VISEGRAD COUNTRIES AS PART OF THE GLOBAL ECONOMY – SOME ASPECTS OF COMPETIVENESS AND THE TECHNOLOGICAL LEVEL OF THEIR EXPORTS

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The purpose of this study[2] is to review some factors of national competitiveness and examine the development of exports in the four Visegrad countries (i.e., Czech Republic, Hungary, Poland and Slovakia), in order to show how these economies have benefited from integration into world economy from the beginning of the 1990s. First, we will review the performance of the Visegrad countries in institutional competitiveness rankings. Second, the external trade performance of the Visegrad countries vis-à-vis the European Union, BRIC, USA and Japanese economies will be reviewed. Finally, the study analyses the international trade competitiveness of the V4 countries based on the most widely used classifications: SITC for trade and ISIC/NACE for economic activities.

Introductory remarks

Competitiveness of nations is high on the agenda. While emerging countries are increasing their shares in the global economy, one of the key questions for developed economies is how to improve their

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competitiveness in the global market. There are ever more research groups and think-tanks that produce rankings to compare countries[3], providing information able to help the decision-making process. However, competitive comparisons can produce different results, due to different approaches. Using yearly rankings based on international benchmarks easily results in premature statements on the reasons for good or bad performance. But can the development policies be based on single-year data? This is an important issue as one of the main goals of government development policies is to enhance national competitiveness. Nevertheless, due to different interpretations of the concept, the way forward is not clear.

Competitiveness at the national level

The question of the national competitiveness arose in the mid-1980s when new competitors emerged in the world economy. Because of increasing competition, the American economy was starting to lose competitive advantage in its internal market. Research dealing with the examination of American competitiveness formulated the concept of national competitiveness. Scott and Lodge defined national competitiveness in 1985 as that which *refers to a country's ability to create, produce, distribute and/or service products in international trade while earning rising returns on its resources*[4].

In the early 1990s, the OECD (1992, p. 237) defined national competitiveness as follows: *„the degree to which an economy can, under free and fair market conditions, produce goods and services which meet the test of international markets, while simultaneously maintaining and expanding the real incomes of its people over longer run"*.[5] Rapkin (1995, p. 2.) offered a similar definition stressing the importance of the economic development as a result of national competi-

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[2] An earlier version of this paper was presented at UniaEuropejska.pl *(Diverging competitive performances of the Visegrad countries: some conclusions from the technology level of external trade.* 2014/24:(3) pp. 36-51.)

[3] World Economic Forum, International Institute for Management Development, Economist Intelligence Unit, International Finance Corporation, European Commission. Cf.: Lukovics (2008), p. 55.

[4] Scott–Lodge (1985)

[5] OECD (1992), p. 237. cited in Thompson (2003), p. 632.

tiveness. In his work, he described the challenges for the U.S. economy posed by East Asian capitalism over the 1980s and 1990s. The above works commonly refer to competitiveness as a factor in creating a country's welfare.

The unilateral approach of competitiveness emphasising economic growth also appears elsewhere. The annually-published World Economic Forum Global Competitiveness Report[6] defines competition *"as the ability of a country to achieve sustained high rates of growth in gross domestic product (GDP) per capita"*[7]. This competitive approach highlights economic growth to show the way in which a given economy is able to provide sustainable growth in changing global economic conditions.

The academic literature of the past decades (including Aiginger[8] and Thompson[9]) confirms that the concept of national competitiveness is highly controversial. Some authors like Reich[10] and Krugman[11] judge any effort to measure competitiveness as meaningless. They stress that national competitiveness has broad and diverse interpretations and lacks a clear and agreed definition. Several methodological questions arise during measurement (Buckley et al.[12]; Lall[13]; Szentes[14]; Török[15]). Losoncz refers to more than 10,000 different approaches to competition.[16] No consensus has been achieved regarding the factors and measurement. Further, this field of research is characterised by subjectivity. On this basis we can distinguish between two different "schools". Knack and Keefer[17], Krugman[18], Lall[19] and Reinert[20] emphasise that public policy matters in national com-

6 World Economic Forum (1998)
7 Cited in Dijck–Faber (2000), p. 74.
8 Aiginger (1998)
9 Thompson (2003)
10 Reich (1990)
11 Krugman (1994)
12 Buckley et al. (1998)
13 Lall (2001)
14 Szentes (2011)
15 Török (1989)
16 Losoncz (2004)
17 Knack- Keefer (1995)
18 Krugman (1991)
19 Lall (2001)
20 Reinert (1995)

petitiveness. The notion of the "competition state „was coined by Cerny[21]. He emphasised that the way state intervention had been formed was a response to the changing global environment to preserve the competitiveness of the nation. Stiglitz also strengthens this political line when he points out to the situation of market turmoil when government intervention can improve market efficiency.[22] The other idea approaches the problem from the business side. Porter[23], Oral and Chabchoub[24] emphasise that business investment decisions are the key factors. Michael Porter, in his book "The Competitive Advantage of Nations", used a truly economic perspective, and added that competitiveness was basically a microeconomic issue, and was thus hard to interpret on a macroeconomic level.[25] In a study[26] published later Krugman pointed out that – according to Tyson's[27] definition – internal factors matter in the case of a nation with minor international trade. He provided an example of domestic productivity growth. He also highlighted that stressing national competitiveness could cause faulty government policies if governments began wasteful spending to enhance competitiveness. In extreme cases it might result in protectionism in international trade.

Central European authors have also shown interest in the topic of competitiveness. Bieńkowski[28] highlighted the importance of the institutional framework and macroeconomic policy in enhancing the competitiveness of companies. Kutasi et al. utilise the competitiveness approach to the economic policy, i.e. the nation's economic competitiveness originates from a competitive state.[29] This vision distinguishes between the state responsibility and market functions for competitiveness and development. However, they state that a multitude of available resources does not provide a clear answer to cer-

[21] Cerny (1990)
[22] Stiglitz (2002)
[23] Porter (1990)
[24] Oral–Chabchoub (1996)
[25] Porter (1990)
[26] Krugman (1991)
[27] Laura D'Andrea Tyson chairs President Clinton's Council of Economic Advisors and she wrote a paper titled: Who's Bashing Whom? (Institute for International Economics, November 1992).
[28] Bieńkowski (2007)
[29] Kutasi–Vigvári–Dani (2012)

tain questions. Excessive intervention can be detrimental to the market. Ágh examines the performance of the domestic public/state institutions, and underlines that "social progress" (as defined by the European Union) is a basic variable measuring progress in competitiveness.[30] Regarding this question, Kovács provides an even more specific answer: in order to enhance economic competitiveness the harmonious functioning of public households and a sustainable path of modernisation should be kept in mind.[31] Others analyse competitiveness with sectoral breakdowns.

Verner investigates the relationship between competitiveness and expenditure on higher education and research and development in the triad countries (the European Union, Japan, and the USA)[32]. Based on panel data analysis he concluded that increasing expenditures on education and research and development did not always promote national competitiveness. Concerning the situation in Slovakia during the (current) economic crisis, Ručinská and her co-authors highlight that the production factors are not the only important factors of competitiveness.[33] The question is more complex, because providing long-term sustainability of total production and relative satisfaction of the population concurrently are also the determinant factors.

Mrak referring to the OECD method[34], investigates cost- and qualitative competitiveness[35]. He points out that at the cost-competitiveness side of wages in foreign currency is crucial, thus exchange rates influence external trade performance. A study by Landesmann and Wörz deals with the global competitiveness of the CEE region vis-à-vis the EU-15 and Asian emerging economies.[36] The authors use hard data such as external trade positions, market shares and costs of financial intermediation as well as some soft points (based on perceptions of entrepreneurs) like costs related to running business (negotiation costs and distribution costs) in the business sector. In a global comparison, the CEE countries have gained a

[30] Ágh (2011)
[31] Kovács (2005)
[32] Verner (2011)
[33] Ručinsk –Urge–Ručinský (2009)
[34] OECD (1998)
[35] Mrak (2000)
[36] Landesmann–Wörz (2006)

relatively strong competitive position. However, the new member states are found in the middle position between the first and the second development wave of "Asian tigers"[37] and the third wave, including China and India.

Kovačič, in order to rank factors of the World Economic Forum's (WEF) competitiveness report[38] for the selected countries, uses the standard deviation method.[39] Slovenia, Hungary, the Czech Republic and Slovakia have the leading positions, ahead of Poland, Croatia and Romania.

Visegrad countries in institutional rankings – an analysis of national competitiveness

Measuring international competitiveness and preparing benchmarking lists, economic development is often used in analyzing the performance of countries (c.f., World Competitiveness Yearbook). The other main institutional competitiveness observer, the World Economic Forum defines[40] competitiveness as the ability of a country to achieve sustained high rates of growth in gross domestic product (GDP) per capita. In recent years during the "great crisis" that affected the performance of the economies, regional distribution of growth has changed. The crisis interrupted a long growth period in the US economy, moderated Chinese development and amplified the structural problems of public finances in the countries of the European Union.

Regarding benchmarking of economies, there are two widely used sources based on international competitiveness. These ranks are comparisons with "non-priority countries"[41], which means that the competitiveness of a country is not measured in relation to others. The World Economic Forum – a private think-tank – has been publishing the Global Competitiveness Report since 1979. The WEF de-

[37] The first development wave of the newly industrialized countries (NIC) covered Hong Kong, the Republic of Korea, Singapore and Taiwan, the second one Indonesia, Malaysia, Philippines and Thailand, the third one – Philippines, India and China.
[38] World Economic Forum, Global Competitiveness Report.
[39] Kovačič (2008), pp. 3-26.
[40] World Economic Forum (1998)
[41] Szilágyi (2008)

veloped a measure called the Global Competitiveness Index, which is a weighted complex indicator[42] based on twelve different observational points of view. These areas[43] cover different governmental policies as well as different economic sectors. The driving point of the index is GDP growth.[44]

The other highly cited source is the International Institute for Management Development (IMD) World Competitiveness Center, which has been publishing the World Competitiveness Yearbook since 1989. International benchmarking is calculated over 300 criteria, two-thirds of which is based on hard data statistics and one-third on opinion surveys of business executives.

Based on the data of the Global Competitiveness Report, the V4 countries are in the lower-third of the ranking list of examined economies.[45] Spain, Portugal, Italy and Greece from the European Union, and Brazil and India from the BRIC countries have ranks that are similar to those of the four Visegrad countries. It is obvious that those Central and Eastern European emerging economies which have been economically embedded in the EU for the last 20 years face different conditions than the South European or the BRIC countries. Figure 1 shows the score numbers[46] for the last eight years. Three Visegrad countries, as well as the European Union countries, experienced deteriorating performances. For those emerging economies that based their growth and development on inward FDI and increasing demand in external markets, the question of the competitiveness cannot be independent from their external economic environment.

Real differences and competitive factors between countries become apparent when we consider more detailed data, i.e., dissimilar per-

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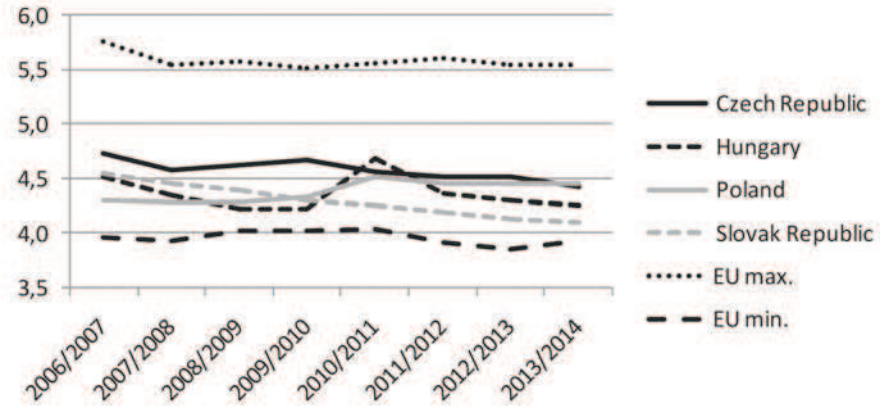
[42] Further: World Economic Forum (2012), pp. 8-9.
[43] The 12 pillars of competitiveness: Institutions, Infrastructure, Macroeconomic environment, Health and primary education, Higher education and training, Goods market efficiency, Labour market efficiency, Financial market development, Technological readiness, Market size, Business sophistication, Innovation
[44] van Dijck–Gerrit (2000), p. 74.
[45] We examine the EU28 plus Brazil, India, the U.S., People's Republic of China, Russian Federation and Japan
[46] The Global Competitiveness Report provides scores between 1 and 7.

formance of along sub-indexes.[47] Considering the average values of their rankings, the Czech Republic and Poland have the best positions. Compared to the other countries examined V4 countries showed the worst position for governmental/state performance (institutions) and some market/business indicators (labour market efficiency).

Figure 1. Scores of the Visegrad countries compared to the best and worst scores from the EU28 between 2006 and 2013



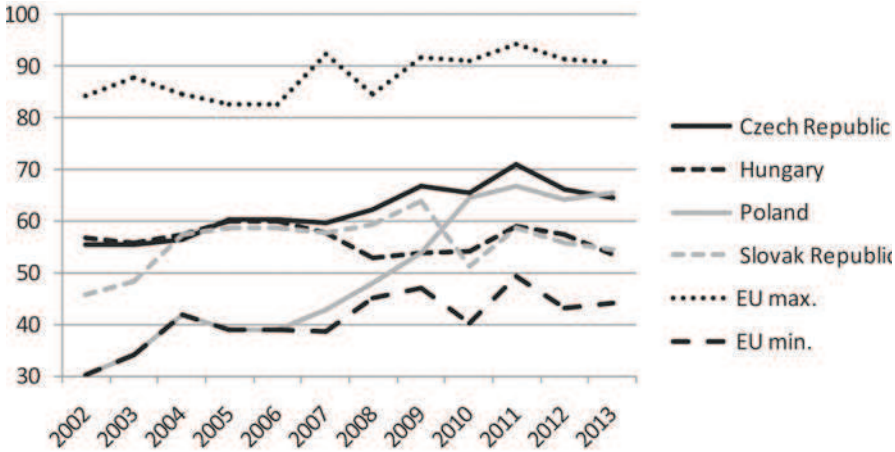
Source: author's calculations based on relevant issues in the World Economic Forum Global Competitiveness Report

The former plays an important role in investment decisions and the organization of production of business entities, and further determines cost-benefit calculations for the costs of development strategies. The efficiency and flexibility of the labour market are critical for the effective allocation of the appropriate workforce. We can distinguish advantageous and disadvantageous factors among nations as well, e.g., a large-scale internal market and the lack of a trans-European road transport network in Poland, or favourable innovation capacity in the Czech Republic and the (small) size of the domestic market in Slovakia. The World Competitiveness Yearbook edited by

[47] 1. Institutions; 2. Infrastructure; 3. Macroeconomic environment; 4. Health and primary education; 5. Higher education and training; 6. Goods market efficiency; 7. Labour market efficiency; 8. Financial market development; 9. Technological readiness; 10. Market size; 11. Business sophistication; 12. Innovation

IMD is also continuously ranks an increasing number of countries[48] according to their competitiveness. It is one of the most thorough and comprehensive annual reports on the competitiveness of nations. Overall the calculations are based on 327 variables[49] organized into four groups: economic performance, government efficiency, business efficiency and infrastructure. There is high volatility between different years thanks to the complexity of measurement methods. Based on data for different years in the World Competitiveness Scoreboard we compared the best and worst values of the EU countries[50] with the scores of the Visegrad countries (see Figure 2).

Figure 2. IMD scores of Visegrad 4 countries compared to the best and worst figures from the EU15+V4+Estonia+Slovenia



Source: author's calculations based on the IMD World Competitiveness Yearbook 2013 and relevant years of the IMD World Competitiveness Scoreboard

A review of the two competitiveness rankings (see Table 1) reveals discrepant results in long-term time series. The comparison of the

[48] In 2002: 49 countries; in 2013: 60 countries
[49] This can be problematic when making comparisons – when comparing successive years. For example, in 2007 the competitiveness ranking was investigated under 232 indices.
[50] Due to a lack of national data we use the EU15 countries and the Visegrad 4 countries plus Estonia and Slovenia.

ranks between the two investigations not useful, thanks to divergent sampling methodology and the ranking of countries taken into account. However, summarizing the most important experiences is useful. The trends of the time-series are clearly drawn out for developing economies and the lagging economies. Concerning the Global Competitiveness Report, the European Union (EU28) continuously dropped down in the list. Emerging economies performed differently, with Brazil, China (PRC) and the Russian Federation improving their performances. Traditionally developed economies like the USA and Japan dropped down in the list, as did the EU. Small Visegrad countries dropped in competitiveness while Poland was able to move forward. If we take into account previous years, among the new member states Poland was the only EU member that avoided recession, due to its favourable internal demand. The economic output in the other three Visegrad countries was significantly affected by the crisis, leading to other structural problems as well.[51] IMD's World Competitiveness Yearbook confirmed the good performance of Poland in recent years. The report also highlighted the Czech Republic as an example of a well-performing country for businesses. The European Union saw improvement in its competitiveness, contrary to the Global Competitiveness Report. All noted developed and developing economies have been improving their competitiveness over the last 11 years.

External trade performance of Visegrad countries

The external trade balance and the global market share in high-tech industries are the easiest way to compare national economies in the global economy. Investigating external trade is the obvious way to define the competitiveness of nations (Éltető[52]; Tomáš[53]) because it is a comprehensive concept, expressing the potential of national economies to stand the test of international products.

[51] Túry (2012)
[52] Éltető (2003)
[53] Tomáš (2011)

Table 1. Competitiveness development in the countries studied

Ranks and period/country	WEF Global Competitiveness Report 2006-2013	IMD World Competitiveness Yearbook 2002-2013
Czech Republic	-	+
Hungary	-	-
Poland	+	+
Slovak Republic	-	+
China	+	+
United States	-	0 (+)
Japan	-	+
Brazil	+	+
India	-	+
Russian Federation	+	+

Some (Török[54]) believe that measuring competitiveness on the demand side is impossible. Further, Török points out that there is a weak linkage between the export structure, technological level of manufacturing output and R&D expenditure.[55] A globalised examination of the international trade raises further questions. Is it possible to speak of the national competitiveness or just competitiveness of firms in the 21st century, when numerous transnational companies carry out production in almost all regions/countries of the world? There is ample evidence of the existence of isolated multinational corporations in national economies as a result of globalisation.[56] Firms with global value chains across economies create a global network of production and distribution.

The Central European emerging markets[57] are open and highly dependent on foreign demand. If key partners experience shrinking demand, export development is hit hard. In terms of external trade, Poland – with its rather large internal market – is different from the

[54] Török (1998)
[55] Török (2008)
[56] Sachs–Yang–Zhang (2000)
[57] I use this term in parallel with the term "the Visegrad countries" despite the two terms are not equivalent. The Visegrad countries are part of the Central European region, here defined as the Czech Republic, Hungary, Poland, Slovakia and Slovenia.

other three countries, which are deeply involved in external markets. The net value of exports showed a positive turn during the time of breakdown of internal consumption and the relapse of the import-based production of large multinational companies during the world economic crisis. The improvement of the trade balance took place despite a declining trade performance, i.e. the decreasing volume of exports due to the lack of demand growth in external markets

The Central European countries have been showing tremendous development – in terms of both quantity and quality – in foreign trade since the beginning of the 1990s. According to WTO statistics[58], from the beginning of 1990 until 2012 the world trade increased threefold, while the external trade turnover of the Visegrad countries tenfold. Landesmann and Wörz highlighted that evolution of trade balance was a sign of the catching-up processes of the Central and Eastern European countries.[59] Concerning export competitiveness, despite a relative export price growth, productivity gains were able to offset the process. In this regard, a number of studies have explored the relationship between trade development, economic growth and pattern of trade in the CEE region. Pavličková deals with the export competitiveness of the Slovak Republic, giving a comprehensive summary of the empirical studies dealing with the topic[60]. She investigated export data using Peneder's[61] classification of industries according to involvement of human resources between 1999 and 2011. Using statistical methods (Constant Market Share Analysis, Revealed Comparative Advantage, Michaely Index, and unit export and import values) she confirmed the increasing competitiveness of Slovak exports in European markets. Nevertheless, she did not assess any significant change in the Slovak commodity structure during the observed period. Price competitiveness fulfils the main role in trade development. Outrata and co-authors examined foreign trade trends as part of intra-industry trade tendency using the Grubel-Lloyd Index[62]. They found that CEFTA countries had a comparative advan-

[58] WTO (2013)
[59] Landesmann–Wörz (2006)
[60] Pavličková (2013)
[61] Peneder (1999)
[62] Outrata–Gajdošová (2004)

tage in products of lower added value. CEE countries are competitive in the labour-intensive industries and have disadvantage in marketing- and technology-driven industries. Vokorokosová and Čarnický, using the Revealed Competitive Advantage and the Michaely Index, added to this claim, showing that in term of international trade Slovakia had a competitive advantage not just in the labour-intensive industries but also in those industries which are relatively higher capitalised.[63]

The mentioned articles deal with a time period far before the crisis. In this paper, I concentrate on the developments of the recent decade. A deeper analysis of external trade development is necessary. Additional methods were used to attain a picture of a qualitative aspect. First, the share of high-technology products in total exports and the structure of the high-technology products are analysed. Second, high-technology production and the high-technology trade are compared.

The Eurostat's high-technology aggregation[64] based on OECD's high- and medium-high-technology manufacturing classification[65], reveal remarkable developments and differences among the Visegrad four (see Table 2). The Czech Republic and Hungary are in the leading position, while Slovakia and Poland can be found behind them. Despite the outstanding figures, the trend of Hungarian high-technology exports in the last decade was showing a remarkable decrease.

How did exports vs. high-technology export growth develop over the last decade? Determining the nexus between growth of exports and high-technology trade between 2000 and 2013[66], we use the Pearson product-moment correlation coefficient.[67] There are strong correlations between the yearly export figures and high-technology export figures in all V4 countries (the Czech Republic: 0.9918; Hungary: 0.9379; Poland: 0.9482; Slovakia: 0.9541). If we examine the relative figures, i.e. year-on-year figures of the growth of total and

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[63] Vokorokosová–Čarnický (2003)

[64] Eurostat (2009). High-technology aggregations based on SITC Rev. 4 http://epp.eurostat.ec.europa.eu/cache/ITY_SDDS/Annexes/htec_esms_an5.pdf

[65] OECD (2013), p. 240.

[66] For long tern analysis I use Eurostat data. For comparison to developed and emerging economies I use the database of UN Comtrade based on the same classification as Eurostat's data.

[67] http://en.wikipedia.org/wiki/Pearson_product-moment_correlation_coefficient

high-technology exports, the dynamics of the two series are similar in the Czech Republic and Hungary, but the correlation is low in the case of Poland and Slovakia.

Table 2. Share and growth of high-technology products in total exports (%)

Country	2000	2005	2010	2013	Growth rate 2013/2000	
					total exports	high-tech exports
Czech Republic	7.7	11.8	16.1	15.0	386	750
Hungary	23.7	20.8	21.8	16.1	267	182
Poland	2.7	3.0	6.0	6.7	443	1086
Slovakia	2.8	6.3	6.6	9.6	505	1711

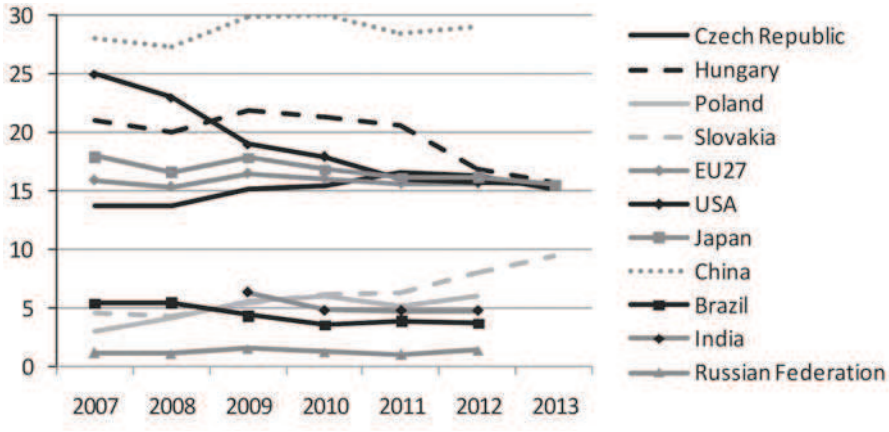
Source: author's calculations based on Eurostat Comext (2014)

The reason should be the different growth rates of total and high-technology exports (see Table 2). The table also shows the level of sustainability of exports of the high-technology products in the examined economies. There is a remarkable development in high-tech exports in three Visegrad countries. The increase of high-technology exports was growing above the export growth by 3.4 times in Slovakia 2.5 times in Poland and almost doubled (1.9 times) in the Czech Republic, while in Hungary the high-tech growth was below (0.7 times) the dynamics of overall exports. Concerning Hungary, the cause of the decline is that in 2008 the exports of computers (SITC Rev.4.: 752) decreased and in 2012 the exports of telecommunications equipment (SITC Rev.4.: 764, excluding 764.93 and 764.99) also decreased. There were corporate issues explaining these developments, reflecting changing global circumstances and multinational-network reorganisations. In 2008, the U.S. company Sanmina-SCI sold its global computer facilities. The deal affected Hungarian production as well[68].

[68] Sanmina-SCI sold its PC manufacture, including the production capacity of the Hungarian facilities (Eladja PC-gyártását a Sanmina-SCI, közte magyar kapacitásának egy részével) http://www.hwsw.hu/hirek/35382/sanmina-sci_hon-hai_foxconn_foxteq_szerzodeses_elektronikai_gyartas_ems_lenovo_flextronics.html

In 2011, the Finnish communications and information technology corporation Nokia had announced the restructuring of its production and reallocations of its facilities[69] that caused the downsizing of the Hungarian production plant in 2012.

Figure 3. Share of high-technology exports in the selected countries



Source: author's calculations, based on the data of the UN Comtrade (2014)

For the comparative analysis of the high-technology exports of the V4 countries with the leading developed and emerging economies, I used the database of the United Nations Commodity Trade Statistics[70] (UN Comtrade) for the available years (i.e. between 2007 and 2013). China has the leading position with an almost 30% high-technology export ratio. The shares of high-technology products in the total exports of Hungary and the Czech Republic are about the same level as in exports of the European Union and the most developed countries (Japan and the USA). However, there is a strong decreasing trend of the ratio of high-technology exports in the USA and Hungary (see Figure 3). Regarding the technological level of the exports of the Slovak

[69] Nokia press release: Nokia continues to align its workforce and operations. 29 September 2011 http://company.nokia.com/en/news/press-releases/2011/09/29/nokia-continues-to-align-its-workforce-and-hai_foxconn_foxteq_szerzodeses_elektronikai_gyartas_ems_lenovo_flextronics.html operations.

[70] Based on Eurostat's high-technology products classification.

Republic and Poland, in recent years the figures have been exceeding the values of Brazil and India and catching up to the most developed countries in terms of output. The values of the Russian Federation, the fourth member of the BRIC countries, are extremely low.

Based on this comparison we can say that some Visegrad countries are among the leading high-tech exporting economies, while some are in the catching-up process. Have these Central European countries completed the catching-up process? Are they technologically at the same level as the developed countries? In order to obtain a full picture we will analyse more detailed data.

Breakdown of exports by technological intensity – international comparison of the Visegrad countries

Beside the differences in shares of high-technology exports among the countries, there are other characteristics as well. The structure of high-technology exports indicates remarkable differences among the economies (see Table 3) that justifies more detailed research of the added value of the manufacturing industry. There are certain characteristics of the countries appearing first. Clusters are based not on the geographical location but on characteristics of economies. Computers and office machines[71] have a large share in high-technology exports in China and all V4 countries. Exports of the electronic telecommunications have the largest share in emerging economies such as China, India, Hungary and Slovakia, and in Japan from the developed world. The export share of the aerospace industry is high in Brazil, the Russian Federation and Poland.[72] Due to the above-mentioned corporate issues, these indices can fluctuate year-to-year, influencing the dynamics and composition of high-technology exports.

Although there are some differences in the export structure of the countries in question, electronic equipment plays the main role in high-technology industries in all V4 counties. In Hungary and Slovakia, telecommunications equipment (excluding 764.93 and 764.99)

[71] For the detailed SITC code see Eurostat (2009): High-technology aggregations based on SITC Rev. 4 http://epp.eurostat.ec.europa.eu/cache/ITY_SDDS/Annexes/htec_esms_an5.pdf.
[72] There are differences in terms of the aerospace industry. While in Brazil the civil aviation industry has the leading role, in the Russian Federation the production of military aircrafts leads.

Table 3. Structure of high-technology exports in the selected countries in 2012
(shares within high-technology exports)

	Brazil	China	India	Russia	USA	Japan	EU27	Czech R.	Hungary	Poland	Slovakia
Aerospace	57	0	1	32	3	2	25	2	0	14	1
Computers office mach.	3	35	3	3	18	4	8	48	18	32	15
Electronics telecomm.	10	49	35	16	37	50	22	35	56	34	73
Pharmacy	8	1	22	3	8	1	16	1	5	3	1
Scientific instruments	6	9	9	12	21	27	17	5	13	9	5
Electrical machinery	1	2	1	4	3	6	2	3	2	1	2
Chemistry	10	2	28	8	4	2	4	1	2	3	1
Non-electrical machinery	1	0	1	17	5	8	6	4	4	4	2
Armament	4	0	0	4	2	0	1	1	0	0	0

Source: author's calculations, based on UN Comtrade 2014 data.

has the highest share with computers (752). In the Czech Republic and Poland computer production (752) has the highest rate alongside electronic boards and consoles (776.4+772.61).

This one-sided high-tech trade structure and the high rate of the electronic telecommunication products raise the question of the structure of output. Authors dealing with the high-technology content of external trade focus their analyses on the structural and geographical fragmentation of production.[73] We have to take into consideration that the international network of multinational enterprises, i.e. global value chains, have become a dominant feature of world trade, encompassing developing, emerging, and developed economies.[74] Saito and his co-authors referring to the World Input-Output Database[75], deal with the input and output sides of world production and trade development.[76] They pointed out to the increasing role of global value chains in terms of global output. The global division of labour in the global value chain means that every country has its own role and value added phase within the global production chain.

Based on the academic literature the following trends can be drawn up. The amount of trade, related to output, has been increasing during the last decades. This is shown in the world export-to-output ratio, which has grown from 20 to 30 per cent from 1995 to 2008.[77] Concerning export growth, global value chains have a decisive role. Due to the global activity of multinational companies, production of the same output involves more intermediate products in global trade. More income is generated by being part of global value chains. This was led by the increase of value-added exports[78] (or income generated by exporting) that are becoming a bigger part of world income. During the 1995-2008 period, it increased from 15 per cent to 22 per cent of the world GDP.[79]

Higher value added in exports has a correlation with the presence of the global value chain. Saito and his co-authors, using VAX Ratio

[73] Grodzicki (2014)
[74] OECD (2013)
[75] www.wiod.org/new_site/database/wiots.htm
[76] Saito–Ruta–Turunen (2013)
[77] Ibidem, p. 8.
[78] Value added produced in a country and absorbed in another country.
[79] Saito–Ruta–Turunen (2013), p. 9.

(Value-Added Exports to Gross Exports, as a summary measure of value-added content of trade) by Johnson and Noguera[80] examined the correlation between the vertical specialisation and value added exports. There are countries with low VAX Ratio at the assembly part of the global value chain (Ireland, the Czech Republic, Taiwan), and countries with high VAX Ratio providing the largest value added to global chains. There are many other measures developed to captured the role of value chains in exports: the import-content of exports[81], foreign value-added shares in exports[82], vertical specialisation of trade[83], and imports to exports.[84] Between 1995 and 2008 the Central and Eastern European region increased its share in the global value chains.[85] The paper by Baldwin and Lopez-Gonzalez (2013) based on the World Input-Output Database shows that importing to produce, i.e. the share of the foreign value added in the exports in 2009, are the highest in the Czech Republic (39%), Hungary (40.5%) and Slovakia (45%) among the countries measured. This confirms Baldwin and his co-authors' (2013) position that multinationals using their own technology and know-how do not rely on local technologies.

Analysis of the production and exports of high-technology industries

Beside the analysis of the export structure and the high-technology share, another aspect is the comparison of the nexus between production and external trade in high-technology industries. The purpose of the comparison is to provide a picture of the value added of the high-technology sector vis-à-vis exports of high-technology goods, i.e. a comparison of the internal and external performance of the countries.

There are several classification systems regarding high-technology production and products. The World Bank aggregates high-technology products with high R&D intensity, such as in aerospace, computers,

[80] Johnson–Noguera (2012)
[81] Hummels–Ishii–Yi (2001)
[82] Koopman–Powers–Wang–Wei (2010)
[83] Daudin–Rifflart–Schweisguth (2010)
[84] Baldwin–Lopez-Gonzalez (2013)
[85] Grodzicki (2014), p. 8.

pharmaceuticals, scientific instruments, and electrical machinery.[86] Eurostat refers to high-tech industry and knowledge-intensive services.[87] The OECD[88] has a technology intensity definition and classification of manufacturing industries based on R&D intensities.[89] Using OECD classification on the gross value added (GVA) side and Eurostat high-technology products (based on the OECD's classification of high- and medium-high-technology industries) on the export side, Table 3 (series01) shows the share of high-technology products in the share of the total exports.

Concerning the examined EU countries[90], the Pearson's correlation coefficient is rather low (0.4192), showing a low dependency between high-technology GVA and the exports of high-technology products, what confirms the results of some authors (Török 2008; Koopman, Powers–Wang–Wei 2010; Daudin–Rifflart–Schweisguth 2010; Baldwin – Lopez-Gonzalez 2013) previously mentioned. Another conclusion is that there are rather huge gaps in some countries between the GVA and the export ratio. On one hand, higher high-technology ratio shows a competitive export structure, while on the other hand it can show the "real value added" of the country regarding high-technology products.[91]

On the methodological side this comparison and common visualisation raises some questions. If we compare the gross value added (GVA) of high-technology production and trade of the high-technology products, we find that data is not compatible. GVA data are based on NACE[92] industry classification, while trade data are based on goods classified by SITC.[93] There is a problem regarding concordance, because the former classification is activity based, while the

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[86] World Bank (2014). World Development Indicators, Science and Technology: High-technology exports (% of manufactured exports) http://data.worldbank.org/indicator/TX.VAL.TECH.MF.ZS
[87] Eurostat: Reference Metadata in Euro SDMX Metadata Structure (ESMS) http://epp.eurostat.ec.europa.eu/cache/ITY_SDDS/en/htec_esms.htm
[88] OECD (2013), p. 240.
[89] OECD (2011)
[90] Belgium, Bulgaria, the Czech Republic, Denmark, Germany, Estonia, Greece, Spain, France, Italy, Lithuania, Hungary, the Netherlands, Austria, Poland, Portugal, Romania, Slovenia, Slovakia, Finland, and the United Kingdom
[91] Saito–Ruta–Turunen (2013)
[92] General Industrial Classification of Economic Activities within the European Communities (NACE) Rev. 2 system
[93] Standard International Trade Classification, Revision 4. nomenclature

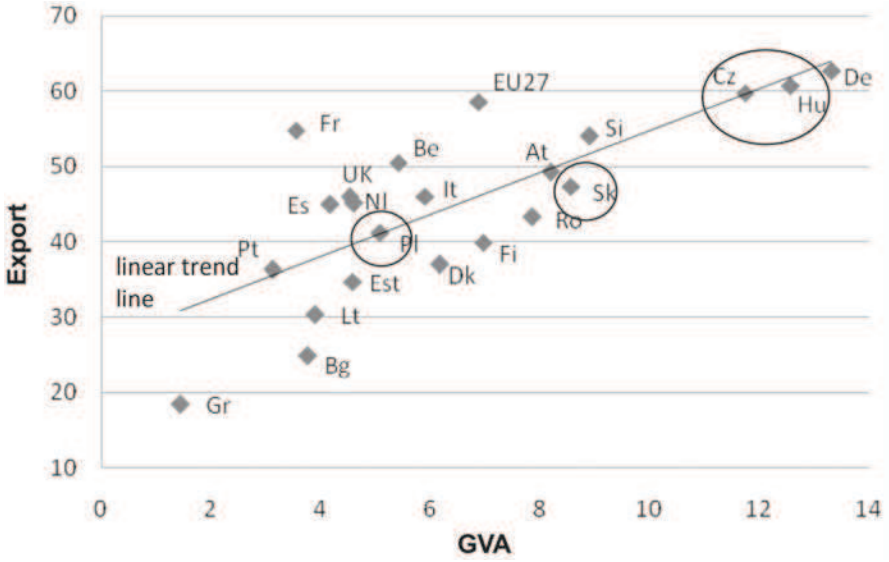
latter is product/goods based. Therefore, based on correspondence tables, the classifications were converted to make them suitable for comparison.[94]

Figure 4 shows the dispersion of the exports of high-technology industries and high-technology gross value added (GVA) regarding the selected countries, i.e. the internal and the external performance of the economies. Against the former dependence value (cf.: Table 3) between the GVA and high-technology export data, the Pearson's correlation coefficient of the recalculated data shows a stronger relationship (0.7557). The position and the rank of the V4 countries were not changed. The Czech Republic and Hungary have the leading position, very close to Germany. There is a change regarding the unusual figure of Hungary. The distance between Hungary and the Czech Republic in the second calculation was largely reduced (see Figure 4). It may have occurred for several reasons. In the Czech Republic, the branches using high technology are presented with broader activity (more products and more variance), expressly high-technology products are not presented as high rate as in the case of Hungary. Poland is in last place and Slovakia is nearer to the average (trend line). Compared to the previous figure (see Table 3), the technology level of Czech and Hungarian exports is much higher, showing a competitive advantage. Taking into account that the Hungarian, Czech and Slovak economies are highly involved in global value chains[95] (foreign value added in the exports in 2009 were the highest in the Czech Republic, Hungary and Slovakia) among the countries, these outstanding values are due to the activity of the largest transnational companies. Taking into account the data of the World Input-Output Database, Hungary, the Czech Republic and Slovakia have the highest rate (around 60% of foreign inputs and domestically produced inputs used in foreign exports as per cent of gross exports) of foreign inputs in direct exports among the selected countries[96] in

[94] See detailed: Túry (2014)
[95] As in the paper of Baldwin–Lopez-Gonzalez (2013)
[96] Austria, Belgium, Bulgaria, Cyprus, the Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, United Kingdom, Japan, the USA, Brazil, China, India, Russia.

2009 concerning electrical and optical equipment and transport equipment industries[97]. Export values represent the value of the semi-finished or finished products which formed only a small proportion in the examined CE countries. That shows the large differences between the GVA and the exports of high-technology products.

Figure 4. The ratio of exports and GVA of industries using high technology in selected EU countries (2011): series02



Source: author's calculations, based on UN Comtrade and Eurostat Comext data.

Analysing the high-technology branches and products, we can see large differences between the examined V4 and EU countries (see Table 3). Having made datasets compatible based on correspondence tables, the differences between the countries are even more pronounced. Sample variance[98] of series01 is 5.4039, while that of series02 is 11.5656, showing that in some countries the industries using high technology are not represented in the whole vertical production, but only in the production of parts.

[97] European Commission (2013), p. 84-86.
[98] http://www.math.uah.edu/stat/sample/Variance.html

Table 3. GVA and export data of the selected countries

Country	Share of the branches using high technology as % of total GVA	Exports			Ratio of the series02 per GVA
		of the high-technology products as % of total (series01)	of the branches using high technology as % of total (series02)	*difference* series02-series01	
Greece	1.4	4.2	18.4	14.2	13.1
Portugal	3.1	3.0	36.3	33.3	11.7
France	3.5	19.1	54.7	35.6	15.6
Bulgaria	3.8	3.8	24.9	21.1	6.6
Latvia	3.9	5.6	30.4	24.7	7.8
Spain	4.2	4.7	44.9	40.2	10.7
UK	4.5	15.2	45.9	30.7	10.2
Estonia	4.6	14.0	34.7	20.7	7.5
Netherlands	4.6	16.0	45.1	29.1	9.8
Poland	5.1	5.2	41.2	36.1	8.1
Belgium	5.4	7.7	50.5	42.8	9.4
Italy	5.9	6.4	46.0	39.5	7.8
Denmark	6.2	9.3	37.0	27.7	6.0
EU27	6.9	15.6	58.6	42.9	8.5
Finland	7.0	8.1	39.9	31.7	5.7
Romania	7.9	9.1	43.2	34.2	5.5
Austria	8.2	10.5	49.2	38.7	6.0
Slovakia	8.6	6.3	47.3	41.1	5.5
Slovenia	8.9	5.2	54.1	48.9	6.1
Czech Republic	11.7	16.5	59.7	43.2	5.1
Hungary	12.6	20.5	60.7	40.2	4.8
Germany	13.3	13.6	62.8	49.2	4.7

Source: author's calculations, based on the data of the UN Comtrade and Eurostat Comext.

Comparing the GVA with series02 (ratio of series02 per GVA; see Table 3), the above shown sequence of the Visegrad countries will be almost the same order. The value of the exports of high-technology branches per GVA, in the case of Poland is 8.1, Slovakia 5.5, the Czech Republic 5.1 and Hungary 4.8. From one side this could mean that Poland is more competitive because relatively less high-technology industries export relatively more high-technology products. On the other side, lower values in the V4 countries, i.e. higher GVA and higher export share, may indicate a better export performance. In this comparison Hungary, the Czech Republic and Slovakia form one cluster, while Poland is far behind them.

Summary and conclusions

Regarding international competitiveness of the V4 economies, the picture is diverse according to different benchmarking ranks. There is increasing competitiveness on one side and a drop in ranking position on the other. There is a significant lagging of the V4 countries based on the rankings of the World Economic Forum Global Competitiveness Report. Further, this trend of the V4 countries parallels the globally declining competitive performance of the European Union. This highlights dependence on European trends as well as the increasing role of emerging markets (e.g., China, Brazil), which will be determinative for the global position of the V4 economies within global value chains.

Because of their export driven economies, most Central European emerging economies are highly dependent on foreign demand. Poland has a unique position with its large internal market. Another part of the picture is that their outstanding export performance derives from the fact that they are deeply involved in global value chains. This, however, causes further differences between the countries examined. One consequence of this is a high proportion of high-technology products in total exports in some countries. Regarding the exports of high-technology products, Hungary and the Czech Republic show the best performance, while Slovakia and Poland have lower exports of this kind. In order to compare the international competitiveness of the Visegrad countries, the study analysed the relation between the internal and ex-

ternal performance of high-technology production. At first, the OECD's high-technology ISIC classification was recounted into SITC classification. In terms of gross value added and export shares of branches using high technology, the Czech Republic and Hungary again have higher values compared to Slovakia and Poland. Regarding the ratio of GVA and exports of branches using high technology, Slovakia catches up to Hungary as well as to the Czech Republic thanks to increasing foreign investments in the automotive industry in recent years. Poland has less favourable data and low GVA and export share, despite developing industrial capacities. The reason is, on one hand, the different level of Poland's integration into the global value chains, which is a crucial factor in export performance. The other issue is Poland's large internal market, which distinguishes it from the other three economies, which are highly export dependent.

Besides these facts, further investigation of the countries involved in the analysis shows there are significant country-specific features. The ratio of exports of the high-tech intensive branches (series02) per GVA of the branches using high technology can be interpreted in two ways. On the one hand, high values can mean better external performance. On the other hand, low values indicate relatively higher export shares of high-technology industries. Therefore, ranks cannot be interpreted without knowing the internal characteristics of the countries, which give us a basis for further investigation.

Based on the examples examined in this paper, we see that corporate decisions affect the external performance of the countries in terms of the level of connection or disconnection of these economies to/from global value chains. For a complete picture we have to take into account the internal structure of the economy, i.e., the proportion of high-technology branches, corporate issues or characteristics of the economy.

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