.8
HIIT	20.0	15.9	16.4	11.2	12.4	7.5	12.2	7.4	5.8	9.4	6.6	18.2	5.4	5.2	14.9	13.8	14.3	11.1	6.2	3.0	0.4	1.8	3.7	2.8
VIIT-LQ	9.4	20.4	9.9	25.5	26.0	22.6	15.4	18.5	19.2	13.6	27.5	18.7	13.7	16.4	9.1	6.1	10.1	15.7	10.8	10.6	6.8	3.4	10.2	17.3
VIIT-HQ	27.5	21.8	30.7	22.7	13.5	20.3	18.8	16.7	18.2	10.5	9.1	9.4	15.9	23.9	25.0	19.9	22.1	32.5	23.4	17.4	16.4	15.9	12.2	4.7
<b>GL-index HS 87</b>	58.8	60.1	55.6	49.9	49.6	49.7	34.1	45.1	43.9	53.5	57.8	45.9	53.8	60.9	57.9	60.6	60.8	64.9	36.8	36.2	36.4	44.9	40.3	44.1
HIIT	9.1	15.3	22.2	16.4	19.7	24.0	2.9	8.3	10.0	2.0	21.3	20.6	1.4	1.3	12.8	29.4	19.0	33.5	8.7	11.8	11.6	15.5	4.0	13.0
VIIT-LQ	33.9	29.0	20.2	22.9	24.4	21.0	20.8	26.1	21.6	33.2	23.8	15.1	44.7	42.4	17.1	18.8	12.9	12.7	18.3	13.1	5.7	15.6	25.8	15.0
VIIT-HQ	15.7	15.9	13.2	10.6	5.6	4.7	10.4	10.8	12.3	18.3	12.8	10.1	7.6	17.2	28.0	12.4	28.9	18.7	9.8	11.3	19.1	13.8	10.6	16.1

Source: Author's calculations based on <http://www.trademap.org> (3.10.2016).



Results of calculations investigating the internal structure of IIT with Germany (see Table 6) point out following observations and interpretations.

In the chapter HS 39 (plastics and articles thereof) competitive advantage against German producers have been lost or essentially weakened (VIIT-LQ > VIIT-HQ) in the case of Czech-, Poland-<sup>23</sup> and Slovakia-based firms, while the position of Hungarian ones remained quite stable. These long-term tendencies may be explained by likely motives of German companies' trade expansion aimed at pushing domestic producers out of the market and taking control over them through acquisitions and greenfield direct investments. The likely effects are new restraints for innovative domestic potential due to dependency on the cooperation within CVCs.

In the chapter HS 84 (machinery) the position of Polish and Hungarian firms was slightly improving<sup>24</sup>, probably because of the inflow of more advanced technologies through the channel of FDIs, whereas Czech-based companies have experienced an opposite trend, but the VIIT-HQ sub-component has been the dominant one. It can be a consequence of the characteristics of German supplies for Škoda (diesel and spark-ignition engines, parts of engines, mechanical components of cars like liquid/fuel pumps, valves) and the cost pressure on first- and second-tier suppliers under the framework of intra-corporate linkages in the Volkswagen Group. Interestingly, Slovak companies may have, to some extent, suffered from joining the European Monetary Union (EMU) in 2009 and the adverse impact of global economic slowdown as the share of VIIT-HQ started to decrease.

In the chapter HS 85 (electrical and electronic equipment) GL-indices were generally dropping, except Polish IIT that was essentially strengthened by the growth of VIIT-HQ<sup>25</sup>. It may be a consequence of global reconfiguration of production to Factory Asia (low-cost producers), especially when transportation of these goods becomes less and less geographically sensitive. What is more, the Czech, Hungarian and Slovak IIT in this chapter was gravitating towards low-quality goods which may also be a response to global competitive price pressures.

In the chapter HS 87 (road transport vehicles) the main component of the Czech, Hungarian and Slovak IIT was VIIT-LQ. In the Polish case the long-term trend was quite reverse as the shares of VIIT-HQ/VIIT-LQ started to rise/shrink respectively after the accession to the European Union. It may mean that Polish economy truly became a "European automotive assembly plant" transforming cheaper suppliers of intermediates into more advanced, thus more expensive goods of higher quality re-exported then to Germany. However, the significant share (since 2007 more than 50%) of these in the Polish exports in the chapter HS 87 has been generated by parts and accessories (HS 8708), which on the whole represents the essence of the middle-income trap. Any technological improvement remains under the corporate control, so

there are justified doubts whether and if so to what extent this positive situation may be considered as sustainable and relatively free from the threat of delocalisation and exposure to the volatility of global demand for automotive products.

## Conclusion

To sum up, there are clear positive developments in the technological intensity of trade of countries covered by this study. What is a promising feature, the shares of mid-tech and high-tech product clusters have tended to grow steadily. At the same time, however, they were significantly exposed to the activity of MNCs and priorities of their FDI projects in a given country, benefiting to some extent from the transfer of advanced technologies, which in turn generates further potential challenges for domestic innovation system and the threat of the middle-income trap.

As far as the IIT with Germany in the most important mid-tech and high-tech chapters of Harmonised System is concerned, it does not bring the V4 countries a positive impact on fundamental technological change through technology diffusion which could create opportunities to reduce existing developmental/imitation gap. Quite the opposite, the patterns of cooperation within CVCs – even though they clearly strengthen the intensity of IIT and increase shares of mid-tech and high-tech goods in the exports of the V4 – fosters technological dependency and structural burdens typical for the middle-income trap. It takes the form of being first- or second-tier suppliers for further stages of production. Therefore, the research hypothesis proposed for this paper can be regarded as confirmed.

Another aspect refers to the loss of competitive potential due to the market expansion of more technologically advanced German corporations and goods which may limit space required for the development of innovative domestic businesses. Hence, this kind of structural underdevelopment stimulates political orientation on making use of simple kinds of locational incentives (e.g. taxes, costs of labour and land, local infrastructure) and a necessity in competing for relative attractiveness as a cheaper location for foreign investors. All these factors pose viable concerns rooted in the realm of international political economy how to effectively address these challenges emphasising economic dominance and political power of corporations (see the spin-off hypothesis) as they may hamper the potential for unconstrained decision-making processes.

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<sup>2</sup> P. Krugman, *Competitiveness: A Dangerous Obsession*, "Foreign Affairs", March/April 1994.

<sup>3</sup> See S. Strange, *The Retreat of the State: The Diffusion of Power in the World Economy*, Cambridge University Press, Cambridge 1996.

<sup>4</sup> D. Acemoglu, J. Robinson, *Why Nations Fail: The Origins of Power, Prosperity, and Poverty*, Crown Publishers, New York 2012.

<sup>5</sup> See F.G. Im, D. Rosenblatt, *Middle-Income Traps. A Conceptual and Empirical Survey*, "Policy Research Working Paper", No. 6594, The World Bank, September 2013; B. Eichengreen, *Escaping the middle-income trap*, Proceedings Economic Policy Symposium, Jackson Hole, [http://econpapers.repec.org/article/fipfedkprly\\_3a2011\\_3ap\\_3a409-419.htm](http://econpapers.repec.org/article/fipfedkprly_3a2011_3ap_3a409-419.htm) (22.12.2015); K. Ohno, *Avoiding the middle income trap. Renovating industrial policy formulation in Vietnam*, "ASEAN Economic Bulletin", Vol. 26, No. 1, 2009.

<sup>6</sup> See K. Ohno, *Avoiding the middle...*, op. cit.

<sup>7</sup> See more: B. Hoekman, S. Djankov, *Intra-Industry Trade, Foreign Direct Investment and the Reorientation of East European Exports*, "CEPR Discussion Paper", No. 1377, 1996; C. Aturupane, S. Djankov, B. Hoekman, *Horizontal and vertical intra-industry trade between Eastern Europe and the European Union*, "Weltwirtschaftliches Archiv", Vol. 135, No. 1, 1999; E. Czarny, *Teoria i praktyka handlu wewnątrzgałęziowego*, SGH, Warszawa 2002; E. Czarny, K. Śledziwska, *Polska w handlu światowym*, PWE, Warszawa 2009; E. Czarny, K. Śledziwska, *Międzynarodowa współpraca gospodarcza w warunkach kryzysu: wnioski dla Polski*, PWE, Warszawa 2012; E. Molendowski, *Liberalizacja wymiany handlowej krajów Europy Środkowo-wschodniej w okresie transformacji ze szczególnym uwzględnieniem doświadczeń krajów CEFTA*, Wydawnictwo Uniwersytetu Ekonomicznego w Krakowie, Kraków 2007; E. Molendowski, *Integracja handlowa w nowych państwach członkowskich (UE-10). Doświadczenia i wnioski dla innych krajów Europy Środkowej i Wschodniej*, Difin, Warszawa 2012; A. Uzagalieva, E. Kočenda, A. Menezes, *Technological Innovation in New EU Markets*, "Emerging Markets, Finance & Trade", Vol. 48, No. 5, 2012; P. Toporowski, *The steps of Visegrad countries towards better integration within the EU: a case of intra-industry trade*, [https://www.researchgate.net/publication/256375091\\_The\\_steps\\_of\\_Visegrad\\_countries\\_towards\\_better\\_integration\\_within\\_the\\_EU\\_a\\_case\\_of\\_intra-industry\\_trade](https://www.researchgate.net/publication/256375091_The_steps_of_Visegrad_countries_towards_better_integration_within_the_EU_a_case_of_intra-industry_trade) (28.04.2016); Ł. Ambroziak, *FDI and Intra-Industry Trade: Theory and Empirical Evidence from the Visegrad Countries*, "The International Journal of Economics and Business Research", Vol. 4, 2012; Ł. Ambroziak, *Wpływ bezpośrednich inwestycji zagranicznych na handel wewnątrzgałęziowy państw Grupy Wyszehradzkiej*, IBRKK, Warszawa 2013; G. Túry, *Diverging Competitive Performances of the Visegrad Countries – Some Conclusions from the Technology Level of External Trade*, "Unia Europejska.pl", No. 3(226), 2014.

<sup>8</sup> See S. Arndt, H. Kierzkowski (eds.), *Fragmentation: New Production Patterns in the World Economy*, Oxford University Press, Oxford 2001.

<sup>9</sup> <http://unctadstat.unctad.org/UnctadStatMetadata/Classifications/Methodology&Classifications.html> (26.10.2012).

<sup>10</sup> See The United States Department of Justice, *Herfindahl-Hirschman Index*, <https://www.justice.gov/atr/herfindahl-hirschman-index> (20.4.2016).

<sup>11</sup> ITC Trade Map, <http://www.trademap.org> (3.10.2016).

<sup>12</sup> H. Grubel, P. Lloyd, *Intra-Industry Trade. The Theory and Measurement of International Trade in Differentiated Products*, Macmillan, London 1975; see also E. Czarny, K. Śledziwska, *Międzynarodowa współpraca...*, op. cit.

<sup>13</sup> D. Greenaway, R. Hine, C. Milner, *Country Specific Factors and the Pattern of Horizontal and Vertical Intra-Industry Trade in the UK*, "Weltwirtschaftliches Archiv", Vol. 130, No. 1, 1994; D. Greenaway, R. Hine, C. Milner, *Vertical and Horizontal Intra-Industry Trade: A Cross-Industry Analysis for the United Kingdom*, "The Economic Journal", November, Vol. 105, No. 433, 1995.

<sup>14</sup> Another drawback is that prices in exports are calculated according to FOB and in imports according to CIF formula.

<sup>15</sup> Polish GDP surpasses accumulated GDP of the Czech Republic, Hungary and Slovakia.

<sup>16</sup> Around 2/3 in the case of Poland.

<sup>17</sup> A. Uzagalieva, E. Kočenda, A. Menezes, *Technological Innovation in New EU Markets*, "Emerging Markets, Finance & Trade", Vol. 48, No. 5, 2012.

<sup>18</sup> See K. Ohno, *Avoiding the middle...*, op. cit.; P. Buckley, *The impact of the global factory on economic development*, "Journal of World Business", Vol. 44, No. 2, 2009.

<sup>19</sup> See more: <http://www.trademap.org> (3.10.2016).

<sup>20</sup> However, the success story of Hungary in high-tech goods between 2007–2011 was achieved because of mobile phones (HS 851712) made by Nokia. In the mentioned period they accounted for 10-12% of the total Hungarian exports. The company ceased its production and relocated it to Asia. So this may be clear evidence how much pressure is put on transition economies as it comes to cost advantages and how to foster them with all negative consequences for a host country.

<sup>21</sup> See more: S. Filippov, K. Kalotay, *Global Crisis and Activities of Multinational Enterprises in New EU Member States*, "International Journal of Emerging Markets", Vol. 6, No. 4, 2011; P. Pavlínek, J. Ženka, *Upgrading in the Automotive Industry: Firm-Level Evidence from Central Europe*, "Journal of Economic Geography", Vol. 11, No. 3, 2011; M. Sass, A. Szalavets, *Crisis and Upgrading: The Case of the Hungarian Automotive and Electronics Sectors*, "Europe-Asia Studies", Vol. 65, No. 3, 2013.

<sup>22</sup> See A. Uzagalieva, E. Kočenda, A. Menezes, *Technological Innovation...*, op. cit.

<sup>23</sup> Except of the year 2015 which may seem a promising result.

<sup>24</sup> In the case of the first one due to diesel engines (HS 8408) and automatic data processing machines, optical readers, etc. (HS 8471) while in the case of the latter due to the same product clusters and additionally spark-ignition engines (HS 8407). It is clear that cooperation within CVCs across all analysed sections is strongly interconnected with automotive industry and that is why research on this particular sector should always go far beyond the goods covered by the chapter HS 87.

<sup>25</sup> This was brought about by the FDIs of Korean and Japanese companies in Poland producing television receivers (HS 8528) as well as insulated wire/cables (HS 8544), especially ignition wiring sets and other wiring sets used in vehicles, aircraft etc. (HS 854430).