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Relationship of Structural Change and Competitiveness in Hungarian Manufacturing 1998–2003

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SUMMARY

Structural change is at the heart of economic modernization. For catching up of an economy can be interpreted as the result of exceptionally quick growth in certain more modern branches, meanwhile other activities' economic role should decline. Structural change has long been regarded as a primary source of economic growth, but it became ever more important in the context of development economics and most currently in relationship with transition economies. Yet, this paper tries to elabourate the various avenues how structural change could contribute to catching up of Hungarian manufacturing industries. The paper concentrates on statistical analysis trying to establish linkages between a set of structural change indicators and another set of economic performance indicators. This exercise verifies the modernization role of structural change: branches with high and increasing value added and productivity gained weight. Attempts were also made to relate the research findings to some existing strings of economic literature. Thus, the paper provides a shift-share analysis of productivity growth. Despite of methodological difficulties and data reliability problems this paper could verify the logic of structural change which is heading towards branches with higher levels of value added. However, no convincing evidence was found that the fast growing branches and activities were the most profitable or most productive ones.

INTRODUCTION*

Structural change and competitiveness are two interrelated phenomena, and few economists would challenge the statement that ways of changes in economic structure can enhance countries' competitiveness. In order to verify the hypothesis, we need to define the two notions, and this is not an easy task. There are many competing interpretations for both. There is even an open debate if the term competitiveness can be applied for countries and national economies, or this is rather a microeconomic term. Even if we agree on the application of competitiveness in national terms, there are very many angles how this competitiveness is regarded. Competitiveness can be regarded as superior export performance, as ability to sell on both domestic and foreign markets, as having an economic structure that is regarded advanced and includes strong high-technology industries, as having strong national innovation system, *etc.*[1]

The analysis of economic structure and structural change is likewise a very heterogeneous topic. I deal with this issue a little more in detail.[2] The original idea of observing the role of structural change in economic development was part of the string of thought that became later the backbone of development economics. This approach dealt with changes in the share of broader economic sectors like agriculture, industry and services and analyzed the macroeconomic implications of the changes. The best-known scholar of the topic was Simon Kuznets. More recent studies of structural change tried to operationalize the notion and introduce appropriate measurement devices. They restricted therefore the focus of analysis on measuring scale and intensity of structural change in particular sectors and on the impacts of the change on various economic indicators. Thus, the range of phenomena became limited to some measurable aspects, and the broader development aspects were not included in their research.

But structural change is not solely understood as changing shares and roles of economic sectors (observed at various levels of aggregation). Many policy-related papers regard "structure" as the whole economic superstructure of countries, and talk about structural changes and reforms very much in the sense of institutional changes that affect macroeconomic performance. Marczewski and Szczygielski (2005) quote only one albeit very emblematic document that uses this approach: the Kok Report. Needless to say, this very broad interpretation of structure and structural change when used for transition economies covers innumerous details and aspects ranging from privatization and price liberalization to innovation policy and beyond. All these aspects are obviously closely related to competitiveness, or at least to certain perceptions of competitiveness, and are documented in detail in the Lisbon Strategy of the EU. However, economic analysis usually focuses on changes in economic structure captured by observations of production statistics, even if these changes are discussed in relationship with the developments in the institutional background. What Marczewski and Szczygielski rightly stress in this relationship is that research into economic structures should be about the allocation of resources, therefore, the focus of eco-

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[1] For an appropriate description of competitiveness interpretations see Anna Wziatek-Kubiak's paper Wziatek-Kubiak (2003).

[2] The main points of this very brief description are taken over from the paper of Marczewski and Szczygielski (2005)

nomic analysis should be kept on issues that have sound operational meaning.

Another potential avenue of interpreting the notion of structural change can be an overview of the main research areas and problems that came up in the past when analyzing structural change. Marczewski and Szczygielski identified five major approaches. The first stream of analyses observed the very process of structural change and measures dynamics, stability and direction of changes. The development aspect comes into the picture when changes in economic structure are combined with measures of "development" like per capita GDP, and certain levels of development are attributed to various qualities of economic structure (like declining share of agriculture, or first growing then stagnating or declining share of industry, *etc.*). This type of problem setting is obviously very much used in the literature of development economics. A potential use of this research is to draw conclusions for economic policy like which branches' development should be supported in order to achieve an economic structure typical for higher level of development.[3] More recent studies on the direction of structural change are carried out on more disaggregated level. They seek to link observed changes to other economic phenomena, particularly economic growth, employment and productivity. A popular analytical tool for this comparison is the shift-share analysis.

The second main topic is the relationship of structural change and economic growth measured at high level of aggregation. Kuznets' hypothesis of bigger structural change and faster GDP growth was also tested recently. Aiginger (2000) could prove the hypothesis using manufacturing industry data of EU countries. Wyznikiewicz (1987), however, came to different conclusion. The third kind of research tries to establish relationship between structural change in the strict sense (changing shares of sectors) and structural change in the broad sense (economic system development). This type of research usually picks one certain feature of the economic system and tries to relate its changes to changing structure of production or employment.

Fourth Marczewski and Szczygielski mention papers that tried to reveal the determinants of structural change (in the strict sense). This is a rather difficult undertaking, since causalities usually work in both directions. The main determinants of structural change more frequently in use are: changes in the structure of demand, technical and organizational progress, labour-capital substitution and international trade. Only few papers came up with clear and sound evidence. The fifth type of research is of normative nature and evaluates directions of changes in economic structure whether they took directions that the authors assumed desirable. Here again materials of the European Commission concerning evaluation of the progress towards the Lisbon Strategy goals can be mentioned. In contrast to the firstly mentioned string of research here structure is related to a hypothetically "optimal" status, not to level of development.

As is seen, there are many different interpretations and research methods concerning structural change, and it is rather difficult to find a theoretically and methodologically equally proven hypothesis and research method. It is equally difficult to find a precise way of problem setting. The relationship of structural change and competitiveness (various measures of perceived competitiveness) is perhaps better approached through the first and fourth method described in the previous paragraphs. If we put aside for a moment interpretation problems of competitiveness then this

[3] We do not go into detailed discussion of the topic here, but draw the attention to the fact, that the causal relationship of economic structure and level of development is most probably opposite: having "modern" economic structure does not necessarily result in higher level of development.

means that indices of structural change can be related to economic variables (supposed to describe aspects of competitiveness). We can also try to identify the determinants of structural change. However, if we use in the analysis such basic economic indicators as per capita output, per capita value added, measures of investment effort and profitability the causality problem emerges in both approaches. The first approach is aimed to describe the first causal link: structural change improves performance. The latter approach describes the other: better performing branches grow faster. Both ways have their economic rationale. In such circumstances a precise mapping of the situation at disaggregated levels of manufacturing industry and the measurement of the strength of correlation as well as its change over time seem to be a plausible research task. In other words, we can try to prove that there is a measurable degree of economic rationale behind structural changes. We can also gather information about the main directions of the changes, and also the major avenues where this rationale is reinforced (see the differences in the use of various measures).

Thus, what we aim to do is to analyze the economic rationale behind structural change, to see why there are differences in industry growth rates, if better performing (more competitive) industries grow faster than others. If the analysis can prove the logic of different growth patterns, we can try do define more precisely what is behind, what are the main factors of structural change.

This type of exercise may seem to be strange and superfluous, since we could simply use the same methodology; for example, relate a measure of structural change to the rate of economic growth or make shift share analysis of various macroeconomic indicators. However, more complex and cautious approach is in place here. The empirical evidence strongly suggests that the process of structural change has been very unique in transition economies. Therefore, those research methods that were based on the usual economic processes of "standard" economic environments have very strong and, yet, hardly described drawbacks and handicaps. It is not by chance that Marczewski and Szczygielski found very controversial results when comparing their aggregate measures of structural change with economic growth rates. The same exercise with Hungarian figures did not prove the hypothesis of quicker economic growth resulting in higher degree of structural change either. We can also recall as a warning many of the early "victory reports" of various governments of transition economies or the shallow progress reports on transition prepared by various important international institutions that all emphasized that decisive structural/institutional changes were achieved already in the first half of the 1990s.

For example, the Hungarian government proudly emphasized in 1992–3 that foreign trade turnover was successfully reoriented from the former COMECON markets to Western markets. Yes, the relational structure indeed changed substantially but at dramatically declining export performance! Or we can also mention that the broad sectors of the Hungarian economy approached the structure of developed countries with rapidly increasing services sector and declining agriculture, mining and industry. But again, parallel with the real growth of the services sector agriculture, mining and industry declined very quickly partly due to severe economic policy mistakes and partly due to the lack of restructuring on company level. Was it perhaps from the competitiveness viewpoint a positively perceived process when the share of such industries like microelectronics or consumer electronics fell back virtually to zero by the year 2004?

It seems, that the process of structural change was carried out at several different ways during the 1990s in Hun-

gary. The different types of processes had controversial impact on macroeconomic figures and on competitiveness. Structural change also occurs if there is only decline in certain sectors and stagnation in others. The early period of transition was very much featured by the contraction process of ailing firms in Hungary.[4] Due to the special circumstances and problems of transition very different companies run into red during these years, many of them potentially viable and promising. Thus, the "selection process" was rather arbitrary and not always influenced by the logic of competitiveness (as perceived by us). On the other hand, in some cases some companies that should have quitted early due to obvious handicaps in the transition process were kept alive.[5] This practice must have distorted the speed and direction of changes in economic structure from the hypothetical logic of more growth in more competitive sectors. The various ways of distortions seriously challenge the applicability of standard methods of analysis in the first half of the 1990s.

The other important avenue of significant and quick structural change was the establishment of the foreign-owned sector in Hungary during the second half of the 1990s. Borsi *et al.* (1998) analyzed NACE 3-digit-level data and proved the very strong growth effect and increasing trade intensity of the evolving foreign sector, especially in electronics and the automotive industry. The then opened growth pattern continued over time and these two sectors remained fastest growing also in the 2000s in Hungary. This change has been a positive one, that is, its speed and direction was deliberately chosen by economic agents. We may expect that behind these important and large-scale investment decisions there is identifiable economic rationale, and these investments served the increase of competitiveness of the branches where they were implemented. However, this process was not that straightforward either. For sure, massive investments in production and services strongly influenced economic growth in Hungary, especially after 1998, when many of the new investments started actual operation.

On the other hand, if we try to add something to this simple observation, it is not so obvious that all foreign investments contributed to positive structural change in the broader sense, at least not in the first few years of their operation. There is plenty of empirical evidence that describes the evolution process of foreign firms' activities in Hungary.[6] They usually started less sophisticated activities like assembling using unskilled labour, producing little local added value. It was only several years later, after gathering positive experiences of working with Hungarian labour force under circumstances of the Hungarian economy, when the activity structure was changed, substantially broadened and developed in the level of sophistication and income generation. Simple statistical analysis cannot capture this important development process either: more detailed analysis is required.

The two different processes that shaped the development process of Hungarian manufacturing during the 1990s took place on various levels of the economy. What we are interested in now is if there were inter-industry shifts, that is if some less competitive branches contracted rather, meanwhile other, more competitive sectors expanded. However, similar process took place within industries (with mass-scale exit and entry of

[4] For a comprehensive analysis of the contraction during the early phase of transition see Balcerowicz *et al.* (1998).

[5] Although state accommodation was stronger in other transition economies than in Hungary, a number of companies received intensive state subsidization in the mid 1990s.

[6] The process is described by several authors, for example Hunya (2002), Éltető (1999) or Szanyi (1999).

companies in the same branch),[7] and on firm level.[8] The popular measuring method of the impacts of structural change, the shift-share analysis is a good tool to separate "within the industry" (or firm) and structural impacts (see Fageberg's, Peneder's or Aiginger's related papers). In all these cases similar logic should play a role: resources are allocated towards more competitive, more profitable use on different levels. The result must be better performance of firms, industries and economies on aggregate level.

Gacs (2003) compared the process of structural change in transition economies using NACE 2-digit-level output data for the years 1989–1999. He found Hungary as an outlier in comparison to other transition economies in Central Europe. Structural change was found much quicker and more fundamental. The large-scale structural change was caused mainly by the increase of the electronics sector, to a lesser extent automotive industry. When compared changes of output and value added, it turned out that much of the increase in the turnover of the electronics sector was due to screwdriver activities, was in a sense artificially inflated. When electronics was taken out from calculations Hungarian economic structure became more similar to other countries. Gacs's results suggestively illustrated the rather controversial nature of Hungarian economic development, the existence of the two main processes (downsizing and expansion), the true background of statistical miracles (inflated turnover and export figures of certain branches), but also the development process of foreign affiliates' activity, that we described earlier.

Given the rather controversial nature of structural change in Hungary a proper analysis and especially the description of structural changes' impact on competitiveness requires the use of several research methods and aspects. The hypothesis itself must be formulated in a rather broad way in order to escape the trap of narrowing down the focus to one particular aspect. A plausible general hypothesis would be if structural change followed the general economic logic and channelled resources towards more competitive branches? Is there a possibility of verifying linkages between measures of structural change and measures of competitiveness?

In order to find answers to these questions several approaches were used. First we analyzed the process and measures of structural change. Three simple measures of structural change in two calculation methods were analyzed to measure the cumulative extent of structural change over the time span of 1998 and 2003. We also calculated aggregated measures for the individual years, and compared the figures with the growth rates of the Hungarian economy. Then, using the sectoral data for two periods (1995–1997 and 1998–2003) a list of winners and losers of structural change was created. The groups were described and confronted to some empirical facts. The first part of the paper is concluded with a shift-share analysis of labour productivity, which also introduces the second part.

In the second part we focus on the competitiveness/performance measures. The analysis of the relationships between the various competitiveness factors is provided. Then structural change and performance indicators are linked through Spearman rank correlation index and panel regression analysis. The third part describes two further attempts at refining the research results. The sample was split into sub-samples, and the basic correlations were calculated for the single groups. Lastly we used two compos-

[7] The dynamics of market exit and entry on the example of the transition economies is extensively discussed in Balcerowicz *et al.* (2002).

[8] We refer here to the widely used distinction of the terms "passive restructuring" and "strategic restructuring" first used by Grosfeld and Roland (1996).

ite measures of performance/competitiveness and measured their correlation with the structural change measures. The paper is completed with conclusions.

Data for the calculations was generated from several sources. Hungarian manufacturing figures were provided by the Central Statistical Office, EU manufacturing data was provided by New Cronos database, trade data was taken from Comext. Since NACE 3-digit-level data was first available for the year 1998 our time frame of research was restricted to the period 1998–2003. In certain parts of the analysis we could use the calculations of Borsi *et al.* (1998) for the years 1993–1997.

1) Structural change of the Hungarian economy 1998–2003

Following Marczewski and Szczygielski analytical background we define structural change between years t and s as distance between the two points measured by a given metrics d. The points may represent branches' shares in total manufacturing or GDP. They suggest two types of measures, the Euclidean metrics:

$$d_E(x^t, x^s) = \sqrt{\sum_i (x_i^t - x_i^s)^2}$$

and the city bloc metrics:

$$d_M(x^t, x^s) = \sum_i \left| x_i^t - x_i^s \right|$$

This later measures is sometimes altered as follows:

$$M(t,s) = 100 \times d_M(x^t, x^s)$$

The application of d_M allows us the conduct of some detailed structural analysis. When assessing structural change between a and b, it might be of interest to check how much has a given subset of branches K contributed to the overall change. To this end the following indicator of contribution to structural change is suggested:

$$\eta(K; x^a, x^b) = \frac{\sum_{i \in K} \left| x_i^a - x_i^b \right|}{\sum_i \left| x_i^a - x_i^b \right|} = \frac{\sum_{i \in K} \left| x_i^a - x_i^b \right|}{d_M(x^a, x^b)}$$

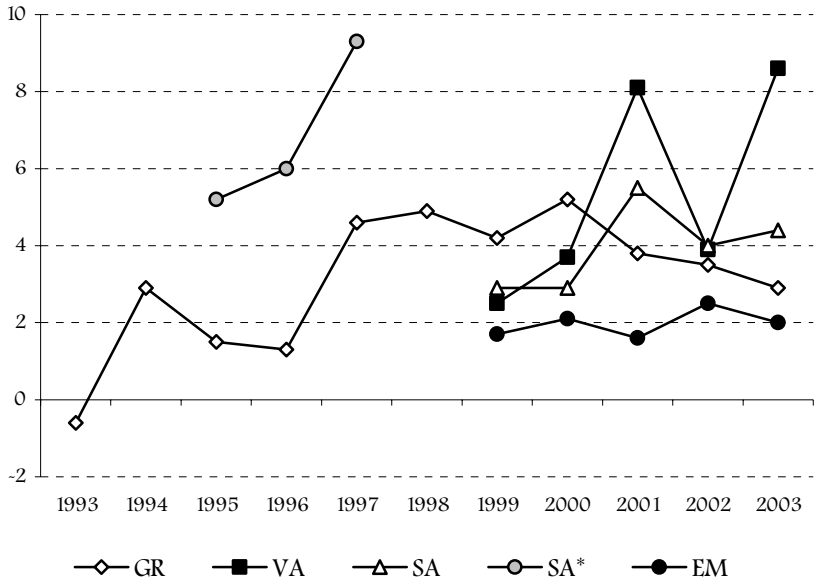
In order to measure the magnitude of changes in the Hungarian economy three structural change measures (nominal value added, sales, employment) were calculated for the whole period (1998–2003) using both measurement methods. Also, the yearly changes were calculated that provided information on the intensity of the process. *Table 1* contains the calculation results. As is seen, yearly changes do not add up to the measures of the whole period. This suggests that the process of structural change was not a straightforward one. Most stability was shown by the employment measures, the higher volatility of value added and sales measures should be explained by higher sensibility to business cycles and temporary market conditions.

Table 1
Structural change (1998-2003) measured by three variables and two methods

	1999/1998	2000/1999	2001/2000	2002/2001	2003/2002	2003/1998
Value Added(M)	14.2	13.6	27.1	20.6	20.3	43.7
Sales (M)	14.4	12.1	19.2	16.2	13.8	37.7
Employment (M)	11.0	11.0	9.1	14.7	9.7	26.8
Value Added (E)	2.5	3.7	8.1	3.9	8.6	11.0
Sales (E)	2.9	2.9	5.5	4.0	4.4	10.8
Employment (E)	1.7	2.1	1.6	2.5	2.0	4.7

When compared the Hungarian figures with the Polish and some selected EU countries', which were provided by Marczewski and Szczygielski for the period 1996–2000, Hungarian figures show markedly higher values than any other country, though the period observed was not equally long and did not overlap fully in the two cases. Compared the year-to-year changes of Poland and Hungary, however, also shows higher values in the case of Hungary, though the difference is smaller. In the case of employment, the Euclidean measure showed figures of slightly above 1% in Poland and around 2% in Hungary; in case of sales 1,5–2,5% and 3–4% respectively. For value added we found very strong fluctuation of the Hungarian figure, a steep drop in 2002. Otherwise, Polish figures were higher until 2000, Hungarian measures grew over in the years 2001 and 2003. In both Poland and Hungary structural change in the production of value added was subsequently higher than sales.

Figure 1
Comparison of structural change and growth rates



Data of Table 1 also suggests that the years 1999 and 2000 were characterized by a relatively high and stable change pattern that changed in the years 2001, 2002 and 2003 when the pace of changes started to fluctuate strongly, and the levels of change increased (also in employment). Similar breaks in the process patterns could be observed in Poland where the authors did not find evidence that the rate of economic growth was inducing quicker structural- change. A comparison of structural change measures and growth rates of the Hungarian economy provides us with similar insight (*Figure 1*).

After the twin recession (1992/3 and 1995/6) the Hungarian economy achieved considerably high growth rates that started to decline in 2001. The structural-change measures moved on a high but stable level in 1998–2000 and begun to fluctuate in 2001 when economic growth started to run out of steam. This means that structural change was more intensive and hectic during the years of slow growth. An explanation of this may be that sales and value-added figures are rather sensitive to negative conjuncture changes. Crisis hit industries reduced output. Thus, it was perhaps rather the negative factor that dominated these years' structural developments.

The stability of the structural change process was measured by the relative

Table 2
Relative deviations of structural change measures 1998-2002

	1998/99	1999/00	2000/01	2001/02	Average
Sales	0.43	1.14	1.03	0.34	0.73
Value added	0.36	0.57	0.47	0.35	0.44
Employment	0.37	1.03	0.87	0.56	0.71

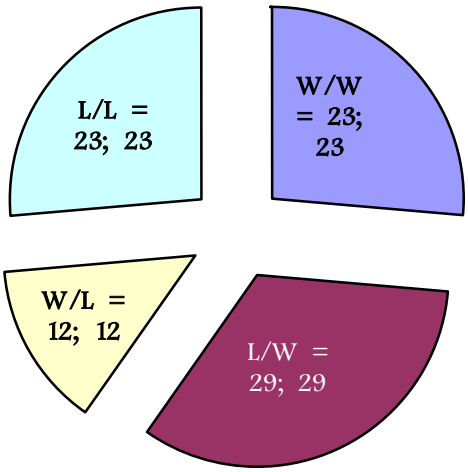
average deviations for the period 1998–2002. Similarly to the Polish case, the change of employment showed the most consistent change pattern with relatively smaller average deviations than the two other measures. But value added and sales also proved to be rather stable changing certain particular years, though not throughout the whole period. (*Table 2*)

As mentioned earlier, the growth patterns of the Hungarian economy changed over time during the 1990s. The first part until 1997 was characterized by sluggish growth and large scale changes in the environment when structural change mainly occurred through the negative process (contraction of branches). It was in 1997/8 when positive structural changes dominated economic development with the mass-scale entry of foreign-owned facilities into full-steam operation. As far as earlier periods are concerned, we used data from Borsi *et al.* to calculate structural-change measures. Since then no raw data was accessible. We could only use the annual growth rate figures of the sectors, and compared changes of growth rates, not sectors' shares in total sales. Hence, these measures cannot be compared with the later period's figures. Results are included in *Figure 1.* Structural-change measure was high during the recession years 1995–6, but further increased in 1997 when economic growth took momentum again.

But which were the industries that increased their share being the "winners" and who were the "losers" whose share declined over time? As it is seen in *Figure 2*, there were approximately the same number of winners and losers over time: 23 branches lost weight in both periods, 23 gained, 12 first gained then lost weight, 29 first contracted then expanded. *Table 3* contains the branches of the four groups.

Winners of the transition process were food industry (15), paper-publishing-printing (21-22), various material intensive industries, including plastic and fabricated metal products (28). All of them were local-market suppliers that gained

Figure 2
Share of winning and losing branches



excessive turnover with rising living standards and consumption in Hungary. Out of the internationally cooperated branches only two low-end industries boomed during both periods: cable and electronics parts manufacturing (this latter after the complete collapse of the Hungarian-owned electronics industry in 1992–3). It seems that changes in domestic demand were a very important driving force of structural change throughout the 1990s and the early 2000s.

Table 3
Winners and losers of structural change

Branches that expanded in both periods (23)	151 152 153 156 174 211 212 222 223 242 247 264 271 273 281 282 313 321 335 355 362 363 365
First contracting then expanding (30)	157 171 172 175 176 181 182 183 191 192 193 201 202 204 205 221 241 246 261 283 285 287 292 295 300 322 343 353 361 366
First expanding then contracting (12)	245 251 252 262 266 291 293 316 323 341 352 364
Contracting in both periods (23)	154 158 159 160 203 232 243 244 263 265 267 272 274 286 294 297 311 312 314 315 342 351 354

It is also interesting to look at the second group of branches that could successfully stabilize their position, and recovered some initial decline. We find here large parts of the textile industry (17), leather and footwear (18, 19), wood products (20), parts of the chemical industry (24), segments of the metal industry (28), general machinery, computers, telecommunications equipment, aircraft repair. Generally low-tech industries again, with a few exceptions, those branches where foreign investments were concentrated. This means, that there was an important concentration process in the Hungarian manufacturing industry. Within certain branches the contraction process was paralleled and later offset by the creation of new facilities.

It is also interesting to see the list of contracting branches. Here we can repeatedly find many branches where Hungarian production does not seem to be at a handicapped position, nevertheless, due to the international concentration process they leaked out of Hungarian competence. Hungarian markets are growingly served from other countries' production in these branches. Industries like fine chemicals, drugs, agricultural machinery, consumer electronics, electrical apparatus industry and others are good examples where there is competitive Hungarian production while the branches grew more slowly than other industries. But there were also industries that continued contracting, such as much of the building materials industry and basic metal products. Also, there were some industries where the expansion of the demand was slow (previous levels were high), hence production grew also slowly (branches of the food industry).

If we compare these findings with our knowledge of the restructuring process of the Hungarian manufacturing industry, we can point out some important factors that seem to have an important influence on structural change. First of all, the increase of the general welfare increased demand for a wide range of consumer goods, much of which is traditionally produced near to the consuming markets. These sectors grew fastest, and without major interruption. Some of the branches were turned over through new investments (mostly foreign), or through the establishment of new cooperation linkages abroad (we can count here also the growing throughout the 1990s subcontracting in textiles, leather, fabricated metal and chemical products). The time horizon of the available data did not allow us to monitor the years 2004 and 2005 when some of these activities were abandoned causing a likely change in their percentage share in production and employment.

Then the less vigorously growing part of the Hungarian manufacturing contained many of those industries which were also developed through foreign investments. These industries' development, however, was either slower than the contraction of some other less viable parts of the same branch, or the concentration of production reduced output of some products that were produced elsewhere in international cooperation networks, and this contraction was not offset by increasing turnover of other products. Last, but not least, there were also industries that underwent restructuring and ended up with much smaller in size production scope after only profit-making competitive activities were continued.

As the next step, we try to find out the reason of the differences in the structural change measures of employment and sales (value added). For the rather stable employment change pattern may reflect either the smaller growth of highly productive branches, or the rather robust growth of less productive industries. As it is seen on the list of winners there is a number of highly productive internationalized production networks that took strong roots in the second half of the 1990s in Hungary. But there are also many more traditional industries possibly with lower levels of per capita output that significantly increased share

in production and employment. Also, the peculiar jumps and drops in the value added measure require some explanation. We will check these issues by examining the change of the aggregate apparent labour productivity in the manufacturing industry (*i.e.* per capita value added and per capita sales). A popular analytical tool for this purpose is the "shift and share" technique, based on the following identity:

$$\Delta r = \sum \Delta r_i s_i + \sum r_i \Delta s_i + \sum \Delta r_i \Delta s_i$$

where r stands for labour productivity and s_i for the share of the i-th industry in manufacturing employment. Operator Δ denotes the difference in the variable between 1998 and 2003 while symbols without Δ – for instance s_i – stand for the value of variables in the base year (1998).

The interpretation of the three components is the following. The first component measures the productivity change within industries, the "within-growth effect" (Savona, 2004). If there is no structural change at all, this is equal to the overall productivity change. If we allow structural change, *i.e.* employment in certain branches grows/declines faster than in others, then the second component measures the impact of these differences in employment growth on productivity, provided there is no productivity growth within industries. This factor is called by Savona "the static shift effect". The third component combines productivity growth within industries with structural change. This component measures the gain or loss in productivity attributable to labour shifting towards branches with higher/lower than average productivity growth. Hence it is called the "dynamic shift effect". In analyses seeking to relate growth to structural changes the second component is interpreted as the effect of labour moving to more productive branches and the third one – as the effect of labour moving to most dynamic industries. (*Table 4*)

The explanation of the results is that productivity change in Hungary was determined by within the industry changes rather, than by structural shifts. While this phenomenon is similar in many developed economies (Savona, 2004; Fagerberg, 1999), the very strong negative impact of the dynamic shift effect on the per capita value added measure is quite unusual. This means, that labour was increasingly employed in branches with slowly growing productivity levels, though, specialization increased in higher than average productivity industries. In other words, specialization increased in branches with already high level of productivity where there is less further productivity growth potential.

Table 4
Results of the shift and share analysis of labour productivity 1998–2003
(value added/employed persons; sales revenue/employed persons)

	Total change	Within-growth effect	Static shift effect	Dynamic shift effect
VA/L	15.10%	25.19%	4.68%	-14.76%
Y/L	65.61%	52.26%	10.54%	2.83%

2) The competitiveness (performance) measures

With the introduction of the shift-share analysis we turned back to the general performance and competitiveness of the Hungarian manufacturing industry. Next we seek to examine potential links between various aspects of competitiveness and structural change. Since we do not use a precise definition of competitiveness we use a broader range of performance measures. First the existence of causal

link between performance measures and structural change measures will be tested with the use of Spearman rank correlation indexes. Then, panel regression analysis will be introduced in order to verify the existing correlations.

We calculated the following measures:

1. value added per employed persons
2. sales turnover per employed persons
3. value added per sales revenue
4. profits per sales revenue
5. average investment effort (cumulated investments per cumulated sales)
6. cash flow per sales
7. profit per employed persons

We calculated changes over the investigated period (1998–2001) of the performance measures, then ranking list of the individual measures were created. Likewise, rankings of the three structural change measures (value added, sales turnover and employment) were created. While analyzing the raw measures no strong fit between the performance measures and the structural change measures could be observed. In order to find statistically meaningful correlation of performance and structural measures, before we continued with the calculation of the Spearman rank correlation indices we refined our database as well as introduced some new measures. The changes were the following:

(1) The first minor but methodologically important refinement was deflation of the figures, using the separate price indices of the individual NACE 3-digit-level groups. Since most indicators compared relative changes of measures this refinement should not have caused dramatic changes, but since there were 10-15% differences between various groups in the price indices concerning the whole period, minor changes in the rankings could be observed.

(2) More important change was the comparison of moving averages instead of first and last years' values. There were branches that provided fluctuating figures over the years. To avoid the impact of random peaks and drops of figures, we decided to use moving averages. In case of Hungary, the rather short period of observation (four whole years) provided only the calculation of the first and last two years' averages. In other countries with six years' data series three-year averages were calculated.

(3) In order to widen the analytical possibilities, we prepared four sets of calculations. The four sets were different from two aspects. We calculated indices using changes in absolute figures (of the moving averages) and differences in growth rates. On the other hand, we compared indices of structural change to starting levels of performance measures (structural change measures versus ranking of the 1998 absolute figures of performance measures), and in the second set to changes of structural measures (calculated the same way as structural change indices).

As next step of the analysis we compared the performance measures with each other for the four available years. This comparison could also bring some interesting correlations though, obviously, in many cases correlation is primarily determined by the usage of figures with the same origin. *Table 5* contains the results.

Table 5 contains plenty of information, but we would like to emphasize only a few interesting issues. Let us start the analysis with the statement that rankings of the various performance indicators in the single years always mean a comparison of rankings based on absolute levels of the indicators, not changes over time. They show if the ranking of branches according to one and another measure are similar or not. The one extreme is the complete coincidence of the rankings, like that of row 6 in 1998, where the two rankings were found completely

Table 5
Correlations of the various performance measures

	1998	1999	2000	2001
1 Profit/sale – value added/sale	0.29**	0.28**	0.35**	0.32**
2 Profit/sale – value added/empl.	0.57**	0.47**	0.36**	0.24*
3 value added/sale – value add/empl.	0.05	-0.06	-0.12	0.00
4 Profit/sale – sale/empl.	0.57**	0.28**	0.18	0.16
5 value added/sale – sale/empl.	0.05	-0.44**	-0.49**	-0.23*
6 value added/empl. – sale/empl.	1.00**	0.89**	0.90**	0.76**
7 Profit/sale – profit/empl.	0.82**	0.60**	0.62**	0.22*
8 value added/sale – profit/empl.	-0.01	0.59**	0.46**	0.70**
9 value add/empl. – profit/empl.	0.86**	0.26*	0.15	0.33**
10 sale/empl. – profit/empl.	0.86**	0.60**	0.56**	0.39**
11 Profit/sale – cashflow/sales	0.70**	0.64**	0.68**	0.36**
12 value added/sale – cashflow/sales	0.57**	0.60**	0.62**	0.22*
13 value add/empl. – cashflow/sales	0.74**	0.59**	0.46**	0.70**
14 sale/empl. – cashflow/sales	0.74**	0.26*	0.15	0.33**
15 profit/empl. – cashflow/sales	0.68**	0.60**	0.56**	0.39**
16 Profit/sale – investment		0.31**	0.13	0.00
17 value added/sale – investment		-0.19	-0.20*	-0.11
18 value add/empl. – investment		0.45**	0.40**	0.37**
19 sale/empl. – investment		0.48**	0.43**	0.50**
20 profit/empl. – investment		0.45**	0.39**	0.20*
21 cashflow/sales – investment		0.21*	0.12	0.25*

identical. This is just a little surprising since a strong correlation of the two measures can be expected: sale – material cost = value added, and both measures are divided by the same figure of employment. Nevertheless, this is an outstanding fit, the next strongest is "merely" 0.9. A second important observation is that in almost all rows we can discover a declining trend of the strength of correlation. In many cases this declining strength is quite dramatic changing the level of significance from 1 to 5 per cent, and in one case even to the lack of correlation.

Another interesting feature is that almost all performance measures positively correlate, which is very much in the line of our expectations. We used positive measures of performance, where higher levels mean better performance. Nevertheless, in row 5 we can see two measures that correlate negatively. Moreover, in some years the correlation is significant, though not especially strong. Value added/sales and sales/employment are the two measures, which is the added-value content of sales and the per capita sales level. The negative correlation indicates that the higher is the productivity in a branch (per capita sales), the lower is the added value in the branch. This is an interesting finding that suggests that automatized production usually concentrates on minor handling procedures that has little added-value content.

A more positive linkage is expressed by the figures of row 13. Here per capita added value is compared with the cash-flow content of sales. The positive and strong correlation in each year suggests, that the higher is the per capita added value (the more demanding the activity is), the higher potential cash-flow stream can be achieved. A clear incentive to specialize on activities that produce more value added.

The third linkage that we would like to emphasize is profitability that is the realized profits compared to various measures. Rows 10, 11, 12 and 13 are of special interest from this angle. All these rows show strong but declining positive correlations. Row 10 says that the higher is the per capita turnover, the higher profits can be achieved. This is a very simple aspect; the contrary would be very much surprising. The next 11 row is more interesting. It indicates that there was a positive correlation between the cash-flow and the profit content of sales in Hungarian manufacturing. This finding underpins our previous observation that investments did not reduce substantially the profit content of the cash-

flow stream. Most interesting of the three compared rows is row 12. Here the value added content and the cash-flow content of sales is compared. That is two subsequent phases of the calculations; the difference between them is labour costs. There was a dramatic drop in 2001, which means that in this year cash-flow levels were not necessarily highest in the branches where value added was also high. This probably meant that the pace or maybe even the direction of changes of cash-flow streams was different in that year than added-value changes. This can be explained, for example, by the substantial real-wage increases of that year. The division ratio of the increasing locally added-value between labour, investment and profits started to change in that year, in favour of labour, and especially in those branches with higher value added. The continuously high and significant correlations between per capita value added and cash-flow content of sales in row 13 seems to contradict to this previous finding of row 12. There is an opposite movement in the year 2001. If wage-cost content of value added increased in this year particularly in high value-added branches, the only possible explanation of the contradiction is that value added/employee figures also dropped in 2001. This would mean either a rapid increase in employment in the better performing branches or a decrease of added value there. The later could be the case concerning the starting recession on world markets in the year 2001.

Last, but not least, we observed significant correlation between investment and a series of performance measures. Not surprisingly, investment is low where profit is high. Productivity and profitability figures, on the other hand, show correlation with investments. The more productive branches and those with higher income spent more on investments. The correlation is not very strong.

After the analysis of how the various performance measures are linked together, now we turn to figure out correlations between the performance indicators and the structural change measures, using the Spearman rank correlation method. *Table 6* introduces the main findings of this analysis. Sales and employment measures of structural change did not produce many significant results. However, value added used as structural-change measure proved to be much more useful. It produced significant correlations with all performance measures except investments. For obvious methodological reasons, correlation was strongest with per capita value-added figures, but not much less significant correlation was spotted with our cash-flow measure. Moreover, the correlation was significant at the 1 per cent level in both absolute terms and in the case of growth rates as well.

The better results with using value-added as structural measure can be partly explained by methodological reasons. A comparison of employment and profit/sales would certainly mean correlation of two completely different measures. Our value-added figures are calculated from sales data, thus the origin of

Table 6
Correlation of structural and performance measures, Spearman rank correlation indices

	Absolute change figures ranked			Growth rates ranked		
	Sales	Employ-ment	Value Added	Sales	Employ-ment	Value Added
Investments	-0.01	0.00	-0.10	0.01	0.01	-0.05
Value added/employment	0.22*	-0.14	0.54**	0.17	-0.17	0.54**
Cashflow/sales	-0.03	-0.14	0.42**	0.06	-0.07	0.51**
Sales/employment	0.38**	0.00	0.26*	0.54**	-0.02	0.33**
Profit/sales	-0.01	-0.03	0.24*	0.08	-0.03	0.26*
Value added/sales	-0.22*	-0.10	0.28**	-0.30*	-0.16	0.29**
Profit /employment	0.16	-0.05	0.39**	0.18	-0.04	0.36**

the two variables is the same, to a certain degree they contain identical elements. The strongest is the similarity with value added/employment, of course. The description of the calculation method helps realize the reason and degree of similarity. The calculation procedure was the following: total sales – material costs (value added) – labour costs (cash flow) – depreciation (profits). Sales, value added, cash flow and profits were divided by either sales or employment, to produce relative measures.

Despite of the impact of similarity of the measures, we believe that changes in the rankings of branches along value added described the best the structural changes of the Hungarian manufacturing industry in the 1998–2001 period. This measure showed strong correlation with two performance measures, and did not deny the existence of correlation with four other performance measures. This observation leads to two conclusions. First, the logic of the hypothesis that structural changes must have a kind of standard economic rationale was proved. Structural change occurred in directions mainly where production resulted in higher level of cash flow and profits. Second, the nature of changes in Hungarian manufacturing during this period was rather complex. There was substantial expansion and contraction in certain branches although, we believe, this was not comparable with magnitude of changes in the 1992–1996 period. Changes in size of branches did not prove to be influenced by the standard economic rationale. The direction of changes was not always significantly influenced by factors of competitiveness. On the other hand, there was a very important shift in production structure within branches. Differences in capacities of producing higher share of local value added increased. And this shift proved to be influenced by factors of competitiveness. Changes in value added were accompanied by changes in profitability.

The co-movement of the production of value added and profitability obviously indicates improvements in competitiveness of growing sectors. We can also spot the sources of increased competitiveness, *i.e.* local labour. The shift share analysis also showed that one source of improved competitiveness in the 1998–2001 period was a shifting towards activities producing higher level of value added. More added value can be divided among three major cost factors: labour cost, investment (depreciation) and profits. Our calculations show no significant correlation with investments, therefore, the shift was largely achieved using existing capacities. The higher level of added value was basically realized as profits since until 2001 there was only a modest increase in average wage costs (in fact, wages started to rapidly increase only in 2001).

The relationship between performance measures and structural change measures can be also verified by a simple panel regression analysis. After having discussed the linkages and relationships of the measures the panel regression analysis introduces the relative differences among branches, not just their rankings, like the Spearman rank correlation index. Now yearly changes in the shares

Table 7
Panel regression analysis of 6 performance (competitiveness) Measures and three structural change measures

	VA/Y	VA/L	CASHF/Y	Y/L	PROFIT/Y	PROFIT/L
DYw	4.8E-03	1.0E-06	1.4E-03	7.7E-07	8.3E-03	4.5E-0.6
(P)	0.227	0.000**	0.760	0.000**	0.308	0.000**
dLw	-1.5E-03	1.7E-0.9	2.5E-04	1.8E-0.8	1.5E-0.3	1.3E-0.7
(P)	0.087*	0.933	0.812	0.003**	0.429	0.076*
dVAw	1.1E-0.2	1.4E-0.6	3.3E-01	4.7E-0.7	1.7E-0.1	3.4E-06
(P)	0.005**	0.000**	0.000**	0.000**	0.029*	0.000

* significant at 10 % level
** significant at 1 % level

of branches were explained by the performance measures for the period 1998–2003. The regression results are included in *Table 7*.

The regression results largely supported the Spearman analysis. Value added proved to be the most sensitive structural change measure which provided strongly significant and in the case of cash flow/sales and value added/sales performance measures the coefficient was also remarkably high value. Changes in employment were not explained by the performance measures except for per capita sales. Sales per employed persons proved to have significant explanatory power also on changes of sales, however, the coefficient here was rather small. The same applied for per capita value added measure.

3) Two attempts at refining research results: sample split and composite measures

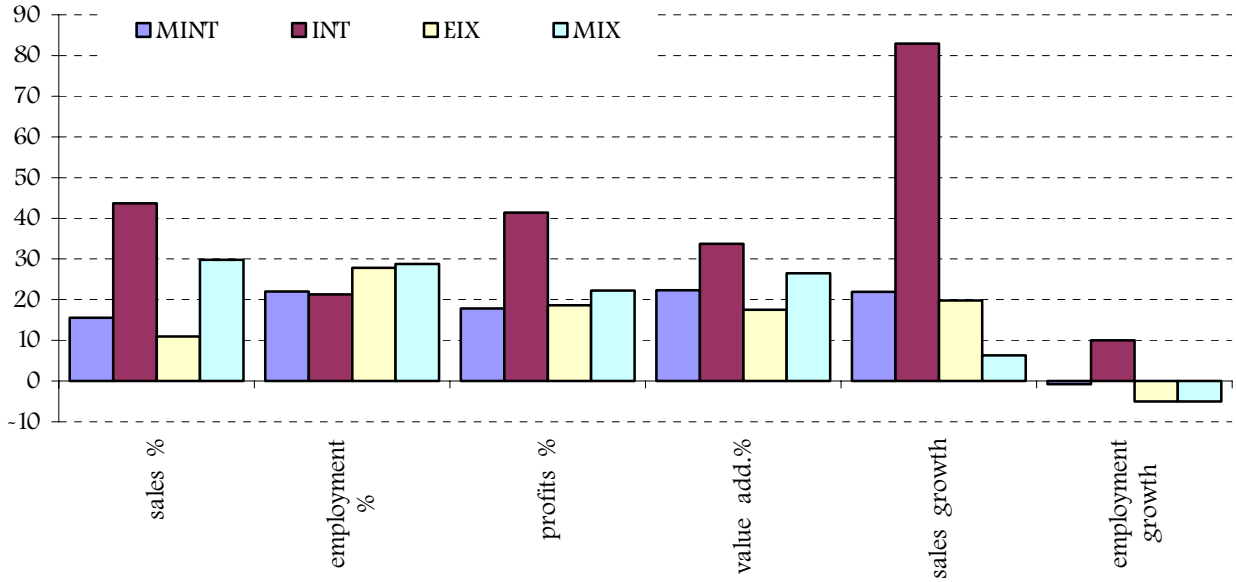
Analysis of the structural-change figures proved that there are markedly different types of industries in Hungarian manufacturing. They are influenced by different factors and their competitiveness (performance) is measured at different scales. Local market oriented industries proved to perform well during the whole 1995–2003 period. Meanwhile export intensive and globalized industries showed very mixed results. Therefore, the manufacturing branches were divided into more homogenous groups. Relative export and import shares in total inputs and outputs were compared to average levels. We differentiated between four groups: one with above average export and import ratios (internationalized group – INT), one with below average value of both measures (non-internationalized – NINT), one with higher export and lower import shares (export-oriented domestic supply dependent – EIX) and one with lower export and high import ratio (domestic market oriented but import dependent – MIX). We calculated a variety of measures to characterize the groups. These are included in *Table 8* and in *Figure 3*.

Table 8
Main features of the branch categories for the period 1998–2001

	Sales (%)	Sales growth 1998=100	Employ (%)	Empl. growth 1998=100	Profits (%)	Value added (%)	Cumulat investm	Profitability (profit/sales)
NINT (26)	15.5	121.9	22.0	99.2	17.8	22.3	11.5	6.54
INT (22)	43.7	182.9	21.3	110.0	41.4	33.7	34.1	5.39
EIX (24)	11.0	119.8	27.8	95.1	18.6	17.5	8.7	9.64
MIX (27)	29.8	106.3	28.8	95.1	22.2	26.5	45.8	4.23

Each of the four groups contains roughly the same number of the branches, approximately one-fourth of the total sample. Nevertheless, their economic functions and importance are different. Smallest in number but largest in both sales and value added is the internationalized branches' group. Moreover, this is the most dynamic group. The growth rates of both sales and of turnover were by far the highest. The quick expansion is clearly fuelled by vigorous investment activity as well. At the same time, this is not the part of the economy where the highest profit margins are realized. This is the more interesting since Hungary served as a tax heaven during the 1990s, and this made profit transfers to (and not from!) Hungary more likely.

Figure 3
Basic characteristics of the four sample groups



A possible explanation of this feature may be the dual structure of the internationalized sector. Besides the affiliates of large multinational companies, a large number of local firms also belong here, which take part in active processing activity (subcontracting). The profit margins of this activity is thought to be below average though latest empirical surveys found evidence on the contrary, on higher than average profitability, at least in Hungarian companies.

Most profitable is the export oriented, domestic supply dependent sector (EIX), but this has the lowest weight in Hungarian manufacturing sales and also in investments. The relatively high employment in this sector indicates above average labour intensity of these activities. The two domestic market oriented sectors (NINT and MIX) also differ in size and composition. Import using processing for Hungarian markets also includes a large number of foreign dominated branches. This is the largest sector measured by employment and second largest by sales, after the internationalized sector. Growth rates here are much smaller though than in the other foreign dominated sector. This observation very much corroborates with the general experience: Hungarian growth is fuelled basically by exports, the economy is very much dependent on the conjuncture of the European Union. However, domestic demand remained an important factor. Growth rates of employment and sales were second largest in group MINT. However, the data indicates a higher than average labour intensity in this sector as well: it seems, that labour intensity is generally lower in the sectors that use more imported inputs. Profitability too, was second largest in this sector behind EIX. This means that the profit margins are higher in the two domestic input using sectors. This feature together with higher labour intensity provides the impression that labour intensive, local source-based activities' profitability is higher: they enjoy comparative advantage.

The homogeneity of the sample was tested in the next step. Hence, it is important to see if and to what extent are inter-group differences bigger than intra-group differences. Put it another way, the standard deviations of measures within the branch-groups may be much smaller, than among the groups of branches. We tested eight measures for the four groups of companies. In this analysis we used different threshold levels (30%) and also considered the dominant ownership pattern of the branch.

The first group consisted of branches that imported and exported more than 30 per cent of their production inputs and sales, moreover, they had over 30 per cent foreign ownership in subscribed capital. This group consisted of 43 branches, and was called foreign assemblers. The second group had similar patterns of production inputs and sales, but were not dominated by foreign owners. This group incorporated 8 branches, and we called them subcontractors. The third group sold over 30 per cent of output on foreign markets, but had a lower level of imported inputs. Twenty branches of this group were called export driven branches. Lastly, the fourth group included 28 branches with low levels of exports and imports. They were called domestic oriented manufacturing branches. The 8 measures were: (1) change in the share of sales revenues, (2) change in the share of employment, (3) relative investment effort (cumulated investment/cumulated sales), (4) change in per capita value added, (5) change in per capita cash-flow, (6) change in per capita sales, (7) growth rate in the share in domestic demand, (8) growth rate in domestic sales. *Table 9* summarizes the results of the calculations.

Table 9
Comparisons of three groups of manufacturing branches through eight variables

Groups and pairs compared		Share in sales	Share in employ	Invest/ sales	Val.add/ employ	Cashflow/ sales	Sales/ employ	Growth in DD share	Growth in dom sales
Gr.1	Average	2.94	4.88	0.071	0.82	-27.83	22.41	51.09	-58.31
	Std.	69.45	30.48	0.029	35.01	24.22	60.21	194.05	274.58
Gr.3	Average	-14.50	-2.46	0.072	0.47	0.75	7.92	5.64	3.48
	Std.	15.50	19.62	0.032	15.16	167.65	14.91	25.10	30.67
Gr.4	Average	12.49	2.48	0.083	17.29	-9.64	26.01	15.59	42.47
	Std.	89.92	56.67	0.142	41.29	31.34	28.44	70.54	145.61
1-3	F	20.07	2.41	1.18	5.33	47.92	16.30	59.74	80.12
1-4	F	1.67	3.45	23.33	1.39	1.67	4.48	7.56	3.55
	T estim	4.47*			11.08*	14.41*			-2.01**
	T critic	1.667			1.667	1.667			1.703
3-4	F	33.65	8.34	19.62	7.41	28.6	3.63	7.89	22.53
	T estim				1.97**		2.86**		
	T critic				1.729		1.729		

* Simple T test
** Welsh-type T values

The main result of this exercise was the recognition that there were significant differences between groups of branches in the Hungarian economy. However, these differences were registered only between the domestic market oriented group, and the two export-oriented groups (including the assemblers). Since the subcontractor group consisted only eight branches, we omitted them. Not only differed domestic oriented branches from both other groups, but the tests did not show major differences between the assemblers and exporters. This means that due to differing market orientation measures of trade-intensive branches are usually different than domestic sales oriented branches. The first conclusion from this result is that much of the standard error in the previous structural calculations can be traced back to inherently different business structures in trade oriented and in domestic market oriented manufacturing branches.

A little more analysis of the measures also discovers some interesting features of this split of manufacturing branches. The stars in Table 8 show those T values that were significantly lower than the critical T level, which means that there was no extraordinary distortion in the two samples compared concerning the given measure, hence differences in the average values of the measures were

significant and not random. There was one measure where domestic oriented branches differed from both the assemblers and the exporters: in per capita value added. The average was below 1 for the trade dependent branches and was over 17 for the domestic oriented firms. The difference was therefore quite large: branches producing for the domestic market produced much higher level of added value than exporters and assemblers. Per capita sales, cash flow/sales, share in sales and growth in domestic sales were the 4 further measures where domestic oriented branches performed significantly differently than others. And if we take a look at the averages, it is interesting that in all these cases their average values were higher than those of the assemblers and exporters. It seems that in the case of a variety of performance measures domestic oriented firms performed better. This finding stresses again the relative importance of domestic markets and domestic demand on structural changes of the Hungarian manufacturing industry.

The previous body of the research tried to map the relationship of performance/ competitiveness and structural change. We used a variety of measures in order to see which indicators described best the relationship, provided it existed and was significant. We found that value-added-based measures responded most sensitively, and showed the strongest relationship.

The various measures described different aspects of the relationships. Profitability, income generating power, investments were all measures that tried to characterize capital owners' logic that makes them investing in one industry rather than in another. Structural changes in manufacturing were regarded as a result of this logic: the weight of those branches should increase where there is some kind of advantage when compared with other branches that makes certain industries more attractive for investments than others. Structural change itself was described by various measures to test which best describes the process.

*

We did not succeed in obtaining conclusive results as concerns the "best indicators" of structural change and of performance/competitiveness. Many aspects proved to be important. The best performing few measures were therefore combined and two composite measures of competitiveness were created. Competitiveness is clearly influenced by both supply side abilities but also by demand side changes. Our analysis proved the importance of both sides.

The supply side indicator included four aspects of competitiveness. Average growth rate of market share described the flexibility of branches to improve positions on markets. Change in unit labour cost relative to EU average provided information about change in the competitive factor that was regarded as most important for the new member-states: the relative cost of labour. But not only the changes of labour cost were regarded important, but also differences in the relative wage levels of the various branches, compared to patterns in the EU 15. The third part of the composite was therefore relative per capita wage level. The fourth indicator was relative investment efforts with the argument that structural change was linked to changing competitiveness if it was a result of new investments. For production structure might also change without having significant investments, but in this case competitiveness would hardly change. As concerns the demand side composite measure, we created an indicator that described demand growth on both the domestic and the main export markets. Structural change was described by three indicators. The first was change in the branches' shares in total manufacturing employment. The second was change in the branches' shares in total value added. The third indicator was net job loss or creation in the branches.

Table 10
Spearman rank correlation measures of the various performance and structural change measures

Spearmans	Side 1	Side 2	Side 3	Side 4	Supply side composite	Demand side	*Structural: Labour*	*Structural: Value Added*	*Jobs Lost-Jobs Created*
Side 1		–0.02	0.02	–0.02	*–0.47*	–0.08	–0.01	0.08	0.03
Side 2			0.00	0.01	*–0.51*	*–0.25*	–0.04	*-0.34*	0.14
Side 3				–0.11	*–0.48*	–0.04	*0.39*	0.02	0.09
Side 4					*–0.45*	–0.02	–0.03	0.04	0.06
Supply side composite						0.16	*0.21*	0.09	–0.19
Demand side composite							*0.37*	*0.30*	0.07
Structural: Labour								*0.60*	0.08
Structural: Value Added									–0.02
Jobs Lost-Jobs Created									

A table in the Appendix contains the rankings that we achieved for the composite supply side and composite demand side competitiveness measures. It is rather clear when comparing the figures of the same industries in the two columns that there were significant differences between the two types of rankings. There were only 24 branches where the difference between the two rankings was less than 10 positions that would perhaps mean a strong fit of the two types of competitiveness measures. On the other hand, there were large differences, like 83 positions in the case of branch 267 or 69 positions in case of branch 351. These big differences emphasize the fact that the combination of the two types of competitiveness measures is hardly possible.

Using these mentioned indicators, we created order of rank of the industries, and using Spearman rank correlation we tried to find link between these rankings. As in *Table 10* (in which we presents the supply side indicators individually and as composite too) one can see we found weak but significant correlation (on 5 percent significance level) between the supply side composite measure and share in value added, and the demand side composite measure and both share in employment and share in value added.

Figures in Table 10 can be interpreted as follows. From the three structural change indicators changes in the share of employment showed the better, not strong but significant correlation to both the demand side and the supply side composite competitiveness measures. Changes in the share of value added proved to have significant correlation only with the demand side composite competitiveness measure. The third structural change measure, job creation and loss in the branches did not show significant correlation. The supply side measure had only one significant correlation (with changes in branches' shares in employment). But this correlation was very weak.

Demand side composite competitiveness measure proved to have significant correlation with two of the three structural-change measures used here (share in labour and value added). The correlation is not very strong but existing. This can be explained in three ways, and supposedly all are equally important. First is that not all industries could use the possibility that market size growth provided them. Second, that not all industries could use it with the same effectiveness. And the third reason behind the weak correlation could be that the optimal or potential level of value added and employment at a specific level of production

is different in the various industries, so the reaction of these to changes in market size could be different. But the fact that we were able to find a link between market size and structural indicators means that Hungarian manufacturing industries were able to react to the market signals and could use the possibilities of growing markets, but also suffered from the diminishing possibilities that declining markets provided.

Two other links can be seen in our table. Both of them were related to wage costs. First is the positive correlation between our third supply side component (change of relative wage level relative to the EU) and the change of share in total manufacturing employment. In our case this means that during our period of analysis those industries increased their share in total manufacturing employment in which wage level related to the average manufacturing wage level decreased relative to the same measure of the EU industries. It means that Hungary was on the way to specialize its manufacturing production to those industries where the relative advantage in wages is the highest with respect the EU. So the important question is not the absolute wage level of the industries, but the relative one!

The second component (relative labour cost intensity) of the supply side composite also showed significant correlation with changes in branches shares' measured by value added. The correlation was negative, meaning that those branches' share increased in manufacturing value added, which had decreasing labour cost intensity relative to the EU. Or put it the other way: branches that became more labour intensive in comparison with the EU lost weight in the production of value added.

CONCLUSIONS

(1) Hungarian manufacturing industry underwent fundamental changes during the 1990s and early 2000s. Structural change was more vigorous than in developed EU countries. The process had two major components, which only partly overlapped in time: a strong contraction process which was especially important during the twin transition crisis years (1992–3 and 1995–6). The establishment of new capacities was the other main element of structural change. This process speeded up especially after 1997 when large scale foreign investments started operation.

(2) The process did not show strong linkages with the growth pattern of the economy. Contrary to the common hypothesis structural change seemed to be less turbulent during the years of high growth, and showed higher intensity in recession periods. Also, the high rate of restructuring remained until the end of the period. This means that changes were fuelled by several factors, only one of which was the reorganization of the economy after the twin crisis.

(3) Most stable growing sectors were the ones that supplied the domestic markets. The expansion of living standards and consumption provided very good opportunities for many branches producing consumer goods. On the other hand, despite of huge foreign investments, the share of export-oriented manufacturing industries grew only in few cases, in parts of the electronics and automotive industry. But there was no fundamental shift into these industries. In other cases branches' shares in production or employment might

even decline despite of important foreign investments. This happened when, for example, domestic companies further contracted, or when foreign companies gave up certain activities in order to concentrate production on just few products.

(4) Out of the three main indicators of structural change value added provided the most important information, employment and sales were less useful.

(5) The shift share analysis of productivity change proved that productivity increased also in Hungary mainly through "within growth", that is improvements achieved within given industries, and not primarily through shifting towards more productive branches. Sectoral change influenced the process to some extent negatively, since specialization increased in those industries which had less than average productivity gain potential (negative dynamic shift effect). This may be because fastest growing Hungarian industries have achieved an already very high level of productivity, but also because fastest growing industries are such that do not provide much opportunity for productivity gains.

(6) The calculations could provide some evidence on existing economic rationale behind structural change. Branches with higher level of cash flow and profits tended to grow faster than others.

(7) In the observed period competitiveness did not influence the size of branches (measured by sales turnover or employment). But it did influence the value added content of the branches. This means that there was less statistically captured change among sectors during the period 1998–2003. The essence of the changes was rather the quicker increase of value added in certain branches. This finding corroborates with earlier empirical experiences.

(8) The fit of correlation was increased when groups of branches were separated according to their specialization and ownership pattern. The basic divide among firms concerning profitability and growth potential was their market orientation: domestic market oriented firms had the better chances to grow.

* * * * *

APPENDIX

Rankings generated using supply and demand composite competitiveness indicators

	Supply rank	Demand rank		Supply rank	Demand rank		Supply rank	Demand rank		Supply rank	Demand rank
151	39	75	203	57	18	267	86	3	316	1	39
152	83	89	204	79	40	268	51	47	321	90	83
153	65	67	205	34	62	271	58	59	322	53	5
154	87	88	211	70	8	272	9	45	323	18	86
155	49	77	212	36	79	273	26	87	331	48	30
156	55	76	221	60	55	274	12	28	332	45	23
157	84	81	222	73	63	281	7	26	334	27	16
158	55	66	232	88	25	282	61	14	335	41	70
159	46	46	241	39	34	283	85	22	341	33	2
171	53	80	242	30	72	286	50	33	342	10	35
172	70	57	243	21	65	287	68	60	343	6	1
174	24	90	244	44	74	291	32	32	351	89	20
175	52	71	245	36	37	292	27	49	352	43	9
176	69	58	246	65	61	293	24	36	353	27	50
177	21	69	247	59	41	294	11	10	354	21	64
181	77	13	251	75	31	295	20	12	355	72	85
182	34	84	252	64	42	296	16	27	361	31	38
183	63	52	261	13	51	297	46	24	362	15	78
191	75	82	262	80	15	311	74	7	363	5	11
192	91	91	263	16	68	312	4	4	364	7	19
193	61	73	264	14	53	313	3	6	365	2	44
201	82	56	265	80	43	314	78	29	366	67	48
202	41	54	266	19	21	315	38	17			

WP3

Methodology for calculations of new Composite Competitiveness measures and ranks (supply side and demand side), and for structural indicators.

Necessary basic data (home country data by industry [3-digit-level] if otherwise not indicated):

Total sales of domestic producers: **S**
Total import: **IM**
Total export: **EX**
Total sales of EU: **Se**
Total import of EU: **IMe**
Total export of EU: **EXe**
Home country export to EU: **EXte**
Labour cost (total): **LC**
Labour cost (total) in the EU: **LCe**
Investment: **I**
Amount of wages and salaries (without social contribution): **W**

Employment: **L**
Amount of wages and salaries int he EU (without social contribution): **We**
Employment int he EU: **Le**
Value added: **VA**

Not compulsory:
*Jobs lost: **JL***
*Joibs created: **JC***

Supply side composite ranking:

We decided to compose four indicators:

1. Average growth rate of market share(s)

Domestic demand = **DD** = S-EX+IM
Market share on domestic market = **MS** = (S-EX)/DD
EU demand = **DDe** = Se-EXe+IMe
Market share on EU market = **MSe** = EXte/DDe

Yearly change is calculated as (in our example for 1999):

$$YC_{99} = \frac{MS_{99} - MS_{98}}{MS_{98}} * \frac{S_{99} - EX_{99}}{S_{99} - EX_{99} + EXte_{99}} + \frac{MSe_{99} - MSe_{98}}{MSe_{98}} * \frac{EXte_{99}}{S_{99} - EX_{99} + EXte_{99}}$$

If we have our yearly changes, we have to find the X which minimize the next expression:

$$(X-(YC_1+1))^2+(X^2-(YC_1+1)*(YC_2+1))^2+\ldots+(X^n-(YC_1+1)*\ldots*(YC_n+1))^2$$

where YC_1 is the first yearly change we have, and certainly YC_n is the last. Excel can produce this X, using the logaritmic fitting function. The name of the function is maybe different (i do not have the English version of the Excel)). Thus (X-1)*100 will be a kind of average growth rate (in percentage points) of market share of the given industry. Using X, we can have a ranking of our industries. Industry with the highest X will gain the rank 1.

2. Labour cost/sales relative to EU

Yearly change is calculated as (in our example for 1999):

$$YC_{99} = \frac{\frac{LC_{99}/S_{99}}{LCe_{99}/Se_{99}} - \frac{LC_{98}/S_{98}}{LCe_{98}/Se_{98}}}{\frac{LC_{98}/S_{98}}{LCe_{98}/S_{98}}}$$

If we have our yearly changes, we have to find the X which minimize the next expression:

$$(X-(YC_1+1))^2+(X^2-(YC_1+1)*(YC_2+1))^2+\ldots+(X^n-(YC_1+1)*\ldots*(YC_n+1))^2$$

where YC_1 is the first yearly change we have, and certainly YC_n is the last.

Thus (X-1)*100 will be a kind of average growth rate (in percentage points) of labour cost/sales relative to EU of the given industry. Using X, we can have a ranking of our industries. Industry with the lowest X will gain the rank 1.

3. Relative wage level relative to the EU

$$\text{Relative wage level} = \mathbf{RWL} = \frac{W/L}{\Sigma W/\Sigma L}$$

where Σ means sum of all industries value. The same indicator for the EU is **RWLe**.

$$\mathbf{YC_{99}} = \frac{RWL_{98}}{RWLe_{98}}$$

During our consultation the Hungarian team decided to use this simple indicator instead of that mentioned in the previous version of the description of methodology, because we believe this is more closely related to structural changes. If we have our yearly changes, we have to find the X which minimize the next expression:

$$(X-(YC_1+1))^2+(X^2-(YC_1+1)*(YC_2+1))^2+\ldots+(X^n-(YC_1+1)*\ldots*(YC_n+1))^2$$

where YC_1 is the first yearly change we have, and certainly YC_n is the last.

Thus (X-1)*100 will be a kind of relative wage level relative to EU of the given industry. Using X, we can have a ranking of our industries. The industry with the highest X will gain the rank 1. X-1 is the slope again.

4. Investment/sales (RI)

$$RI = \Sigma I/\Sigma S$$

where Σ means sum of yearly (investment or sales) figures for the whole period.

The industry with the highest RI will gain the rank 1.

The composite ranking:

For our WP3 work, we needed a composite rank indicator. Using our just calculated four ranks we can have a composite rank of supply side performance/competitiveness, which can be calculated as follows:

For every industry we have four ranks, which mean four value between 1 and about 100 (it depends on how many industry in the individual country we can count). If we find (separately for every industry) Y which minimize the value of the next expression, using the value of Y for the different industries we can have our final ranking. The industry with the highest Y will gain the rank 1. The expression is:

$$(Y-R_1)^2+(Y-R_2)^2+(Y-R_3)^2+(Y-R_4)^2$$

where R_i is the ranking created using by the i^{th} indicator we described above.

Demand side composite ranking:

Growth rate of demand will be calculated as a composite of domestic demand growth and EU demand growth, where the weights are similar that of indicator one of the supply side indicator, namely the importance of the given market for the given industry in the given year.

$$YC_{99} = \frac{DD_{99} - DD_{98}}{DD_{98}} * \frac{S_{99} - EX_{99}}{S_{99} - EX_{99} + EXte_{99}} + \frac{DDe_{99} - DDe_{98}}{DDe_{98}} * \frac{EXte_{99}}{S_{99} - EX_{99} + EXte_{99}}$$

If we have our yearly changes, we have to find the X which minimize the next expression:

$$(X-(YC_1+1))^2+(X^2-(YC_1+1)*(YC_2+1))^2+\ldots+(X^n-(YC_1+1)*\ldots*(YC_n+1))^2$$

where YC_1 is the first yearly change we have, and certainly YC_n is the last.

Thus (X-1)*100 will be a kind of average growth rate of the demand for the products of the given industry. Using X, we can have a ranking of our industries. The industry with the highest X will gain the rank 1.

Structural indicators:

We decided to use 2 or 3 structural indicators:

1. Share in employment:

$$YC_{99}=\frac{L_{99}/\Sigma L_{99} - L_{98}/\Sigma L_{98}}{L_{98}/\Sigma L_{98}}$$

where ΣL is the total employment in manufacturing.

If we have our yearly changes, we have to find the X which minimize the next expression:

$$(X-(YC_1+1))^2+(X^2-(YC_1+1)*(YC_2+1))^2+\ldots+(X^n-(YC_1+1)*\ldots*(YC_n+1))^2$$

where YC_1 is the first yearly change we have, and certainly YC_n is the last.

Thus (X-1)*100 will be the average growth of weight (in percentage points) of the given industry in the total employment in manufacturing. Using X, we can have a ranking of our industries. The industry with the highest X will gain the rank 1.

2. Share in Value Added:

$$YC_{99}=\frac{VA_{99}/\Sigma VA_{99} - VA_{98}/\Sigma VA_{98}}{VA_{98}/\Sigma VA_{98}}$$

where ΣVA is the total value added in manufacturing.

If we have our yearly changes, we have to find the X which minimize the next expression:

$$(X-(YC_1+1))^2+(X^2-(YC_1+1)*(YC_2+1))^2+\ldots+(X^n-(YC_1+1)*\ldots*(YC_n+1))^2$$

where YC_1 is the first yearly change we have, and certainly YC_n is the last.

Thus (X-1)*100 will be the average growth (in percentage points) of weight of the given industry in the total value added in manufacturing. Using X, we can have a ranking of our industries. The industry with the highest X will gain the rank 1. X-1 is the slope again.

3. Jobs lost – jobs created

This is a special indicator, which not necessarily can be calculated in every country. In the hungarian case, as we have firm-level data, we can separate the firms which increased the number of employed persons, and the ones which decreased it. So we can have a sum of jobs lost and jobs created. Certainly it is not a perfect measure, but this is the best we can have.
Using this data we can calculate an indicator of fluctuation of employment (**FE**):

$$FE = (JL+JC)/L$$

$$\text{Relative fluctuation of employment} = \mathbf{RFE} = \frac{\frac{JL+JC}{L}}{\frac{\Sigma JL+\Sigma JC}{\Sigma L}}$$

where Σ again means summing the values of all industry.

Regarding this indicator we have to decide what form of it we want to use to generate a ranking. We can calculate the yearly change, or we can have a periodic sum. **I propose** to use yearly changes, which can be explained as the trend toward stabilization of employment of the given industry. Yearly changes and ranking can be calculated again as:

$$YC_{99}=(RFE_{99}-RFE_{98})/RFE_{98}$$

If we have our yearly changes, we have to find the X which minimize the next expression:

$$(X-(YC_1+1))^2+(X^2-(YC_1+1)*(YC_2+1))^2+\ldots+(X^n-(YC_1+1)*\ldots*(YC_n+1))^2$$

where YC_1 is the first yearly change we have, and certainly YC_n is the last.

Thus (X-1)*100 will be the average pace toward stabilization of its employment portfolio of the given industry. Using X, we can have a ranking of our industries. The industry with the highest X will gain the rank 1.

REFERENCES

Aiginger, K. (2000): *Speed of Change and Growth of Manufacturing*. Cited by Marczewski and Szczygielski (2005)

Borsi, B. – Molnár P. – Papaneg G. – Viszt E. (1998): *Structural Changes in the Hungarian Foreign Trade and Industry between 1993 and 1997*. GKI Economic Research Co. Budapest, November 1998.

Barriers to Entry and Growth of New Firms in Early Transition. A Comparative Study of Poland, Hungary, Czech Republic, Albania and Lithuania. Edited by Iraj Hoshi, Ewa Balcerowicz, Leszek Balcerowicz. Kluwer Academic Publishers, Boston/Dordrecht/London, 2002.

Ewa Balcerowicz, Iraj Hoshi, Jan Mladek, Tamás Novák, Alison Sinclair, Miklós Szanyi (1998): 'Downsizing as an Exit Mechanism: Comparing the Czech Republic, Hungary and Poland'. In: Leszek Balcerowicz, Cheryl W. Gray and Iraj Hoshi (eds.): *Enterprise Exit Processes in Transition Economies*. Central European University Press, Budapest.

Éltető, A. (1999): A külföldi működőtőke hatása a külkereskedelemre négy kis közép-európai országban (The Impact of FDI on Foreign Trade of Four Small Central European Countries). *Közgazdasági Szemle*, Vol. 46, No. 1, pp. 66–80.

Fagerberg, J. (1999): *Specialization and Growth: World Manufacturing Productivity 1973–1990*. mimeo

Gacs, J. (2003): 'Structural Change and Catching Up: the Experience of the Ten Candidate Countries'. In: Noltie, H. J. (ed.): *Economic Convergence and Divergence in Europe*. Edward Elgar, Cheltenham.

Grosfeld I. – Roland G. (1996): Defensive and Strategic Restructuring in Central European Enterprises. *Journal of Transforming Economies and Societies,* 3(4):21-46.

Hunya, G. (2002): *Recent Impacts of Foreign Direct Investment on Growth and Restructuring in Central European Transition Countries*. WIIW Research Reports, No. 284, May 2002

Marczewski, K. – Szczygielski, K. (2005): *Process of Structural Change in Polish Manufacturing between 1995–2003: Characteristics and Factors*. mimeo

Peneder, M. (2002), *Structural Change and Aggregate Growth*. WIFO Working Paper No. 182, Austrian Institute of Economic Research, Vienna.

Savona, M. (2004): *Structural Change and Macro-economic Performance: the Structural Bonus Hypothesis in Services*. mimeo.

Szanyi M. (1999): 'The Role of FDI in Restructuring and Modernization: an Overview of Literature'. In: G. Hunya (ed.): *Integration through Foreign Direct Investment – Making Central Europe Competitive* (Cheltenham: Edward Elgar, 1999), pp. 50–80.

Wyznikiewicz, B. (1987): *Zmiany Strukturalne w Gospodarce. Rawidlowosci I Organiczenia*, Warszawa, PWE. Cited by Marczewski and Szczygielski (2005).

Wziątek – Kubiak A. (2003): *Critical Synthesis, Review of the Main Findings, Methodologies and Current Thought on Competitiveness of Accession Countries. Mapping of Competence.* mimeo