A BREAKDOWN OF SECTOR PERFORMANCE OF THE VISEGRAD COUNTRIES AND GERMANY IN LIGHT OF STRUCTURAL CONVERGENCE[1]

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Abstract: The aim of this contribution is to analyze a breakdown of sector performance of the Visegrad countries and Germany in light of structural convergence. The macroeconomic view on structural convergence was researched by the estimation of business cycle synchronization of pairs of countries. The microeconomic aspect of structural convergence is characterized by the breakdown of sector performance of the analyzed countries and the application of the Krugman specialization index.

Keywords: business cycle synchronization, sector breakdown, Krugman specialization index.

1. Introduction

Structural adjustments and sector specialization are relevant for the long-term growth potential of the European Union countries, affecting the speed at which the economy can grow without building up inflationary pressures. Sectors are a broader classification than industries, although some companies (especially modern ones) can make a case for being "counted" in several different sectors. Companies within the same sector tend to have relatively high correlations in their rate of growth, stock price performance, and forecasts – especially over short and medium-term time periods.

As far as business cycle synchronization is concerned, given that the production structures of euro zone countries appear to be relatively

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similar and fairly stable over time, misalignments in the business cycles, which could hinder the smooth conduct of the single monetary policy, are not quantitatively important. Indeed, over time, there has been a convergence towards more similar business cycle characteristics across euro zone countries. That is why we aim to analyze the macroeconomic and microeconomic aspects of the structural convergence of the Czech Republic, Hungary, Poland and Slovakia to Germany, the country which is the economic and political leader of the euro zone. We chose Germany instead of the euro zone on purpose. In recent months the discussions about the split of the euro zone into hard core countries (led by Germany) and the rest of the countries are no longer taboo. Obviously, in future the Czech Republic, Hungary, Poland and Slovakia too, would like to belong to this group.

This paper is organized as follows: Section 1 is the introduction, 2 gives the review of the relevant literature, which deals with convergence, especially structural. Section 3 contains the characteristics of the data and methodology used in the contribution. Section 4 focuses on the empirical outcomes of our research. The final section concludes.

2. Literature review

The literature on convergence has been dominated by the analysis of real convergence, i.e. income convergence [Barro, Sala-i-Martin 1991 1992] and productivity convergence [Abramovitz 1986; Abramovitz, David 1996]. During the period of the creation of the European Monetary Union, nominal convergence dominated [De Grauwe 2007; Lein-Rupprecht, León-Ledesma, Nerlich 2007]. Structural convergence, on the other hand, has received far less attention, although studies indicate that real convergence does not necessarily imply structural convergence [Fujita et al. 1999]. Structural convergence became more researched in Europe when the monetary union took place as it keeps the member states of the monetary union protected from asymmetric shocks which might take place in "one monetary policy economic space".

In our paper we would like to focus on the macroeconomic and microeconomic aspects of the structural convergence of the Czech

Republic, Poland and Slovakia to Germany. In theory, the structural change, and hence the structural convergence, can result from three main forces [Wacziarg 2001]. Firstly, demand side effects, i.e. an income growth, might generate increased sectoral similarity between pairs of countries with converging incomes. Secondly, on the supply side, convergence in sectoral labor productivity levels across pairs of countries would create a tendency to allocate increasingly similar shares of labor intersectorally. Thirdly, structural convergence could be linked to trade-related considerations.

We can distinguish two types of structural convergence, i.e. intersectoral and intrasectoral convergence. Intersectoral convergence treats convergence between the aggregate sectors across economies, i.e. the shares of agriculture, manufacturing, construction, trade and services. Intrasectoral convergence, on the other hand, is concerned with the convergence of production structures within one of the aggregate sectors, e.g. the share of the automotive industry on the total manufacturing sector. In our analyses we focus on the intersectoral convergence of the Czech Republic, Poland, and the Slovak Republic to Germany. The basic concept of the intersectoral hypothesis says that all economies are following the same development path, starting with the dominating agricultural sector. Increases in labor productivity make workers redundant and they switch over to the manufacturing sector. When later productivity rises in the manufacturing sector as well, workers are forced to find jobs in the service sector. This process is assumed to continue until all the economies have reached an economic structure dominated by the service sector. The development of the economic structures of the "old" European countries over the last three decades using employment data proved an overall structural convergence among Western European countries over time, especially inter-sectoral convergence [Höhenberger, Schmiedeberg 2008].

Structural convergence is, in literature, often characterized by the harmonization of the business cycles. The simplest way of examining synchronization is by detrending an indicator of economic activity (usually GDP or its components) and by calculating pairwise correlations, cross correlations, or Spearman correlation coefficients. This approach was followed by many researchers. As for the Visegrad countries (the Czech Republic, Poland, Hungary, the Slovak Republic)

and their relationship to the euro zone, most papers conclude that the correlations of the V4 countries' business cycle are caused by the intensity of mutual trade and by the intra-industry trade index [Fidrmuc, Korhonen 2003; Fidrmuc 2004; Benčík 2011].

3. Data and methodology

3.1. Data characteristics

The used annual data of nominal gross domestic product per capita in purchasing power parity cover the period from 1995 to 2011 (for Poland available up to 2010) and they are from the data source of Eurostat.

As to output gap correlations, we selected the output gap derived from the quarterly GDP series. The time series were first seasonally adjusted and set as logarithms. We calculated potential output using an HP filter (smoothing parameter $\lambda = 1600$) and deducted it from seasonally-adjusted real GDP.

To estimate the structural convergence, the sectoral breakdown of quarterly gross value added figures (available from Eurostat; National Accounts detailed breakdowns – NACE Rev. 1) is used as follows:

A – B – agriculture; fishing (hereafter agriculture);
C – E – industry except construction (hereafter industry);
D – manufacturing;
F – construction;
G – I – wholesale and retail trade; hotels and restaurants; transport (hereafter trade);
J – K – financial intermediation; real estate (hereafter finance);
L – P – public administration and community services; activities of households (hereafter public services and households).

The estimations and figures were produced by the software EViews 7 and MS Excel.

3.2. Measure of the structural convergence

Business cycle synchronization is the macroeconomic evidence of the structural convergence of the analyzed countries. Output gap correla-

tions investigate whether there has been an increase or a decrease in business cycle co-movement between the analyzed countries. In our contribution we also present the index of nominal gross domestic product per capita with the based year 2005 = 100.

To measure the intensity of the microeconomic structural convergence we have used the Krugman specialization index (K). This is a measure of the extent to which a country's production patterns differ from those of a reference group of countries or (as it is in our case) of the reference country. The Krugman specialization index can be specified as

$$K^k(t) = \sum_{k=1}^{N} \left| V_j^k(t) - V_{GER}^k(t) \right|,$$

$$j = CZ, HU, PL, SK;$$

$$t = 1995, 1996, ..., 2010.$$

(1)

The Krugman specialization index runs from zero if the country and reference country produce the same goods in the same proportions, to two if they produce only different structures of goods and services.

4. Empirical results

As was stated above, from the macroeconomic point of view the structural convergence of the economies is analyzed by the output gap correlations. The contribution investigates whether there has been an increase or a decrease in business cycle co-movement in Germany and Czech Republic, Germany and Hungary, Germany and Poland, and Germany and Slovak Republic from 1995 to 2011.

The output gaps of the Czech Republic and Germany surprisingly show that in the period from 1995 to 2000 there might be a stronger positive correlation compared to the period from 2001 to the first quarter of 2012. This development proves the fact that there are structural changes needed to be implemented in the Czech economy via long term policies which influence the potential of long-term sustainable growth.
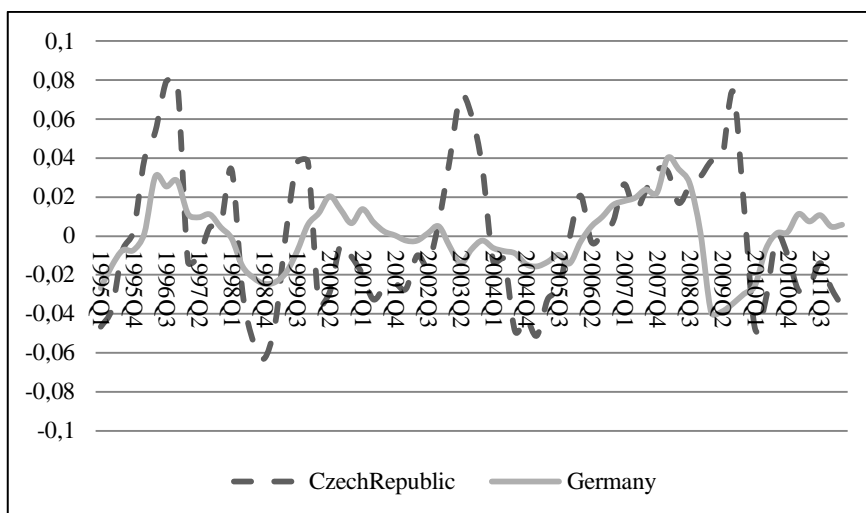
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Figure 1. Output gaps of the Czech Republic and Germany
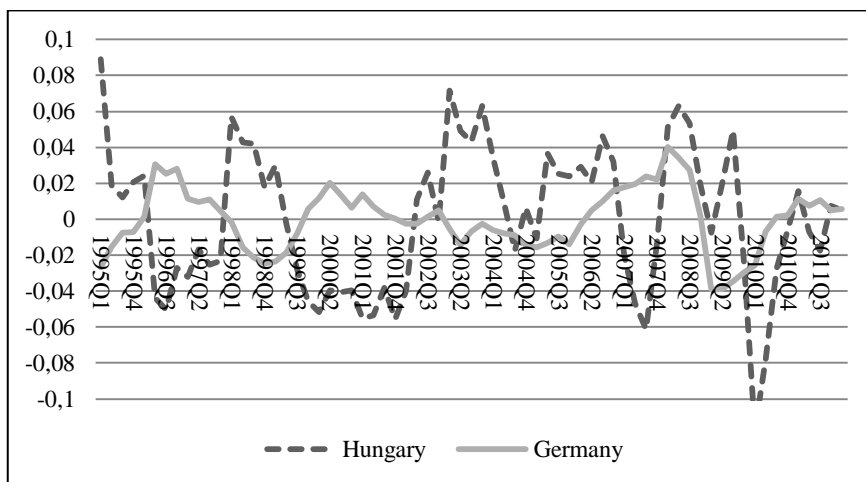
Source: own estimation.

Figure 2. Output gaps of Hungary and Germany

Source: own estimation.

The output gaps of Hungary and Germany show that they are not synchronized at all. The Hungarian economy grows either above its

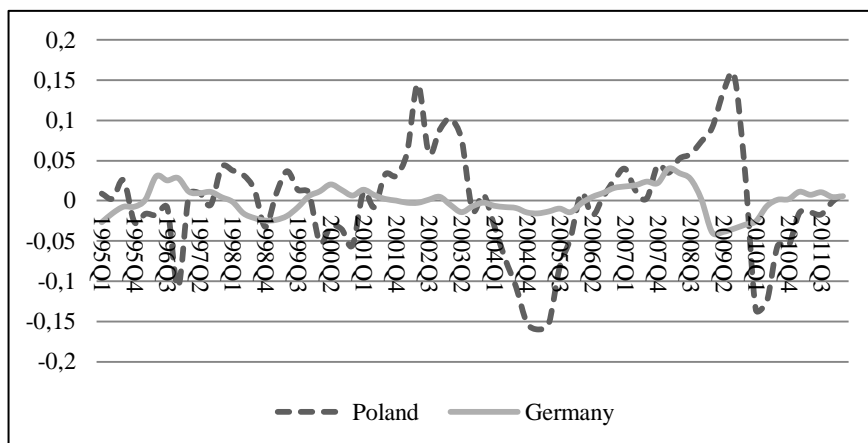potential or below its potential, while the German economy tries to reach sustainable long-term growth.

Figure 3. Output gaps of Poland and Germany
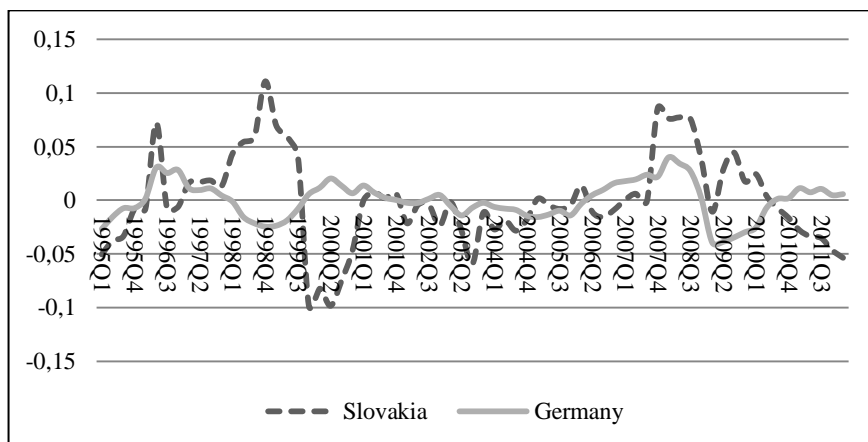
Source: own estimation.

Figure 4. Output gaps of the Slovak Republic and Germany

Source: own estimation.

The output gaps of Poland and Germany show that the German economy grows at its potential and only rarely is there a need to apply short-term demand side policies as monetary policy or tax policy. This

reflects the strict wage restrictions implemented in the public and private sector before the financial crisis, which made the German economy the most competitive in Europe.

The output gaps of the Slovak Republic and Germany show the strong correlation within the period 2001-2008. During that time Slovakia was implementing structural policies which helped the country to join the European Union and experience strong economic growth based on the healthy economic condition.

Table 1 gives an overview of the evolution of business cycle synchronization measured by cross correlations for the Czech Republic, Hungary, Poland, and Slovakia against the cycle of Germany. The Eurostat data from the first quarter of 1995 to the first quarter of 2012 are used. We calculated cross correlations of output gaps (also possible leads/lags) from 1995 to 2012 and we also divided the calculations into three periods: 1995 to 2000, 2001 to 2008, and 2001 to 2012. We chose two overlapping periods in order to highlight the potential effect of the economic crisis which started in 2008 in the USA, but could have been influencing the real economy of European countries since 2009.

Cross correlations of output gaps showed interesting results. Before 2001 the business cycle of Poland and Germany, Slovakia and Germany as well as Hungary and Germany were not synchronized (negative correlations). But the business cycle of the Czech Republic and the Germany has got a high positive correlation. Between 2001 and 2008, the correlations describing the business synchronization between Poland and Germany and the Slovak Republic and Germany became positive and high, reflecting the positive effect of entry into the EU and the increase of mutual trade. Surprisingly, at the same time, between 2001 and 2008, the synchronization of the business cycle of the Czech Republic and Germany, measured by cross correlations of output gaps, decreased (though it was still positive) and the cross correlations of output gaps between Hungary and Germany still remained negative. We are aware that the result might be influenced by the short span of the analyzed data in the light of the whole business cycle of the analyzed countries. The economic crises decreased the business cycle synchronization between the analyzed countries and Germany, which is why the cross correlations describing all the ana-

lyzed period, from 1995 to 2012, are smaller than the cross correlations from the period 2001-2008.

Table 1. Cross correlations of output gaps

Period: 1995Q1 – 2000Q4							
CZ – G		**PL – G**		**SK – G**		**HU – G**	
i lag	lead	i lag	lead	i lag	lead	i lag	Lead
0 *0,662*	*0,662*	0 *-0,489*	*-0,489*	0 -0,357	-0,357	0 *-0,780*	*-0,780*
1 *0,412*	*0,613*	1 *-0,383*	*-0,381*	1 -0,338	*-0,401*	1 *-0,489*	*-0,672*
2 0,119	*0,498*	2 -0,316	-0,350	2 -0,145	-0,318	2 -0,184	*-0,482*
3 -0,167	0,341	3 0,098	-0,253	3 0,127	-0,238	3 0,025	-0,260
4 -0,270	0,055	4 0,294	-0,171	4 0,323	-0,130	4 0,257	-0,021
Period: 2001Q1 – 2008Q4							
CZ – G		**PL – G**		**SK – G**		**HU – G**	
i lag	lead	i lag	lead	i lag	lead	i lag	Lead
0 *0,349*	*0,349*	0 *0,446*	*0,446*	0 *0,709*	*0,709*	0 -0,069	-0,069
1 *0,350*	*0,401*	1 *0,514*	*0,393*	1 *0,765*	*0,623*	1 -0,065	-0,107
2 *0,372*	*0,400*	2 *0,495*	0,331	2 *0,686*	*0,451*	2 -0,109	-0,197
3 0,321	0,304	3 *0,423*	0,211	3 *0,566*	0,300	3 -0,144	-0,253
4 0,216	0,174	4 *0,368*	0,053	4 *0,485*	0,177	4 -0,064	-0,206
Period: 2001Q1 – 2012Q1							
CZ – G		**PL – G**		**SK – G**		**HU – G**	
i lag	lead	i lag	lead	i lag	lead	i lag	Lead
0 -0,016	-0,016	0 0,070	0,070	0 *0,252*	*0,252*	0 0,059	0,059
1 0,071	-0,052	1 0,215	-0,056	1 *0,255*	*0,182*	1 0,122	-0,074
2 0,209	-0,065	2 0,379	-0,117	2 *0,241*	-0,007	2 0,165	*-0,241*
3 *0,392*	-0,075	3 0,555	-0,165	3 *0,292*	-0,167	3 0,256	*-0,351*
4 *0,495*	-0,140	4 0,662	-0,208	4 *0,360*	-0,298	4 0,319	*-0,383*
Period: 1995Q1 – 2012Q1							
CZ – G		**PL – G**		**SK – G**		**HU – G**	
i lag	lead	i lag	lead	i lag	lead	i lag	Lead
0 *0,247*	*0,247*	0 -0,035	-0,035	0 -0,035	-0,035	0 *-0,216*	-0,216
1 *0,200*	*0,202*	1 0,097	-0,125	1 -0,025	-0,103	1 -0,087	*-0,284*
2 0,162	0,149	2 *0,236*	-0,170	2 0,057	-0,174	2 0,026	*-0,342*
3 0,150	0,075	3 *0,451*	*-0,188*	3 0,208	*-0,230*	3 0,135	*-0,346*
4 0,162	-0,081	4 *0,574*	*-0,210*	4 *0,334*	*-0,246*	4 *0,242*	*-0,294*

Note: statistically significant values in Italic.

Source**:** own calculations.

As to concrete correlations, we have focused mainly on the contemporaneous correlation and the first lags. Significant leads would mean the fact that the output gaps of the Czech Republic, Hungary, Poland or Slovakia are leading the German lags and that would be

strange or spurious. Taking into consideration the relative size of the Czech Republic, Hungary, Poland and Slovakia, significant external demand impulses may be transmitted to them only from Germany. That is why we are omitting the significant leads in our calculations.

To measure the microeconomic structural convergence, we have also used the Krugman specialization index (K). The share of concrete industry in the analysed country's output and the share of concrete industry in the referenced country is the main component of the Krugman specialization index. That is why we disclosed first the detailed breakdowns of the national accounts of the analysed countries (Figures 5-9). Consequently, Figure 10 represents the Krugman specialization index.

Figures 5-9 show the differences in leading industries which make the biggest value added in the analysed countries.
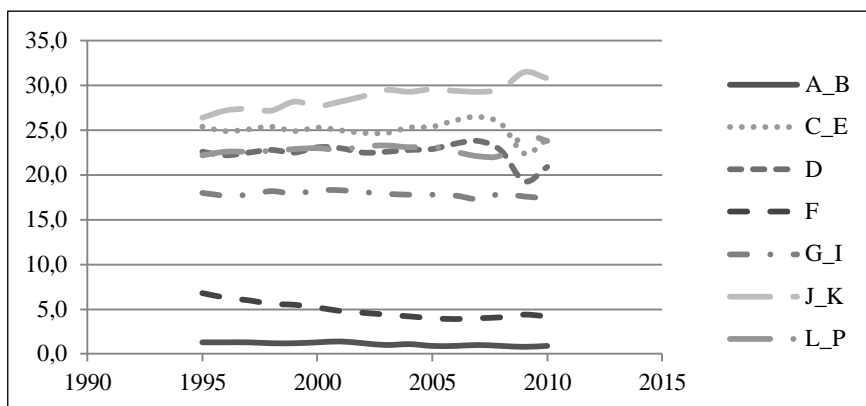

Figure 5. National Accounts of Germany – detailed breakdowns

Source: NACE Rev. 1, at basic prices, percentage of total.

In Germany, finance has the highest share in its output (J – K – financial intermediation and real estate). Second position in the creation of the GDP is taken by industry (C – E) and mainly manufacturing (D). The share of agriculture (A – B) in the GDP creation came bottom. Construction (F) shows a declining trend.

Agriculture (which in the past employed the majority of inhabitants in the countryside) came last regarding the share in input of all the analysed countries. As we expected, construction has a higher

share in total output of the Czech, Polish and Slovak economies compared to Germany . Its share is the second lowest among all the industries in the analysed economies. The field of public services, which is highest in Germany (23,8%) and lowest in Czech Republic (17%), also provides some interesting information.

Germany is the largest national economy in Europe. The country has been a driver and innovator of the globalised economy. Germany is the world´s second largest exporter with $1.408 trillion of exports in 2011. Exports account for more than one-third of national output. Germany imports about two thirds of its energy. The service sector contributes around 70% of the total GDP, industry 29,1%, and agriculture 0,9%. Most of the country's products are in engineering, especially in automobiles, machinery, metals, and chemical goods. Germany is the leading producer of wind turbines and solar power technology in the world. The largest annual international trade fairs and congresses are held in several German cities such as Hanover, Frankfurt, and Berlin. The combination of service-oriented manufacturing, research and development spending, links between industry and academia, international cooperation and SMEs, contribute to the overall competitiveness of the economy of Germany.
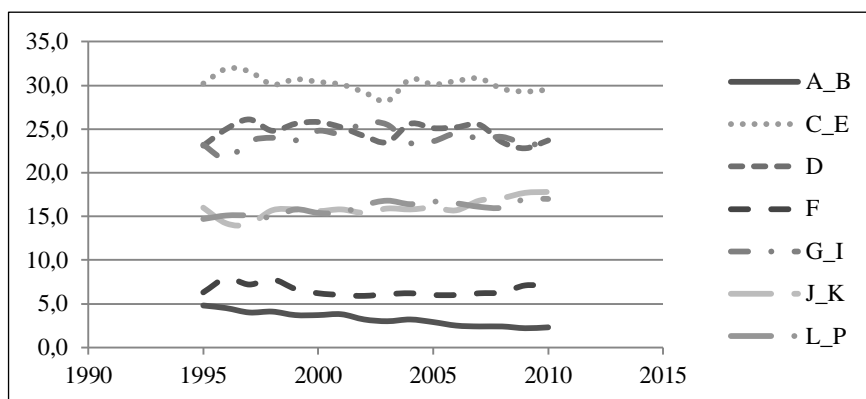

Figure 6. National Accounts of the Czech Republic – detailed breakdowns

Source: NACE Rev. 1, at basic prices, percentage of total.

In the Czech Republic and Slovakia the highest share of their output is provided by industry (C– E), especially manufacturing (D). The

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dominant part of it is the automotive industry. This pattern reflects the joint history of both countries, despite the fact that they have been independent for nearly two decades.

The Czech Republic has one of the most developed industrialized economies. The principal industries are heavy and general machine-building, iron and steel production, metalworking, chemical production, electronics, transportation equipment, textile, glass, brewing, ceramics, and pharmaceuticals. Its main agricultural products are sugar beet, fodder roots, potatoes, wheat, and hops.
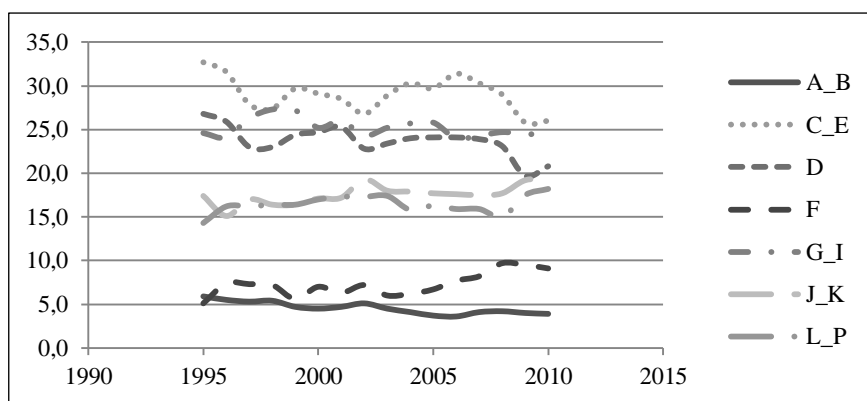

Figure 7. National Accounts of the Slovak Republic – detailed breakdowns

Source: NACE Rev. 1, at basic prices, percentage of total.

In the Slovak Republic, the main industries with growth potential are the following sectors: automotive, electronics, mechanical engineering, chemical engineering, and information technology. The automotive sector is among the fastest growing sectors in Slovakia due to the recent large investments of Volkswagen (Bratislava), Peugeot (Trnava), and Kia Motors (Žilina). Other big industrial companies include US Steel (metallurgy), Slovnaft (oil industry), Samsung Electronics (eletronics), Sony (electronics), Mondi Business Paper (paper), and the Whirlpool Corporation.
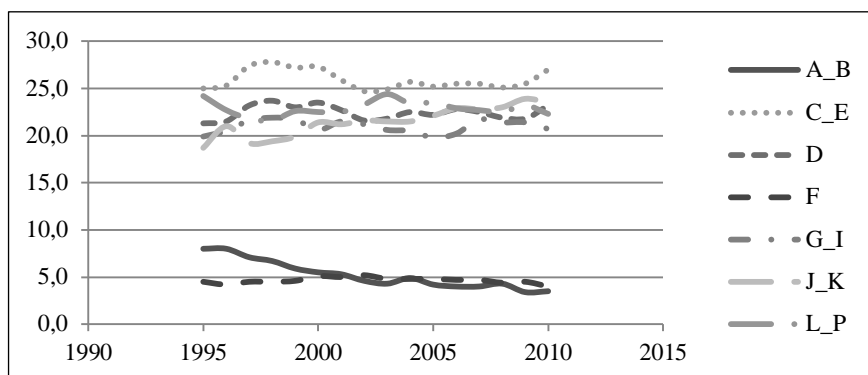
Figure 8. National Accounts of Hungary – detailed breakdowns

Source: NACE Rev. 1, at basic prices, percentage of total.

In Hungary, the largest share of GDP growth is produced by industry (C – E), mainly manufacturing (D). Surprisingly we can see a different trend, where industry is still growing but manufacturing is falling . In Hungary we can also observe the declining trend of the share of agriculture (A – B) over the whole analyzed period.

Hungary´s main industries are mining, metallurgy, construction materials, processed foods, textile, chemicals (especially pharmaceuticals), and motor vehicles. Hungary´s main agricultural products are wheat, corn, sunflower seed, potatoes, sugar beet, pigs, cattle, poultry, and dairy products.
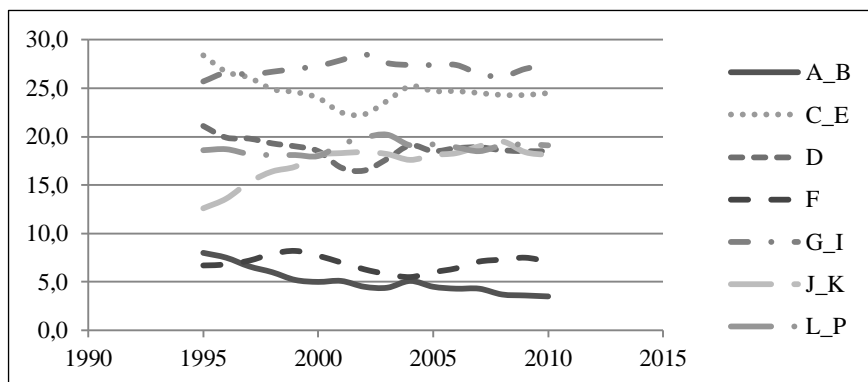

Figure 9. National Accounts of Poland – detailed breakdowns

Source: NACE Rev. 1, at basic prices, percentage of total.

In Poland, trade has the highest share in its output (G – I; wholesale and retail trade; hotels and restaurants; transport). At the beginning of the analyzed period there was not the same pattern for industry (C – E) and manufacturing (D). Since the proportion of the mining industry in the whole GDP industry is declining, the patterns of industry and manufacturing have become similar.

The economy of Poland is a high income economy and is the sixth largest in the European Union. It is the only member country of the European Union to have avoided a decline in the gross domestic product, meaning that in 2009 Poland created the largest gross domestic product in the European Union. The agricultural sector remains handicapped by structural problems, inefficient small farms, and the lack of investment. The most important investments in Poland have been investments into energy and steel. The largest component of the Polish economy is the service sector.

By analyzing the differences in the leading industries which make the biggest value added in the analyzed countries we still found differences. In Germany, finance has the highest share in its output, in Poland it is trade, in the Czech Republic, Hungary and Slovakia industry, especially manufacturing has the highest share in the output. Agriculture (which in the past employed the majority of the inhabitants in the countryside) reached the lowest share of the total output in all the analyzed countries. As we expected, construction has the higher share of the total output in the Czech, Hungarian, Polish and Slovak economies compared to Germany , its share is the second lowest among all the industries in the analyzed economies. The field of public services, which is highest in Germany and lowest in the Czech Republic, also provides some interesting information.
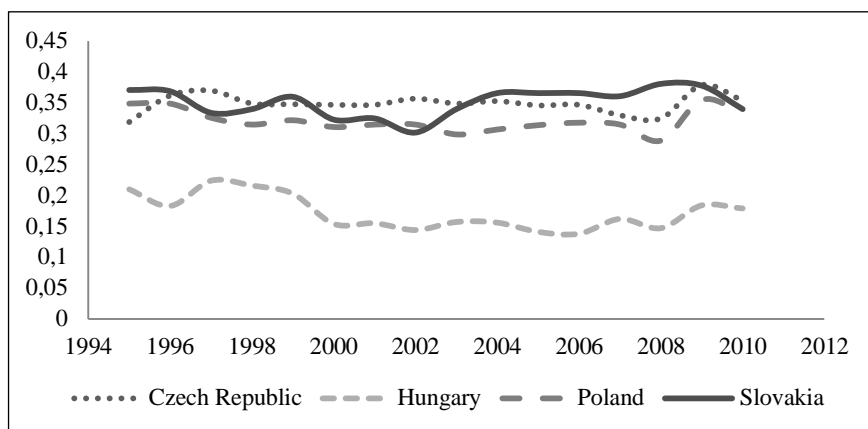
Figure 10. Krugman index

Source: own stimation.

As was mentioned above, the Krugman specialization index runs from zero to two. The index gains the value zero if the country and reference country produce the same goods in the same proportions, and it gains the value two if they produce only different structures of goods and services. The Krugman specialization index was elaborated for four pairs of countries (the Czech Republic and Germany, Hungary and Germany, Poland and Germany and Slovakia and Germany) and showed that the structures of these countries are highly harmonized with the structure of Germany.

The highest structural convergence was reached between Hungary and Germany as the Krugman index of those countries has the lowest value. This is a rather surprising result. It seems that the structure of the economy is very much harmonized with the German one, but economic mismanagement has brought this country macroeconomic troubles.

5. Conclusion

The macroeconomic aspects of structural convergence were researched by the cross correlations of the output gaps between the Czech Republic and Germany, Hungary and Germany, Poland and Germany, and Slovakia and Germany. In light of the threat of the breakup of the euro zone, we have chosen Germany as the reference

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country because of its leading position in the euro zone from the economic and political point of view. Cross correlations of output gaps showed interesting results. Before 2001 the business cycle of Poland and Germany, Hungary and Germany as well as Slovakia and Germany were not synchronized (negative correlations). But the business cycle of the Czech Republic and Germany has a high positive correlation. Between 2001 and 2008, the correlations describing the business synchronization between Poland and Germany and the Slovak Republic and Germany became positive and high, reflecting the positive effect of entry into the EU and the increase of mutual trade. Surprisingly, at the same time, between 2001 and 2008, the synchronization of the business cycle of the Czech Republic and Germany, measured by the cross correlations of output gaps, decreased (though it was still positive), and the synchronization of the business cycle of Hungary and Germany, measured by cross correlations of output gaps, was still negative. The economic crises decreased the business cycle synchronization between all three analyzed countries and Germany, which is why the cross correlations describing all the analyzed period, from 1995 to 2012, are smaller than the cross correlations from the period 2001-2008.

The microeconomic aspects of structural convergence were studied by the calculation of the Krugman specialization index and by comparing the structure of the national accounts of the analyzed countries. The Krugman index showed that, out of the Czech Republic, Hungary, Poland, and the Slovak Republic, the most harmonized structure of the economy to the German one is the Hungarian economy, although the results of the analyzed countries are very similar.

The structure of the economies will be influenced by the so called silver economy – future products and services will have to reflect the ageing of our population. On the one hand, we need a more educated labor force to compete with advanced economies, on the other hand, we have to diversify foreign direct investment. Investment in the high-tech industry, finance and trade is definitely very important for the structure of the economy. But we should, for instance, attract more foreign direct investment into agriculture to improve the quality and quantity of foods (pioneering investment shows good results) and thus influence the long-standing unemployment in the countryside and its

impact on the health conditions in these countries. Although agriculture is not dominant from the perspective of structural convergence, it might improve slightly our quality of life, too.

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ZAŁAMANIE FUNKCJONOWANIA SEKTOROWEGO PAŃSTW GRUPY WYSZEHRADZKIEJ Z PERSPEKTYWY KONWERGENCJI STRUKTURALNEJ

Streszczenie: Celem artykułu jest analiza rozbieżności funkcjonowania sektorowego państw Grupy Wyszehradzkiej i Niemiec z perspektywy konwergencji strukturalnej. Analiza makroekonomiczna dokonana jest przez estymację synchronizacji cyklów gospodarczych. Mikroekonomiczne aspekty scharakteryzowane są za pomocą wskaźnika specjalizacyjnego Krugmana.

Słowa kluczowe: synchronizacja cyklów gospodarczych, załamanie funkcjonowania sektorowego, wskaźnik specjalizacyjny Krugmana.