COMPARISON OF THE PRODUCTIVITY LEVELS OF AUSTRIAN AND HUNGARIAN INDUSTRY: METHODS AND RESULTS

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Cooperation between the Austrian and Hungarian central statistical offices in the field of industrial productivity has a history of two decades. The first comparison, carried out in 1965, was partly experimental in objective and nature. The second full scale survey took place a decade later in 1975. This was followed by a further study of about two years duration of the level of productivity and the factors influencing it in three sectors: food, metallurgy and engineering. For this study the three sectors were broken down into 31 sub-branches and nearly 400 product groups. An important and labour-intensive element of the comparisons was harmonization of the sector and product classification system; UN recommendations were increasingly helpful for this work, and relying upon them will be expedient also in the future.

In the decade under review the productivity advantage of Austrian industry increased, from about 40 percent in 1965 to an average 75 percent in 1975. The dispersion of sectoral productivity indices around the average value was significant in both years.

The similarity of the 1965 and 1975 comparisons offered an exceptional opportunity to examine the reliability of extrapolation. The investigations unambiguously demonstrated that extrapolation did not give reliable results for a period as long as ten years, primarily because of structural changes in production and changes in price weights.

The most important conclusion to be drawn from the investigation of the three selected branches is its extraordinary usefulness from the economic, political and methodological points of view. A further important conclusion is that the method of comparison must be selected in the light of an extensive consideration of the output and technological structure of the branches.

International comparisons have formed an integral part of the long run programme of Hungarian industrial statistics since the early 1960s. These activities have developed in two different directions.

1. On the basis of published data, comparisons covering a wide range of countries were made, with the fundamental objectives of observing the level of economic and technical development and the extent of division of labour of Hungarian industry relative to international experience; examining the adjustment of trends and rates of increase to international developments; and finally exploring where we are in the transformation of our obsolete economic structure inherited from the past. But because of the rather different content of the published data, the results of these comparisons served only as indicators of order of magnitude. They offered no satisfactory basis either for exploring deeper economic interrelations or for elaborating economic policy measures.

2. Industrial productivity comparisons based on cooperation with partner countries, both methodologically and analytically more reliable and useful, were evolved in the early 1960s. These studies were usually called productivity comparisons, but they covered a far wider scope of information. In addition to the volume of production and labour input and their rates of change, the bilateral comparisons also in each case investigated the factors behind the differences. The first comparisons, essentially of an experimental nature, were carried out

in cooperation with Czechoslovakia; this was followed by comparisons with Austria and Yugoslavia, and later a quadrilateral comparison of an experimental character with Austria, Czechoslovakia, and France.[1] This paper considers exclusively the comparisons between Austria and Hungary.

The cooperation between the central statistical offices of Austria and Hungary in the field of industrial productivity comparisons covers nearly two decades. The first comparison was carried out on the basis of data for 1965, and was partly experimental in objective and nature. This experimental character was determined by several conditions. The most important was the divergent statistical data-gathering system of the two countries, and in addition, we had no usable experience regarding methods of approach. The international methodological recommendations needed for this work had not yet been completed, and the only possibility for comparison was bilateral. The results were used with certain corrections and additions for the quadrilateral international comparison already mentioned, with further elements provided by the comparisons of Czechoslovakia and France and of Czechoslovakia and Hungary. Despite the inevitable inaccuracies of investigations of this kind, the representatives of the two statistical offices were of the opinion that the indices of level derived from the Austrian-Hungarian comparisons approximated the actual differences in productivity level between the two countries relatively well.

In the early 1970s, international political and economic conditions offered good possibilities for a new Austrian–Hungarian comparison, better founded this time in both methods and programme. The work was carried out on the basis of data for 1975, applying methods that were in several respects more highly developed than those used for the previous study. The sectoral breakdown of industry followed the two-digit classification of ISIC (the United Nations International Standard Industrial Classification of All Economic Activities), and the analysis of functions also received greater emphasis. It was also possible to determine, on the basis of the results of the two comparisons and the productivity indices for the two countries, whether it is necessary to perform detailed calculations every ten years or whether extrapolation of the results for the earlier year was sufficient. Formulating the question in methodological terms, what reliability can be expected in extrapolating inter-spatial productivity indices for a ten-year interval? Besides the numerical results, the 1965 and 1975 comparisons also yielded considerable methodological experience, a part of which can be generalized to contribute to the enrichment of the methodology of international comparisons.

The comparison based on the two-digit level of the ISIC offered positive results utilizable in economic management and decision-making, but it gave but slight possibility for an exploration of differences in productivity level at greater depth. That would demand a finer sectoral breakdown and a significant widening and closer specification of the factors examined. This could hardly be done for the whole of industry, because of the extraordinarily high labour and time input

[1]The methods and results of this work are reported in the following publications: "Industrial Productivity Comparison Between Austria, Czechoslovakia, France and Hungary," Periodical Statistical Publications, Vol. 247, Hungarian Central Statistical Office, 26 April 1972 (in Hungarian), and Statistical Standards and Studies, Series M, No. 24, United Nations, 1971 (in English).

required. The detailed investigation program was therefore applied to three sectors only: the food, metallurgy, and engineering industries. The work was completed in May 1980, and the analysis and report on methodological experience were presented to the Conference of European Statisticians.

I. Methods Applied and Experiences Obtained in Their Use

The Measurement of Output and Input, and the Investigation of Productivity Factors

The basic method used for the Austrian–Hungarian productivity comparisons was that of individual output indices, which had proved to be successful in a number of binary international comparisons.[2] Productivity indices were defined as the quotient of output and labour input indices. The theoretical basis and practical application of the individual output index method is described in a UN recommendation published in 1973[3] and we will therefore not present it here. Rather, we content ourselves with the presentation of practical experience with some basic principles.[4]

In comparisons carried out by the individual output indices method, the index varies depending on the weights applied. In the Austrian–Hungarian comparisons, we applied gross weights, since unit prices (unit values) were available for both countries. We developed Laspeyres and Paasche type indices, using as weights first the price data of one country and then the price data of the other. Geometric averages were calculated for each comparison, and the interspatial Fisher type index was accepted as the basis for evaluation. We also made supplementary calculations in both 1965 and 1975, in which the individual output indices were weighted by the sum of wages and consumption of fixed capital in Hungary. In the majority of branches, however, these supplementary indices did not differ significantly from those weighted by unit prices.

For evaluating the performance of economic units by productivity level, two possible choices are theoretically available: net performance or gross performance, but the latter requires also taking into account all resources used up in producing the performance. Given the information available, however, it was necessary to use a still different method in practice. Gross production per unit of direct labour input was used as the basic indicator, and this was interpreted as an approximation of sector performance. Neither of the countries had available the net weights needed for a better reflection of sector performance difference. Nor was it possible to use the total input/gross output concepts, since the information needed to convert fixed asset inputs and material inputs to a common currency was not available. The results obtained with the individual output

[2]See Dr Vera Nyitrai, "Comparison of the Austrian and Hungarian Industry Level," *Statisztikai Szemle*, 1977, No. 8–9, pp 832–836.

[3]Methodological Problems of International Comparison of Levels of Labour Productivity in Industry," Statistical Standards and Studies, Series M, No. 21, United Nations, 1973.

[4]This subject is considered comprehensively, covering sectors other than industry and including international results, in I. B. Kravis, "Review of International Productivity Comparisons," *The Economic Journal*, March 1976.

indices method were interpreted as an approximation of net output indices, bearing in mind the limitations and inevitable distortions involved.

The UN recommendation referred to above specifies preferred methods of approximation for particular branches of industry. However, as far as we know, these recommendations were applied only once, in the Czechoslovakia–France comparison. The advantage of the method we used uniformly for all branches lies in the relatively simple elaboration of basic data and in the easier manageability of the algorithm.

Harmonization of the industry and product classification systems formed an important element of the Austrian–Hungarian comparison, partly because of the objective of obtaining a reliable index on the branch level, and partly because of the peculiarities of the individual output indices method. The classification framework for the 1965 comparison was created by examining the industrial classifications of the two countries. The basis for the 1976 comparison was ISIC. Despite its numerous advantages, the application of this international classification system was not free from problems. Because of the peculiarities of the two countries, we had to depart from ISIC in certain cases in order to harmonize the coverage of industrial activities. For this reason, the printing industry, instrument manufacture, bauxite mining and certain smaller activities were excluded from the comparisons. The branches included in the comparison covered about 93–95 percent of the labour input of Austrian and Hungarian industrial production.

The most crucial and also the most laborious part of the comparison, from the methodological point of view, was the selection and conceptual harmonization of the products representing the output of the individual branches. In 1975 we worked with 620 product groups, which significantly exceeded the number used in the previous comparison. The item-by-item harmonization of the content of product groups and the execution of the necessary corrections considerably increased the reliability of the results, and moreover offered a good review of the scope of activities and the conceptual peculiarities of the individual branches. The output of the branches covered by the comparison amounted to 75 percent of Austrian and 80 percent of Hungarian industry in 1975; the degree of representation was thus rather high in both countries.

In the process of harmonizing the product groups, an attempt was made to eliminate differences resulting from divergent organizational and technological factors and from the different degree of cooperation. This was particularly needed in the engineering industry, which is of heterogeneous product structure, and in certain branches of the chemical industry. Harmonization was achieved partly by broad range coverage of spare parts and semi-finished products, and to a lesser extent by using the gross-gross concept of output, which includes output used up as input within the same establishment. Another sensitive point in international comparisons is the treatment of quality differences, but the possibility of correcting for quality differences in the Austrian–Hungarian comparison was limited.

Since the degree of product representation was considerably higher than had been achieved so far in similar comparisons, non-comparable unique products caused relatively few problems and distortions. Production not represented

by products included was converted to the alternative currency through the use of average branch parity indices determined on the basis of products that were comparable. Gross sector production was defined as the aggregate of the production of individually specified product groups and the so-called "other" (non-comparable) production. This procedure implies the assumption that the productivity level of comparable and non-comparable activities differs to the same extent in the two countries. It can be expected that this assumption does not, in general, lead to great distortion of the results. But if the nature and labour demand of non-comparable activities differs fundamentally from the main (specified) activity, further investigation is needed. A decision on the proper corrections can only be made in the light of a study of each case. An example of this situation is to be found in the food industry, as will be pointed out later.

In 1965 labour input was measured by two indicators: the number of manual workers and the number of all employees. In 1975 this was not possible, since it was not always possible to separate the categories of workers and employees. Thus the comparison in 1975 used only a single indicator, the production level per employee.

The supplementary study after the 1975 comparison covering three sectors in more depth contained no new methodological elements. The far wider scope of productivity factors considered, however, brought with it a qualitative improvement in evaluating the results. The nature of the work is shown in the level of detail: for the three branches, 31 sub-branches and nearly 400 product groups were investigated. The narrower branches offered greater possibilities for a more varied and deeper investigation of the factors influencing productivity. Besides the general factors influencing all three branches, valuable and useful information was obtained on the specific factors reflecting sectoral technological peculiarities. The technical level and the level of mechanization were measured by general indicators. Of these, the following are of major importance:

- the value of machine investments per production unit in the past 10 years
- energy consumption per employee
- electric energy consumption per employee
- energy demand of production.

Specific factors were numerous in metallurgy and the food industry; most of them referred to raw material quality, up-to-dateness of the technology used, and the scale of production.

The report on the results of the special study was submitted to the Conference of European Statisticians in 1980. Later the full material was sent to the Statistical Offices of ECE member countries.

Extrapolation of Productivity Indices

The extrapolation of the results of international comparisons is of great significance from a practical point of view. Extrapolation of a result obtained from a well-founded information base involves far less time and labour input than the repetition of the whole program. The extrapolation of production indices is of particular interest in the Austrian–Hungarian comparisons, because only rarely are consecutive results based on a detailed programme available at ten

year intervals. The comparison of results obtained by extrapolation of national indices with those of the direct 1975 comparison, and the exploration of the possible reasons for the differences, may offer internationally useful information for the practical testing of the conditions under which extrapolation is appropriate.

The comparison of the 10-year extrapolation of the 1965 data with the level indices obtained from the 1975 comparison was impeded by differing classifications of branches in the two studies. The more detailed 1965 breakdown made it possible, however, to combine branches so that a classification similar to ISIC could be developed. The 1965 branch indices were extrapolated by branch inter-temporal indices calculated by national methods. It was not possible to eliminate the effects of some structural changes in the industries of the two countries.

The difference between the results calculated on the basis of the detailed comparison programme and on the basis of extrapolation is significant in industry as a whole and in the majority of the branches, as shown in Table 1.

The indices calculated by the two methods reflect nearly identical levels and trends in the more conventional and stable branches, representing about one-fourth of both Austrian and Hungarian industry, namely mining, manufacture of textiles, manufacture of wood and wood products, metallurgy, and electric energy, where the difference between the corresponding pairs of indices remains within 10 percent. The difference is significant in the branches with heterogeneous product structures that differed in the two countries, particularly the engineering and chemical industries. Comparison of productivity levels in these branches itself raises many difficult problems that can hardly be solved. The possibilities for extrapolation are decreased by the rapid technical change taking place in these branches, by the rapid widening of national and international cooperation, by the intensive change in product structure, and so on. A good example of the effects of structural differences is given by the manufacture of paper and paper products, where the fact that production of intermediate products (wood pulp, cellulose) doubled in Austria whereas in Hungary it increased by only 50 percent played an important role in the diverging results. This difference in the rate of increase is only slightly reflected in the intertemporal indices used as the basis for extrapolation.

The difference between the productivity indices calculated by the two methods is even greater than the difference in the production indices, owing to differences in the change in labour inputs. This change can significantly modify labour demand, which is reflected in our calculations as a change in productivity. Moreover, certain kinds of activity such as marketing, service-network, packing, etc., can grow significantly. The demand for such secondary activities is increasing rapidly in less developed countries, and because of their high labour intensity the differences in productivity level between developed and less developed countries are increased by the growth of such activities. Long run comparability is also hampered by differences in the price structure and its changes, and last but not least by the peculiarities in the calculation of national production indices.

On the basis of the significant differences in the results, and of a brief review of the reasons for the differences, it can safely be stated that the results of

TABLE 1

PRODUCTION AND PRODUCTIVITY LEVEL INDICES
CALCULATED BY THE EXTRAPOLATION METHOD AND ON THE BASIS OF THE 1975 COMPARISON:
AUSTRIA, HUNGARY = 100

ISIC Branch	Production Indices		Production Indices per Employee	
	By extrapolating the 1965 indices	On basis of 1975 comparison	By extrapolating the 1965 indices	On basis of 1975 comparison
	a	b	c	d
2. Mining	36.3	39.2	237.8	221.2
31. Manufacture of food, beverages and tobacco	44.9	52.1	108.1	146.4
321. Manufacture of textiles	73.0	60.7	158.9	151.2
322. Manufacture of wearing apparel	55.4	65.7	106.0	139.9
323+324. Manufacture of leather and fur products and footwear	41.5	32.8	154.4	136.2
33. Manufacture of wood and wood products	104.1	103.0	167.6	176.7
341. Manufacture of paper and paper products	250.4	292.2	148.2	203.0
35. Manufacture of chemicals and chemical products, oil refinery and coal processing, manufacture of rubber and synthetic products	62.9	97.9	111.0	153.8
36. Manufacture of non-ferrous minerals	77.5	116.7	166.6	208.7
37. Manufacture of metallurgical products	71.0	100.6	120.1	114.6
38. Metal working and engineering industry	67.1	91.8	133.4	190.2
41. Electric energy industry	134.2	124.4	146.0	135.5
Industry branches, total	67.6	84.7	136.3	174.7

international production and productivity comparisons cannot be extrapolated for periods as long as 10 years. Branches with a more homogeneous and stable product structure can be extrapolated with greater reliability, but even in this case ten years would seem to be rather long and questionable.

II. The Results of Comparisons Covering Industry as a Whole[5]

It is difficult to evaluate the performance of industry in the two countries solely on the basis of productivity indices and some supplementary factors, especially under present world economic conditions and for small countries where adaptability, competitiveness, the economic structure and the product structure are factors that are not reflected in production and productivity indices in the short run. This fact was taken into account in summarizing the results, and in the course of the evaluation we made an effort to consider the peculiarities and general development levels of the countries. Austria and Hungary are both small European countries. The size of their territories and their populations are of a similar order of magnitude. However, the level of economic development is higher in Austria.

The higher level of development of the Austrian economy appears in the sectoral composition of production. In Austria, the share of gross domestic product produced in industry was 31 percent and that of tertiary branches 37 percent in 1975. The greater importance of tertiary branches reflects the broader range of services, more developed energy and water supply, and a high degree of international tourism, closely connected to favourable natural conditions. In Hungary, 52 percent of gross domestic product was provided by industry, while the share of service branches amounted to 11 percent in 1975.

The share of the major economic branches in the two countries is so different that the discrepancies cannot be attributed to characteristics of methodology or the price system. The higher level of development of Austrian industry is also

TABLE 2

Branch Structure of Industry in 1975

Branch	Branch Value Added as a Percent of GDP	
	Austria	Hungary
Industry	31.3	51.8
Construction	9.9	8.4
Agriculture and sylviculture	5.2	16.2
Transport and telecommunication	5.4	4.7
Trade	11.5	7.5
Other branches	36.7	11.4
Total	100.0	100.0

[5]For detailed results see "Comparison of the Industrial Production and Productivity Level of Austria and Hungary," CSO Budapest, Periodical Statistical Publications, Vol. 404, 29 July 1977, distributed at the 1977 Plenary Session of the Conference of European Statisticians.

reflected in employment rates. On the basis of the number of active earners, the share of industry and agriculture in the early seventies was higher in Hungary, and that of services was higher in Austria.

Despite the differences in natural and economic conditions, industry is the leading branch of the economy in both countries, and its development was dynamic between 1965 and 1975; gross output increased in both countries at approximately the same yearly rate, 6.4–6.6 percent. In 1975, further progress was considerably influenced by the world economic crisis, the unfavourable effect of which was felt in the two countries at different points of time and to a different degree, and this also influenced the level ratios.

The branch structure of industry in the two countries reflects the differences in the level of development to a smaller extent, yet the effect of various natural conditions can easily be demonstrated. On the basis of production, the engineering industry is the largest branch in both countries (28–29 percent), and the chemical and metallurgical industries are important. Due to more favorable topographical and soil conditions, the share of the food industry is considerably higher in Hungary than in Austria.

The volume of industrial production in Austria in 1975 amounted to about 85 percent of Hungarian industrial production. Owing to more favourable natural conditions, Austria developed a paper industry nearly three times greater than Hungary's. The volume of production of metallurgy and the chemical and engineering industries is approximately the same in both countries, and the production of the Hungarian food industry is double that of Austria. The number of employees in Austrian industry is less than half (48.5 percent) of those employed in Hungarian industry, and there are significant differences by branch.

The ratios of indices of production and of number of employees determine the differences in the level of productivity. The productivity of Austrian industry was one and a half to two times higher in 1975 than that of Hungarian industry in the majority of branches, and Austrian industry as a whole exceeded the Hungarian productivity level by an average of 75 percent. The productivity of the Austrian paper industry, construction materials industry, and mining is over double that of Hungary. In four branches the Austrian advantage is between 50 and 90 percent. In a further five branches, including the food industry which is important for Hungary, the difference is more moderate, varying between 15 and 46 percent in 1975.

In 1965, the Austrian productivity level had exceeded that in Hungary by about 40 percent. The Austrian advantage was very high in mining (nearly double), and about 50 percent higher in engineering, electric energy, construction materials, and wood processing. Hungary had a higher productivity level in 1965 in the food industry and in the manufacture of wearing apparel.

Comparison of the productivity indices of the branches shows that the differences in branch structure between the countries increases Austria's advantage. This comes mainly from the fact that in Austria the shares of the paper industry, construction materials industry and electric energy industry (which have much higher productivity there) are higher, while in Hungary mining, with lower productivity, has a larger share.

TABLE 3

PRODUCTION PER EMPLOYEE IN AUSTRIA AS A PERCENTAGE OF HUNGARY

	1965	1975
Mining	295.5	221.2
Manufacture of food, beverages and tobacco	88.2	146.4
Manufacture of textiles	119.1	151.2
Manufacture of wearing apparel	93.6	139.9
Manufacture of leather and leather products and footware	121.2	136.2
Manufacture of wood and wood products and furniture	151.1	176.7
Manufacture of paper and paper products	128.7	203.0
Manufacture of chemicals and chemical products, rubber and synthetic products	121.4	153.8
Manufacture of non-metallic mineral products	147.0	208.7
Basic metal industries	130.0	114.6
Manufacture of fabricated metal products, machinery and equipment	150.1	190.2
Electricity and electric energy	152.9	135.5
Total, all industrial branches	138.1	174.7

The differences in level and rate of increase in productivity can only partly be accounted for by structural differences and differences in natural conditions. In the ten year period under review, the character of industrial development was also different in the two countries. Austrian industrial development was of an intensive character; the increase in production resulted from raising the technical level and improving organization and management. In Hungarian industry, extensive development dominated; investment was aimed at increasing working places, and the increase in employment in industry amounted to 14.3 percent in the period under review. Consequently, technical equipment increased more slowly relative to labour, and the pressure to rationalize management was less. This is apparent in the engineering and chemical industries, which are less influenced by natural conditions. In both cases, the lag of Hungarian industry behind Austrian increased between 1965 and 1975, in engineering from 50 to 90 percent and in the chemical industry from 21 to 54 percent. In addition, Austrian industrial policy in both these branches sought to exploit the advantages to be gained from international division of labour. In Austria, a large part of the engineering industry is mechanized assembly, and labour-intensive spare parts and component production is more and more done outside the country. In the chemical industry, the differences in the efficiency of direct labour can be explained by the different share of staff members engaged in auxiliary activities. In addition, the different shares of labour-intensive products in the two countries may also play a role.

The higher direct labour efficiency of Austrian industry is also apparent in the data on working hours performed. In 1975, the number of part-time workers was higher in Austria than it had been earlier, owing to the economic recession. They amounted to 2 percent of the total number of employed persons, while the comparable figure in Hungary was only 0.5 percent. Its effect was also manifested in the change in working hours per day. Taking a five-day working week as a basis, the average work day was 7.7 hours in Austrian industry and almost 9 hours in Hungarian industry.

III. Comparison of the Level of Productivity of the Food Industry, Metallurgy, and the Engineering Industry[6]

The previous sections discussed the results of the comparisons made in 1965 and 1975 for ISIC two-digit level branches. As has already been pointed out, these offered little possibility for study of productivity level differences and their causal factors in depth. The latter required a more detailed branch breakdown, at the four-digit level of ISIC, and an important widening of the scope and specification of factors investigated. The branches covered in this deeper comparison had a total share of over 50 percent of industrial production.

In the period between 1965 and 1975, the total share of the branches reviewed did not change significantly. On the basis of output, the share of metallurgy decreased and that of the engineering industry increased in both countries. On the basis of number of employed persons, the share of the branches was higher in both countries in 1975, except for Hungarian metallurgy.

1. *Manufacture of Food, Beverages and Tobacco*

On the basis of the detailed investigation, the productivity level of this branch as a whole was 20 percent higher in Austria than in Hungary in 1975. From a methodological point of view, there is a striking difference between productivity indices calculated in the more detailed examination of the food industry and that calculated at the two-digit level. That at the two-digit level showed an advantage in favour of Austria of 46 percent, while on the basis of the detailed data this advantage was only 20 percent. These differences are due to differences in treatment of non-industrial activity in the food industry (purchasing, retail trade, etc.). In Hungary, the ratio of non-industrial activity is 10 percent of labour input, whereas its production value is not more than 1–2 percent. In Austria, these activities are not classified in the food industry. The number of persons employed in the non-industrial activities of the food industry in Hungary amounted to almost 25 percent of the total number of persons

TABLE 4

Share of the Branches under Review in Total Industry, 1975
(Percentages of Output and Number of Employees, Industry = 100)

ISIC Number and Branch	Output		Number of Persons Employed	
	Austria	Hungary	Austria	Hungary
31. Manufacture of food, beverages and tobacco	13.4	19.3	9.0	12.2
37. Manufacture of metallurgical products	9.1	9.1	10.4	5.7
38. Manufacture of fabricated metal products, machinery and equipment	27.6	28.7	34.1	34.4
Total, specified branches	50.1	57.1	53.5	52.3

[6]The results are published in "Productivity Comparison in Food, Metallurgy and Engineering Industries between Austria and Hungary," CSO, Budapest, Periodical Statistical Publications, Vol. 472. 15 September 1980, distributed at the 1977 Plenary Session of the Conference of European Statisticians.

employed in the Austrian food industry. It therefore seems appropriate to exclude these activities from the comparison. At the same time, these conclusions show convincingly the need for thorough attention to the classification.

The basic task of the Hungarian food industry is the satisfaction of domestic demand. Because of insufficient processing capacity, the manufacture of products of lower processing level demanding much handwork predominated in 1975. In Austria, more valuable products embodying a higher level of processing and more mechanization are manufactured. It is typical that electric energy consumption per employee in Austria was almost double that in Hungary. Among the major sub-branches, the greatest advantage in favour of Austria was found in the sugar industry and in the canning and preserving of fruits and vegetables, while Hungary has a higher productivity level in the meat industry. The detailed results are shown in Table 5.

TABLE 5

GROUPING OF THE SUB-BRANCHES OF THE FOOD INDUSTRY ON THE BASIS OF PRODUCTIVITY LEVELS

ISIC code	Branch	Productivity Index for Austria (Hungary = 100)	Percent Share of Sub-Branch in Total Production of Branch	
			Austria	Hungary
Index over 300				
3118	Sugar factories and refineries	352.1	7.0	2.7
3113	Canning and preserving of fruits and vegetables	311.8	4.1	7.1
	Total		11.1	9.8
Index 150–190				
3119	Manufacture of cocoa, chocolate and sugar confectionery	187.4	4.9	2.0
3112	Manufacture of dairy products	179.0	10.2	10.8
3134	Soft drinks and carbonated waters industry	158.8	4.1	2.1
3116	Grain mill products	156.0	4.9	5.5
	Total		24.1	20.4
Index 110–130				
3140	Tobacco manufactures	121.9	5.5	1.9
3133	Malt liquors and malt	116.5	9.5	2.6
	Total		14.9	4.5
Index below 100				
3111	Slaughtering, preparing and preserving meat	90.5	17.1	42.5
3117	Manufacture of bakery products	89.8	8.0	5.9
3131, 3132	Production of wine, spirits and alcoholic beverages	80.0	4.5	2.8
3114, 3115, 3121, 3122	Manufacture of other food, beverages and tobacco	64.0	20.3	14.1
	Total		49.9	65.3
3100	Food, Beverages and Tobacco, Total	116.1	100.0	100.0

Austrian productivity in the sugar industry was 3.5 times the Hungarian level. One of the reasons for this was that in 1975–76 the sugar content of the beets used was 11.5 percent in Hungary, compared to 20 percent in Austria. In addition, the equipment of the Hungarian sugar industry is rather obsolete and its repair requires a relatively high number of staff. In Austria, the sugar industry was updated in the sixties, when new technology was introduced with a simultaneous rationalization and improved organization.

In the canning and preserving of fruits and vegetables, Austrian productivity was 3.1 times higher than Hungarian. The difference was partly due to much more intensive Austrian investment and the higher level of mechanization, and partly to the more flexible Austrian management of manpower. It is characteristic of the flexibility of the management of manpower that while in Hungary the average monthly number of staff in the "out of season" months was only 7 percent below the number employed in the high season, the fluctuation in staff reached 32 percent in Austria.

The meat industry, based on developed animal breeding, is a dominant sub-branch of the Hungarian food industry, its share reaching 42.5 percent in 1975 compared with 17.1 percent in Austria. The approximately 10 percent advantage in favour of Hungarian productivity can be attributed to several factors. Due to the lower level of mechanization of slaughtering activity, especially with respect to poultry, raw meat constituted a higher proportion of the value of total output in Hungary than in Austria.

2. *Manufacture of Metallurgical Products*

The productivity level of metallurgy was 15–18 percent higher in Austria than in Hungary in 1975. Within the branch, iron and steel basic industries play the major role in both countries; their production amounted to 87.1 percent in Austria and 78.8 percent in Hungary. The productivity of this sub-branch was 22 percent higher in Austria than in Hungary in 1975. The productivity of the sub-branch is determined by that of the three major stages of technology, raw iron manufacturing, steel, and rolled steel production.

In Austria the production of raw iron was 68.7 percent higher per working day, and 60.0 percent higher per employee, than in Hungary. The difference was mainly due to the considerably larger average size of Austrian blast furnaces (951 cubic metres, vs. 565 cubic meters). Consequently 30 percent less foundry coke per ton of raw iron was required in Austria than in Hungary.

The relative productivity of steel production varied by technical procedure. In the production of Martin steel the output per employee in Hungary exceeded that in Austria by 26.9 percent. Over 90 percent of Hungarian steel production was supplied by Martin furnaces, and their capacity significantly exceeded that of the equipment in Austria; of 25 Hungarian furnaces there were 21 of over 50-ton capacity, while in Austria only one of the 11 furnaces was over 50 tons. The operation of the Hungarian furnaces was improved by oxygen insufflation. In Austria, only 7.5 percent of steel was produced by the Martin technology.

The production of electro-steel was a similar share of steel output in both countries, 12 and 8 percent. However, about 40 percent of Austrian furnaces

exceed the capacity of 10 tons, while in Hungary only one of 39 furnaces had a similar capacity. This mainly accounted for the fact that the electro-steel production per employee in Austria exceeded that in Hungary by 33.7 percent.

Four-fifths of the steel in Austria was produced in LD converters in 1975, whereas this technology had not yet been introduced into Hungary. It is characteristic of the spreading of this modern technology that in 1975 converter-steel production in Austria was 2196 tons per person employed, which is 3.2 times more than that in the Hungarian Martin steel industry. As a result of the widespread application of LD converter technology, the *per capita* production of total steel in Austria exceeded the Hungarian level by 77.2 percent.

In the production of rolled steel the difference in productivity level was lower, 21.7 percent on a per person employed basis. The lag in Hungary is mainly due to obsolete rolling mills; nearly half of those operating at the end of 1975 (46.4 percent) were put into operation in 1940 or earlier. This is true of only 24.5 percent of the rolling mills in Austria. The frequent repair required by the old rolling mills entails a considerable labour surplus, leading to lower productivity.

The productivity of the two countries' non-ferrous metal basic industries was essentially the same, the advantage in favour of Austria being 3.6 percent. The Hungarian sub-branch attained a relatively high level of technology through a continuous development of the aluminum program based on considerable bauxite wealth and on international cooperation. The production of aluminum products, amounting to nearly 60 percent of the output of the sub-branch, has been continuously modernized from the beginning of the seventies. Significant new investment increased productivity. Between 1971 and 1975, the value per production unit of machinery put into operation was slightly higher in Austria. The majority of the Hungarian investments were, however, put into operation at the beginning of the period under review, so that their effect on productivity was felt to a greater extent in 1975.

3. *Manufacture of Fabricated Metal Products, Machinery and Equipment*

The manufacture of fabricated metal products, machinery and equipment is a leading branch in the industry of both countries. Its productivity was about 70–80 percent higher in Austria than in Hungary in 1975. The productivity differences in the branch as a whole and in most of its sub-branches were considerably influenced by the wide scale Austrian international cooperation in trade and production from the beginning of the seventies, which created suitable conditions for an increase in technical level and for changes in product structure favouring increased productivity. A further important factor is that the intra-branch cooperation in the engineering industry is much more developed in Austria than it is in Hungary. Nor should the influence of investment be neglected. Between 1971 and 1975, of the 17 sub-branches of the engineering industry under review there were at least 8 where the value of machinery put into operation related to production was at least 20 percent higher in Austria than in Hungary. Of these 8 sub-branches, the productivity level of 5 attained a level 2 to 3 times greater in Austria than in Hungary. The productivity level of the

major sub-branches of the engineering industry and its production conditions are outlined below. The detailed results are shown in Table 6.

The manufacture of iron and metal products is the largest sub-branch of the Austrian engineering industry, and the second largest in Hungary. In Austria, development was continuous and dynamic. Machinery put into operation per unit of output in the period between 1971 and 1975 in Austria exceeded that in Hungary by 65.8 percent. The technical level was less modern in Hungary in

TABLE 6

GROUPING OF THE SUB-BRANCHES OF THE ENGINEERING INDUSTRY ON THE BASIS OF PRODUCTIVITY LEVELS

ISIC Code	Branch	Productivity Index for Austria (Hungary = 100)	Percent Share of Sub-Branch in Total Production of Branch	
			Austria	Hungary
Index over 260				
3842	Manufacture of railroad equipment	297.5	2.7	1.8
3844	Manufacture of motorcycles and bicycles	281.7	2.1	0.6
	Total		4.8	2.4
Index 210–260				
3811, 3812, 3819	Manufacture of other metal and fabricated metal products	258.3	15.7	14.0
3821	Manufacture of engines and turbines	257.6	4.6	2.9
3832	Manufacture of radio, television and communication equipment and apparatus	243.7	11.0	10.6
3824, 3825	Manufacture of other industrial machinery	233.1	13.5	9.8
3829	Machinery and equipment except electrical, n.e.c.	228.8	4.4	3.2
3850	Manufacture of measuring and controlling equipment and optical goods	227.3	3.5	2.6
3813	Manufacture of structural metal products	210.3	9.3	3.7
3822	Manufacture of agricultural machinery and equipment	210.1	4.2	5.3
	Total		66.2	52.1
Index 130–170				
3833	Manufacture of electrical appliances and housewares	167.4	2.6	2.1
3839	Manufacture of electrical apparatus and supplies n.e.c.	153.4	9.4	11.3
3831	Manufacture of electrical industrial machinery and apparatus	150.4	6.6	4.9
3849	Manufacture of transport equipment n.e.c.	143.4	0.6	0.8
3823	Manufacture of metal and woodworking machinery	139.8	2.7	2.1
3841	Shipbuilding and repairing	139.5	0.3	1.2
	Total		22.2	22.4
Index below 100				
3843	Manufacture of motor vehicles	47.4	6.8	23.1
3800	Engineering industry, Total	164.0	100.0	100.0

1975, and the pace of development was much slower. The productivity level of the Austrian sub-branch is two and a half times as high as that of Hungary.

The manufacture of telecommunications products is one of the small number of engineering sub-branches in which investment per unit of output was higher in Hungary than in Austria in the period 1971 to 1975. In spite of the large volume of investment, however, the productivity level was 2.4 times as high in Austria as in Hungary. From the information available, it is probable that the ratio of less labour intensive assembling activity is larger in Austria. In Hungary, a large part of the structural elements of general telecommunications were produced within this sub-branch, and accounted for the large number of persons employed.

The production of machinery and equipment (machine tools) is the second largest sub-branch of the Austrian engineering industry, with significant technical traditions. In Hungary, however, the activity of the corresponding sub-branch was restricted mainly to the production of spare parts and auxiliary machinery for imported technology equipment, and this is a rather labour-intensive process. In total, the productivity level of the Austrian sub-branch is 2.3 times that of the Hungarian.

In the manufacture of household electrical apparatus and equipment, Austrian productivity was higher than Hungarian by approximately the same margin (67.4 percent) as the average for the engineering industry as a whole. In Hungary the productivity-increasing effect of larger production runs was significantly offset by the low level of cooperation. The enterprises producing finished products manufactured the majority of components themselves, which dispersed their capacity and lowered efficiency. This factor was probably also important in electrical engineering and in the manufacture of electrical machinery, appliances and supplies, where the productivity level was higher in Austria by approximately the same margin (50.4 and 53.4 percent), but this difference was somewhat smaller than the average for the branch as a whole.

The largest branch of the Hungarian engineering industry is the manufacture of transport equipment. This is the only sub-branch in which the productivity level in Hungary exceeded that in Austria; it was double in 1975. The Hungarian result was made possible by a central government program for the development of this sub-branch. Here, unlike the other sub-branches of the Hungarian engineering industry, wide scale international and domestic cooperation was achieved, and even before 1970 successful and important investments had been made. As a result, Hungary now has one of the largest autobus factories in Europe, and production in 1975 was nearly 50 times more than that in Austria. The development of autobus production also entails a significant growth in the production of engines and chassis. In engine production foreign licences were used. The production of chassis was limited to the manufacture of axle-housings.

IV. Conclusion

To sum up in a few paragraphs the experiences and results obtained in a decade and a half of study of the productivity level in Austria and Hungary would be a hopeless endeavour, especially since this paper is in itself a summary,

a selection of the most important points. In conclusion I would therefore like to call the attention of those working in similar fields to two circumstances.

1. As a result of the activity of international organizations, enough information is available for countries with developed statistics to make possible a relatively objective "judgement of their place in the world." Bilateral and multilateral comparisons, at least for industrial production, are urgently needed, in the first place in order to show the reasons and factors involved in the differences. Results that can also be used for economic policy will need deeper and many-sided analyses, covering the most important branches only. The methodological progress resulting from the activities of the international organizations create more and more favourable conditions for this.

2. In the branches where the international division of labour plays an important role, technical development is intensive and the change in product structure is rapid. Methods of comparison have to be selected in a way that can be separated from physical measures, and should contain a comparison of new value produced. We have in mind here first of all the engineering and chemical industries, which have a very different content in the various countries; in some cases it is difficult to discover any signs of similarity, and this tendency is further strengthened by the development of technology.