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by
Johannes Stephan

5/2003
Sonderheft

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Dr Johannes Stephan

Halle (Saale), August 2003

Final research report of workpackage WP1 of an EU funded RTD-project in the 5th Framework Programme

Research project “EU Integration and the Prospects for Catch-Up Development in CEECs - The Determinants of the Productivity Gap”.

This research has been partially financed by the EU Commission, in the Key Action on Improving the Socio-economic Knowledge Base, contract no HPSE-CT-2001-00065. The author is solely responsible for the contents which might not represent the opinion of the Community. The Community is not responsible for any use that might be made of data appearing in this publication.

Keywords: Integration, catch-up development, specialisation, structural change, sectors, industrial branches, structural adjustment, labour productivity, productivity gap, productivity growth

JEL-codes: F15, O33, O40

Herausgeber:
INSTITUT FÜR WIRTSCHAFTSFORSCHUNG HALLE - IWH

Hausanschrift: Kleine Märkerstraße 8, 06108 Halle (Saale)
Postanschrift. Postfach 11 03 61, 06017 Halle (Saale)
Telefon: (0345) 77 53-60
Telefax: (0345) 77 53-8 20
Internetadresse: http://www.iwh-halle.de

Druck bei Druckhaus Schütze GmbH,
Fiete-Schultze-Str. 6, 06116 Halle (Saale)

ISBN 3-930963-76-0

Preface

The formerly socialist countries in Central East Europe strive to close the development gap between their economies and those of the countries in West Europe. Their main vehicles in support of catch-up development featured the internal and external liberalisation of markets.

Internal liberalisation was geared towards replacing the system of economic planning with the governance of markets and external liberalisation aimed at integration into the World market in general and the European market in particular. European integration itself was coined to serve as an engine for economic development: market access, efficient allocation of resources in the international division of labour, and access to more advanced technology were perceived to be the main drivers. The political instrument in support of this is the prospected European Union membership. In fact, a selection of Central East European countries have been admitted and will become full members in April 2004.

Today, slightly more than one decade after the outset of systemic transition, most of those countries are widely considered 'functioning market-economies'. Their markets are well integrated into the European economic area, in as much as foreign trade had been liberalised gradually since the early 1990s and fully-fletched currency convertibility allows trade on the respective capital and foreign exchange markets in East and West. The notable exception, however, remains the labour markets: here political concerns of absorptive capacities in the West still postpone integration.

With product markets near to full integration, the economies have undergone a profound process of structural change. The pattern of international specialisation which has emerged as a result of sectoral change in a selection of Central East European economies is the focus of the research presented here. The main objective of research was to determine the patterns as they have evolved over time, and to assess the prospects of catching up derived from those sectoral patterns.

This publication reports research and the results of one of the workpackages in a larger international cooperative research project, financed by the EU in its 5th Framework Programme: EU Integration and the Prospects for Catch-Up Development in CEECs - The Determinants of the Productivity Gap (HPSE-CT-2001-00065). This project is coordinated by the author of this report at the IWH. Whereas research in this workpackage is concluded with this report, other workpackages will continue to assess further determinants until late summer 2004, when the project formally ends. All research proceedings of this project can be revisited on the project internet-site:
www.iwh-halle.de/projects/productivity-gap.htm

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Introduction

The research project, in the framework of which this workpackage forms part, aims to enquire into the determinants of the productivity gaps between the average EU-15-levels and the levels of individual CEECs, namely in geographical order Estonia, Poland, The Czech and Slovak Republic, Hungary and Slovenia.

All those countries exhibit levels of GDP *per capita* well below the EU-15 average. All countries will hence most probably qualify for cohesion fund policies (< 90%) and most regions will probably meet the eligibility-criteria for EU structural fund policies (<75%). Regions above this threshold include today the ones around Prague, Bratislava and Budapest. Amongst the economic objective of their integration is prominently their catching up to the higher levels of economic development predominant in the EU.

Productivity levels as a measure for levels of economic development provide a slightly different picture from the one presented by GDP *per capita*.[1] In particular, differences arise with labour participation rates: *e. g.* the higher the unemployment rates, the greater the level differences between GDP *per capita* and national productivities. Identification of sources of lower levels of economic development in candidate countries, and quantification of their respective weights in explaining development gaps are necessary pre-requisites for the targeting of economic policy in the framework of EU cohesion policies. Hence, analysis focuses on the determinants of productivity growth and levels: knowledge about the relative roles played by individual determinants as well as analysis of the determinants themselves can highlight deficiencies hampering swift real economy catch up.

Assuming that deepening integration with the West and eventual EU membership does not necessarily have to lead to complete economic convergence in all accession countries, the aim of this research is to determine, from the viewpoint of economic structures, the *prospects* of economic catch-up for a selection of accession countries. The generated insights can then be used to assess the scope for economic policy to assist improving the conditions for economic development. This is not to deny that integration generally is a necessary condition for catch-up development in transitional CEECs via technology transfer and efficiency-improving participation in intra-industrial trade and/or specialisation. Rather, integration might prove to be insufficient. In its latest report on economic cohesion, the EU Commission takes the opinion that sectoral struc-

1 For empirical reasons, this paper focuses on labour productivity only and disregards the productivities of other factors of production, as *e. g.* capital. Moreover, the most profound modernisation of capital stock is still under way, making year-on-year comparisons difficult. This is not to neglect that an analysis of capital productivity and total factor productivity could lead to slightly different results and that such will gain more importance with transition countries reaching higher levels of economic and technological development.

tures in candidate countries will prove to be decisive in a process of real economy convergence (EU 2001b, pp. 37-41). The report suggests to target EU cohesion policies towards the intermediate aim of structural change.

Amongst the most prominent effects of integration between unequal partners are the structural adjustments guided by the new pattern of respective competitive advantages, and the technological catch-up process via technology transfer. The aim of workpackage 1 in this project is to identify the structural determinant of productivity gaps. To this end, research focussed in the first instance on the identification and analysis of determinants of aggregate, average economy-wide (national) productivity gaps. In a second step, the determinants of aggregate productivity growth have been assessed. This led research to focus on productivity determinants within manufacturing industry. The research report on this workpackage closes with a projection of future industrial productivity growth potentials in each of the candidate countries assessed.

A few words on connotations, concepts and data availability: productivity, the central explanans of this research, is precisely ‘apparent value added labour productivity’, defined by value added per employment. Productivity, as will be referred to it in the text, is not corrected by the intensity of use of the factor labour (as *e. g.* hours worked by employment), as comparable data was not available to establish *e. g.* the total hours worked.

The structural entities of the economy at the highest level of aggregation are denoted ‘broad sectors’ and include the six broad sectors of agriculture (NACE: A+B), industry (NACE: C+D+E), construction (NACE: F), household-related services (NACE: G+H+I), enterprise-related services (NACE: J+K), and finally the state-administration sectors (NACE: L+M+N+O, and where available: P). For the average of the EU-15, including all weighted 15 current member states, broad sectors were the only level of aggregation for which comparative data was available from EUROSTAT. Some of the missing data was complemented by OECD and official national statistics. The level below that aggregation consists of ‘sectors’ and includes the 15 one-digit NACE sectors of A-O. For the group of the accession states, data on value added and employment at this level of aggregation was readily available from national statistics and the WIIW database. Comparisons between accession states and the EU were only possible for some EU member states, and not even the complete group of the largest EU countries or the core-EU. Comparative analysis was hence conducted between accession states and Germany.

Within the sector of manufacturing, analysis was conducted at two different levels of aggregation: wherever productivity levels at the industrial branch level were required, analysis used the higher level of aggregation including the 13 double-digit NACE manufacturing branches of DA-DN (with DF and DG in one group). Where only shares of branches within total manufacturing were needed (either measured in terms of employment or value added shares), analysis was able to include 102 industrial bran-

ches at the 3 digit NACE level of 151-372. In the case of Estonia and Poland, such disaggregated data was not available and had to be estimated by use of 2-digit NACE data from EUROSTAT and (incomplete) data from national statistical offices at lower levels of aggregation.

1. Determinants of the National Productivity Gap

1.1 Setting the agenda: the sizes of productivity gaps

Within the past decade, national levels of labour productivity in CEECs have converged significantly towards the levels predominant in the EU. Yet, levels are still significantly lower, large gaps are still prevalent. Needless to say, levels within the EU also differ greatly; comparisons with the EU as an economic area use the weighted average of all current 15 EU member states.

Table 1 reports levels in 1000 € for the year 2000, calculated by use of annual average market exchange rates as well as PPP-corrected exchange rates (shaded columns).[2] In 2000, three groups of countries amongst CEECs with similar productivity levels can be identified: Estonia and Poland rank in a lowest productivity group, the Slovak and Czech Republics as well as Hungary in a second and Slovenia sticks out as the country with the highest productivity level. At the outset of economic transformation and integration into western markets, productivity levels were not only much lower but also more diverse. Slovenia had always achieved higher productivity levels even during its socialist era; the gap to its fellow accession candidates has even further increased.

Throughout the 1990s, productivity levels of Hungary and the Czech Republic were more or less the same, albeit Hungary growing at a slightly faster rate. Ever since the break-up of the CSFR remained the Slovak Republic's productivity level slightly lower than the ones of the Czech Republic and Hungary. Estonia started from a low level but managed to overtake Poland in 1997.

All transition economies in our sample exhibit sizeable productivity gaps *vis-à-vis* the EU-average and most of the 15 European economies (last row of the table). All of them have already surpassed Portugal, the EU member country with the lowest national productivity level. Only three, the Czech Republic, Hungary and Slovenia, com-

2 All countries reported have lower living expenses than the EU-15 average (measured in terms of living expenses), hence the significantly higher figures for PPP-adjusted levels.

mand higher levels than Greece, the second but weakest EU member country. By 2000, the Slovak Republic nearly caught up with Greece. In comparison to the average EU-15 level in end 2000, Slovenia reaches nearly 80%, Hungary, the Czech and Slovak Republics around 60% and Poland and Estonia still less than 50%.

Table 1:
Productivity levels in selected EU-countries and CEECs, in 2000

	Market exchange rates	PPP-exchange rates	
	in 1000 € per employment		in % of EU-15
EU-15	42.5	42.5	100.0
Portugal	10.0	15.4	36.1
Greece	19.4	25.0	58.8
Spain	26.1	31.9	74.9
Estonia	8.3	20.5	48.2
Poland	9.3	19.7	46.3
Czech Republic	10.9	26.7	62.7
Slovak Republic	9.2	24.9	58.6
Hungary	11.1	26.0	61.1
Slovenia	21.3	32.7	76.9

Note: Aggregate, economy-wide productivity levels calculated as aggregate value added per employment.

Sources: EUROSTAT; WIIW; National Statistical Offices; own calculations.

Of particular interest is the comparison of CEECs with East Germany. In effect also a transition economy, East Germany was integrated into the ESM and the currency-area of the West German DM already in 1990. Moreover, East Germany was integrated into the German *Länderfinanzausgleich*, a system of re-distribution of revenues to support weaker *Länder* on the cost of more prosperous ones. The region therefore gained access to a stable currency, a stable institutional framework and vast financial resources for investment and restructuring, all of which was not available in fellow transition countries. By 1999, the last year for which data on the region is available, East Germany had already reached a level of slightly more than 99% of the EU-15 average in PPP-terms. This level is by far higher as compared to any of the CEECs of this analysis.

1.2 The shares of sectoral differences in productivity gaps

Sectoral structures play a relevant role during economic catch-up development via integration: the pattern of sectoral structures can explain some of the lower levels of economic development, measured here as national labour productivity gaps. This

means that even in case of complete catch up of development levels within each sector, the whole economy as an aggregate can still sustain a gap, if structures favour sectors with typically lower levels of productivity. This can limit the scope for complete catch-up: as integration deepens, technology and skills in CEECs will improve and possibly even catch up completely (technology transfer), institutions will be reformed to match the ones in the EU (via the acquis communautaire), but the development of sectoral structures is less clearly determined.

From the viewpoint of integration and development theories, sectoral structures can be thought of as being determined either by country-specific factors or by the level of economic development. In the first, resource-based view, sectoral structures between integrating partners will correspond to the country's own competitive strengths, regardless of the maturity of the economy. Both Ricardo and Heckscher-Ohlin assume that structural patterns are determined by comparative advantages. In as much as those comparative advantages are stable over time, sectoral structures will also remain unchanged, that is after the adjustment process induced by intensifying integration is complete.

The second approach belongs to the family of development-ladder theories: here, sectoral patterns change in the course of time. They correspond to the country's level of economic development, *i. e.* there exists a typical sectoral structure for every stage of economic development. In the course of economic development, employment will shift away from low-income agricultural sectors and gradually move into industry. With the economy maturing, renewed shifts will increase the share of the service sectors at the expense of again agriculture and now also industry (Chenery-Hypothesis). Sector-specific income-elasticities of demand are the driving forces here.

Both those concepts are essentially long-term and hence beyond the scope of this research. For the purpose of the analysis here, experiences from other European economies were used: sectoral structures can differ regardless of the level of economic development. For the CEECs, this means that sectoral structures might exhibit hysteresis, and some of the following analysis will make use of this assumption.

The most important features of patterns of sectoral structures in the selection of accession candidates as compared to the patterns predominant in the EU are presented in Table 2. Most notably, the share of the service sectors (NACE: G-K) and in particular in enterprise-related services (NACE: J+K) are much smaller than the corresponding sectors in the average EU-15. Furthermore, the industrial sectors (NACE: C+D+E) of mainly the Czech and Slovak Republics and Slovenia, and to a lesser extent in Hungary and Estonia, are much larger as compared to the EU.

Contrary to common belief, agricultural sectors (NACE: A+B) are in general not much larger in accession candidates, with the notable exception of Poland. This, however, might be might be due to a particular empirical distortion in the agricultural employ-

ment share (amounting to even more than 28% at the end of 2000).[3] Furthermore, the sector of state administration, education and social services employ much larger shares in most accession candidates as compared to the countries in the EU. Only in the cases of the Slovak Republic and Hungary are the differences negligible.

Table 2:
Patterns of sectoral structures in selected CEECs as compared to the pattern in the average EU-15, in 2000

NACE	A+B	C+D+E	F	G+H+I	J+K	L+M+N+ O(+P)	Devia- tionindex
Estonia	2.4	6.1	0.1	0.4	-6.0	-3.1	9.4
Poland	23.7	0.4	-1.4	-6.6	-6.9	-9.2	27.2
Czech Republic	-0.1	9.9	2.5	-2.5	-6.6	-3.5	12.9
Slovak Republic	-1.9	9.0	1.2	-3.5	-8.2	-0.4	12.9
Hungary	1.7	6.5	0.2	-1.3	-6.8	-0.4	9.7
Slovenia	0.8	11.3	1.1	-3.0	-5.3	-5.1	13.9

Note: Differences to the average EU-15 of employment shares in percentage points.

Sources: EUROSTAT; WIIW; National Statistical Offices; own calculations.

What is the extent to which the productivity gaps of individual CEECs today root in their respective sectoral patterns? The analysis was conducted at a NACE one-digit level, including some 15 sectors (NACE A-O). The data source is EUROSTAT. Due to non-availability of data for some important European countries even at this highly aggregated level, Germany rather than the EU-15 average has been used as comparative country.[4] The period of analysis was chosen to start in 1993, when the most intense structural breaks due to transformational recession have already been absorbed and sectoral structures are since determined by more stable markets. The most recent data available are from the year of 2000.

3 Employment data in official Polish statistics distinguish less clearly between former occupation of unemployed persons and mere ownership of agricultural land. Already during the socialist era, a large share of agricultural land was owned privately. In particular during transformational recession and its sharp decline of industrial employment, many former industrial workers, having been laid off, tried to make a living by way of subsistence farming. In other transition economies, unemployed workers with an industrial employment history do not enter agricultural employment statistics.

4 In an earlier attempt, this analysis was conducted on a still broader economic sector level including only 6 sectors for which aggregate EU-15 data was available. In fact, the results are not very different between both methods (see *Stephan* 2002, p. 269).

The empirical method used is very simple. The average, national productivity level π of a country is defined as the sum of each product of sectoral productivity levels π^i and employment shares α of sectors i:

$$\pi = \sum_i \left(\pi^i \ \alpha^i\right) \tag{1}$$

The productivity gap between an individual country in CEE and the German level $\overline{\pi}_{CEE/D}$ is then calculated as:

$$\overline{\pi}_{CEE/D} = \frac{\pi_{CEE}}{\pi_D} = \frac{\sum_i \left(\pi^i_{CEE} \alpha^i_{CEE}\right)}{\sum_i \left(\pi^i_D \alpha^i_D\right)} \tag{2}$$

The sectorally determined productivity gap $\overline{\pi}^{Sectoral}_{CEE/D}$ can be quantified by comparing the actually observed productivity gap with a hypothetical gap which would emerge, if sectoral patterns between CEECs and Germany would be equal (note the use of German employment shares in the first term of the right side of equation 3.2).[5]

$$\overline{\pi}^{Sectoral}_{CEE/D} = \overline{\pi}^{Hypothetical}_{CEE/D} - \overline{\pi}^{Observed}_{CEE/D} \tag{3}$$

$$\hat{\pi}^{Sectoral\ \ share}_{CEE/D} = \left(\frac{\sum_i \left(\pi^i_{CEE} \alpha^i_D\right)}{\sum_i \left(\pi^i_D \alpha^i_D\right)}\right) - \left(\frac{\sum_i \left(\pi^i_{CEE} \alpha^i_{CEE}\right)}{\sum_i \left(\pi^i_D \alpha^i_D\right)}\right) = \frac{\sum_i \left(\pi^i_{CEE} \alpha^i_D\right) - \sum_i \left(\pi^i_{CEE} \alpha^i_{CEE}\right)}{\sum_i \left(\pi^i_D \alpha^i_D\right)} \tag{4}$$

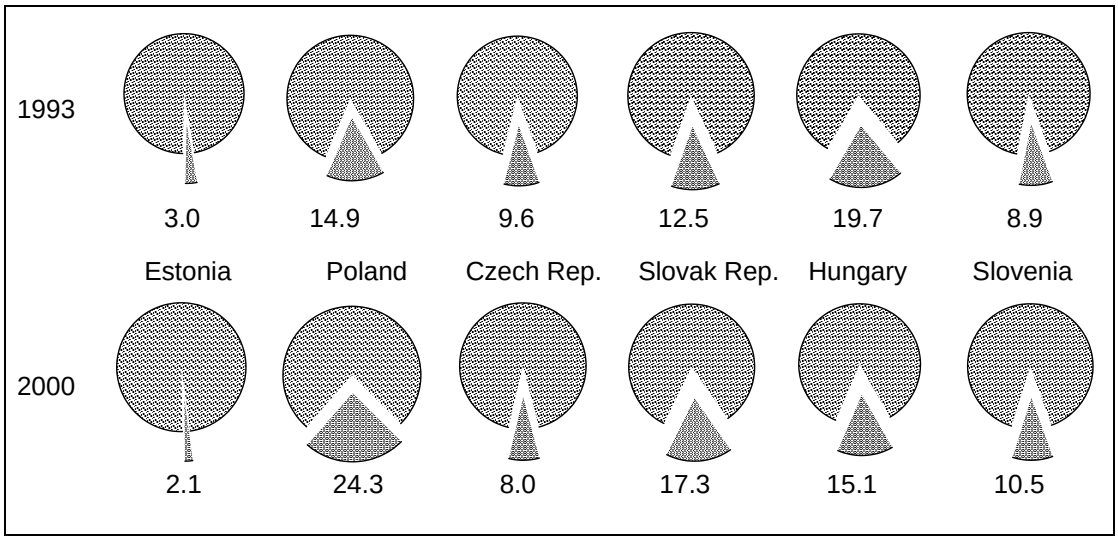
To allow cross-country comparison, this sectoral productivity gap is then related to the total of the observed productivity gap to denote the percentage share of the sectoral content in the national productivity gap. Chart 1 depicts those sectoral contents of productivity gaps in observed total productivity gaps in 1993 and 2000, *i. e.* the extend to which the national productivity gaps are rooted in the respective patterns of specialisation.

The explanatory power of the sectoral structure for the size of the productivity gap is very different amongst the selection of transition economies and between the two years of observation: had the Slovak Republic had the same sectoral employment pattern as the economy of Germany in end 2000, then the productivity gap would have turned out to be much smaller. A share of some 17.3% of the observed productivity gap in fact roots in the country's particular sectoral structures if compared to the ones

5 This is not to imply structural convergence in a normative manner of methodology. Rather, this method calculates a hypothetical level which might never be achieved not least given today's technology.

prevailing in a more mature European economy, *e. g.* in Germany. The productivity gap *vis-à-vis* Germany amounted to some 46.3%, of which 8 percentage points can be explained by differing sectoral structures only. The growth of the sectoral content between 1993 and 2000 in the Slovak Republic is a result of rather unfortunate employment shifts: sectors with above-average productivity levels have experienced little (*e. g.* enterprise-related services) or even negative growth (*e. g.* industry) in employment shares, against positive growth (*e. g.* public administration) in below-average productivity sectors.

Chart 1:
Sectoral contents of the national productivity gaps of CEECs, in 1993 and 2000
- in *per cent* of the observed productivity gap -



Sources: EUROSTAT; WIIW; National Statistical Offices; own calculations.

The results for Slovenia are comparable to the ones for the Slovak Republic, albeit here, the sectoral content only amounted to some 10.5% of the observed productivity gap in 2000. In the case of Hungary, the sectoral content is larger as compared to the one in Slovenia (15.1%), but has on the contrary been on the decline during the period of analysis. This is mainly due to a pronounced rise in employment shares of enterprise-related services. The sectoral structures prevailing in the Czech Republic do account for some of the observed productivity gaps, but the indicator remains rather small with 8.0% of the national productivity gap. This result incidentally corresponds to the sectoral content of the productivity gap between East and West Germany in 1999, conducted in another analysis using a comparable method (IWH, 2001, p. 183). In Estonia, differences in sectoral patterns result in a rather negligible sectoral content of some 2.1% in 2000.

In the case of Poland, the results have to be interpreted with particular caution, due to the above noted differences in methodology of employment numbers in the Polish ag-

riculture sector. When assuming an agricultural employment share comparable to the methodology applied in other transition economies, *i. e.* a much lower share yet still significantly higher than in other transition economies, then the sectoral content would become negligible. Poland would then compare with Estonia. The high sectoral content therefore is driven overwhelmingly by the large employment share in the agricultural sector.

What are the main driving sources of the sectoral contents in the other countries?[6] In the Slovak Republic, the sectors of real estate, renting and business activities in enterprise-related services, and the manufacturing sector proved to be the most important sources of the sectoral content. Whereas enterprise-related services are underrepresented in the Slovak Republic, manufacturing industries employ a higher share as compared to Germany. In particular, enterprise-related services have exceptionally high levels of sector-specific productivities: on average, they exhibit a level of productivity of nearly 4 times the national average in the Slovak Republic. In the case of Hungary, the high value of the sectoral determinant of the productivity gap can be explained by, again a comparatively lower employment share in enterprise-related services, and additionally much higher employment shares in the agricultural sector. This sector typically exhibits well below-average productivities. Whereas the sources of the sectoral content in Slovenia can be traced back mainly to higher employment shares in manufacturing, the results for the Czech Republic also point to enterprise-related services, preceded only by manufacturing. When abstracting from the agricultural role in explaining the sectoral contents in Poland, it is again the sector of enterprise-related services to drive the Polish result.

Returning to the theories pertaining to structures and development briefly sketched above may guide us to deduct from those results some idea on the future prospects of individual CEECs to catch up. In a resource-based world with some degree of hysteresis in sectoral structures, where sectoral structures reflect comparative advantages, we should expect countries with large or increasing sectoral contents to experience some form of an upper limit to the process of catching up: complete productivity convergence is inconceivable even after catch-up of all other determinants of lower levels of productivity (methodologically: after sector-specific productivity levels have caught up completely), if the economy has above-average shares in sectors which typically have below-average levels of productivities. This can be thought of as a purely statistical effect of averaging. The effect might become relevant foremost in the cases of the Slovak Republic and possibly Slovenia, which not only share a significant sectoral content of their productivity gaps but also experienced a rise in their sectoral contents between 1993 and 2000. Given the high level of unemployment in the Slovak Repub-

6 To account for the most important sectors driving the results above, a simple variation analysis was conducted. Each NACE sector was assigned a percentage value as weight in explaining the results of sectoral contents. The text only reports the most important results.

lic, the country might sustain an even larger gap in *per capita* income. In the case of Hungary, the sectoral content is large, yet contrary to the above-mentioned countries, experienced a decline. Hence prospects for complete catching up of productivity levels are slightly better here. This is even more true for the Czech Republic, where a still smaller sectoral content has also become smaller in the period of analysis. The most optimistic view can be deducted from the analysis for Estonia, where the content has become negligible.

It is impossible to quantify the limit to productivity catch-up as effected by sectoral structures, as relative prices will change in the process. A sufficient magnitude of change in prices to let national productivities fully converge, as predicted by the factor-price equalisation theorem in the Heckscher-Ohlin concept, however, is not to be expected: empirically, we can observe that sectors constantly share typical sector-specific productivity levels across countries even in the highly integrated European region.

The main results can be summarised per accession candidate as follows:

Estonia's sectoral structures differ from the ones in the average EU-15, but the differences are comparatively low. They feature much higher weights in industry and in agriculture, whilst shares in enterprise-related services are much lower in Estonia. The country does not appear to be in danger of getting subjected to a limit to real economy catch-up effected by the country's sectoral patterns.

An interpretation of results at the sectoral level for Poland is difficult. Still, the share of employment in state-administration, education and social services appear to be much smaller than in the average EU-15. The country's sectoral patterns only seem to potentially restrict real convergence if the distortional large employment share in the agricultural sector is taken for granted. Here, the sectoral productivity level is extremely low, compared to other Polish sectors.

The Czech Republic's sectoral structures show the largest differences as compared to the EU-15 (that is following to Poland). They differ mainly in that industry is much larger at the expense of enterprise-related services. The country's prospects for complete productivity catch-up can be evaluated positively, as larger employment shares coincide with above-average sectoral productivity levels.

In the Slovak Republic, structural differences at the sectoral level are nearly as large as in the Czech Republic. This is due mainly to particularly low employment shares in enterprise-related services and much higher ones in industry. The distribution of the country's sectoral shares and sector-specific productivity levels give rise to a rather pessimistic view on the prospects for complete productivity catch-up on the national level.

Hungary's sectoral structures compare much better to the ones in the EU. However, the high sector-specific productivity levels in enterprise-related services and low employment shares in the same sector, as well as the opposite pattern in industry give rise to a slightly less optimistic assessment. Yet trends in the past clearly serve to improve prospects.

Slovenia's sectoral patterns are closest to the ones in the EU amongst the countries assessed here. Never-the-less, the analysis suggests a slightly pessimistic view on Slovenia's prospects for a complete closure of the national productivity gap. This is driven mainly by below-average productivity levels in the manufacturing sector and above-average productivity levels in enterprise-related services.

1.3 The role of individual sectors in explaining national productivity gaps

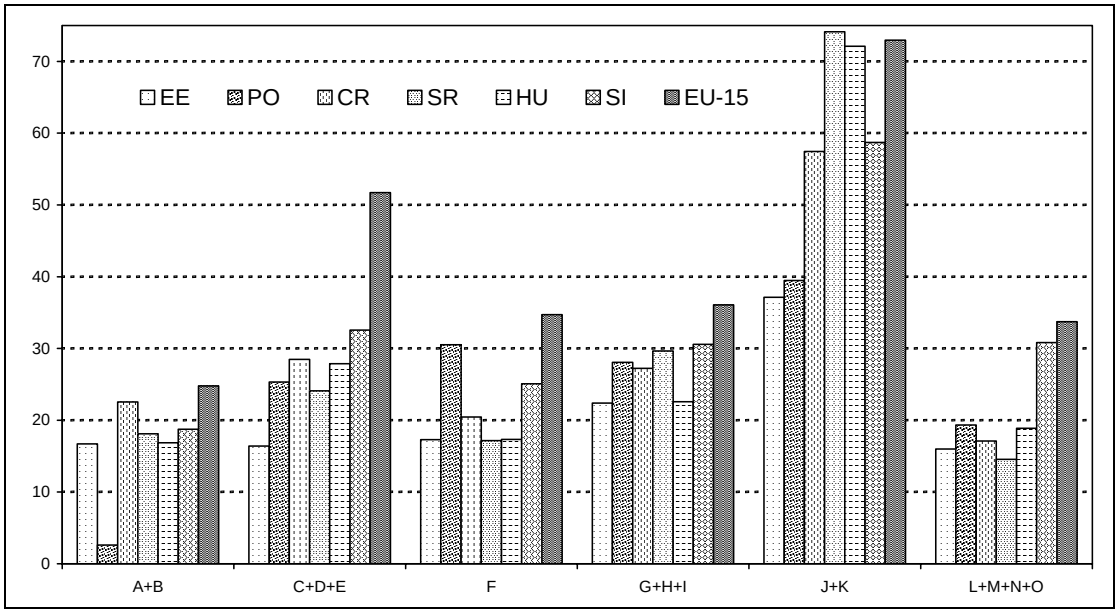
So far, sectoral analysis was concerned with the sectoral content of the productivity gap across the whole economy. That is, analysis was mainly concerned with sectoral specialisation patterns and their influence on productivity gaps and the prospects of their closure. In the following, analysis focuses on productivity gaps at the sectoral level and the role that individual sectors play in explaining the national productivity gap.

If CEECs apply in general less sophisticated technology in production, then one can expect that comparative sectors in CEECs exhibit lower levels of productivities than in the more advanced EU countries, and the EU average. Hereby, the largest gaps across all CEECs in comparison to the average EU-15 levels typically emerge in industrial sectors (see Chart 2: NACE: C+D+E).

Whilst the data suggest that the gaps are lowest amongst the group of service industries (NACE: G-K), this needs to be treated with due care: with prices and hence output values typically determined administratively here, productivity levels are not calculated but rather estimated directly (the calculation of value added in services typically assumes a given level of productivity). Large gaps also exist for the construction industry (NACE: F), however, this sector is rather small.

Sectoral productivity gaps are not only significantly different in size in every economy. In terms of their respective role in explaining their country's national productivity gap, their relative weights within each economy assessed is an important determinant. This is calculated below at a NACE one-digit level. Again, due to data restrictions at this level of aggregation for the EU-average, the comparator economy is Germany.

Chart 2:
Productivity levels in CEECs and the EU-15 average, in 2000
- in 1000 PPP-€ -



Sources: EUROSTAT; WIIW; National Statistical Offices; own calculations.

Individual sectoral productivity gaps are defined according to the same method as the national productivity gaps (from formula 2). In order to provide a quantitative account of the role played by each sector in determining the national productivity gap, our analysis attaches respective weights in terms of employment shares to the sectoral productivity gaps.

$$\bar{\pi}^{i}_{CEE/D} * \alpha^{i}_{CEE} = \frac{\pi^{i}_{CEE}}{\pi^{i}_{D}} * \alpha^{i}_{CEE} \qquad (5)$$

To allow cross-country comparison, this indicator is then related to sum of all sectoral indicators to exhibit the relative explanatory power of sector *i* in explaining the national productivity gap.

$$\tilde{\pi}^{i}_{CEE/D} = \frac{\pi^{i}_{CEE}\alpha^{i}_{CEE}}{\pi^{i}_{D}} * \left[\sum_{i} \frac{\pi^{i}_{CEE}\alpha^{i}_{CEE}}{\pi^{i}_{D}} \right]^{-1} \qquad (6)$$

Table 3 provides an account of explanatory powers of individual sectors as a source of national productivity gaps for the selection of CEECs at the end of the year 2000. The most obvious result of this analysis is that in all transformation economies assessed, the sector of manufacturing (NACE: D) is mainly responsible for national productivity gaps: this sector exhibits the highest values of the indicator (solely in the case of Poland, the agricultural sector is the quantitatively strongest source of the national pro-

ductivity gap[7]). This is owed to in particular the typically highest productivity gap amongst all sectors in combination its their high relative weight in the economies.

Table 3:
Ranking of most influential sectors as a source of the productivity gap, in 2000

Estonia	
Sector	$\tilde{\pi}^i$
D	28.5
G	9.6
M	9.6
Sum 3 sectors	47.7

Poland	
Sector	$\tilde{\pi}^i$
A	32.6
D	18.6
G	11.8
Sum 3 sectors	62.5

Czech Republic	
Sector	$\tilde{\pi}^i$
D	35.6
F	9.7
M	9.3
Sum 3 sectors	54.6

Slovak Republic	
Sector	$\tilde{\pi}^i$
D	30.9
N	12.3
F	10.9
Sum 3 sectors	54.1

Hungary	
Sector	$\tilde{\pi}^i$
D	29.5
M	11.4
G	11.4
Sum 3 sectors	52.3

Slovenia	
Sector	$\tilde{\pi}^i$
D	53.3
K	13.7
G	8.9
Sum 3 sectors	75.9

Note: Share of sectoral productivity gaps, weighted by employment shares, as a fraction of the sum of all weighted sectoral productivity gaps.

Sources: EUROSTAT; WIIW; National Statistical Offices; own calculations.

The dominant role of the manufacturing sector as a source of the national productivity gap is particularly pronounced in the case of Slovenia with an indicator of over 50%. Although the manufacturing sectors' productivity gap had diminished significantly (by more than 8 percentage points between 1993 and 2000), much smaller productivity gaps in other sectors and an exceptionally high employment share account for this dominant role. The Czech Republic finds slightly more than 35% of her national productivity gap caused by the manufacturing sector. Here, the productivity gap remained by-and-large unchanged between 1993 and 2000. In the other countries, the manufacturing sector plays an even less important role, yet remains clearly dominant around 30%. The lowest manufacturing source for the national productivity gap is to be found in Estonia. The country additionally exhibits a more evenly distribution of sectoral

7 This result might again be driven by the methodological difference in the treatment of unemployed land-owners as small-scale farmers. Again assuming a corrected employment share, the agricultural sector would be placed behind household-related services (trade, transport and communication) in the list. The industrial sectors would then advance to the top of the list just as in the other countries assessed.

sources in general, in as much as the sum of the three most important sectors only reaches less than 50%.

The second most important group of sectors across the CEECs assessed here belong to the broad sector of public administration, education, health and social services (NACE: L-O).[8] This result, however, can be expected to be inflated due to the inherited role of administrative prices as re-distributive instrument. This role, however, can be expected to diminish gradually in the course of integration and restructuring of these sectors: in the process of rising wages and incomes in the private sector, prices will adjust upwards. In particular, employment shares in this broad sector are generally lower as compared to the average EU-15 (see table 2). In the case of Slovenia (and possibly in Poland, even when discounting the high employment share in agriculture), public administration plays a comparatively weak role. In particular in the Slovak Republic, but also in Hungary, the Czech Republic and in Estonia, this broad sector accounts for a much larger share of the national productivity gap. With a sum of on average 30%, the role played by the broad sector of public administration is comparable to the role played by the manufacturing sector alone.

The role played by household-related services (NACE: G-I) is important particularly in Poland, Hungary, Estonia and Slovenia. This, however, might probably be more due to a price-effect than a question of efficient allocation of resources. Typically, household-related services are not internationally tradable. With rising income and wealth, prices for such services will tend to increase, narrowing the sectoral productivity gap and the sector's role in the national productivity gap. Enterprise-related services (NACE: J+K) are to a large extent tradable; in particular financial services are well integrated with the West, following engagement of foreign banks in Central East Europe. The intensity of competition is high, hence, productivity gaps are low. Prices for the non-tradable part of enterprise-related services (mainly to be found in real estate, renting and business activities, NACE: K) will tend to be lower due to the same reason as with household-related services and do not count as technology-intensive. In line with that, enterprise-related services only play a relevant role in the case Slovenia. Despite the typically small relative size of the construction sector (NACE: F), it does still play a relevant role apart from in the cases of the Slovak and Czech Republics.

Given this assessment of results, the analysis indicates that in accession countries, potentials for a closure of the productivity gap today predominantly lie with efficiency-improvements in manufacturing industry. Indeed, industrial manufacturing productivity gaps have fallen during the period of analysis particularly fast in Estonia and the Slovak Republic and to a lesser extent in Slovenia. In the case of the latter two, however, gaps still remain the largest in our sample of CEECs. In Poland, Hungary and the

8 Again, results have to be interpreted with due care, due to the methodological problems with price and output determination in those sectors.

Czech Republic, industrial manufacturing gaps have closed up, yet at a much lower pace. Given the demonstrated dominant role of industry in real economy convergence of all countries assessed, this result suggests that the greatest potentials for the respective growth paths are to be found here. In the cases of the Slovak Republic, Hungary and to a lesser extent in Estonia and the Czech Republic, future productivity increases also depend to a high degree on a reduction of the historical re-distributive determination of prices in public administration, education and social services. Productivity gaps in this sector diminished in all those accession countries; only in the Slovak Republic was this improvement very small.

Not in all sectors have levels of sectoral productivities converged: significant increases in sectoral productivity gaps occurred in the agricultural sectors (NACE: A+B) of Poland, Slovenia and Hungary. In Poland, the share of agricultural employment grew during the period of our analysis, whereas it fell in all other accession candidates assessed here. Further significant increases in gaps can be observed in some parts of Czech services sectors (in particular NACE: I and J) and the Slovak services sectors (in particular NACE: H and J), with dramatic increases in gaps in the financial intermediation sectors (NACE: J) of both countries, and in the hotels and restaurants sector (NACE: H) of the Slovak Republic.

Furthermore, gaps increased significantly in the electricity, gas and water supply industry (NACE: E) of the Slovak and Czech Republics, as well as in Poland. This sector contains some extent of administrative prices. Finally, productivity growth in Hungary's construction industry (NACE: F) did not meet the same sector's rate of growth in the comparator country of Germany.

The main results can be summarised per accession candidate as follows:

> All productivity gaps of the countries assessed here root predominantly in their respective manufacturing industries. Only in Poland is this possibly topped by the agricultural sector (if official data is taken for granted).
>
> In Estonia, the manufacturing productivity gap has fallen particularly fast during the period of analysis. The country's sectoral sources of the national productivity gaps are more evenly distributed as compared to the other countries. Domestic trade in household-related services and the state-administration sector also play an important role in determining the national productivity gap.
>
> In Poland, the results again depend mainly on the agricultural sector. When discounting from this, the manufacturing sector becomes the prime source of the national productivity gap. Here, improvements were comparatively slower since 1993. Next to the afore mentioned sectors, domestic trade as part of the household-related services sector also accounts for a large share of the national productivity gap.

In the Czech Republic, the industrial productivity gap has narrowed at a comparatively slow pace. Despite its small size, the construction sector plays an important role in explaining the national productivity gap, followed by the state-administration sector. Productivity gaps have increased in the energy sector, and even dramatically in enterprise-related services.

In the Slovak Republic, manufacturing productivity gaps have also decreased fast since 1993. As was the case in the Czech Republic, the state-administration and the construction sectors account for large shares in national productivity gaps. Also here, the energy sector's and the service sector's productivity levels have increased at a slower pace as was the case in the comparator country of Germany.

In Hungary, industrial productivity gaps have narrowed, yet at a comparatively slow pace. The sectors of state-administration and household-related services also play an important role in explaining the national productivity gaps. The rate of growth of productivity in financial intermediation was slightly lower as compared to the one in Germany, increasing the gap.

In Slovenia, industrial productivity gaps have fallen significantly, yet this sector still accounts for by far the largest share in the country's national productivity gap. Hence, the sectoral sources of the productivity gap are much more concentrated here than in any other country assessed here. Enterprise-related services and domestic trade are also important sources of the national productivity gaps in Slovenia.

1.4 Economic policy considerations of results

The results of sectoral analysis of determinants of national productivity gaps suggest that promoting technological development alone could prove to be insufficient in Hungary, the Slovak Republic and Slovenia. Rather, measures geared towards increasing the flexibility in the reallocation of production factors to promote sectoral change could be a decisive factor in those countries. Here, the opinion taken by the EU in its latest cohesion report (EU 2001b) appears to be well founded.

The assessment of Poland depends entirely on the view taken on the size of agricultural employment. If it were as high as quoted in national statistics, then complete real economy convergence would critically depend on sectoral change reducing agricultural employment to the benefit of industry and services.

The analysis into the most important sectors determining the national productivity gaps established that future increases of national productivity levels depend to a high degree on a convergence of prices in the sectors of public administration, education and social services. This will largely depend on the ability of the governments to exe-

cute potentially socially painful reforms of the state administration and social systems: this might prove especially difficult in the case of Hungary, where the formally well developed social security system had been significantly downsized in the austerity programme of March 1995. It remains to be seen whether accession candidates are able to introduce reforms to their state administrations whilst retaining a socially acceptable level and comprehensive coverage of social security.

In general and at least in the medium term, economic policy in CEECs could be most efficient in closing the productivity gap, if focussed on an upgrading of technology and organisation-efficiency in industry via technology transfer and indigenous research and development. Foreign direct investment, closer ties in production, innovation and marketing networks spreading across the West and accession countries, improvement of infrastructure as well as financial support and integration of firm-R&D and universities are the typical and well tested political measures in this field. Not least, such policies can also increase the flexibility of production factors to promote the kind of sectoral change that this analysis pointed out as necessary for complete productivity catch-up in some accession countries.

2. Determinants of National Productivity Growth

Productivity growth can root from several sources. Typically, sources of productivity growth would be assessed in the methodological framework of sectoral 'growth accounting': in a first step, production (or cost) functions would be estimated. In a second step, the resulting indicator for technological progress could be compared with observed productivity growth to distinguish the technological from other sources of productivity growth (like *e. g.* reduction in overmanning, structural change, etc.).

This method was not applied here. First, for growth accounting to make sense, it is necessary to estimate the value of the capital stock for each country assessed. The necessary data base for such an exercise, however, is not available: following systemic transformation, a large fraction of the capital stock turned obsolete practically over night – some of the capital was scrapped, but some is still in operation. It impossible to estimate a sensible value of such capital still in operation plus capital newly invested without extensive field work – a task which only a national statistical office can comprehensively fulfil. The alternative possibility of the perpetual inventory method can only produce sensible estimations if sufficiently long historical time series of depreciation and investment exist. This, however, is not the case for transition economies.

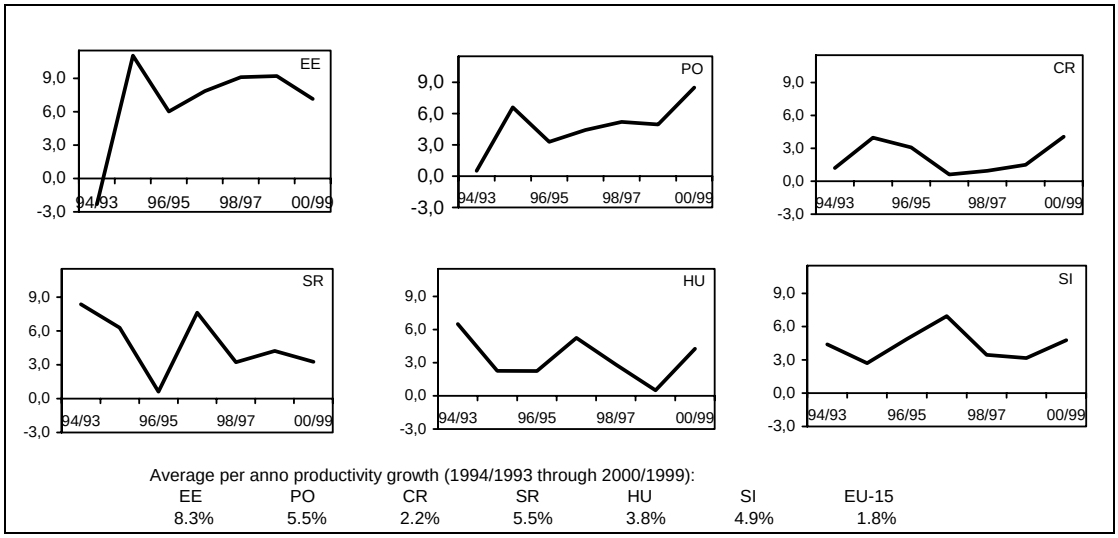
Following a brief description if actual productivity growth the our sample of countries, this chapter on the determinants of productivity growth rather assesses the most impor-

tant non-technological sources of productivity growth directly by use of simple empirical methods. This way, the results are robust, and speculation can be separated from analysis (rather than an implicit intertwining of assumptions and facts in an application of a comprehensive model).

2.1 Setting the agenda: growth of national productivity

All countries assessed here experienced positive real growth rates of national productivity levels at least since 1994/1993 (see Chart 3). The notable exceptions are Estonia and the Czech Republic. Both countries achieved negative rates in 1994/1993. In Estonia, this is mainly because the country started some years later with systemic transition – transformational recession was still active in 1994. Not least due to the much lower starting level, Estonia achieved the comparably highest productivity growth rates over the total period of analysis between 1993 and 2000. In the Czech Republic, the negative growth rate in 1994/1993 is mainly due to (as noted above) the dramatic fall in productivity levels in enterprise-related services (NACE: J), which was particularly pronounced back then. The country's comparatively weakest productivity growth performance in the group of countries for the total period can be attributed additionally to the financial crisis with negative GDP growth rates between 1997 and 1999.

Chart 3:
Growth of national productivity levels in CEECs and the average EU-15, 1994/1993 to 2000/1999
- in *per cent per anno* real growth rates -



Note: The rates of growth have been calculated in national currency and constant prices.

Sources: EUROSTAT; WIIW; National Statistical Offices; own calculations.

At least since 1995/1994 were growth rates of national labour productivities in accession candidates consistently higher as compared to the countries' integration region of the EU-15. Hence were can observe some productivity catch up, some closure of national productivity gaps.

Whilst Poland and the Slovak Republic achieve comparable average p.a. growth rates for the whole period of 1993 to 2000, Poland's growth path of national productivity shows a rising trend and is more consistent as compared to the one in the Slovak Republic. This is mainly due to the country's consistently high GDP growth during the same period. Slovenia also exhibits a consistent growth path of national labour productivity, yet at slightly lower level. Hungary's productivity performance during the total period is still a bit weaker with on average 3.8%, and shows a falling trend. This, however, coincides with positive growth of employment: positive productivity growth coinciding with positive employment growth was only achieved amongst this panel of candidate countries by Hungary since 1997 and in Slovenia since 1998. In all other countries, productivity growth was of a labour-saving kind.

2.2 Productivity growth and changes in employment

What are the main sources of productivity growth? In a first approach, the analysis attempts to establish, how much of it can be attributed to labour-saving technological change, or to a reduction of the kind of overmanning typical to firms in socialist economies. In contrast, in what countries were productivity increases actually accompanied by employment growth via improvements of competitiveness? At the microeconomic level of enterprises, the question pertains to whether firm-restructuring was rather *defensive* or *strategic* (see Roland 2000, p. 234). That means: did the process involve either downsizing to less profitable entities and factors of the firm (or complete firms), or rather a strategic reorientation of the firm by way of adjustment in the product variety, product and process innovations, successful marketing strategies, etc. with the aim of increasing the firm's competitiveness? In reality, both effects will have increased productivity growth, but the question pertains to the relative share of either effect.

As note in the introduction to chapter 2, this question was approached by assessing productivity and employment levels' annual data between the years of 1993 to 2000 by use of a simple correlations analysis: a large and significant negative correlation would indicate that productivity growth can to a large extent be attributed to a downward adjustment of employment in firms (or even the firm's exit) in an attempt to gain competitiveness on an increasingly contestible market due to integration with the EU. On the other extreme, a significant positive correlation would suggest that firms were able to employ additional -and more productive- personnel, and/or that the number of firms entering (with higher productivity) was larger than the number of firms exiting.

In fact, Estonia's productivity growth was until recently mainly accompanied by a reduction of employment (see table 4). This might be due to either layoffs in firms, where personnel did not contribute significantly to produce value added (reduction of socialist overmanning). Or, productivity gains were 'bought' by labour-saving technological advancement. Finally, national productivity growth could have been a result of some of the least productive firms exiting the market without being (fully) replaced by more productive firms. In Hungary and possibly Slovenia, the same employment-reducing productivity growth-pattern during the first sub-period of 1993 to 1996 is indicated by the results. In the case of Hungary, this result is even statistically significant. However, in both countries, this pattern reversed in the second sub-period from 1997 to 2000. Then, national productivity could grow hand-in-hand with growth in the number of employed persons.

Table 4:
Productivity and employment at the sectoral level: a correlation analysis

	Sub-period 1 1993 - 1996	Sub-period 2 1997 - 2000	Total period 1993 - 2000
Estonia	-0.80	-1.00***	-0.93***
Poland	+1.00***	-1.00***	+0.67
Czech Republic	+0.80	-1.00***	-0.62
Slovak Republic	+0.80	-1.00***	-0.02
Hungary	-1.00***	+1.00***	-0.25
Slovenia	-0.40	+1.00***	+0.14

Note: Non-parametric, Spearman correlation. – *** Significant at the 1% level, – ** at the 5% level, and – * at the 10% level.

Sources: EUROSTAT; WIIW; National Statistical Offices; own calculations.

In the other countries, the story is not as easily told: here, earlier productivity growth was achieved in parallel with employment growth. This, however, does not appear to have been sustainable: in Poland and the Slovak Republic, the change in the productivity growth regime coincided with a downward adjustment in GDP growth rates, and in the Czech Republic, GDP growth abated due to financial crisis in 1997.

Common to all countries apart from Slovenia and Hungary is therefore that during the more recent past (second sub-period), productivity growth was achievable only at the expense of employment growth. Considering the high rates of unemployment in those countries, it will be particularly important to generate the kind of productivity growth which does not rely on a rationalisation of labour – or to achieve high enough overall productivity growth rates to allow improved competitiveness to overcompensate labour saving effects.

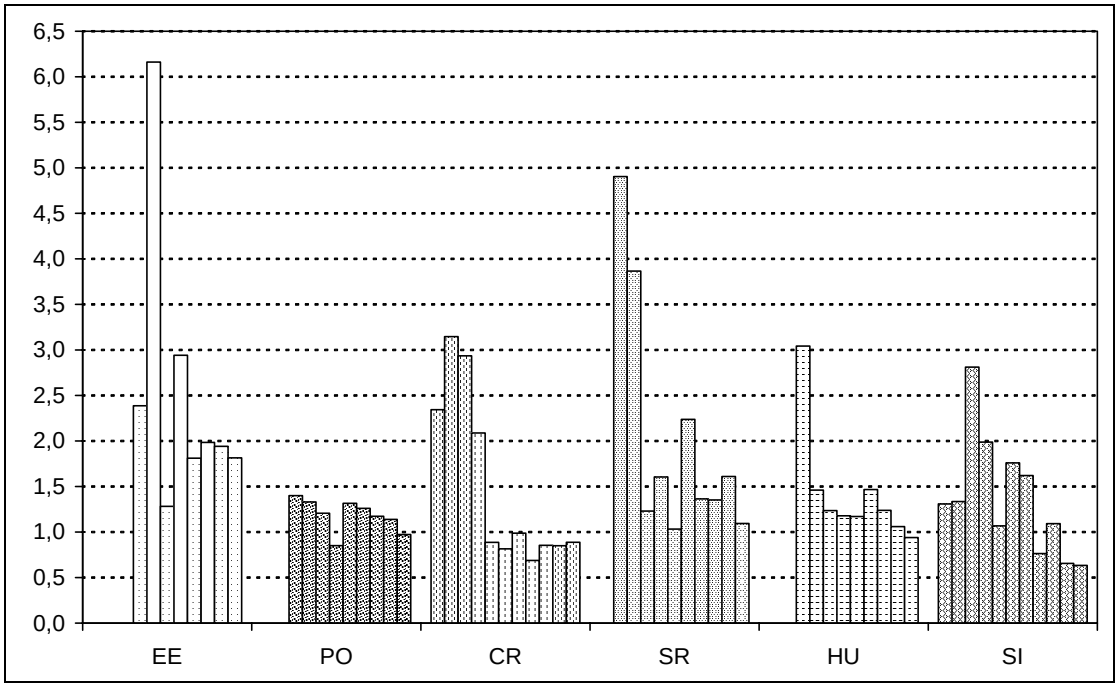
2.3 The shares of sectoral change in national productivity growth

The second approach in our analysis of sources of productivity growth assesses structural change at the sectoral level. Statistically, productivity growth rates are an aggregate effect of productivity changes in individual sectors and shifts between sectors. *E. g.* the more agricultural employment migrated to manufacturing industry (with typically higher levels of sectoral productivities), the higher was *ceteris paribus* also national productivity growth. The intensity of sectoral structural change between the *i* sectors of an economy can best be assessed by use of a deviation indicator, here the Euclid-measure:

$$s = \sqrt{(\sum_i (a_t^i - a_{t-1}^i)^2)} \qquad (7)$$

It provides an indication of how much economies have been subject to structural adjustment at the sectoral level in the course of integration and catch-up development. Chart 4 provides an overview of intensities of structural change at the sectoral level (including the 15 single digit NACE sectors of A-O) in our accession candidates for each year between 1992/1991 and 2000/1999.

Chart 4:
Intensities of structural change at the sectoral level in CEECs, 1991/1990 to 2001/2000 (missing values)



Sources: EUROSTAT; WIIW; National Statistical Offices; own calculations.

The most obvious result from this exercise is that sectoral change has been more intense early into the transformation period, abating with time. Only in Poland and Hungary is that result not as robust as in the other countries. Estonia started later with systemic transition, hence structural adjustments can be expected to be comparatively higher even today. In the other countries, sectoral change as of latest show an intensity-index of about 1, and even undercut by Slovenia with a level of 0.6. These results indicate that sectoral adjustment to systemic change and integration have been intense at the outset of economic liberalisation but short-lived. By today, most of the adjustment has taken place and intensities in CEECs have reached levels comparable to *e. g.* Germany (average 1993-2000: 0.8) or Italy (average 1993-2000: 0.6).

From the Euclid-measure, however, one cannot infer the direction of change, and hence its effect on productivity growth. The identification of sectors growing relative to others is however an important issue in the assessment of national productivity growth. Productivity growth which roots to a large extent in changes of sectoral structures indicates a high degree of restructuring at a macro or mezzo level of the economy. In contrast, if national productivity grew without much sectoral change, then either sectoral structures are sufficiently competitive (or adapted to the new competitive surrounding in the new integration area) and restructuring appeared within sectors. The following analysis not only relates the extent of sectoral change to growth of national productivities. Rather, the analysis attempts to identify the extent to which productivity increases at the national level can be explained by restructuring between sectors. This then includes not only the extent of restructuring but also its direction.

Following the same intuition as in the above sectoral analysis, the share of observed national productivity growth that rooted exclusively in sectoral structural change is calculated. The rate of growth of national productivity levels between the points in time of *t* and *t-1* is defined by:

$$\frac{d\pi}{dt} = \frac{\left(\sum \pi_t^i \alpha_t^i\right) - \left(\sum \pi_{t-1}^i \alpha_{t-1}^i\right)}{\left(\sum \pi_{t-1}^i \alpha_{t-1}^i\right)} \tag{8}$$

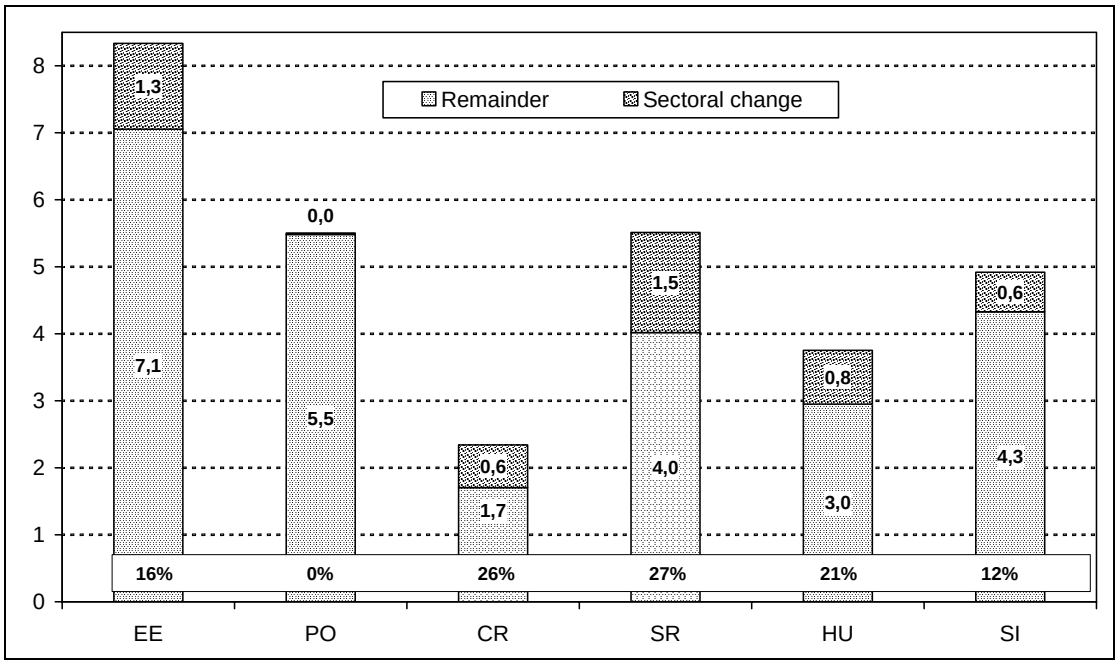
The rate of growth of national productivity levels which roots exclusively in the statistical effect of change of sectoral patterns is calculated by assuming that no productivity growth had occurred within individual sectors, *i. e.* sectoral productivity levels are held constant at the level achieved at the beginning of the period of analysis in 1993:

$$\frac{d\pi_{hypo}}{dt} = \frac{\left(\sum \bar{\pi}_{t_0}^i \alpha_t^i\right) - \left(\sum \bar{\pi}_{t_0}^i \alpha_{t-1}^i\right)}{\left(\sum \bar{\pi}_{t_0}^i \alpha_{t-1}^i\right)} \tag{9}$$

The results of this statistical calculation (see Chart 5) suggest that the largest share of sectoral change in national productivity growth can be found in the Slovak Republic

with 27% (or 1.5 percentage points). This coincides with the country's second but largest intensity of sectoral change amongst the other fellow economies.

Chart 5:
Shares of sectoral change in national productivity growth, 1994/1993 to 2000/1999
- average *per anno* real growth rates in percentage points -



Note: The rates of growth have been calculated in national currency and constant prices.

Sources: EUROSTAT; WIIW; National Statistical Offices; own calculations.

Estonia highest intensities of sectoral change amongst the countries assessed did not translate into equally high shares of sectoral change in productivity growth. Rather, structural adjustment between sectors only account for some 16% of national productivity growth. The main reason for this can be found in an exceptionally small variation of productivity levels between sectors (see chart 2). On the other extreme, intensity of sectoral change between 1993 and 2000 in the Czech Republic was the lowest in our country sample, yet the share of sectoral change contributed with 26% to national productivity growth, *i. e.* nearly as much as in the Slovak Republic. This result is mainly driven by employment growth in the financial intermediation sector at the expense of the agricultural sector – the latter typically exhibiting much lower sector-specific levels of productivity.

Despite the fact that Hungary, Slovenia and Poland reach on average comparable intensities of sectoral change between 1993 and 2000, sectoral change itself during the same period of time played a comparatively large role for productivity growth in Hungary (with 21%), a more moderate role in Slovenia (12%), but virtually no role in Po-

land.[9] Poland's development of national productivity appears to not have been driven by sectoral change at all, but rather exclusively by productivity growth within sectors.

'Within-sectoral productivity growth' (*i. e.* the share of productivity growth which excludes the pure statistical effect) can be held to contain a larger share of technological advancement proper as compared to 'between-sectoral productivity growth'. For obvious reasons, this does not mean that 'within sectoral productivity growth' can be equated with technological advancement *per se*. Rather, an economy exhibiting a lower share of sectoral change in national productivity growth can be expected to also have achieved a higher share of technological advancement in comparison to an economy with a high share of the sectoral content. Then a comparison of results between the Slovak Republic and Poland, despite having achieved identical growth rates of national labour productivities, would suggest that Poland has possibly experienced more technological advancement as compared to the Slovak Republic.[10] In the case of the Czech Republic and Hungary, the results suggest that their productivity growth pattern included significant shares of the statistical effect, whereas this is less pronounced in the cases of Estonia and Slovenia.

2.4 The role of individual sectors as sources of national productivity growth

Which sectors are subsequently mainly responsible for national productivity growth? Using the same methodology as in chapter 1.3 (see formula 5 and 6), adapted to growth variables, formula 10 and 11 calculate the quantitative role of the sector *i* as a source of national productivity growth: in the three sectors listed in table 5, sector-specific productivity levels grew particularly fast and these sectors have large shares in the economy. The sum of the roles of these three sectors provides a picture of the level of concentration of national productivity growth across sectors.

$$\frac{d\pi^i}{dt} * \alpha^i = \frac{\pi_t^i * \alpha_t^i - \pi_{t-1}^i * \alpha_{t-1}^i}{\pi_{t-1}^i} \tag{10}$$

$$\hat{\pi}^i = \frac{\pi_t^i * \alpha_t^i - \pi_{t-1}^i * \alpha_{t-1}^i}{\pi_{t-1}^i} * \left[\sum_i \frac{\pi_t^i * \alpha_t^i - \pi_{t-1}^i * \alpha_{t-1}^i}{\pi_{t-1}^i} \right]^{-1} \tag{11}$$

9 This adds credence to this indicator: rather than observing the intensity of sectoral change alone (possibly even calculating regressions), our indicator of the share of sectoral change in productivity growth can inform about the actual role of structural change for productivity growth.

10 A further, more disaggregated analysis of the sources of productivity growth within sectors is needed to generate a clearer picture. This is the focus of the following sub-section in which exemplarily the manufacturing industry is assessed, assuming that this sector holds the most interesting insights in this respect.

The first result to be read from this analysis is that the sector of manufacturing (NACE: D) played the most important role in respective national productivity growth in all countries of our sample. Not only is manufacturing the most influential sector explaining national productivity gaps (with the exception of Poland), manufacturing also accounts for the largest source of productivity growth. The distances to the second most influential sectors for national productivity growth in all countries assessed is sufficiently large to grants this sector a particularly important role in the analysis of productivity in CEECs, which is reflected in chapter 3.

Table 5:
Ranking of the most influential sectors as sources of national productivity growth, between 1994/1993 and 2000/1999

Estonia	
Sector	$\hat{\pi}^i$
D	21.0
I	11.3
N	9.7
Sum 3 Sectors	42.0

Poland	
Sector	$\hat{\pi}^i$
D	20.3
A	15.4
G	14.0
Sum 3 Sectors	49.7

Czech Republic	
Sector	$\hat{\pi}^i$
D	30.6
G	12.4
F	7.8
Sum 3 Sectors	50.8

Slovak Republic	
Sector	$\hat{\pi}^i$
D	27.7
A+B	9.6
I	9.4
Sum 3 Sectors	46.7

Hungary	
Sector	$\hat{\pi}^i$
D	28.8
G	12.4
I	9.8
Sum 3 Sectors	51.0

Slovenia	
Sector	$\hat{\pi}^i$
D	34.4
G	12.6
F	7.2
Sum 3 Sectors	54.2

Note: Share of sectoral productivity growth, weighted by employment shares, as a fraction of the sum of all weighted sectoral productivity growth rates.

Sources: EUROSTAT; WIIW; National Statistical Offices; own calculations.

Between all countries assessed, household-related services, namely domestic trade (NACE: G) and transport, storage and communication (NACE: I) appear to also belong to the most influential sectors for national productivity growth. In addition, agriculture played a leading role in the cases of mainly Poland and possibly also the Slovak Republic (although here, the agricultural and fishing sectors could not distinguished in the raw data), and the construction industry, despite being relatively small in size, in the Czech Republic and Slovenia.

Interestingly, the highest level of concentration of national productivity growth on the three most influential sectors is exhibited in Slovenia with only manufacturing and

domestic trade with indicators of over 10%. The most evenly distribution of sectoral sources can yet again be found in Estonia.

The main results can be summarised per accession candidate as follows:

Estonia achieved the highest rates of growth of national labour productivity. This growth, however, was not driven by technological advancement only, it was rather accompanied over the whole period of analysis by a reduction of overmanning, *i. e.* falling employment. The country also exhibits the highest intensity of employment shifts between sectors, yet the share of sectoral change in productivity growth turned out to be rather moderate. This means that the statistical effect of productivity growth due to structural change was not as high as the intensity of sectoral change would suggest, which can be explained by only small differences between levels of productivity of the sectors assessed.

Poland experienced a clear upward trend in national productivity growth, averaging between 1993 and 2000 some 5.5% p.a. This parallels the exceptionally high growth rates of GDP during the same period. However since 1998, productivity grew at the expense of employment. Poland's national productivity growth was not driven by the statistical effect of sectoral change at all, this despite the fact that the intensity of sectoral change was significant, yet comparatively low.

In the Czech Republic, productivity growth was clearly the lowest amongst the countries assessed (averaging 2.2%). This meagre result was furthermore paralleled by a reduction in employment since 1997. In addition to that, a very large fraction of this productivity growth can also be attributed to sectoral change (a shift of employment from low to high productivity sectors) rather than an improvement of technology and efficiency of use of resources at the firm level.

Productivity growth in the Slovak Republic turned out much higher, yet with a falling trend. These falling rates were moreover accompanied by falling employment since 1997. As was the case in the Czech Republic, national productivity growth was driven to a large extent by employment shifts between sectors. Here, sectoral change was particularly intensive.

In the case of Hungary, productivity growth also exhibits a falling trend, but here, employment actually grew since 1997. The sectoral composition of Hungary's economy did change considerably between 1993 and 2000, and in line with that, sectoral change plays an important role in explaining national productivity growth.

Relatively high productivity growth rates in Slovenia were also accompanied by growing employment sine 1998. Here, sectoral change was intense, yet its role in productivity growth turned out to be rather small.

2.5 Economic policy considerations of results

Economic growth in general and productivity growth at the national level in particular are not sufficient conditions alone to increase competitiveness of firms, *i. e.* to improve the potentials of firms to withstand intensifying competition in the process of integration with the EU.

Rather, in the cases of the Slovak Republic and Estonia, above-average rates of growth of national productivity were 'bought' to a large extent by falling employment and structural shifts in employment at the sectoral level. In effect, therefore, the pure technological content of productivity growth is lower than predicted by productivity growth rates. This might serve to signal to economic policy-makers that additional reform and/or support efforts at the micro-level could improve the countries' conditions for catch-up development.

Our analysis suggests that in both countries, such intervention might turn out to be most profitable in terms of productivity growth in the manufacturing sectors, in Estonia additionally in household-related services of transport, storage and communication. Additional research (in particular see the next section on manufacturing industry and research in other workpackages of this project), however, is needed to pinpoint the specific fields of intervention where and how scarce resources are best allocated to. The same applies to the Czech Republic, albeit here, productivity growth additionally turned out to be rather slow, mainly due to the country's suffering a financial crisis in 1997.

In Poland, Hungary and Slovenia, the pictures are rather mixed: whilst in Poland, above-average productivity growth rates were achieved only by way of falling employment (at least towards the end of the period of analysis), those rates were actually achieved within each sector, and not via structural change at the sectoral level. This could lead us to conclude that sectoral restructuring could further improve the country's conditions for catch up development.

Economic policy could assist structural adjustment by increasing flexibility and removing possibly existing barriers to the migration of employment between regions and sectors of the economy. Hungary and Slovenia both achieved average productivity growth rates, whilst assisted by sectoral restructuring, still however substantial enough to allow employment to grow in the recent past. Here, the scope for additional economic policy appears to be rather small: firms are already improving competitiveness, and the economies have gone some way in adjusting sectoral structures. Hence, economic policy could aim at improving general condition for economic activity, amongst which most importantly the development of infrastructure.

3. The Focus on the Sector of Manufacturing Industry: Determinants of Productivity Gaps in Manufacturing

Sectoral analysis highlighted the sector of manufacturing industry as the most influential sector as a source of productivity gaps and national productivity growth (with the possible exception of the role of agriculture in Poland). This suggests that further analysis should produce the most promising results if focussed on manufacturing. What is even more, objectives of analysis in this workpackage included the notion of specialisation in domestic production – and its effect on productivity growth and potentials. Specialisation can be assumed to be most pronounced in the case of manufacturing branches due to the high share of tradeables.

Research on specialisation-matters typically focuses on a theoretical explanation of emerging specialisation-patterns by use of models of the tradition of Heckscher-Ohlin or Ricardo. Some more recent literature attempts to use New Trade and New Growth Theories (see e. g. the large body of literature by Grossman-Helpman, Krugman, Puga and Venables), but usually falls short of expectations in terms of an empirical application of these concepts. With the demise of structuralism as a theoretical concept of development economics (see body of literature by Prebish), very little theoretical research proceeds from there to interpret specialisation-patterns in terms of conditions for economic catch-up. This research matter is largely non-existent in empirical applications. At most, empirical research examines whether industrial structures are either 'advantageous' or 'disadvantageous', without however providing a sound theoretical framework.[11]

Some theoretical models, predominantly based on endogenous growth theories and economic geography concepts, perceive the possibility of catching up not taking place in particular conditions due to externalities, non-perfect competition, path dependence, and hysteresis (e. g. 'North-South', 'core-periphery' models, Krugman's and Posner's 'technology gap' and 'imitation gap' models, 'product life cycle theories', 'quality ladder' concepts, Snower's 'low-skill, bad-job trap' model (1994), see Wolfmayr-Schnitzer (1999) for a literature-review of integration theories). In general, however, such models remain largely theoretical and do not lend themselves to a convincing empirical analysis.

Analysis in the two sub-sections below follows largely the same points of interest and methods as was the case in sub-section 2.1 and 2.2 on the sectoral level. This time, the

11 See *e. g. Peneder* (2000), p. 21, and *Zeman* (2002). A more demanding approach is used by *Mickiewicz, Zalewska* (2002) on a sectoral level. Here, a particular theory from the de-industrialisation debate is applied on the cases of transition economies.

focus of interest is on the manufacturing sector and the structures and development of specialisation within the manufacturing sector.

The concept of specialisation used here assesses division of labour between individual CEECs and the current EU. Analysis of specialisation is therefore comparative in nature and should use data at the lowest possible level of aggregation. Comparative industrial data, however, is not available for the average EU-15, hence comparison is made to Germany. Here, analysis can make use of productivity data at a 2-digit NACE level and for a selection of accession states and Germany even employment data on 3-digit NACE level from the CRONOS database of EUROSTAT.

3.1 Setting the agenda: the sizes of productivity gaps in branches of manufacturing and branch specialisation

Slovenia's manufacturing industry exhibits the lowest productivity gap for total manufacturing (NACE: D) when compared to Germany (see table 6). In fact, the levels of productivity of some of the most advanced manufacturing branches in Slovenia even outclass their counterparts in Germany: 'transport equipment' (NACE: DM) reaches a level 28.5% higher than in Germany, and 'food products, beverages and tobacco' (NACE: DA), a level 21.7% higher than the same branch in Germany. On the bottom end of the scale, Slovenia's weakest branches exhibit productivity gaps of up to nearly 80% (in particular 'coke, refined petroleum products and nuclear fuel', NACE: DF). By far the largest productivity gap in total manufacturing *vis-à-vis* Germany was diagnosed for Estonia, with the most developed branch still exhibiting a gap of some 40% ('food products, beverages and tobacco'). However, the largest branch-specific productivity gap is not to be found in Estonia, but rather in the Slovak Republic with over 85% in the branch of 'textiles and textile products' (NACE: DB). For total manufacturing, the Slovak Republic's gap (53.3%) is average amongst the countries assessed.

Poland's manufacturing industry is the second but weakest within our sample with a gap of 58.1%. Amongst the most developed branches, Poland's 'pulp, paper and paper products, publishing and printing-industry' (NACE: DE) still exhibits a gap of some 22%. The gaps for total manufacturing of Hungary and the Czech Republic are comparable to the Slovak Republic. In Hungary, the lowest gap is reported for 'transport equipment', probably an effect of foreign direct investment. In the Czech Republic, the industry of 'food products, beverages and tobacco' has come closest to productivity levels in Germany.

It is quite obvious to see, that the industry branch of 'food products, beverages and tobacco- manufacturing' is the most advanced in our country sample in terms of productivity. This is followed by the manufacturing branches of 'transport equipment' and 'pulp, paper and paper products, publishing and printing'. These are the branches whe-

re EU accession states have come closest to branch-specific levels of productivity in Germany, yet in most cases, countries were not able to align their branch specialisation in domestic production to correspond to these productivity results.

Table 6:
Branch productivity gaps *vis-à-vis* Germany and structural differences in employment shares, in 2000

Estonia			Poland			Czech Republic		
Branch	$\overline{\pi}^{i}_{CEE/D}$	$\alpha_{CEE}-\alpha_{D}$	Branch	$\overline{\pi}^{i}_{CEE/D}$	$\alpha_{CEE}-\alpha_{D}$	Branch	$\overline{\pi}^{i}_{CEE/D}$	$\alpha_{CEE}-\alpha_{D}$
DA	39.3	+ 5.3	DE	22.3	-1.8	DA	7.8	-0.6
DD	45.4	+ 9.4	DA	37.3	-2.7	DI	26.8	+2.8
DE	51.8	-2.2	DL	39.7	-1.8	DE	30.7	-4.1
...	...	...	...	...	...	...	...	...
DB	66.8	+15.6	DK	60.0	-4.3	DB	55.9	+ 6.5
DL	67.9	-4.3	DC	65.3	+2.7	DK	56.7	-1.7
DK	75.2	-10.0	DB	68.2	+10.6	DF	61.4	+ 0.1
Total D	68.1	+1.0	Total D	58.1	-3.4	Total D	50.0	+5.5

Slovak Republic			Hungary			Slovenia		
Branch	$\overline{\pi}^{i}_{CEE/D}$	$\alpha_{CEE}-\alpha_{D}$	Branch	$\overline{\pi}^{i}_{CEE/D}$	$\alpha_{CEE}-\alpha_{D}$	Branch	$\overline{\pi}^{i}_{CEE/D}$	$\alpha_{CEE}-\alpha_{D}$
DF	- 4.7	+ 1.0	DM	1.3	- 6.8	DM	- 28.5	- 8.0
DM	30.0	- 5.9	DG	30.2	- 1.8	DA	- 21.7	- 2.7
DA	33.4	+ 0.5	DL	34.5	+ 4.8	DE	18.7	- 1.8
...	...	...	...	...	...	...	...	...
DK	76.0	- 1.4	DK	57.5	- 6.7	DD	50.1	+ 2.5
DC	79.8	+ 3.7	DC	68.7	+ 2.8	DB	61.4	+ 10.6
DB	85.2	+ 8.9	DB	68.8	+ 10.3	DF	79.4	0.0
Total D	53.3	+ 4.2	Total D	51.0	+ 2.6	Total D	42.4	+ 7.8

Note: The three branches with the largest and the three branches with the smallest productivity gaps, in *per cent* of Germany's branch-productivity levels. Gaps are PPP-corrected to allow comparison across countries and calculated according to formula 2. Structural differences presented as percentage points differences of employment shares of individual accession states to Germany.

Sources: EUROSTAT; WIIW; National Statistical Offices; own calculations.

In particular, in all countries except Estonia, branches with lower productivity gaps are actually smaller in size relative to Germany. On the other side of the coin, all countries have larger employment shares than Germany (*i. e.* exhibit positive specialisation) typically in branches where productivity gaps are large. Only in the cases of Estonia

are the two most advanced branches also comparatively larger than in Germany ('food products, beverages and tobacco' and 'wood and wood products'). In the Czech Republic is the second most advanced manufacturing branch larger than in Germany ('other non-metallic mineral products'); in the Slovak Republic the most advanced and the third most advanced branches ('coke, refined petroleum products and nuclear fuel', 'food products, beverages and tobacco'), and in Hungary it is only the third most advanced branch which exhibits a positive specialisation compared to German manufacturing ('electrical and optical equipment').

3.2 The shares of industrial specialisation-differences in manufacturing productivity gaps

Those results lead us to ask for the structural content of manufacturing productivity gaps: if specialisation generally favours manufacturing branches which exhibit above-average productivity gaps, how much of the average manufacturing sector-wide productivity gaps are then accountable to specialisation rather than lower levels of technology in production?

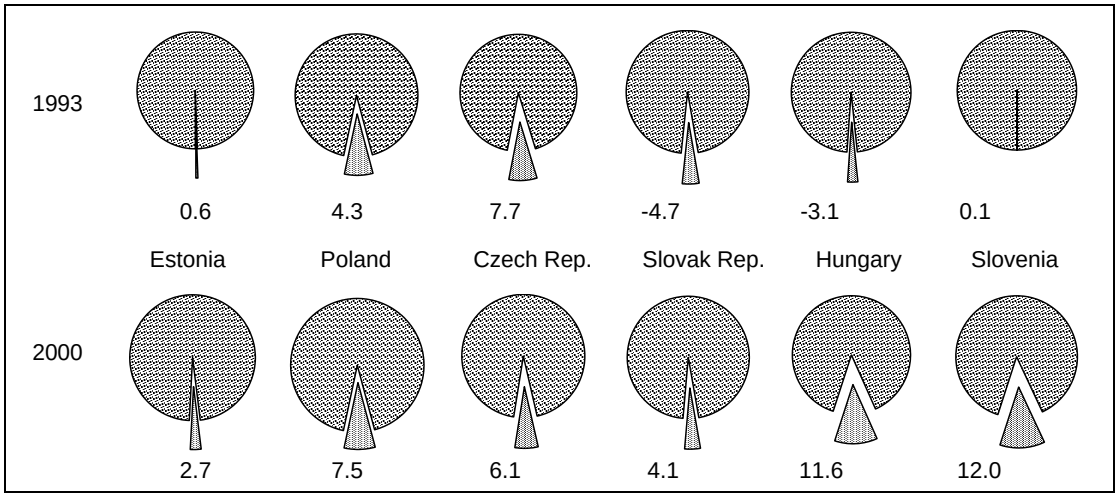
The magnitude of structural contents of productivity gaps at the manufacturing level is calculated according to the same method as applied in the sectoral analysis (see formula 4). Also the same representation of results has been used to facilitate access to results (see Chart 6). In comparison to the roles played by differences at the sectoral level for determining the national productivity gaps, the roles played by manufacturing specialisation for industrial productivity gaps are typically much smaller but have been growing in all countries assessed bar the Czech Republic. The highest contents in 2000 can be found for Slovenia and Hungary: had those two countries had the same structural pattern in manufacturing as the pattern predominant in Germany, the productivity gaps would have turned out to be some 12% lower in both countries. In the other countries, much smaller shares of the manufacturing productivity gaps are accountable to the countries' structural differences.

In 1993, structural patterns of manufacturing in the Slovak Republic and Hungary actually featured larger employment shares in branches with above-average productivity levels as compared to Germany: the sectoral content of the manufacturing productivity gap was in fact negative.

Analogous to the theoretical assessment of sectoral contents of national productivity gaps, we can here assume that the structural patterns as they evolved between 1993 and 2000 might represent lasting trends. At a slight variance to the sectoral analysis, these interpretations for the manufacturing level can be assumed to be more robust: whereas sectoral structures can be assumed to be endogenously determined by the level of economic development ('logistic growth path' concepts, the Clark-concept or

the Chenery-Hypothesis), industrial specialisation is typically perceived to be driven by constant (at least in the medium term) country-specific factors, comparative advantages.[12] At the level of manufacturing industry, therefore, we can assume that at least for the medium term, past trends in structural adjustment will prevail and give rise to a distinct pattern of specialisation between EU member countries and EU accession countries.

Chart 6:
Structural contents of manufacturing productivity gaps of CEECs, in 1993 and 2000
- in *per cent* of the observed productivity gap -



Sources: EUROSTAT; WIIW; National Statistical Offices; own calculations.

If specialisation trends persist into the medium-term future, then the manufacturing sectors of mainly Slovenia and Hungary, and to a lesser extent Poland, the Slovak Republic and Estonia might not be able to catch up completely to productivity levels of the German manufacturing sector: even if branch-specific productivity levels had caught up, structural patterns would still effect a lasting productivity gap. This had been termed an upper limit to real convergence in the sectoral analysis and should raise concern with economic policy programmes assisting a swift process of real economy catch-up: in such a scenario, technological assistance might turn out to be ineffective with respect to closing the productivity gap.

12 For a critical assessment of applicability of the Heckscher-Ohlin concept in transition economies can be found in *Brakman*, *Garretsen* (1994). Here, the focus is on the particular case of East Germany.

3.3 The role of individual branches in explaining manufacturing productivity gaps

What are hence the branches that drive contemporary productivity gaps in the manufacturing sectors of the countries assessed? What branches are most influential for the productivity gaps in terms of size and branch-specific gaps? Applying the same methods as described by formula 5 and 6 of sectoral analysis, table 7 lists the three most influential branches.

Table 7:
Ranking of most influential branches as a source of manufacturing productivity gaps, in 2000

Estonia	
Branch	$\tilde{\pi}^i$
DB	22.0
DA	13.6
DD	12.2
Sum 3 Branches	47.8

Poland	
Branch	$\tilde{\pi}^i$
DA	27.9
DK	13.2
DN	10.8
Sum 3 Branches	51.9

Czech Republic	
Branch	$\tilde{\pi}^i$
DJ	20.8
DK	17.8
DB	13.4
Sum 3 Branches	52.1

Slovak Republic	
Branch	$\tilde{\pi}^i$
DK	21.3
DB	18.6
DL	13.1
Sum 3 Branches	53.0

Hungary	
Branch	$\tilde{\pi}^i$
DB	20.6
DA	17.7
DL	14.0
Sum 3 Branches	52.3

Slovenia	
Branch	$\tilde{\pi}^i$
DB	23.9
DJ	19.7
DN	16.6
Sum 3 Branches	60.2

Note: Share of productivity gaps of branches. weighted by employment shares. as a fraction of the sum of weighted productivity gaps of all branches.

Sources: EUROSTAT; WIIW; National Statistical Offices; own calculations.

Amongst the most influential branches as sources for manufacturing productivity gaps countries between the countries assessed, no common pattern can be deducted from results. This does come as a surprise, considering that all those countries have shared similar histories in economic development as planned socialist economies with a near-complete separation from the West, and despite the fact that all those countries share the common comparative advantage of lower labour (unit) costs[13] and larger agricultural sectors in comparison to most countries in West Europe.

13 For a detailed empirical evaluation of CEEC's labour cost advantages, see *e. g. Havlik* (1998).

Similarities can be diagnosed mainly for the branches of ‘food products, beverages and tobacco’ (NACE: DA) and ‘textiles and textile products’ (NACE: DB): either one of those manufacturing branches play a leading role in explaining manufacturing productivity gaps in each of the countries assessed. In the cases of Estonia and Hungary, both branches belong to the group of the thee most influential industries. Both branches can be considered to be rather less technologically sophisticated and more likely to benefit from low labour costs and larger agricultural sectors.

Results however also show that not only less sophisticated branches are at the root of the manufacturing sectors’ productivity gaps, but rather also branches which better lend themselves to above-average increases in productivity levels: in Poland, the Czech Republic and the Slovak Republic, the manufacturing branch of ‘machinery and equipment’ (NACE: DK) is listed as influential, as does the branch ‘electrical and optical equipment’ (NACE: DL) belong to the three most important branches for manufacturing productivity gaps in the Slovak Republic and Hungary.

The main results can be summarised per accession candidate as follows:

Estonia’s manufacturing sector is still furthest away from closing up the levels of economic development predominant in current EU member states, here represented by German manufacturing. Whilst the country’s national productivity gap *vis-à-vis* Germany amounts to only some 57% and is therefore even lower than the national gap of the Polish economy, Estonia’s manufacturing productivity gap is some 10 percentage points larger and considerably behind that of Poland.

Yet, Estonia’s structural pattern within the manufacturing sector features positive specialisation in those branches that have come closest to productivity levels in Germany. In line with this, the structural content of manufacturing productivity gaps is negligible, further structural change within manufacturing industries could not significantly improve conditions for catching up. Between branches, the gap is mainly driven by industries related to the country’s large wood-processing industries (wood and wood products, paper and furniture).

In the case of Poland with the second largest manufacturing sector’s productivity gap, patterns of specialisation favour branches with typically large productivity gaps whilst branches exhibiting lower gaps are underrepresented in terms of relative employment shares in comparison to the benchmark country Germany. As a result of this, the structural content of the manufacturing productivity gap is considerable and the most influential manufacturing branches typically share low levels of sophistication, like food processing, textiles, and basic metals.

The Czech Republic has the second but lowest productivity gap amongst the countries assessed here. Yet, patterns of specialisation show little correspondence to branch-specific productivity gaps. Moderate structural contents of the ma-

nufacturing productivity gap were subsequently diagnosed here. Amongst the most influential branches as a source of manufacturing productivity gaps belong industries such as motor vehicles, machinery and equipment as more sophisticated branches, but also the branch of basic metals manufacturing. This is obviously a result of FDI inflows in the Czech car-manufacturing industry, and the associated effects on downstream supplier-industries.

The manufacturing productivity gap of the Slovak Republic is with 53.3% somewhat higher as compared to the one of the Czech Republic, yet branch productivities exhibit some correspondence with specialisation patterns. Hence, the structural content of the manufacturing productivity gap in 2000 is small. It has, however, risen considerably since 1993, suggesting that the trend in structural adjustment and specialisation might in the future grow into a hindrance for complete real economic convergence. The group of most influential manufacturing branches for the sector's productivity gap largely consists of technologically sophisticated industries like motor vehicles, machinery and equipment, and electrical and optical equipment.

Hungary's manufacturing productivity gap lies between those of the Czech and Slovak Republics. Here, the motor vehicle manufacturing industry nearly caught up with German productivity levels, however, specialisation patterns are negatively related to the sizes of productivity levels. Subsequently, Hungary's manufacturing industry might well experience a barrier to real economic convergence: the trends in structural adjustment in the course of real economy integration in manufacturing industry has led the structural content of the manufacturing sector to grow from a negative content in 1993 to a considerable size today, The most influential industrial branches driving the Hungarian manufacturing productivity gap are typically technologically sophisticated and include branches like electrical and optical equipment, transport equipment, but also food processing, beverages and tobacco.

The lowest productivity gap in the manufacturing sector with only 42.8% is achieved by Slovenia. Here, two manufacturing branches even appear to have achieved significantly higher levels of productivity as compared to Germany, namely transport equipment and food processing, beverages and tobacco. Those branches, however, show a negative specialisation *vis-à-vis* Germany, hence the high structural content of the manufacturing productivity gap. What is even more, this content has experienced considerable growth since 1993 and if such trends in specialisation prevail. Slovenia might also be unable to catch up completely in terms of productivity levels. The group of the most influential branches as sources of manufacturing productivity gaps in Slovenia consist mainly of the less sophisticated industries of basic metals and fabricated metal products, and the textile industry. An important role is however furthermore played by machinery and equipment manufacturing, a technologically more sophisticated branch.

3.4 Economic policy considerations of results

Alike in the policy-interpretation of results from the sectoral analysis, assistance in across-the-board technological development alone might prove to be insufficient for complete real economy convergence in the manufacturing sectors of some accession countries: while such policy measures can be assumed to be most efficient with respect to the envisaged further closing of productivity gaps in all countries assessed, they might prove to be less powerful and even ineffective at a later stage in the cases of Hungary, Slovenia and possibly the Slovak Republic.

In those countries, considerable shares of productivity gaps are accountable to the industries' particular patterns of specialisation. Trends in the past suggest that those shares might even rise further to form a barrier to complete convergence when driven by technological development only. Here, supporting additional structural change could prove to be an effective policy measure.

In particular, analysis for Slovenia suggested that the manufacturing productivity gaps mainly root in technologically less sophisticated industries: those industries are less likely to benefit from support for technological advancement as would industries of higher technological sophistication. In the case of Slovenia, therefore, policies directed towards structural change, *e. g.* by supporting a delineation of specialisation patterns to the sizes of branch-specific productivity gaps could turn out to be more effective.

For the short term, however, technology-oriented economic policy measures could still assist the manufacturing industries of Hungary and the Slovak Republic: in both cases, productivity gaps to a large extent root in branches which could be considered to be receptive to technology-policy in swift productivity growth.

Estonia's manufacturing industry is clearly geared towards wood-processing industries, in some of which the country already has below-average productivity gaps *vis-à-vis* Germany. Here, clearly targeted technology-policy could be expected to yield the largest effects.

In the case of Poland, policy support can probably not be targeted as narrowly to a defined goal with respect to structures in manufacturing industries. Rather intervention and support would have to consider structural change just as much as technological development on a comprehensive scope.

4. The Focus on the Sector of Manufacturing Industry: Determinants of Manufacturing Productivity Growth

The following subsection assesses the sources of productivity growth, this time of the manufacturing sectors of EU accession countries. The data limitations again make it unfeasible to approach this topic by way of a growth accounting exercise – in fact data on capital stocks at this level of disaggregation are even less frequently available, and less likely to be reliable than is the case at the sectoral level. The analysis therefore largely follows the same direct methods as applied at the sectoral level.

4.1 Setting the agenda: growth of productivity in the manufacturing sector

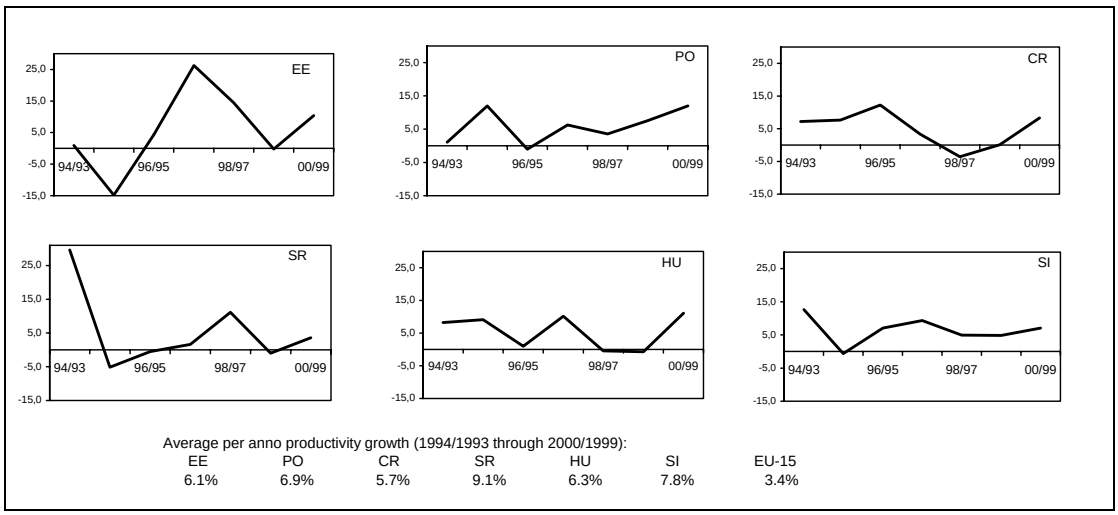
Productivity growth in manufacturing industry has been much more volatile as compared to national productivity growth with frequent negative growth rates over the whole period of analysis (see chart 7). Possibly, the financial crisis in Russia and the Czech Republic have had more direct effects on manufacturing productivity growth than on the national level: in particular, the Czech rate of manufacturing productivity growth turned negative in 1997. More importantly, however, migration of labour between the manufacturing sector and other sectors will have had a levelling effect on national productivity growth (diversification of effects of the crisis). The largest variation of productivity growth rates can be observed in the case of Estonia: here, rates jumped from -15 to some 25% within only two year, *i. e.* by about 40 percentage points. In this case, the average *per anno* rate of growth over the whole period of 6.1% is probably more telling. Rates in the Slovak Republic vary between some 27% in 1995/1994 and -5% only one year later. The most consistent growth path of productivity can be observed in Slovenia.

All accession countries assessed here have achieved higher growth rates as compared to the average EU-15 over the whole period of analysis. The Slovak Republic, Slovenia and Poland even achieve growth rates exceeding double the rate of the average EU-15. In the case of the Slovak Republic, however, this results is driven by the extremely high rate of growth during the year of 1994. This puzzling rate of growth is not a result of a steep fall in industrial employment, or a particularly small increase or fall in the GDP deflator. Rather, value added reported for the manufacturing sector grew particularly fast between the end of 1994 and that of 1995. The growth rates of the Czech Republic and Poland over the whole period of analysis reach average levels between 5.7% and 6.9% respectively. In general and over the whole period of analysis we can clearly observe productivity catch-up for the manufacturing sector, *i. e.* some extent of closure of manufacturing productivity gaps.

4.2 Productivity growth in the manufacturing sector and changes in employment levels

Again, a simple correlation analysis was applied to indicate in how much manufacturing productivity growth can be attributed to labour-saving technological change and to a reduction in overmanning at the firm level (see the *defensive* versus *strategic* strategy-dichotomy as suggested by Roland 2999, *op. cit.*). In terms of the analytical approach applied here, a large and significant negative correlation between employment and productivity levels would indicate downward adjustment of employment at the firm level, or the exit of below-average productivity firms. A large and significant positive correlation can be interpreted as firms having successfully employed additional labour and/or as new and more productive firms having successfully entered the market.

Chart 7:
Growth of productivity in manufacturing sectors in CEECs and the average EU-15, 1994/1993 to 2000/1999
- in *per cent per anno* real growth rates -



Sources: EUROSTAT; WIIW; National Statistical Offices; own calculations.

At the national level in section 2 of this report, the analysis showed a clearer picture of a shift from employment augmenting (between 1993 and 1996) to labour saving productivity growth (1997 to 2000) in most accession countries with the notable exception of Hungary and Slovenia. This is not as clear-cut at the level of the manufacturing sector: here, industrial productivity growth in both sub-periods is accompanied by a fall in industrial employment in most countries. Labour saving technological change and/or reduction in overmanning appears to be the dominant driving factor of productivity growth at the level of the manufacturing sector.

The notable exceptions are Poland and the Slovak Republic during the first sub-period of analysis and Hungary between the years of 1997 and 2000. In those cases, employment and productivity exhibit a positive correlation, which however is not significant and could therefore be the result of a random process.

Table 8:
Productivity and employment in the manufacturing sector: a correlation analysis (non-parametric)

	Sub-period 1 1993 - 1996	Sub-period 2 1997 - 2000	Total period 1993 - 2000
Estonia	- 1.00***	- 0.40	- 0.91***
Poland	+ 0.80	- 1.00***	- 0.33
Czech Republic	- 1.00***	- 0.40	- 0.81**
Slovak Republic	+ 0.60	- 0.60	- 0.29
Hungary	- 0.80	+ 0.20	- 0.05
Slovenia	- 0.80	-1.00***	- 0.98***

Note: *** Significant at the 1% level, – ** at the 5% level, – * at the 10% level.

Sources: EUROSTAT; WIIW; National Statistical Offices; own calculations.

In Hungary, industrial employment started to rise already in 1995, after the country overcame transformational recession. However, industrial productivity fell slightly in 1998 and 1999, only to pick up again during the year of 2000. In all other accession countries assessed here, industrial employment grew only from 2000 onwards in parallel with positive productivity growth (in Estonia already in 1999, however at the expense of productivity growth in the same year). The picture drawn for Poland and the Slovak Republic indicates that high initial rates of growth of value added in manufacturing did not necessitate deep restructuring until 1995/1996. Then, however, value added growth abated significantly in both countries. Employment growth in manufacturing industry was not sustainable any more from then onwards, and the correlation coefficient turned negative.

In Estonia, the Czech Republic and Slovenia, manufacturing productivity growth was accompanied by a significant downward adjustment of industrial employment. over the whole period of analysis. Considering the development of unemployment, further productivity growth will have to be increasingly labour-augmenting, or sufficiently high to allow improved competitiveness to let employment growth exceed the labour saving effect. In effect, this is already the case in Estonia and Hungary since 2000, and in the Czech Republic, the Slovak Republic and Slovenia since 2001, not as yet, however, in Poland.

The main results can be summarised per accession candidate as follows:

Estonia's manufacturing productivity growth was been most volatile with considerable shifts from large negative to large positive rates and *vice versa*. Over the total period of analysis, average productivity growth was rather low, yet still faster than in the average EU-15. This productivity growth was mainly achieved by way of reducing overmanning or the exit of less efficient firms. Future productivity growth as yet still has to allow employment in manufacturing industry to rise. Parallel growth ion employment and productivity can however be observed already for the year of 2000.

Poland's productivity growth in the manufacturing sector is somewhat larger than in Estonia, rates are also less volatile over the years than in most other countries assessed. Over the whole period, productivity growth exceeded that of the average EU-15 by more than double, or 3.5 percentage points. During the initial years, manufacturing productivity growth was achieved in parallel with growing employment. This, however, proved to be not sustainable, and further productivity growth was 'bought' by a downward adjustment of labour use. Future productivity growth as yet still has to allow employment in manufacturing industry to rise.

Growth of manufacturing productivity in the Czech Republic has experienced a considerable slump due to the country's financial crisis in 1997 with its associated demise in real economy growth.. Hence, the Czech Republic exhibits the lowest rate of growth of manufacturing productivity over the whole period amongst the countries assessed. In the aftermath of the crisis, however, productivity growth picked up again. This productivity growth was mainly driven by a downward adjustment of employment over the whole period of analysis and manufacturing employment only started to grow again in the year 2001, *i. e.* outside of our period of analysis.

Productivity growth in the manufacturing sector of the Slovak Republic is clearly dominated by the exorbitant growth rate in 1995, for which no sufficiently convincing explanation could be found. Following this, rates of growth have been rather moderate and considerably volatile. As was the case in Poland, productivity growth started to go hand in hand with positive employment growth in the manufacturing sector during the early years of integration. Also here, this proved to be unsustainable, and the downward adjustment set in during the year of 1997. By the year of 2001, manufacturing employment started to grow simultaneously to productivity in the manufacturing sector.

Hungary's development of productivity in the manufacturing sector exhibits some distinct features: without suffering from an own financial crisis, the average productivity growth rate for the whole period remains comparatively small.

From 1997 onwards, furthermore, the correlation between employment growth and productivity growth turned positive, unlike in all other countries assessed. If the manufacturing sector of the country is able to sustain this quality of development, then a consistent path of catching up at a moderate speed seems likely.

In the case of Slovenia, productivity growth in the manufacturing sector was most consistent and always positive. Over the whole period, the country achieves the second but largest average growth rate. This growth was however accompanied by a significant reduction in employment in the manufacturing sector and a parallel movement of labour and productivity in the upward direction could only diagnosed for the year of 2001.

4.3 The share of inter-branch restructuring in manufacturing productivity growth

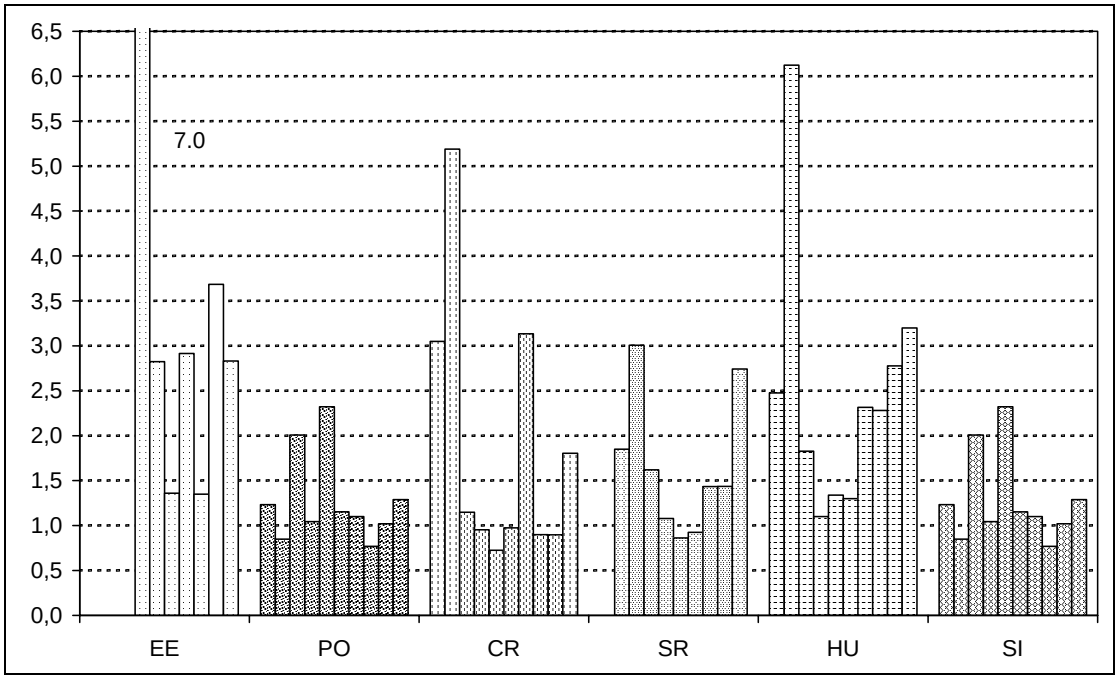
The following two sub-chapters aim at assessing the role of branch-structures and structural adjustment within manufacturing industry as sources of productivity growth. In the course of real economy integration, the industries of integration partners typically specialise on production, where the respective partner has some comparative advantage. Because EU accession and member states had developed in near-complete separation for nearly 50 years, we would expect structural adjustment and re-specialisation to have been profound after re-integration began in 1990, only to abate later with integration effects gradually wearing off. The analysis of intensity of structural change by use of the EUCLID-measure (see equation 7) can provide insight into the intensity of structural adjustment in each of the accession states of our panel. Data used includes the same number of 13 double-digit NACE manufacturing branches of DA-DN in all countries assessed.

As expected, structural change was particularly intense at the outset of integration in all countries assessed. In the Czech Republic and Hungary, this is particularly pronounced in the year of 1993, in the Slovak Republic in 1994 and in Estonia, the highest intensity is recorded for the year of 1995. The intensities of structural change in Poland and Slovenia have been less volatile between years. Here, structural change was most intense in 1996, *i. e.* later than in the other countries, and intensities have also been generally lower than in the other countries of our sample. While this indicates some postponed or lagged real economy adjustment, we are unable, however, to infer from this analysis alone whether further structural adjustment will be necessary or supportive to future productivity growth potentials. More insight into this field will be carefully developed in the following sub-chapters.

At a slight variance to our expectation raised above, intensities of structural change began to pick up in some countries again as of lately. Apparently, structural adjust-

ment was still incomplete after the initial surge during the first half of the 1990s. The effects of integration on re-specialisation seem to be still ongoing in the latest year reported. This in particular applies to Hungary, the Slovak Republic, Estonia and possibly also the Czech Republic. It is fair to assume that the initial success in productivity growth in the manufacturing sectors of these countries did not necessitate more profound restructuring (*e. g.* by way of reduction of overmanning), productivity growth was achieved without much restructuring. Further improvement of competitiveness, then, might well have depended on additional adjustment in parallel with deepening integration – which includes the process of re-specialisation and restructuring at the level of manufacturing branches.

Chart 8:
Intensities of structural change between branches of manufacturing industry in CEECs, 1992/1991 to 2001/2000 (missing values)



Sources: EUROSTAT; WIIW; National Statistical Offices; own calculations.

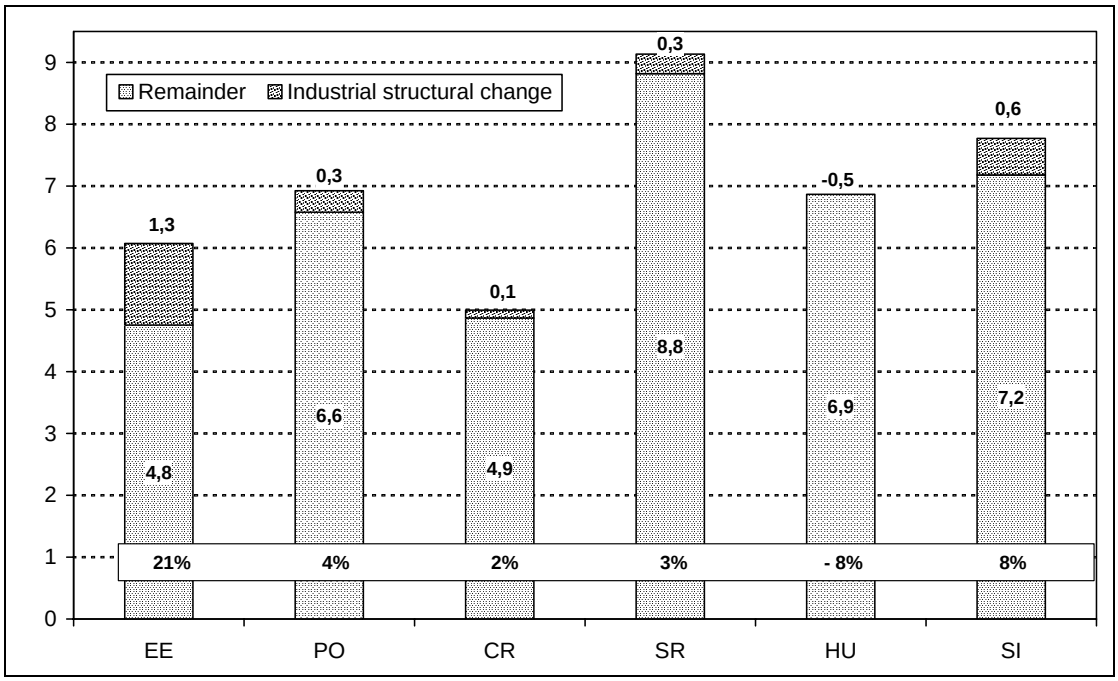
It is an important result of our analysis that – contrary to common belief – the effects of integration on the real sphere of the economy are still ongoing, this even after more than a decade of integration. This result, however, pertains to the manufacturing sector only: at the national level and between sectors, intensities of structural change show a clearly falling trend in all countries assessed.

This analysis is again refined by determining the direction of change of specialisation patterns, and the effect, this change had on the manufacturing productivity gap (the structural content of manufacturing productivity growth). The calculation follows the

same intuition as developed for the sectoral analysis: the structural content denotes the statistical effect of productivity levels rising or falling due to the reallocation of labour to different uses in different industrial branches (with differing levels of productivity). The lower the size of this statistical effect, the larger have been within-branch increases in productivity levels, the larger can technological advancement be expected to have been achieved within firms (or between firms of the same industrial branch).

Obviously, this analysis will correspond to some degree to the results of the simple assessment of intensities of structural change. Yet here, the direction of structural change as well as its quantitative effect on manufacturing productivity growth are highlighted. The calculation uses the equations (8) and (9) from the sectoral analysis, only this time at the level of the same 14 double-digit NACE manufacturing branches in all countries assessed.

Chart 9:
Shares of structural change in manufacturing productivity growth, 1994/1993 to 2000/1999
- average real rates of growth in percentage points *per anno* -



Sources: EUROSTAT; WIIW; National Statistical Offices; own calculations.

The most obvious result is that, compared to the results generated in the sectoral analysis, the structural contents of manufacturing productivity growth turn out to be smaller in most countries. Only in the cases of Estonia and Poland are the structural contents higher for the manufacturing sector as compared to the national level.

In particular, the high intensity of structural change in Estonia had a significant impact on productivity growth: over one fifth of manufacturing productivity growth can be traced back to employment shifts at the expense of branches which achieved lower levels of efficiency of use of resources. Had it not been for this particular reallocation of employment between branches of manufacturing, Estonia's productivity growth in this sector would have turned out to be much lower at an average 4.8% *per anno* for the period between the end of the year of 1993 and the end of 2000.

In contrast to that, the structural contents calculated for Hungary, the Czech and Slovak Republics are much less in line with their considerably high intensities of structural change. In the case of Hungary, industrial employment appears to have grown slightly more in *below*-average productivity branches at the expense of branches that achieved higher productivity levels: hence the structural content of productivity growth turned out to be negative. Here, specialisation in manufacturing industry had a dampening effect on productivity growth and with structural change having grown more intensive towards the end of the period of analysis, we might see a further deceleration-effect on productivity growth in the future. In the Czech and Slovak Republic, structural contents of productivity growth are rather negligible, yet positive.

Poland and Slovenia both exhibit comparable structural contents at moderate levels. In line with that, both countries also share comparable intensities of structural change which, however, are lower than in the three afore-mentioned countries.

With more confidence as compared to the sectoral level, we can assume that the 'remainder' share of productivity growth, *i. e.* the residual growth rate after deducting the structural content, contains largely technological advance.[14] Given this, we can assume that in all countries bar Estonia, manufacturing productivity growth is overwhelmingly driven by technological advance. In particular, Poland and Hungary achieved comparable rates of growth of manufacturing productivity growth, yet Hungary can be expected to have experienced slightly more technological advancement as compared to Poland.

14 Obviously, there will always be some extent of structural change and hence some share of productivity growth due to structural change at every level of aggregation. A clear-cut distinction between this statistical effect and pure technological advance can only be drawn at the firm level. The level of disaggregation applied here represents the lowest level possible in terms of availability of comparative data. This sort of problem would also emerge in a growth accounting exercise, had it been applied here.

4.4 The role of individual branches in manufacturing productivity growth

So far, analysis could establish whether manufacturing productivity growth was rather of a labour-saving or labour augmenting kind, whether manufacturing productivity growth was subject to a large-scale reallocation of labour between industrial branches, and what role this inter-branch restructuring played for productivity growth. In the following, the analysis determines the most important of the 14 double-digit NACE manufacturing branches as a source of productivity growth. Using the same method as in chapter 2.4 at the sectoral level, analysis here identifies the three most influential branches as a source of manufacturing productivity growth (see table 9).

Table 9:
Ranking of most influential branches as a source of manufacturing productivity growth, between 1994/1993 and 2000/1999

Estonia	
Branch	$\hat{\pi}^i$
DN	18.8
DD	15.6
DL	10.5
Sum 3 Branches	43.9

Poland	
Branch	$\hat{\pi}^i$
DA	16.6
DK	9.1
DI	8.3
Sum 3 Branches	34.0

Czech Republic	
Branch	$\hat{\pi}^i$
DM	15.9
DK	15.5
DJ	13.7
Sum 3 Branches	45.1

Slovak Republic	
Branch	$\hat{\pi}^i$
DM	22.8
DK	14.6
DL	12.7
Sum 3 Branches	50.1

Hungary	
Branch	$\hat{\pi}^i$
DL	22.6
DA	14.1
DM	16.6
Sum 3 Branches	53.3

Slovenia	
Branch	$\hat{\pi}^i$
DJ	17.1
DK	13.1
DB	12.4
Sum 3 Branches	42.6

Sources: EUROSTAT; WIIW; National Statistical Offices; own calculations.

The most obvious result is that in each of the countries of our sample, a different group of industry branches appear to be at the root of the manufacturing sectors' productivity growth. The branches that appear most often in the list of the three most influential industries as a source of manufacturing productivity growth are in particular 'machinery and equipment' (NACE: DK), 'electrical and optical equipment' (NACE: DL), and 'transport equipment' (NACE: DM). All those branches can be considered to be rather sophisticated in terms of technology, or lend themselves to swiftly grow into technologically sophisticated industries.

A comparable pattern of branches as sources between countries can only be found in the case of the Czech and Slovak Republics: in both countries, the branches of 'transport equipment' and 'machinery and equipment' belong to the two most influential industries for manufacturing productivity growth. In the case of the Slovak Republic, however, the sum of their influences as measured by $\hat{\pi}^i$ is somewhat higher. Between the Czech Republic and Slovenia, the two manufacturing branches of 'machinery and equipment' and 'basic metals and fabricated metal products' (NACE: DJ) both belong to the group of most influential branches for manufacturing productivity growth.

The branch of 'transport equipment' also plays an important role in the case of Hungary, and 'machinery and equipment' belongs to the three most influential branches for manufacturing productivity growth in Poland. The Polish and Hungary's manufacturing sectors share a common branch as an influential source of industrial productivity growth, namely 'food products, beverages and tobacco' (NACE: DA). Another overlap is reported for the manufacturing branch of 'electrical and optical equipment' between the accession countries of Hungary, the Slovak Republic and Estonia.

Apart from these few overlaps, each manufacturing industry of EU accession countries assessed appears to feature independent structures: as was the case in the analysis of the most influential sources of manufacturing productivity gaps, country-specific factors appear to have become by now more important for manufacturing productivity growth than any particular feature common to all transition economies in Central East Europe.

The main results can be summarised per accession candidate as follows:

> Between the Estonian manufacturing branches, intensity of structural change was considerably larger than in all other countries of our panel, and in line with that, the structural content of manufacturing productivity growth also turned out to be considerable. In terms of branches, manufacturing productivity growth in Estonia was mainly driven by the country's specialisation on wood-processing industries. Those industries can be assumed to lend themselves well as a core for a sustainable, *i. e.* productivity-driven, growth path in the future.
>
> In line with a rather small intensity of structural change between branches, the share of productivity growth in the Polish manufacturing sector accountable to the statistical effect is rather small – hence technological development (which includes labour saving productivity growth) will have been dominant in manufacturing productivity growth. The most influential branch for manufacturing productivity growth between 1994 and 2000 turned out to be the food processing industry, this in line with the country's large agricultural sector. For the assessment of future prospects, however, this branch does not suggest the highest potentials.
>
> Despite the fact that the Czech manufacturing sector experienced intense structural change in particular at an early date of the integration process, the share of

productivity growth accountable to this structural change remained negligible. Hence, the engine of productivity growth must have been rather of a technological kind. The group of branches most influential for the productivity growth achieved in the Czech manufacturing sector contains a large share of industries with typically higher technological sophistication.

In line with the Slovak Republic's rather moderate intensity of structural change (which however started to pick up again during the second half of the 1990), the structural content of manufacturing productivity growth turned out to be negligible. Productivity growth may be assumed to have been mainly achieved by way of technological advance. Amongst the branches most influential for the growth of productivity in the manufacturing sector as a whole are typically industries at the upper end of technological sophistication, shedding a positive light on the country's future potentials for catching up.

Hungary's considerably intense structural change between manufacturing branches did not translate into an equally large share for the structural content of manufacturing productivity growth – rather, this content turned out to be slightly negative: manufacturing productivity growth would have turned out slightly higher, if it had not been for the rising employment in below-average productivity branches at the expense of above-average productivity branches. None of the productivity growth therefore is attributable to structural change, rather productivity growth was exclusively of a technological kind. This technological development was however achieved largely in manufacturing branches which do not belong to the typically technology-intensive group. Future prospects therefore to a considerable extent depend on whether the recently considerably rising intensity of structural change will in fact benefit more sophisticated branches of manufacturing.

The Slovenian manufacturing sector experienced a rather low intensity of structural change within the manufacturing sector, hence the structural content of productivity growth is also rather moderate. Most of the productivity growth was therefore achieved by technological advance. The most influential branches for manufacturing productivity growth have so far included both more and less sophisticated industries, reducing the scope for targeted economic policy.

4.5 Productivity growth potentials in the manufacturing industry

The final chapter of this research report is devoted to an attempt to quantify future potentials of real economy catching up for each EU accession state by use of the information conveyed by economic structures. An empirical model is developed to determine the typical relationship between economic structures and productivity growth by

use of experience gathered from previous cases of real economy integration in West and East Europe. A projection of future growth potentials can best be developed at the meso-level of manufacturing industry: here, patterns of specialisation can be assessed in terms of existing comparative advantages and we can safely assume that each country will retain its country-specific features into the short to medium term future.

This is why, from a theoretical perspective, the notion of specialisation patterns and path depend development can be applied with much more confidence here as compared to the sectoral level: depending on what resources in an economy integrating with another is relatively more abundant in supply (and hence available at a lower price), will the manufacturing industry of this economy specialise on production that uses this resource most intensively. Both integrating partners adjust in terms of relative sizes of manufacturing branches to match those comparative advantages. With integrating partners being able to focus on their own strengths, their aggregate production after integration will be higher. The beneficial effects from integration will hence be largest, where patterns of scarcities and abundancies are most complementary, and hence allow a deep level of specialisation, of division of labour.

Of course, potentials for future productivity growth depend on a multitude of factors existing today and evolving over time. However here, we assume that structural patterns of branch-specialisation contain the necessary critical amount of information needed to assess manufacturing productivity catch-up. In a way, this assumption allows us to use structural patterns as an umbrella, catching most of the explicit determinants of productivity catch-up. In short: patterns determine prospects. The assumption can be backed by a number of stylised facts:

- Manufacturing branches' productivity levels not only differ across branches in the same country, the same branches across different countries also exhibit comparable deviations from the respective countries' average: each branch typically uses different techniques and technologies in the production of value added that correspond to the respective type of product/production. Hence, in a developed manufacturing sector, each branch achieves a branch-specific productivity level, giving rise to a 'system of relative productivity levels'.

  In particular, both in West and East Europe, the manufacturing branches of *e. g.* 'textiles and textile products', 'leather and leather products', and 'furniture and recycling' typically exhibit productivity levels well below the national average for total manufacturing. Branches like 'coke, refined petroleum products and nuclear fuel', 'chemicals, chemical products and man-made fibres', and 'transport equipment' on the other end of the spectrum are typically situated at the top of the list of branches with respect to their relative productivity levels in total manufacturing. The branches listed at the bottom range of branch-specific productivity levels are typically associated with a high labour intensity and are rather less demanding on the qualification of personnel, whereas branches listed

at the top of the range are typically characterised as being more technology and knowledge-driven. In accession countries, this categorisation was less pronounced at the outset of integration, but with relative prices adjusting and due to the transfer from West to East of new production techniques and product technologies, the ranking of relative branch-specific productivity levels there became more comparable to the ranking in the West (and hence more pronounced).

- What is even more, this categorisation also holds in terms of growth of branch-specific productivity levels: the group at the lower margin in accession states typically achieved lower rates of growth of branch-specific productivity levels, whereas the growth rates exhibited in the branches of the second group above also outperformed the average growth rate of all branches contained within the manufacturing sector. Apparently, some branches lend themselves better to swift productivity convergence than other branches.

  In some theoretical work, the effects of particular patterns of specialisation have been linked to prospects for catching up development: in Snower (1994), a distinct specialisation on low-skill branches is shown to possibly lead into a development trap.

- From the viewpoint of a manufacturing sector experiencing integration with a more developed economic area, the largest improvements in firm-level productivity can be expected to stem from technology transfer. This includes product and process technology, both in terms of technical advancement and organisational efficiency in the firm, as well as improvements in the management and marketing of the firm. Technology is not transferred with the same speed and to the same amount across different branches: the decision of a foreign investor in typically labour-intensive branches is based on comparatively lower labour costs, hence not much technology transfer is involved. The opposite applies to branches that are typically more demanding on the qualification of personnel: to operate machinery of higher technological sophistication, personnel has to supply some minimum qualification. In branches that are marketing driven, competitiveness critically depends on factors other than technology. Investors in such branches, whether foreign or domestic, will focus on the market rather than the technological advancement of the production process. Again, the scope for technology transfer is hence limited.

  On the contrary, in branches where competitiveness depends on sophisticated technology, an investor in a less developed country will strive to implement as much of the more developed foreign technology as the host country is able to absorb. Such branches will be the main channels for technology transfer, and a country with particularly strong investment activity in such branches can expect to catch up more swiftly: *i. e.* branches which can benefit most from technology transfer will also have the largest productivity growth potentials. In total: the lar-

ger the share of more sophisticated branches, the larger the base for productivity growth potentials in total manufacturing in the future.

Of course, the notion of branch-specific productivity levels and of branch-specific potentials for future productivity catch-up are assumptions that have so far not been tested empirically. Further support in favour of these assumptions can only be derived from field studies which are amongst the objectives of other research conducted in the project.

Accepting those assumptions, we can, already at this high level of aggregation, generate an intuition for which accession country's manufacturing sector could be expected to contain the largest potentials, hence to catch up the fastest and which might be expected to consume more time. To generate a more reliable and quantifiable picture of respective productivity growth potentials in manufacturing sectors of accession countries, we develop a simple empirical model that essentially takes a production (supply-side) viewpoint of manufacturing industries. The model aims to quantify the potential for average manufacturing productivity growth determined by the particular composition of the manufacturing sector in relative shares of individual branches (the structural pattern).

The development of the model proceeds in two steps: first, a generalisable, nomological rule for the relationship between patterns and prospects in manufacturing industries catching up *via* integration is set up by way of a regression analysis. Here, structural patterns and observed productivity growth rates are regressed in a cross-country panel analysis of accession states between 1994 and 1999, a period which characterises the time of gradual real economic integration. To add credibility to the model, further experience with real integration of Portugal, Greece and Spain was considered for the years between 1973 and 1985. That period corresponds to the decade or so prior to complete real integration, as manifested by full EU membership. Of course, the amount of experience considered in the development of this model is still limited, hence generalisability is also restricted. Moreover, our model is restricted by virtue of the assumptions made to manufacturing industries catching up to such industries in more developed or even matured market economies *via* real economy integration.

In a second step, scenarios for possible future developments of structural patterns are projected by recourse to the resource-based view, in which integration partners tend to gradually specialise on production in which they can make use of comparative advantages. If we are able to determine the prospects contained in past and existing structures, and if we are able to project future patterns of specialisation, then this model could generate an idea on the prospects of manufacturing sectors of individual accession countries to catch up in terms of productivity (out-of-sample projection).

The description of structural patterns therefore has to bridge a gap between two opposing objectives: on the one hand, the estimation of the relationship between structural

patterns and structure-specific prospects improves in terms of robustness with falling levels of aggregation. The more precise the description of a manufacturing branch (*i. e.* the lower the level of aggregation), the more confidence we can have in our assumption that a particular branch can be associated with branch-specific productivity growth potentials. Consider *e. g.* the two-digit manufacturing branch of 'transport equipment': it contains several heterogeneous three-digit (sub-)branches, including 'manufacturing of bicycles' and 'manufacture of aircraft'. From a production side perspective, it is plain to see that those two branches will contain quite different potentials for productivity growth.

On the other hand, however, structural patterns at the same time have to lend themselves to a projection of future patterns evolving in the short to medium term. While it is not possible to predict with sufficient confidence the development of relative sizes of every 3-digit manufacturing branch, the development of sizes of classes of branches, grouped by class-criteria that correspond to the resource-based view on structural patterns (comparative advantages), can more robustly be projected.

The model therefore has to strike a good balance between homogeneity on the one hand (low level of aggregation), and predictability of future structural patterns on the other hand (higher aggregation). Such balance can be found in a suitable taxonomy: the new WIFO-taxonomy unambiguously groups together 3-digit manufacturing branches into homogeneous classes: each manufacturing branch is allocated to only one class (*i. e.* classes are free from overlaps) and according to the class-criterion that is best fulfilled by the branch. Typically, each branch will contain some of each of the features which are characteristic of classes, but it forms part of the class for which the branch exhibits the highest proximity to the criterion (cluster analysis). This taxonomy groups manufacturing branches in classes of three dimensions: first, "comparative cost advantages stemming from exogenous and location dependent factors such as relative endowment with capital and labour"; and second, "firm-specific advantages stemming from targeted investment in intangible assets such as advertising and R&D" (Peneder, 1999, p. 10). The third dimension classifies industries according to labour skills (ibid., pp. 29-34).

Amongst the most prominent features, manufacturing industries in European transition economies typically share a high intensity of manual work, technology gaps in terms of production and products, and they tend to achieve lower prices in particular for products which are marketing driven. The criteria used in this model hence include 'labour intensive' (LI), 'marketing intensive' (MI), 'technology-intensive' (TI), and 'low-qualification intensive' (lQI). The latter category is a cross-sectional one and includes all branches which can be considered to employ mainly less qualified labour, and not included in either of the other classes.[15]

15 From theoretical experience, we would expect the class of 'capital intensive' branches to also be considered. However, this class does not provide a sufficiently homogeneous relationship with

Of course, *a priori*, we do not know the actual sizes of class-specific productivity growth potentials, but intuition can lead us some way to generate hypothesis on the direction of a relationship. The precise relationship is assessed in the first step of the model: manufacturing productivity growth is a function of the structural pattern within the manufacturing sector, corrected by the actual extent of backwardness. The latter is derived from Gerschenkron's concept of 'advantages of backwardness', in which it is assumed that productivity growth will be faster in 'backward' countries than in countries at the contemporary technological frontier, as here, the scope for technology transfer is greater.[16]

$$\pi^i = f\left(LI^i, MI^i, TI^i, lQI^i\right) * PG^{EU/i} \tag{12}$$

This relationship is assessed by way of a cross-country pooled least squares panel regression: The dependent variable, productivity growth π^i of the manufacturing sector of accession country *i*, is regressed against the structural pattern described by the shares of classes of labour intensive branches, marketing intensive branches, technology intensive ones, and branches which are intensive in employing low-qualification personnel, and finally the extent of backwardness, proxied by the size of the productivity gap *vis-à-vis* the average EU-15. The model therefore regresses a flow variable against a group of stock variables. The regression was conducted in logarithmical form, so that the estimated β - values, corrected with the normalised productivity gap, can be interpreted as elasticities. The empirical form of formula 12 then reads:

$$\ln\left(\frac{\pi^i}{PG^{EU/i}}\right) = C^i + \beta_1 \ln LI^i + \beta_2 \ln MI^i + \beta_3 \ln TI^i + \beta_4 \ln lQI^i \tag{13}$$

The data used in the regression analysis include annual full-time equivalent employment shares of three digit manufacturing branches grouped in the above four classes. In the cases of Poland and Estonia, comparative three digit employment data was not available and had to be estimated by use of (incomplete) national data. In all other accession countries, comparative data was available from EUROSTAT. The sums of shares of all classes in respective countries amount to some 70-90 *per cent* of total manufacturing employment. The remaining employment not considered could not be classified into either of the four classes and are mainly employed in capital intensive branches.

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productivity growth: in the panel of EU cohesion countries, a correlation analysis suggested a significant positive relationship, whereas in the panel of EU accession countries this correlation was significantly negative. Hence, this class was not considered here.

16 Available technology can be implemented via imitation. Backward countries have the advantage of being able to improve their performance without having to invest into own innovations. See *Gerschenkron* (1962), or product cycle theories. In fact, *Landesmann, Stehrer* (2002) find evidence for this backwardness-effect in accession candidates.

The annual rates of growth of manufacturing productivity and the productivity gaps between individual accession countries and the average EU-15 were calculated by use of EUROSTAT data on value added and employment in manufacturing sectors. In the case of productivity growth, some adjustment of data was necessary: Hungary experienced a near-crisis in 1995, the Czech Republic did in 1997. Those crises and associated reductions in value added growth (and hence also in productivity growth) are independent of structural patterns and clearly exogenous to our model. The productivity gap correction factor was normalised to one and takes values smaller than one for backward countries.

In all accession countries, three year moving averages of data were used to iron out the largest fluctuations which were particularly strong for productivity growth rates. In line with the assumed model, the regression was restricted to estimate a common constant for all countries: despite possible country-specific conditions, the model is geared towards determining the relationship between the structures and productivity growth of an integrated, yet still backward manufacturing sector regardless in which country.

The results of the regression exercise are reported in table 10: three regressions were made. The first included regression all classes of manufacturing industry. It comes as no surprise that the a larger share of labour intensive branches is associated with lower labour productivity growth rates for the whole manufacturing sector; the same intuition is supported by the results for marketing driven branches and low-qualification branches. Contrary to intuition are the results produced for technology intensive and high-qualification intensive branches. The results, however, also suggest that the coefficients are insignificant with error probabilities exceeding the 10 *per cent* level, and hence might be considered statistically accidental. No unambiguous intuition can be formed with respect to capital intensive branches, including more traditional branches like ‘pulp, paper and paperboard’ and more sophisticated ones like ‘basic chemicals’ and ‘parts and accessories for motor vehicles’. The regression analysis suggests a negative association with productivity growth. Due to this and the fact that labour intensity and capital intensity might economically be considered opposites (*i. e.* possible negative correlation, multicollinearity-problem), the explanatory variable of the share of capital intensive manufacturing branches was discarded in the subsequent regression exercises.

In the second regression, the coefficient for the technology intensive branch-class turns out to be significant and bears the sign we would have expected. The class of high-qualification branches also received the right sign now, but remains insignificant. Additionally, some statistical negative correlation with low-qualification branches might exist in the data (which is not due to the design of the classes: not all branches qualify as either low or high-qualification ones due to our correction exercise to get rid of overlaps between classes). Overall explanatory power, measured in r-squares, sharply falls from the first to the second regression.

Table 10:
Results of the regression analysis

		Explanatory variables								
	N	ln LI	ln CI	ln MI	ln TI	ln lQI	ln hQI	constant	R^2	adjust. R^2
1	72	-1.30*	-0.64*	-2.23*	-0.21	-0.63*	-0.10	16.52*	0.82	0.81
		(-8.30)	(-7.17)	(-9.93)	(-1.56)	(-6.51)	(-1.26)	(9.40)		
2	72	-0.52*		-1.12*	0.31*	-0.50*	0.10	6.71*	0.68	0.65
		(-4.17)		(-6.30)	(2.45)	(-3.94)	(1.00)	(5.65)		
3	72	-0.39*		-1.62*	0.50*	-0.66*		8.09*	0.71	0.69
		(-2.31)		(-5.71)	(2.96)	(-4.01)		(6.47)		

Note: Dependent variables are in all regressions are the logs of backwardness-corrected manufacturing labour productivity growth. Coefficients market * are significant at least at the 5 *per cent* error probability. T-ratios are provided in subscripted parentheses.

In the third and final regression exercise, we omitted the explanatory variable of high-qualification branches and all result are now conclusive: labour intensity, marketing intensity and low-qualification intensity branches are all given a negative sign, the coefficients are all statistically significant. The shares of technology intensive branches are positively associated with labour productivity growth and the coefficient for all countries in our panel is significant at least at the 5 *per cent* error probability. Moreover, the explanatory power of the regression increased slightly again and reaches a comfortable level around 70 *per cent.*

The highest elasticity of changes to the structural pattern turn out to concern the group of marketing-intensive branches: if, in a given manufacturing sector, the share of such branches were to grow by 1 *per cent*, total manufacturing productivity growth would turn out to be 1.6 *per cent* lower as compared to the period before that structural change. The lowest elasticity is recorded for labour intensive branches with 0.4.

The first indication of the quality of the regression model is provided by a comparison of estimated manufacturing productivity growth rates (inner-sample) and observed values. In fact, some deviation exists: in the case of Poland and the Czech Republic, observed growth rates exceed estimated rates by some 18 to 19 *per cent*, and in the case of Slovenia, the cumulated rates of growth between 1994 and 1999 calculated by use of the regression results exceed observed rates by some 1.7 percentage points, or some 20 *per cent*. Deviations in the other countries remain much lower from 5 to 10 *per cent*. Overall, however, and when considering that the pool-regression was conducted between a sample of transition economies from Central East Europe and West European cohesion countries, the results seem robust enough to warrant further exploration.

This allows us to use the results for the second step of the projection exercise. Future structural patterns are calculated in four different scenarios. The first, scenario A, re-

presents what the resource-based view on specialisation would suggest: past trends in structural change between the four classes are extrapolated into the future by way of a logarithmical trend analysis. This assumes that structural adjustment is more intense at the outset of integration and gradually abates with deepening real economy integration. Scenario B assumes that the patterns of specialisation as they have emerged nearly one decade after integration began represent final patterns – no further changes are made to the sizes of class shares here.

Scenarios C and D assume structural convergence scenarios: it is perceivable that in line with technological catching up, the industries of accession countries will engage in the kind of intra-industrial trade typical for the industries of most member states.[17] In scenario C, the structural patterns of accession states by 2014 converge to the patterns that prevailed in EU cohesion countries some decade after their own individual EU membership. This scenario is motivated by the fact that both groups of countries share common productivity gaps during their respective times of accession, they also share their main comparative advantage of lower labour (unit) costs. Finally, scenario D assumes that structural patterns in accession states will converge to patterns observed today in Germany. Despite the fact that this last version can be held to be the least realistic, it does help to put the results of the other scenarios into perspective. For both convergence scenarios, the convergence paths were estimated by use of a polynomic trend analysis to the power of three.

Table 11 provides an overview of average rates of manufacturing productivity growth projected by the model in each scenario. Charts 10 to 13 plot the resulting developments of manufacturing productivity levels for each scenario in *per cent* levels of the EU-15 average (to estimate future EU-15 average manufacturing productivity levels, a constant annual rate of growth of 2.77 *per cent* was applied; this rate corresponds to the observed average growth rate in the period 1994 to 1999).

The most important results to be highlighted pertain to scenario A, because, according to the resource-based concept, this is the most likely outcome of structural adjustment. If structural trends of the past were to persist into the short to medium term future, then Poland is projected to achieve the lowest manufacturing productivity growth with on average 3 *per cent* over the period 2000 to 2014. The Slovak manufacturing sector on the other extreme is projected to achieve the highest productivity growth rates averaging 8.4 *per cent* per year. In the framework of our model, we can conclude that the potentials for catching up in terms of manufacturing productivity are lowest for Poland and highest for the Slovak Republic. Prospects in Estonia with projected annual

17 For an assessment of structures in trade between the industries of EU accession and members states, refer to *Gabrisch*, *Segnana* (2001). The results however do not suggest structural convergence. Rather, a distinct pattern of vertical intra-industrial trade emerging between East and West would indicate the emergence of distinct specialisation patterns across the criterion of product quality (interpretable in the framework of the product-cycle concept).

growth rates of some 4 *per cent* are only slightly better than in Poland, catching up would still be extremely slow considering that the manufacturing productivity level of the EU-15 average is a moving target with assumed growth rates of 2.8 *per cent* per year. The Czech Republic is projected to catch up with annual average rates of 5.8 *per cent*, and Hungary and Slovenia with annual rates averaging some 6.6 *per cent*.

Table 11:
Projected manufacturing productivity growth rates in accession candidates, between 2000 and 2014

	Scenario A	Scenario B	Scenario C	Scenario D
Estonia	4.0	3.7	3.9	8.4
Poland	3.0	3.3	3.5	7.5
Czech Republic	5.8	5.5	4.1	7.7
Slovak Republic	8.4	7.0	4.7	8.4
Hungary	6.6	5.6	4.2	7.8
Slovenia	6.6	6.0	4.2	7.2
EU-15	2.8	2.8	2.8	2.8

In terms of potentials of catching up to EU-15 levels, the model suggests that the Slovak Republic could reach 75 *per cent* of the EU-15 average manufacturing productivity level as early as by the year of 2007 (see chart 10). Because Slovenia already achieved the highest productivity levels, growth rates of only 6.6 *per cent* per year would suffice to let the country's manufacturing sector catch up to 75 *per cent* of the EU-15 average already by 2005. Hungary is projected to reach that threshold some time around 2011 and the Czech Republic around 2014. Prospects for catching up as projected by our model are bleak for Poland and Estonia.

The comparison of results for scenarios A and B provides another interesting insights: were structures to remain at their patterns of 1999, then our model would actually project slightly higher growth rates in Poland as compared to the scenario in which past structural change describes a trend into the future. In fact, this would suggest that structural adjustment in Poland appears to, in our model, dampen future prospects of the country to see its manufacturing sector catch up in terms of productivity. For all other countries, assumed future structural adjustments in manufacturing sectors result in our model in accelerating productivity growth rates: here, the direction of structural adjustment so far improved the countries' prospects for high future productivity growth rates.

Chart 10:
Projected development of productivity gaps in scenario A in *per cent* of the average EU-15 level, 2000 - 2020

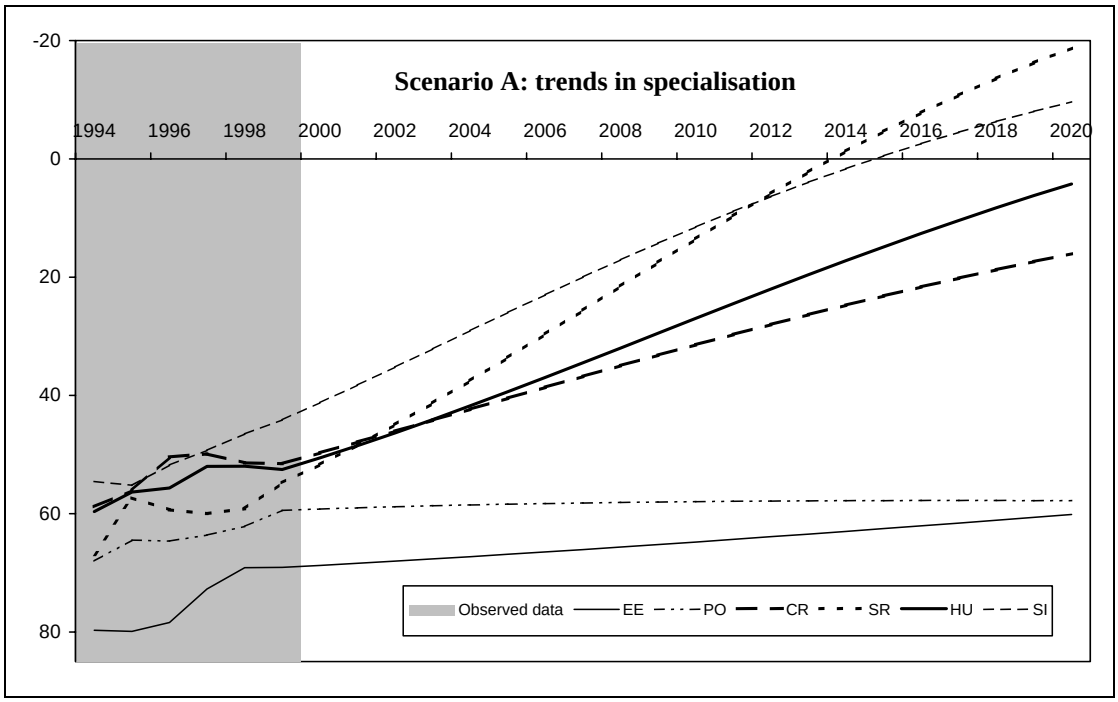


Chart 11:
Projected development of productivity gaps in scenario B in *per cent* of the average EU-15 level, 2000 - 2020

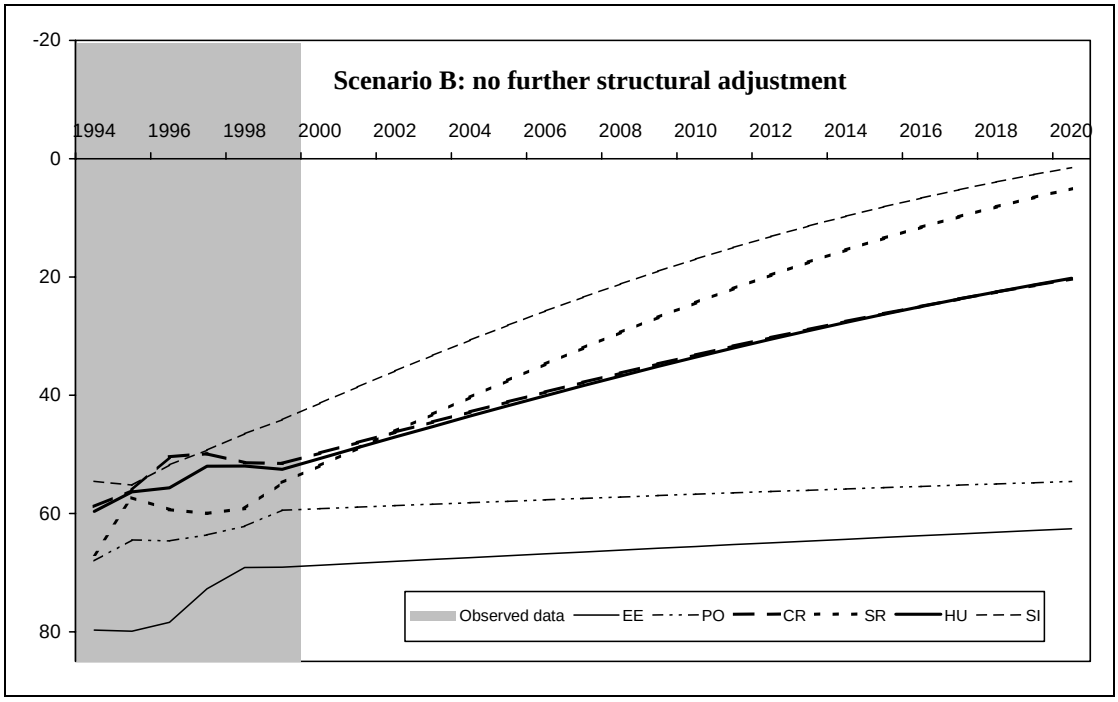


Chart 12:
Projected development of productivity gaps in scenario C in *per cent* of the average EU-15 level, 2000 - 2020

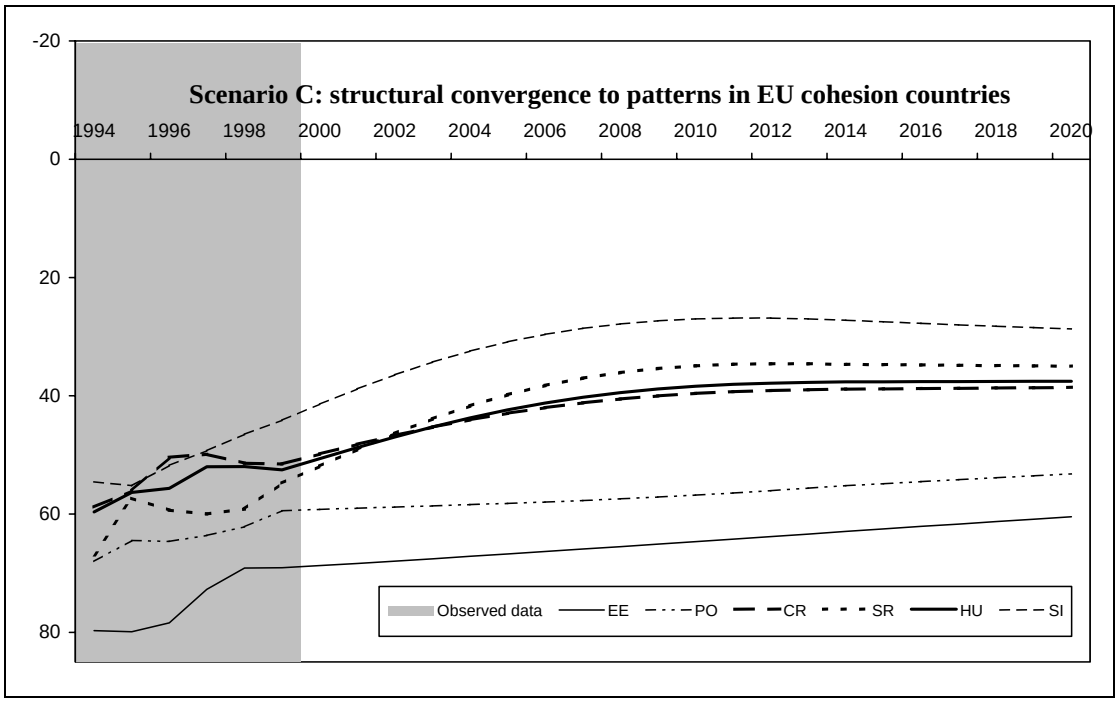
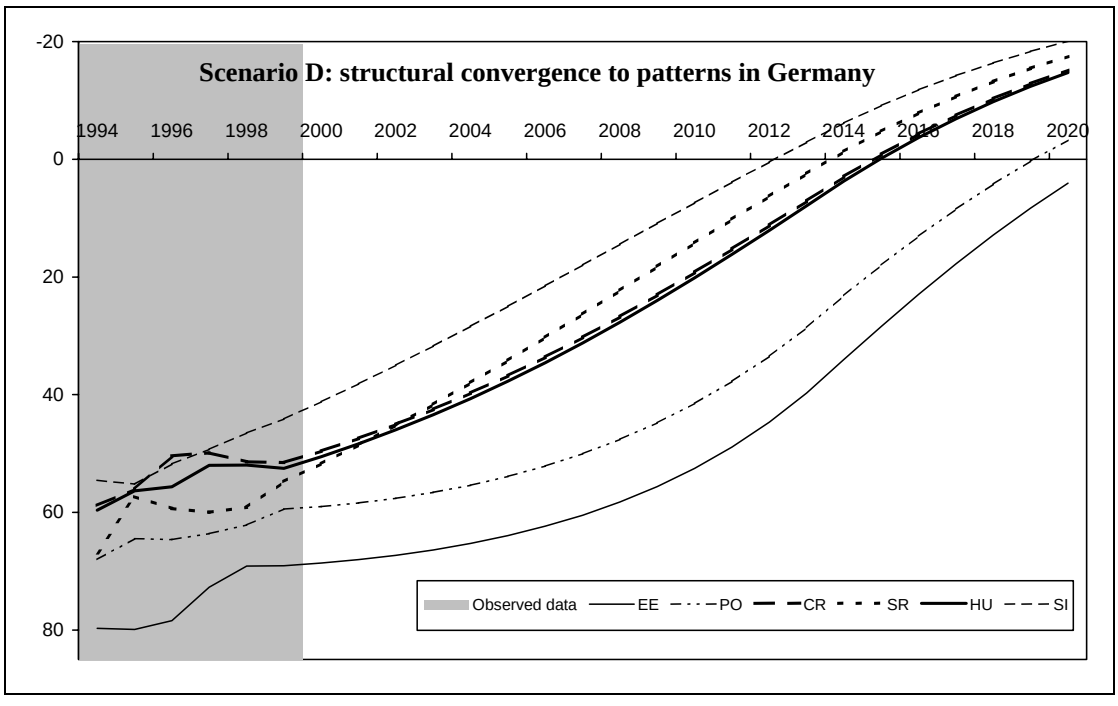


Chart 13:
Projected development of productivity gaps in scenario D in *per cent* of the average EU-15 level, 2000 - 2020



Between all scenarios, projected growth rates are highest in the ‘convergence to Germany’ scenario D. This is not surprising, because in particular technology-intensive branches exhibit much smaller shares in accession countries as compared to the German pattern: the shares of technology intensive branches would grow at the expense of all other branches, in particular low qualification branches. Only in the case of the Slovak Republic are rates for scenario D not higher than in other scenarios, which is of course due to the fact that past trends let structural patterns in the Slovak Republic come closer to the ones in Germany, extrapolation of past trends already describes a path of structural convergence. The countries that would benefit most in terms of our model here from structures converging to such in Germany would be Estonia and Poland. In both countries, the projected rates of manufacturing productivity growth would more than double in size. Subsequently, projected trajectories of productivities in accession candidates allow much faster closure of gaps in this scenario: all accession candidates of our sample are projected here to exceed the 75 *per cent* threshold within our period of analysis. All countries assessed with the notable exception of Estonia are projected to catch up completely by 2020, Estonia only a couple of years later.

Also of little surprise are the results for scenario C, the ‘convergence to cohesion countries’ scenario: all countries (bar Poland) are projected to achieve lower rates of manufacturing productivity growth if structural patterns of today were to converge to patterns that prevailed in EU cohesion countries some decade after their own individual membership in the European Union. Apparently, structural patterns in accession candidates are already, in terms of our model, more preferable than in cohesion countries after most profound structural adjustments *via* integration were complete there. Only in the case of Poland would a delinearisation of structural patterns to the ones in EU cohesion countries lead to higher projected growth rates. The projected development of productivity gaps in chart 12 hence imply stagnation for all countries except for Estonia and Poland, where some moderate catching up could till take place.

4.6 Economic policy considerations of results

Manufacturing productivity growth was so far mostly a result of a reduced allocation of labour, *i. e.* falling employment. This was particularly pronounced in the cases of Poland, the Czech Republic and Slovenia. This development reflects a necessary process of adjustment to intensified competition not only at the firm level (reduction of overmanning). In particular in the two latter accession countries, manufacturing sectors employ a significantly larger share of total employment in comparison to the average EU-15. This also applies to the Slovak Republic, albeit here, the labour saving effect of productivity growth only gets visible from 1997 onwards.

Labour saving productivity growth alone, however, may not provide a sufficient basis for a sustainable process of catching up. Rather, with a view on the typically leading role of manufacturing industries for technological development in other sectors of the economy, with a view on the comparative advantage of significantly lower labour (unit) costs in EU accession states *vis-à-vis* most EU member states, and not least with a view on high unemployment levels, productivity growth will have to exceed the labour saving effect at some point of time to allow a swift process of catching up in the manufacturing sectors.

Hence, the aim of economic policy could be directed towards improving the conditions for firms to grow sufficiently competitive to increase overall employment. By that way, either competitive firms increase their personnel or new firms emerge, employing additional labour. Due to intensifying specialisation in the course of integration, employment growth will tend to be biased in those branches where the country has the largest comparative advantages. While it is best left to the market mechanism to determine the 'winning' branches and the firms in them, our analysis was able to pinpoint in some countries specific branches which appear to contain more potentials for future catch up than others. At least for the medium term, they can be expected to remain valid. Each accession country would benefit most if policy would be directed at their country-specific peculiarities. Our analysis did show that common features, *e. g.* such inherited from their socialist past play a less important role.

The structure within Estonia's manufacturing sector would suggest that the wood-processing industry is amongst the most important branches with respect to future productivity growth: a process of particularly intense structural change has singled out those branches as positive specialisation branches *vis-à-vis* Germany. In addition, those branches belong to the most influential ones as sources of manufacturing productivity growth, yet productivity gaps in those branches are still considerable.

A path of economic development in manufacturing which focuses mainly on the structures as they have emerged today, however, could result in comparatively low potentials for future productivity growth – this result is suggested by our model in chapter 4.5. Economic policy could hence support further structural change, possibly allowing additional specialisation-industries to emerge.

The large Polish food-processing industry does not really suggest itself to economic policy assistance, but some intervention in terms of economic structures could prove to be very effective here. After all, structural change within the manufacturing sector was not very intense so far. However, the manufacturing industry of the country does also exhibit a considerable positive specialisation towards the textile manufacturing branch. Here, improvements in the efficiency of labour intensive production techniques could further increase competitiveness (a considerably gap still exists, however, it is the lowest gap amongst manufacturing branches in Poland). At later stages, this

industry even lends itself to technological development as experience from Italy teaches.

Next to the focus on those two branches, our manufacturing productivity growth-projecting empirical model strongly suggests that future prospects for a swift process of catching up are not the brightest, and some further structural change could improve potentials. However, past trends in specialisation already served to worsen the prospects as indicated by the model. This points attention to a possible danger: specialisation patterns in the Polish manufacturing sector might lock the country into a sustained productivity gap, and breaking up that deadlock would necessitate profound structural change into a particular direction – possibly against the market trend. The scope for economic policy in this respect is very limited indeed, and interventions will probably only be successful if sufficient proximity to trends provided by the market mechanisms can be found. Typically, intervention could then take the form of support for technological development, as R&D, technology-intensive FDI, investment-support, etc.

In the past, the Czech and Slovak Republics' manufacturing productivity growth patterns were mostly influenced by mechanical engineering branches with considerable technological sophistication. However, specialisation patterns rather favoured less sophisticated industries in the manufacturing sectors of both countries, amongst which are the textile industry and manufacturing of non-metallic mineral products. The intensities of structural change between manufacturing industries have been considerable mainly at the outset of economic transition, this in particular applies to the Czech Republic. For economic policy, this would indicate that some structural policy in support of adjustment to more sophisticated industry branches could further improve prospects.

The results of the empirical model, however, suggest that the manufacturing industry of in particular for the Slovak Republic appears to be very well suited to promise a swift process of catching up. In respect to potentials for future manufacturing productivity growth in the Slovak Republic therefore, no need for political intervention as such appears to be advisable. Rather, the usual technological support measures could apply. In the case of the Czech Republic, however, the model presents a different picture: prospects as projected by the model are not bleak, but clearly less favourable than in the Slovak Republic. Hence, some structural policy in the Czech manufacturing sector in support of more sophisticated industry branches could further improve prospects.

The analysis for Hungary is less clear cut, specialisation patterns favour rather less sophisticated branches like textiles and non-metallic mineral products, yet manufacturing productivity growth was mainly driven by electrical and mechanical engineering industries. Also structural change was significant and is clearly rising again in the more recent past.

The results of the projections model suggest that the manufacturing sector's structural pattern is well suited for a swift process of catching up, yet prospects are not as bright as *e. g.* in Slovenia and the Slovak Republic. The results of the model also clearly show that the direction of the lately renewed intensity of structural change in the Hungarian manufacturing sector does improve its potentials for future productivity growth. Hence, there appears to be little scope for economic policy intervention apart from the generally applicable support for technological development.

The pattern of specialisation in the Slovenian manufacturing sector and its structural development path do not contain obvious shortcomings: intensity of structural change was low, productivity growth so far was probably dominated by technological advancement, and specialisation patterns include a mix of more and less sophisticated branches.

The empirical model also suggests that prospects for future productivity growth and catch up to standards in the West look very bright. Even more pronounced than in the case of Hungary, our analysis suggests that there appears to be very limited scope for economic policy intervention in the Slovenian manufacturing industry. Rather, support of further technological advance could speed up a process which appears to be well under way.

Summary of main results

The objective of this research was to uncover the role played by specialisation patterns for the explanation of observed labour productivity gaps between CEECs and the average EU. Derived from this, the analysis attempted to determine the potentials of each of the six accession candidates for closing the productivity gap, given their respective patterns and trends of specialisation. This assessment was divided in four categories, in sectoral and industrial branch-level specialisation patterns and in such patterns as determinants of productivity gaps and growth.

With respect to the sectoral patterns of specialisation, our analysis established that in some accession countries, *national productivity gaps* can be explained by differing sectoral structures: in the cases of the Slovak Republic, Hungary, Slovenia, Czech Republic, and possibly Poland, a significant share of the national productivity gaps root in a pure statistical effect of larger shares of employment in sectors that exhibit lower levels of sector-specific productivity levels. Furthermore, in the Slovak Republic, Poland and Slovenia, this 'sectoral content' even grew larger since the early years of transformation. With these trends solidifying, those countries will sustain national productivity gaps of up to one-fifth of the average EU-15 level even after all their firms have completely caught-up in terms of firm-specific productivity levels. Only in Hungary and the Czech Republic did this sectoral content show a falling trend.

In all accession countries assessed, the sectors of manufacturing industry play the largest role as a source of national productivity gaps: this results from a combination of first large shares in terms of employment and second large sector-specific productivity gaps. Only in the case of Poland did the large employment share and the vast productivity gap in the agricultural sector result in this sector assuming a more important role even than manufacturing industries. Here, however, problems with the statistical raw data could drive that result.

The assessment of *productivity growth at the national level* could establish at productivity growth often resulted from a downward adjustment of employment – labour-saving technological change or the reduction of historical overmanning to sustain intensifying competition via integration: whereas Poland, the Czech and Slovak Republics were able to increase productivity and employment levels simultaneously during the initial years of systemic transformation and economic integration with the West, this proved to be not sustainable. In the years following, employment adjusted downwards. Only in the cases of Hungary and Slovenia did employment numbers adjust during the early years, to allow simultaneous employment and productivity growth thereafter. In Estonia, the assessment turned out to produce a significant negative correlation between employment figures and productivity levels for the total period between 1993 and 2000.

The second source of productivity growth assessed here pertains to structural change: with employment shifting from one sector of the economy to another, national productivity levels (calculated as weighted averages) might also change: productivity levels are not employment-specific but rather sector-specific. In fact, in all countries assessed here bar Poland, some of the national productivity growth can be traced back to employment shifts between sectors: in the Slovak Republic, the Czech Republic, and in Hungary, the share of productivity growth accountable to this statistical effect amounts to between 20 and 30 *per cent.* , in the case of Estonia and Slovenia to roughly 15 *per cent*. In all countries, the most important sectoral source of productivity growth pertains to manufacturing industries again. Hence, from our sectoral analysis, we are pointed to the manufacturing sector as potentially the most important sector in terms of determinants of productivity levels and growth. This warrants our focus on the manufacturing sector in the second part of the analysis.

First, we could establish that unlike at the national levels, *manufacturing sectors' productivity gaps* are on average less intensively determined by differing structural patterns. The shares of productivity gaps accountable to the countries' particular specialisation patterns within manufacturing sectors are highest for Slovenia and Hungary with values of the 'structural contents' of some 12 *per cent*. In the cases of the Slovak Republic and Hungary, those shares have risen considerably since the early years of transition and integration. If one were to assume that those trends depict evolving specialisation patterns in the course of intensifying integration, then one could conclude that those countries might run into some form of 'barrier' to complete closure of the productivity gap: rather, specialisation patterns could 'lock' those countries into a disadvantaging position *vis-à-vis* the EU. Within the manufacturing sectors, all countries exhibit differing structures: despite the fact that all countries share the common comparative advantage *vis-à-vis* the EU of lower labour (unit) costs, it is the technologically more sophisticated industrial branches of machinery, electrical equipment and the like that play a leading source of manufacturing productivity gaps in the cases of Poland, the Czech and Slovak Republics. In the cases of Estonia, Hungary and possibly Poland, the largest shares of the productivity gaps are accountable to the industrial branches with a close proximity to agriculture (food, beverages and tobacco) and to labour-intensive production (textiles).

Again compared to the national level, *manufacturing sectors' productivity growth* more often than not resulted from a downward adjustment of employment figures: the co-existence of productivity and employment growth during the initial years proved to be unsustainable where that occurred. Only in the case of Hungary did employment in manufacturing start to grow simultaneously with productivity levels during the more recent past. In Slovenia, Estonia, and the Czech Republic, the correlation between employment growth and productivity growth even amounts to nearly minus one. On this level of aggregation, the share of inter-branch restructuring in manufacturing productivity growth is much smaller than at the national level: here, the statistical effect of

employment restructuring (*i. e.* exclusive the closure of productivity gaps at the firm-level) amount to a considerable share only in the Estonian case; in Hungary, manufacturing productivity growth would have even turned out to be higher, if not for the rise in the structural content of the productivity gap at the manufacturing level. The most important manufacturing branches as sources of productivity growth of the total manufacturing sector turned out to be very different across the countries assessed. The most frequently appearing branches pertain to particularly technology-intensive industries as *e. g.* machinery, electrical and optical equipment, and transport equipment. Only in the cases of Poland and Hungary do agricultural manufacturing sectors play a significant role.

In a final analysis, we attempt to quantify the potentials of productivity growth in the manufacturing sectors of the countries assessed here: assuming some path dependency in economic development, we assess the contemporary patterns of specialisation, trends in the past and attempt to model some scenarios of future trends of specialisation. In a simple empirical deductive model, our out-of-sample projections for future manufacturing productivity growth suggest:

- the manufacturing sector of the Slovak Republic is probably best suited for a swift process of productivity catch-up if we assume path dependency in the development of specialisation patterns; Estonia and Poland are projected to lag considerably behind that development;
- if we were to assume structural convergence with currently weakest EU member states, *i. e.* the EU cohesion countries, only Poland and Estonia are projected to gain somewhat wile all other countries would achieve much lower rates of productivity growth;
- if accession countries' manufacturing industries were to converge to specialisation patterns as they exist today in Germany, all countries are projected to achieve much higher productivity growth rates than in any other scenario.

Those results suggest that structural patterns are in fact relevant for the potentials of countries to catch up in terms of productivity levels. And this result is very intuitive, yet so far under-researched: some sectors or industrial branches lend themselves better for a swift process of economic catch-up development than others. Some accession countries (*e. g.* the Slovak Republic, Slovenia) appear to be better suited for fast catch up, whilst others (*e. g.* Estonia, Poland) might well need a much longer period to close up to the levels of development predominant in mature EU countries.

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Statistical Annex

Annex Table 1:
Sectoral productivity levels in Estonia, in 1000 PPP-EUR
- current prices-

NACE	Sector	1993	1994	1995	1996	1997	1998	1999	2000
A	Agriculture, hunting and forestry	6.2	7.2	10.0	11.0	14.2	14.0	17.0	19.4
B	Fishing	2.2	2.8	6.7	8.0	8.7	10.6	12.5	12.2
C	Mining and Quarring	9.9	10.7	15.4	16.1	20.2	16.3	16.6	17.4
D	Manufacturing	7.5	8.8	9.1	9.9	13.1	14.9	15.3	17.7
E	Electricity, gas and water supply	11.8	11.2	21.2	22.7	20.9	22.2	24.4	28.6
F	Construction	7.5	8.4	14.1	14.6	13.8	15.8	17.3	19.5
G	Wholesale and resale trade; repair of motor vehicles, motorcycles and personal and household goods	12.6	11.6	16.9	18.4	17.4	18.3	20.1	22.2
H	Hotels and restaurants	4.9	4.2	5.4	6.5	9.0	9.8	9.6	9.3
I	Transport, storage and communication	12.6	13.1	13.5	15.4	22.6	27.1	29.1	36.3
J	Financial intermediation	25.7	26.8	43.3	66.3	58.4	46.8	53.4	68.3
K	Real estate, renting and business activities	15.9	18.5	25.1	27.3	31.0	31.6	33.5	34.9
L	Public administration and defence; compulsory social security	5.9	8.2	11.5	12.3	14.0	13.3	17.1	17.5
M	Education	6.9	7.8	9.2	9.1	9.8	10.8	14.7	16.1
N	Health and social work	3.2	5.0	9.5	10.7	11.2	11.6	14.6	16.1
O	Other community, social and personal service activities	9.4	11.6	19.4	20.2	15.5	17.5	18.3	19.8
	Total (sum of all sectors of the economy)	8.5	9.5	12.9	14.3	16.1	17.5	19.7	20.5

Note: Productivity levels are calculated as value added per full-time equivalent employment.

Sources: EUROSTAT; National Statistical Offices; own calculations.

Annex Table 2:
Manufacturing branches productivity levels in Estonia, in 1000 PPP-EUR
- current prices -

NACE	Manufacturing branch	1993	1994	1995	1996	1997	1998	1999	2000
DA	Manufacture of food products, beverages and tobacco	17.2	17.3	15.9	16.0	20.6	21.3	20.0	22.2
DB	Manufacture of textiles and textile products	3.7	4.3	5.7	6.8	8.5	9.4	9.7	11.4
DC	Manufacture of leather and leather products	4.4	4.8	4.8	5.9	7.8	8.9	10.8	12.0
DD	Manufacture of wood and wood products	5.7	6.2	7.6	8.7	11.3	14.6	15.8	20.3
DE	Manufacture of pulp, paper and paper products; publishing and printing	6.8	7.0	9.8	10.8	14.3	17.9	20.8	22.5
DF+ DG	Manufacture of coke, refined petroleum products and nuclear fuel, of chemicals, chemical products and man-made fibres	9.5	14.8	14.7	13.7	17.8	19.3	28.9	34.8
DH	Manufacture of rubber and plastic products	5.4	8.3	10.8	10.9	19.9	18.5	18.1	22.2
DI	Manufacture of other non-metallic mineral products	8.3	10.1	8.7	9.7	14.9	18.5	21.4	23.2
DJ	Manufacture of basic metals and fabricated metal products	7.4	7.1	7.4	9.3	11.9	16.0	13.7	17.6
DK	Manufacture of machinery and equipment n.e.c.	2.6	4.4	4.4	5.8	7.0	8.4	8.6	12.7
DL	Manufacture of electrical and optical equipment	4.7	4.0	4.9	5.8	9.1	14.0	14.0	14.8
DM	Manufacture of transport equipment	13.3	9.8	8.2	9.5	12.8	13.8	17.1	19.9
DN	Manufacturing n.e.c.	3.3	6.3	6.7	7.4	10.3	11.3	12.9	14.5
	Total manufacturing	7.5	8.8	9.1	9.9	13.1	14.9	15.3	17.7

Note: Productivity levels are calculated as value added per full-time equivalent employment.

Sources: EUROSTAT; National Statistical Offices; own calculations.

Annex Table 3:
Sectoral productivity levels in Poland, in 1000 PPP-EUR
- current prices -

NACE	Sector	1993	1994	1995	1996	1997	1998	1999	2000
A	Agriculture, hunting and forestry	3.2	3.2	3.5	3.3	3.1	2.9	2.5	2.6
B	Fishing	7.5	8.4	7.6	7.8	7.6	7.3	10.3	9.3
C	Mining and Quarring	17.6	23.0	24.5	25.4	26.9	25.4	28.6	36.8
D	Manufacturing	13.4	13.8	16.1	16.2	17.4	18.3	20.1	23.0
E	Electricity, gas and water supply	29.5	27.7	30.9	33.2	32.7	33.8	38.2	41.1
F	Construction	18.4	17.8	18.6	19.5	20.8	24.3	26.8	30.5
G	Wholesale and resale trade; repair of motor vehicles, motorcycles and personal and household goods	19.7	19.5	22.2	25.1	25.3	25.9	27.4	30.0
H	Hotels and restaurants	9.3	10.3	10.2	12.3	13.0	13.5	16.2	16.7
I	Transport, storage and communication	15.3	16.7	16.6	17.7	18.5	19.6	22.5	26.2
J	Financial intermediation	5.0	8.2	7.7	8.3	11.2	12.8	15.5	22.9
K	Real estate, renting and business activities	22.6	28.3	31.3	33.2	34.9	41.0	42.4	45.5
L	Public administration and defence; compulsory social security	29.4	24.5	30.6	32.4	31.0	32.7	31.8	32.0
M	Education	7.0	8.0	9.6	10.3	11.8	12.3	13.6	15.3
N	Health and social work	7.8	7.6	8.6	9.2	10.0	10.2	11.4	11.5
O	Other community, social and personal service activities	20.1	22.6	24.6	25.1	25.2	29.9	29.2	30.9
	Total (sum of all sectors of the economy)	12.3	12.6	14.0	14.7	15.5	16.6	17.7	19.7

Note: Productivity levels are calculated as value added per full-time equivalent employment.

Sources: EUROSTAT; WIIW; National Statistical Offices; own calculations.

Annex Table 4:
Manufacturing branches productivity levels in Poland, in 1000 PPP-EUR
- current prices -

NACE	Manufacturing branch	1993	1994	1995	1996	1997	1998	1999	2000
DA	Manufacture of food products, beverages and tobacco	15.1	12.8	16.8	15.8	18.0	18.1	19.4	23.0
DB	Manufacture of textiles and textile products	8.9	8.7	9.1	9.0	9.5	10.1	11.4	10.9
DC	Manufacture of leather and leather products	7.7	9.0	8.8	9.5	8.0	8.5	13.9	11.2
DD	Manufacture of wood and wood products	10.7	14.4	13.0	13.5	14.7	14.7	15.3	19.1
DE	Manufacture of pulp, paper and paper products; publishing and printing	18.2	21.3	29.5	26.9	25.3	26.5	30.2	36.2
DF	Manufacture of coke, refined petroleum products and nuclear fuel	54.0	49.7	49.7	34.1	54.4	61.3	48.7	111.2
DG	Manufacture of chemicals, chemical products and man-made fibres	21.4	22.7	30.2	29.5	31.0	32.9	35.5	39.0
DH	Manufacture of rubber and plastic products	18.4	18.6	22.1	20.6	21.6	22.1	23.9	26.1
DI	Manufacture of other non-metallic mineral products	12.1	14.6	15.4	16.9	17.6	19.7	21.4	26.8
DJ	Manufacture of basic metals and fabricated metal products	13.5	15.0	17.6	17.2	18.7	19.8	20.0	22.6
DK	Manufacture of machinery and equipment n.e.c.	11.3	11.9	14.1	15.7	16.4	16.1	17.8	20.5
DL	Manufacture of electrical and optical equipment	14.3	13.6	17.1	20.0	21.2	23.1	28.6	27.7
DM	Manufacture of transport equipment	13.0	14.3	14.3	16.9	16.8	18.9	18.1	23.4
DN	Manufacturing n.e.c.	11.1	11.8	12.5	12.2	14.6	14.4	16.7	17.0
	Total manufacturing	13.4	13.8	16.1	16.2	17.4	18.3	20.1	23.0

Note: Productivity levels are calculated as value added per full-time equivalent employment.

Sources: EUROSTAT; WIIW; National Statistical Offices; own calculations.

Annex Table 5:
Sectoral productivity levels in the Czech Republic, in 1000 PPP-EUR
- current prices -

NACE	Sector	1993	1994	1995	1996	1997	1998	1999	2000
A+B	Agriculture, hunting and forestry, and fishing	13.5	14.6	15.7	18.1	18.2	20.4	20.2	22.5
B	Fishing	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
C	Mining and Quarring	21.2	22.2	24.6	32.2	25.4	22.8	23.3	24.6
D	Manufacturing	16.2	17.8	19.9	22.7	24.0	23.5	24.0	26.5
E	Electricity, gas and water supply	58.2	60.3	54.0	66.1	51.1	50.4	57.6	64.2
F	Construction	17.6	16.3	20.7	18.9	19.4	17.9	19.4	20.4
G	Wholesale and resale trade; repair of motor vehicles, motorcycles and personal and household goods	21.9	19.1	20.2	18.4	23.3	25.5	26.7	29.4
H	Hotels and restaurants	12.4	17.6	25.3	21.8	15.1	12.8	15.2	18.2
I	Transport, storage and communication	21.3	22.6	23.2	22.7	25.0	26.0	25.9	27.5
J	Financial intermediation	90.5	71.1	56.2	47.7	44.3	62.6	59.3	57.1
K	Real estate, renting and business activities	51.9	50.9	51.5	52.1	52.9	56.9	56.2	57.6
L	Public administration and defence; compulsory social security	13.6	13.0	15.8	17.3	19.9	19.6	19.5	19.5
M	Education	9.2	11.1	11.6	13.1	12.6	12.1	14.7	14.9
N	Health and social work	10.3	12.2	13.2	14.2	14.8	14.7	15.3	15.4
O	Other community, social and personal service activities	14.7	16.5	17.9	19.9	19.4	17.5	19.4	19.5
	Total (sum of all sectors of the economy)	19.8	20.1	22.0	22.5	23.7	24.2	25.1	26.7

Note: Productivity levels are calculated as value added per full-time equivalent employment.

Sources: EUROSTAT; WIIW; National Statistical Offices; own calculations.

Annex Table 6:
Manufacturing branches productivity levels in the Czech Republic, in 1000 PPP-EUR
- current prices -

NACE	Manufacturing branch	1993	1994	1995	1996	1997	1998	1999	2000
DA	Manufacture of food products, beverages and tobacco	25.8	30.4	27.6	27.4	26.4	26.5	29.1	33.8
DB	Manufacture of textiles and textile products	10.6	8.9	11.7	12.9	14.0	13.8	13.2	15.1
DC	Manufacture of leather and leather products	8.8	10.7	11.1	12.5	8.6	10.1	12.4	15.0
DD	Manufacture of wood and wood products	26.5	26.1	15.9	16.3	20.1	18.2	21.1	24.5
DE	Manufacture of pulp, paper and paper products; publishing and printing	29.4	25.1	28.8	25.6	28.5	27.3	30.4	32.3
DF	Manufacture of coke, refined petroleum products and nuclear fuel	44.6	49.3	66.8	20.0	77.0	92.3	73.1	79.6
DG	Manufacture of chemicals, chemical products and man-made fibres	20.3	21.5	27.7	37.4	41.0	40.2	40.3	46.1
DH	Manufacture of rubber and plastic products	14.8	13.7	19.4	23.4	29.8	27.4	29.7	30.3
DI	Manufacture of other non-metallic mineral products	18.6	17.7	23.6	27.3	30.4	29.6	32.3	35.7
DJ	Manufacture of basic metals and fabricated metal products	19.7	20.0	21.2	20.6	23.4	22.4	20.5	23.6
DK	Manufacture of machinery and equipment n.e.c.	12.3	12.1	15.5	16.3	20.5	20.3	19.3	22.2
DL	Manufacture of electrical and optical equipment	12.8	11.1	16.2	17.8	23.3	21.6	20.9	20.6
DM	Manufacture of transport equipment	13.3	13.6	18.4	22.6	31.4	30.8	33.6	35.0
DN	Manufacturing n.e.c.	12.1	12.6	16.9	17.7	17.8	17.4	18.3	19.6
	Total manufacturing	16.2	17.8	19.9	22.7	24.0	23.5	24.0	26.5

Note: Productivity levels are calculated as value added per full-time equivalent employment.

Sources: EUROSTAT; WIIW; National Statistical Offices; own calculations.

Annex Table 7:
Sectoral productivity levels in the Slovak Republic, in 1000 PPP-EUR
- current prices -

NACE	Sector	1993	1994	1995	1996	1997	1998	1999	2000
A+B	Agriculture, hunting and forestry, and fishing	7.0	11.2	12.4	12.3	13.3	14.6	15.3	18.1
B	Fishing	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
C	Mining and Quarring	11.8	12.4	14.7	12.7	10.3	12.4	14.7	18.4
D	Manufacturing	11.7	14.3	19.3	18.6	19.2	19.7	22.4	22.7
E	Electricity, gas and water supply	67.3	68.3	43.4	35.4	33.6	32.4	42.6	42.7
F	Construction	8.5	11.5	11.3	17.3	17.1	17.3	14.9	17.2
G	Wholesale and resale trade; repair of motor vehicles, motorcycles and personal and household goods	31.3	27.7	22.9	24.4	23.5	26.4	28.4	32.2
H	Hotels and restaurants	13.8	10.3	5.9	4.5	5.1	5.2	5.2	5.5
I	Transport, storage and communication	16.5	23.9	25.6	27.7	32.6	32.2	33.5	35.1
J	Financial intermediation	119.6	103.9	90.7	66.0	107.6	78.2	74.2	58.6
K	Real estate, renting and business activities	21.1	27.8	42.7	50.5	69.9	72.7	80.5	80.5
L	Public administration and defence; compulsory social security	13.4	9.2	16.4	16.9	19.7	20.6	20.3	19.3
M	Education	8.5	8.5	12.3	12.6	16.3	17.1	16.3	16.9
N	Health and social work	4.4	3.6	4.1	4.9	7.0	7.8	7.1	7.5
O	Other community, social and personal service activities	7.8	11.5	6.1	6.3	8.1	10.1	11.5	13.6
	Total (sum of all sectors of the economy)	15.2	16.8	18.7	19.1	21.2	22.2	23.6	24.9

Note: Productivity levels are calculated as value added per full-time equivalent employment.

Sources: EUROSTAT; WIIW; National Statistical Offices; own calculations.

Annex Table 8:
Manufacturing branches productivity levels in the Slovak Republic, in 1000 PPP-EUR
- current prices -

NACE	Manufacturing branch	1993	1994	1995	1996	1997	1998	1999	2000
DA	Manufacture of food products, beverages and tobacco	19.2	22.4	27.6	26.6	26.4	25.2	26.5	24.4
DB	Manufacture of textiles and textile products	5.3	6.0	6.8	6.1	5.9	5.6	6.1	5.1
DC	Manufacture of leather and leather products	5.0	5.3	6.3	5.8	4.8	6.2	6.9	6.5
DD	Manufacture of wood and wood products	6.8	7.7	11.1	10.2	10.7	9.4	11.6	11.8
DE	Manufacture of pulp, paper and paper products; publishing and printing	13.1	17.4	25.5	23.6	24.5	24.9	27.5	27.2
DF	Manufacture of coke, refined petroleum products and nuclear fuel	67.3	89.2	117.3	126.6	137.9	111.8	142.6	216.3
DG	Manufacture of chemicals, chemical products and man-made fibres	17.5	22.3	32.7	30.7	28.8	25.5	28.4	29.3
DH	Manufacture of rubber and plastic products	15.6	18.2	25.6	24.5	25.5	21.3	23.3	23.9
DI	Manufacture of other non-metallic mineral products	9.3	10.8	14.4	14.2	14.7	15.8	17.9	16.9
DJ	Manufacture of basic metals and fabricated metal products	19.3	23.1	30.7	25.2	25.9	24.8	29.1	26.1
DK	Manufacture of machinery and equipment n.e.c.	5.8	6.7	9.2	9.7	9.7	9.6	11.5	12.3
DL	Manufacture of electrical and optical equipment	7.3	9.0	11.4	12.1	13.7	15.0	15.2	14.4
DM	Manufacture of transport equipment	8.9	13.0	24.3	26.2	28.5	49.8	58.9	59.6
DN	Manufacturing n.e.c.	7.4	8.6	12.1	12.2	11.9	11.5	14.2	14.5
	Total manufacturing	11.7	14.3	19.3	18.6	19.2	19.7	22.4	22.7

Note: Productivity levels are calculated as value added per full-time equivalent employment.

Sources: EUROSTAT; WIIW; National Statistical Offices; own calculations.

Annex Table 9:
Sectoral productivity levels in Hungary, in 1000 PPP-EUR
- current prices -

NACE	Sector	1993	1994	1995	1996	1997	1998	1999	2000
A+B	Agriculture, hunting and forestry, and fishing	12.8	14.6	17.1	16.9	17.0	17.5	16.7	16.9
B	Fishing	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
C	Mining and Quarring	10.2	9.3	10.2	10.0	13.7	10.8	10.9	14.1
D	Manufacturing	15.8	17.4	19.8	20.3	23.0	23.2	23.5	26.7
E	Electricity, gas and water supply	25.2	21.2	25.5	29.3	32.3	35.1	40.4	45.0
F	Construction	17.2	18.3	15.9	15.2	17.4	17.5	17.1	17.3
G	Wholesale and resale trade; repair of motor vehicles, motorcycles and personal and household goods	16.1	16.4	18.4	17.9	19.2	21.6	19.8	20.2
H	Hotels and restaurants	12.3	12.1	12.8	13.4	13.7	12.9	12.5	13.1
I	Transport, storage and communication	17.9	19.4	21.0	22.0	26.2	28.7	30.5	30.8
J	Financial intermediation	42.9	61.4	47.7	47.7	45.2	44.6	45.5	47.1
K	Real estate, renting and business activities	64.0	76.4	81.9	95.6	83.2	81.1	81.4	82.3
L	Public administration and defence; compulsory social security	16.8	16.6	16.7	17.3	19.7	21.5	22.4	23.7
M	Education	10.8	12.0	11.4	11.0	12.9	13.3	14.5	14.7
N	Health and social work	13.1	14.5	15.0	15.4	16.0	16.4	17.4	18.8
O	Other community, social and personal service activities	13.9	15.0	14.2	15.2	14.8	14.9	17.7	18.2
	Total (sum of all sectors of the economy)	17.5	19.1	20.3	21.1	22.8	23.8	24.4	26.0

Note: Productivity levels are calculated as value added per full-time equivalent employment.

Sources: EUROSTAT; WIIW; National Statistical Offices; own calculations.

Annex Table 10:
Manufacturing branches productivity levels in Hungary, in 1000 PPP-EUR
- current prices -

NACE	Manufacturing branch	1993	1994	1995	1996	1997	1998	1999	2000
DA	Manufacture of food products, beverages and tobacco	15.8	16.5	17.5	18.6	19.5	19.0	18.3	22.6
DB	Manufacture of textiles and textile products	8.3	8.6	9.9	9.6	9.9	9.7	10.2	10.7
DC	Manufacture of leather and leather products	7.6	9.7	9.1	8.7	8.6	8.5	9.3	10.1
DD	Manufacture of wood and wood products	17.1	19.3	21.4	20.5	21.1	19.7	17.5	17.2
DE	Manufacture of pulp, paper and paper products; publishing and printing	19.9	23.4	23.8	26.5	33.2	35.0	28.9	29.9
DF	Manufacture of coke, refined petroleum products and nuclear fuel	74.1	62.6	64.3	62.8	81.6	79.7	99.9	88.7
DG	Manufacture of chemicals, chemical products and man-made fibres	21.6	26.8	33.2	29.7	38.1	38.8	40.4	51.9
DH	Manufacture of rubber and plastic products	17.7	19.9	22.9	23.7	23.5	22.9	23.1	24.8
DI	Manufacture of other non-metallic mineral products	14.4	18.4	20.7	19.6	20.8	22.2	24.6	29.5
DJ	Manufacture of basic metals and fabricated metal products	12.0	14.5	19.4	19.7	20.3	23.2	19.4	24.0
DK	Manufacture of machinery and equipment n.e.c.	13.2	13.7	16.8	17.3	20.3	18.8	20.2	21.8
DL	Manufacture of electrical and optical equipment	14.8	18.6	18.5	22.8	26.0	25.5	25.6	30.1
DM	Manufacture of transport equipment	14.6	19.2	27.5	30.3	38.0	41.4	52.1	56.6
DN	Manufacturing n.e.c.	13.7	14.8	15.1	14.8	16.9	16.4	14.4	15.2
	Total manufacturing	15.8	17.4	19.8	20.3	23.0	23.2	23.5	26.7

Note: Productivity levels are calculated as value added per full-time equivalent employment.

Sources: EUROSTAT; WIIW; National Statistical Offices; own calculations.

Annex Table 11:
Sectoral productivity levels in Slovenia, in 1000 PPP-EUR
- current prices -

NACE	Sector	1993	1994	1995	1996	1997	1998	1999	2000
A	Agriculture, hunting and forestry	14.4	14.9	17.3	19.6	19.0	19.1	18.5	18.7
B	Fishing	10.3	6.9	10.0	10.4	14.2	14.3	20.5	20.4
C	Mining and Quarring	21.5	24.3	23.7	28.3	38.7	39.6	41.0	46.8
D	Manufacturing	17.1	19.6	20.3	22.1	24.3	25.9	27.7	30.3
E	Electricity, gas and water supply	37.8	42.7	42.1	42.3	51.2	66.9	65.1	73.6
F	Construction	18.2	17.6	19.4	21.8	21.1	22.3	24.7	25.1
G	Wholesale and resale trade; repair of motor vehicles, motorcycles and personal and household goods	19.4	20.8	22.1	22.1	23.5	24.5	25.8	27.1
H	Hotels and restaurants	18.0	16.3	17.3	18.1	19.4	19.6	21.2	23.6
I	Transport, storage and communication	26.0	27.7	29.4	30.9	37.4	39.8	41.9	43.6
J	Financial intermediation	41.6	35.5	44.7	49.5	51.7	52.0	55.5	60.6
K	Real estate, renting and business activities	47.6	49.3	51.5	52.8	51.8	53.4	55.6	58.0
L	Public administration and defence; compulsory social security	21.3	22.8	25.8	26.5	33.6	33.5	34.1	36.1
M	Education	20.0	21.4	23.5	23.8	25.3	25.3	26.5	29.4
N	Health and social work	21.3	22.9	24.3	25.6	25.7	25.8	26.3	28.1
O	Other community, social and personal service activities	30.6	24.5	23.2	25.3	25.7	27.1	28.1	30.6
	Total (sum of all sectors of the economy)	21.2	22.6	24.1	25.7	27.7	29.0	30.5	32.7

Note: Productivity levels are calculated as value added per full-time equivalent employment.

Sources: EUROSTAT; WIIW; National Statistical Offices; own calculations.

Annex Table 12:
Manufacturing branches productivity levels in Slovenia, in 1000 PPP-EUR
- current prices -

NACE	Manufacturing branch	1993	1994	1995	1996	1997	1998	1999	2000
DA	Manufacture of food products, beverages and tobacco	34.9	37.3	36.8	40.2	40.6	42.3	45.0	44.6
DB	Manufacture of textiles and textile products	8.3	9.8	9.6	9.9	11.4	13.0	13.8	13.2
DC	Manufacture of leather and leather products	11.6	14.1	12.1	11.5	12.4	10.7	12.7	17.1
DD	Manufacture of wood and wood products	12.8	16.1	16.7	17.2	16.0	17.7	17.8	18.6
DE	Manufacture of pulp, paper and paper products; publishing and printing	18.1	22.7	26.2	25.2	28.2	29.9	31.4	37.9
DF	Manufacture of coke, refined petroleum products and nuclear fuel	103.6	83.6	134.1	118.4	161.5	53.4	38.6	42.6
DG	Manufacture of chemicals, chemical products and man-made fibres	40.3	37.6	37.0	42.9	47.7	48.2	52.1	58.3
DH	Manufacture of rubber and plastic products	21.4	22.9	22.6	24.0	23.6	21.2	25.6	27.7
DI	Manufacture of other non-metallic mineral products	16.8	18.3	15.8	18.9	22.9	24.4	27.6	28.4
DJ	Manufacture of basic metals and fabricated metal products	14.0	15.4	19.2	19.2	20.1	20.9	23.0	27.2
DK	Manufacture of machinery and equipment n.e.c.	13.8	20.8	18.7	19.4	24.7	26.0	28.6	32.0
DL	Manufacture of electrical and optical equipment	12.7	14.6	15.0	17.4	20.2	21.0	21.2	23.4
DM	Manufacture of transport equipment	26.2	28.0	31.8	39.7	49.7	64.0	62.4	73.8
DN	Manufacturing n.e.c.	15.1	20.2	17.2	19.1	18.1	20.4	24.5	23.6
	Total manufacturing	17.1	19.6	20.3	22.1	24.3	25.9	27.7	30.3

Note: Productivity levels are calculated as value added per full-time equivalent employment.

Sources: EUROSTAT; WIIW; National Statistical Offices; own calculations.