

## STRUCTURAL ADAPTABILITY OF MANUFACTURING IN CENTRAL EUROPEAN COUNTRIES DURING THE TRANSITION\*

### 1. Introduction

The response of the supply side of economy on the shifts of foreign demand, domestic consumer preferences and also to the external shocks is shown in the structural changes of the production, employment and exports. As the openness of the Central Europe Transition Countries (CEC) has been increasing gradually, the external imbalance is envisaged as the main barrier of the long-term growth sustainability. The structural dynamics of economy also determines the efficiency of the production factors due to smoother movement towards more productive and technologically advanced activities. In this respect, the flexibility and adaptability of economy is a key factor for achieving catching up process.

Transition of the CEC was accompanied with sizable and historically unique structural changes during the last decade. On the aggregate level the structural changes followed similar patterns in the international comparison. However, the analysis of the deeper structural changes on subsectoral level shows significant and growing differences among the CEC. This study is focused on the comparison of the most developed transition economies (the Czech Republic, Hungary, Poland, Slovakia and Slovenia) in the period 1989-2000. A comparison with the CEC main trading partner Germany is also included. First, I sum-up the macroeconomic framework of the transition with the focus on production and external balance and then I move to the broad structure of production and employment. As the manufacturing is the most export-oriented sector of economy, the main body of this analysis focuses on the structural changes in the manufacturing. The standard analytical framework seems to be insufficient for the purpose of such analysis. Therefore, I use indicators developed for the structural analysis as a structural changes indicator, specialisation index, shift-share analysis etc. to stress the role of structural transition for the catching-up process of the CEC.

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## 2. Macroeconomic Framework

The macroeconomic development is analysed in Table 1. For the purpose of structural analysis the transition is divided into three periods. During the first period (1990-1992), called “the transition recession”, GDP considerably plunged in all CEC countries and industrial production slumped even by one quarter. The structural changes proceeded under the pressure of overall domestic demand drop and loss of foreign markets after the Council of Mutual Economic Assistance (CMEA) collapse. The structural adjustment was rather passive. During the overall economic slowdown the share of those industries was raising whose production declined less than average. The inter-sectoral share changes were important.

During the second period (1993-1996), recovery was obvious. However, the economic growth was fuelled by strong domestic demand with weak response of domestic supply side. External imbalance was gradually deepening and macroeconomic restriction or trade balance crisis became inevitable (with different timing and sequencing among the CEC). Structural changes were more intra-sectoral and showed different growth potentials of the individual industries. The intensity of structural changes and restructuring in the second period were pre-conditions for sustainability of the recovery in the second half of the nineties.<sup>1</sup>

Significant differences in the growth dynamics were observed among the CEC during the third period (1997-2000). There was second recession in the Czech Republic and deceleration of economic growth in Poland, Slovakia and Slovenia. On the other hand, there was a notable acceleration of GDP growth and industrial production boom in Hungary.<sup>2</sup> The different paths of structural changes became evident among the CEC. In the case of deep industrial restructuring the recovery is moderate in the first two periods, though, it graduated in the third period based on sound structural and institutional background. Above all, in Hungary the economic growth was export oriented and pulled by hi-tech industries with sizable productivity and competitiveness gains.

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<sup>1</sup> The time frames of the chosen periods are rather imaginary and are country-specific. The macroeconomic restriction was introduced in Hungary in 1995, in the Czech Republic in 1997, in Slovakia in 1998 and in Poland in 1999.

<sup>2</sup> In the whole decade GDP growth was the highest one in Poland, where the GDP level of 1989 was reached already in 1996. Until 2000 all the CEC (except the Czech Republic) exceeded their GDP levels of 1989.

Table 1. **Macroeconomic Framework of Structural Changes (average annual grow rates in %, average annual figures in the period)**

	Real GDP				Industrial Production				Fixed Investment			
	90-92	93-96	97-00	90-00	90-92	93-96	97-00	90-00	90-92	93-96	97-00	90-00
Czech Rep.	-4.6	3.2	-0.3	-0.2	-11.3	1.7	2.0	-1.9	-6.1	9.1	-1.6	0.9
Hungary	-6.2	1.3	4.7	0.4	-12.6	5.4	13.0	2.7	-6.8	4.0	8.9	2.6
Poland	-5.5	5.5	5.0	2.2	-10.5	9.1	6.7	2.5	-9.7	11.9	11.1	5.3
Slovakia	-8.0	3.4	3.6	0.2	-11.8	2.9	2.6	-1.5	-15.4	5.8	0.1	-1.0
Slovenia	-7.5	4.0	4.6	0.9	-12.0	1.6	2.6	-2.0	-12.2	12.6	10.7	6.4

	Unemployment Rate				Current Account Balance (bln. USD)				Foreign Direct Investment Inflow (bln. USD)			
	90-92	93-96	97-00	90-00	90-92	93-96	97-00	90-00	90-92	93-96	97-00	90-00
Czech Rep.	2.5	3.3	7.7	4.7	0.4	-1.5	-2.1	-1.2	0.5	1.4	4.0	2.1
Hungary	7.1	11.0	9.5	9.4	0.2	-2.9	-1.8	-1.6	1.1	2.6	2.0	2.0
Poland	11.0	15.1	12.2	12.9	-0.3	0.4	-8.2	-2.9	0.1	1.3	6.0	2.7
Slovakia	7.9	13.8	16.3	13.1	-0.5	-0.4	-1.5	-0.8	0.1	0.2	0.8	0.4
Slovenia	11.7	14.7	10.6	12.4	0.5	0.2	-0.2	0.1	0.1	0.2	0.2	0.1

Note: The first period of fixed investment growth is 1991-1992 in Slovakia and Slovenia. The first period of unemployment rate is 1991-1992 in Slovenia.

Source: United Nations: *Economic Survey of Europe*. Geneva, United Nations, Economic Commission for Europe, 2001 No. 1, p. 254-269; own calculations.

### 3. Sectoral Structural Changes

In developed countries the sectoral changes proceed in long-term towards growing share of services, first at the expense of agriculture and then of industry. These trends can be called as “desagrarisation, desindustrialisation and terciarisation” of the developed market economies.<sup>3</sup> Before the transition the CEC were isolated from these global trends, so that in early nineties the CEC showed high shares of industry and also agriculture but less developed services (see Figure 1). In the first period during the transition recession the inter-sectoral shifts were considerable and the most pronounced differences vanished. However, after 1993 the inter-sectoral shifts were rather moderate and the structural changes proceeded more within the broad sectors.

<sup>3</sup> M. Landesmann, *Structural Change in the Transition Economies since 1989*. United Nations, Economic Commission for Europe, Geneva, April 2000.

Table 2. **Structure of Employment in the United Kingdom and the United States (in % of total employment)**

	United Kingdom			United States		
	1820	1890	1998	1820	1890	1998
Agriculture	37	16	2	70	38	3
Industry	33	43	26	15	24	23
Services	30	41	72	15	38	74

Source: A. Madisson, *The World Economy – a Millennial Perspective*. OECD Development Centre Studies, Paris, OECD 2001, p. 95.

In international comparison the main structural weakness of the Polish economy is the disparity between high share of agriculture in employment (18.8%) but only tiny share in value added (3.3%). The number of people employed in the farm sector has fallen appreciably in recent years, though, the farm productivity is still far less than the EU average.<sup>4</sup> It is obvious that the high surplus of agricultural labour will have to be trimmed further with the need to increase employment in other sectors or rising unemployment. Hungary had the highest share of value added in agriculture (15.6%) among the CEC in 1989. However, Hungary shows opposite picture to Poland during the transition with substantially declining share of agriculture both in value added and employment. Other CEC also restructured agriculture successfully and its proportion is at the level of 5% and declining in recent years.

The share of industry fell during the transition recession in all CEC as the drop in industrial production was deeper than the drop of the whole GDP. In the Czech republic the share of industry in value added was the highest one and the share in employment the second highest one compared to the rest of the CEC in 2000. In the Czech Republic the employment in industry declined as far as in the late nineties because of the weak restructuring until 1997. On the contrary, the Hungarian industry rebounded after 1993 and its share in value added and employment increased. The services sector developed significantly during the last decade in the CEC. Nevertheless, until 1993 the share of services in value added and employment jumped rather because of severe recession in industry than expansion of services itself. In 2000, the share of services amounted between 55 and 62% in value added and in employment<sup>5</sup> in all the CEC, though, it is still several percentage points less compared to developed countries represented by Germany in Figure 1.

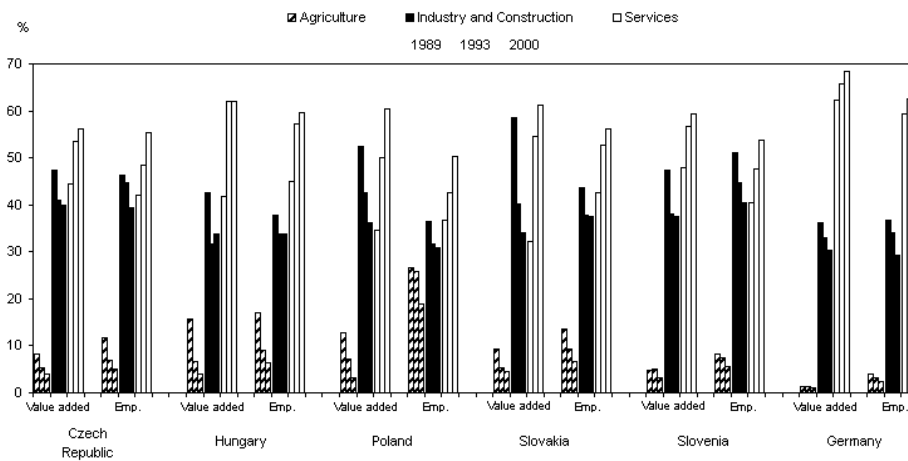
It is necessary to bear in mind that the expansion of services is not an ultimate goal for catching up economy as long as it is not followed by growing

<sup>4</sup> Polish agricultural sector features a very high proportion of small holdings (56% of which measure less than two hectares), this situation cannot take advantage of the economy of scale (see Deutsche Bank Research: *EU Enlargement Monitor*. Frankfurt, Deutsche Bank, No. 4, May 2001, p. 9).

<sup>5</sup> Except employment in services in Poland.

competitiveness of industry. As the most of the services produce non-tradable goods, its development increase domestic demand and induce imports. If the country doesn't have competitive and export-oriented manufacturing, the trade balance deficit deepens. This was the case of the most of the CEC in the middle of the nineties when the economic growth was fuelled by recovering domestic demand instead of long-term sustainable export-oriented economic growth. This is also the main difference between successful catching up in Hungary compared to cyclical development in the Czech Republic, Slovakia and recently also in the former growth "role player" Poland. The manufacturing is crucial sector for maintaining external balance because in OECD countries employment in manufacturing amounts from 20 to 30%, its share in value added is between 25 to 35% but it produces 95% of the goods export. In this respect, the importance of the growing competitiveness of manufacturing is a crucial factor of successful transition and catching up.

Figure 1. **Structural Changes of Gross Value Added and Employment by Main Sectors (current prices, in %)**



Source: OECD STAN Industrial Database 2000; European Commission 2001 Regular Report (different issues); M. Landesmann, *Structural Change in the Transition Economies since 1989*. United Nations, Economic Commission for Europe, Geneva, April 2000, p. 58-59; own calculations.

Note: Germany – data from 1991, 1993 and 1998. Slovenia – employment in 1999.

#### 4. Structural Changes in Manufacturing

I analyse structural changes of manufacturing production according to two-digits NACE classification and the decade is divided into three periods again (see Figure 2). I focus on the comparison between the Czech Republic,

Hungary and Poland, though, I also follow the pattern of development in other CEC.

Before 1993, the intra-industry growth differences reflected rather different intensity of demand drop for different branches than the adaptability of the supply side (the preference of foreign goods against domestic products in electronics, household equipments and textiles, the jump of demand on packaging and publishing & printing and so called “ratchet effect” related to food products etc.). As a result, in all the CEC the share of food industry (DA) increased first but declined gradually after 1993. The share of textile and leather products (DB+DC) shrank during the nineties in favour of competition by high-quality goods from the EU and cheap imports from developing countries. In the first period the share of wood and paper products (DD+DE) increased due to the boom of publishing and marketing activities, which were underdeveloped in the centrally planned economies, but later their growth potential also faded facing robust foreign competition.

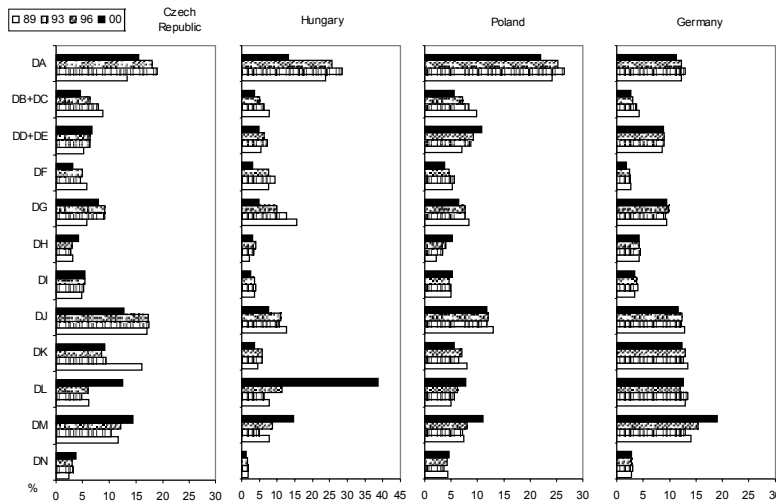
Importance of coke and petroleum refining has been limited over the decade due to falling energetic intensity of production in the CEC and also as a consequence of cut-off of the reasonable raw materials supply from former Soviet Union. The latter impact also hit other raw material and energy intensive industries producing mostly intermediate products (DG, DH, DI, DJ). However, developments of these industries were the most heterogeneous across the CEC. In Hungary the share of chemical products (DG) decreased to one third of the initial level in 2000. Actually, this is not the case of pharmaceuticals, which prospered already prior to transition in Hungary. The rubber and plastics industry (DH) profited from expansion of the automotive industry, in particular the production of tires in the Czech Republic.

The steel industry (DJ) was broadly supported and cherished before 1989 in the CEC. The steel industry found itself over-capacitated for the market economy at the beginning of the transition and there is also an over-production and import barriers on the western markets. Moreover, its production was centralised in several regions with long-term heavy-industry tradition and developed mining – regions hit by structural crisis during the transition. As a result, the restructuring of the steel industry became also a political issue and it was delayed in most of the CEC till late nineties. Therefore, in the Czech Republic the steel industry had the largest share in manufacturing production in 1989 and it was keeping the second position until 1996. Similar patterns are also observable in the rest of the CEC. However, in Hungary the steel industry was relatively less developed and its share nearly halved till 2000.

The key structural changes undergone the technologically most advanced industries machinery equipment (DK), electrical and optical equipment (DL) and transport equipment (DM). Although their shares decreased in favour of technologically less intensive industries before 1993; they expanded afterwards. However, this is not the case of machinery equipment, which was developed in the Czech Republic, but its exports were mostly oriented to the CMEA markets and after the CMEA collapse its share nearly halved.

The machinery industry failed to re-orientate exports on western markets and its share didn't restore afterwards. The most positive impacts of foreign direct investment (FDI) are observable in the electrical and optical and transport equipment industries. The role-players were Skoda Auto in the Czech Republic and Tungstam in Hungary, which were privatised in the early nineties to Volkswagen, respectively to General Electric and flourished during the whole decade.<sup>6</sup> After 1995 many Greenfield investments projects have been attracted by investment incentives in Hungary and after 1998 similar patterns have occurred in the Czech Republic and Poland, which further powered the boom of these industries.

Figure 2. **Structural Changes of Manufacturing Production (constant prices, in %)**



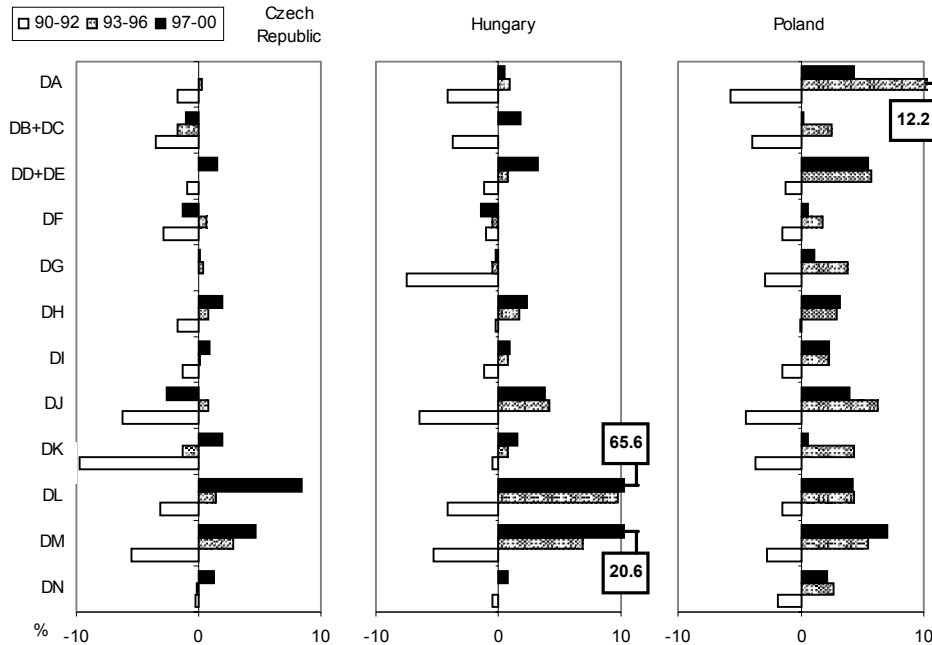
NACE Categories – Manufacturing	Manufacturing													
	DA	DB	DC	DD	DE	DF	DG	DH	DI	DJ	DK	DL	DM	DN
Food products; beverages and tobacco														
Textiles and textile products														
Leather and leather products														
Wood and wood products														
Pulp, paper & paper products, publishing & printing														
Coke, refined petroleum products & nuclear fuel														
Chemicals, chemical products and man-made fibres														
Rubber and plastic products														
Other non-metallic mineral products														
Basic metals and fabricated metal products														
Machinery and equipment n.e.c.														
Electrical and optical equipment														
Transport equipment														
Manufacturing n.e.c.														

<sup>6</sup> Dozens of other multi-national companies followed during the nineties. For further details see EBRD: Czech Republic Investment Profile. *EBRD Annual Meeting*, London, April 2001; EBRD: Hungary Investment Profile. *EBRD Annual Meeting*, London, April 2001.

Source: WIIW Industrial Database, December 2001; OECD STAN Industrial Database 2000; own calculations.

Note: Germany – data from 1991, 1995 and 1998 (current prices).

Figure 3. **Contributions to Manufacturing Production Growth (constant prices, in percentage points)**



Source: WIIW Industrial Database, December 2001; own calculations.

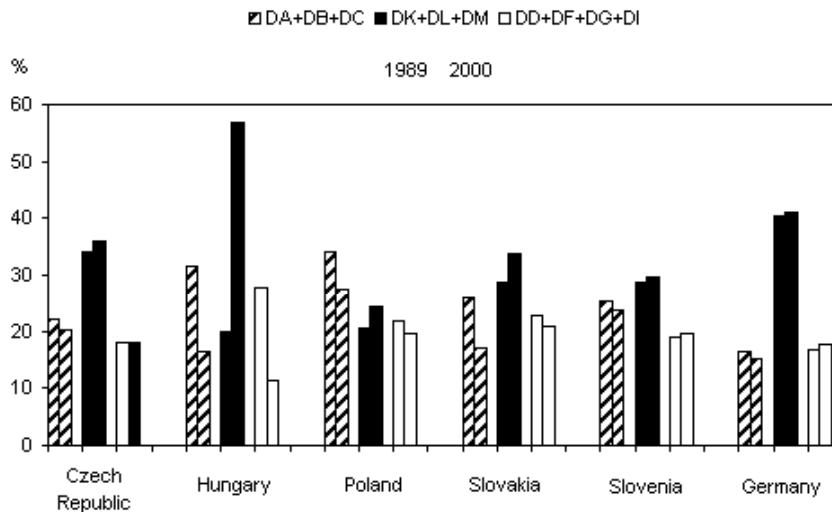
In Hungary the shares of all other industries decreased in favour of electrical and optical equipment and transport equipment after 1996. The share of electrical and optical equipment more than tripled and its contribution to total manufacturing production growth amounted to incredible 65,6 percentage points in the period 1996 to 2000 (see Figure 3). The Transport industry also boomed in Hungary with its share being nearly doubled between 1996 and 2000. In this respect, I have divided the manufacturing industries into three groups according to technological intensity of production to compare the structural shifts in the whole decade 1989-2000 and across the countries (see Figure 4).<sup>7</sup> The success of Hungarian restructuring is evident even with the comparison to Germany because in Hungary more than half of manufacturing production was related to technologically most advanced

<sup>7</sup> For a detailed analysis of CEC manufacturing production technological structure see A. Kaderabkova, M. Srholec, *Structural changes in transition economies. Prague Economic Papers*, Prague, 2001, n. 4, p. 335-351.



industries (DK+DL+DM) in 2000. In the rest of the CEC the structural changes proceeded in the same direction but with much lower intensity.

Figure 4. **Technological Levels of Manufacturing Production (constant prices, in %)**



Note: Classification according to Landesmann, M., et al.: *Structural Developments in Central and Eastern Europe*. WIIW Report 1999, p. 240.

Source: WIIW Industrial Database, December 2001. OECD, STAN Industrial Database 2000.

## 5. Intensity of Structural Changes

I measure the intensity of structural changes in time by structural change indicator (S) defined as follows:<sup>8</sup>

$$S = \sqrt{\sum (sh_k^{t_2} - sh_k^{t_1})^2 \cdot (sh_k^{t_1} / 100)}$$

where  $sh_k$  is share of branch  $k$  on total production, employment, investment, etc. in period  $t_i$  for  $i = 1, 2$ .

The Structural change indicator (S) measures the intensity of structural changes as the shares of individual branches change in time. If the result of this indicator is low (close to zero), structural change is very small in the analysed country and a vice versa. The intensity of inter-branch shifts in-

<sup>8</sup> M. Landesmann, et al.: *Structural Developments in Central and Eastern Europe*, WIIW Report 1999, p. 21.

creases in long-term period, though, it could be fuelled by external or internal economic shocks in short-run. The typical examples of negative external shocks and following structural adjustment are oil crises in the 1970s. Examples of positive internal shocks are technological break-through such as Internet or biotechnologies. Historically unique economic shock is the transition of the former centrally planned economies to market economies. In this respect low intensity of structural changes would prolong the initial recession or limit the growth potential of the economy later. Cross-country analyses show positive correlation between intensity of structural changes and economic growth in long-term, though, it doesn't imply causality of course.<sup>9</sup>

Table 3. **Structural Change Indicator (S) in Manufacturing (1966-1990) and in Industry (1971-1985)**

	1966-1990	1971-1985		
		1971-1975	1976-1980	1981-1985
<b>Czechoslovakia</b>				
Employment	1.18	0.9	1.3	1.2
Value Added	1.11	-	-	-
Production	1.21	4.0	3.6	3.8
Investment	-	8.5	9.6	8.3
<b>Hungary</b>				
Employment	3.19	1.9	1.8	3.0
Value Added	2.55	-	-	-
Production	2.20	5.6	3.3	3.1
Investment	-	11.1	15.5	16.0
<b>Poland</b>				
Employment	1.95	2.8	2.6	4.3
Value Added	3.41	-	-	-
Production	n.a.	4.5	3.9	3.2
Investment	-	12.2	17.2	7.6

Source for 1966-1990: M. Landesmann, M. Szekely (1995), The Pattern of East-West European Integration: Catching-up of Falling Behind? In: *Dobrinsky, R., Landesmann, M., (eds.): Transforming Economies and European Integration*. Aldershot, Edward Elgar, 1995, p. 28.

Source for 1971-1985: United Nations: *Economic Survey of Europe in 1987-1988*. New York, United Nations, Economic Commission for Europe, 1988, p. 246.

Note: Results of the indicator differ between the periods because of methodological differences<sup>10</sup> and different classification detail of the input data (Manufacturing industry according

<sup>9</sup> OECD: *Report on European Industry Competitiveness – The 1999 Report*. OECD, Paris, 2000; United Nations: *Economic Survey of Europe in 1987-1988*. New York, United Nations, Economic Commission for Europe, 1988, p. 245; for correlation between production and export growth and intensity of structural changes see WIFO: *Specialisation and (Geographic) Concentration of European Manufacturing*. EC Enterprise Directorate-General, Brussels, 2000.

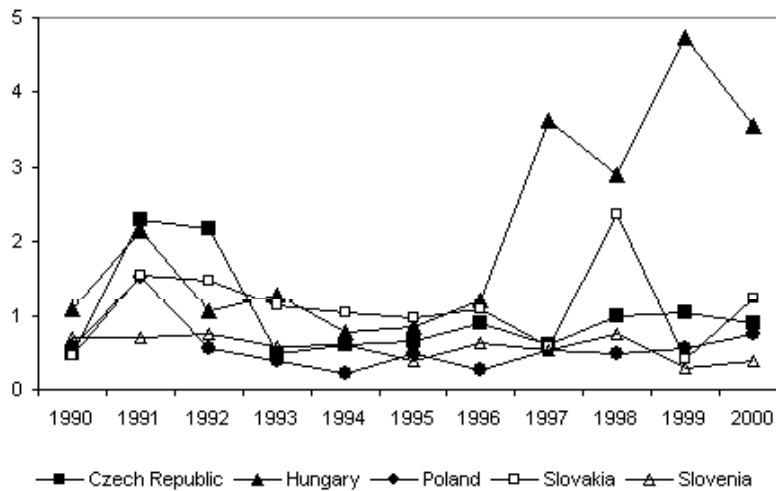
<sup>10</sup> For the period 1966-1990 is used the above defined formula and for the period 1971-1985 is used following formula:  $S = \sum (sh_k^{t_2} - sh_k^{t_1})$ , for  $sh_k^{t_2} \geq sh_k^{t_1}$

to ISIC-28 branches in the period 1996-1990 and Industry according to ISIC-11 branches in the period 1971-1985).

The long-term structural dynamism of the CEC industry is shown in Table 3. The intensity of structural changes was substantially lower in the former Czechoslovakia compared to Hungary and Poland in the period 1966-1990. The main reasons are following: lower share of private business, higher export-orientation on the Council of Mutual Economic Assistance (CMEA) markets and deeper centralisation and political purity in the former Czechoslovakia. Therefore, the scope and need for structural changes were relatively stronger in the former Czechoslovakia after 1989.

I divide the transition into three periods according to the intensity of structural changes of manufacturing production in the CEC (see Figure 5). During the transition recession (1990-1992) the structural changes in all the CEC deepened with the peak after the collapse of the CMEA in 1991. The intensity of structural changes was slightly higher in the Czech Republic in 1991-1992 compared to other CEC but later the historically lower Czech structural mobility prevailed. In the second period (1993-1996) the pressure on structural adjustment eased as the domestic demand expanded. The beginning of the third period differs across the CEC depending on the year of external balance deterioration and resulting macroeconomic restriction.

Figure 5. **Structural Change Indicator (S) of Manufacturing Production (constant prices)**



Source: WIIW Industrial Database, December 2001; own calculations.

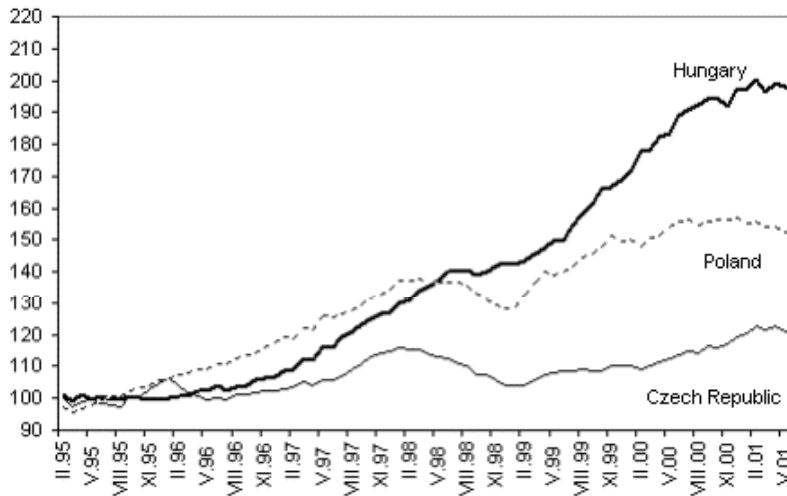
In Hungary the new economic policy was implemented in March 1995 and the

structural changes have burst after 1996 fuelled by sizable foreign direct investment inflow. During the period 1997-2000 the manufacturing production doubled in real terms as the production of the high-tech and export oriented industries boomed: the real production of electrical and optical equipment increased nearly seven times and real production of transport equipment increased more than three times. Similar patterns are observable in Slovakia after 1997. The macroeconomic restriction was implemented and the intensity of structural changes jumped in 1998. However, the intensity of the structural adjustment and related production growth was only moderate compared to Hungary. During the period 1997-2000 the real manufacturing production increased by 26% (by 10.4% in 2000) pulled by production of transport equipment which nearly tripled in real terms. In the Czech Republic the development was radically different compared to Hungary. The macroeconomic restriction was implemented in 1997 and the economy undergone recession in 1998 and 1999. During the period 1997-2000 the manufacturing production increased only by 16.1% in real terms (in 1999 it even declined by 1.5%) but the intensity of structural changes increased only negligibly. It is surprising that even after 1998 when the investment incentives in manufacturing were implemented and many greenfield foreign direct investment projects were attracted, the intensity of structural changes decreased in 2000. In Poland the development of structural changes is different due to large domestic market as the Polish manufacturing is relatively less dependent on its competitiveness and lower openness of the Polish economy reduces impacts of external shocks or external demand cycles. Therefore, in the large economy the structural changes proceed in longer period and the structure of the manufacturing production is more diversified among individual industries.<sup>11</sup> I mention Slovenia in this analysis rather marginally because the structural adjustment in Slovenia was specific. In Slovenia the structural changes proceeded already in the 1980s and its industrial structure was the most similar to the advanced EU economies in 1989. Therefore, the drop of Slovenian manufacturing production in the early nineties was more related to the collapse of the former Yugoslavia than to the transition.

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<sup>11</sup> For details in this respect see M. Landesmann, et al., *Structural Developments in Central and Eastern Europe*. WIIW Report 1999.

Figure 6: **Manufacturing Production (Indices on base 1995=100, constant prices, seasonally adjusted 3M moving averages)**



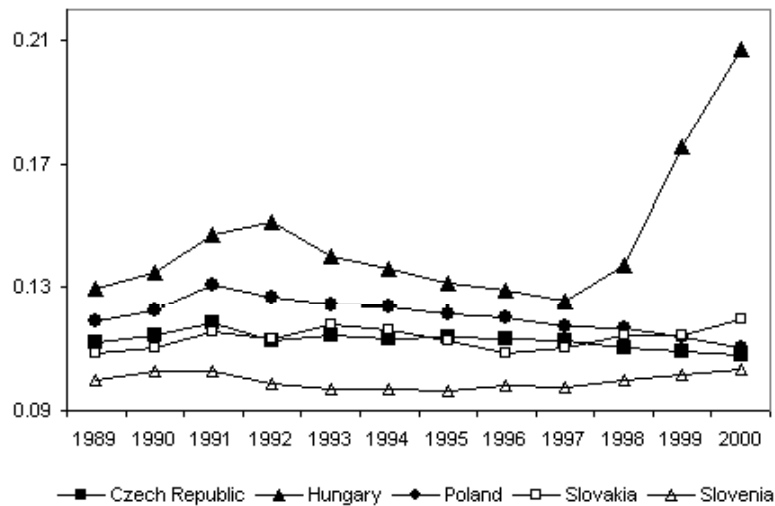
Source: OECD IIS Database (Indicators of Industry and Services); own calculations.

It is evident that the latest recession in the Czech Republic didn't fuel the structural changes in manufacturing in contrast to the development in Hungary after 1995. The explanations would be as follows: first, the structural shifts would have proceeded within the analysed branches rather than inter-branches in the Czech Republic (I used data according to two-digit NACE classification – 14 manufacturing branches), though, this doesn't explain so large difference compared to Hungary. Actually, I also tested the data according to three-digit NACE classification (100 manufacturing branches) for the Czech Republic and there is still no jump of structural changes after 1997. Second, the Czech economy would remain relatively more rigid in long-term as was shown in Table 3. The structure of the Czech manufacturing production is historically more diversified as it used to be before 1989 that is rather structural pattern of the large or less developed market economies. It is still open question if the Czech manufacturing would follow the Hungarian path with rapidly increasing specialisation or the Polish path with broad scale of manufacturing production (see Figure 7). After 1997 the specialisation jumped in Hungary and also slowly increased in Slovakia and Slovenia. On the contrary, the specialisation of the Czech and Polish manufacturing production has been substantially decreasing after 1992.<sup>12</sup>

<sup>12</sup> For further details on trade specialization analysis see P. Havlik, M. Landesmann, R. Stehrer, *Competitiveness of CEE Industries: Evidence from Foreign Trade Specialization and Quality Indicators*. WIIW Research Report, No. 278, Vienna, August 2001; Y. Wolfmayr-Schnitzer,

Although some relative higher rigidity of the Czech economy is apparent, after 1999 the amount of foreign direct investment inflow was so robust, that the impact on manufacturing structure is inevitable. Finally, I believe that there would be some longer time lag between the main wave of foreign direct investment inflow and the deepening of structural changes intensity in the Czech Republic compared to Hungary. Therefore, I expect that the structural changes in the Czech manufacturing production would accelerate in coming years. This explanation is also supported by the latest data from the Czech Statistical Office for 2001. The most dynamic Czech industry was the production of electrical and optical equipment (similar to Hungary) increasing by 29.4% in real terms in 2001, which is also the industry with the highest number of greenfield foreign direct investment projects in recent years. According to these data, the structural changes indicator (S) of the Czech manufacturing slightly increased to 1.04 in 2001 from 0.90 in 2000.

Figure 7. **Specialization of Manufacturing Production (constant prices, Herfindahl index)<sup>13</sup>**



Source: WIIW Industrial Database, December 2001; own calculations.

## 6. Shift-share Analysis of Labour Productivity in Manufacturing

Changes of production and employment shares translate into different gains and losses in labour productivity. I measure the impact of structural

Economic Integration, Specialisation and the Location of Industries, A Survey of the Theoretical Literature. *WIFO Working Paper*, 1999.

<sup>13</sup> Herfindahl index is defined as a sum of squared shares of individual manufacturing industries on total manufacturing production, for two-digit NACE classification (14 branches).

changes on labour productivity by the so-called “*Shift-share analysis*”, which decomposes the change of an aggregate into a structural component reflecting changes in the composition of the aggregate and changes within the individual units that make up the aggregate. I decompose the labour productivity change to the three partial effects:<sup>14</sup>

$$\frac{\Delta P}{P_0} = \sum_i \left[ \underbrace{\frac{P_{i0} \Delta S_i}{P_0}}_I + \underbrace{\frac{\Delta P_i \Delta S_i}{P_0}}_{II} + \underbrace{\frac{S_{i0} \Delta P_i}{P_0}}_{III} \right]$$

$P_i$  = labour productivity in industry  $i$ ,  $S_i$  = the share of industry  $i$  in total employment and  $\Delta S = S_t - S_0$ ,  $\Delta P = P_t - P_0$

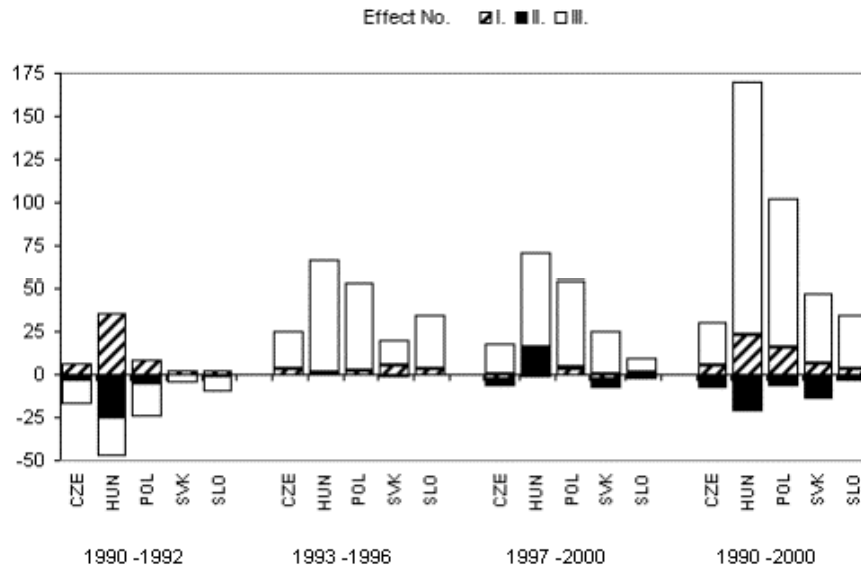
The interindustry effect (I) measures the ability of a country to move resources from low to high labour productivity activities. Its contribution will be positive if the employment in the above average productive industries increases at the expense of industries with lower productivity.

The interaction effect (II) reflects the ability of a country to reallocate its resources towards industries with rapid productivity growth. Its contribution will be positive if industries with fast growing labour productivity also increase its share on employment.

The intraindustry effect (III) measures the contribution of labour productivity growth within individual industries weighted by the share of these industries in total employment.

<sup>14</sup> J. Fagerberg, *Technological Progress, Structural Change and Productivity Growth: A Comparative Study*. Working Paper No. 5, Oslo, *University of Oslo*, 2000, p. 13.

Figure 8. **Shift-share Analysis of Labour Productivity Changes in Manufacturing (constant prices, in percentage points)**



Source: WIIW Industrial Database, December 2001; own calculations.

Note: CZE = Czech Republic, HUN = Hungary, POL = Poland, SVK = Slovakia, SLO = Slovenia. Slovakia in 1991-1993 and 1991-2000.

I divided the labour productivity development again into three periods during the last decade (see Figure 8). The interindustry effect (I) was important factor contributing positively to the labour productivity growth during the transition recession (1990-1992). The intraindustry effect (III) was negative in all cases. The interaction effect (II) had lower impact, though; it made the most negative contribution in Hungary. As a result, the overall labour productivity dropped in all CEC in the period 1990-1992. In contrast, the labour productivity soared after 1992, especially in Hungary and Poland, as the overwhelming part of productivity growth was accounted for productivity growth within individual industries (III) in all CEC. The productivity gains were much lower in the Czech Republic after 1992 and even weakened after 1996. Hungary's performance stands out again: after 1996 it was the only country among the CEC where the interaction effect (II) contributed positively to labour productivity growth mainly due to the employment growth in the booming electrical and optical equipment industry.

## 7. Structural Decomposition of Unit Labour Costs Changes in Manufacturing

Unit labour costs (ULC) measure the price competitiveness. The ULC are



defined as the ratio of real wages ( $W$ ) and real labour productivity ( $LP$ ) which is defined as real production ( $P$ ) per employed person ( $EMP$ ) in the next step:<sup>15</sup>

$$ULC = \frac{W}{LP}$$

$$ULC = \frac{W}{\frac{P}{EMP}}$$

In a dynamic notion, I roughly express contribution of the ULC main components by natural logarithm (see Figure 9):

$$\ln(ULC) = \ln(W) - \ln(LP)$$

$$\ln(ULC) = \ln(W) - \ln(P) + \ln(EMP)$$

Price competitiveness is improving if the ULC decline which is the case when wages are growing less than labour productivity. The decomposition of labour productivity shows that production growth leads to the lower ULC, contrary to rising employment that contributes to the ULC growth. Similar, during a recession the ULC can improve if wages and employment decline more than production.

Cross-industry comparison of the ULC changes in manufacturing reveals several characteristic development patterns in the Czech Republic and Hungary during the transition. The real wages and employment dropped in nearly all branches of Hungarian and Czech manufacturing during the transition recession (1990-1992). The employment decline was most pronounced in the technologically most advanced industries (DK, DL, DM) and also in the labour intensive industries (DB, DC) and food industry (DA) in both countries.<sup>16</sup> On the other hand, the overall production drop counterbalanced the employment and real wage cuts implying a contribution to ULC growth. As a result, the ULC remained stable in Hungary and declined by 16.5% in the Czech Republic in the early nineties.

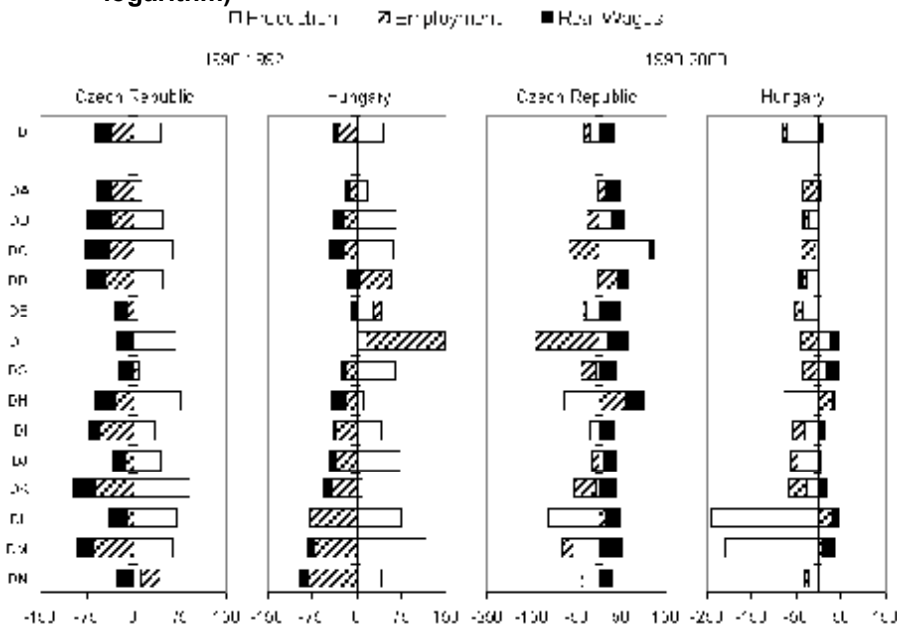
Growing labour productivity has been a major driving force of the competitiveness improvements after 1992. In Hungary the ULC declined at remarkable speed as real production was strongly growing while employment and real wages hardly changed at all. ULC improvements are clearly visible in electrical and optical equipment industry (DL) and transport equipment in-

<sup>15</sup> The price competitiveness is also significantly influenced by exchange rate development, reprs. by real effective exchange rate. However, the exchange rate is the same for all sectors of an economy. Therefore, in structural analysis I do not take the exchange rate fluctuation into account and the ULC are measured in domestic currency.

<sup>16</sup> In some cases, industries with small share on overall production or employment in absolute terms (DF, DH, DJ) show significant contribution to the ULC growth (decline) within the particular industry. However, ULC changes in these industries have negligible impact on the development of whole manufacturing in the concerned country.

dustry (DM) where the production boom was also associated with moderate growth of employment and real wages. Similar but much less pronounced development features may be observed in these industries in the Czech Republic as well. Different picture is observable in the development of real wages in both countries. In the Czech manufacturing the real wages dropped significantly until 1993 but recovered thereafter and more than compensated the productivity gains. In the period 1993-2000 the real wages increased by 42.5% compared to real labour productivity up by 37.2% in Czech manufacturing. As a result, in the Czech manufacturing the ULC rose by 3.8% but in the Hungarian manufacturing it declined by 52.1% in the period 1993-2000.

Figure 9: **Contributions of Real Production, Employment and Real Wages to Unit Labour Costs Growth in Manufacturing (natural logarithm)**



Source: WIIW Industrial Database, December 2001; own calculations.

Note: Real wages deflated by CPI. In Hungary the second period is 1993-1999.

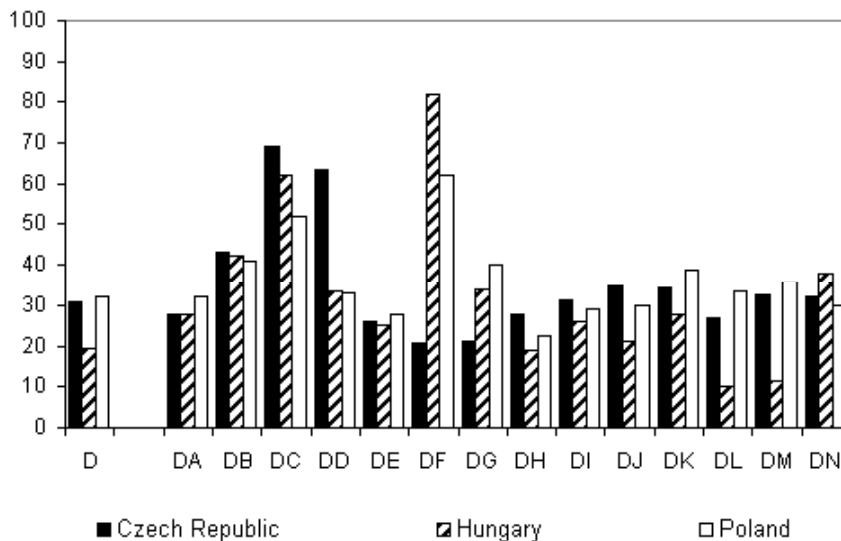
#### NACE Categories – Manufacturing

DA	Food products; beverages and tobacco	DH	Rubber and plastic products
DB	Textiles and textile products	DI	Other non-metallic mineral products
DC	Leather and leather products	DJ	Basic metals and fabricated metal products
DD	Wood and wood products	DK	Machinery and equipment n.e.c.
DE	Pulp, paper & paper products, pub-	DL	Electrical and optical equipment

	ishing & printing		
DF	Coke, refined petroleum products & nuclear fuel	DM	Transport equipment
DG	Chemicals, chemical products and man-made fibres	DN	Manufacturing n.e.c.

Cross-country comparison of the relative ULC levels reveals that in Czech and Polish manufacturing the ULC amounted to one third and in Hungarian manufacturing only one fifth of the Austrian level in 1999 (see Figure 10). Especially relative low wage levels are the main comparative advantage ranging only from 15-18% of either the Austrian or German level.<sup>17</sup> However, productivity gains were the crucial factors for price competitiveness improvements in Hungarian electrical and optical equipment (DL) and transport equipment (DM) industries where the ULC reached only one tenth of Austrian level and also only one third of the Czech or Polish level in 1999.

Figure 10. **Unit Labour Costs in Manufacturing in 1999 (Austria=100)**



Source: WIIW Industrial Database, December 2001.

## 8. Conclusions

The differences in GDP growth performance among the CEC during the

<sup>17</sup> P. Havlik, *Patterns of Catching-Up in Candidate Countries' Manufacturing Industry*. WIIW Research Report, No. 279, Vienna, August 2001, p. 15.

nineties raise an essential question how to reach the sustained and high growth path under the conditions of external and internal equilibrium. Convergence toward the more developed countries requires both higher growth of incomes per capita and the capacity of maintaining the positive growth differential for a sufficiently long time. In this respect, I stressed the role of structural changes for the CEC capacity to catch-up developed economies as the structural adaptability determines the growth potential and competitiveness of the economy.

At the sectoral level the CEC successfully converge towards the structure of the developed countries. However, the long-term economic growth based on high export performance is conditional mostly on profound industrial restructuring accompanied by technological upgrade of manufacturing production. In general, the intensity of structural changes reflects different speed of restructuring across countries and resulting productivity gains or losses at branch level. It is still too short period to reach firm conclusions about long-term catching-up patterns of the CEC as it is significantly biased by one-off events or economic cycles. However, despite the relatively short period, the intensity of structural changes seems to be positively associated with the catching up process. In this respect, Hungarian leadership is confirmed by the highest intensity of structural changes, the fastest growth of the most technologically advanced manufacturing industries (DK, DL, DM) and the fastest real convergence towards the EU levels in GDP per capita after 1996.<sup>18</sup> Another interesting conclusion is that the differences in unit labour costs improvements are caused mostly by varying labour productivity gains. Hungarian manufacturing shows not only better productivity performance but also increasing price competitiveness as the wage growth lagged behind the labour productivity growth. In the rest of the CEC the structural changes showed similar patterns, though, with far less intensity compared to Hungary during the second half of the nineties. Therefore, their manufacturing structure remains less specialised across the industries which is usually pattern of large or less developed economies. The crucial factor of successful restructuring of Hungarian manufacturing was sizeable inflow of foreign direct investment and their spillover effects in the host country after 1995. Bearing in mind large foreign direct investment inflows into the Czech Republic, Poland and Slovakia at the late nineties, I expect them to follow the Hungarian path in the future. This development was apparent at least in the Czech Republic in 2001.

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<sup>18</sup> For details on the catching-up patch of the CEC see European Commission: *Real Convergence in Candidate Countries – Past Performance and Scenarios in the Pre-Accession Economic Programmes*. ECFIN/708/01, Brussels, 20 November 2001; Eurostat: *The GDP of the candidate countries. Statistics in focus*, Brussels, 42/2001.

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