

LABOUR PRODUCTIVITY COMPARISON BETWEEN CZECHOSLOVAKIA AND FRANCE

BY JAROSLAV KUX, JACQUES MAIRESSE, AND LÁSZLÓ DRECHSLER

This paper reports on the results of the bilateral study of the comparison of levels of labor productivity in industry between Czechoslovakia and France in 28 branches of industry. Because of the importance of common studies of the questions of productivity of labor and its international comparison, the Economic Commission for Europe of the U.N. decided several years ago to introduce a concrete programme of work in this sphere. This study was made jointly by Czechoslovakia and France. The present paper reports on the first stage of the study, giving results based on physical unit methods. The second stage of the work includes comparisons for branches of industry not covered in this paper, on the basis of value indicator methods; detailed results will be published in respective U.N. series to the end of 1969 (Series Conf. Eur. Stats.).

The theoretical principles of possible ways of solving the problems of international comparisons of the levels of labour productivity are basically known, but the problems connected with such calculations in practice have limited the comparisons completed so far to a small number of studies. These studies are mostly of a research character, and generally have not hitherto become part of the regular statistical work of individual countries.

Because of the importance of common studies of the questions of productivity of labour and its international comparison, the Economic Commission for Europe of the U.N. decided several years ago to introduce a concrete programme of work in this sphere. After approval, and a preliminary examination of intertemporal productivity indices, the first steps were taken to organize the examination of questions of intercountry productivity indices, that is the comparison of the levels of labour productivity in different countries.

Under the auspices of the Conference of European Statisticians and the International Labour Office, Czechoslovakia and France decided to make jointly a comparison of levels of labour productivity in industry. The aim of the study was to measure the differences between the levels of labour productivity in the two countries and to carry out the necessary methodological work.

It was agreed that the comparison of levels of labour productivity was to be considered as a first step in a wider programme. The possibilities of making a joint analysis of the factors entering into productivity differences in an appropriate frame could be examined in the future.¹

Hitherto only the first stage of the whole study has been finished, giving results in 28 branches of industry based on physical unit methods. In the second stage of work, which was planned to be concluded in the beginning of 1969, comparisons will be made for the remaining branches on the basis of value indicator methods. Thus, an overall picture on the basis of differences in labour

¹The study has already begun, and is expected to be completed in 1970.

productivity in all branches of industry will be provided, with data extrapolated to 1967 (the calculations of the first stage refer for practical reasons to 1962 for the time being), and with the necessary analysis of the results.²

THE METHODOLOGICAL CONCEPT OF THE COMPARISON

The present productivity comparison is not the first undertaking in this field. Nevertheless both countries have tried to improve some aspects of the methods used in earlier studies, and consider it necessary to emphasize the experimental character of this work. In making international comparisons of such aggregates as industrial production or labour productivity, one encounters not only the problems which are common to most statistical studies (e.g. lack of sufficiently detailed data, gaps in coverage, etc.) but difficulties which are connected with the structural differences between the countries (many products produced only in one of the two countries, considerable quality differences between the same products of the two countries, substantial differences in relative prices in the two countries, organizational and conceptual differences in statistics, etc.). Therefore the reliability of the results of such international comparisons is only relative and they should be used with some caution. Nevertheless it is thought that even these results provide useful information on the pattern of the productivity differences between the two countries.

First it was necessary to choose the labour productivity concept which might serve as the basis reference for the different methods which could be used in practice. In other words the question arose which productivity indicator should be considered as the most appropriate one for international comparisons if the practical possibilities were unlimited. The answer to this question seemed to be important because it provided a means of judging the value of the different practical approaches in the light of their relation to the reference basis. The use of several indicators at the same time was also interesting of course to a certain extent from an analytical point of view.

As in several other labour productivity studies, it was considered that the most appropriate concept for international comparison was net output per unit of labour input. The term net is used here in its wider sense: both intermediate consumption and depreciation of fixed assets are deducted from the value of gross output. Thus the inter-spatial productivity comparison can be schematically described by the following formula (the first part of which is referred to hereafter as the inter-spatial Geary formula):

$$\frac{\sum q_A p - \sum q'_A p' - \sum q''_A p''}{\sum q_B p - \sum q'_B p' - \sum q''_B p''} \cdot \frac{\sum m_A}{\sum m_B}$$

where $q_A, q_B - q'_A, q'_B - q''_A, q''_B$ denote the quantities of output, of intermediate consumption and of depreciation of fixed assets in countries A and B respectively, m_A, m_B denote the quantities of labour input in countries A and B respectively, p, p', p'' denote prices and Σ denotes the summing of the categories distinguished in the various aggregates.

²The study has already begun, and is expected to be completed in 1970.

This formula only gives theoretical guidance for the comparison. In practice the inter-spatial Geary formula can seldom be used (for lack of data and other problems).

There are several possibilities of making approximations to the inter-spatial Geary formula. Each of them has short-comings which may distort the results of the comparison. Whether the distortions are important or not for a given industry depends on certain circumstances in the industry. The advantages and the shortcomings of a given approach are therefore not the same in different industries.

The above consideration leads to the conclusion that it is not worthwhile to follow a uniform method, to endeavour to use the same approximation in each of the industries. In the Czechoslovakia–France comparison different approximations were used in different industries in an endeavour to take into account the different circumstances (availability or lack of certain data, homogeneity or heterogeneity of the outputs or of the input/output ratios, etc.) of the particular industries in order to obtain the relatively most reliable indices. In fact in the majority of industries more than one approximation was (or will be) used. This provides more information not only from an analytical point of view, but also for checking the reliability of the particular indices.

It was decided to try to apply the following 4 main approximations:

- (A) value added method
- (B) gross output method
- (C) individual output indices method
- (D) individual productivity indices method.

In the first stage of work only the two last mentioned methods were applied, the first two being intended to be applied in the second stage of work.

It is not possible to give a full description of the two methods applied in this paper. Only the basic formula is introduced here: the reader is referred to the more detailed information in the original report of the comparison:³

Method C

Comparison on the basis of individual output indices (generally referred to as the “single indicator method”). Here the net output index is approximated by an average computed from the individual output indices. The formula is:

$$\frac{\sum q_B^n (q_A/q_B)}{\sum q_B^n} \cdot \frac{\sum m_A}{\sum m_B}$$

where q_B^n denotes the value of the net output or its substitute.

As substitutes for q_B^n two indicators were used—labour input, measured by the average of wage earners, and producer prices.

³See Conf. Eur. Stats/WG. 21/7, Bilateral Study on The Comparison of levels of Labour Productivity in Industry in Czechoslovakia and France, and Conf. Eur. Stas/WG. 21/7/Add 1, Annexes to the study.

Method D

Comparison on the basis of individual productivity indices. Here the productivity index for a given industry is determined as an average of the productivity indices for the individual commodities. The formula is:

$$\frac{\sum m_B[(q_A/m_A) \cdot (q_B/m_B)]}{\sum m_B}$$

NUMERICAL RESULTS OF THE COMPARISON

It was possible in the first stage of the Czechoslovakia–France comparison to apply methods C and D based on physical units in 28 branches of industry. It is thought that the reliability of the results which have been attained by these methods in most branches is relatively satisfactory in spite of the important differences in the structure of industrial production and in the organization of statistics between the two countries.

A shortcoming of the results attained is that in most cases it was not possible to take sufficient account of differences in the qualities and technical parameters of the products.

On the other hand, consultations with branch experts facilitated the task of finding the most reliable solution and/or the necessary adjustments to increase comparability. As a result it is considered that the productivity indices are sufficiently reliable in 18 branches, and sufficiently good in 8 branches to give at least a rough evaluation. The results are unacceptable only in the case of the leather and rubber industries, but an attempt will be made in the second phase of the work to obtain more reliable results for these two branches too.

In most branches several variants of the calculations have been made, for example, in simple physical and in converted units, on the basis of a more detailed and a less detailed breakdown of the data, etc. Except for a few cases it was possible generally after consultation with branch experts to select the variant which could be considered as most reliable.

For most of the branches several calculations were made for each variant; they differed in respect of: (i) whether method C or D was used, (ii) whether labour input data or prices were used as weights, and (iii) whether Czechoslovakian or French weights were used. In most cases the results of these calculations did not differ significantly. In the remaining cases one result was generally selected which was considered to be more reliable than the others.

The differences between the results of the different calculations could be interpreted as economic differences only in certain cases. Thus the differences between the indices compiled on the basis of French weights on the one hand and Czechoslovak weights on the other (i.e. the differences between the “Laspeyres” type and “Paasche” type indices) were connected with the extent of the structural differences within the given branch between the two countries. From this point of view, the geometric average of the two results was considered to be the most suitable measure of the productivity differences. Differences between the results according to whether labour input or prices were used as weights may be caused

by several factors (differences in the degree of utilisation of intermediate consumption and of fixed assets, price disproportions, etc.).

Different indices were also computed by using different types of labour input data as the denominator of the productivity indicator: (i) number of wage earners, (ii) number of persons employed, and (iii) hours of work performed. For the aggregate of the 28 branches compared there are only small differences among these types of indices. One can draw the conclusion from this that on the aggregate for the 28 branches there is no considerable difference with respect to the ratio of wage earners to number of persons employed. At the same time one can also conclude that there is no significant difference with respect to the ratio of hours of work performed to number of wage earners (which does not necessarily mean that length of the working week is the same in the two countries).

As a general conclusion one may say that in selecting the most reliable result preference was given in the majority of cases to method C, to weighting by labour input data, and to the use of the number of wage-earners as the denominator.

The main object of this article is to give a picture of the differences in labour productivity between the two countries in the branches compared. In general, it is not intended at the present stage to explain the reasons for these differences; however, in some cases the results obtained make it possible to draw some conclusions in this respect too.

THE RESULTS OF THE CZECHOSLOVAKIA-FRANCE COMPARISON

Branch of Industry	Labour Productivity in France = 100 (Data for 1962)
<i>Branches in which Czechoslovak productivity is higher:</i>	
Confectionery	120
Clothing industry	120
Grain mill and bakery products industry	120
Oils and fats industry	115
<i>Branches in which there are no significant productivity differences.</i>	
Sugar industry	110
Manufacture of bricks and tiles	105
Non-metallic mineral mining	100
Silk industry	100
Footwear industry	100
Beer industry	90
Knitting industry	90
<i>Branches in which productivity in France is higher to a moderate extent.</i>	
Wool industry	85
Non-alcoholic beverages industry	85
Paper industry	85
Tobacco industry	80
Cotton industry	80
Metallurgy	80
Cement industry	70
Manufacture of transport equipment	70
Gas manufacturing	70
<i>Branches in which productivity in France is higher to a great extent:</i>	
Milk industry	60
Manufacture of concrete products	50
Manufacture of wines and spirits	45
Electric energy	40
Iron ore and manganese mining	20

The overall index for the *confectionery* industry is affected by two broad components. In respect of chocolate and chocolate confectionery the productivity level seems to be lower in Czechoslovakia than in France (relatively low volume of chocolate production and a higher ratio of chocolate confectionery that is packed by hand in Czechoslovakia). In the case of non-chocolate confectionery, on the contrary, the productivity level seems to be considerably higher in Czechoslovakia (modern concentrated production).

In the *clothing* industry there are no significant differences between the results of the different calculations. However, it must be borne in mind that in this branch the influence of possible differences in the structure and relative labour requirements of the assortment may play a fairly considerable role. Thus the results obtained may not give a full picture of the real relations.

In the *grain mill and bakery products* industry seven products have been distinguished for which in both countries the relationships between the prices and the labour inputs per unit of production differ to a great extent. It was considered that using labour inputs as weights gives a much better approximation in this branch than using prices, and therefore preference was given to the index weighted by number of wage earners (120 per cent) than to that weighted by producer prices (90 per cent). The higher productivity level in Czechoslovakia in this branch is probably affected by a relatively considerable concentration of production (in general the industrial mills and bakeries are quite large).

As regards the *oils and fats* industry, in both countries the relative importance of oils measured in terms of labour input is substantially lower than when measured in terms of value; the contrary is the situation in respect of soap. This explains why the numerical results obtained on the basis of labour input and price weighting in method C are considerably different: 125 and 105 per cent respectively. One reason for these differences is the fact that in both countries the value of intermediate consumption (and possibly also that of the fixed assets used) is greater in respect of the production of oils than in respect of the production of soap. Another reason may be that there are probably certain disproportions in the prices. It seems therefore that the best approximation will probably be somewhere in between these two results. The productivity is higher in Czechoslovakia for all products distinguished in this branch; however, one should note that the results may be influenced by differences in the internal structure of the assortment. A likely factor in the higher level of labour productivity may be the greater degree of concentration in Czechoslovakia.

The results for the *sugar* industry have been calculated on the basis of separate data for the production of raw sugar and for its refining. The productivity level in this branch is evidently affected to great extent by the sugar content of the sugar beets in the given year; therefore, the results obtained may be used for a rough orientation and need not be characteristic of the relations of the productivity level in other years.

It has been possible to distinguish only two products in the branch of *non-metallic mineral mining*. Their relative importance is very different in the two countries; for this reason the differences between the numerical results are considerable: with price weighting 85, with Czechoslovak labour input weights 90, with French labour input weights 110. It is probable, too, that the contents

of the two products were not sufficiently specified. For this reason preference was given to the result obtained by using method D: 100 per cent. On the whole, it is believed that this result is acceptable.

The results for the branch of *silk manufacturing* are affected by several components. In the manufacture of woven fabrics the productivity level in Czechoslovakia seems to be slightly higher while it is lower by about 15 per cent in the production of fibres. At the same time in the manufacture of viscose (rayon) fibres the productivity level of both countries is substantially the same. In the manufacture of polyamide silk France disposed in 1962 of more efficient equipment and the productivity level was in that year evidently much higher than in Czechoslovakia; however, in view of the very small share of polyamide fibre in the total output of both countries in 1962, the difference in the level of productivity in respect of this product did not affect substantially the overall results in this branch.

In the *footwear* industry, if no internal breakdown is applied, the productivity level in Czechoslovakia attains only about 70 per cent of that in France. France, however, manufactures a substantially higher ratio of light footwear, and if this fact is taken into account, i.e. if a breakdown into more detailed groups is used, the productivity level in both countries seems to be the same. In spite of the corrections which were carried out, the result obtained is still affected to a certain degree by the different assortments of footwear produced.

In the *beer* industry the total production of beer per number of wage earners in Czechoslovakia is about 30 per cent higher than in France. This result is affected, however, by a high ratio of barrel beer in Czechoslovakia (60 per cent as compared with 15 per cent in France). If the two kinds of beer are treated separately in the computation, the relatively lower productivity in Czechoslovakia (90 per cent of the French level) is due, in the case of barrel beer, to a relatively high ratio of wooden barrels in Czechoslovakia (which have a good effect on the quality, but at the same time involve a greater labour requirement, owing to the necessary maintenance), and in the case of bottled beer to the low level of automation in the bottling of beer in 1962 (automation in Czechoslovakia being carried out at a later time).

In the *knitting* industry the results for the manufacture of socks and stockings seem to be reliable, showing a lower productivity (by about 25 per cent) in Czechoslovakia. The calculated results referring to the manufacture of knitted garments and underwear may be affected to a certain degree by the different structure and degree of elaborateness of the assortment; it seems, however, that two opposite tendencies appear in this group of products: a lower productivity level in Czechoslovakia in the knitting of fabrics and a higher productivity in the manufacture of machine-knitted ready-to-wear garments.

In the *tobacco* industry two kinds of indices were calculated. The first was based on simple physical units (index 90), and the second on converted units (index 70). The second variant is, theoretically, more correct, but it is very difficult to find a fully comparable type of product to serve as the equivalent. On the basis of detailed information it seems that the Czechoslovakia-France comparison did not succeed in this branch in ensuring a satisfactory comparability of the two kinds of cigarettes that were chosen as the equivalent units

(French cigarette Gauloises and the Czechoslovak cigarette Start). Therefore, the actual productivity difference probably lies somewhere between the two variants.

The calculation of the labour productivity indices in the *basic metal* industries were based on a number of products. In iron manufacturing Czechoslovak labour productivity is about two-thirds as high as the level in France, in steel manufacture it is about three-quarters as high and in rolling mill products it is about 10 per cent lower than in France. As regards rolling mill products, in 1962 the Czechoslovak assortment was less labour consuming than the French (especially owing to the lower ratio of cold rolled strip and sheets); if this is also taken into account the productivity difference between the two countries becomes greater for these products. The most substantial lag in Czechoslovakia occurs in the case of tube manufacturing (only about one-half of the level in France). However, Czechoslovakia produces mainly seamless tubes whereas France produces mainly welded tubes. The labour requirements for seamless tubes are about twice as great as those for welded tubes and if this is taken into account the Czechoslovak level of labour productivity in respect of these products attains about 80 per cent of that in France. On the other hand, more favourable results in Czechoslovakia are attained for the manufacture of castings (about 10 per cent better in Czechoslovakia); however, if one takes into account that in France steel castings account for one-third of this group, while in Czechoslovakia they only account for 20 to 25 per cent and that the elaborateness of steel castings is about 2.5 times as high as in respect of gray cast iron, one can conclude that the productivity level in the manufacture of castings is roughly the same in the two countries. The global result obtained may be affected by differences in the relative importance of ancillary plants (the different amounts of services rendered by these plants); nevertheless this result seems in principle to be relatively reliable.

In the branch of *means of transport* in spite of the fact that computation was based on a relatively detailed breakdown (e.g. lorries were broken down by tonnage, motor cars and motor cycles by cubic capacity), the total results obtained may only be regarded as a rough indication, since the productivity indices may be, to some extent, distorted by differences in the quality and technical parameters of products as well as by incomparabilities resulting from differences in the organization of production in the two countries (due to different ratios of co-operation and the unequal inclusion or exclusion of some ancillary plants).

The considerably lower level of labour productivity in Czechoslovakia in respect of the manufacture of *concrete products* is affected by the relatively high ratio of ancillary workshops and in some cases by old-fashioned types of equipment that were used in 1962. However, structural differences in the assortments manufactured in this branch, which were not successfully taken into account in the calculations, may have had an influence on the results obtained. Therefore the results obtained may only be regarded as providing very rough information.

The low productivity level in Czechoslovakia in the *electric energy* industry in 1962 seems to be affected to a great extent by relatively small installed capacities and their low degree of utilization, especially in the case of hydro-electric power plants.

The very substantial lag of Czechoslovakia in the branch of *iron and manganese ore mining* is due to relatively inefficient methods of extraction and obsolete mine equipment.

Three other branches compared (coal mining, leather, and rubber industries) were not classified into the above four groups of branches either because it was not possible to select one variant which could be considered more reliable than the other (coal mining), or because the results obtained were not sufficiently reliable (leather and rubber industries, as already noted).

In the case of *coal mining* six variants of the calculations have been computed which give rather different results, but which can be considered as equally reliable in providing answers to different questions. They are summed up in the table below:

INDICES OF LABOUR PRODUCTIVITY IN COAL MINING
France = 100

	Lignite Included	Lignite Excluded	
	Per Unit of All Wage Earners	Per Unit of Wage Earners Working Underground	
Simple physical units (tons)	220	105	90
Converted units (to 6,000 calories)	105	70	60

In Czechoslovakia lignite accounts for 75 per cent of the total output of the branch; in France, on the contrary, black coal accounts for nearly all of the total output. The productivity expressed in tons per wage earner is four times higher in Czechoslovakia for lignite than for black coal and this difference in the structure of production explains to a considerable extent the differences noted in productivity (in tons per worker).

For the purposes of aggregation (where only one result for coal mining can be used) it is intended to select the variant which is computed on the basis of the total production of coal (i.e. including lignite), all wage earners and in converted units (taking thus into account the differences in calorific value), that is the result which shows that Czechoslovak productivity is 5 per cent higher than that in France.

The calculation concerning the *leather* industry shows roughly a threefold higher productivity level in Czechoslovakia (in terms of physical units per wage earner). This result may be affected, to a certain degree, by a high degree of specialization of production and a high degree of concentration in Czechoslovakia (about two-thirds of the total production being concentrated in one establishment). However, apart from these objective factors the decisive influence is obviously the more fastidious processing and greater emphasis on quality in France, which the method applied could not take into account sufficiently. For these reasons the results obtained in this branch are considered as not acceptable and an attempt will be made in the next phase of the work to improve them.

The results showing a higher productivity level in Czechoslovakia in physical units as regards the *rubber* industry (index 140) also do not reflect sufficiently the difference in quality and the different kinds of products manufactured. In France mostly radial tyres are manufactured which provide greater security and have a longer service life but require a higher labour input. It is hoped that the influence of the different quality and types of products will be covered also in the second phase of the work on the basis of some correction coefficients, already agreed upon.

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The results which have been presented above did not provide a basis for making a trustworthy evaluation of the relative levels of labour productivity in Czechoslovakia and France for industry as a whole. The products included in the comparison represented about one-third of the total value of industrial production in each of the two countries. Important branches such as the engineering and chemical industries, a number of branches engaged in producing consumer goods, etc., were taken into account only in the second stage of the comparison.

The experience gained in the study showed that for such comparisons joint bilateral (respectively, multilateral) co-operation of countries provides a better basis for attaining more reliable results than those obtained by comparative studies carried out by one country on the basis of the published data that are available for the other country.⁴

⁴The complete study contains results in 39 branches of industry, representing about 70 per cent of the total industrial production in both countries. The aggregated results for industry as a whole show that the relative level of labour productivity in Czechoslovakia computed on the basis of output/wage earners attained in 1962 was 79-82 per cent of that of France. Since the growth of the labour productivity in the last five or six years was approximately the same in the two countries, the difference in the level of labour productivity did not change for all practical purposes. As already mentioned in the introductory words, the final results of the whole study will be published in respective official documentation to the end of 1969.