An atypical relation between structural change and changes in labour input: Hungary in an international comparison

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The paper investigates the quality of Hungary's structural-upgrading performance with a novel approach. It compares the evolution of the output structure with changes on the input side, more specifically, with changes in the quantity and quality indicators of labour.

We find that despite the similarity between advanced and Central European economies (CEE) in terms of structural upgrading, the upgrading of CEE's labour input was lagging much behind that of advanced economies. Hungarian performance was the worst among CEE in this respect.

While technical change in advanced economies was skill-biased in the surveyed period, and demand for highly-skilled workforce increased considerably, in the surveyed CEE (and especially in Hungary) demand for the relatively-skilled labour declined, and the skill structure of persons engaged deteriorated. Transfer-driven technical change in CEE' manufacturing industries has thus been complementary to raw, low-skilled labour and the thesis of capital/skill complementarity did not apply.

KEYWORDS: International analyses, comparisons. Labour statistics, price and income statistics.

Intertransitional country differences in the extent of structural change have been subject to a large number of analytical papers that related these countries' restructuring and competitive performance to foreign direct investment (FDI) involvement by branches and to the technological features of both the new industry mix and trade specialization (*Soós* [2000], *Landesmann–Stehrer* [2002]).

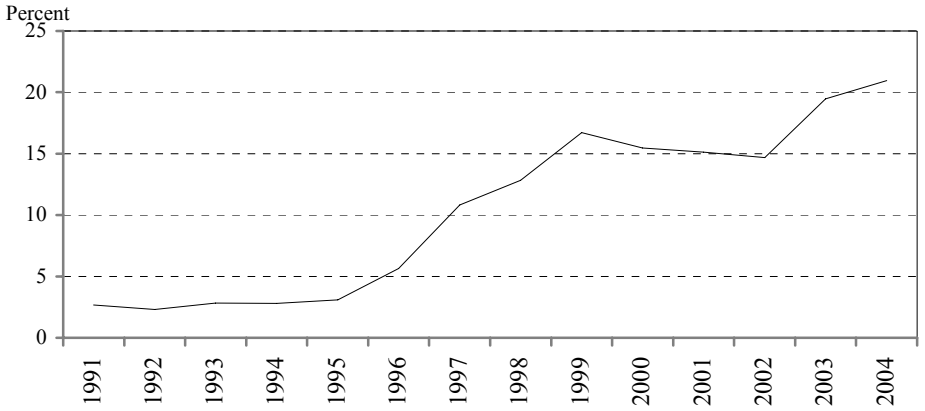
Early papers usually praised the countries with extensive structural change. The performance of transforming economies with an increasing specialization in high-technology industries was particularly acknowledged. Two main indicators were used to measure the quality of structural upgrading. The first one was the technological composition of production and exports, i.e. the share of high-growth, high-technological-opportunity industries. The second indicator structural upgrading performance was measured with, was the degree of export similarity. High values of export-similarity index suggested an advanced stage in the catching-up process.

Later papers have, however, pointed to substantial quality differences hidden behind the surprisingly high values of export-similarity indices of transforming countries (e.g. *Dulleck et al.* [2005]). Similarity of production structure may hide important quality differentials. Hence, these papers used other indicators to measure quality differences: export-unit values, quality-segment indicators, and indicators referring to the prevailing and very slowly diminishing productivity gap between the transforming and the advanced economies.

Realistic assessment of the quality of structural change is especially important for a small open economy like Hungary, with a spectacular and rapid foreign direct investment (FDI-) led structural-upgrading performance. The country's reintegration – following the political transition – into the global structure of world manufacturing, with the help of efficiency-seeking foreign investors, brought about a spectacularly increased share of high-tech products both in total Hungarian output and exports. The Figure uses office-accounting and computing machinery (NACE 30) and radio, television and communication equipment (NACE 32) as a proxy for high-tech industries and presents their increasing weight within total manufacturing output.

In spite of this spectacular shift to high-technology production (inter-industry upgrading), from time to time scholars have recalled that Hungary's competitiveness cannot be assessed as unambiguously positive. The evolution of the industry mix ought to be considered together with the country's technological potential, R&D indicators etc. to be able to provide realistic assessment. With poor performance in the latter field, the beneficial evolution of indicators in the former field reflects only cost competitiveness (*Török–Petz* [1999], *Török–Borsi–Telcs* [2005]).

The evolution of high-tech industries' share in total manufacturing output in Hungary, 1991–2004



Note. According to OECD and Eurostat classifications, high-tech manufacturing industries also comprise NACE Groups 24.4: Pharmaceuticals; 33: Instrument engineering and 35.3: Manufacture of aircraft and spacecraft.

Source: Here and in the following Tables the author's own calculations from EU KLEMS Database (www.euklems.net).

This study examines the quality of Hungarian structural upgrading performance with a new approach. It compares the evolution of the output structure with changes on the input side, more specifically, with changes in the quantity and quality indicators of labour. This method reconciles two usual approaches of development economics, *1.* the accumulationist and *2.* the structuralist. The former focuses on physical and human capital accumulation, considered as key drivers of development, catching up and productivity growth. The latter concentrates on the transformation of the sectoral and the industry composition of economic activity as a fundamental characteristic of growth and development. This paper deals with the interaction of changes in the composition of output with changes in the factor (labour)[1] use. With this method, the analysis of structural change is not restricted to the output side.

In principle, the upgrading of the composition of output ought to be in line with the evolution of inputs, i.e. with quality changes in factor use and in contribution of factors to growth. According to textbook theses, the correlation is very strong: quality changes in the structure of factor inputs imply increasing capital/labour ratios, as well as an increasing share of human capital within total inputs.

As opposed to this reasoning, in economies where FDI is the key driver of structural upgrading, the development of the input side may lag behind the upgrading of the output structure. The technological structure of these catching-up economies'

[1] The author analyzed the interaction between technical change and capital use and capital intensity in *Szalavetz* [2007].

output is similar to those of the advanced economies, while other indicators – capital/labour ratios, research and human capital intensities of production[2] – are comparable rather to those of the relatively underdeveloped economies.

This disharmony in the evolution of input and output indicators is puzzling, since in standard analyses that relate factor supplies to specialization or factor accumulation to structural change, the temporal sequence of the evolution of inputs and outputs is just the opposite. The traditional *Heckscher–Ohlin theory* states that countries' specialization patterns are determined by their relative factor endowments. In these analyses, changes in the structure of production (and exports) are preceded by changes in factor proportions. By *Romalis* ([2004] p. 67) "Countries that rapidly accumulate a factor see their production and export structures shift towards industries that intensively use that factor."

Nonetheless, experiences of recently integrated economies that had undergone an FDI-driven structural upgrading justify an investigation "in the opposite direction". In the following I will analyze whether the evolution of factor use has been in line with the FDI- and transfer-driven rapid upgrading of the composition of output. Can a growing similarity – beyond increased structural similarities between advanced economies and transforming economies – be detected in the structure of labour inputs as well?

I investigate four post-transforming economies: *1.* Hungary, *2.* the Czech Republic, *3.* Slovakia and *4.* Poland. I examine labour-input indicators in three industries, in the traditional industry of textile and textile products (TT), in a mature industry: transport equipment (TE) and in the emerging electrical and optical equipment industry (EOE).[3]

The analysis is based on EU KLEMS database. EU KLEMS project created a database on measures of economic growth, productivity, employment creation, capital formation and technological change at the industry level for all European Union member states from 1970 onwards. Data were made available for the public as of March, 2007 at www.euklems.net.

My investigation proceeds as follows. Section one examines intercountry labour-share differences, i.e. differences in the value-added share of labour compensation. This section analyzes whether this indicator can be regarded as a good proxy for la-

[2] The BERD / GERD ratio was 41.1 percent in Hungary, in 2004, compared to 70.1 percent in the U.S.; 70.4 percent in Germany; 57.8 percent in the Netherlands (*OECD* [1998]). According to Eurostat, in 2003, R&D expenditure/value added was 1.4 percent in manufacturing in Hungary. The respective value was 6.4 in the EU 25; 0.5 in Poland; 2.1 in the Czech Republic and 0.8 in Slovakia. R&D personnel intensity (R&D personnel/number of persons employed) was 0.7 percent in manufacturing while the respective indicators were 4.9 for the Netherlands; 6.7 for Finland; and 4.1 for Germany. This performance is similar at our CEE competitors: the respective indicators are 0.5 in Poland; 0.9 in the Czech Republic and 0.3 in Slovakia. (*Wilén* [2007]).

[3] EOE is, of course, a much broader category than that of high-tech or emerging industries. Nevertheless, I use this aggregate since I intended to obtain a fairly large country coverage for comparison.

bour-intensity differences. Section two reviews the labour-input (quantity and quality) indicators of selected advanced and Central and Eastern European (CEE) economies. I scrutinize whether the evolution of labour use in the surveyed new member states has been in line with both their rapidly increasing development level and the advanced economies' respective evolution patterns. The analysis is characterised by a descriptive approach rather than an intention to make formal calculations.

1. Structural change and the evolution of labour share in total value added

It is not the purpose of this paper to provide a detailed analysis of CEEs' structural change performance. Simply for the sake of illustration we provide Table 1 that summarizes the increasing weight of electric and optical equipment industry in the surveyed countries' manufacturing value added.

Table 1

EOE's share in total manufacturing value added
(percent)

Country	1995	2004
Hungary	9.27	23.8
Czech Republic	7.41	11.9
Slovakia	5.88	11.0*
Poland	7.01	8.57

* 2005.

Note. Table 1 is restricted to NACE 30 and 32 since these two industries are the ones that were more or less newly established by efficiency-seeking foreign greenfield investments, and the performance indicators of which showed a spectacular evolution.

The question this paper investigates is whether the spectacular changes in the output structure, as shown in Table 1, have also been accompanied by similar changes in the quality of labour input.

As it was argued before, specialization in the fields of high-technology opportunity does not necessarily reflect technological competitiveness. With quickly increasing production fragmentation the previous strong relation between technological spe-

cialization and technological competitiveness has considerably weakened. Countries can feature high revealed comparative advantage in fast-growing technological fields without substantial own R&D activity and technological capabilities, i.e. capabilities that exceed production and technology assimilation (e.g. innovation-generation capability). Therefore, occupations, rather than industries, should be regarded as the basic units of analysis: a country's or a region's competitiveness and the real local human-capital intensity of apparently technology-intensive industries are reflected by its occupation mix rather than its industry mix (*Feser* [2003]).

Since detailed statistics on labour-force skills are available only in a few countries, I rather examined, whether the indicator of "labour compensation as a percentage of value added" can be applied to assess the quality of changes in the output structure. My working hypothesis was that a higher than the international industry-average value of this indicator would reflect a higher than the average labour intensity in a specific country. Table 2 presents the share of compensation of employees in the total value added of the three selected industries.

Table 2

Compensation of employees over value added, 2004
(percent)

Country	TT-ndustry	TE-industry	EOE	Deviation
Austria	49.8	51.2	59.0	5.0
Czech Republic	70.5	50.0	61.5	10.3
Finland	70.2	83.8	41.5	21.6
France	66.8	63.1	81.4	9.7
Korea*	62.4	61.7	41.6	11.8
Poland	68.1	44.1	45.2	13.6
Hungary	81.5	41.7	42.3	22.8
Mexico*	48.5	30.8	53.5	11.9
Germany	68.7	81.0	75.6	6.2
Spain	72.3	68.0	65.4	3.5
Slovakia	83.1	37.6	52.2	30.0
USA	71.2	80.2	80.8	5.4
Average	68.8	59.7	56.4	
Deviation	12.4	16.0	16.8	

* 2003. The source of these data: *OECD* [2005].

As it can be seen, with the exception of some countries (Finland, Hungary, Slovakia) the intercountry dispersion of labour shares exceeds the interindustry devia-

tion of the indicator. Although the value-added share of the compensation of employees is higher on the average in the traditional labour-intensive TT industry than in the other two industries, intercountry differences are quite large even in this industry. It is puzzling that the relation between the surveyed indicator and the relative development level of the countries does not seem very strong. Data do not support my hypothesis of a larger-than-the-average labour share in the relatively underdeveloped countries which could be expected to specialize in unskilled labour-intensive screwdriver operations within industries classified as technology-intensive.

Analysis based on wage convergence or the lack of it would be misleading, since in relatively low wage countries such as Hungary or Slovakia the value of the indicator in the TT industry is much higher than the international average. Nevertheless in Austria – a country with a relatively high wage level compared to, say, Spain[4] – the value of the indicator is systematically lower in all the three surveyed industries than the respective Spanish values. Therefore, explanation for the previous results ought to be found elsewhere.

In Korea the value of the indicator is quite high both in TT and TE industries. In recent decades Korean firms have implemented sizeable investment in modern production machinery embodying state-of-the-art technology (similarly to other South-east Asian economies) in order to compensate for increasing labour costs. According to *Lim* ([1999] p. 17.) the machinery and equipment stock per worker has increased 3.5fold at constant prices in the manufacturing sector between 1970 and 1990. Increase has been much higher in traditional industries: in the shoe industry a more than twenty-fold, in the textile industry a 5.3fold and in the food industry a 5.8fold increase can be observed. At the same time, significant changes took place in the employees' skill composition: the share of highly-skilled and well-paid technicians and employees with tertiary education increased considerably (*Loo* [2002]).[5] As a consequence of these changes Korea has become similar to advanced economies in the sample. High labour share in the TT industry reflects a relatively high share of skilled workers, specialization in high value-adding activities and industry segments. In advanced economies, the restructuring of the textile and apparel industries has been marked by extensive investment in modern machinery, while changes in the composition of the labour force have been in line with the thesis of capital skill complementarity (*Griliches* [1969], *Goldin–Katz* [1998]).

As opposed to the foregoing reasoning, the outstanding high value of the indicator in Hungary's and Slovakia's TT industries is the result of completely different tendencies. Transformation recession as well as the collapse of the Council for Mu-

[4] In industry and in services the Spanish wage level was 61-63 percent of the Austrian level in 2002. (Source*: Mittag* [2006] the author's own calculations).

[5] *Loo's* [2002] data refer to TT industry in Hong Kong. Nevertheless, changes in employees' skill-composition were similar in the Korean TT industry as well.

tual Economic Assistance (Comecon) market and intensive import competition hit TT industries relatively harder than other manufacturing industries. Undercapitalized Hungarian actors failed to carry out the painful but efficient restructuring steps their advanced economy competitors had implemented. As the industry was unable to attract FDI, its deteriorating performance indicators hardly improved even after the transformation recession. TT industries in these countries are characterised by a relatively large weight of outward processing.[6] In outward processing the compensation of employees accounts for the dominant part of value added, since the material to be processed (and in some cases also the machinery) is in the contractor's ownership. The contractor assumes responsibility for the design and the technical specifications; it organizes for logistics, marketing and sales. As a result, labour share accounts for a very high percentage of the processing firms' value added. The high value of the surveyed indicator therefore fails to reflect high competitiveness or high technology- and human-capital intensity of the industries in question. What the high value of the indicator suggests is just the opposite: adverse perspectives and vulnerability.

The evolution of the level of labour share in value added did not allow for unambiguous conclusions concerning the quality of production activity. I assumed that within technology-intensive industries, relatively underdeveloped economies would specialize in activities characterised by higher-than-the-average labour intensity, thus labour share in these countries will exceed the industry average. However, data in Table 2 show opposite results: labour share in the EOE industry is higher in the advanced economies, while in catching-up countries this share is lower than the international average.

The high value of the surveyed indicator in advanced economies can be explained with the fact that in these countries a large part of EOE industry value added stems from production-related services, including R&D, design, marketing, etc., rather than from manufacturing. These services feature much lower capital/labour ratios than processing activities, and their (skilled) labour intensity is higher than that of manufacturing. Physical processing activities are outsourced to relatively lower wage catching-up economies.

The indicator's lower-than-the-average value in these countries can be explained with the fact that although the processing activities local producers undertake are more labour-intensive than the international average in this industry, production activity started as a result of foreign greenfield investments and has been performed with high-value, state-of-the-art machinery (characterised by significant depreciation rate). Furthermore, the share of operating profit as well as the balance of taxes and subsidies can also be different from the ones prevailing in advanced economies which all have an impact on the value of the labour share.

[6] Ninety percent of sales of some industries within the Hungarian apparel industry were realized within the frame of outward processing contracts even in the 2000s. (*Lázár* [2003]).

In sum, one can conclude that similar labour share values mask large differences in the quality composition of the labour force, as well as in the capital/labour ratios or in the skill levels of local operations. From comparative levels of the labour share – without complementary indicators (e.g. the share of white-collar workers or other, even more detailed occupational data and/or the R&D-intensity of production, unit value of exports, etc.) – no reliable conclusions can be drawn concerning the quality features of the output. Analysis of the relation between changes in the composition of output and labour input has to be carried out with the help of other indicators.

2. Quantity and quality indicators of labour input

In this section I will compare the evolution of simple quantity indicators of labour use (number of employees, number of hours worked). International comparison in Table 3 and 4 suggests that although there was an across-the-board reduction in manufacturing's labour use, substantial intercountry and interindustry differences can be observed in the extent of this reduction.

Table 3

Changes in the number of employees in manufacturing, 1995–2004
(1995 = 100)

Country	Changes in numbers
Austria	91
Finland	105
France	92
Germany	90
Spain	121
USA	85
Hungary	114
Czech Republic	92
Slovakia	86
Poland	80

According to *Amil–Giannoplidis–Lipp-Lingua* [2007], there is a strong correlation between the technology intensity of an activity and the rate of employment

growth. The referred authors established four groupings of manufacturing activities to reflect differing levels of technology intensity (*1.* high technology, *2.* medium-high technology, *3.* medium-low technology and *4.* low technology). They showed that EU 27 manufacturing activities, classified into different groupings by technology intensity, exhibited different evolution patterns in terms of employment in the period between 1995 and 2006. Low-technology industries have experienced the largest reduction in employment. In technology-intensive industries employment started to fall only after 2000, but reduction was sharp from that time on.

As for intercountry differences, Table 4 reveals that the highest increase in labour input can be observed in the surveyed relatively underdeveloped economies pursuing an FDI-driven catching-up strategy. The number of employees or the hours worked increased much slower even in Finland which otherwise rapidly increased its specialization in EOE industries.

Table 4

Evolution of labour input in EOE and TE industries, 1995–2004
(1995 = 100)

Country	EOE	TE-industry	EOE	TE-industry
	Number of employees		Hours worked	
Czech Republic	141	122	135	116
Slovakia	143	115	143	118
Hungary	217	197	207	193
Poland	84	76	83	77
Austria	84	135	80	119
Finland	124	86	127	82
France	91	101	86	97
Germany	89	118	84	102
Spain	114	122	113	119
United Kingdom	74	99	72	98
United States	81	90	80	88
EU 15	91	107	89	100

Quantity indicators of labour input ought to be complemented with a review of intercountry differences in the skill intensity of production. In a dynamic setting, the evolution of labour use has to be examined together with changes in the skill mix of

the labour force. The (rising) share of non-production workers is a good proxy for (increasing) the skill intensity of production (*Berman–Bound–Griliches* [1994]). Since only a few countries publish industry-level data on the share of non-production workers I rely (partly) on anecdotal evidence when claiming that skill intensity – proxied by the previous indicator – of the surveyed industries in advanced economies has significantly increased in the last decade.

According to *Pilat* and *Wölfl* ([2005] p. 19.), in Austria and in Italy 40 percent of all manufacturing employees was in reality engaged in service activities rather than in physical processing in the early 2000s. In the Netherlands the respective figure was as high as 58 percent, while in less developed economies (e.g. Portugal, Greece) it was about 30 percent. *Nunnenkamp* [2005] documented the decline (from 76.2 percent in 1992 to 70.2 percent in 2003) of the share of production workers in the German vehicles industry. Changes were spectacular in the apparel industry of Canada. There was a significant (25%) reduction in the overall number of employees between 2003 and 2005, and in this short period the share of non-production workers almost doubled: from 45 to 84 percent. (The Canadian Apparel Industry: The Shape of the Future. Apparel Human Resources Council. www.conferenceboard.ca/education/symposium/partners2004/presentations/partners04_rivard.pdf) In the United States the share of production workers also declined between 1995 and 2005 (Annual Survey of Manufactures http://www.census.gov/econ/overview/ma0300.html): from 95.5 to 83.7 percent in the textile industry, from 95.5 to 76.5 percent in the apparel industry, from 91.7 to 71 percent in the transport equipment industry.

In contrast, the upgrading of employees' skill mix in manufacturing has been very slow in Hungary and in the other surveyed catching-up economies. Irrespective of the direction of the changes in employment, i.e. whether there was an expansion or a reduction in the employment of the given industry, the ratio of non-production/production workers hardly increased. Employment in TT industry, for example, fell by more than 50 percent between 1995 and 2005 in Hungary. Meanwhile the increase of the ratio of non-production/production workers was hardly noticeable: from 14.3 to 14.7 percent. However, employment in EOE industry doubled in this period. At the same time the surveyed ratio increased from 23.7 only to 27.5 percent. As for the TE industry data suggest even a deterioration of quality: 82 percent employment growth and a reduction in the non-production/production ratio from 37.4 percent in 1995 to 25.3 percent in 2005 (HCSO: *Statistical Yearbooks* [1996], [2006]. www.ksh.hu).

Crinó [2005] documented the evolution of the skill ratio (i.e. non-manual employment relative to manual employment) in selected Central European economies. According to his calculations, relative employment of skilled workers in manufacturing – proxied by the ratio between the number of non-manual and manual employees – has shown a decline in the case of Hungary and the Czech Republic (from 0.29 in 1993 to 0.25 in 2001 and from 0.38 to 0.33, respectively). In Poland, the ratio has

slightly increased since 1994 (0.28), and in 2001 it amounted to 0.31. The picture is gloomy at the industry level as well, with Hungary showing far the poorest results, as presented in Table 5.

Table 5

Ratio of non-production to production workers

Industry	Hungary		Poland		Czech Republic	
	1993	2001	1994	2001	1993	2001
Textile and textile products	0.16	0.13	0.18	0.16	0.25	0.21
Transport equipment	0.34	0.26	0.34	0.32	0.40	0.36
Electrical and optical equipment	0.39	0.23	0.39	0.43	0.48	0.32

Source: *Crinó* [2005].

The adverse changes documented by *Crinó* [2005] are attributable to foreign investors' strategic approach towards their newly acquired local subsidiaries. The new owners closed down the marketing and sales departments, design labs and R&D labs of the newly acquired subsidiaries since they considered them as unnecessary under the circumstances of exclusively intra-firm deliveries and manufacturing according to the owner's technological specifications. In most cases even the procurement function became superfluous as the owner-customer organized for the timely delivery of the raw material and components necessary for the subsidiary's production. In this way the local companies that used to perform each single corporate function have become single-functional production facilities within their owners' organization. This has led to substantial labour shedding of skilled, white-collar workers, in many cases in excess of relatively unskilled blue-collar workers. Although this strict division of tasks and corporate functions began to change at the end of the 1990s, changes are slow to manifest.

Another indicator – quantified in EU KLEMS Database (www.euklems.net) – that sheds light on the quality of labour inputs is the share of hours worked by high-skilled persons engaged, in total hours worked. Table 6 shows the evolution of this indicator.

The situation revealed in Table 6 is slightly less gloomy in the case of the surveyed catching-up economies than the one reported by *Crinó* [2005], probably because alongside to pure processing activities local subsidiaries in CEE have also assumed increasingly some relatively skill-intensive production-related services in the past couple of years (after 2000). Locally performed production-related services included product

and/or process R&D, logistics, customer-relationship management, etc. Nevertheless, the evolution of this indicator is far slower than in advanced economies.

Table 6

Hours worked by high-skilled persons engaged in total hours worked
(percent)

Country	Manufacturing			TT- industry		EOE		TE-industry	
	1990	1995	2004	1995	2004	1995	2004	1995	2004
Austria	3	4	7	1	4	5	9	5	9
Finland	18	23	28	16	18	27	35	27	35
France	5	6	8	4	4	8	10	8	10
Germany	6*	7	9	2	3	13	15	13	15
Spain	6	7,5	13	3	7	15	22	8	15
United Kingdom	5	8	13	5	9	8	13	8	13
United States	18	20	25	11	12	32	44	23	29
Hungary	.	8	10	4	5	9	10	9	10
Czech Republic	.	6	7	3	4	7	8	7	8
Slovakia	.	6	8	4	4	7	8	7	8
Poland	.	7	12	4	8	9	14	9	14

* 1991.
Source: EU KLEMS Database.

Another indicator suggesting the lagging quality improvement of employees' skill composition in the surveyed catching-up economies is the persisting large gap between advanced economies' and the CEEs' apparent labour productivity. (See Table 7.)

A further method to investigate quality changes in labour input is to compare the evolution of labour services – an indicator that combines both the quality and the quantity of labour as a production input – with the evolution of the pure quantity indicator of labour input (hours worked). In cases of skill upgrading, i.e. quality changes in employees' skill mix, increases in labour services exceed increases in hours worked. Similarly, if in a given industry total labour input decreases but in the meantime skill upgrading occurs, the reduction of labour services is inferior to the decrease in the hours worked. Table 8 compares the gap between the evolution of labour services and that of hours worked in the surveyed economies.

Table 7

Apparent labour productivity in the surveyed industries, 2004
(value added per employee, 1000 euros)

Country	TT-industry	EOE	TE-industry
Austria	53.8	76.3	87.9
France	48.2	56.9	74.8
Germany	43.3	67.1	72.5
Finland	40.2	116.6	45.0
Spain	22.8	41.6	46.7
Hungary	5.8	23.6	32.0
Czech Republic	8.3	14.4	21.0
Slovakia	5.9	12.5	26.5
Poland	7.3	18.4	17.5

Note: Slovakia and Hungary 2005. Applied euro-conversion rates: Hungary: HUF 248; Czech Republic: CZK 32; Slovakia: SKK 38.4; Poland: PLN 4.5.

Source: The author's own calculations from EU KLEMS Database.

Table 8

Labour services and hours worked, volume indices, 2004
(1995 = 100)

Country	TT-industry		EOE		TE-industry	
	Labour services	Hours worked	Labour services	Hours worked	Labour services	Hours worked
Czech Republic	61	54	139	135	118	116
Slovakia	82	80	143	143	119	118
Hungary	74	79	176	207	163	193
Poland	56	55	87	83	79	77
Austria	63	59	83	80	123	119
Finland	77	67	133	127	88	82
France	58	52	90	86	101	97
Germany	58	55	87	84	107	102
Spain	114	108	121	113	121	119
United Kingdom	45	37	80	72	108	98
United States	49	46	89	80	92	88

There are only two countries (Finland and the United Kingdom) where the gap between the two indicators is significant in each of the surveyed industries, pointing to an across-the-board skill upgrading and a switch to quality competition.

Catching-up economies' skill-upgrading performance lags much behind the one in advanced economies. In Hungary, the situation is even worse than the case of a simple time lag: the evolution of the surveyed indicators does not conform to the one in advanced economies. The increase in hours worked exceeds that of labour services (and similarly, the reduction of hours worked in the TT industry is smaller than that of labour services). Nevertheless this points to fairly good performance in employment creation. However, economic-policy decision makers ought to be concerned with the other side of the coin: with the increasing vulnerability of a strategy based purely on price competition. The other CEE economies fare a little better in this respect, nevertheless their performance still lags much behind the one in advanced economies.

3. Conclusions

From the foregoing, it emerges that despite advanced economics, CEE similarity in terms of structural upgrading – with Hungary being the best performer in this respect – the upgrading of CEE countries labour input, in contrast to advanced economies' experience, has not been in line with this development. Hungarian performance was the worst in the CEE countries in this respect.

While technical change in advanced economies was skill-biased in the surveyed period, and demand for highly-skilled workforce increased considerably, in the surveyed CEE countries (and especially in Hungary) demand for the relatively skilled labour declined, and the skill structure of persons engaged deteriorated.[7] Transfer-driven technical change in CEE manufacturing industries has thus been complementary to raw, low-skilled labour and the thesis of capital/skill complementarity did not apply for several reasons.

First, the newly installed high-technology production equipment simplified processing tasks. The new, modern machines required routine skills that could be assimilated and mastered within two or three weeks of shopfloor learning-by-doing. Secondly, the deterioration of the skill structure can also be explained with the fact that similarly to the accumulated physical capital stock, part of the human capital stock also became suddenly obsolete following the political transition. Furthermore, as it

[7] This development is in puzzling contrast with the substantial upsurge in the skill premium that can be observed in CEE countries as well. Note, that the quantity and quality of skills in each of the skill categories has undergone sizeable changes in this period.

was already mentioned, FDI-driven structural change and modernization had a negative side effect: production-related human-capital-intensive activities, especially R&D, were abandoned in the privatized entities.

Nevertheless, interindustry disparities in the quality upgrading of labour input calls for caution concerning the working hypothesis of this paper. I assumed that changes in the output mix are strongly correlated with changes in the structure of inputs. When, for example, a shift towards technology-intensive industries becomes manifest in the composition of output, the quality structure of labour input will improve as well, at least in advanced economies. However, data suggest remarkably large input-quality changes in low-technology industries, which question the hidden assumption of our hypothesis that the larger a shift towards higher-tech industries, the more improvement in the structure of labour input can be expected. We may conclude that the correlation of changes in input and output structures is more complex than it was originally assumed.

A model that describes this correlation would contain variables quantifying the extent of structural change as well as the extent of the shift towards high-tech industries. These variables ought to be weighed with the given countries' potential to attract outsourced processing activities (OPA potential). OPA potential is a narrower category than the well-known FDI-attraction potential, quantified in the annual UNCTAD World Investment Reports (www.unctad.org/wir).

OPA potential focuses on manufacturing activities, at a time when the services sector is characterised by sizeable and increasing FDI-attraction potential.[8] OPA potential excludes FDI transactions with the purpose of technology acquisition as well as other M&A (materials and applications) deals with the purpose of market extension; product or service extension; various defensive purposes, etc. The gap between FDI-attraction potential and OPA potential that can be explained with this latter reason is significant only in advanced economies: in catching-up countries the annual flows of manufacturing FDI can more or less allow for estimating the given country's OPA potential.

Using OPA potential as a weight to correct for distortions caused by large shifts towards high-technology industries is necessary because in countries with a large OPA potential, the correlation between changes in input and output structures is weaker than the one in countries with insignificant OPA potential.

The other variables of the model quantify the extent of changes in the quality and quantity of labour input. However, similarly to measurement problems related to intangible capital, measuring the quality of labour presents non-negligible difficulties. Recall *Corrado–Hulten–Sichel* [2006] estimates of the scope of intangible investment in the United States. According to the cited authors, intangible business in-

[8] According to *UNCTAD World Investment Report* ([2004] p. 97), world FDI stock in the services sector has quadrupled between 1990 and 2002.

vestment in the U.S. amounted to about USD 1000 billion in 1999. Nevertheless, only 15 percent of this amount was included in the national accounts with the capitalization of investment into software. Capital intensity of production quickly increased as a result of this reform. Since software investment is only a fragment of total intangible investment the authors conclude that the capital intensity of value-added creation is higher than calculated.

Nevertheless, measurement problems related to the other source of growth should not be neglected either. Capital/labour ratios are hard to estimate, not only as a reason of unmeasured intangible investment but also because of unmeasured human capital. Calculating the exact extent and the value of human capital is even more difficult than that of intangible capital, so the real labour intensity of value-added creation may also be higher than its officially calculated value.[9]

An indicator that indirectly refers to increasing labour input in manufacturing is the increase both in the volume of intermediate-service inputs and their share within total intermediate inputs.[10] Of course, capital/labour ratios calculate only direct labour input, but in contrast to the past when dominant part of purchased intermediate inputs consisted of raw materials, parts and components (the labour input of which is accounted for in other manufacturing industries), at present an increasing volume of labour input in manufacturing, i.e. the one related to purchased services, is accounted for in the services sector not in manufacturing. The human-capital intensity of purchased services is difficult to estimate, since a part of purchased services consists of low-skilled outsourced services. However the share of high-skilled business services is also rapidly increasing (*Alajääskö* [2007]).

It also can be seen that the elaboration of a complex model that describes the relation between changes in input and output structures, driven by technological change, as well as the realistic assessment of individual industries' capital/labour ratios and of factors that influence these ratios requires substantial further research.

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[9] Although substantial efforts have been made to improve the measurement of human capital (*Fitzenz* [2000]), it remains much to be done.

[10] We provide some data to illustrate this statement. The volume of purchased intermediate services in German manufacturing increased by 44 percent between 1995 and 2004 accounting for altogether 24.8 percent of total intermediate inputs at the end of the surveyed period. Respective data for the U.S. were 20 percent growth and a share of 27.6 percent; for Hungary 107 percent growth and a share of 16.7 percent. (Source: EU KLEMS Database. www.euklems.net)

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