MEASURING
LABOUR
PRODUCTIVITY

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For tables on indices of labour productivity see Appendix 2.
Since it is often regarded as the most significant—and characteristic—index of the technical and economic efficiency of an undertaking, industry or country, productivity—including labour productivity—naturally bulks large in economic analysis and projection. But in order to gauge its effect on economic growth, anticipate its influence on employment or unemployment and ascertain the relationship between output, employment, wages and prices, it is essential to possess instruments for measuring it. Statistical data on the level of productivity and its variations in the past are used in many countries in preparing economic development plans and are likewise taken into account when guidelines for wage policies are laid down or changes made in plans for the allocation of national resources. The importance of accurate measurement of labour productivity is equally great at the plant level, where it is the key to higher efficiency and also has the effect of acting as a check on managerial performance.

It is not surprising therefore that growing interest should be taken in the measurement of productivity. This is illustrated by the many investigations carried out in recent years, both nationally and internationally, and by the steadily increasing number of countries that have begun to compile statistics on labour productivity or enlarge the scope of those already being collected. Canada, for example, began a comprehensive research programme in the early 1960s into various aspects of labour productivity. The first results showing the trend of labour productivity in the country as a whole and for certain major economic sectors were published in April 1965. [73] The United States, with long experience of the statistical measurement of productivity at different levels, has devised methods of making productivity projections by industry which can be used in estimating future levels of employment. [223; 226] In France priority was given at one stage to research designed to improve the definition and measurement of productivity and their relation to the other economic indices and factors. [35; 59] Special investigations were made into productivity in agriculture, building and public works and some of the service industries. [57; 136; 138; 140; 183]

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1 The numbers in brackets refer to the List of Bibliographical References at the end of this volume (Appendix 7).
In the USSR attempts have been made to work out methods of expressing the various types of actual labour input in standard abstract form and of converting labour and capital inputs into standard labour units. [195]

The developing countries are also beginning to recognise the importance of research into labour productivity, the low level of which is often an obstacle to further industrialisation. Evidence of this tendency is provided by the opening of national productivity centres in a number of Latin American and Asian countries. The centres are designed not only to promote higher productivity but also to encourage research into various aspects of productivity and ways and means of measuring it. For example, the Inter-American Productivity Association, consisting of national centres, held a first meeting of Latin American experts on productivity measurement in Buenos Aires in July 1965, which discussed the possibility of using a common method for the analysis and measurement of labour productivity.

The ILO itself has been concerned with labour productivity from the start because of the way in which it influenced the living and working conditions of the working class. But it was not until the Seventh International Conference of Labour Statisticians held in Geneva in 1949 that the problem of deciding which methods should be used to compile labour productivity statistics was tackled.

This Conference, basing itself on a report by the International Labour Office 1, examined the relevant concepts and definitions and reviewed all aspects of the measurement of labour productivity and the making of comparisons in time and space. However, it did not adopt any international standards but recommended that research should be continued. During the 1950s questions of methodology were not discussed by the International Labour Office, which confined itself to assembling material on productivity trends in individual countries or in manufacturing industries, and on various special aspects of the question. The results were published in the International Labour Review. [1; 2; 3; 7; 11; 16; 17; 21; 24; 25]

A number of questions concerned with productivity factors and the relationship between labour productivity and employment or wages were also examined at meetings of a number of ILO Industrial Committees 8 and by the International Labour Conference at its 33rd and 36th Sessions. [26]

Following the recommendations of the Industrial Committees and at the request of the United Nations European Conference of Statisticians, the Office resumed its research into productivity statistics and related problems of method-

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1 Methods of Labour Productivity Statistics, Studies and Reports, New Series, No. 18 (Geneva, 1951) (out of print).

8 For example, at sessions of the Coal Mines Committee [15]; the Metal Trades Committee [61]; the Building, Civil Engineering and Public Works Committee [5]; the Textiles Committee [14]; the Chemical Industries Committee [4]; and the Committee on Work on Plantations [13]; see also [10].
ology. It assembled information on national labour productivity statistics and made a survey of the methodological problems preventing their international comparability. The results of this research were embodied in two reports which were submitted to a working group which met in the summer of 1964 under the auspices of the International Labour Organisation and the European Conference of Statisticians. This research also led to the inclusion of a chapter on labour productivity indices in the Year Book of Labour Statistics from 1965 onwards.

Analysis of national productivity indices soon showed that many aspects, both theoretical and practical, called for further examination. Additional information was obtained from the appropriate national bodies, and with their valuable help, for which the ILO is greatly indebted, it became possible to clear up a number of problems.

Recent work by the United Nations in the field of productivity statistics has fallen under two headings: compiling data for industrial productivity statistics for the world as a whole and its main regions and having certain aspects of the question studied by its Economic and Regional Commissions.

The United Nations Economic Commission for Europe has based itself on the conclusions of a meeting on labour productivity problems held in Geneva in 1961, which concentrated on three main points: first, the measurement of labour input; second, the measurement of output; and third, the measurement of the other inputs. The discussions showed how necessary it still was at that time to carry out further methodological research in order to keep up with the progress being made in other branches of economics. Acting on the conclusions of this meeting, the Economic Commission for Europe tackled various methodological questions through its own industrial committees, and in the summer of 1964 convened a working group on productivity statistics in collaboration with the ILO. It also endeavoured to promote bilateral studies of comparative levels of productivity.

The Economic Commission for Latin America has sponsored a survey of industrial productivity in the isthmus of Central America, and is now making a similar survey for Mexico and the South American countries.

The ILO and the United Nations are by no means alone in their concern for improving the measurement of labour productivity. The 28th Session of the International Statistical Institute held in Rome in September 1953 had on its agenda an item dealing with the application of statistics to the study of productivity problems in industry, and a number of papers on the subject were

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1 Labour Productivity Statistics in European Countries (Conf. Eur. Stats./WG/21/3) and International Productivity Comparisons: A Brief Survey of Some Methodological and Statistical Considerations (Conf. Eur. Stats./WG/21/2; memorandum by Professor M. Frankel, consultant to the ILO) (mimeographed documents; out of print).
The European Productivity Agency of the Organisation for European Economic Co-operation—and later the Productivity Measurement Advisory Service of the Organisation for Economic Co-operation and Development—also helped to clarify productivity concepts and improve methods of measurement. A working party, of which the chairman was Professor J. Fourastié, prepared a first attempt at definition of these concepts, which was published in 1950. In 1954 an ad hoc panel of statisticians suggested that a manual on productivity measurement should be issued, but the European Productivity Agency had to abandon the idea because new concepts and methods were being developed so rapidly that it seemed premature to lay down any precise rules at that stage. Instead of this manual it issued a set of three volumes, prepared with the help of groups of experts from the member countries, covering various aspects of productivity. The first two, which appeared in 1955, dealt respectively with the significance of productivity measurement and the concepts underlying it, and with methods of measurement based on data collected at the enterprise level; a third volume published in 1966 contained the results of a survey of the member countries of the OECD on the availability and suitability of statistics for international comparisons at the industry level. Lastly, the Productivity Measurement Review for many years promoted the exchange of ideas and the discussion on both theoretical and practical aspects.

The High Authority of the European Coal and Steel Community has set up a working party to examine the whole question of the definition and measurement of productivity and to analyse its social significance as it affects the coal and steel industries.

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The purpose of this study, prepared by Mrs. Rosalie Ducournou of the Statistical Branch of the ILO, is to make a contribution to the development and improvement of national labour productivity statistics and to enhance their comparability. This has been attempted by means of a comprehensive survey of definitions, methods and other theoretical aspects, combined with detailed information on labour productivity indices, in the hope that this will help national agencies to improve their statistics in the light of other countries' experience. It is not concerned with the causes or effects of high or low productivity, but deals exclusively with statistical questions.

Part I examines the basic methods of calculation employed in measuring labour productivity and gives a brief account of the advantages and drawbacks of each. It likewise reviews a number of special problems encountered in the measurement of labour and tries to draw conclusions that may be of
assistance to countries in their own choice of measures. Part II contains a comparative analysis of national labour productivity statistics; it also deals with the question of their international comparability and makes a number of brief suggestions concerning ways and means of improving it. The theoretical problems and various recent attempts at international comparison of levels of labour productivity are examined in Part III.

Appendix 1 gives an account of the national series concerned with labour productivity. Details of national indices covering the period 1956-68 are also given in the appendices, together with extracts from or summaries of the international recommendations dealing with the compilation of statistics on employment, hours of work and output.
PART I

METHODOLOGY OF LABOUR PRODUCTIVITY STATISTICS
INTRODUCTORY NOTE

This part is mainly concerned with the theoretical aspects of the measurement of labour productivity. It attempts a brief outline, which in a study such as this is bound to be extremely synoptic and can make no claim to be complete. It draws heavily on one of the Office’s previous reports, *Methods of Labour Productivity Statistics*¹, and the paper by Professor Marvin Frankel.² As both of these sources are now out of print, it has been felt preferable to give quotations from them instead of references.

Chapter 1 reviews the various definitions of productivity, the factors of production and the relationship between them, and the difficulties encountered in expressing them in numerical form. Chapter 2 discusses a number of special problems encountered in measuring the labour input and the methods employed in various countries to overcome them. Chapter 3 analyses the different types of measurement employed, describes the methods used to calculate them in accordance with different definitions of output, and assesses the advantages and drawbacks of each of the main types of measurement. Chapter 4 deals with the criteria that should govern the choice of measurement and reviews the characteristics required by any generally applicable yardstick and the data that would be needed to put it into operation. Lastly, Chapter 5 draws attention to ways and means of improving the comparability of labour productivity statistics at the international level.

¹ Studies and Reports, New Series, No. 18.
² See Foreword, p. 3, footnote 1.
1. GENERAL DEFINITIONS OF PRODUCTIVITY

While "productivity" may simply mean "ability" to produce, it commonly implies a relationship between a source or means of producing and what is produced. This relationship is generally quantitative and therefore, in principle, measurable. The term is also, of course, applied loosely; indeed, it has been suggested that productivity has become for the masses an ill defined panacea for achieving the happiness of mankind, materially at least. [22, p. 1]

The broadest definition of productivity is the ratio between output and the total input of factors required to achieve it. In this sense, productivity is "the end result of a complex social process including: science, research and development, education, technology, management, production facilities, workers and labour organisations". [8]

Of course, it is not easy to measure such a huge complex in order to obtain what some writers have called "total factor productivity" and others "over-all productivity or efficiency". Virtually all, if not all, analyses seeking to measure productivity have confined themselves to partial—sometimes known as specific—productivity, expressed as the ratio between a given measure of output and a given measure of one or more production factors. It follows that there are many definitions, each of which fits one particular factor. Thus it is possible to speak of the productivity of labour, of capital, raw materials or of power, depending on whether output is related to the input of labour, capital, raw materials, power, etc. Often the definition varies in accordance with the level at which productivity is analysed, e.g. plant, industry, branch of the economy or the national economy as a whole.

Productivity can be calculated in either of two ways: as average productivity—which in turn can be obtained in two ways—and as marginal productivity, i.e. the change in output per additional unit of the production factor in question. Commonly, average productivity is meant and this is the theme of the present study.

For the calculation of average productivity for a group of products or a number of sectors of the economy, there is a choice between averaging the productivities of the different components and calculating an average reflecting the relative importance of each component in the group. In the second case, the productivity of the group will change—even if the individual productivities remain unchanged—whenever there is an alteration in the relationship between
the components. It may even rise when the individual productivities fall, if the workers or other resources are moved out of low-productivity into high-productivity industries.

Some authors consider that variations in productivity in the strict sense of the term can only be measured by means of an average calculated using the former method, and that an average calculated in accordance with the second principle only provides information on the efficiency of the allocation of resources. In point of fact, when an investigation is concerned with variations in the output of an industry or the cumulative effect of such variations in a whole group of industries, then the first type of average is normally used. The second type is generally employed in economic analysis for comparing "over-all changes in the ratio of manufacturing output to total manufacturing employment, or national output to total employment or total labour force". While theoretically it is not difficult to distinguish between these two sorts of averages, it is not easy to gauge their respective importance because the available statistics often relate to data reflecting the influence of both types of variations simultaneously and not always in the same proportions. For example, in Norway two-thirds of the increase in national productivity between 1938 and 1948 was due to more efficient distribution of manpower, while nearly 80 per cent of the rise between 1948 and 1953 was due to higher productivity within the economic sectors themselves. [45]

There are many factors affecting the level of productivity and its variations.

Productivity is a relative concept. This means that it occupies a central position among economic factors and greatly influences a number of them, but conversely it is also influenced by a number of other factors. Speaking very generally, these factors include the market, demand and the price ratio between wages and investments. . . . One can of course go on analysing these general conditions governing the growth of productivity and finding many other factors besides. But for the time being, the conclusion can be drawn that we are not dealing with unilateral relationships between productivity and the other economic factors, but with reciprocal relationships, and that the direction of the linkage may change with economic and historical circumstances of from country to country. [105, p. 14]

The first investigations into productivity carried out by government or private statisticians were concerned with labour productivity, and many more studies have been devoted to it since. It is perhaps because human labour is a universal key resource that labour productivity has remained the centre of interest, whatever research has been undertaken into the productivity of other production factors. It also helps to explain how the term "productivity" has often been—and still is—used to mean labour productivity. [163, para. 3]

It is true that—theoretically at least—most of the factors of production (equipment, raw materials, services) can be expressed in terms of labour input
on the basis of the working time that has been needed to produce them. Research on this subject has been done recently, particularly in the USSR.

Labour productivity is increasingly regarded as of major importance in general economic analysis. Together with population and output trends, it is used in economic growth models to forecast output and employment, as well as the distribution of manpower and other resources between different sectors of industry. It also serves as a basis for analysis of the relative dynamism of different economic activities.

Labour productivity is influenced by any factor which affects either output or employment. Many of these factors are related to general demographic, economic and social conditions; others reflect the individual characteristics of the management or operatives; yet others are the result of natural conditions. The factors can be classified in accordance with various criteria, e.g. by distinguishing between "objective" factors due to the plant or its equipment, the supply of goods or services, geographical situation or the point reached in the economic cycle, and "subjective" factors due to the management, workers' attitudes and working conditions generally. In some investigations the technological factors are separated from the economic and financial factors and the factors under the management's control from those dependent on government decisions.

It may be worth recalling at this point the main factors listed in an earlier ILO report to illustrate "the number and variety of the important factors influencing labour productivity":

**General Factors**

Climate.
Geographical distribution of raw materials.
Fiscal and credit policies.
General organisation of the labour market.
Proportion of the labour force to the total population, degree of unemployment, of labour shortage and of labour turnover.
Technical centres and information concerning new techniques.
Commercial organisation and size of market.
General scientific and technical research.
Variations in the composition of the output.
Influence of low-efficiency plants and their varying proportion in total output.

**Organisation and Technical Factors**

Degree of integration.
Percentage of capacity used.
Size and stability of production.
Quality of raw materials.
Adequate and even flow of materials.
Subdivision of operations.
Balancing of equipment.
Multiple machine systems.
Control devices.
Quality of output.
Rationalisation and standardisation of work and material.
Layout and location of the plant.
Maintenance and engineering services: safety, light, sound, ventilation, air conditioning, telephone, etc.
Availability, fitness and accessibility of tools.
Wear and tear of machines and tools.
Amount of machinery (or power) available per worker.
Proportion of maintenance labour to operating labour.
Length and distribution of working hours.
Selection of personnel.

**Human Factors**

Labour-management relations.
Social and psychological conditions of work.
Wage incentives.
Adaptability to, and liking for, the job.
Physical fatigue.
Composition (age, sex, skill and training) of the labour force.
Organisation of the spirit of emulation in production.
Trade union practices.

This study is concerned only with labour productivity, but the theoretical points it makes are also applicable to the other production factors.

Before going on to discuss the different types of measurement it may be helpful to emphasise one point they have in common.

The use of a labour productivity concept, or for that matter any other unit for measuring productivity, carries no necessary implications about the causes of productivity levels or changes. An increase in labour productivity, for example, may be attributable to a change in the skills of workers or in the intensity of worker effort. Or it may result from the use of more or better capital equipment, better-quality raw materials or improved organisation or management. Sometimes all of these factors may be operative.¹

¹ **Frankel**, op. cit.
2. PROBLEMS IN THE MEASUREMENT OF LABOUR

Since labour is the key element in the calculation of labour productivity, certain special problems in its measurement should be considered before examining the different measures used.

Labour has been defined as "effort—mental or physical—applied during a certain time". For measuring the labour input in production, the definition is confined to effort applied to an economic purpose, though the dividing line is not always clearly drawn and in the last analysis depends on the kind of statistics available. For example, the effort expended by the great majority of workers in travelling to and from their place of employment is not taken into account in calculating labour productivity unless this travelling time is actually reckoned as working time and paid accordingly, which is the case only in a handful of countries and in special circumstances.

In view of the marked differences in the intensity of effort, and particularly in its nature, it is hardly possible to measure it except in terms of the units of time or the human units involved. This explains why labour inputs for productivity purposes are estimated on the basis of hours of work, the total labour force or certain specified categories of workers.

HETEROGENEOUS NATURE OF LABOUR

But merely adding up the number of hours worked, for example, ignores the qualitative aspect, which may vary with age, sex, skill and the physical or mental abilities of each individual. Any of these qualitative aspects is, of course, liable to affect labour productivity. Differences in the age and sex structure of the population and the general standard of education and even of health or nutrition [8] are often responsible, at least to some extent, for differences in levels of labour productivity as between periods or countries. In a study of labour productivity in the United Kingdom and the United States, L. Rostas noted that if the sex composition of the active population had been identical in the two countries, the comparison over industry as a whole would have been less unfavourable to the United Kingdom, where the proportion of women in employment was higher than in the United States. He
drew this conclusion from the results he obtained by converting female labour into man-equivalents on the basis of the ratio between their respective wages. [179] This method has since been used by other countries and has likewise been of help in assessing the differences between the labour inputs of young workers and adults.

Recent research ¹; [144, pp. 192-238; pp. 218-224] has been aimed at finding yardsticks capable of measuring the quality of labour and gauging the effect of differences on productivity.

In its series for labour productivity over the national economy as a whole, France adds 0.3 per cent per year to its indices for hours of work outside agriculture to make allowance for changes in standards of skill.

Usually the quality of labour input is assumed to coincide with the skill level of the workers and is assessed on the basis of wage rates or scales. This method is somewhat arbitrary because it makes two assumptions: first, that there is a close correlation between qualifications and quality; and second, that wages do in fact reflect differences in the quality of labour. Another method is to adjust the data concerning the labour force to take account of vocational training, length of schooling or type of education, which would be wholly justified if the jobs performed by workers actually matched their qualifications.

The use of weights based on wages or qualifications assumes that different classes of labour are interchangeable. This is not, however, the case in everyday economic life—nobody would dream of asking the same services from a doctor as from a teacher of linguistics or of replacing a bricklayer by a secretary, although the length of training and level of earnings may in fact be comparable.

While it is perfectly legitimate to try to measure the influence of the composition of the labour force by sex, age and skill, the use of weights comes up against a difficulty.

Standards on which they might be based are lacking. The problem is inherently more difficult than the weighting problem in the case of output where choice is largely limited to a few basic and well-known measures and to current or base year weights. In the case of input weighting several plausible procedures may commend themselves, they may yield different results, little basis may exist for choosing among them, and no one of them may be preferred by two or more observers. Under the circumstances, it seems best to use labour input adjustment factors circumspectly and, where they are used, to accompany the resulting productivity measure with another based on an unadjusted but otherwise comparable input measure.²

TYPES OF LABOUR TO BE MEASURED

As two French authors have pointed out, "the labour to be set against a given production is essentially previous work.... The problem is to know

¹ [71, pp. 13-59; 144, pp. 192-238; 242, pp. 218-224].
² FRANKEL, op. cit.
how far previous work should be taken into account, and what categories of labour that have been to a greater or lesser extent integrated or incorporated should be considered.” [174, p. 123]

In order to overcome these problems, it is essential to define the content of different types of labour and to draw a clear dividing line between direct labour and indirect labour, and between present—sometimes called “live”—labour and embodied labour.

Usually, the concept of direct labour covers any labour directly connected with production, while indirect labour covers labour not directly on production but essential to the operation of the establishment. The distinction drawn by the United States Bureau of the Census affords an example of the way in which activities may be classified as direct or indirect labour, the former covering production and related workers and the latter covering all other employees:

Production and related workers are those (up through the working foreman level) engaged in fabricating, processing, assembling, inspection, receiving, storage, handling, packing, warehousing, shipping (but not delivering), maintenance, repair, janitorial watchman services, product development, auxiliary production for plants' own use (e.g. power plant), record keeping, and other services closely associated with these production operations at the establishment covered by the report. Supervisory employees above the working foreman level are excluded from this category.

All other employees represent non-production personnel of the manufacturing establishment, including those engaged in the following activities: factory supervision above the working foreman level, sales (including driver salesmen), sales delivery (highway truck drivers and their helpers), advertising, credit collection, installation and servicing of own products, clerical and routine office functions, executive, purchasing, financing, legal, personnel (including cafeteria, medical, etc.), professional, and technical. Also included are employees on the payroll of the manufacturing establishment engaged in the construction of major additions or alterations to the plant and who are utilised as a separate workforce.

Employees of central administrative offices or auxiliary units at a different location from the establishments served or at the same location but not operated as an integral part thereof and administering or serving two or more establishments are not included in the industry employment statistics. [209, p. 415]

A study of the practice of other countries would yield different but fairly similar definitions, and the points made in an earlier ILO report are also applicable to the present situation, namely that “standard definitions of direct and indirect labour have not yet been established” and that “comparisons in time (and still more in space) will be of doubtful value until specific definitions are adopted”.

Direct and indirect labour together constitute the “live” labour performed in an establishment or industry, whereas “embodied” labour represents the labour contributed from outside in the form of equipment, machinery, raw materials, power, ancillary services, transport, etc. It is, of course, possible—at least theoretically—to convert all these production factors into man-hour equivalents, but in practice, owing to the sheer complexity of the calculations
involved (e.g. in obtaining the data for every single product) research is advancing only very slowly.¹

THE MAIN TYPES OF MEASURES

There are at first sight a considerable number of means of measuring labour inputs in production. Depending on the nature of the investigation and its purpose, it is possible to use the total national labour force, the number of persons in employment, the number of employees or the number of wage earners; alternatively, the investigation can be limited to the number of production workers or a specific category of them, e.g. those employed in cutting shoe uppers. Similarly, the number of hours actually worked or the number paid for can be calculated or a unit of a working week or working year selected.

Despite their variety, all these measures can be divided into two main categories: those that express labour input per unit of time and those based on the number of workers engaged in production. In practice, however, the distinction between the two categories disappears because any reference to the number of workers is circumscribed in time and any unit of time must be related to the labour of a person. In many cases the data concerning hours of work are not obtained through direct statistical surveys but from estimates based on normal hours of work and the number of workers involved.

Time Units

A year and even a week have too many variable elements to provide any satisfactory basis of comparability. In the past century, the number of hours worked per week in the industrialised countries has fallen from sixty or more to forty and sometimes less. The number of weeks of holiday has increased. Neither the working week nor the annual holiday is identical in all countries at any given time. The working year includes a number of hours not worked for one reason or another, and this number is difficult to ascertain.

The most suitable unit of measurement for purposes of comparison is therefore the hour of work. Even so, it must be borne in mind that the concept of the man-hour is only an imperfect guide to the actual input of labour which is to be related to output in order to measure productivity, for, as working conditions change, there may also be upward or downward variations in the number of hours needed for leisure, holidays, retraining, etc.

¹ Work on these subjects is being done in a number of countries, especially Hungary and the USSR.
"Hours of work" may mean the number of hours actually worked or the number paid for. If the difference between the two were identical in all industries and did not vary from one period or country to another, the choice of the one or the other would not influence the measurement of productivity. But this is not the case. For example, in 1958 the proportion of hours for which workers in the United States were paid but did not actually work varied between 4 and nearly 9 per cent, depending on the industry [212], and a survey by the ILO has shown that, taking manufacturing industry as a whole, there are variations from 5 to 15 per cent depending on the country. [12, pp. 68-71] Accordingly, it is clear that there is an advantage in measuring the efficiency of an economy on the basis of the number of hours actually worked; the index of labour productivity calculated on the basis of this concept is the only reliable guide to the wage adjustments that can be made to match higher productivity without causing any upward pressure on costs. [70, pp. 347-372]

Labour Force

The labour force is perhaps the most widely used yardstick of the input of labour. The primary reason is of course that statistics on the labour force are far more readily available than statistics on the number of hours worked. Most countries compile statistics of employment and manpower, and are trying to improve the supply of data on the structure and evolution of their active population—working owners, self-employed, salaried employees, wage earners, unpaid family workers, apprentices, etc.

A number of problems are due to the influence on productivity measurement of the methods employed to collect labour force statistics. Employment statistics usually give details of the number of persons on the register or payrolls at a given date (beginning, middle or end of the month). The same person may be counted more than once if he changes jobs or has part time jobs in two establishments. Other statistics show the average number of daily attendances or the number of persons who have actually worked.

The extent to which casual and part-time workers are counted is also reflected in labour productivity statistics, especially when the proportion of this category to the total number of workers varies from one period or country to another. For example, in Italy between 1958 and 1966, labour productivity over the national economy as a whole went up by 60 per cent if the entire active population is counted, but the increase was no more than 48 per cent if only workers in regular jobs or the equivalent are counted. Israel, which makes a distinction between persons with jobs and persons at work, calculates its national productivity series on the basis of the number of persons at work.
Another problem, which may be by no means unimportant in some industries, is that of homeworkers. In Poland they are not taken into account at all because their output is not included in the calculation of industrial productivity. In Canada if a worker owns his equipment his output is treated in the same way as any other goods and services that are purchased and his labour is not taken into account; if the equipment belongs to a contractor, then the homeworker is regarded as a member of the contractor's labour force.

Output per Man-hour or Output per Man

Which concept—hours of work or the number of workers—is best suited to the calculation of productivity? Each has usefulness, and the choice usually depends on the purpose of the calculation and the use to be made of the results.

A management which is anxious to find out the exact effect of a change in a physical production process in a particular workshop will confine its calculations to the wage earners directly engaged in that process. If, on the other hand, more extensive changes are to be made, it will have to include other categories of employees as well. In most cases, major changes at the production stage also entail changes in the duties and size of the technical, sales or managerial staff.

The full value of productivity measurement at the national level can only be obtained if it relates to the total national labour force; this is the measure to be used in accessing future manpower needs and job opportunities or in making national income projections.

When analysing the productive capacity of labour or endeavouring to ascertain the effect of changes in working hours, measurements based on hours of work will normally be chosen. For short-term projections, hours actually worked are undoubtedly the most suitable instrument for forecasting productivity, whereas normal working hours or the number of persons employed would probably be preferable for long-term projections. There would also be logical justification for calculating the productivity of the active population as a whole, including the unemployed, because any rise in productivity leading to unemployment is partially offset and the results should show the effect of this.

National practices in measuring the labour input are briefly described in Appendix 1. Examination shows that, by and large, countries take as their starting point existing series for employment or hours of work. Very often, adjustments are required to make the figures comparable with the output data. This is a difficulty which in practice has not always been satisfactorily overcome and is a possible source of distortion. Moreover, errors in the measurement of the number of persons employed and hours of work are directly reflected in productivity calculations if the scope or source of the output data is identical or if the estimating methods are similar, though, admittedly, distortions in the nominator and denominator may wholly or partly cancel each other out.
3. THE DIFFERENT MEASURES OF LABOUR PRODUCTIVITY

An engineer in charge of a workshop or an economist responsible for planning the output of a whole industry at the national level will select the measurement best suited to his objective, i.e. obtaining the maximum output per working hour or allocating the national resources with the greatest economy of means, as the case may be. In the former case, the information needed to take a decision will be based on a measurement of output in physical units (number of components, pounds, yards, etc.) per hour actually worked, and in the latter case on the ratio between the value of the industry's net output and the total number of persons required to achieve it.

Despite all the research carried out and the progress made in standardising output, employment and hours of work statistics, there has been little change in recent years in what might be called the basic methodology or theory of productivity measurement. The alternative concepts that one might plausibly seek to implement, and that may be regarded as valid formal expressions of the term “productivity”, are much the same as those which had become familiar by, say, the mid-forties. The recognised limitations attaching to them are also much the same, though in the last several years they have come perhaps to be better understood and more widely appreciated.¹

Usually the different methods of measuring labour productivity are classified according to different definitions of output. The two main methods are based on physical and value measurements. There are of course other possible classifications, e.g. by different definitions of input or by level of aggregation. For example, it is possible to make a classification in accordance with the different measurements used to assess the input of labour to achieve a given output; this would have two main subdivisions, the first based on the labour force (all employees or a specified category of workers, for instance) and the second based on a time unit (the working hour, day or year), which in turn could be related to various categories of workers. This classification, however, would have the drawback of being applicable only to different types of labour productivity and not to the other production factors, whereas a classification based on various forms of output (number of items produced, gross value, net value, volume, etc.) could be used to measure the productivity of factors other than labour.

¹ FRANKEL, op. cit.
Different measures of productivity are reviewed below from the standpoint of the two principal methods of measuring output. In the formulas quoted, the labour factor is defined in terms of working hours, but one can equally well choose any other feature to express the input of labour. Even a working hour is not in fact a precise concept. Its duration is clearly defined, but it gives no indication of the quality of the work nor does it tell us whether it was time worked or time paid for. These points have already been dealt with, but it is worth noting that, while they undoubtedly influence the results, they need not be taken into account in considering the theoretical aspects of productivity measurement.

**Physical Measures**

Physical measures of labour productivity are homogeneous physical units (of weight, volume, area, etc.), used to express an output, usually consisting of a single product or group of similar products, while the labour input is measured in terms of the number of workers or hours worked.

Physical measures are often used to calculate the efficiency of factors other than labour, e.g. bales of cotton per acre to compare agricultural yields, tons of wheat per ton of chemical fertiliser to compare the efficiency of materials, or tons of steel per ton of coal consumed to compare the efficiency of fuels.

**Measurements Based on Homogeneous Physical Units**

These measurements are obtained by a straightforward computation of the physical units produced—tons of cement, square yards of grey cotton cloth, gallons of beer or pairs of shoes for example—over a given period, usually a year. This total is then divided by the number of units chosen to represent the labour input required to achieve this output, and the result shows the productivity of labour for a given product or group of products.

The formula employed is extremely simple when a comparison has to be made between physical productivity in two periods or countries. One of the results is merely divided by the other:

\[
R_{01} = \frac{Q_1}{m_1} \div \frac{Q_0}{m_0} = \frac{Q_1}{Q_0} \div \frac{m_1}{m_0}
\]

where \(Q\) represents the quantity of units produced, \(m\) the manpower input and the figures 1 and 0 two different periods or countries. \(R_{01}\) therefore represents the ratio either of the productivity for a single product (or given group of
homogeneous products) during the present period to that during the reference period, or of the productivity of one country to that of another.\footnote{The formula is often used to compare the productivity of different factories.}

The first research into labour productivity was based on this formula, and it continues to be used, especially for purposes of international comparison, because it involves no problems of weighting or currency conversion.

**Homogeneous Output.**

If output is to be regarded as homogeneous, a number of conditions must be fulfilled:

- the product must be of a specified quality, e.g. carbon steel or stainless steel;
- the product must conform to precise standards of size, volume, density, etc. (beer with a certain alcoholic content, shoes of a given pattern, for example);
- the limits of the manufacturing process must be clearly stated, e.g. in the case of cement, it must be made clear whether or not the process includes the mining of limestone.

Defining a product in such a way that differences of quality become immediately apparent is by no means easy and it often happens that items differing in quality are designated by the same name, especially at a time of rapid technological change. This incidentally is a difficulty that has to be overcome in other branches of statistics, especially when price indexes are compiled.

When output is homogeneous, each unit produced is given the same weight, so that it is not necessary to resort to a weighting system. Nor, since homogeneous products are not measured in terms of value, is it necessary to know their cost, and it is possible to compare a homogeneous type of production during two periods or in two different countries without having to calculate “constant” prices or “appropriate” conversion rates. This perhaps explains why physical measurements are so attractive and so widely used in comparing labour productivity as between different undertakings, regions or countries.

However, physical measurements have their limitations in that they can hardly ever be used except in the case of clearly defined products. Once the output becomes heterogeneous, the method is distinctly liable to give misleading results. And the fact is, as Professor Frankel points out, that “With allowance for certain exceptions, notably in the mineral extraction and agricultural spheres, not only all industries but most enterprises produce non-homogeneous outputs, in the form of differing qualities of the same product, different types of related or sometimes unrelated products or both”.

The Working Group on Productivity Statistics, in the report on its 1964 session, also made a number of reservations regarding the use of "physical" measures in making direct international comparisons. It noted that—

...the results of such direct comparisons may not be comparable because of differences in the degree of integration of production in the different countries; for example, in one country component parts may be home-produced, whereas in the other they are imported. The same problem often arises in the case of agriculture (e.g. more or less fertiliser being used in the different countries) and this may be of particular importance when a developed and a developing country are compared.¹

TABLE 1. MAN-HOUR REQUIREMENTS PER TON OF PRODUCT IN THE UNITED STATES IRON AND STEEL INDUSTRY, 1961 ¹

(Expressed as ratios; base: coke = 1.0)

<table>
<thead>
<tr>
<th>Product group</th>
<th>Carbon</th>
<th>Alloy</th>
<th>Stainless</th>
</tr>
</thead>
<tbody>
<tr>
<td>Blooms, slabs, billets, tube rounds, skelp, etc.</td>
<td>4.8</td>
<td>10.9</td>
<td>24.1</td>
</tr>
<tr>
<td>Wire rods</td>
<td>8.5</td>
<td>20.2</td>
<td>87.1</td>
</tr>
<tr>
<td>Structural shapes (heavy) and steel piling</td>
<td>7.1</td>
<td>17.6</td>
<td>84.5</td>
</tr>
<tr>
<td>Plates</td>
<td>6.1</td>
<td>15.5</td>
<td>78.4</td>
</tr>
<tr>
<td>Rails—standard and all other</td>
<td>6.7</td>
<td>18.1</td>
<td>—</td>
</tr>
<tr>
<td>Joint bars, tie plates and track spikes</td>
<td>19.1</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Wheels and axles</td>
<td>25.3</td>
<td>37.6</td>
<td>—</td>
</tr>
<tr>
<td>Bars, hot-rolled (including light shapes)</td>
<td>10.7</td>
<td>16.7</td>
<td>104.9</td>
</tr>
<tr>
<td>Bars, reinforcing</td>
<td>6.6</td>
<td>16.7</td>
<td>—</td>
</tr>
<tr>
<td>Bars, cold-finished</td>
<td>18.5</td>
<td>31.8</td>
<td>154.2</td>
</tr>
<tr>
<td>Bars, tool steel</td>
<td>89.3</td>
<td>161.8</td>
<td>—</td>
</tr>
<tr>
<td>Standard pipe</td>
<td>15.9</td>
<td>21.1</td>
<td>120.7</td>
</tr>
<tr>
<td>Oil country goods</td>
<td>20.3</td>
<td>27.4</td>
<td>—</td>
</tr>
<tr>
<td>Line pipe</td>
<td>13.7</td>
<td>21.1</td>
<td>—</td>
</tr>
<tr>
<td>Mechanical tubing</td>
<td>32.6</td>
<td>48.4</td>
<td>284.5</td>
</tr>
<tr>
<td>Pressure tubing</td>
<td>46.6</td>
<td>76.3</td>
<td>294.3</td>
</tr>
<tr>
<td>Wire, drawn</td>
<td>23.7</td>
<td>39.5</td>
<td>159.3</td>
</tr>
<tr>
<td>Wire products</td>
<td>31.3</td>
<td>—</td>
<td>163.0</td>
</tr>
<tr>
<td>Black plate</td>
<td>10.5</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Tin and terne plate, hot-dipped</td>
<td>18.9</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Tin plate, electrolytic</td>
<td>12.6</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Sheets, hot-rolled</td>
<td>4.8</td>
<td>11.2</td>
<td>17.1</td>
</tr>
<tr>
<td>Sheets, cold-rolled</td>
<td>6.9</td>
<td>13.4</td>
<td>97.0</td>
</tr>
<tr>
<td>Sheets, galvanised</td>
<td>10.4</td>
<td>18.1</td>
<td>—</td>
</tr>
<tr>
<td>Strip, hot-rolled</td>
<td>11.4</td>
<td>14.3</td>
<td>44.2</td>
</tr>
<tr>
<td>Strip, cold-rolled</td>
<td>23.2</td>
<td>198.3</td>
<td>81.5</td>
</tr>
<tr>
<td>Sheets, all other coated</td>
<td>11.4</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Electrical sheets and strip</td>
<td>23.6</td>
<td>23.8</td>
<td>—</td>
</tr>
<tr>
<td>Ingots and steel for castings</td>
<td>2.0</td>
<td>3.5</td>
<td>7.2</td>
</tr>
<tr>
<td>Pig-iron and ferro-alloys</td>
<td>1.4</td>
<td>—</td>
<td>—</td>
</tr>
</tbody>
</table>


¹ The factors for steel-mill products were calculated from man-hours required beyond the ingot state, those for coke, pig-iron and crude steel from man-hours allocated to those specific operations. Man-hours included direct and indirect requirements of labour. ² Excluding stainless steel.
Heterogeneous Output.

In some industries, especially steel, brewing, cement, tobacco, footwear and certain branches of textiles (cotton and jute), the output consists of fairly homogeneous products which can be converted into standard units by using conversion ratios. Usually one of the products is selected because it is best suited to serve as a standard and then conversion ratios are worked out for the others. Very often, the ratios employed are based on unit labour requirements. It is not, however, necessary to measure the labour input needed to manufacture each product that has to be converted—usually it is sufficient to know the relationship between this input and that required for the standard product.

As examples, tables 1 and 2 show the ratios used in the United States for the iron and steel industry and in France for tobacco manufacture.

In France the Industrial Tobacco and Match Manufacturing Agency (SEITA) has converted its output into "Gauloise equivalents" in order to assist the measurement of changes in labour productivity. The results for the year 1962 are shown in table 2, using weights employed at two different periods:

<p>| TABLE 2. CONVERSION OF OUTPUT INTO &quot;GAULOISE EQUIVALENTS&quot; IN THE FRENCH TOBACCO INDUSTRY, 1962 |
|------------------------------------|--------|--------|--------|</p>
<table>
<thead>
<tr>
<th>Product</th>
<th>Unweighted 1</th>
<th>1958 weight 2</th>
<th>1962 weight 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cigarettes</td>
<td>50 313</td>
<td>57 696</td>
<td>58 238</td>
</tr>
<tr>
<td>Shag pipe tobacco</td>
<td>18 109</td>
<td>13 432</td>
<td>14 074</td>
</tr>
<tr>
<td>Cigars</td>
<td>269</td>
<td>15 511</td>
<td>12 820</td>
</tr>
<tr>
<td>Whiffs</td>
<td>351</td>
<td>7 290</td>
<td>7 513</td>
</tr>
<tr>
<td>Other products</td>
<td>654</td>
<td>1 495</td>
<td>1 056</td>
</tr>
<tr>
<td>Total</td>
<td>69 696</td>
<td>95 424</td>
<td>93 701</td>
</tr>
</tbody>
</table>

1 Unit: million units (unconverted). * Unit: million Gauloise equivalents, base = 1958. " Unit: million Gauloise equivalents, base = 1962. 2 Unit: ton. 3 Not including snuff, rolls and plugs, or nicotine, i.e. 695 tons in all.

In the case of a heterogeneous output in which conversion factors can be used, productivity in two different periods or countries can be compared using the following formula:

\[
R_{01} = \frac{\sum L_1 Q_1}{\sum L_0 Q_0} \div \frac{\sum Q_1 L_1}{\sum Q_0 L_0}
\]
where $L$ denotes unit man-hour requirements for each of the several output items and $L^*$ denotes such requirements for the standard product. $\frac{L}{L^*}$ thus specifies the unit man-hours for any item relative to the standard item.

Both the numerator and denominator of the left-hand term involve the weighting of output quantities by relative unit labour requirements, and their division expresses the ratio of the output of [the two periods or] the two countries in terms of the numeraire product. The right-hand term expresses the ratio between the two countries of the total man-hours expended in the industry, and division of the left by the right-hand term gives simply:

$$A3. \quad R_{01} = \frac{L^*_0}{L^*_1}$$

which is the ratio between the two countries [or the two periods] of the unit man-hour requirements for the numeraire product.\(^1\)

All the weights, however, are not based on unit man-hour requirements. In agriculture, for example, output is often converted into food calories, either vegetable or animal; similarly, fodder resources can be compared by working out their calorific equivalents. \([139]\) Fuels, especially coal or gas, can be expressed in energy or thermal units. Other ratios can be calculated from costs or unit prices.

Which conversion ratio is best? The answer must be that the choice depends on circumstances and that the ratios should suit the sectors and countries concerned at a particular time. This amounts to saying that ratios may vary with time and conceal differences between one period or country and another.

Despite the use of conversion ratios, the scope for physical measurements is limited. As differences of quality between the standard product and the other products increase and the items to be converted grow in number, this method becomes more and more difficult to employ.

**Measurements Based on Working Time**

These measurements have a certain similarity to measurements based on homogeneous physical units whenever the conversion ratios selected are based on standard units of working time. In either case, prices do not have to be taken into account. There is, however, one fundamental difference, namely that when productivity comparisons are being made between two periods or two or more countries, a single series of weights is used. The composition of output is held constant and the aim is to show the difference in the labour time

\(^{1}\) Frankel, op. cit., para. 17.
needed to produce a fixed composite of goods or services. The simplest formula is the following:

\[ R_{01} = \frac{\sum Q_1 L_0}{\sum Q_0 L_0} \div \frac{\sum Q_1 L_1}{\sum Q_0 L_0} = \frac{\sum Q_1 L_0}{\sum Q_1 L_1}. \]

The outcome is equivalent to that obtained when, for output, the quantity relatives of the two countries are weighted by the total man-hours of the base country or period. Thus—

\[ R_{01} = \frac{\sum \left( \frac{Q_1}{Q_0} \right) Q_0 L_0}{\sum Q_0 L_0} \div \frac{\sum Q_1 L_1}{\sum Q_0 L_0} = \frac{\sum Q_1 L_0}{\sum Q_1 L_1}. \]

It is equivalent also to the result obtained from weighting the productivity relatives of the several products by the man-hours of the given country or period, as the following shows 1:

\[ R_{01} = \sum \left( \frac{L_0}{L_1} \right) Q_1 L_1 \div \frac{\sum Q_1 L_1}{\sum Q_1 L_1} = \frac{\sum Q_1 L_0}{\sum Q_1 L_1}. \]

Professor Frankel, in his paper submitted to the Working Group, discusses the characteristics of this measure:

First, for any aggregate like an industry, a sector or the economy, the measure represents an internal average of the productivities of the individual components. If for example the measure relates to an economic sector which in turn is composed of a given number of industries whose output and input quantities and man-hours are the primary ingredients on which the measure is built, the productivity of the sector will always fall within the range of the productivities of the individual industries. . . .

A second and closely related property of the measure is that it reflects only those changes in productivity that take place within the individual components and abstracts from such changes as might seem to result from a shift of labour from components in which unit man-hour requirements are high to those in which they are low. The effect of such shifts is exactly offset by the application of unit man-hour weights. . . .

Exclusion from the measure of the effects of structural changes may be regarded as both an advantage and a disadvantage. It is an advantage because it helps us to keep separate the different sources of productivity change and because for certain kinds of economic analysis one has need of a "pure" measure of this kind. It is a disadvantage because both sources of change are equally constituents in the growth process, and because for many purposes a knowledge of their combined impact, as well as the separate contribution of each, is essential. . . .

A third noteworthy feature, and one that underlies the other two, is that the composite of goods for which productivity is measured is identical for both countries [or both periods] measure. . . . [This] suggests that the measure is much like a purely physical measure and it sometimes is referred to
as such. . . . In the case of the physical measure, however, "the quantities entering the measure are those actually produced", while in the unit man-hour measure the constant output composite may be that of the base period or country, the given period or country or a hypothetical composite. It is likely that the result will be affected by the choice of composite, and if, for example, composites differ from one country to another, as they almost invariably will, "the results in the two cases will generally differ, and each must be accepted as a valid measure of the productivity differences between the two countries."

The major drawback of this type of measure lies in the fact that the statistical data needed for it are simply not available in most cases. Depending on the choice of the formulas given above, it is necessary to know the total number of man-hours devoted to each product or component at every stage of the comparison; in addition, it is necessary to have details of the physical quantities produced or of the relationship between the physical quantities or unit man-hours measured at the beginning and end of the comparison. For an industry, economic sector and particularly for the national economy as a whole, it is difficult to obtain all this information. On the other hand, for purposes of comparison between workshops or factories, this type of measure can help to "pinpoint the weak spots in the production process and make it possible to eliminate them and thereby improve productivity" since they permit the calculation of the input of labour required at different stages of the production process for the same product.

**Value Measures**

We have seen that the economic performance of a whole nation—and of most branches of economic activity—can only be measured by means of an estimate of output value.

In the last resort, the true yardstick of the output of a country or a branch of its economy is the value assigned to it by the market. . . . Output in other words is not estimated in absolute terms but in relative exchange values reflected in market price relationships. . . . Thus, when we measure productivity using a value numerator, we are measuring not a homogeneous entity but a mixture of elements which are interacting on each other . . . . The value of output is therefore not the result of productive effort alone . . . . The productivity that is measured is not a technical productivity but an economic productivity. [105, p. 26]

**Basic Measures**

In value measurements, output is evaluated either by means of a price series or by multiplying the physical quantities by a series of value weights. By choosing appropriate prices or value weights, either of the formulas can be made equivalent to the other. In comparing two periods or two or more countries, the basic formula is as follows:
DIFFERENT MEASURES OF LABOUR PRODUCTIVITY

C 1.

\[ R_{01} = \frac{\Sigma P_0 Q_1}{\Sigma P_0 Q_0} \div \frac{\Sigma m_1}{\Sigma m_0}, \]

where \( P \) denotes unit price so that \( PQ \) is the value of the quantity \( Q \) and where the other symbols have the same meanings as before. It is seen that for output the quantities in each country or reference period can be aggregated directly, using the prices of one, or the quantities in one country can first be expressed as a ratio of the corresponding quantities in the other and then extended by value of output weights. This gives the following formula\(^1\):

C 2.

\[ R_{01} = \frac{\sum \left( \frac{Q_1}{Q_0} \right) P_0 Q_0}{P_0 Q_0} \div \frac{\Sigma m_1}{\Sigma m_0}. \]

It is worth recalling at this juncture the distinction between the concepts of "price" and "value". The latter is the aggregate cost of production, i.e., wages and other manpower costs, raw materials and other intermediate items of consumption, depreciation, insurance, rent, interest, etc., together with profits. Price includes not only these factors but also transport and handling costs, discounts, taxes, etc. Prices are affected by supply and demand and also by official regulations which may result in raw materials, finished or semi-finished products and services being sold at more or less than their true cost. \([113]\)

A common characteristic of all monetary measurements... is that they are based on prices of both products and factors of production, and thus will reflect economy in the utilisation of resources only under competitive conditions. These conditions very seldom are obtained in real life and consequently prices are distorted in the sense that they are influenced by market imperfections of various kinds. \([177, p. 35]\)

This is one of the reasons why value measures are sometimes considered unsatisfactory, because price variations do not necessarily keep step with productivity variations.

The use of a value measurement to compare labour productivity in either time or space implies therefore that allowance must be made for fluctuations in prices or differences in relative prices. For comparisons between one period and another, some countries, such as Poland and the USSR, employ fixed compulsory prices. Other countries prefer to compile price indices for the following reason.

\[ \text{[They]} \text{ can often be developed on the basis of much more limited data than output indexes. This is so because it is more often reasonable to assume that the prices of an industry's products move together than that the quantities move together. A relatively small sample of data may suffice therefore in building a price index whereas it might well be insufficient for building an output index.} \]

\(^1\) FRANKEL, op. cit., paras. 28 and 29.

\(^2\) Ibid., para. 29.
On the other hand, it is extremely difficult to ascertain the extent of changes in relative prices, i.e. when the value relationships between commodities change. [30]. Some countries, especially the United States, employ the “double deflation technique”. Thus, special price indices are constructed for each industry for each component of value added (value of shipments, inventories, etc.). The constant dollar value of each of these components of value added is obtained by deflating the current dollar value of the specified component by its appropriate price index. Value added in constant dollars is then obtained for each industry by deducting the deflated value of material purchases or service costs from the deflated value of output (shipments adjusted for net inventory change). The industry estimates of value added in constant dollars are summed to obtain value added in constant dollars for all manufacturing. The all-manufacturing estimate of value added in current dollars is then divided by the all-manufacturing estimate of value added in constant dollars to obtain the price index for deflating manufacturing GNP. [107, p. 403]

Since the term “output” covers the whole assortment of goods and services actually produced and this assortment is hardly ever the same in any two periods or countries, the result of the comparison is affected by the choice of weight. For example, the weights selected may be applied to either price or value in the reference period or country or in the period or country under investigation. Thus, in Australia in 1953-54 and 1962-63, the GNP per person employed went up by an annual average of 2.4 per cent if 1953-54 prices are used, whereas on the basis of 1959-60 prices the rate of increase was 2.2 per cent; taking manufacturing as a whole, the corresponding figures were 4.7 and 4.3 per cent. [170]

The United Kingdom affords a further example of this. According to a study based on industrial output returns, the index of output in manufacturing between 1948 and 1954 went up by either 4.7 or 2.9 per cent per annum depending on whether 1948 or 1954 prices are used as weights. [157]

The GNP per head in a number of European countries in 1950 and 1955 has been compared with that in the United States. Weighting on the basis of United States prices is more favourable to the European countries than if the comparison is based on domestic prices in each country, as is shown by table 3.

When the weight is based on value added, it is important to choose the most representative period for which data are available.

Unlike physical measurements, value measurements obtained by means of the formulas mentioned earlier (see C 1 and C 2) reflect not only the variations—or differences—in labour productivity in each industry or sector but also the changes—or differences—in the distribution of resources, and above all of manpower.
A number of investigations have been carried out recently into the effect of structural changes on the rates of growth of labour productivity. For example, the Austrian Economic Research Institute has calculated for the period 1951-65 the share of the increase in national productivity considered attributable each year to changes in the pattern of employment. The method was to calculate how far labour productivity would have risen if employment in each of the sectors of the economy had not changed from one period to another; the result was then multiplied by the rate of productivity increase that would have been secured if the labour force during the reference period had had exactly the same productivity as it achieved during the period under consideration. This research showed that, with the exception of 1952, changes in the pattern of employment favoured higher national productivity to an extent ranging from less than 5 to more than 25 per cent, but averaging about 11 per cent. [131, pp. 151-160]

Canadian industrial statistics also make it possible to measure the effect of the replacement of less productive industries by more productive ones and vice versa [43, pp. 141-142], together with the effect of the shift of workers out of agriculture into other industries. Thus the productivity of the national economy, with the exception of non-commercial industries, rose differently between 1946 and 1964 as shown in table 4 overleaf, depending on whether or not allowance is made for changes in the distribution of manpower in employment during the two periods and for the change in the relative importance of agriculture in the economic statistics:

Research has also been carried out in the Federal Republic of Germany, where comparisons have been made between the changes in labour productivity
MEASURING LABOUR PRODUCTIVITY

TABLE 4. PRODUCTIVITY INCREASE IN CANADA BETWEEN 1946 AND 1964, CALCULATED BY DIFFERENT METHODS

<table>
<thead>
<tr>
<th>Rise in productivity</th>
<th>Per person employed</th>
<th>Per man-hour</th>
</tr>
</thead>
<tbody>
<tr>
<td>Allowing for the effects of structural change</td>
<td>69.4</td>
<td>96.5</td>
</tr>
<tr>
<td>Not allowing for the effects of structural change:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(a) with 1946 labour input proportions</td>
<td>60.2</td>
<td>78.1</td>
</tr>
<tr>
<td>(b) with 1964 labour input proportions</td>
<td>51.3</td>
<td>69.4</td>
</tr>
<tr>
<td>(c) with 1946 output proportions</td>
<td>65.2</td>
<td>87.5</td>
</tr>
<tr>
<td>(d) with 1964 output proportions</td>
<td>57.7</td>
<td>78.6</td>
</tr>
</tbody>
</table>

that have actually occurred in various industries and the results of calculations based on the assumption of a constant distribution of manpower. For the industry sector as a whole—excluding construction—structural changes exercised a negative influence between 1960 and 1964. As in Canada, federal statistics do not contain the data needed to calculate the changes that have occurred in the relative importance of establishments with high and low productivity. [150, pp. 288-290]

In his paper for the Working Group in 1964, Professor Frankel describes one of the methods that can be used when making inter-country comparisons in order to distinguish between differences in productivity that exist between different industries and differences in the distribution of resources by economic sector. The method he advocates for making comparisons between two countries can also be adapted for comparisons between two periods. It begins with the formula C 1 rewritten as follows:

\[ R_{01} = \frac{\sum P_0 \frac{1}{L_1} m_1}{\sum P_0 \frac{1}{L_0} m_0} \times \frac{\sum m_1}{\sum m_0} \]

In other words, using country 0’s prices we have, in the numerator and denominator, unit price times (physical) output per man-hour times total man-hours, which gives the total value of the product. One form in which they may be rewritten is—

\[ R_{01} = \frac{\sum P_0 \frac{1}{L_1} m_0}{\sum P_0 \frac{1}{L_0} m_0} \times \frac{\sum P_0 \frac{1}{L_1} m_1}{\sum P_0 \frac{1}{L_1} m_0} \times \frac{\sum m_1}{\sum m_0} \]
another form of which is—

\[ C_5. \]

\[
R_{01} = \frac{\sum \left( \frac{P_0}{L_0} \right) P_0 \frac{1}{L_1} m_0}{\sum P_0 \frac{1}{L_0} m_0} \times \frac{\sum \left( \frac{P_0}{L_1} \right) P_0 \frac{1}{L_0} m_0}{\sum P_0 \frac{1}{L_1} m_0} \div \frac{\Sigma m_1}{\Sigma m_0}. \]

In this manner, the productivity index as given by C1 and C3 is split into two parts. The first, as rendered by the initial term on the right in C4 or C5 reflects only those productivity differences between the individual industries of the two countries. It can be computed, as in C4, by means of a ratio of aggregates in which, for each country, the value of product per worker in the different branches (in country 0's prices) is extended through the use of country 0's man-hour weights. Or it can be computed as an average of relatives (C5) in which, for each branch, the index of value of product per worker is extended by means of country 0's value of product weights.

The second part is given by the two remaining right-hand terms which together tell us the difference in productivity arising from the difference between the two countries in the distribution of labour among industries. (In this case value of output per worker in each industry is held constant.) The first of these terms can be computed as a ratio of aggregates (C4) in which for each country man-hours in each branch are extended by means of value productivity weights. Or it can be computed as an average of relatives (C5) in which, for each industry, an index of value of product (at constant productivity) is extended by means of value of product weights (based on country 0's prices and man-hours and country 1's productivity). It gives us essentially a measure of the change in output with industry productivity constant. ¹

But—and here Professor Frankel merely confirms the observations of the statisticians in Austria and the Federal Republic of Germany—"there is an element of fiction in this separation process. The two kinds of differences occur jointly in practice and it cannot be assumed that either would be of the magnitude observed without the concurrent presence of the other."

**Measurements Based on the Gross Value of Output.**

Prices and values may be gross or net of certain components. For example, one can choose between market prices or prices at factor cost or one can include or deduct purchased inputs, consumption of output, consumption of fixed capital, direct taxation, etc.

Measurements based on the gross value of output are those in which the numerator itself is the gross value of output, i.e. without any deduction of any kind. The data are usually obtained by adding together the turnover of all the

¹ FRANKEL, op. cit., paras. 38-40.
enterprises in the sector in question, making allowance in most cases for variations in stocks of finished and semi-finished products and in work in progress. Some countries, including Bulgaria, Czechoslovakia, Hungary, Poland, Romania and the USSR, have adopted this method in calculating the output figures or indices on which their labour productivity series are based. Their choice is perhaps due to the ease with which this measurement can be obtained and fitted into the economic planning system and also to the fact that if the trend of productivity were measured by means of net output it would not be substantially different, since the structure of industry and the internal organisation of the enterprises themselves are fairly stable.

There are two drawbacks to the widespread use of gross value measures. The first is that the output does not correspond to the input of labour required to obtain it; the value of the raw materials, fuel, services and other purchased inputs enters into gross value, but their labour content is not taken into account. It follows that once there is a change or difference in the degree of integration or in the proportion of purchased inputs, the productivity comparison between the two periods or countries is distorted.

The second drawback becomes increasingly apparent as production becomes more specialised or the economic sector expands. When this happens, the finished products of one enterprise or industry may pass through several processes before they are finally consumed and as a result are counted more than once in gross output. The extent of the distortion depends ultimately on the way the industry or economy is organised, the degree of specialisation or integration of the enterprises concerned and any changes or differences there may be in the pattern of production.

In short, gross value productivity measurements only yield information—though perfectly valid information—on apparent productivity. What is measured is the result of the whole economic process of production, including activities further up the line from the industry in question. In this way, the performance of the industry embodies transfers of productivity changes to the benefit or detriment of the industry due to variations—in terms of price and quantity—in the pattern of purchases from other industries.\(^1\)

Measurements Based on the Net Value of Output.

These measurements, as in the previous case, are based on formulas in which the numerator corresponds to a value concept; the value, however, is net value, which is obtained by deducting from the value of gross output that of all the items purchased from other enterprises or supplied by other industries which are consumed in the production process. In other words, the net

\(^1\) Frankel, op. cit., paras. 42-45.
value represents the contributions made by an enterprise or industry over and above the value of the materials and services it purchases—hence the term "value added". The advantage of this way of measuring output is that the products are only counted once irrespective of the number of times they are bought and sold. The sum total of the contributions by all economic sectors constitutes the gross domestic product—a concept which lends itself particularly well to estimates of national productivity.

Value added can be calculated at market prices (in which case indirect taxes and subsidies are included) or at factor cost (in which case taxes and subsidies are excluded), and the extent to which it is genuinely net varies according to whether certain other items are included or not.

When isolating an industry in order to measure its productivity... care must be taken not to make... double deductions. For example, when input is deducted from output, one deducts the value not only of current purchases (raw materials, power, etc.) but also investment costs (depreciation plus net investment). In this case, in order to obtain the net value added, one must not of course deduct depreciation but one must add net investment to the value added if investment outlays are higher than total depreciation or deduct them if they are lower. If value added minus depreciation is termed "net", then the "gross" value added for the industry can be defined as the added value including depreciation. This is not the same thing as the added value obtained by subtracting input from output, which includes neither depreciation nor net investment.

In fact we can distinguish between three and not two forms of added value:

1. Value added by the industry (output minus input, i.e. gross output minus (current purchases plus investment outlays)). Fixed capital investment is deducted.

2. Gross value added by the industry (gross output minus current purchases). Fixed capital investment is included.

3. Net value added (gross output minus (current purchases plus depreciation) which is equal to gross output minus (current purchases plus investment outlays plus/minus net investment)).

Depreciation is deducted from the gross value added by the industry. [105, pp. 36-37]

To these could be added a fourth term—“census value added”, i.e. that based on information supplied by economic censuses. The most important use made of this concept is in the weighting of the series used to calculate the industrial production indices published by a number of countries. Census value added differs from net value added in that it includes the value of such purchased services as insurance, banking, advertising, legal consultations, etc. These services are therefore included in the value of net output even though they ought not to be. Where census value added is used instead of other types of value added, it is largely because data for deducting the value of purchased services are not available.
It is possible to attempt a direct measurement of the labour input, even though it is usually impossible to achieve a uniform definition [203, Annex D, para. 2], by working out the difference—for each component or branch of activity—between the value of output and the value of all purchased inputs, both at constant prices. The formula for comparing productivity in two periods or two countries is therefore as follows:

\[
C_6. \quad R_{01} = \frac{\sum P_o \pi_1 - \sum \pi_0 \mu_1}{\sum P_o \pi_0 - \sum \pi_0 \mu_0} \div \frac{\sum m_1}{\sum m_0}
\]

where \( P \) denotes factory or sales prices of products, \( Q \) the quantities of products, \( \pi \) the prices of purchased inputs and \( \mu \) the quantities of purchased inputs.\(^1\)

It must be emphasised that this method makes no allowance for consumed output, i.e. the value of the production factors directly consumed in the industry itself, which are not therefore reckoned in the value of net output. The method is also subject to variations in the relative prices of products and production factors. These variations are also the cause of the differences that usually occur in the results obtained by means of weighting indexes, either for the reference period or country or for the period or country under consideration. Lastly, when the value of the output is a residual item, it is extremely sensitive to errors of measurement and the data have to be a good deal more precise than in the case of the other methods.

\(^1\) Frankel, op. cit., paras. 47-48.
4. SOME PRINCIPLES GOVERNING THE CHOICE OF MEASURE

Which measure should be given preference—value or physical units? Should output be related to hours of work or a particular workforce? The answer depends on two factors, namely the purpose of the measurement [177] and the available statistical data. In practice, the decisive factor is usually whether or not the data are available. Often, one is faced with conflicting requirements which make a choice difficult. On the one hand, there is an urgent demand for data that can be used immediately for economic analysis, while, on the other, there is a need for thorough, lengthy and expensive research if the results are to be wholly reliable.

Table 5, which was drawn up in the United States by A. D. Searle, summarises the chief characteristics of labour productivity indices and the factors influencing their trends, and shows the use that can be made of them in practice.

Comparable tables by other authors could also be quoted [231, p. 766bis; 105, Annex II], but the proposed yardsticks are very similar though differing in level of aggregation, economic scope, length of cycle and purpose.

The analysis often gains in depth if it can be based on information secured by more than one productivity measurement and, as Professor Frankel states, “while it is fair to say that the measure to be used should be suited to the purpose at hand, it is not fair to conclude that only one measure will serve any chosen goal. Often, if not usually, two or more measures are capable of serving and, if the practical problems of data availability are taken into account, perhaps none of them are capable of serving with distinction... [Furthermore] no measure, however much preferred on other grounds, will be serviceable in the absence of suitable data or a means of obtaining it.”

It is also possible to adopt another approach to this problem of the choice to be made by trying to decide what should be the characteristics of a general-purpose measurement.

The best formula should —

(1) lend itself to use at any level of aggregation, permit ready combination of the results obtained at lower levels in order to achieve measures at higher levels, and yield for any level results that are consistent with those at other levels;

1 FRANKEL, op. cit., paras. 65-67.
be consistent with and readily usable for analytical purposes in conjunction with other forms of economic data;

(3) be adaptable to use with alternative labour input measures;

(4) lend itself to use with non-labour inputs and with combined labour and non-labour inputs;

(5) be of a kind that minimises the difficulties involved in applying the base country's weights to the given country;

(6) permit with a minimum of effort computation on alternative weight bases;

(7) minimise the need for data, and especially for new data and data beyond what is ordinarily required for purposes other than productivity measurement. Likewise, it should keep to a minimum the time and expense of computation;

(8) for higher levels of aggregation, be capable of reflecting both separately and in combination that type of productivity differences (or change) that exists within individual industries and that type resulting from differences (or changes) in the relative importance of individual industries;

(9) be uninfluenced by and independent of arbitrary institutional or technical factors which may affect the reporting of data or the data themselves, e.g. tax systems or ownership or transactions structures, and which are not constituent elements in outputs and inputs.¹

Several of these criteria mention the “ease” with which data can be obtained, thereby giving priority to practical aspects rather than to theoretical considerations. The reason for this is that most labour productivity statistics are derived from data compiled for other purposes. The prospects of obtaining information about the labour input required per unit of output, whether in man-hours or man-years, are not hopeful at the present time because data of this type would require complicated and expensive investigations; in addition, the results would hardly fit in with economic research carried out for other purposes.

On the other hand, data concerning value, prices and, to a lesser extent, quantities belong to fields in which most countries compile statistics, and therefore the prospects of future improvement and development are more promising. “On the practical side, therefore”, as Professor Frankel concludes, “both present conditions and future trends favour value types of measures.”

Data of another type are also needed, namely those required to understand and explain the results. The following are a few examples of the kind of data required at different levels of aggregation.

In the first place, we need a detailed knowledge of the component parts of the production process and a fuller breakdown of the industry's turnover.

In the second place, we must have some idea of the extent of consumed output, especially in the industries manufacturing durable goods, and of the amount of subcontracting to other industries. All these items do not usually enter into estimates of an industry's net or gross output, but analysis of them can be enlightening in explaining some of the phenomena encountered.

¹ FRANKEL, op. cit., para. 68.
### Table 5. Chief Characteristics and Applications of Labour Productivity Indices

<table>
<thead>
<tr>
<th>Type of index</th>
<th>Factors which influence trend</th>
<th>Practical applications</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. Industry indexes based on physical production data combined with fixed establishment man-hour and product weights.</td>
<td>Includes only influences internal to the establishment-interplant shifts and interproduct shifts eliminated.</td>
<td>Management: Comparison of own plants with industry trend. Factors beyond control of engineer eliminated.</td>
</tr>
<tr>
<td>B. Industry indexes based on physical production data combined with changing establishment man-hour and product weights.</td>
<td>Includes, in addition to above, effect of interplant and interproduct shifts.</td>
<td>Manpower problems: Employment expected at given levels of production. Economic analysis.</td>
</tr>
<tr>
<td>C. Indexes for industry groups—industry indexes (as in B) combined with man-hour weights to form group or total index.</td>
<td>Same as B—Inter-industry shifts eliminated.</td>
<td>Same as above. Appropriate economic series for comparison would be those which are unaffected by changes arising from changing importance of industries.</td>
</tr>
<tr>
<td>D. Indexes for industry groups—industry indexes based on physical production data, combined with value-added weights to form group of total index.</td>
<td>Same as B, plus effect of inter-industry shifts.</td>
<td>Same as above but comparable economic series would be those which are affected by changes arising from shift of workers between industries.</td>
</tr>
<tr>
<td>E. Indexes for industry groups or divisions—based on data on gross product originating in the group or division, in constant prices, per man-hour.</td>
<td>Includes, in addition to above, effect of changing proportion of materials input from other industries.</td>
<td>Broadest economic analysis. Economic health and well-being of economy. Comparable economic series are those affected by inter-industry shifts.</td>
</tr>
</tbody>
</table>


In the third place, we need sufficiently representative price indices for the main items composing the final output. It is helpful to have price indices for all the items constituting the value added, as well as for purchases by the industry. This makes it possible to calculate a price index for the industry's output which can be compared with a general index so as to assess any relative variations in the industry's prices, while comparison of the index of gross output prices with that of purchase prices will cast light on the industry's terms of trade, etc.

In the fourth place, the productivity measurements selected because of their relevance to the purpose of the investigation need to be supplemented by technical or partial ratios, which of course will vary widely from one industry to another. [105, p. 42]
Even after a measurement has been selected, it is sometimes impossible in practice to calculate it because of lack of appropriate data, and in the case of both output and labour input one has to make do with alternative indicators or else make adjustments to existing data.

Output indices, for example, are largely based on the quantities produced, but other indicators are also used, the extent varying from one country to another, e.g. the value of deliveries, the quantity of materials consumed and, in some cases, employment or the number of hours worked. If no data are available on the number of man-hours per unit produced, and it is desired to base the weights on them, it becomes necessary to find alternative coefficients which may or may not be close to the original concept and may, for example, relate to unit value, value added per unit produced or unit labour cost.

National accounts statistics yield values which are unsuitable for calculating labour productivity because the contributions of certain service sectors are estimated by means of an index of wage rates. Similarly, industrial statistics do not always supply information about the value added in each of the years in the period covered, and several countries use an index of gross output on the assumption that value added is subject to the same fluctuations. When output is estimated in terms of value, it is essential to use indices which eliminate price fluctuations. But the price statistics by no means cover all goods and services, and one is therefore faced with the problem of relative prices and their influence on productivity, especially when making inter-country comparisons.

The measurement of the labour input is also based in many cases on data reflecting several concepts. For example, the number of hours worked by salaried staff is usually calculated from changes in the hours of work of wage earners, and the concept is therefore neither wholly a measurement in time units nor a measurement in terms of the numbers employed, but a combination of the two.

Other difficulties are caused by the fact that the data on output, employment and hours of work do not come from identical sources; this may lead, for example, to differences in scope or in industry classifications. The data must therefore be adjusted to ensure comparability, which is essential before any productivity ratio can be calculated. Even if the source is identical, differences may occur when, for instance, the value of output is calculated for the financial year and the level of employment for the calendar year.

Nevertheless, the use of alternative indicators or somewhat arbitrarily adjusted data can in practice yield results very close to those that would be obtained from data fitting the concept selected. Professor Frankel quotes the following examples taken from experiments designed to test the effect of the choice of method on the results:
(a) In the United States experiments were conducted with a group of seventy consumer product series. The series were, in turn, weighted by value added including indirect taxes, value added excluding indirect taxes, value measured at retail prices, and they were evenly weighted. Aggregate rates of growth computed on each of these bases differed little over a period covering several years.

(b) Canada and the Netherlands have experimented with indexes of the net output type on bases both gross and net of depreciation. At the aggregate level, for inter-temporal movements, both types of series behaved similarly. But at lower levels of aggregation there were sometimes significant differences between them.

(c) The United Nations Statistical Office has experimented for several countries, combining physical output indexes first by gross output weights and second by census value added weights. The results for the 1953-58 period for the rate of aggregate growth, which here depend on the ratio of census value added to gross output in industry branches and on the rates of growth of the branches, were variable with significant differences sometimes existing between the two series.\(^1\)

Finally, when taking a close look at the methods employed to measure labour productivity, one finds that the data on which calculations are based do not quite tally with the concepts that would be theoretically ideal. Physical measurements and measurements based on the amount of working time tend in practice to become value measurements, while net value measurements tend to develop into gross value measurements. Similarly, labour input is often expressed in units derived from data relating simultaneously to units of time and to a labour force.

\(^1\) Op. cit., para. 79.
5. FUTURE NEEDS AND PROSPECTS

It has often been noted that the existence of international standards for statistics promotes the development of national statistics as well and makes it easier to compare them at the international level. The question naturally comes to mind, therefore, whether international standards could not also be set for methods of measuring labour productivity.

Present circumstances, however, hardly seem to be suitable for singling out one of the many possible measures and making it into an international standard. Indeed, it is useful to have a whole set of measures which can help to bring out the various features responsible for differences in productivity. But here too, it would be premature to try to set standards with the aim of choosing a single productivity ratio for each purpose. At the most, one can merely say that some measures are more suitable than others for particular types of analyses. If the aim, for example, is to ascertain the effect of productivity on the trend of hourly wages or hours of work, then measures based on the time worked will probably yield the most significant information. On the other hand, for finding out the relationship between productivity and the composition of the labour force, for projecting employment trends and the demand for labour according to skill or for planning a policy of full employment, it would be advisable to use measures based on the workforce as an instrument of analysis.

Physical measures are eminently suitable for comparisons of labour productivity in industries where output is confined to a single product or a homogeneous group of products; however, it would probably be better to use a value measure at a higher level of aggregation or when assessing the productivity of services.

Considerations such as these led the Working Group on Productivity Statistics to put forward a number of suggestions for the establishment of labour productivity statistics in accordance with certain broad common principles, especially as regards the economic coverage of series and the choice of units of measurement for output and the corresponding labour input.¹

The Working Group recommended that, as far as economic coverage was concerned, countries should compile indices of labour productivity both for

¹ A summary of these recommendations is given in Appendix 6.
the economy and for industry as a whole (defined as mining and quarrying, manufacturing, electricity, gas and water supply); it likewise recommended separate indices for the other sectors and for twenty-three industrial groups.

After discussing the measurements of output that were most suitable at various levels of aggregation, the Working Group took the view that the use of gross value measures should be confined to cases where the output of sectors in which productivity is being compared is on a similar pattern and that it would be better to base comparative analyses on value added measurements whenever there are marked differences in the use of goods and services supplied by other sectors. As regards the productivity of the national economy as a whole, the Working Group did not decide which concept was most suitable for measuring output; however, several participants took the view that preference should be given to estimates at constant prices of the gross domestic product at factor cost, owing to the difficulties encountered in assembling data at constant prices on capital consumption.

The suggestions by the Working Group regarding the measurement of labour inputs in production reflect its constant concern to ensure that account is taken of the activities of all persons engaged in production and that the data respecting output and labour should be comparable. In the industrial sector, for example, the measurement of labour should not be confined to the number of manual workers or the hours actually worked by them, but should cover all employees or the hours worked by them, since the value added includes salaries as well as wages.

In the last analysis, the improvement of labour productivity statistics largely depends on better national statistics on output and on the existence of corresponding data for employment or hours of work. Similarly, the opportunities of comparing the trend and level of productivity between one country and another increase in step with the use of comparable concepts for the definition of output, input and prices and the wider use of the standards in existence in these fields.

As regards scope, the International Standard Industrial Classification of All Economic Activities—especially the revised version—provides a basis for presenting comparable statistics at each level of aggregation. A number of International Conferences of Labour Statisticians have analysed the definitions and methods of compilation of statistics on employment and hours of work and have laid down standards on the subject. Standardised definitions and methods for the establishment of national accounts and production indices have also been worked out by the United Nations.1

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1 See Appendices 3 and 4, together with Chapter 7.
What is often lacking is adequate price indices to provide an output series in constant prices. Research has been carried out recently by the Statistical Office of the European Communities into the objectives of price statistics and the possibility of establishing a common system to correct variations due to the influence of prices on value aggregates, observe the evolution of prices and compare their level in the member countries of the Community. [98, pp. 64-65]

In this connection, it would be extremely helpful if countries were to publish at regular intervals the conversion rates they use for purchasing power in each sector and at each of the main levels of aggregation or, failing that, the "unit prices" of identical assortments of goods.
PART II

NATIONAL LABOUR PRODUCTIVITY STATISTICS
AND THEIR COMPARABILITY
INTRODUCTORY NOTE

Part II contains a detailed analysis of existing national statistical series dealing with labour productivity. This analysis not only shows how problems of methodology have been solved in practice but also brings out the obstacles encountered in making comparisons at the international level and suggests a few guidelines for dealing with them.

There are numerous indices of labour productivity but many of them cover only one industry or one group of firms. It would be neither possible nor helpful to discuss each of these series in this study. Two groups have been used: the series relating to labour productivity in the national economy as a whole and those relating to productivity in the industrial sector or in manufacturing.

The main features of national series are analysed in Chapter 6, while the difficulties of making international comparisons owing to differences in concepts and methods are examined in Chapter 7, which also discusses various ways of improving the international comparability of national series.

For the methodological descriptions of the series forming the subject of the analysis see Appendix 1.
6. ANALYSIS OF NATIONAL SERIES

The descriptions in Appendix 1 deal with about 100 national series in all, calculated by thirty-four countries of which twenty-three are in Europe, one in Africa, two in North America, one in Latin America, six in Asia and one in Oceania. Six of these countries only compile one index, but the remaining twenty-eight issue anything from two to over ten series based on different concepts or calculated for different levels of economic aggregation.¹

Indices for labour productivity in the national economy as a whole are available in eighteen countries; twenty-seven publish indices of productivity in the industrial sector and twenty-two have series showing the trend of productivity in manufacturing. A list of these countries and details of the scope of their series are given in table 6.

Most of the series are calculated from the end of the 1940s or the beginning of the 1950s onwards, although a few countries have longer series going back to before the First or Second World War. Cyprus, Ghana, Greece, South Korea and Spain have calculated series only since 1960 or later.

The main characteristics of these series are listed in two comprehensive tables, one of them (table 7) dealing with the series for labour productivity in the national economy as a whole and the other (table 8) with the series for labour productivity in industry. These two groups of series usually differ not only in scope but also in concept and in the methods by which the data used in calculating them are obtained. Each group therefore requires to be examined separately.

SERIES RELATING TO THE PRODUCTIVITY OF THE NATIONAL ECONOMY AS A WHOLE

Eighteen countries, eleven of them in Europe, compile a total of twenty-nine series for labour productivity in the national economy as a whole. With the exception of Canada, the Federal Republic of Germany, Israel, Italy, Norway, the Philippines and the United States, each country has only one index of this type.

¹ These series are reproduced in Appendix 2; in order to facilitate comparison, they have all been recalculated by the ILO on the basis 1963=100.
### TABLE 6. STATISTICAL SERIES ON LABOUR PRODUCTIVITY, BY COUNTRY AND LEVEL OF AGGREGATION

<table>
<thead>
<tr>
<th>Country</th>
<th>National economy as a whole</th>
<th>Industrial sector</th>
<th>Manufacturing</th>
</tr>
</thead>
<tbody>
<tr>
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<td>O</td>
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<tr>
<td>Austria</td>
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<td>Belgium</td>
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<td>Germany, Federal Republic of</td>
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<td>Yugoslavia</td>
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</tbody>
</table>

- 1 Usually mining and quarrying, manufacturing, electricity, gas and steam; sometimes including public water supply.
- 2 Including building.  3 Including construction and certain services.
The volume of the national output which is used in these series as the numerator is estimated on the basis of national accounts data. Concepts, however, are by no means identical, nor—above all—are estimating methods.

Ten countries base their calculations on the gross domestic product estimated either at factor cost (Canada, Finland, Ireland, Italy and the United Kingdom) or at market prices (Belgium, Federal Republic of Germany, Israel, Malta and Norway). In five countries (Austria, China (Taiwan), Japan, the Philippines and the United States), the numerator is the gross national product at market prices, except in the case of Austria which obtains its data at factor cost. The Federal Republic of Germany, Italy, Norway and the Philippines also have series based on the net domestic or national product, estimated at factor cost in Italy and at market prices in the other three countries.

France uses gross final output, a concept which is akin to the gross domestic product but includes imports that are not for direct consumption or capital investment. The volume of output in the Czechoslovak series, as in one of the Italian series, corresponds to the national income. Lastly, New Zealand bases its series on the volume of output calculated from the indices of production of goods and services.

Normally the entire national economy is covered, except in Canada, Czechoslovakia, New Zealand and the United States. In the last country, the index of national productivity covers only the private sector and certain government services which can be measured in terms of volume without using data relating to the labour force or the wages paid, i.e. postal services, public utilities and municipal transport. Canada excludes from its series all non-commercial economic activities such as public administration, national defence and non-profit-making services. New Zealand also leaves national defence out of account. In Czechoslovakia foreign trade is not covered and the national income does not include the value of houses built by individual owners.

The labour units used as denominators in the series for labour productivity in the national economy as a whole usually consist of the number of persons in employment or the total hours worked by the active population as a whole. Some countries, such as Canada, Italy and the United States, compile series using both measurements. The United States calculates a third series based on the concept of hours of work actually paid for. Finland and Norway use an estimate of the number of man-years worked by the active population.

Of course, the statistics for the number of persons employed or the hours worked are not obtained directly. They are estimates based on more or less complete statistics derived from a variety of sources, such as censuses of the population or industry, labour force sample surveys, establishment reports, social security records, or official returns. The definition of the total number of persons employed also varies from one country to another; some include
TABLE 7. MAIN CHARACTERISTICS OF SERIES RELATING TO LABOUR

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<th>Country</th>
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Available. O Not available.

1 Data also available for 1913 and 1924-37. * Absolute figures only. * Excluding public administration, national defence and certain non-profit-making services. * The indices are also published on the basis 1955 = 100
PRODUCTIVITY IN THE NATIONAL ECONOMY AS A WHOLE

<table>
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<tr>
<th>Measure of labour input</th>
<th>Periodicity (in months)</th>
<th>Base period of index</th>
<th>Data available with effect from</th>
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<td>Man-years</td>
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</tr>
</tbody>
</table>

for recent years. ¹ Gross final output. ² Annual data available from 1950 onwards on the basis of an earlier index. ³ Data available from 1957 onwards on the basis of an earlier index. ⁴ Quarterly indices available only from 1963 onwards. ⁵ Private economy, including certain government sectors (postal services, public utilities and municipal transport). ⁶ Data available from 1909 onwards on the basis of earlier indices.
TABLE 8. MAIN CHARACTERISTICS OF SERIES

<table>
<thead>
<tr>
<th>Country</th>
<th>Measure of output</th>
<th>Measure of labour input</th>
</tr>
</thead>
<tbody>
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<td>Canada</td>
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(Footnotes at end of table)
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<tr>
<th>Year</th>
<th>Base Period</th>
<th>Man.-days (wage earner)</th>
<th>Man.-hours (wage earner)</th>
<th>Industry covered</th>
<th>Measure of labour input</th>
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<td>1951</td>
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<td>Man.-hours and man.-days</td>
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<td>0</td>
<td>manufacturing</td>
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RELATING TO LABOUR PRODUCTIVITY IN INDUSTRY

ANALYSIS OF NATIONAL SERIES


<table>
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<th>Country</th>
<th>Measure of output</th>
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(Footnotes at end of table)
### TABLE 8 (concl.)

<table>
<thead>
<tr>
<th>Country</th>
<th>Measure of output</th>
<th>Measure of labour input</th>
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<tbody>
<tr>
<td></td>
<td>Gross output</td>
<td>Net output</td>
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<tr>
<td>Rumania 6</td>
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<td>USSR 18</td>
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<td>United Kingdom</td>
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<td>United States</td>
<td>■</td>
<td>■</td>
</tr>
<tr>
<td>Yugoslavia</td>
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</table>

- Available.  ○ Not available.

1 In general, mining and quarrying, manufacturing, electricity and gas.  2 Absolute figures only.  3 Half-yearly or quarterly indices available in recent years.  4 Persons directly involved in production.  5 Socialist sector only.  6 Indices also calculated on another basis.  7 Including construction.  8 Gross final output.  9 Indices

domestic servants, casual workers, homeworkers, members of the armed forces, aliens, etc., while others exclude them. Thus in China (Taiwan) and Czechoslovakia family workers are not included but are taken into account in the other countries. China (Taiwan) also excludes aliens, whereas the Federal Republic of Germany counts them if they are working in Germany or employed in German missions abroad. On the other hand, persons living within the Federal Republic and working outside it or for foreign missions or members of armed forces stationed in Germany are not reckoned. In Israel the concept is that of the number of persons at work; persons with jobs who during the period covered by the surveys did not work because of holiday, sickness, an industrial dispute or for other reasons are not included in the statistics. In the United States two concepts are used to estimate the number of persons employed;
### TABLE 8 (concl.)

<table>
<thead>
<tr>
<th>Measure of labour input</th>
<th>Industrial sectors covered</th>
<th>Periodicity (in months)</th>
<th>Base period of index</th>
<th>Data available with effect from</th>
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<td>Total 1</td>
<td>Man-days (wage earners)</td>
<td>Mining and quarrying and manufacturing</td>
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<th>Periodicity (in months)</th>
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<th>Industrial sectors covered</th>
<th>Periodicity (in months)</th>
<th>Base period of index</th>
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<td>Mining and quarrying and manufacturing</td>
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</tbody>
</table>

also available for the years 1939-43 and 1946-48. * Including construction and certain services. \[ Persons in regular employment or who work more than thirty-two hours a week; including casual workers, expressed in units of regular work. \] \[ Index also available for the period 1955-59 on the basis 1955 = 100. \] \[ Earlier indices from 1921 onwards are also available. \] \[ Indices also available from 1927 onwards. \] \[ Contributions to net domestic product. \] \[ Excluding kolkhoz industries. \] \[ Indices also available from 1950 onwards. \] \[ Earlier indices from 1905 onwards are also available. \]

One relates to the actual number of persons—a figure obtained largely from labour force sample surveys—while the other relates to the number of jobs—largely derived from establishment reports.

There would be hardly any point in going into the differences between the exact coverage of the estimates of the number of hours of work. For one thing, information about the estimating methods employed is extremely sketchy and for another, these estimates are often very approximate, and inevitably the scope of the figures cannot be accurately defined.

Depending on the statistics available, countries usually try to select as denominator in their series for labour productivity in the national economy as a whole the data that correspond most closely to the concept used to measure output, where necessary with adjustments.
What influence do differences in concepts or estimating methods have on productivity statistics? The series calculated in absolute figures are naturally affected both by the choice of measure of the volume of output and by the choice of measure of the unit of labour input. However, when the series are converted into indices, the influence is less and in some cases seems to be negligible.

The use of different concepts for the volume of output hardly seems to affect the indices. In Italy, according to an investigation by the National Productivity Committee, the gross domestic product at factor cost per person employed evolved in almost the same way between 1951 and 1963 as the net domestic product at factor cost per person employed. [65]

In Norway the trend of the gross domestic product has been slightly different from that of the net domestic product, and this is also reflected in the productivity indices based on the two concepts, as is shown by the figures in Appendix 1.

The possible extent of the influence exercised by the choice of different estimating methods can be gauged with the help of an example provided by the United Kingdom. This country has three indices relating to the gross domestic product, the first two consisting of estimates based on expenditure measured at market prices and at factor cost and the third relating to estimates based on the contributions of the various branches of economic activity; the three indices (1958 = 100) were as shown in table 9 from 1955 to 1964.

### TABLE 9. TREND OF THE GROSS DOMESTIC PRODUCT OF THE UNITED KINGDOM ACCORDING TO DIFFERENT CONCEPTS, 1955-64

<table>
<thead>
<tr>
<th>Year</th>
<th>Based on measured expenditure</th>
<th>Based on contributions by branches of the economy</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>At market prices</td>
<td>At factor cost</td>
</tr>
<tr>
<td>1955</td>
<td>96.3</td>
<td>96.5</td>
</tr>
<tr>
<td>1956</td>
<td>98.1</td>
<td>98.5</td>
</tr>
<tr>
<td>1957</td>
<td>100.0</td>
<td>100.3</td>
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<td>100.0</td>
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<td>1959</td>
<td>104.1</td>
<td>103.6</td>
</tr>
<tr>
<td>1960</td>
<td>109.3</td>
<td>108.8</td>
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<tr>
<td>1961</td>
<td>113.0</td>
<td>112.7</td>
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<tr>
<td>1962</td>
<td>113.8</td>
<td>113.5</td>
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<tr>
<td>1963</td>
<td>118.9</td>
<td>118.3</td>
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<tr>
<td>1964</td>
<td>125.3</td>
<td>124.4</td>
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</table>

While the choice of concept for the volume of output has little effect on variations in the series, this is not usually the case when it comes to choosing the unit of labour input. Since the average number of hours worked varies over the years, indices of national productivity per person employed and per man-hour or man-year measure different things and are subject to the influence of different factors. For example, in Canada national productivity per person employed went up at an annual rate of 3.5 per cent between 1949 and 1965 as against 4.4 per cent per man-hour. In Italy, from 1960 onwards, productivity in industry and manufacturing has risen faster when measured on the basis of the total number of persons employed than when the contribution of these persons is expressed in standard labour units. On the other hand, the use of different estimating methods for these two concepts does not appear to have any appreciable effect on the trend of the indices. This at least is the conclusion to be drawn from experience in the United States. For example, the United States Bureau of Labor Statistics has compiled its series on national productivity on the basis of two different concepts of labour input; each of these is based on two different statistical sources, one being largely derived from labour force sample surveys and the other from establishment reports. Despite this, variations in the indices between 1956 and 1966 remain very similar, the widest deviation, which occurred in 1964, amounting to only 1 per cent. Table 10 gives a fuller picture of the evaluation of the four indices.

Series relating to Labour Productivity in Industry and Manufacturing as a Whole

Some eighty indices of labour productivity calculated by thirty-three countries are given in Appendix 2. Albania, China (Taiwan), Cyprus, Greece, New Zealand, the Philippines, Poland, and Yugoslavia compile only one series; all the other countries have at least two series based on different concepts or relating to more than one level of aggregation in the industrial sector. Details of the scope and concepts are given in table 8. Some essential differences and their possible effect on indices of labour productivity are discussed below.

Differences in Economic Scope

Under the influence of technical progress labour productivity has not evolved in the same way in all economic sectors in recent years; differences in economic structure may therefore have an effect on the trend of labour productivity indices. Usually labour productivity has risen faster in mining and quarrying than in manufacturing, but has tended to be lower in construction. According to the available statistics, variations in productivity in electricity, gas and steam
### TABLE 10. INDICES OF NATIONAL PRODUCTIVITY IN THE UNITED STATES BASED ON DIFFERENT CONCEPTS AND ESTIMATING METHODS, 1956-66

\((1957-59 = 100)\)

<table>
<thead>
<tr>
<th>Year</th>
<th>Gross national product</th>
<th>Per person employed</th>
<th>Per man-hour</th>
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</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>a</td>
<td>b</td>
</tr>
<tr>
<td>1956</td>
<td></td>
<td>96.6</td>
<td>95.8</td>
</tr>
<tr>
<td>1957</td>
<td></td>
<td>97.9</td>
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<tr>
<td>1966</td>
<td></td>
<td>127.7</td>
<td>127.2</td>
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</table>


a Estimates of the number of persons employed and hours worked, based mainly on labor force sample surveys.
b Estimates of the number of persons employed and hours paid for, based largely on establishment reports.

1 Private economy, including certain government sectors.

Supply, which in any event are similar to those encountered in other sectors, do not affect the trend of the indices for the industrial sector as a whole.

Some forty series calculated by twenty-three countries cover the whole of the industrial sector, including mining and quarrying, manufacturing, electricity, gas and steam. Four countries have eleven indices covering mining, quarrying and manufacturing; Appendix 1 also gives details of about forty series calculated by twenty-two countries for manufacturing alone. Most of the countries also have indices covering only one or several manufacturing industries or all or part of other branches of activity, e.g. agriculture, construction, commerce, transport or services. A detailed examination of these series would be beyond the scope of this study.

Within the three groups mentioned, there are also certain differences in coverage. Some of the series for the industrial sector as a whole relate to only part of the total production, transport and distribution of gas, electricity and steam. Others also include public water supply. In China (Taiwan), Ireland, Italy and the United Kingdom the indices also cover construction; Ireland includes government services, laundries and dry-cleaning as well. In Rumania and the USSR, the industrial sector also includes logging, while in Poland it includes deep-sea fishing. Because of differences between national classifica-
tions or in some cases difficulties in obtaining data, the scope of the indices for manufacturing is not always the same in every country. For example, the series for the Federal Republic of Germany include quarrying but exclude the repair of footwear, the manufacture of cement and other non-metallic mineral products, shipbuilding, the manufacture of railway equipment and aircraft and motor car repair workshops. The figures used by Austria do not cover the manufacture and repair of footwear or printing and publishing; publishing is not included by Czechoslovakia, Hungary, Poland and Rumania; in Israel the index does not cover slaughter-houses or the armaments industry.

Differences in coverage may also be due to another factor, namely the size of the establishments to which the data relate. Coverage may vary from one country to another, since surveys often exclude establishments employing not more than four, five or nine persons, depending on the country. The limit may be a good deal higher, especially in the developing countries: in China (Taiwan), for example, establishments not using motive power are covered only if they employ more than forty wage earners (less if motive power is used, in which case it depends on the number of horsepower). In Ghana the data are obtained from surveys of establishments employing thirty persons or more.

Differences in the Measurement of Output

The measurement of output is almost always based on statistics of industrial production, but two different concepts are used.

Under the first, indices of labour productivity are calculated on the basis of gross total output, usually obtained by adding up the value—corrected to allow for price variations—of the finished and semi-finished products and services of an industrial character accounted for by all the establishments covered by the statistics. All the countries with planned economies, as well as Brazil, Cyprus and Ghana, use this method to measure their industrial output.

Under the second concept, which relates to net output, purchased inputs such as raw materials and fuel, together with administrative, sales and maintenance overheads, are deducted from the value of gross output. Purchased inputs may or may not include an allowance for depreciation. Twenty-three countries use a concept involving net output; to these should be added Brazil, Ghana and Hungary, which calculate series based on net output in addition to an index based on gross output. The index of net output is usually a weighted arithmetical average of indices based mainly on the quantities produced in each industry or obtained from other indicators assumed to represent the volume of output. In most cases the weights used correspond to the value added. Some countries, such as New Zealand and Norway, base themselves on the contribution to the gross national product; Hungary uses the number of
hours worked by wage earners, while Yugoslavia relies on wages and other labour costs and the rate of depreciation. The value added may be gross or net, but in practice hardly ever fits the concept completely and includes items which should not normally be covered. For example, in the Federal Republic of Germany the value of certain intermediate goods and services from other sectors (maintenance of purchased goods, carriage, advertising and insurance expenses, legal services, etc.) is included in the value added.

Variations in productivity are of course affected by the choice of concept used to measure output. The series for Brazil, Ghana and Hungary can be used as examples to illustrate the influence of the choice. The indices show that between 1950 and 1964 the index of labour productivity per person employed in mining and quarrying, manufacturing and electricity supply in Hungary went up at an annual rate of 5 per cent if calculated on the basis of gross output and of 4 per cent if based on variations in net output. Similarly, in Ghana, the index based on gross output rose faster than the index based on net output—the former went up by 12 per cent between 1962 and 1964 compared with an increase of 8 per cent in the latter.

Differences in the Measurement of Labour Units

Of the indices of labour productivity in industry analysed in Appendix 1, forty-two relate to output per person employed, nine to output per employee, sixteen to output per wage earner, two to output per man-year, five to output per worker-day, thirteen to output per worker-hour and seven to output per hour of work of the active population as a whole.

The data relating to the workforce or hours of work are taken in most cases from the industrial statistics from which the output figures are also obtained. However, the methods of obtaining the data, their scope and the definitions of persons employed, workers and hours of work display differences, some of which are inevitably reflected in labour productivity indices.

The fact that some employment statistics are based on the number of persons actually in employment on the last working day of each month, while others relate to the total number of persons on the payroll, probably does not particularly affect the series any more than the fact that apprentices are included in, or excluded from, the total number of persons employed. On the other hand, whether or not casual workers or part-time, home or handicraft workers are included in the statistics of the number of persons employed may cause major differences in the results if the number of these workers fluctuates appreciably over a period of time in relation to the total number of persons employed.

There are also differences in the definitions of a working hour. Some countries base themselves on the hours of work paid for, while others use the
hours actually worked; yet others employ estimates based on normal hours of work. To judge by the experience of Austria during the period 1956-61, variations in output per man-hour worked differ only very slightly from those in output per man-hour paid for. Other countries, however, may have found that the differences were greater.

The fact that some countries calculate different series based on different measurements of labour demonstrates the influence of the choice of measurement on indices of productivity in the industry sector. The indices in Appendix 2 show that, in general, series calculated on the basis of the workforce do not rise as sharply as series based on hours of work, and that if the series for the workforce or hours worked relate only to manual workers or the hours worked by them, the increase is greater than if all persons employed or all wage earners or the hours worked by the active population as a whole are included. Thus in the Federal Republic of Germany labour productivity in the industrial sector went up between 1958 and 1966 by 46 per cent per person employed, 56 per cent per wage earner, 61 per cent per hour worked by each person employed and 72 per cent per man-hour (wage earners) actually worked.

National Methods of Adjustment

As we saw in Part I, the choice of data for calculating productivity indices in the industrial sector must be guided by two principles: the series for the nominator and denominator must be identical in scope and the volume of output must be estimated on a basis other than units of labour measurement.

It often happens, however, that data on output and employment or on hours of work have been collected for other purposes and do not come from the same surveys; this means that they have to be adjusted to ensure that the two sets of data are the same in scope. Even when the data come from the same source, adjustments may be necessary. In some countries with planned economies, for example, the returns by establishments which only supply full information for one of these two sets of data are not used in calculating indices of labour productivity.

Usually, it is the series dealing with labour units that are adjusted. The most marked divergences are due to the use of different classifications for output

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<tbody>
<tr>
<td>Man-hour paid for</td>
<td>100.0</td>
<td>105.3</td>
<td>108.5</td>
<td>118.5</td>
<td>127.8</td>
<td>131.5</td>
</tr>
<tr>
<td>Man-hour worked</td>
<td>100.0</td>
<td>105.9</td>
<td>108.6</td>
<td>119.4</td>
<td>128.6</td>
<td>132.5</td>
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Source: [164, p. 8].

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on the one hand, and for employment and hours of work on the other. In the first case, the classification is based on the type of product, while in the second, establishments are allocated to particular industries in accordance with their main or basic product (in terms either of output or numbers employed).

Austria has just compiled a revised employment series which will be used in calculating productivity indices. In this new series, all establishments producing goods in a number of industrial categories are allocated percentage points accordingly, which are fixed for one year and adjusted at the end of it. In the Federal Republic of Germany, the series for hours worked by both manual workers and all persons in employment are taken from the returns by industry, in which establishments are classified in accordance with their main product in terms of the number of persons employed. In order to make these series tally with the data on output, the total number of hours worked in each industry is recalculated in accordance with the classification principle employed for output and the labour force, which is based on subdivision by local production unit.

Other countries make do with unadjusted series because they have sometimes found as a result of special investigation that differences between the two sources of information exercise virtually no influence on variations in the indices. For instance, in the United Kingdom the National Institute of Economic and Social Research came to the conclusion that the employment index for Northern Ireland moves in much the same way as the index for Great Britain, which it uses to calculate the index of productivity for all manufacturing. The influence of the differences in scope is considered to be negligible, especially when it is borne in mind that the number of employees in Northern Ireland in 1964 accounted for little more than 2 per cent of the total number for the United Kingdom. In Italy, the series for output and hours worked in manufacturing are obtained from two different sources, but no adjustments are made because the information on productivity obtained in this way is regarded by the Italian Government as being for general guidance only. Japan, which does not possess data on the number of hours worked that are at all comparable with the data for output, does not calculate a productivity index on the basis of this unit of labour.

Adjustments of another type are often made to output series. This is the case when, in the absence of any better indicators, the volume of output in certain elementary series is estimated on the basis of the workforce or the number of hours worked. This method of estimating output is used mainly for monthly output indices, and fortunately is used much less widely for annual indices; otherwise the indices of labour productivity based on it would of course be virtually meaningless. Some countries adjust their series to take account of productivity changes. These adjustments may be made in a number
of ways. Canada, for some of its monthly or quarterly series dealing with manufacturing, uses data on shipments or inventories which in themselves are not sufficiently reliable for the measurement of output. The data on shipments and inventories adjusted to allow for changes in prices are divided by the number of hours worked in the industry in question. The mobile average of the result thereby obtained is examined and if necessary modified in the light of historical productivity indices based on annual returns or payrolls for the reference period. Multiplying indices of employment and hours worked by the coefficients obtained in this way gives series adjusted to take account of productivity trends. [75, pp. 56-57]

Norway likewise adjusts its monthly series in which output is estimated on the basis of the hours worked by manual workers. This adjustment is in fact the average increase in productivity recorded during the last five years for which statistics are available. Similarly, in Sweden, the monthly series based on hours worked are adjusted annually by extrapolating the rise over the past five years as shown by annual censuses of industrial production.
7. INTERNATIONAL COMPARABILITY OF NATIONAL LABOUR PRODUCTIVITY SERIES

SOME METHODOLOGICAL CONSIDERATIONS

This chapter confines itself to making a brief examination of the difficulties that may arise in comparing changes in labour productivity indices at different levels of aggregation in two or more countries. Comparative studies of differences in levels of productivity—especially direct studies—are discussed in Part III.

While it seems likely that comparative studies of productivity levels yield the best results, it is quite certain that they are inadequate to give a general picture of variations in labour productivity in all economic activities, since in most cases they cover only a few sectors or selected periods. The value of an international comparison of these variations over a period of time has often been emphasised. With the issue of new national series in the past few years and the increase in the number of countries calculating indices, a further expansion in intertemporal studies can be expected.

It is one of the advantages of these indices that they afford a measurement of variations over a period of time and make it possible to compare one country with another, even though the data on which they are based hardly lend themselves to comparison in absolute values. In addition, the employment of indices gets round the difficulties caused by differences in exchange rates and the relative values of national currencies.

Nevertheless, other difficulties remain. These are due to the fact that productivity indices often express the ratio between two composite indices. Minor errors or systematic distortions of the indices of output, employment or hours of work may in themselves be negligible, but cumulatively are liable to become significant. Similarly, the choice of base year is important—whether it was a year of boom or recession. A further point is that the degree of utilisation of productive capacity may also vary between one period or country and another. These factors inevitably influence variations in productivity, perhaps even to a greater extent than differences in methods of compiling the indices.

Comparative studies based on indices would give a more faithful picture of changes in productivity over a period of time in different countries to the extent that the choice of methods of obtaining basic data, weighting formulas and
systems, level of aggregation and pattern of production were the same. These ideal conditions, however, are hardly ever encountered, and it may well be that the differences noted in the trend of indices merely reflect the influence of factors unconnected with changes in labour productivity in the strict sense of the term.

Higher productivity is not always due to an improvement in the productivity of a country’s production units. It may quite possibly be due to changes in the structure of these units, especially when the period concerned is a long one. If, for example, the indices of labour productivity are based on returns by industrial establishments of a given size, the figures for output and the workforce will not be strictly comparable in successive years because firms are constantly moving in and out of the statistical limelight, i.e. during boom years small firms will be covered by the survey, but in slumps these same firms and other less competitive enterprises will be forced out of business and this will inevitably affect the productivity indices.

Another difference is that indices are essentially national in character. In other words, the weighting used in calculating output is peculiar to each country.

When a comparison is between two countries and two periods there is, theoretically, a choice between four weights. But for reasons of convenience and lack of sufficient data to devise anything better, the method that is nearly always selected is to use the weights of each country to measure the evolution of its own output. Differences in production trends between the two countries may therefore be due to differences in the quantities of goods produced or in the relative prices used to weight these quantities.

**Difficulties of Comparing National Indices**

The practical difficulties of making productivity comparisons between one period and another vary according to the country. Although published and unpublished data are far more plentiful nowadays than in previous decades and the problems encountered in making intertemporal comparisons are fewer than formerly, there are still many disparities between national series which may make the conclusions of comparative analyses subject to considerable qualification.

The main differences between national indices as regards scope, concepts and methods were discussed in the previous chapter. Strictly speaking, proper comparisons of productivity in the national economy as a whole for more than two countries would only appear possible between Belgium, the Federal Republic of Germany, Israel and Malta on the one hand and between China (Taiwan), Japan and the Philippines on the other. Even then, the most that can be said is that the methods used in each of these two groups of countries are
MEASURING LABOUR PRODUCTIVITY

derived from the same basic concept and do not differ sufficiently to impair the comparability of the series obtained.

The number of countries for which valid comparisons can be made between labour productivity indices in industry appears at first sight to be higher, since six of them—all with planned economies—collect data of gross output per person employed; Ghana calculates one of its indices in the same way, but the data cover only establishments employing thirty persons or more. In ten countries, including Ghana, the yardstick for measuring changes in productivity is net output per person employed. For productivity in manufacturing, thirteen countries possess series relating to net output per person employed, while the hourly productivity of operatives can be compared in six countries.

In order to obtain a general idea of the extent to which the available information is suited to productivity comparisons at different levels of aggregation, Professor Frankel undertook a brief survey of five countries in five different parts of the world during the years 1950-60. The results of this comparative study are given in Appendix 5; the conclusion to be drawn is that the opportunities for making comparisons are still limited, even between countries with well-developed statistical systems.

Difficulties in comparing the series of one country with those of another continue even when the definitions and concepts used to calculate output and labour input are similar, owing to the fact that weighting systems differ; even the choice of base year for the weights has some effect. A few countries in fact use several sets of weights to measure the effect of certain structural factors on productivity. Canada has used this method to investigate the share in the rise of national productivity attributable to the fall in the proportion of its active population employed in agriculture. The Federal Republic of Germany has also found, by using different weighting systems, that in recent years, when there has been an acute shortage of labour, the retention of workers by certain industries has actually slowed down the rise in productivity. In Italy work has been done on these lines to find out what the rise in national productivity would have been without the migration of workers from the south to the north. Similarly, in France, the question of the influence exercised by the structure of the active population on productivity has been examined.

WAYS OF ENHANCING THE INTERNATIONAL COMPARABILITY OF NATIONAL LABOUR PRODUCTIVITY SERIES

Improvements in the Comparability of Existing National Series

The descriptions given in Appendix 1 and the brief analysis made in Chapter 6 show that the comparability of labour productivity indices is often impaired by differences in economic scope or by the use of widely differing
measures of output or units of labour input. It should be noted, however, that these differences have far less influence on variations in the indices than on comparisons in absolute value.

The question of scope hardly arises at the level of the national economy, although some countries exclude certain service sectors.

On the other hand, as is shown by the analysis of various series in Appendix 1, differences do occur in the definition of the industrial sector. The comparability of these indices would be greatly increased if countries were to make them identical in economic scope. This would mean, for example, China (Taiwan), Italy and the United Kingdom excluding data for construction from their series, and the Federal Republic of Germany, Israel and Sweden including electricity, gas and steam.

A number of countries calculate their productivity series on the basis of more than one measurement of labour, which, of course, increases the scope for international comparison. However, as national statistics show, the opportunities are not always taken, and many countries possess data on which they could base one or more additional concepts of labour measurement in their productivity series.

Another method that could be used more widely than hitherto is to use more than one concept to measure output, either nationally or for the industrial sector. If—like Hungary—the other countries with planned economies also calculated series on the basis of net industrial output, their indices would be more easily comparable with those of countries with other economic systems. Indeed, many countries tend to use several indices to obtain information about certain production factors for economic analysis and projection.

Lastly, it is worth emphasising the benefit of very detailed information about the definitions, concepts, weights and formulas used in calculating indices. A study of the series described in Appendix 1 points to the conclusion that the available information on methodology is not always sufficiently detailed. In many cases there is no precise indication of the procedures used to assess the number of persons employed or the total number of hours worked which serve as the denominator in calculating labour productivity. The same obstacle is encountered when one tries to explain differences in estimates of the national product or the volume of industrial output. Lacking detailed information of this kind, however, one may hesitate to draw conclusions on the basis of comparative analysis of national indices, since variations may merely be due to differences in the choice or definition of the concepts employed.

**Improvement of Basic Statistics**

The comparability of national productivity indices, whether calculated for the national economy as a whole or for fairly large segments of industry, de-
pends first and foremost on the comparability of the statistics measuring output and labour inputs.

In order to provide standards for statistics measuring output, the United Nations has devised a system of national accounts and supporting tables (SNA) based on a number of concepts, including the following:

(a) net domestic product at factor cost;
(b) gross domestic product at factor cost (equal to (a) plus provisions for the consumption of domestic fixed capital);
(c) gross domestic product at market prices (equal to (a) plus provisions for the consumption of fixed capital plus indirect taxes minus subsidies);
(d) net national product at factor cost (equal to (a) plus net factor income from the rest of the world);
(e) gross national product at market prices (equal to (c) plus net factor income from the rest of the world).

Since consumption of fixed capital, indirect taxes and subsidies, and net factor income from the rest of the world are separate items in the accounts, it is possible to define output in various other ways, e.g. by combining the gross or net product, either domestic or national, at factor cost or market prices, each calculation having a different significance.

The system of national economic balance sheets employed in the countries with centrally planned economies (i.e. the material product accounts system (MPA)) distinguishes between two forms of output: the "social product" and the "national income". These definitions only cover the output of material goods and services, i.e. non-material services such as personal services are excluded. The product is domestic and net in that depreciation is deducted and market prices are used. The social product is to all intents and purposes the sum total of the outputs of all the production units and contains a large proportion of intermediate products delivered by one production unit to another. The national income—leaving aside the fact that the productive activities covered are different—is akin to the net domestic product at market prices as defined in the SNA.

It should be added that the latter and the MPA have just been revised with an eye to the co-ordination of national accounts with other economic statistics. A complete set of definitions and classifications was drawn up in preparation for the revision of the SNA, and a number of proposals were put forward to adapt this system for application in the developing countries. During this revision, special attention was also paid to increasing the number of points in common between the SNA and the MPA.
As regards basic industrial statistics, the United Nations Statistical Com­mission adopted a revised series of recommendations on the subject at its Eleventh Session in 1960. These recommendations, which were published by the Statistical Office of the United Nations [204], deal with the statistics that should be published and the data that should be obtained from the units in classes 11-51 (inclusive) of the International Standard Industrial Classification of All Economic Activities (ISIC), both in infrequent surveys of all statistical units and in annual surveys confined to the main statistical units. The recom­mendations concerned more particularly with labour productivity statistics deal with the collection and publication of data on the value of gross output, value added, the subdivisions used in computing these aggregates, the average number of persons employed, the average number of employees, the average number of wage earners and the total number of hours worked by wage earners or by all persons employed.

International standards concerning indices of industrial production were laid down by the Statistical Commission of the United Nations at its Fifth Session in May 1950. Its recommendations [203] deal with coverage, classification by industry, the formula, the base period, the weighting system, periodical adjustments of indices, etc. The Working Group on Industrial Statistics of the Conference of European Statisticians, since drawing up a European pro­gramme of basic industrial statistics in 1963, has devoted its energies to improv­ing and standardising the indices of industrial production calculated by the European countries. A summary of its recommendations designed, inter alia, to enhance the usefulness of these indices in calculating national productivity series on an internationally comparable basis is given in Appendix 4.

It is indeed hopeless to look for comparable indices of labour productivity unless countries employ identical or at least very similar procedures for measur­ing labour inputs. It would seem that the reason why the substantial progress made in many countries during the 1950s in developing their national accounts and bringing them into line with international standards has not involved greater progress in productivity statistics is that employment and hours of work statistics have not been improved to the same extent.

The productivity of labour throughout the national economy as a whole has to be related to the total number of persons employed or (better still) to the labour input of the entire active population. International standards and definitions of employment and hours of work were laid down by the Eighth and Tenth International Conferences of Labour Statisticians. The Eighth Con­ference in 1954 adopted a resolution containing definitions of the labour force, employment and unemployment; it gives details of the categories of workers who should be classified as being in employment; and a distinction is also drawn between persons at work and those with a job but not at work. The
resolution on statistics of hours of work adopted by the Tenth Conference in 1962 contains an international standard definition of hours actually worked.\footnote{Extracts from these two resolutions are given in Appendix 3. For further details see [20, pp. 44 ff.].}

The 1952 proposals for the revision of the system of national accounts submitted to the Fourteenth Session of the United Nations Statistical Commission contained a table dealing with the employment of manpower by type of economic activity. It states that data should relate to persons engaged in domestic production and should, if possible, be expressed in full-time employment equivalents calculated on the basis of normal hours worked during a full year or, failing this, the number of persons employed on average during the different months or pay periods of the year. According to the proposed definition, the number of persons employed includes—in addition to employees—working proprietors and unpaid family workers in unincorporated establishments. Details are also requested regarding the number of employees expressed as full-time man-year equivalents and the total number of hours worked by employees.

At present there is still no international definition of an operative or, therefore, of the hours he works. The international recommendations on basic industrial statistics issued by the United Nations Statistical Commission contain definitions of the data required. The category of operatives includes all employees who are directly engaged in the production or related activities of the undertaking or other statistical unit in question. According to this definition, the category—

includes any clerical or working supervisory personnel whose function is to record or expedite any step in the production process. Examples are persons engaged in fabricating, processing or assembling; shop messengers, stokers and shop cleaning personnel, warehousemen, packers, repairmen, shop testing and record-keeping personnel, and inspectors. Employees of a similar type engaged in activities ancillary to the main activity of the unit should also be considered operatives as are persons engaged in truck driving, repair and maintenance, etc. \[204, p. 37\]

Within the category “operatives”, the Commission proposed that distinctions should be made according to functional categories, e.g. fabrication, processing and assembly, transport and warehousing, and repair and maintenance.

Nearly all countries use their own national industrial classification rather than ISIC. In most cases, the difference between two national classifications will not have any major influence on labour productivity indices for a whole branch of economic activity, since the general scope of these branches (extractive industry or manufacturing) is much the same in all countries, and an industry
which happens to be classified under a different heading is included in the total anyway. Even so, however, owing to the effect of the weightings used, differences are probably not entirely inexistent.

Development of National Labour Productivity Statistics

An analysis of national statistics may at first suggest optimistic conclusions as to various countries’ prospects of being able to calculate labour productivity series. A number of countries in various stages of development possess estimates of their output at constant prices derived from their national accounts statistics, just as many countries hold surveys or censuses of their industrial production at fairly short intervals. Some African countries in fact hold annual surveys.

The difficulties begin when these data have to be converted into productivity indices. At the national level, the usual lack is of statistics which measure or estimate the labour input, i.e. the number of persons employed or the total number of hours worked by the economically active population as a whole. In the case of censuses or surveys of industrial production, which as a rule also yield comparable data regarding the number of persons employed, the number of wage earners and sometimes the number of hours or days of work, difficulties of two kinds have to be overcome before the results can safely be used as a basis for labour productivity series. For one thing, annual surveys (according to an inquiry carried out in the African countries) are not conducted on a comparable basis, i.e. their scope may vary, definitions may be modified and methods of obtaining data may all change from one year to another. Often, there is no census to serve as a source of guidance in adjusting the results. In other words, it is hardly possible to calculate the trend of productivity from these surveys. And secondly, the value of gross or net output is given in current prices, which forms another obstacle to the calculation of chronological labour productivity series. Some countries, however, have calculated productivity ratios on the basis of current price data. For example, in Ethiopia the Central Statistics Office and the Ministry of Trade and Industry have calculated net average output per operative and per employee in manufacturing industry for the years 1953-54 to 1955-56, and in the Philippines the results of annual surveys of manufacturing industry from 1956-60 and in 1962 have been used to calculate the value added per employee.

In several Latin American countries, such as Argentina, Chile and Peru, research has been or is being carried out to measure labour productivity and to analyse the statistics that lend themselves to the calculation of national indices. The results so far only relate in most cases to a few individual industries. In Brazil, following the issue of an order pegging wages to productivity, the Economic Section of the National Economic Council has been
instructed to examine ways and means of measuring productivity at the national level, and indices have in fact been worked out for manufacturing industry. In Asia, the national productivity centres set up by many countries in recent years are also studying the question of the measurement of labour productivity.

The European countries which do not calculate regular series include Iceland, Luxembourg, Portugal and Switzerland. In the last-mentioned country estimates of labour productivity are at present made only on the basis of somewhat sketchy statistics compiled for other purposes. The difficulties are that at a high level of aggregation (the entire economy or sectors) the labour input statistics expressed in man-hours per year and man-years are inadequate, as are also the statistics of production; the latter are also inadequate at the branch level, while at a low level of aggregation—such as the individual establishment—both production and labour input statistics are inadequate. The few series that have been calculated are not official.

The statistics compiled by Iceland, Luxembourg and Portugal, which have been subjected to exhaustive technical analysis [161, pp. 321-328 and 369-384], do not at present make it possible to calculate series at high levels of aggregation, either because information is not collected regularly or because the data on industrial production and employment are not sufficiently comparable. It should be added, however, that there are good prospects that these countries will calculate labour productivity series for a number of individual industries on the basis of existing statistics.
PART III

INTERNATIONAL COMPARISONS OF LEVELS OF LABOUR PRODUCTIVITY
INTRODUCTORY NOTE

International comparisons of productivity of labour not only show relative levels of real income and thus relative standards of living in different countries; they also give some indication of why these differences arise. [18, p. 284]

This statement by Doctor László Rostas, one of the pioneers of the comparative study of labour productivity, has not been disputed and his successors have acknowledged the key importance of such studies in any policy of raising productivity. They are also an indication of competitive power on the international markets and a guide to comparative productivity levels in countries whose economies are largely dependent upon exports. Inter-firm comparisons, originally designed to help in raising labour productivity, are now regarded as a standard feature of modern management.

Before the Second World War, labour productivity was hardly ever compared internationally. Most of the data published on the subject had been obtained through studies of manpower costs or the relationship between wages and productivity. [176, pp. 612-613; 194; 135; 240, pp. 1059 and 1061; 91] Interest in international comparisons really dates from the publication of the fundamental study by Rostas. [179] In Europe the impact was particularly strong because of the conclusion which he reached, namely that output per hour worked in nearly all the main American industries was over twice as high as in Germany or the United Kingdom. In this way productivity came into prominence and many plant-level investigations were made, often based on United States experience.

It soon became clear that these studies, which in any event were uneven in quality and unco-ordinated, would be more useful if they went beyond national frontiers and made it possible to compare performance internationally.

Furthermore, information from inter-plant comparisons turned out to be an unreliable guide to differences in productivity over the whole of an industry, and renewed interest was shown in studies based on indirect statistical data along the lines followed by Rostas. With the steadily growing influence of the State on economic organisation, the demands of economic planning and forecasting bodies for more information helped to strengthen this tendency. Accordingly, research institutes have gradually shifted their emphasis from inter-firm comparisons to bilateral—and sometimes multilateral—surveys of entire industries or economic sectors. In some countries these surveys have
been or are being carried out by official bodies. Not only do bilateral com-
parisons supply valuable information about respective levels of productivity;
they also lead to improvements in methods of measurement both in the parti-
cipating countries and in other countries.

Part III begins by dealing with the problems of methodology encountered in comparing levels of productivity (Chapter 8); it goes on to give a brief account of comparisons that have been made at different levels of aggregation (Chapter 9) and to analyse the methods used in certain bilateral studies recently carried out at the industry level (Chapter 10).
8. SOME METHODOLOGICAL PROBLEMS

In comparing labour productivity in an industry or the national economy as between two or more countries, the difficulties are similar to those that have to be dealt with when comparing trends within the same country. But of course, the practical difficulties are usually more numerous and harder to solve than in the case of intertemporal comparisons, and the influence of technological, structural or institutional differences is greater. Natural resources and historical factors also play an important part, for otherwise it is hard to account—in part at least—for the differences in technical achievement and organising ability between industrialised countries at a time when the great bulk of scientific knowledge is available to any developed nation.

The data for comparing labour productivity between one country and another are usually taken from economic censuses, industrial returns and national accounts statistics. However, the census data published by various countries by no means meet all the requirements, and in fact the number of industries or sectors that can be included depends in the last resort on the volume and quality of the statistics available.\(^1\) Similarly, the choice of method is dictated by the availability of comparable data.

One special difficulty in the way of international comparisons occurs when the available data only relate to certain establishments and the dividing line is not the same in both countries. In such a case the results are likely to be distorted, because it is not certain that productivity in the establishments not included is the same as in the others; nor is it certain that the relative size of the establishments left out of the census is the same in both countries. The result will be more favourable for the country leaving out the small firms, in which productivity per unit of labour input is usually lower.

Differences in the composition of the labour force by sex, age, skill or participation rate may play an important part in determining the level of productivity. Such differences are far more marked between two countries than between two periods in the same country. For example, in the United Kingdom the participation rate of the active population in 1968 was 47.5 per cent—i.e. 65.9 per cent for men and 30.2 per cent for women—as against

---

\(^1\) In the study by Rostas, for example, the comparison between the United Kingdom and the United States covered only thirty-one industries, although the censuses in the two countries supplied data for more than a hundred.
36.4 per cent in the Netherlands—56.8 per cent for men and 16.1 per cent for women. One way of getting over this difficulty is to weight different types of labour inputs using conversion factors based on man-equivalents, age, wages, length of vocational training, etc. [179; 40; 71]

Another difficulty which may have a marked influence on the results is that production censuses do not relate to the same years, and production capacity—whether capital or labour—is not always used to the full. The results should therefore be adjusted to take account of progress between the census year and the year used for comparison. If the years selected are not comparable where the level of unemployment is concerned, this too must be allowed for and an adjustment made to eliminate the difference. The same applies to changes in the degree of utilisation of equipment and other production factors.

Perhaps the most difficult problems to be overcome are, firstly, the definition of products and industries, and, secondly, the differences in the breakdown of output between main products, subproducts and related products and in the degree of integration.

Within the same industry the range of products is never exactly the same in two countries, being governed by the degree of economic and technical development, market needs, social traditions, taste, etc. Similarly, the relative importance—or quality—of each type of product varies between one country and another. Moreover, industries are not classified in accordance with standard principles. Some countries, for example, classify synthetic fabrics among the output of the textile industry, while others include them in the figures for the chemical industry. Thus, in the United Kingdom, rubber footwear is classified under the heading of the rubber industry, whereas in the Netherlands it is treated as part of the output of the footwear industry.

In addition to the main form of production, there may also be a fairly large number of subproducts. Ancillary activities such as power production, transport, certain types of construction, the manufacture of tools and assembly or packaging equipment may account for a by no means negligible share of the total output of an industry in one country, whereas in the other these activities may be performed by establishments classified under the heading of another industry.

Difficulties also occur when manufacturing processes are not classified in accordance with uniform principles. For example, in the census used as a basis for the comparison between the Netherlands and the United Kingdom [51, pp. 11-13], establishments manufacturing parts of boots and shoes are not classified as part of the footwear industry in the Netherlands, whereas in the United Kingdom they are. Similarly, in textiles, finishing may be included in the cotton or woollen industries or alternatively may be treated as a separate industry.
It is possible (at least partially) to minimise or eliminate the effect of these differences in the pattern of production on comparative levels of productivity by selecting appropriate units of measurement, by using a common set of factors to convert products that are heterogeneous or of different quality into a single product of standard quality, by defining precisely the manufacturing process for each product, by comparing products at the same stage of production, by laying down technical limits and by defining the operations included, especially ancillary activities not directly connected with the manufacture of the products being compared.

It would seem, moreover, that some differences can be brought out by means of weighting systems. Thus, differences in the results according to whether one uses the weighting of the reference country or that of the country under consideration usually reflect differences in the relative importance of the basic industries of the two countries. Similarly, differences between the results when they are weighted according to the size of the labour force or the value of output may show that the degree of utilisation of raw materials and capital is very different as between industries.

When comparison of productivity levels in two or more countries is based on value indicators, other equally serious difficulties are encountered, such as the problem of converting the data for each country into the same monetary unit, since it is essential to decide on the purchasing parity rate for the products being compared.

For this purpose it is necessary firstly to list the main products of the industries to be compared, and, secondly, to ascertain the prices of these products in both countries. It would be even more appropriate to ascertain the purchasing parity rate for both the finished products and for the materials which were used in their manufacture, and thus to calculate an exchange rate which is more corresponding to the concept of net output. Prices, of course, must relate to identical products as well as to identical conditions of sale, for example, "ex works" or "delivered at site", and so on. The ratio of such prices gives the exchange rate in terms of these products.

The ascertaining of comparable prices is not easy, if possible at all. Two supplementary methods can be applied, neither of them being very satisfactory.

1. Instead of the purchasing parity rate the official exchange rate merely can be applied, which expresses price differences in terms of all commodities and not only of those under investigation.

2. The exchange rate in terms of average factory values (as ascertained from the census) can be calculated: this would be identical with the purchasing parity rate only if the average product of the countries compared were identical (which is very seldom indeed), but the differences between this rate and the general exchange rate usually gives some indication of the direction in which the purchasing parity rate would deviate from the general exchange rate. [179, p. 10]

Other difficulties may be encountered when in a particular industry the relative costs of the factors of production vary substantially between two countries and if there is simultaneously a marked difference in the proportions in which these factors are used in the two countries. As Professor Frankel notes,
the application of one country's weights to the other can, at the extreme, result in a negative output measure for the second country. The situation would be one in which the latter country's quantities, combined with the other's prices, yielded a value of input exceeding the value of output. It is, of course, an unreal outcome in that the second country, if in fact confronted with the relative prices of the first, would have altered its composition of inputs and perhaps also its composition of output.\(^1\)

These discrepancies are particularly liable to occur if a comparison is being made between an industrialised country and a developing one, or between one where economic planning is highly centralised and prices are largely determined by the authorities and one where prices are determined by market forces.

Accordingly, it is preferable to choose a price pattern which broadly reflects the actual structure of costs. This is why preference is sometimes given to a definition of production based on factor cost and prices exclusive of direct and indirect taxes. However, it often happens that data are not available in the desired form, and, since it is impossible to recalculate the data at factor cost on the basis of the market prices obtained by industrial censuses or to eliminate direct and indirect taxes from the cost of the finished product and factors of production, one has to make do with approximations.

There is one obvious way of making up for the shortcomings in the material available and obtaining the data needed to achieve worthwhile results, though the cost is often prohibitive. This is to make special surveys covering two or more countries. The value of such surveys was emphasised by the ILO in an earlier publication, which noted that they—

appear to have, from the international point of view, the considerable advantages of eliminating most of the drawbacks due to the lack of comparability of production figures with labour figures or their non-comparability in time, and, in addition, permit of detailed comparisons and analysis of the influence of the various factors affecting labour productivity. They require the collaboration of technicians, because of the necessity of complete technical knowledge of the processes of the industry studied; but they appear essential if complete information is to be gathered on international labour productivity differences.

The recommendations of the Working Group on Productivity Statistics which met in 1964 under the auspices of the Conference of European Statisticians and the International Labour Organisation point the same way when they suggest that joint studies should be carried out by pairs of countries to compare their respective levels of productivity.

Inter-country comparisons are based on productivity ratios, usually obtained using the same formulas as in calculating productivity indices for purposes of intertemporal comparison. But it must be emphasised that some of these measurements hardly lend themselves to comparisons of labour productivity in two or more countries. This is particularly true in the case of the formula in

\(^1\) FRANKEL, op. cit., para. 49.
which the nominator is the value of gross production\(^1\), since it is affected by frequent sale and purchase of the products and is also inevitably influenced by the way the industry or economy is organised. An economy based mainly on integrated industries will certainly display less overlapping than an economy composed of specialised undertakings, but there is very little likelihood that the degree of overlapping will be the same in two countries. Even for countries with a similar economic structure, this method does not normally yield satisfactory results.

The formula which helps to eliminate the major differences in the degree of overlapping is the one in which the nominator relates to the gross value added.\(^2\) The results obtained with this formula usually vary, depending on which country's weightings are used. This occurs, according to Professor Frankel, even when output and purchased inputs are similar, if the ratio between them is different in the two countries and if their prices are not in the same ratio to each other in both countries.\(^3\)

Often—in certain industries at least—there is a marked disproportion in the amount of fixed capital used in production. When this is considerable in the case of the countries being compared, it is necessary to deduct from the gross value added a sum representing the depreciation of the fixed capital employed. The formula based on the net value added can be written as follows:

\[
R_{01} = \frac{\sum P_0 Q_1 - \sum \pi_0 \mu_1 - \sum \pi'_0 \mu'_1}{\sum P_0 Q_0 - \sum \pi_0 \mu_0 - \sum \pi'_0 \mu'_0} \div \frac{\sum m_1}{\sum m_0}
\]

where \(P\) and \(Q\) are the prices and quantities of the products, \(\pi_0\) and \(\mu_0\) are the prices and quantities of the purchased inputs and \(\pi'\) and \(\mu'\) are the prices and quantities of fixed capital depreciated in the course of production; \(m\) relates to the measurement of labour and 0 and 1 designate the two countries.

However, this formula is only of theoretical value, because in practice it cannot be used through lack of the necessary data. Even in the case of formula \(C\ 6\)\(^4\), it is difficult most of the time to obtain the data, especially on relative prices. Accordingly, the methods most commonly employed in making international productivity comparisons involve weighting the quantities produced in each country by a value indicator (e.g. value added) for the different products of each country. The formula can be written as follows:

\(^1\) Formula \(C\ 1\) (see above, p. 28).

\(^2\) Formula \(C\ 6\) (see above, p. 29).

\(^3\) FRANKEL, op. cit., para. 48.

\(^4\) This formula is based on the method described by D. PAIGE and G. BOMBACH as the "double indicator method".
where \( N \) designates the value added of the products (or the industries in question) and the other symbols have the same significance as in formula C 7.

Usually the comparison is made for a fairly large number of representative products.

Instead of comparing levels of labour productivity on the basis of individual production indices, it is possible to calculate the difference on the basis of productivity ratios for individual products and then to work out an average which can be weighted, for example, in accordance with the structure of the labour force in each country. The formula can then be written as follows:

\[
R_{01} = \frac{\sum N_i \frac{Q_0}{Q_1}}{\sum N_i} = \frac{\sum m_1 \frac{Q_0}{m_0}}{\sum m_1}
\]

This will yield results that are less liable to errors of representation than the formula based on production indices, since the latter have a greater dispersion than the productivity indices. It has, however, one drawback—it is essential to have data on the labour input for each product and these are difficult to obtain.
9. RECENT PRODUCTIVITY COMPARISONS

The period between the immediate post-war years and 1960 or thereabouts witnessed a steady flow of studies comparing labour productivity at the plant level. According to a list drawn up by the OEEC in 1960 [29], inter-plant comparisons had by then been made in fifteen countries and over sixty industries.

The impetus for this had been given by the publication of forty-nine monographs on productivity and factory performance in United States industry issued by the United States Bureau of Labor Statistics for the benefit of the highly industrialised countries.¹ Most of these studies were designed to make it possible to compare on the basis of a variety of data labour productivity or financial performance for a small number of selected products in a group of plants in a given country. Usually the plants themselves were also few in number and, except in a handful of cases, did not exceed twenty-five. Productivity was measured on the basis of the input of working time required for a product or for various manufacturing operations. The characteristics of these studies are summarised in an appendix to the volume published by the European Productivity Agency on methods and results of productivity measurement at the plant level. [160; 162] Sometimes the results of these national studies were compared with the productivity of similar plants in the United States, e.g. in the case of the footwear industry in France and the United Kingdom. [33, pp. 1-3; 154, pp. 241-243]

The growing use of inter-plant comparisons within individual countries has also encouraged attempts to devise a workable system of international comparison and to standardise methods to make this possible.

The International Labour Office, following the resolution on labour productivity adopted by the Seventh International Conference of Labour Statisticians [19, pp. 63-65], put forward as long ago as the beginning of 1951 a very detailed plan for an international survey of absolute productivity levels in five specified manufacturing industries.² This idea had to be abandoned, partly because the countries to which it was submitted were dubious about the prospects of obtaining co-operation from their industries and partly because the

¹ Most of these studies have been published by the United States Bureau of Labor Statistics in the series Case Study Data on Productivity and Factory Performance.
² These were the industrial equipment, electrical engineering, machine-tool, fertiliser and soap industries.
experience and techniques of measurement at the plant level needed to make a success of the survey were lacking at that time in most of the countries concerned.

The first European Conference on Inter-firm Comparison, held in Vienna in September 1956 under the auspices of the European Committee of the International Council for Scientific Management and the European Productivity Agency [119, pp. 5-19], reviewed the theoretical and practical problems of making studies in this field and discussed ways and means of standardising systems of measurement.

One of the first comparative studies at the international level involving more than two countries dealt with the manufacture of tomato concentrate. It began as an inter-firm comparison confined to France, but subsequently firms in Israel, Italy and Tunisia took part. [89, pp. 113-117] There have been other cases in which inter-firm comparisons within a single country have also been used as a starting point, e.g. the survey carried out by the Research Association of British Rubber Manufacturers, which was later taken up by the European Productivity Agency and extended to other countries. [67, pp. 5-25] The international survey fell into two stages. During the first, information was collected by means of a standard questionnaire; during the second, visits were paid to the factories concerned.

In order to standardise the methods used in different countries for making inter-firm comparisons and to test the efficiency of management, the European Productivity Agency carried out a pilot international survey in the footwear industry for the year 1957, involving firms in France, Italy and Spain. In view of the pioneering nature of the survey, the group of experts in charge took great pains over their definitions, the choice of product specifications and the interpretation of any differences. [31] The domestic heating and cooking appliance industry was the subject of a comparative study by the OECD covering seventeen representative firms in five countries (Austria, Belgium, France, the Federal Republic of Germany and Italy); the survey dealt with the year 1962. Labour productivity in the seventeen firms was compared on the basis of the turnover or value added by the labour force as a whole or by particular categories of workers. [173, pp. 18-101]

Another OECD survey covering the European paper-making industry involved fifty-eight firms in Austria, France and the Federal Republic of Germany. The direct and indirect man-hours on each group of machines during the second quarter of 1963 were broken down for four main grades of paper and for clearly defined stages of the production process. [32, pp. 35-60; 132]

Similarly, the European Committee of Foundry Associations has also organised an inter-plant comparison at the international level in which differences in labour productivity were the main centre of interest.
The most ambitious international comparisons of productivity at the plant level have been carried out in the countries with centrally planned economies by the productivity working party set up by the Standing Commission on Economic Questions of the Council for Mutual Economic Assistance. These comparisons, covering 128 staple products for the year 1964, involved thousands of plants, accounting for some 10 per cent of the industrial sector in the USSR and approximately 20 per cent in each of the following countries: Bulgaria, Czechoslovakia, Eastern Germany, Hungary, Poland and Rumania. The chief industries covered were engineering, chemicals, certain branches of light industry, and food. Comparisons were based on indicators representing the volume of output expressed in physical units. Information was assembled on average levels of productivity for all the products of each industry covered by the survey. A detailed investigation was made into plants with particularly high productivity.\(^1\)

Inter-plant comparisons have, however, never claimed to measure labour productivity in a whole industry and even less in the national economy as a whole. But a country’s economic growth is closely linked with the productivity of its labour force and in the last analysis depends on the progress achieved in this respect. Accordingly, research has gradually come to be directed towards comparisons of labour productivity in particular industries. This tendency, which was in response to the growing need for information, was greatly assisted by the availability of the results of the first industrial censuses conducted after the Second World War. It can be expected that statistics from this source will become steadily more suitable for international comparisons of productivity levels as a result of United Nations efforts to co-ordinate and standardise industrial census procedures.

The number of countries involved in comparative labour productivity studies for a whole industry in a post-war year is now nearly forty if we include the Latin American countries, where a special survey is now being carried out under United Nations auspices.

The countries which have been dealt with most often in bilateral or multilateral surveys are the United Kingdom and the United States, followed by the USSR and Hungary. Most of the comparisons are between two countries and refer to individual manufacturing industries, usually selected because their output consists of fairly homogeneous products. Research has also been made into comparative labour productivity levels in agriculture, building, retailing, and even for the national economy as a whole.

A good many recent studies have taken the work of Rostas as their model. As might be expected, one of the earliest comparisons in the post-war years

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\(^1\) The results of this survey have not yet been made public.
was between labour productivity in manufacturing industries in the United Kingdom and the United States. [93] Using data taken from the United States census of manufacturing in 1947 and the United Kingdom census of production in 1948, Professor Frankel has calculated the comparative productivity of labour in thirty-four selected manufacturing industries representing 18 per cent of employment in manufacturing as a whole in the former country and 15 per cent in the latter. He based his comparison on the ratios between output, expressed in physical units, and the number of wage earners and hours worked by them. In order to obtain comparable estimates, he had to make a series of adjustments to allow for differences between the production and employment data, the description and classification of the products and the integration and classification of production processes. Of the thirty-four industries examined, there were only three in which the productivity of the British worker was higher than that of his American counterpart, namely sugar-beet refining, fish curing and the manufacture of industrial ice; only in the last-mentioned industry did productivity per man-hour in the United Kingdom exceed the United States level.

Professor Frankel's survey is supplemented by an analysis of certain other ratios such as output per unit of invested capital, consumption of fuel and fixed and movable capital available per worker. The differences in these ratios between the two countries and in the scale of the market, the size of firms and relative prices, e.g. the cost of fuel and wages, are examined side by side with the differences in productivity in order to measure the influence of these factors on the latter.

The data yielded by the 1948 census of production in the United Kingdom were also used to compare labour productivity in the latter with that of Canada for the same year. [114, pp. 665-691] John B. Heath, the author of this study, based himself on the value of output and not on the number of units produced, and therefore limited his comparison to the fourteen manufacturing industries in which the pattern of production was much the same in both countries. He found that the input of labour required per unit produced was lower in Canada whether Canadian or British prices were taken as a basis.

In a pilot survey covering the years 1959-60, productivity in New Zealand and Australia was compared in the following six manufacturing industries: brewing, ice cream, tobacco and cigarettes, footwear (excluding rubber footwear), animal feeding stuffs, hosiery and knitwear. [101] Using data taken from annual production statistics, the value of gross output, purchased inputs and net output was then calculated, in most cases using unit prices in the two countries, and related to the number of employees. The results obtained by means of these two sets of prices yielded geometrical averages representing the differences in productive efficiency between the industries examined in the two countries.
Few exhaustive statistical studies comparing labour productivity in the USSR and the United States appear to have been made.

Mention should, however, be made of a study published in 1955 by Walter Galenson, a former professor at the University of California (Berkeley) [99], although its value was limited by the fact that it was based on data for 1936-39. At that time, according to Professor Galenson's conclusions, productivity in the thirteen USSR industries studied was 40 per cent of the level in the United States. By making projections of his figures, Professor Galenson estimated that the setback due to the war should have been overcome by 1950.

An economist in the USSR, A. Kats [127], working on data concerning twenty-eight industries in 1956\(^1\), estimated that at that date labour productivity in the USSR was about half that in the United States.

As regards other economic sectors, the productivity of workers in retailing and certain personal and repair services in the United Kingdom, measured on the basis of sales volume per employee, has been compared with that of their counterparts in the United States. [109, pp. 72-88]

Two studies have been made of comparative levels of productivity in agriculture and construction in the USSR and the United States. [47, pp. 3-9, and 123, pp. 25-32]

Labour productivity comparisons for the national economy as a whole and for its component sectors and branches were made for the post-war period by two economists in the case of the United Kingdom and the United States, basing themselves on the gross national product and the contribution of each sector to it. [166] In order to obtain comparable statistics, the national accounts data of the two countries were adjusted to provide common definitions of the industries concerned, together with data on an activity—not an establishment—basis and a common classification making comparison possible. The data on employment were also adjusted to correspond as closely as possible to the data on value added.

In addition to this research work based on published data, investigations have been conducted in recent years by national statistical offices in a position to use unpublished material.

For example, the Hungarian Central Statistical Office has compared labour productivity in various sectors of Hungarian industry with a number of other countries. [175; 53] The Netherlands Central Bureau of Statistics has also used a comparison of productivity levels with the United Kingdom to pinpoint some of the problems encountered in making such comparisons. [51] Lastly, in France the Study Group on Productivity Measurement of the French Productivity Association and the National Institute of Statistical and Economic Research

\(^1\) Data for 1954 in the case of the United States.
have undertaken two surveys of comparative labour productivity—in France and Italy and in France and Czechoslovakia. The two surveys, which are being carried out in conjunction with the Italian and Czechoslovak central offices of statistics, the Italian National Productivity Council and the Czechoslovak State Planning Commission, have not yet been completed, but it is hoped, by analysing differences, to obtain an insight into the effect of economic and social patterns on levels of labour productivity.

A small number of multilateral comparisons have been or are being carried out, mainly in Latin America (as part of a survey by United Nations experts) and in the countries with planned economies, under the auspices of the Council for Mutual Economic Assistance.

The first direct survey by the United Nations was conducted in 1950, and dealt with labour productivity in the cotton industries of Brazil, Chile, Ecuador, Mexico and Peru. In each of these countries, visits were paid to a few mills considered to be representative in size, age of equipment, type of output and geographical location, and the productivity of each spinning and weaving operation was analysed and compared as the first step towards drawing up a programme for improving efficiency.

At the request of the Central American Council for Economic Co-operation, which wished to ascertain the comparative competitiveness of Costa Rica, El Salvador, Guatemala, Honduras, Nicaragua and Panama before forming a common market in the Central American isthmus, the United Nations Economic Commission for Latin America surveyed labour productivity in fourteen industries represented by eighteen products selected as indicators. The data were supplied by 179 firms employing twenty persons or more; the aim was to ascertain the time needed to manufacture each selected product in each country.

Similar surveys are being prepared in Mexico and the following South American countries: Argentina, Bolivia, Brazil, Chile, Colombia, Peru, Uruguay and Venezuela. The surveys cover manufacturing, but it is hoped to extend them later to other sectors such as agriculture and commerce.

Lastly, the Steel Committee of the United Nations Economic Commission for Europe has studied the problems of making international productivity comparisons in attempting to assemble comparable data on the iron and steel industry in its member countries.

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1 Some information concerning the survey of comparative labour productivity in France and Czechoslovakia is given on pp. 101-103, as well as in [134].

10. ANALYSIS OF THE METHODS USED IN A FEW RECENT SURVEYS

Publications on the methodology of the international comparison of labour productivity levels are relatively few. Similarly, statistical research aimed at measuring the effects of the main factors which give rise to productivity differences between countries has hardly advanced beyond the initial stage. It may, therefore, be worth while to see how some countries have tackled the problem and to take a look at the criteria they have used in trying to overcome the obstacles caused by the differences—or gaps—in the available data when making comparisons between whole industries or economic sectors.

The surveys that seem to lend themselves best to this type of analysis are those involving comparisons between the Netherlands and the United Kingdom, between Hungary and Czechoslovakia and the other countries belonging to the Council for Mutual Economic Assistance, and between Czechoslovakia and France.

The analysis, though brief, shows that the methods used are very similar whether countries have market or centrally planned economies. Precise results are often impossible to obtain because of the lack of comparable data, especially on the basis of published statistics as regards comparative levels of labour productivity in countries with different economic systems.

COMPARISON BETWEEN THE NETHERLANDS AND THE UNITED KINGDOM

Basing itself on the 1958 census of production, the Netherlands Central Bureau of Statistics made an exhaustive analysis to compare labour productivity in the Netherlands and the United Kingdom in ten specified manufacturing industries as well as in gas, electricity and agriculture.¹

The industries for which comparisons could be made were too limited in size for it to be possible to reach any worth-while conclusions regarding manufacturing industry in general or the national economy as a whole. Accordingly, in order to have some idea of the extent of differences in productivity

¹ This analysis was directed by G. J. A. Mensink; a detailed description of the methods employed and the results for each economic sector was published by the Central Office of Statistics under the title Vergelijkingen van de arbeidsproductiviteit in het Verenigd Koninkrijk en Nederland 1958 (Hilversum, 1965). There is also an abridged version in English [51].
between the two countries and to illustrate the results obtained, the Netherlands Central Bureau of Statistics used data taken from national accounts and employment statistics to estimate the gross value added at factor cost per man-year in the primary sector and in manufacturing. The figures obtained for the Netherlands were converted into pounds sterling at the official exchange rate in force in 1958. The gross value added per man-year was as follows in the three branches of the economy concerned:

<table>
<thead>
<tr>
<th>Branch</th>
<th>United Kingdom £</th>
<th>Netherlands £</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agriculture, forestry and fishing</td>
<td>800</td>
<td>760</td>
</tr>
<tr>
<td>Extractive industries</td>
<td>820</td>
<td>1,140</td>
</tr>
<tr>
<td>Manufacturing industries</td>
<td>810</td>
<td>730</td>
</tr>
<tr>
<td>All branches</td>
<td>810</td>
<td>750</td>
</tr>
</tbody>
</table>

All the industries with very different patterns of production in the two countries were left out of the detailed comparative survey. Even in the case of sectors where at first sight there should have been no difficulty in making a comparison, such as tobacco and dairy products, the Central Bureau of Statistics had to make use of unpublished data taken from the replies of Netherlands firms to census questionnaires or supplied direct by the United Kingdom; these data were used to eliminate differences in the pattern of production, the classification of products, the size of the establishments covered or the quality of the products manufactured or raw materials employed. In the end, the following industries were selected for comparison: dairy products, tobacco, brewing and malting, woollens and worsteds, clothing, hosiery and other knitted goods, footwear, leather, building bricks, shipbuilding and marine engineering, public gas and electricity, and agriculture and horticulture.

All the calculations were made on the basis of the gross value added per worker. Only in agriculture and horticulture were estimates of depreciation made, so that productivity in this group was also compared on the basis of net value added per worker, which made it possible to measure differences in respective levels of investment.

The results were expressed in the form of indices, with the Netherlands forming the basis of comparison.

1 See tables 3 and 4, pp. 10 and 11 of the abridged version; data by type of industry are also given.

2 For example, the classification of leather products in the Netherlands had to be adapted to tally with that of the United Kingdom.
In most sectors, the productivity ratios were worked out on the basis of the quantities produced per unit of work in each country, weighted by the value added per unit produced in the Netherlands, measured at Netherlands prices. It would have been advisable to compare productivity in the two countries by using value added per unit produced in the United Kingdom as well, on the basis of prices in that country, but this proved to be impossible with the statistical material available except in the case of the public utilities (gas and electricity production and distribution).

Production was estimated on the basis of prices in the case of shipbuilding and marine engineering only, since this was the only sector where relative prices could be obtained and even then only for gross production. The comparison was, therefore, made on the assumption that the relative prices for the materials used were the same as those for gross production.

Purchased inputs were allowed for only in two sectors: the public utilities (gas and electricity), and agriculture and horticulture.

The input of labour was taken to be the number of man-years worked by employees and working proprietors as shown by the censuses of production. In the United Kingdom, the figures related on the average to the twelve months of 1958, while in the Netherlands they covered the number of persons employed on 30 September 1958. The Netherlands Central Bureau of Statistics also made use of annual employment data based on twelve monthly averages, or four quarterly averages in the industries affected by heavy seasonal fluctuations, such as building bricks. No adjustment was made to take account of differences between the two countries in breakdown by sex, age, skill or occupational status. Similarly no account was taken of differences in the annual average length of time worked in each industry, except in the case of homeworkers and agricultural workers. When homeworkers were included in the calculations, their input of labour was converted into normal man-years on the basis of their earnings. In the case of agriculture, the activities of casual workers, women and unpaid family helpers were converted into man-years on the basis of estimates of the average number of hours worked per week. The results are shown in table 11.

METHODS USED BY HUNGARY IN MAKING INTERNATIONAL COMPARISONS OF LABOUR PRODUCTIVITY

The Hungarian Central Statistical Office has made a number of studies in recent years to compare labour productivity in Hungary with that of other countries, especially Czechoslovakia and the other member countries of the Council for Mutual Economic Assistance, but also with Austria, Denmark and the Federal Republic of Germany.
### Table 11. Comparison of Labour Productivity in Various Industries in the United Kingdom and the Netherlands, 1958

<table>
<thead>
<tr>
<th>Branch</th>
<th>Value added per worker in the United Kingdom as a percentage of value added in the Netherlands, weighted according to prices</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>In the Netherlands</td>
</tr>
<tr>
<td>Dairy products</td>
<td>109</td>
</tr>
<tr>
<td>Tobacco</td>
<td>118</td>
</tr>
<tr>
<td>cigarettes</td>
<td>76</td>
</tr>
<tr>
<td>Brewing and malting</td>
<td>-</td>
</tr>
<tr>
<td>Woollens and worsteds</td>
<td>98</td>
</tr>
<tr>
<td>Clothing</td>
<td></td>
</tr>
<tr>
<td>waterproof garments</td>
<td>95</td>
</tr>
<tr>
<td>foundation garments</td>
<td>99</td>
</tr>
<tr>
<td>men's and boys' clothing</td>
<td>102</td>
</tr>
<tr>
<td>women's and girls' clothing</td>
<td>91</td>
</tr>
<tr>
<td>Hosiery and knitwear</td>
<td>100</td>
</tr>
<tr>
<td>knitted fabrics</td>
<td>81</td>
</tr>
<tr>
<td>hosiery</td>
<td>115</td>
</tr>
<tr>
<td>underclothing and nightwear</td>
<td>94</td>
</tr>
<tr>
<td>other knitted goods</td>
<td>87</td>
</tr>
<tr>
<td>Leather (tanning)</td>
<td>82</td>
</tr>
<tr>
<td>Footwear</td>
<td>113</td>
</tr>
<tr>
<td>Building bricks</td>
<td></td>
</tr>
<tr>
<td>Shipbuilding and marine engineering</td>
<td>69</td>
</tr>
<tr>
<td>Gas</td>
<td>97</td>
</tr>
<tr>
<td>production</td>
<td>104</td>
</tr>
<tr>
<td>distribution</td>
<td>112</td>
</tr>
<tr>
<td>Electricity</td>
<td>101</td>
</tr>
<tr>
<td>production</td>
<td>86</td>
</tr>
<tr>
<td>distribution</td>
<td>97</td>
</tr>
<tr>
<td>Agriculture and horticulture</td>
<td>66</td>
</tr>
</tbody>
</table>


The comparison between Hungary and Czechoslovakia, which was carried out by the two countries in close collaboration, covered the industrial sector. The statistics were supplied directly by establishments. The comparison was divided into two stages, in the first of which productivity in the year 1958 was compared for thirty-five selected products on the basis of the ratio between the output, measured in physical units, and the number of workers or of hours actually worked. This method proved satisfactory in industries where output is homogeneous. In other industries, such as machine tools or chemicals, the Hungarian Central Statistical Office endeavoured to improve comparability by measuring the volume of output in equivalent units as well as physical units, taking account of differences in quality or assortment, and by delimiting manu-
facturing processes according to their technical content, the ancillary activities performed and the amount of work done in co-operation with other undertakings.

During the second stage, covering the years 1959-60, productivity was compared in forty-four branches and for the industrial sector as a whole. The results were based on the ratios between the output indices for the various products and the corresponding indices of employment or hours of work. The weighting system was based on the labour input. Two sets of weights were used, the first using Hungarian and the second Czechoslovak coefficients.

Normally, output indices were derived from the quantities produced. In branches where this was not possible, they were calculated by converting the value of the output into a common monetary unit. Some of the results of the 1958 comparison are given in table 12.

<table>
<thead>
<tr>
<th>Product</th>
<th>Unit of measurement</th>
<th>Type of ratio</th>
<th>Productivity in Czechoslovakia</th>
<th>Productivity in Hungary</th>
<th>Productivity in Czechoslovakia as a percentage of Hungarian productivity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anthracite</td>
<td>t</td>
<td>a</td>
<td>350</td>
<td>169</td>
<td>207</td>
</tr>
<tr>
<td>Lignite</td>
<td>t</td>
<td>a</td>
<td>1 210</td>
<td>278</td>
<td>435</td>
</tr>
<tr>
<td>Electricity</td>
<td>1 000 kWh</td>
<td>a</td>
<td>1 220</td>
<td>635</td>
<td>192</td>
</tr>
<tr>
<td>Pig-iron</td>
<td>t</td>
<td>b</td>
<td>906</td>
<td>305</td>
<td>259</td>
</tr>
<tr>
<td>Cement</td>
<td>t</td>
<td>b</td>
<td>766</td>
<td>575</td>
<td>133</td>
</tr>
<tr>
<td>Sulphuric acid</td>
<td>t</td>
<td>b</td>
<td>777</td>
<td>547</td>
<td>141</td>
</tr>
<tr>
<td>Cotton yarn</td>
<td>km</td>
<td>c</td>
<td>112.0</td>
<td>90.5</td>
<td>124</td>
</tr>
<tr>
<td>Woollen worsted yarn</td>
<td>km</td>
<td>c</td>
<td>46.9</td>
<td>33.4</td>
<td>140</td>
</tr>
<tr>
<td>Cotton cloth</td>
<td>piece</td>
<td>c</td>
<td>20 640</td>
<td>18 100</td>
<td>114</td>
</tr>
<tr>
<td>Woollen cloth</td>
<td>piece</td>
<td>c</td>
<td>2 710</td>
<td>2 420</td>
<td>112</td>
</tr>
<tr>
<td>Silk fabric</td>
<td>piece</td>
<td>c</td>
<td>15 400</td>
<td>11 100</td>
<td>139</td>
</tr>
</tbody>
</table>


Meaning of symbols:

- \( a \) = output per worker
- \( b \) = output per worker directly engaged in production
- \( c \) = output per man-hour of workers directly engaged in production

In the comparisons between Hungary and the other member countries of the Council for Mutual Economic Assistance, respective levels of productivity in industry have been gauged by selecting certain products as indicators so that productivity can be calculated on the basis of the physical output per unit of labour input. A survey is now going on to compare the level of industrial production using price indices as well, so that the value of output can be expressed in common currency units. The results of these calculations will also be used to compare respective levels of productivity.
In making the comparison with the Federal Republic of Germany, the Central Statistical Office used data taken from the industrial censuses of 1959. The figures related to fifty-eight industries, individually and taken together. For both countries, production statistics were available as regards physical volume and value for some 3,000 articles. These statistics, adjusted where necessary by converting the data for Hungary into units of measurement employed in the Federal Republic of Germany, were used to compute 863 weighted indices for various groups of products. The productivity ratios were calculated in both Hungarian and Federal German unit prices. In addition, comparisons were made on the basis of weighting coefficients based on the data for the volume of labour input in Hungary.

In the case of products not manufactured in Hungary and for which there were no Hungarian unit prices, all the calculations were based on Federal German prices. When the data for the Federal Republic of Germany showed either the volume or the value of output but not both, the Federal German prices were estimated on the basis of world prices, converted at the official rate of exchange. In some industries, such as wheat milling and oil refining, output indices were calculated on the basis of the volume of materials consumed. The data relating to hours worked and different classes of employees were adjusted in scope and type of classification to fit the standards of the Federal Republic of Germany.

Some of the results are shown in table 13.

### Table 13. Productivity in the Federal Republic of Germany Compared with Productivity in Hungary, 1959

<table>
<thead>
<tr>
<th>Industry</th>
<th>Weighting</th>
<th>Output in the Federal Republic of Germany in 1959 (Hungary = 100)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Per hour by production workers</td>
</tr>
<tr>
<td>Coal mines and coal by-products</td>
<td>(a)</td>
<td>236</td>
</tr>
<tr>
<td></td>
<td>(b)</td>
<td>238</td>
</tr>
<tr>
<td></td>
<td>(c)</td>
<td>277</td>
</tr>
<tr>
<td>Textiles</td>
<td>(a)</td>
<td>120</td>
</tr>
<tr>
<td></td>
<td>(b)</td>
<td>120</td>
</tr>
<tr>
<td></td>
<td>(c)</td>
<td>138</td>
</tr>
<tr>
<td>Clothing</td>
<td>(a)</td>
<td>150</td>
</tr>
<tr>
<td></td>
<td>(b)</td>
<td>135</td>
</tr>
<tr>
<td></td>
<td>(c)</td>
<td>133</td>
</tr>
</tbody>
</table>

\(a\) = Index calculated at Hungarian prices. \(b\) = Index calculated at Federal German prices. \(c\) = Index calculated according to man-hours worked in Hungary.

Source: Román, op. cit., p. 103.
COMPARISON BETWEEN FRANCE AND CZECHOSLOVAKIA

Following a recommendation in July 1964 by the Working Group on Productivity Statistics, France and Czechoslovakia concluded an agreement to compare labour productivity in their two countries.

Its purpose was not merely to ascertain any differences in absolute levels of productivity between the two countries, but also to make use of the experience acquired in dealing with the practical problems involved to improve methodology in this field. At a later stage the two countries hoped to analyse the factors causing differences in labour productivity.

Details of the organisation of the survey and the theoretical aspects of the comparison were settled at a number of meetings held by a group of French and Czechoslovak experts.

The comparison was confined to the industrial sector, defined as mining and quarrying, manufacturing, electricity and gas.¹

In the case of France, the statistical data for a detailed comparison came from the industrial census of 1962, and, in the case of Czechoslovakia, from various sources relating to the years 1962-65. The aggregated results were brought up to date for the year 1967. This extrapolation of course involved some uncertainty because of the possibility of mistakes due to the difference in weighting since the intertemporal and inter-country coefficients were not identical.

In order to obtain more significant results, the whole of the industrial sector was divided into fifty branches, in each of which an index of comparison was calculated separately.

It was agreed that it would be neither helpful nor necessary to use the same method for each branch. The choice of method was dictated by the character of the branch and the kind of detailed information available in either country. In some branches a number of methods were used so as to obtain more information and as a check on the calculations.

The productivity comparisons were based on gross added value per unit of labour, the gross value of the final output estimated at factor cost and individual production indices related to the physical quantities produced, and on productivity indices for each product or group of products, also expressed in physical quantities.

The ratios were calculated for three types of labour unit—total labour force, the number of wage earners and the number of hours worked by them.

The weighting of the indices, whether based on prices, added value, the number of hours worked or the labour force, was done wherever possible using both French and Czechoslovak coefficients. At the lowest level of aggre-

¹ The industrial sector thus corresponds to Branches 1, 2-3 and Class 51 of ISIC.

<table>
<thead>
<tr>
<th>Industry</th>
<th>Labour productivity indices (on the basis of wage earners) in Czechoslovakia (France = 100)</th>
<th>Weights based on labour input</th>
<th>Weights based on prices</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Czecho-slovakia</td>
<td>France</td>
<td>Geometrical average</td>
</tr>
<tr>
<td>Coal-mining (a)</td>
<td>216.0</td>
<td>223.8</td>
<td>219.9</td>
</tr>
<tr>
<td>Coal-mining (b)</td>
<td>106.5</td>
<td>106.9</td>
<td>106.7</td>
</tr>
<tr>
<td>Metalliferous ore mining</td>
<td>22.1</td>
<td>22.1</td>
<td>22.1</td>
</tr>
<tr>
<td>Non-metallic mineral mining</td>
<td>91.9</td>
<td>107.4</td>
<td>99.4</td>
</tr>
<tr>
<td>Dairy products</td>
<td>58.7</td>
<td>—</td>
<td>58.7</td>
</tr>
<tr>
<td>Flour milling and bakery products</td>
<td>115.5</td>
<td>126.0</td>
<td>120.6</td>
</tr>
<tr>
<td>Sugar</td>
<td>108.0</td>
<td>107.0</td>
<td>107.5</td>
</tr>
<tr>
<td>Confectionery</td>
<td>120.2</td>
<td>—</td>
<td>120.2</td>
</tr>
<tr>
<td>Oils and fats</td>
<td>124.8</td>
<td>—</td>
<td>124.8</td>
</tr>
<tr>
<td>Wines and spirits, vinegar and yeast</td>
<td>39.6</td>
<td>52.8</td>
<td>45.7</td>
</tr>
<tr>
<td>Brewing</td>
<td>89.9</td>
<td>—</td>
<td>89.9</td>
</tr>
<tr>
<td>Non-alcoholic beverages</td>
<td>83.1</td>
<td>83.0</td>
<td>83.1</td>
</tr>
<tr>
<td>Tobacco (a)</td>
<td>82.2</td>
<td>92.8</td>
<td>87.3</td>
</tr>
<tr>
<td>Tobacco (b)</td>
<td>71.8</td>
<td>72.5</td>
<td>72.1</td>
</tr>
<tr>
<td>Cotton and linen</td>
<td>81.5</td>
<td>82.7</td>
<td>82.1</td>
</tr>
<tr>
<td>Wool</td>
<td>87.4</td>
<td>87.2</td>
<td>87.3</td>
</tr>
<tr>
<td>Artificial and synthetic textiles</td>
<td>102.8</td>
<td>—</td>
<td>102.8</td>
</tr>
<tr>
<td>and silk</td>
<td>86.7</td>
<td>87.1</td>
<td>86.9</td>
</tr>
<tr>
<td>Footwear</td>
<td>—</td>
<td>100.0</td>
<td>100.0</td>
</tr>
<tr>
<td>Clothing</td>
<td>120.6</td>
<td>119.7</td>
<td>120.1</td>
</tr>
<tr>
<td>Paper</td>
<td>84.7</td>
<td>83.8</td>
<td>84.2</td>
</tr>
<tr>
<td>Leather and skins</td>
<td>269.0</td>
<td>271.4</td>
<td>270.2</td>
</tr>
<tr>
<td>Rubber</td>
<td>142.3</td>
<td>—</td>
<td>142.3</td>
</tr>
<tr>
<td>Cement</td>
<td>68.2</td>
<td>68.3</td>
<td>68.2</td>
</tr>
<tr>
<td>Bricks and tiles</td>
<td>103.6</td>
<td>—</td>
<td>103.6</td>
</tr>
<tr>
<td>Concrete products and building</td>
<td>51.0</td>
<td>—</td>
<td>51.0</td>
</tr>
<tr>
<td>ceramics</td>
<td>82.9</td>
<td>—</td>
<td>82.9</td>
</tr>
<tr>
<td>Metallurgy</td>
<td>68.7</td>
<td>—</td>
<td>68.7</td>
</tr>
<tr>
<td>Transport equipment</td>
<td>40.9</td>
<td>43.0</td>
<td>41.9</td>
</tr>
<tr>
<td>Electric power</td>
<td>70.4</td>
<td>70.4</td>
<td>70.4</td>
</tr>
</tbody>
</table>

(a) Based on physical units. (b) Based on converted units.

gation, the widest use was made of unit production prices or the number of wage earners; in the branches where productivity was compared on the basis of productivity indices per product, aggregation was in accordance with employment weightings. It was decided to obtain the geometrical average
of the results obtained. The final aggregation was calculated as the average of the productivity ratios for the different branches.

Several aspects of the comparisons between the two countries became clear only as work progressed. For example, the statistics supplied by the two countries showed differences in their classifications of production. In order to make them comparable, they had to be supplemented either on the basis of estimates or by calling in expert advice. Without close collaboration between the two countries, the data would never have become fully comparable.

In the branches where the comparison was based on output measured in physical units, efforts were made to take account wherever possible of qualitative and technical characteristics. In some cases standard units were found, while in others differences in quality were reduced through careful selection of representative products. A special effort was made to define the technical phases of production precisely, to analyse structural differences and to harmonise the definitions used in the measurement of work.

One of the major obstacles in the way of making comparisons is the difficulty of allocating a given volume of labour to a given volume of output. It is often impossible, because of lack of information, to deduct from the labour force all the workers engaged in secondary activities, such as power production, the repair and maintenance of equipment, internal transport, tool manufacture, etc. These problems had to be dealt with separately in each case by means of exhaustive analysis, and in most cases it proved possible to make the necessary corrections usually by adjusting the French data to the Czechoslovak labour force and hours of work statistics.

Although the final report on this study is still in preparation, a preliminary report appeared in 1968 containing information on methodology and the results for the thirty-odd industries in which the comparison is based on physical indicators. The results of the first part of the comparison, from which the data in table 14 were taken, have also been published in both France and Czechoslovakia. [134]
APPENDIX 1

DESCRIPTION OF NATIONAL SERIES RELATING TO LABOUR PRODUCTIVITY

The descriptions given below will be confined to labour productivity series calculated for the national economy as a whole, for the industrial sector or for manufacturing.

In each case an endeavour has been made to present the available information in a uniform manner, giving the official title of the series and the name of the body compiling it, as well as the scope, base year and periodicity of the series and the method followed in calculating the productivity index and in obtaining data on the national product or industrial output on the one hand and employment and hours of work on the other. Each description also includes references to publications in which the series are reproduced and to any other available documents containing more detailed methodological descriptions.

These descriptions are designed mainly to facilitate the study of the problems involved in measuring labour productivity at the different levels of aggregation and the practical solutions found to these problems. The descriptions give a better idea of the possibilities of comparison between the national series published in various countries as well as of the extent and effect of these differences.

* * *

Albania

Official title of the series. Labour productivity (rendiment e punës).
Responsible body. Statistical Office (Drejtoria e Statistikës).
Base year, periodicity and scope. The index (1955 = 100) has been calculated since 1955 and covers mining and quarrying, manufacturing and electricity. The Statistical Office also computes indices of labour productivity in construction and transport.
Method of computation. Ratio of the production index to the employment index.
Publication. Vjetari Statistikor (statistical year book) Tirana, Drejtoria e Statistikës (e.g. table 9, p. 119, 1963 edition).

* * *

Austria-I

Official title of the series. Gross national product per person employed (Brutto-
Nationalprodukt je Erwerbstätigen).
Responsible body. Austrian Institute of Economic Research (Österreichisches Institut für Wirtschaftsforschung).
Base year, periodicity and scope. The indices (1913 and 1937 = 100) have been calculated annually for the period 1924-37 and from 1948 onwards; they cover the entire national economy. The Institute also calculates an index of productivity in agriculture.

Method of computation. Ratio of the gross national product to the number of persons employed.

Gross national product. The gross national product, estimated at factor cost and at 1954 constant prices, is obtained by adding the contributions (valued at constant prices) of the various branches of the economy.

Number of persons employed. On the basis of the population censuses, the Austrian Institute of Economic Research estimates the number of persons exercising an economic activity, deducting the average annual number of unemployed from this figure.


For more detailed information on methodology see, as regards the gross national product: Österreichs Volkseinkommen 1950 bis 1960, Neuberechnung, 13. Sonderheft des Österreichischen Institutes für Wirtschaftsforschung (the national income of Austria, 1950-60, recomputed, Special No. 13, Austrian Institute of Economic Research), Vienna, 1963.

Austria-II

Official title of the series. Indices of production per employee (Produktion je Beschäftigten) and per man-hour (wage earners) (je Arbeiterstunde). The Institute has also calculated indices of production per wage earner and per hour paid to employees; these indices, however, have not been published since 1961.

Responsible body. Austrian Institute of Economic Research (Österreichisches Institut für Wirtschaftsforschung).

Base year, periodicity and scope. The indices (1956 = 100) have been calculated quarterly and annually since 1954; they cover mining and quarrying, manufacturing (with the exception of sawmills and the graphic industries) and electricity.

Method of computation. Ratio of the production index (calculated by the Central Statistical Office) to the indices of employment or hours of work (hours for which wage earners are paid or for which they actually work).

Production indices. On the basis of a monthly survey of all industrial undertakings, except sawmills, the Central Statistical Office calculates 420 production series which cover 1,600 commodities, representing from 82 to 100 per cent of the net value of industrial production according to the branch. The data relate to quantities produced, except for the construction of central heating installations and for pharmaceutical products, for which production is measured in terms of value adjusted to take account of price fluctuations. The weighting system of the indices is based on the net value added in 1953-54; the weighting coefficients for 1956 are assessed on the basis of the net value for 1953-54 applied to output in 1956. The series have been corrected to eliminate fluctuations due to variations in the number of days actually worked each month.

Indices of employment and hours of work. The Austrian Institute of Economic Research uses the figures on the number of employees and the number of man-hours.
(wage earners) paid or worked, collected by the Federal Chamber of Arts and Crafts (Bundeskammer der gewerblichen Wirtschaft) by means of a monthly survey of all industrial establishments with six or more employees, excluding head office staff. As from 1965 homeworkers and their hours of work are no longer included. Hours paid for but not worked include annual paid holidays, public holidays and other paid days and hours off (such as those for funerals and weddings in the family, visits to doctors, etc.) and paid sick leave.

Publications. Statistisches Handbuch für die Republik Österreich (statistical hand­book of the Republic of Austria) and Statistische Übersichten zu den Monatsberichten des Österreichischen Institutes für Wirtschaftsforschung (statistical surveys on the monthly reports of the Austrian Institute of Economic Research) (e.g. the handbook for 1965, and survey No. 12, 1966, table 5.4).

For more detailed information on methodology see, as regards the productivity indices, [164], and, as regards the production index, Der neue Index der österreichischen Industrieproduktion, (new index of Austrian industrial output), Supplement No. 69, Monatsberichte des Österreichischen Institutes für Wirtschaftsforschung, Dec. 1961.

* * *

Belgium-I

Official title of the series. Gross domestic product per person employed.

Responsible body. National Institute of Statistics (Institut national de Statistique).

Base year, periodicity and scope. The data, in absolute figures, were calculated annually for the period 1953-67; they cover the entire national economy. Data concerning the gross domestic product per person employed are available separately for the various branches of economic activity (agriculture, forestry, fishing; mining and quarrying; manufacturing; construction, electricity, gas, water; commerce, banks, insurance; transport and communications; services).

Method of computation. Ratio of the gross domestic product at constant prices to the number of persons employed.

Gross domestic product. The gross domestic product at market prices and at 1953 constant prices has been obtained by adding the contributions, valued at constant prices, of the various branches of economic activity. The value added by branch of activity is calculated on the basis of information taken from annual production statistics; in the case of a series of branches for which there are no production statistics (such as agriculture and forestry, transport, communications, commerce and services), the value added is estimated by means of production indices and statistics collected by ministries and associations, either by the National Institute of Statistics or by the Department of Applied Economics of the University of Brussels. The value added for the housing sector is not taken into consideration.

Number of persons employed. The number of persons employed is assessed on the basis of statistics from the National Social Security Office; surveys carried out by the National Institute of Statistics on industrial activities and on employees of the State, communes and public utilities; information from the National Family Allowances Office; and other sources. This number includes all persons working for private or public employers, employers, independent workers and family workers;

1 Divergences in the results due to these exclusions are considered negligible, since in December 1964, for example, only approximately 3 per cent of employees worked in head offices, while undertakings not covered by reason of their limited size only employed 1,000 persons (i.e. 0.2 per cent).
those occasionally or partly unemployed are included but not the totally unemployed. Conscripts, Belgian frontier workers and Belgian seasonal workers abroad are also excluded.

The annual figure is an average calculated on the basis of monthly, quarterly or half-yearly data.


**Belgium-II**

**Official title of the series.** Index of hourly productivity of employees in manufacturing.

**Responsible body.** Economic, Social and Political Research Institute of the Catholic University of Louvain (*Institut de recherches économiques, sociales et politiques de l'Université catholique de Louvain*).

**Base year, periodicity and scope.** The index (1953 = 100) has been calculated annually since 1952 and quarterly since 1961; it covers manufacturing.

**Method of computation.** Ratio of the production index to the index of the number of hours actually worked by wage earners and salaried employees.

**Production index.** This index, calculated by the Louvain Institute and based on statistics from various bodies, is a weighted arithmetical average of component indices, generally established for each product or for a group of products, on the basis of the quantities produced. The weighting is based on the value added in the course of the manufacture of each product in 1953. Adjustments are made at product level to obtain the production per standard month of uniform length. The half-yearly indices are averages of the months from March to May and from September to November.

From 1961 onwards the indices have been revised to allow for the increase in the number of products included in the general index.

**Index of the number of hours actually worked.** This index is calculated from estimates made by the Louvain Institute on the basis of indices of the number of employees and of the number of hours worked per week.

**Publication.** *Recherches économiques de Louvain*, Institut de recherches économiques, sociales et politiques de l'Université catholique de Louvain (e.g. No. 7, Nov. 1966, p. 545).

For more detailed information on the production index see “Statistiques rétrospectives”, in *Service mensuel de conjoncture*, Institut de recherches économiques, sociales et politiques de l'Université catholique de Louvain, Mar. 1956, pp. VII-IX.

**Brazil**

**Official title of the series.** Gross production and value added per person employed and per person engaged in production (*valor da produção e valor da transformação por pessoa ocupada e por pessoa diretamente ligada à produção*).
**Responsible body.** National Statistical Council, General Secretariat, Office of the President of the Republic (*Conselho nacional de estatística, Secretaria Geral, Presidência da República*).

**Base year, periodicity and scope.** Data, in absolute figures, and indices (1958 = 100) have been calculated annually since 1955 with the exception of 1960-61; they cover manufacturing.

**Method of computation.** Ratio of the value of gross output and value added, at 1958 constant prices, to the total number of persons employed or the number of persons engaged in production.

**Gross output and value added.** The value of output and the value added, corrected to take account of price fluctuations by means of a wholesale price index, are worked out from the industrial registers and the industrial census of 1959. The value of the gross output corresponds to the sale value, at factory prices, of all goods produced in industrial establishments during one year; it includes not only the value of products sold, distributed free of charge or kept in stock, but also the value of services of an industrial nature carried out for other establishments within the firm or for third parties; it also includes the processing of agricultural products for the account of third parties and income from the installation or maintenance of machinery and equipment. Taxation on all consumer goods is deducted.

The value added is obtained by deducting the value of raw materials, packing and protective materials, fuel, lubricants, electricity and services contracted out, including home work, from the gross values of output.

**Total number of persons employed and number of persons directly engaged in production.** The total number of persons employed includes all persons having an activity in an establishment on 31 December of each year, including proprietors, partners, and non-remunerated members of their families; persons employed on a part-time basis are included, as are persons on holiday or absent because of illness for a period of less than thirty days. Homeworkers are not included if they are paid by the job and if their materials are supplied by the establishment.

Persons directly engaged in production are foremen, wage earners, apprentices, middle-level technicians in general and top-grade technicians such as chemists, engineers, etc.

**Publication.** The data in absolute figures and indices have not yet been published.

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**Bulgaria**

**Official title of the series.** Indices of the total annual production per person employed and per wageearner.

**Responsible body.** National Information Office of the Council of Ministers (*Drzhavno Upravlenie za Informatsia pri Ministerskia Svet*).

**Base year, periodicity and scope.** The indices (1948 and 1960 = 100) have been calculated for 1948, 1950 and annually since 1952; they cover mining and quarrying, manufacturing and electricity in the socialised sector. Separate indices are also available for state undertakings on the one hand and for co-operative undertakings on the other.

**Method of computation.** Ratio of the total annual output at constant prices to the annual average number of persons employed or wage earners.

**Total annual output.** The value of the total annual output is obtained by adding the value of finished and semi-finished products (with the exception of semi-finished products and components which will subsequently be processed in the same
undertaking) and services of an industrial nature. The data are taken from the statistics of the establishments. Until 1960 inclusive, the series was calculated on the basis of the production prices on 1 April 1956; since 1961, it has been calculated on the basis of prices on 1 April 1962.

**Annual average number of persons employed and of wage earners.** The average annual number of persons employed includes all persons on the books of undertakings in the socialised sector and who have a contract of employment, as well as persons employed for at least one day on work relating to main production or for at least five days in ancillary activities. Persons absent for reasons of holidays, sickness, maternity leave, etc., are included in the numbers employed. Persons not engaged in production (i.e. those employed in ancillary agricultural undertakings, in commercial activities or in the training and health services of industrial undertakings) are not counted.

The data are taken from the periodic reports of establishments in the socialised sector. The annual average number of persons employed or wage earners is an average of figures for periods of twelve months or of four quarters; the monthly figures are based on the average number of persons on the payrolls for each day; in the case of public holidays the number for the preceding working day is used.

**Publications.** *Statisticheski Godishnik* (statistical yearbook) and *Statisticheski Izvestia* (statistical bulletin) Sofia, Drzhavno Upravlenie za Informatsia pri Minister-ska Svet (e.g. 1965 yearbook, p. 124).

Some methodological information on statistics concerning employment and industry is given in the introduction to the relevant chapters (the introductory sections of the 1962 yearbook have been translated into English).

**Canada**

**Official title of the series.** Output per person employed and per man-hour.

**Responsible body.** Productivity Research and Analysis Section, National Accounts, Production and Productivity Division, Dominion Bureau of Statistics (DBS).

**Base year, periodicity and scope.** The indices (1961 = 100) have been calculated annually and are available from 1946; they cover the entire national economy with the exception of non-commercial activities comprising public administration, national defence and certain services established on a non-lucrative basis such as hospitals and educational institutions.

Separate indices are available for agriculture, manufacturing, the entire industrial sector (with the exception of manufacturing) and for commercial non-agricultural industries as a whole. Indices are also calculated for the whole of industry producing goods, non-agricultural goods as a whole and for the service industries as a whole.

**Method of computation.** Ratio of the index of the gross domestic product to the indices of the number of persons employed and of man-hours worked.

**Gross domestic product index.** Annual indices of output in volume terms are obtained, for each of the industries from which the gross domestic product is derived, on the basis of indices calculated at the level of individual industries. Weighting coefficients are based on the 1961 input/output table worksheets drawn up by the DBS. Indices for particular industries are based on the value added or on figures for gross output, except in a few industries representing approximately 13 per cent of the total weight, where other indicators are used such as labour input in the case of certain services, particularly the intermediate financial services.

**Indices of the number of persons employed and of man-hours worked.** These indices are based on information taken from monthly labour force sample surveys and monthly employment surveys as well as on further information taken from the annual
censuses of manufacturing, mining, censuses of population, agriculture, commerce and services, and from other sources.

The number of persons employed includes all persons engaged in productive activities, whether classified as employees, employers, self-employed persons or unpaid family workers.

Figures for hours of work are special estimates of the total number of hours actually worked by all persons 14 years of age and over. The estimates, taken from labour force sample surveys, have been based on the annual average number of hours worked per person employed and on the average employment figures. Separate data for sex and status group distributions are used in calculating the average number of hours worked; adjustments are made to take public holidays and leave into account.

Publications. DBS Daily Bulletin, Ottawa (e.g. bulletin of 18 April 1969, pp. 3-6; see also [76].

For more detailed information on methodology see [73], [75] and [77].

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China (Taiwan)-I

Official title of the series. Index of the gross national product per person employed.¹

Responsible bodies. Directorate-General of Budgets, Accounts and Statistics and Provincial Department of Civil Affairs.²

Base year, periodicity and scope. The index (1963 = 100) has been calculated annually since 1952; it covers the entire national economy.

Method of computation. Ratio of the gross national product index at constant prices to the index of the number of persons employed.

Gross national product. The gross national product, calculated at market prices and at 1963 constant prices by the Directorate-General of Budgets, Accounts and Statistics, corresponds to the value of goods and services produced by the nation before deducting provisions for fixed capital consumption; it is obtained by adding household and state consumption expenditure, gross domestic capital formation (including stock variations) and net exports of goods and services.

Number of persons employed. On the basis of the household registers, the Provincial Department of Civil Affairs collects data concerning the number of persons over 12 years of age in employment. Family workers, persons on military service and foreigners are not included.

Publication. Information relating to the gross national product and to the number of persons employed is published regularly in the Taiwan Statistical Data Book, Taiphe, Council for International Economic Co-operation and Development.

For more detailed information on methodology see, in respect of the gross national product, National Income of the Republic of China, Taiphe, Directorate-General of Budgets, Accounts and Statistics, and Report of Taiwan Labour Statistics, Taichung, Department of Reconstruction, Taiwan Provincial Government.

¹ The index is calculated by the ILO.
² These two bodies are responsible for preparing the information which is used in calculating the index.
China (Taiwan)-II

**Official title of the series.** Index numbers of industrial productivity.

**Responsible body.** Ministry of Economic Affairs.

**Base year, periodicity and scope.** The index (1952 and 1956 = 100) has been calculated annually since 1952; it covers mining and quarrying, manufacturing, building, electricity, gas and water. The Ministry also calculates an index of agricultural productivity.

**Method of computation.** Ratio of the production index to the employment index.

**Production index.** This index is obtained on the basis of 193 separate series representing 80.6 per cent of production from the sectors covered in 1961. The general index is a weighted arithmetical average; the weighting system, derived from the results of the 1961 census of industry and commerce, is based on the value added of the different products in 1961.

The information is obtained from monthly surveys of all undertakings with more than forty employees; firms are also included if they use 5 h.p. and have more than ten employees or less than 5 h.p. and more than twenty employees. Data concerning certain undertakings are collected by the municipal or district authorities.

**Employment index.** This index is based on information derived from household registers. The number of persons employed includes all employed persons over 12 years of age, with the exception of family workers, persons doing military service and foreigners.

**Publication.** Taiwan Statistical Data Book, op. cit. (e.g. 1966 edition, p. 45). Some methodological indications on the production index are published in the introduction to the Taiwan Production Statistics Monthly, Taipei, Ministry of Economic Affairs and The Central Bank of China, and, as regards information on employment, in Report of Taiwan Labour Statistics, op. cit. (e.g. 1964 edition).

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Cyprus

**Official title of the series.** Indices of gross production by person employed.

**Responsible body.** Statistics and Research Department.

**Base year, periodicity and scope.** The index (1962 = 100) has been calculated annually for the period 1962-67; it covers manufacturing; indices have also been calculated for mining and quarrying, and for electricity, gas and water.

**Method of computation.** Ratio of the total output, at 1958 constant prices, to the average number of persons employed.

**Total output.** The value of the total output is obtained by adding the value of finished products and industrial services supplied, as well as variations in stocks of finished and semi-finished products of all industrial establishments. The data are taken from the annual establishment reports.

**Average number of persons employed.** This number includes all persons on the payrolls of industrial establishments, including apprentices and working proprietors.

**Publication.** The indices have not been published.

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Czechoslovakia-I

**Official title of the series.** Social productivity of labour (*společenská produktivita práce*).
Responsible body. Federal Office of Statistics (Federální Statistický Úřad).

Base year, periodicity and scope. The index (1948 = 100) has been calculated annually since 1948; it covers the entire national economy, with the exception of foreign trade and private housing construction; indices exist also for agriculture, the industrial sectors as a whole and for construction.

Method of computation. Ratio of the national income, at constant prices, to the number of persons employed.

National income. The national income, calculated at constant buying and selling prices, corresponds to the value of the net production of the economic units belonging to the material production sectors; it is obtained by deducting expenditure on intermediate consumption and provisions for capital consumption from the value of the gross national product.

Number of persons employed. The average annual number of persons employed comprises employees, members of unified agricultural co-operatives, members of their families if they are employed in the co-operatives on a permanent basis, members of the other co-operatives and other active persons (independent small-holders and others). Apprentices and family helps are not included.

Publication. Statistická Ročenka ČSR (statistical yearbook of the Czechoslovak Socialist Republic), Prague, Federální Statistický Úřad (e.g. 1966 edition, pp. 24-25 and p. 127).

For more detailed information on methodology, see Statistika, Prague, Ústřední Komise Lidové Kontroly a Statistiky, No. 2, 1967, which contains information of a methodological nature in the appendix (příloha časopisu) and, as regards the national income, Generalized Description of the System of Balances of the National Economy (MPS), document Conf. Eur. Stats./WG.22/4, Geneva, United Nations, Economic Commission for Europe, 1965.

Czechoslovakia-II

Official title of the series. Total annual output per person employed (roční produktivita práce pracovníka průmyslového podniku), per wage earner (dělníka průmyslové činnosti), per man-day (wage earners) (denní produktivita práce dělníka průmyslové činnosti) and per man-hour (wage earners) (hodinová produktivita práce dělníka průmyslové činnosti).

Responsible body. Federal Office of Statistics (Federální Statistický Úřad).

Base year, periodicity and scope. The index of output per person employed (1960 = 100) has been calculated since 1960; the index per wage earner (1955 = 100) since 1948; and the indices per man-day and per man-hour (wage earners) (1955 = 100) since 1955. The indices are calculated yearly; half-yearly indices are also available in respect of productivity per person employed and per man-hour (wage earners). All these indices cover mining and quarrying, manufacturing (with the exception of publishing), electricity, gas and steam.

Method of computation. Ratio of the value of the gross output to the different labour inputs (number of persons employed, of wage earners, of man-days (wage earners) and of man-hours (wage earners).

Value of gross output. The data on the value of gross industrial output are obtained, on the basis of reports from industrial establishments, by adding the value (at constant wholesale prices) of all finished industrial products, semi-finished products sold and services of an industrial nature provided by all enterprises; turnover taxes are not included; the value of output of secondary workshops and the value

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1 The index has also been calculated for recent years on the base 1955 = 100.
of services of non-industrial organisations are not included in the total used in computing indices of labour productivity.

The general index and the indices by industry are based on the component output indices, established at the level of undertakings and of individual branches; the weighting coefficients are based on the constant wholesale prices of the undertakings. For the period 1955-60, the series is calculated on the basis of prices at 1 July 1954 and, as from 1960, on the basis of prices on 1 January 1960.

The general index and the indices by industry are also calculated at irregular intervals whenever the need arises, the weighting being based on the number of wage earners.

Number of persons employed, of wage earners, of man-days (wage earners), and of man-hours (wage earners). As in the case of output, this information is taken from establishment reports.

The number of persons employed includes all categories of permanent, seasonal and casual workers who have a contract with the organisation in question, as well as persons temporarily employed (from their first day of work in the undertaking). Apprentices are not included. Those temporarily absent on mission, holiday, sickness, etc., are included.

The number of wage earners does not include those engaged in activities that are not directly related to the production of the industrial undertaking (that is to say staff working in the canteens, nurseries, educational services, etc., of the undertaking).

The number of man-days (wage earners) corresponds to the total number of days put in at work by wage earners or of days spent on official mission; no account is taken of the number of hours actually worked per day.

The average number of persons employed is calculated on the basis of the recorded daily attendance (as regards wage earners) and of attendance at the beginning and end of the month (as regards other categories).

The number of man-hours (wage earners) relates to the total number of hours actually worked by wage earners, including overtime; hours paid but not worked because of annual leave, sickness, absence, etc., are not included; refreshment and rest breaks taken at work are, however, included.

Publications. Statistická Ročenka ČSR, op. cit. (e.g. 1966 edition, pp. 214-217) and Statistické přehledy (statistical summaries), appendix to Statistika, op. cit. (e.g. appendix to No. 12, 1965, p. 124).

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Finland

Official title of the series. Index of the gross domestic product per man-year (reaalikansantuote työpanosyksikköä kohden). The Central Statistical Office has also calculated for 1948-58 indices (1938 = 100) of the net domestic product at constant prices per inhabitant, per person of working age (15 to 64 years), per person employed, and per man-year.


Base year, periodicity and scope. The index (1954 = 100) has been calculated annually since 1954; it covers the entire national economy; separate indices are available by branch and class of economic activity.

Method of computation. Ratio of the index of the gross domestic product to the employment index, measured in man-years.

Index of the gross domestic product. The gross domestic product, at factor cost and at 1954 constant prices, is obtained by adding the contributions, assessed at constant prices, of the various branches of the economy.
APPENDIX 1

Employment index. This index is based on assessments made by the Central Statistical Office of the number of man-years actually worked in the various industries.

The total number of man-years includes the work of wage earners and salaried employees, private contractors and unpaid family workers. Part-time work has been converted into man-years on the basis of the normal working hours for the occupation and type of activity concerned. Estimates are based on the population censuses, general economic censuses, production statistics and balance sheets as well as on labour force sample surveys.

Publications. *Tilastokatsauksia* (bulletin of statistics), Helsinki, Central Statistical Office (e.g. No. 11, 1965, pp. 44-76).

For more detailed information on methodology see also, as regards the index of the gross domestic product, ibid., Nos. 11-12, 1950, pp. 48-61, No. 9, 1959, pp. 65-69; and, as regards the employment index, "The Development of Employment in Finland in 1938-1958. Preliminary Report", in ibid., No. 12, 1959, pp. 39-58.

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France

Official title of the series. Gross labour productivity (*productivité brute du travail*).\(^1\) For the period 1949-60 indices have also been computed for net labour productivity and the gross national product per member of the active population employed and per hour of work.\(^2\)


Base year, periodicity and scope. The index (1949 = 100) has been calculated annually since 1949; it covers the entire national economy. Separate indices are available for non-agricultural activities as a whole, the industrial sector, the processing industries, building and public works, transport and telecommunications and other services.

Method of computation. Ratio of indices of final gross output to those of hours of work.

Final gross output index. Final gross output, derived from national accounts and statistics for foreign trade, comprises goods for household consumption, including the purchases of foreign tourists, home consumption by farmers (at producer cost) and by owner-occupiers of housing, as well as goods for government departments and financial institutions, including military purchases, capital formation and exports; imports of consumer goods and capital goods are deducted.

The index of final gross output is a weighted arithmetical average of the indices calculated for each major category. The weights for the period 1949-56 are based on the structure of final gross production in 1956; from 1957 onwards the weights vary from year to year.

Hours of work index. The index is based on special estimates of the total number of hours worked by the economically active population, except for members of the armed forces and persons in domestic service. Separate estimates are made for three sectors: agriculture, non-agricultural undertakings (covering industry and

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\(^1\) Since 1949 INSEE has also computed for various periods, the first going back to 1896, indices of global productivity of factors; these indices are obtained by dividing indices of the final gross output by those of all the factors, which include productive fixed capital depreciation and imports in addition to the total number of hours of work.

\(^2\) See [229]. INSEE has also computed indices of labour productivity for selected classes of industry.
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services), and the civil service; estimates for the first sector are based on general population censuses and on expert opinion; estimates for the second sector are based on national accounts and on the results of the quarterly survey of economic activity carried out by the Ministry of Labour; and the estimates concerning hours worked by civil servants are based on public service personnel returns and budget documents.

The general index and, from 1957 onwards, the indices for each of the three sectors, are weighted arithmetical averages. For the general index the weighting system is based on the total cost of wages and salaries and, as from 1957, for the sector indices, on hourly labour costs, including social security contributions by employers (even if these are voluntary) and on the profits of individual undertakings representing the earnings of self-employed workers, members of the liberal professions, etc. Indices of working hours other than those of farmers have been increased by 0.3 per cent per annum to allow for changes in occupational qualifications.

Publications. Annuaire statistique de la France, Paris, INSEE (e.g. 1965 edition, p. 547) and Etudes et conjoncture, Paris, INSEE (e.g. “Les comptes de la nation pour l’année 1966”, No. 6, June 1967, pp. 77-79).

For more detailed information on methodology, see [231], [232] and [238] (the last-mentioned article also contains detailed information on changes made in the series).

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Germany (Eastern)

Official title of the series. Productivity indices per employee and per production worker (Index der Produktivität je Arbeiter und Angestellter und je Produktionsarbeiter). Since 1955 the National Office of Statistics has also calculated indices of gross production per hour actually worked by production workers; these indices, however, only cover undertakings in the socialised sector.


Base year, periodicity and scope. The indices (1950 and 1955 = 100) have been calculated annually since 1950; they cover mining and quarrying, manufacturing, electricity, gas and thermal energy. Indices are also established in respect of productivity in construction, as well as in transport and communications.

Method of computation. Ratio of the value, in constant prices, of gross output to the average number of employees and production workers.

Gross output. The value of gross output, adjusted to take account of price fluctuations, is based on reports from undertakings; it includes the value of finished products for sale, including the products given or sold to personnel in the undertaking, and industrial services. Since 1959 account has been taken of variations in the stocks of products in process in the metal industries of the socialised sector.

Employees and production workers. The average number of employees and of production workers is taken from the periodic reports of industrial undertakings normally employing more than ten persons. The number of employees covers all persons having a contract of employment, including homeworkers and casual workers, as well as part-time employees. Production workers include the following categories: workers operating, minding or supervising machines, manual workers (whether or not using tools) and workers responsible for quality control.

The total number of hours actually worked, used in assessing productivity per working hour in the socialised sector, covers all hours worked, including overtime, by all persons engaged in production as well as hours worked by the housewives’ brigades, trainees and students during holidays or periods of vocational training.
APPENDIX 1

Publication. *Statistisches Jahrbuch* (statistical yearbook), Berlin, Staatliche Zentralverwaltung für Statistik (e.g. 1966 edition, pp. 178-180, which also contains methodological information in the introduction to the chapters relating to the labour force (Chapter 4) and to industry (Chapter 6)).

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**Germany (Federal Republic)-I**

**Official title of the series.** Index of the gross domestic product, at constant prices, per person employed (*Bruttoinlandsprodukt in konstanten Preisen je Erwerbstätigen*).¹

**Responsible body.** Federal Statistical Office (*Statistisches Bundesamt*).

**Base year, periodicity and scope.** The index (1960 = 100) has been calculated annually and half-yearly since 1960; it covers the whole of the national economy. An annual index (1950 = 100) has also been calculated since 1960.

**Method of computation.** Ratio of the gross domestic product at constant prices to the number of persons employed.

**Gross domestic product.** The gross domestic product at market prices and at 1954 constant prices is obtained by adding the contributions (valued at constant prices) of the various branches of economic activity; it is also obtained by adding the various items in the appropriation account of the national product: private consumption expenditure, state consumption expenditure, gross capital formation, net exports of goods and services, taking into account net factor income from the rest of the world.

**Number of persons employed.** Estimated on the basis of the 1961 population census, labour force sample surveys and other statistics, this number covers all employed persons, including workers on their own account, family workers, frontier workers and aliens working in German missions abroad; it excludes persons who live in the Federal Republic and work abroad as well as persons employed by foreign missions or foreign armed forces stationed in the Federal Republic of Germany.

**Publications.** *Wirtschaft und Statistik* (economy and statistics), Wiesbaden, statistisches Bundesamt (e.g. No. 10, Oct. 1963, p. 579; No. 12, Dec. 1965, p. 782); *Statistisches Jahrbuch für die Bundesrepublik Deutschland* (statistical yearbook of the Federal Republic of Germany), Wiesbaden, Statistisches Bundesamt (e.g. 1965, p. 565; 1966, p. 558).


**Germany (Federal Republic)-II**

**Official title of the series.** Indices of production per person employed (*Produktionsergebnis je Beschäftigten*), per man-hour worked by all persons employed (*je Beschäftigtenstunde*), per wage earner (*je Arbeiter*) and per man-hour worked by wage earners (*je Arbeiterstunde*).

¹ The Federal Statistical Office also calculates indices of the net domestic product per person employed but does not publish them.

Base year, periodicity and scope. The indices (1962 = 100) have been calculated annually since 1950; quarterly and half-yearly indices have also been calculated since 1962. They cover mining and quarrying and manufacturing. Craftwork and a few small manufacturing firms which do not belong to any industrial or craft association are not included. Separate annual indices are available by branch and class of activity from 1950.

Method of computation. Ratio of the net production index to the indices of employment and hours of work, corrected where necessary to allow for differences in scope between the various series. When the net production indices are used in calculating productivity per person employed or per wage earner, they are adjusted to take into account fluctuations resulting from differences in the number of days in each month (working days, public holidays, weekly days of rest); non-adjusted indices are used in computing productivity ratios based on the number of hours worked.

Output index. On the basis of official statistics, in particular the preliminary output returns (Produktions-Eilbericht) and industrial surveys (Industrieberichtserstattungen), as well as of the statistics of various occupational associations, the Federal Statistical Office calculates a monthly index of net industrial output. This index is a weighted arithmetical average of series mainly based on quantities produced; certain series are based on the value of output or on turnover, adjusted to allow for price changes, on the number of hours worked by wage earners, corrected by a productivity index, or on the quantities of raw materials processed, adjusted to take account of differences in quality. The weighting system is based on the value of net output in 1962, calculated at market prices and including the value of certain goods and services provided by other sectors (such as maintenance costs of goods purchased, transport costs, advertising and office expenses). The weighting coefficients have been obtained through a survey of all industrial establishments employing ten or more persons. Account has been taken, on the basis of estimates, of the value of the net output of industrial establishments which were smaller in 1962.

The monthly indices are adjusted to eliminate fluctuations due to differences in the number of working days per month in each industry.

Indices of employment and of hours worked. These indices are based on data taken from monthly surveys of all establishments normally employing ten or more persons.

The number of persons employed covers all persons having a contract or employment relationship with a firm, including those who are employed but absent on account of illness, accident, leave, a strike or military service. Homeworkers, however, are excluded.

Working proprietors are also included, as well as unpaid family workers if they have been employed for at least one-third of the normal working hours. The definition of wage earners is that used for social insurance purposes. The figures for hours of work correspond to the total number of hours actually worked by wage earners in a calendar month or, if that is not possible, during the pay period falling wholly or mostly within the month covered by the survey. The figures for hours actually worked by employed persons other than wage earners are obtained from estimates based on the average working hours of wage earners.

Publications. Statistisches Jahrbuch für die Bundesrepublik Deutschland, Wirtschaft und Statistik (e.g. No. 6, 1966) and Industrie und Handwerk (industry and crafts) (Reihe 2, Fachserie D), Wiesbaden, Statistisches Bundesamt.

For more detailed information on methodology see, as regards productivity indices, [150] and [151], 1968, pp. 243-247, and, with regard to the production index, Wirtschaft und Statistik, No. 3, 1965, pp. 149-166.

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Ghana

Official title of the series. Average output per person engaged and average value added per person engaged.

Responsible body. Central Bureau of Statistics.

Base year, periodicity and scope. The indices (1962 = 100) have been calculated yearly since 1962; they cover mining and quarrying, manufacturing, electricity, gas and steam. Separate indices are available by branch of economic activity.

Method of computation. Ratio of the gross production and of the value added, at constant prices, to the number of persons engaged.

Gross output and value added. The data on gross output and value added are taken from annual or quarterly industrial statistics, based on surveys of establishments employing thirty or more persons. The value of gross output is obtained by adding the value of finished and semi-finished products and of work in progress in all establishments covered by the surveys. Account is taken of stock variations as well as of services of an industrial nature but the value of goods sent out in their original form is not included. The value added is obtained by deducting the value of consumption at intermediate stages from the value of the gross production. The Central Bureau of Statistics uses the wholesale price indices to obtain estimates at constant prices.

Number of persons engaged. This figure, taken from the industrial statistics covering undertakings with thirty or more employees, covers all persons who have worked or received a wage; working proprietors, unpaid family workers, apprentices and homeworkers are included as well as persons on paid leave (sickness, public and annual holidays).

Publication. Industrial Statistics, 1962-1964, Accra, Central Bureau of Statistics, p. 84. This document also contains some information on the methods used in collecting the basic data.

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Greece

Official title of the series. Productivity indices.


Base year, periodicity and scope. The indices (November 1961 = 100) have been calculated for the months of February, May, August and November since 1962; they cover manufacturing.

Method of computation. Ratio of the production index to the index of hours of work (wage earners).

Production index. This index, established by the National Statistical Service, is based on the industrial survey carried out in 1959 as well as on the special supplementary survey undertaken for the same year. The general index is a weighted average of 108 component series, based on data concerning the quantities produced, the value of production adjusted to take account of price variations, the quantity of raw materials consumed and the number of hours actually worked by wage earners. The weighting is based on the value added in 1959.

Index of hours of work (wage earners). This index is based on the number of hours paid to wage earners for the week nearest to the middle of the month chosen. The data are derived from the quarterly sampling survey of employment and labour remuneration which covers all establishments with ten or more employees.

Publications. For information on methodology see, as regards the production index, Index of Industrial Production 1962 and Results of the Employment and Payroll

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Hungary

Official title of the series. Indices of gross (or net) output per person employed (egy foglalkoztatottra jutó bruttó (vállalati teljes) termelés; egy foglalkoztatottra jutó nettó). Indices have also been computed on the basis of the gross (or net) output per wage earner. Indices based on the production per man-hour (wage earners) are also available.

Responsible body. Central Statistical Office (Közonti Statisztikai Hivatal).

Base year, periodicity and scope. The indices (1938, 1949, 1950 and 1960 = 100) and chain indices have been calculated annually since 1949; they cover mining and quarrying, manufacturing and electricity. Separate indices for manufacturing alone have also been calculated for the socialised sector. Indices of the gross output per person employed are also available (1938 = 100) for the years 1938-43 and 1946-48. Separate indices have been computed for the socialised and private sectors as a whole and for state undertakings.

Indices of productivity in construction also exist.

Method of computation. Ratio of the gross (or net) output indices to the index of persons employed.

Output indices. The gross (or net) output indices are calculated monthly and annually for seventy-three major groups, eighteen sectors and some branches of industry. The total gross output is obtained by adding the value of output in all undertakings, adjusted to take price variations into account; it includes the value of finished products, sold semi-finished products, industrial services, changes in stocks of semi-finished products and of products in the process of manufacture, and construction work carried out by the undertaking on its own account.

In establishing the net output index, the Central Statistical Office computes 1,055 individual series, of which 963 are based on quantities produced, sixty-six on the value of production adjusted for price changes, eleven on the quantity of raw materials used and seven on the number of hours worked. The weighting system of the indices is based on the number of hours worked in 1954 for the period 1949-57, on the number of hours worked in 1958 for the period 1958-61 and, as from 1962, on the number of hours worked by wage earners in 1962.

Index of persons employed. This index is based on the number of employees, members of industrial co-operatives, self-employed craftsmen, homeworkers and young auxilliary workers. The index for state employees is computed separately on the basis of the average number of persons on the payrolls; it covers all persons having a contract of employment for a period of at least three days, with the exception of persons who have been on sick leave for more than three months, who are on compulsory military service, who are taking courses and being paid by their schools, or who have been transferred to another undertaking for more than three days. The average number of wage earners is obtained by dividing the number of recorded daily attendances by the number of working days; the average number of employees is an average of the number employed on the first and last days of the month.

Publications. Statisztikai Évkönyv (statistical yearbook) and Statisztikai havi közlemények (monthly statistical information), Budapest, Central Statistical Office (the titles, headings and notes are published periodically in English; see for example the statistical yearbook for 1965, which contains some information on the definitions used).

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Ireland-I

Official title of the series. Gross domestic product per person in employment.  
Responsible body. Central Statistics Office.  
Base year, periodicity and scope. The indices (1958 = 100) are available annually for the period 1958-67; they cover the entire national economy.  
Method of computation. Ratio of the gross domestic product to the number of persons employed.  
Gross domestic product. The gross domestic product, estimated at factor cost and at 1958 constant prices, is calculated by the Central Statistics Office on the basis of data derived from the national accounts.  
Number of persons in employment. The Central Statistics Office estimates the annual number of persons in employment on the basis of the returns of population censuses, the annual agricultural survey, quarterly industrial surveys, figures concerning the personnel employed in public administration and other information.  
Publication. The indices are not published.

Ireland-II

Official title of the series. Volume of output per wage earner engaged.  
Responsible body. Central Statistics Office.  
Base year, periodicity and scope. The index (1953 = 100) has been calculated annually since 1936; a previous index (1936 = 100) is available for 1931 and for the years from 1936 to 1953. The index covers mining and quarrying, manufacturing, electricity, construction, gas and water, as well as laundering, dyeing and dry cleaning, and government services. The Office also computes a separate index covering only mining and quarrying and manufacturing.  
Method of computation. Ratio of the production index to the employment index.  
Production index. The Central Statistics Office computes a chain index by using Fisher’s ideal formula and converting the results to the base year 1953. The data are taken from the annual production censuses which cover all establishments employing an average of at least three persons; in three industries a simplified questionnaire is used to collect data concerning establishments employing between three and nine persons.  
The production index for mining and quarrying and manufacturing is obtained on the basis of 661 individual series representing nearly 100 per cent of production in the sectors covered and based on the production value, adjusted to allow for price variations, the quantities produced, consumption of raw materials, wages paid and hours worked by wage earners. The weighting system of the general index is based on the census value added and, in the case of the indices for individual industries, on the over-all value.

1 These indices are calculated from time to time as the need arises.
Employment index. This index is based on data taken from annual production censuses and covers wage earners, including store-keepers, messengers and kindred workers; apprentices are included but not homeworkers employed by an establishment covered by the industrial census. The total employment index used to measure productivity is a weighted index of the employment indices for the various industries. The weighting system is the same as that used for production.

Publication. Statistical Abstract of Ireland, Dublin, Central Statistics Office (e.g. 1966 edition, p. 125).


Israel-I

Official title of the series. Indices of the gross domestic product per person employed and per hour of work.¹

Responsible body. Central Bureau of Statistics and Economic Research.²

Base year, periodicity and scope. The indices (1963 = 100) have been calculated annually since 1960; they cover the entire national economy. The index of the gross domestic product per person employed is also available for the period 1957-59.

Method of computation. Ratio of the index of the gross domestic product at constant prices to the index of the number of persons employed or of hours of work.

Index of the gross domestic product. The Central Bureau of Statistics and Economic Research calculates the gross domestic product, at 1964 market prices, by deducting imports of goods and services, also estimated at 1964 prices, from the final total expenditure, estimated at 1964 market prices. The final total expenditure comprises private and general government consumption expenditure, gross domestic fixed capital formation (including increases in the value of stocks) as well as exports of goods and services (including export subsidies).

Indices of the number of persons employed and of hours of work. The first index is based on labour force sample surveys; it covers all persons 14 years of age and over who have worked for at least one hour during the reference week; members of co-operatives and unpaid family workers are also included. Those persons who have a job but have not worked for reasons of sickness, leave, strikes, etc., members of the armed forces and persons on compulsory military service are not included. Data relating to the number of hours of work are obtained on the basis of the number of hours worked per week and the number of persons employed.

Publication. The data relating to the gross domestic product, to the number of persons employed and to hours of work are published regularly in Statistical Abstract of Israel, Jerusalem, Central Bureau of Statistics, which also contains methodological information in the introductory notes.

¹ These indices are calculated by the ILO.
² The Central Bureau of Statistics and Economic Research is responsible for data concerning the gross domestic product, the number of persons employed and the hours of work used by the ILO in computing these series.
³ Prior to 1959, at 1955 market prices.
APPENDIX 1

Israel-II

Official title of the series. Indices of production per man-day.1


Base year, periodicity and scope. The indices (1958 = 100) have been calculated annually since 1958; they cover mining and quarrying and manufacturing, with the exception of mining prospection, slaughtering and the armaments industry.

Method of computation. Ratio of the production index to the index of the number of working days.

Production index. In order to compute this index, the Central Bureau of Statistics and Economic Research calculates 267 individual series, 183 of which are based on quantities produced, sixty-three on the value of production (adjusted for price variations), seventeen on the number of man-days worked and four on the quantity of raw materials used. The weighting system is based on the census value added at factor cost; the weights are based on the results of the 1962 industry and crafts survey.

The data are taken from the reports of approximately 1,500 establishments forming the sample. All establishments with fifty or more employees are covered; smaller establishments are chosen according to five strata. Altogether the establishments covered employ more than 60 per cent of all employees.

Index of the number of days of work. This index is based on the number of days actually worked by wage earners. Days off, for which wages are paid (leave, sickness, accident, etc.) are not counted. Overtime is taken into consideration and converted into standard working days. The number of days worked by wage earners on piece-rates is assessed by the establishment. Wage earners include all persons directly engaged in production, handling and maintenance.

Publications. The production indices and the employment indices (number of employees, wage-earners and man-days) are published regularly in the Statistical Abstract of Israel; each yearbook also contains methodological information in the introductory notes (e.g. 1966 edition, pp. 430-433).

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Italy-I

Official title of the series. Net national labour productivity (produttività netta del lavoro nazionale).

Responsible body. Parliamentary Committee on Labour Statistics (Commissione per le statistiche del lavoro).

Base year, periodicity and scope. The index (1953 = 100) has been calculated yearly for the period 1953-64; it covers the entire national economy.

Method of computation. Ratio of the national income at constant prices to the total number of hours worked.

National income. The national income, calculated at 1954 constant prices by the Central Institute of Statistics, is obtained by adding the net factor income received from abroad to the gross domestic product at market prices, and deducting provisions for fixed capital consumption.

Total number of hours worked. Estimates for the total number of hours actually worked by all employed persons are based mainly on labour force sample surveys.

1 It is also possible, on the basis of the data published, to calculate indices for industrial production per employee, and per wage earner.
carried out since 1960 by Central Institute of Statistics and, prior to 1960, on surveys of industrial establishments carried out by the Ministry of Labour and Social Welfare.

**Publication.** Statistiche del lavoro, "Note e relazioni" (notes and reports) series, Rome, Istituto Centrale di Statistica, No. 20, May 1963, p. 87.

For more detailed information on methodology see, as regards the national income, Indagine statistica sullo sviluppo del reddito nazionale d'Italia dal 1861 al 1956 (statistical investigation of the evolution of national income in Italy between 1861 and 1956). Annali di Statistica, Series VIII, Vol. 9, and, as regards hours worked, Statistiche del lavoro, Rome, Ministero del Lavoro e della Previdenza Sociale, pp. 85-88.

**Italy-II**

**Official title of the series.** Product per work unit (prodotto per unità di lavoro).

**Responsible body.** Central Institute of Statistics (Istituto Centrale di Statistica).

**Base year, periodicity and scope.** The index (1951 = 100) is available for each year between 1951 and 1963; it covers the entire private economy. Separate indices are available for agriculture, the industrial sector and services.

**Method of computation.** Ratio of the net domestic product to the number of persons employed.

- **Net domestic product.** The net domestic product, at factor cost and at 1954 constant prices, is obtained by adding the contributions (estimated at constant prices) of the various branches of economic activity in the private sector; some duplications are included but income from the use of buildings is not counted.

- **Number of persons employed.** The number of persons employed is estimated on the basis of the population censuses of 1951 and 1961 and of labour force sample surveys.

**Publication.** See also the summary of this study, published in Rassegna di Statistiche del Lavoro (review of labour statistics), Rome, Confederazione Generale della Industria Italiana, Nos. 3-4, 1966 (pp. 137-146).

**Italy-III**

**Official title of the series.** Gross (or net) domestic product per person employed (valore aggiunto o prodotto netto interno per addetto).

**Responsible body.** Central Institute of Statistics (Istituto Centrale di Statistica).

**Base year, periodicity and scope.** The data, in absolute figures, have been computed yearly since 1951; they cover the entire national economy. The data for the gross domestic product per person employed are available separately for agriculture, the industrial sector as a whole (mining and quarrying, manufacturing, construction, electricity, gas and water) and for all the other sectors taken together (commerce, finance, transport, communications and services).

**Method of computation.** Ratio of the gross (or net) domestic product at constant prices to the number of persons employed.

- **Domestic product.** The Central Institute of Statistics computes the gross domestic product, at factor cost and at 1963 constant prices, by adding contributions from the

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1. The study has been prepared by the Chairman of the Institute, Mr. Giuseppe de Meso [152].
2. The data are also available in absolute figures.
various branches of the economy; the net domestic product is obtained by deducting from the gross domestic product provisions for fixed capital consumption estimated on a nation-wide basis.

**Number of persons employed.** The number of persons employed is estimated on the basis of the 1951 and 1961 population censuses, on estimates of the resident population at the end of each year and on labour force sample surveys. Two series are computed, one relating to the number of persons having jobs, the other to "permanent" workers, that is to say those who have worked more than thirty-two hours a week during the year or are in regular employment, even if the contract provides for a working week of less than thirty-two hours; casual workers are included, their number being expressed in units of permanent workers.

**Publications.** The series have not yet been published.

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**Italy-IV**

**Official title of the series.** Index of production per person employed (*produzione per occupato*).

**Responsible body.** Bank of Italy (*Banca d'Italia*).

**Base year, periodicity and scope.** The index (1953 = 100) has been calculated annually since 1953; it covers the entire national economy. There is also an index for the industrial sector (mining and quarrying, manufacturing, construction, water, gas and electricity) and an index covering all the remaining branches of activity.¹

**Method of computation.** Ratio of the index of the gross domestic product to the employment index.

**Index of the gross domestic product.** The Central Institute of Statistics computes the gross domestic product at factor cost and at 1963 constant prices. The gross domestic product is obtained by adding the contributions, assessed at constant prices, of the various branches of the economy.

**Employment index.** This index is based, for the period 1953-57, on estimates made by the Association for the Industrial Development of the South (*Associazione per lo Sviluppo dell'Industria nel Mezzogiorno*) and, as from 1958, on labour force sample surveys carried out by the Central Institute of Statistics; the index covers all employed persons of 14 years of age and over, including regular members of the armed forces and young workers between 10 and 14 years of age in regular employment.

**Publications.** *Relazione annuale sulla situazione generale del Paese* (annual report on the general situation of the country), Rome, Banca d'Italia. The indices are also published in *Rassegna di statistiche del lavoro* (review of labour statistics), Rome, Confederazione Generale della Industria Italiana (e.g. No. 3-4, May-Aug. 1964, table A.12, p. 129).


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¹ The Bank of Italy also computes labour productivity indices for selected classes of industry.
Italy-V

Official title of the series. Labour productivity index (indice della produttività del lavoro).

Responsible body. Central Institute of Statistics (Istituto Centrale di Statistica).

Base year, periodicity and scope. The index (1953 = 100) has been computed monthly since 1950; it covers manufacturing.

Method of computation. Ratio of the production index to the index of the number of hours worked.

Production index. The general index of manufacturing output, computed monthly by the Central Institute of Statistics, is a weighted arithmetical average of component indices, based on data relating to the quantity—expressed in physical units—of the various representative products; the output of diesel engines and electrical machinery is measured in hours of work and naval construction is assessed on the basis of the amount of metal used.

The system of weighting the general index and the indices by class of industry is based on the contribution to the net domestic product; the group indices are computed by using the gross value added as weighting coefficients and the component indices are weighted on the basis of the gross value of production at factor cost.

Index of hours worked. This index relates to the number of hours actually worked by wage earners and apprentices. It is computed by the Ministry of Labour and Social Welfare on the basis of a monthly survey of industrial establishments generally employing ten or more wage earners; in thirteen groups of industries all establishments are included.

Publications. "Produttività del lavoro salariato nelle industrie manifatturiere" (productivity of wage earners in manufacturing), Statistiche del Lavoro, "Note e relazioni" Series, Rome, Istituto Centrale di Statistica, No. 20, May 1963 (pp. 23-32 and 129-130).

For more detailed information on methodology see, as regards the production index, Numeri indici della produzione industriale, Series A, No. 1, Metodi e Norme, Rome, Istituto Centrale di Statistica, Oct. 1957, and, as regards the number of hours worked, Statistiche del Lavoro, Rome, Ministero del Lavoro e della Previdenza Sociale, Apr.-June 1961.

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Japan-I

Official title of the series. Gross national product per person employed.

Responsible body. Bureau of Statistics, Office of the Prime Minister.

Base year, periodicity and scope. The index (1963 = 100) has been computed yearly since 1953 and covers the entire national economy.

Method of computation. Ratio of the gross national product to the number of persons employed.

Gross national product. The Economic Planning Agency calculates the gross national product, at 1960 market prices, by adding private consumption expenditure, state expenditure on current consumption of goods and services, gross domestic fixed capital formation, the value of changes in inventories as well as the difference between the value of exports and that of imports.

Number of persons employed. The number of persons employed, estimated on the basis of labour force sample surveys, comprises all persons engaged in an economic activity who have worked for at least one hour during the reference week.
or who, having a job, were not at work; working proprietors and unpaid family workers are included. Members of foreign armed forces and foreign diplomats are not included.


For more detailed information on methodology see also, as regards the gross national product, *Methodology on the National Income Estimates*, Economic Planning Agency, Tokyo, as well as the annual publication of this agency, *National Income Accounts*; as regards the number of persons employed, see *Report on the Revised Figures of Labour Force Survey*, Tokyo, Bureau of Statistics, Office of the Prime Minister, Mar. 1963.

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**Japan-II**

**Official title of the series.** Labour productivity index.

**Responsible body.** Productivity Research Institute, Japan Productivity Center.

**Base year, periodicity and scope.** The indices (1965 = 100) have been calculated annually and quarterly since 1959; monthly indices are also available as from January 1962. The indices cover mining and quarrying, manufacturing, electricity, gas and water; indices are also calculated by industry. For the period 1955-59 indices exist on the basis 1955 = 100.

**Method of computation.** Ratio of the production index to the employment index for computing the component series and those by class of industry. The productivity index for manufacturing as a whole or for the entire industrial sector is a weighted average of component productivity indices; the weighting is the same as that used for the production indices.

**Production indices.** On the basis of data derived mainly from regular surveys on production statistics, carried out each month by the Ministry of International Trade and Industry, the Productivity Research Institute computes eighty-five component indices (1960 = 100). When it is impossible to allocate labour input per product evenly, the Institute calculates indices for groups of products or uses, without changing them, the indices by industry computed by the Ministry of International Trade and Industry. The weighting system is based on the value added at factor cost for the base year (1960); the data are taken from 1960 censuses of mining and quarrying and manufacturing.

**Employment indices.** The component employment indices and the indices of employment by industry are based on the monthly surveys carried out by the the Ministry of International Trade and Industry and relate to the total number of persons employed per month; in some industries (for example food, lumber, raw silk, pharmaceutical products, public utilities), the data on employment correspond to the number of persons on the payrolls at the end of each month. Employment indices for manufacturing as a whole or for the entire industrial sector are weighted indices of the component employment indices or of those for employment by industry. The weighting system is based on the employment structure in 1960.


For more detailed information on methodology, see: "How to Read Labour Productivity Index Numbers", in *Quarterly Journal of Productivity Statistics*, No. 26, 1965.1, pp. 4-6.
Korea (South)

Official title of the series. Labour productivity index number.

Responsible body. Korean Productivity Center.

Base year, periodicity and scope. The index (1960 = 100) has been computed annually and quarterly since 1960; it covers mining and quarrying, manufacturing and electricity; separate indices have been calculated by branch and class of economic activity.

Method of computation. Ratio of the production index to the index of days of work.

Production index. This index, computed by the Research Department of the Bank of Korea, is obtained from 169 individual series, based on quantities produced and, as regards the production of cornmills, sawmills, printing works, publishing and related industries, on the amount of electricity purchased. The weighting system of the general index and of the indices by branch and class of activity is based on the value added at factor cost in 1960; returns from the 1960 census of mining and quarrying and manufacturing have been used for this. The monthly data are taken from sample surveys of industrial establishments.

Index of days of work. In computing this index, the Korean Productivity Center uses figures collected by the Bank of Korea concerning the number of days actually worked by production workers. Individual indices are adjusted to allow for changes in sampling. The indices by industry and for the entire sector covered are weighted arithmetical averages of individual indices. The weighting system is based on the number of production workers on 31 December 1960.

Publications. Labor Productivity Index, Seoul, Korean Productivity Center.

For more detailed information on methodology see, as regards the production index: Monthly Statistical Review, Seoul, Bank of Korea, Vol. XVI, No. 7, July 1962 (pp. 4-12).

Malta

Official title of the series. Gross domestic product per person employed.

Responsible body. Central Office of Statistics.

Base year, periodicity and scope. The index (1958 = 100) has been computed annually since 1956; it covers the entire national economy.

Method of computation. Ratio of the gross domestic product to the number of persons employed.

Gross domestic product. The gross domestic product is obtained by adding household and state consumption expenditure, gross capital formation (including stock variations) and net exports of goods and services. The estimates at constant prices have been obtained by means of the retail price index and of the import price index, as well as of wage rates.

Number of persons employed. The Ministry of Labour uses various sources to compile data concerning the number of persons employed, which comprises all economically active persons, with the exception of unpaid family workers and farmers working only part time in the agricultural sector. Maltese civilian and military personnel in national defence establishments are included but not foreign personnel.


Information on the method used for collecting data on national accounts and employment is contained in the introductory notes to the annual abstracts (e.g. Annual Abstract of Statistics, 1965, Chapter VI, p. 2, and Chapter XI, pp. 2-3).
Netherlands

Official title of the series. Production per employee (produktie per werknemer). Three previous indices of labour productivity (arbeids productiviteit) have also been calculated; the first (1929 = 100) covers the period 1921-38, the second (1938 = 100) the period 1938-52 and third (1953 = 100) the period 1950-62.

Responsible body. Central Bureau of Statistics (Centraal Bureau voor de Statistiek).

Base year, periodicity and scope. The index (1963 = 100) has been calculated quarterly and annually since 1963; it covers mining and quarrying, manufacturing, electricity, gas and public water supply. Separate indices are computed for manufacturing as a whole.

Method of computation. Ratio of the production index to the employment index.

Production index. The general index is a weighted arithmetical average of component indices and of indices calculated by industrial group, generally on the basis of the quantities produced; some indices are based on the quantity of raw materials consumed. The weighting system, to which some changes have just been made, is based on the gross value added at factor cost in 1963, the base year of the index.

Employment index. This index is computed by the Central Bureau of Statistics on the basis of quarterly figures from undertakings generally employing ten or more persons; handicrafts and small firms are not covered. The index covers wage earners and salaried employees.

Publication. Maandschrift van het Centraal Bureau voor de Statistiek (monthly review of the Central Bureau of Statistics), The Hague (see, for example, Kwartaalreksen, K. Nijverheid, column 23 *, No. 6, 1968, p. 662).

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New Zealand

Official title of the series. Index of productivity.

Responsible body. Production and Productivity Branch, Department of Statistics.

Base year, periodicity and scope. The index (1954-55 = 100) has been calculated annually since 1954-55; it covers the entire national economy with the exception of national defence; an index is also available for manufacturing as a whole.

Method of computation. Ratio of the production index to the employment index.

Production index. This index is calculated by the Department of Statistics in accordance with the basic concepts used in the national income and sector accounts; it is a weighted arithmetical average of the volume of all goods produced and services rendered. The weighting system is based on the inter-industry study of 1954-55 and the weights for each indicator are derived from the net indicator during the base year (1954-55).

Employment index. This index, also computed by the Department of Statistics, is based on the total estimated labour force, excluding members of the armed forces and persons on military service, as well as persons registered as unemployed by the Department of Labour.

Data concerning the gross domestic product, at 1958 market prices, per man-year are published for this country by the Statistical Office of the European Communities in National Accounts (see, for example, the 1957-66 edition, p. 143).

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Norway-I

Official title of the series. Indices of the gross or net domestic product per man-year (Bruttonasjonalprodukt or Nettonasjonalprodukt pr. årsverk).

Responsible body. Central Bureau of Statistics (Statistisk Sentralbyrå).

Base year, periodicity and scope. The indices (1961 = 100) have been calculated annually since 1949; they cover the entire national economy.

Method of computation. Ratio of the index of the gross or net domestic product to the index of man-years.

Gross or net domestic product. The Central Bureau of Statistics calculates the gross domestic product, at market prices and at 1955 constant prices, by adding the contributions (estimated at constant prices) of the various branches of the economy; the net domestic product is obtained by deducting an amount representing fixed capital consumption but which does not include the value of repair and maintenance work.

Total number of man-years. On the basis of data derived from establishment and population censuses as well as of the industrial statistics supplied by the Manpower Directorate and other ministerial departments, the Central Bureau of Statistics estimates the number of man-years worked by employees, self-employed workers and family workers resident in Norway. One man-year represents the number of hours worked during a year by a person employed full time. Part-time work is converted into man-years on the basis of the number of working hours.

Publication. Data relating to the gross or net domestic product and to the number of man-years are published by the Central Bureau of Statistics, Oslo (e.g. National Accounts 1865-1960, in Norges Offisielle Statistikk, XII 163, 1965).

Norway-II

Official title of the series. Indices of production per man-hour and per person employed (Indekser over produksjon pr. timeverk og pr. sysselsatt). The Central Bureau of Statistics has also computed indices of the production per employee and per wage earner for the years 1949-55.

Responsible body. Central Bureau of Statistics (Statistisk Sentralbyrå).

Base year, periodicity and scope. The indices (1961 = 100) have been calculated annually since 1955. Indices of production per man-hour are also available for the period 1927-55 (1950 = 100) and for the period 1949-62 (1955 = 100). The indices cover mining and quarrying and manufacturing. Separate indices are calculated by branch and class of economic activity.

Calculated by the ILO on the basis of data published by the Central Bureau of Statistics. The Central Bureau of Statistics is responsible for compiling the statistics on the domestic product and number of man-years which were used by the ILO as a basis for calculating the series.
Method of computation. Ratio of the production index to the indices of man-hours and of persons employed.

Production index. This index is based on data taken from annual censuses of industrial production. Since 1961 these censuses have covered all establishments employing at least five persons and, in the case of mining and quarrying as well as of gas production, all establishments. For eighteen groups of industries, in which small establishments represent a large proportion of total output of the group, establishments are covered if they employ three or more persons. Information concerning smaller establishments is obtained by sampling. Between 1955 and 1960 the censuses covered only establishments employing an average of six or more persons.

The index is a weighted arithmetical average of component indices, calculated on the basis of quantities produced, of the value of production (adjusted for price variations), the number of hours worked (adjusted for variations in productivity) and the quantity of raw materials used. The weighting system is based on contributions from the various industries to the gross national product in 1961, assessed at f.o.b. market prices.

Indices of man-hours and of persons employed. The index of man-hours is based on the total number of hours worked by wage earners in establishments covered by the annual censuses of industrial production. Hours paid for but not worked because of stoppages due to technical failures are also included. The number of persons employed comprises employees and persons working on their own account. Data relating to employees are taken from the annual production censuses whereas figures concerning other workers are supplied by the Manpower Directorate.

Publication. Industristatistik (Industrial Statistics) and Statistical Yearbook, Central Bureau of Statistics, Oslo (e.g. the 1966 yearbook, table 160, p. 114).

For more detailed information on methodology, see Ø. Sundsba, "Productivity Measurement by Branch of Activity", in [180], pp. 355-367; see also Productivity Trends in Mining and Manufacturing 1949-1955, Norges Offisielle Statistikk, XI 326, Oslo, Central Bureau of Statistics. The revised industrial production index has been described in Statistisk Måndshefte (Monthly Bulletin of Statistics), Vol. 83, No. 6, 1965.

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Philippines

Official title of the series. Gross and net national product per person employed.

Responsible body. Office of Statistical Co-ordination and Standards, National Economic Council (OSCAS).

Base year, periodicity and scope. The data, in absolute figures, have been calculated annually since 1956; they cover the entire national economy. Figures for the net domestic product per person employed are also available for the industrial sector as a whole (mining and quarrying, manufacturing and, as from 1962, electricity, gas and steam, water supply and sanitary services).

Method of computation. Ratio of the gross or net national product (or of the net domestic product) at constant prices to the number of persons employed.

Gross or net national product and net domestic product. The gross national product is estimated, at market prices and in 1955 pesos, on the basis of private and state consumption expenditure, gross domestic fixed capital formation (including stock increases) and net factor income received from abroad. The net domestic product, at factor cost and at 1955 constant prices, is obtained by adding the contributions of the various branches of activity, estimated at constant prices adjusted to take account of fixed capital consumption. OSCAS calculates the net national product by adding net factor income from abroad to the net domestic product.
Number of persons employed. The National Economic Council makes its own assessments of the number of persons employed.

Publication. The indices are not published.

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Poland

Official title of the series. Total production per person employed (Produkcja globalna przypadająca na jednego zatrudnionego).

Responsible body. Central Statistical Office (Główny Urząd Statystyczny).

Base year, periodicity and scope. The indices (1949, 1950, 1955 and 1960 = 100) have been computed annually since 1949; they cover sea fishing and refrigerated warehouses, mining and quarrying, manufacturing, electricity and thermal energy in the socialised sector, but exclude prospecting and publishing. An index is also available for productivity in construction.

Method of computation. Ratio of the total production, at constant prices, to the average number of persons employed in the socialised sector.

Total production. The total production value is obtained by adding the value of finished products and services of an industrial nature as well as the difference in the value of stocks of semi-finished products and work in progress in all industrial undertakings of the socialised sector. The production of homeworkers is not included. The information is taken from periodical reports from undertakings. For the period 1949-55 the series has been calculated in accordance with prices established on the basis of average 1937 prices and, for the period 1956-60, on the basis of the controlled cost prices on 1 January 1956; as from 1960 the controlled cost prices on 1 July 1960 are used.

Average number of employees. The average annual number of persons employed includes all persons on the books of industrial undertakings in the socialised sector, including part-time workers; apprentices and homeworkers are excluded. The information is derived from the same establishments from which figures on total production are obtained.

Publication. Rocznik Statystyczny (statistical yearbook), Warsaw, Główny Urząd Statystyczny (e.g. 1963 edition, p. 143, table 36 (156); an English translation of the headings of the tables has been published separately).

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Rumania

Description of the series. Labour productivity per wage earner (productivitate a muncii pe un muncitor) and labour productivity per employee (productivitate a muncii pe un salariat).\(^8\)

Responsible body. Central Directorate of Statistics (Direcție Centrală de Statistică).

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\(^1\) For the period 1951-54 the index is available only on the basis of 1949 = 100.

\(^8\) Labour productivity per man-day and per man-hour can also be computed from the data at the disposal of the Central Directorate of Statistics.
Base year, periodicity and scope. The indices (1950 = 100) have been computed yearly since 1950; annual and quarterly indices (1959 = 100) are also available; all these indices cover forestry undertakings, mining and quarrying, manufacturing, electricity and thermal energy. Handicraft workshops and private industry are not covered.

The Central Directorate of Statistics also calculates series on productivity in construction and rail transport.

Method of computation. Ratio of the total production value to the average number of wage earners and employees. The index of labour productivity, by undertaking and by branch of activity, is obtained by relating labour productivity for the current period to that of the base period.

Total production value. On the basis of reports from all industrial undertakings and the industrial sections of non-industrial undertakings and organisations, the total production value is obtained by adding the value, at constant prices, of finished products, semi-finished products and services of an industrial nature of all undertakings; account is also taken of variations in stocks of semi-finished products and of work in progress.

For the period 1950-55, the series is calculated on the basis of 1948 prices; for the period 1956-62 on the basis of prices on 1 January 1955 and, from 1963, on the basis of 1963 prices.

Average number of wage earners and employees. These data are derived from the reports of the same undertakings which supply information on the total production. The average number of employees comprises all persons employed on the basis of a contract of employment; temporary workers, seasonal workers and apprentices are included. The average number of employees (or wage earners) covers both those present at their work and those absent for various reasons (leave on medical, recuperation, maternity or other grounds).

The term "wage earners" refers to the category of employees directly engaged in the production process or in maintenance; this category includes all persons processing materials by means of simple tools or machines, wage earners employed in maintaining the means of production and supervising their operation, as well as all those carrying out auxiliary functions or who perform services as part of the production process.

Publications. Anuarul statistic al RPR, Buletin statistic trimestrial, Breviarul statistic al RPR and Statistical Pocket Book of the Socialist Republic of Romania, Bucharest, Directia Centrala de Statistică (e.g. 1969 edition, pp. 130-131).

Spain

Official title of the series. Productivity per person employed (productividad por persona empleada) and per hour worked (productividad por hora trabajada).


Base year, periodicity and scope. The indices (1960 = 100) have been computed annually and monthly since 1961; they cover mining and quarrying, manufacturing, electricity and gas. Separate indices have been calculated by branch and by class of economic activity.

Method of computation. Ratio of the production index to the indices of the number of persons employed and of hours worked.

Production index. On the basis of absolute figures, taken from industrial statistics and monthly surveys, production indices are established for forty-five economic sectors; the weighting system is based on the results of national accounts for 1958. The
annual data are derived from reports supplied by all industrial establishments, while
the monthly figures are based on sampling surveys of establishments with ten or more
employees, establishments employing more than 500 workers all being covered by
the monthly survey.

Indices of the number of persons employed and of hours worked. These indices,
which are based on the same statistical sources as the production index, are weighted
by means of data taken from the survey of the active population in 1964.

The number of persons employed covers all persons having an occupation,
including family workers and other unpaid workers if they have worked for at least
one-third of the normal working time. The data on hours of work correspond to the
total number of hours actually worked by wage earners.

Publication. Indicadores Económicos, Madrid, Instituto Nacional de Estadística
(e.g. May 1966, pp. 59-77).

* * *

Sweden

Official title of the series. Index of the volume of production per person employed
and per hour worked (Produktionsvolym per sysselsatt och per arbetstimmeför arbetare,
indexal).

Responsible body. Central Bureau of Statistics (Statistiska Centralbyrån).

Base year, periodicity and scope. The index (1959 = 100) has been calculated
annually since 1959; it covers mining and quarrying and manufacturing. Another
index, based on the former production index, was calculated for the period 1953-59.
The Chamber of Commerce (Kommerskollegium) also published a productivity index
for the period 1939-54.

Method of computation. Ratio of the index of the volume of production to the
indices of persons employed and of hours worked.

Index of the volume of production. The annual index is based on data derived
from annual censuses of production which cover all establishments employing an
average of five or more persons; in some sectors, particularly mining and quarrying,
all establishments are covered. The figures obtained, which relate mainly to quantities
produced, cover nearly 5,000 commodities and information on their selling prices is
generally also available. The weighting system of the individual indices is based on
the gross value of production in 1960; in the case of the indices by industry and of the
general index, the weighting is based on the value added in 1959. In the annual index,
the aggregation by industry is based on the total production of establishments clas-
sified according to their main line of production; this enables a direct comparison
to be made between data concerning the production of various sectors and other
economic indicators for the same sectors.

Indices of persons employed and of hours worked. The index of the number of
persons employed comprises proprietors and persons working on their own account;
the index of hours worked is based on the number of hours worked by wage earners
and apprentices of 18 years of age or over. The data are derived, as for the
production index, from the annual survey of industrial production.

Publication. Industri, Stockholm, Central Bureau of Statistics (e.g. 1966 edition,
pp. 408-413, table 15:2). The previous index is published in Statistik Årskok för
Sverige (Statistical Abstract of Sweden), Central Bureau of Statistics (e.g. 1956 edi-
tion, p. 131, table 137).

* * *
APPENDIX 1

USSR

Official title of the series. Indices of gross production per person employed and per wage earner.
Responsible body. Central Statistical Board of the USSR Council of Ministers (Tsentralnoe Statisticheskoe Upravlenie pri Sovyete Ministrov SSSR).
Base year, periodicity and scope. The indices (1928 = 100) are computed annually; chain indices were published for 1940 and from 1950 onwards for the same series; the indices have also been recalculated on more recent bases.
The indices cover forestry, mining and quarrying, manufacturing and the production of electricity, but do not cover the industrial sector of kolkhozes. Indices of gross production per person employed are also computed separately for manufacturing.
The Central Statistical Board also calculates series on productivity in construction, rail transport and agriculture.
Method of computation. Ratio of the value of gross production (at constant prices) to the average number of persons employed on the one hand and to the average number of wage earners on the other.
Gross production. The value of gross production, adjusted for price changes, is obtained from reports by undertakings, by adding the value of finished products, semi-finished products and services of an industrial nature of various undertakings.
Average number of persons employed and of wage earners. Data on the number of persons employed are taken, as in the case of gross production, from reports of undertakings. The number of persons employed comprises all persons having a contract or who are employed for at least one day in main activities or for at least five days in ancillary activities. Workers temporarily absent for reasons of sickness, maternity, leave, etc., are covered; students on practical training courses and workers temporarily transferred within, and paid by, their undertakings are not included; the same applies to persons engaged in the non-productive activities of the undertaking, such as transport that is not connected with the process of manufacturing, and welfare services. The annual average number is an average of monthly figures.
The number of wage earners is based on the average of the daily recorded attendances; on public holidays the number of attendances on the preceding working day is counted.
Publication. Narodnoe khozyaistvo SSSR: Statistichesky jezhegodnik (national economy of the USSR statistical yearbook), Moscow, Central Statistical Board of the USSR Council of Ministers (e.g. 1963 edition, pp. 46-57).

* * *

United Kingdom-I

Official title of the series. Gross domestic product per head of labour force.
Base year, periodicity and scope. The index (1963 = 100) has been calculated annually since 1960; quarterly indices, adjusted to eliminate seasonal fluctuations, are also available as from 1963; the annual index and the quarterly index cover the entire national economy. Indices on the base 1960 = 100 are also available as from 1950.
Method of computation. Ratio of the gross domestic product to the total number of persons employed.
Gross domestic product. To ensure comparability with indices of labour productivity in other sectors, the gross domestic product, at factor cost and 1963 constant prices, is used. It is obtained in the form of indices by adding the contributions of the different branches of economic activity estimated at 1963 constant prices by methods similar to those used for calculating the index of industrial output. The weighting system is based on the contributions to the gross domestic product in 1963.

Number of persons employed. The number of persons employed is estimated by the Ministry of Labour on the basis of information coming from the national insurance authorities, reports from industrial establishments covered by monthly surveys, the 1951 and 1966 population censuses, and figures for Northern Ireland supplied by the Ministry of Health and Social Security. This number includes the entire active population, including working proprietors and other persons working for their own account, with the exception of the totally unemployed; members of the armed forces are also included.


United Kingdom-II

Official title of the series. Output per head. From the last quarter of 1963 to the first quarter of 1968, quarterly indices were also published on output per hour of work in manufacturing.


Base year, periodicity and scope. The indices (1963 = 100) has been computed annually since 1960; quarterly indices, adjusted to eliminate seasonal fluctuations, are also available from 1963; an earlier index was calculated from 1950. The indices covered mining and quarrying, manufacturing, electricity, gas, water and construction. Separate indices are computed for manufacturing as a whole and for some classes of industry.

Method of computation. Ratio of the output index to the index of the number of persons employed.

Output index. This index, which is calculated annually by the Central Statistical Office, is a weighted average of individual output series, based mainly on quantities produced. The weighting system, which is based on data derived from the 1963 production census, is based on value added recorded in 1963; for the previous period the weights related to 1954 and 1958. The indices are adjusted to eliminate fluctuations due to variations in the number of working days in each month, annual holidays, public holidays and seasonal variations.

Index of the number of persons employed. This index relates to the number of persons employed as assessed by the Ministry of Labour on the basis of data taken from compulsory social insurance, reports sent in by industrial establishments under a monthly survey, the 1951 and 1966 population censuses and data on Northern Ireland provided by the Ministry of Health and Social Security. This number relates to the total active population, including working proprietors and other persons
working for their own account, but does not include the totally unemployed; members of the armed forces are also counted.


* * *

**United Kingdom-III**

**Official title of the series.** Output per person employed and per man-hour.

**Responsible body.** National Institute of Economic and Social Research.

**Base year, periodicity and scope.** The indices (1958 = 100) have been computed annually since 1950; quarterly indices, as well as provisional monthly indices, are also available. The Institute has also calculated indices for the period 1948-60 on a basis of 1954 = 100. The index of output per person employed covers mining and quarrying, manufacturing, construction, electricity, gas and water; the index for output per man-hour covers manufacturing only.

**Method of computation.** Ratio of the production index for the United Kingdom to the employment index for Great Britain.

**Production index.** This index, calculated monthly by the Central Statistical Office, is a weighted arithmetical average of 880 individual series, representing approximately 90 per cent of the net value of industrial production in 1958. The data used refer mainly to quantities produced; for some series production is measured in terms of value adjusted for price changes, or in terms of quantities of materials used, or of the number of persons employed. The weighting system is based on the census value added in 1958; for the 1950-57 period the weights relate to 1954.

The monthly and quarterly indices are adjusted by the Central Statistical Office to eliminate fluctuations due to variations in the number of working days per month as well as seasonal variations.

**Indices of employment and of hours of work.** For the employment index the National Institute of Economic and Social Research uses statistics of employment in Great Britain compiled by the Ministry of Labour. The index covers all employed persons, including temporary workers, casual workers and persons temporarily laid off. The quarterly and monthly indices are adjusted by the National Institute to eliminate seasonal fluctuations.

The index of hours of work is calculated by the Ministry of Labour.

**Publication.** National Institute Economic Review, London, National Institute of Economic and Social Research (see issues from No. 21 onwards).

For more detailed information on methodology see, as regards the productivity index, ibid., No. 33; as regards the production index, “The Index of Industrial Production: Change of Base Year to 1958”, in Economic Trends, op. cit., No. 101, Mar. 1962, pp. ii-xiii; and, as regards employment, Labour Statistics, Guides to Official Sources, No. 1, London, Ministry of Labour, revised edition, 1958. See also K. S. Lomax: “Measurement of Industrial Productivity in the United Kingdom”, in [161], pp. 385-399.

* * *
United States

Official title of the series. Output per man-hour and output per person employed.¹


Base year, periodicity and scope. The indices (1957-59 = 100) have been computed annually since 1947; indices for previous years are available from 1909 onwards. The indices cover the entire private economy; some government sectors such as the postal service, public utilities and municipal transport are also covered. Separate indices are available for agriculture, non-agricultural activities as a whole and manufacturing as a whole.²

Method of computation. Ratio of the index of the gross domestic product to the indices of the number of hours worked and of persons employed (based on labour force sample surveys) on the one hand and to indices of the number of hours paid and of persons employed (based on establishment reports) on the other.

Index of the gross national product. The gross national product, calculated at market prices and at 1954 constant prices by the National Income Division of the Department of Commerce, corresponds to the value of goods and services produced by the nation before deduction of provisions for fixed capital consumption; it is obtained by adding private and state consumption expenditure, gross domestic private capital investments (including stock variations), net exports of goods and services and net investments abroad.

Indices of hours of work. The index of hours actually worked is based on data derived from monthly labour force sample surveys and published by the Bureau of Labor Statistics. It covers hours actually worked by all persons 14 years of age and over, including family workers. Adjustments are made to deduct the working hours of officials in general government services.

The index of hours paid for is based on data derived from monthly surveys of selected establishments in the non-agricultural sector. Hours paid for include normal working hours, overtime and time paid but not worked for reasons of leave, holidays and sickness. Estimates of hours paid for in agriculture and the hours of working proprietors, family workers, domestic servants and other categories of workers not covered by the surveys are based on other sources, particularly the monthly labour force sample survey, and statistics compiled by the National Income Division.

Each employed person is counted only once in the series based on the sample surveys, whereas the series based on establishment reports relate to all persons on the payrolls of the establishments; such persons may thus be counted more than once if they have more than one job.

Publications. Indexes of Output per Man-hour for the Private Economy, annual reports of the Bureau of Labor Statistics (e.g. [220], Manpower Report of the President, 1966, Washington, DC, Department of Labor, and Statistical Abstract of the United States (e.g. 1966 edition, p. 237, table 330).


¹ Two different series are established for each evaluation of the labour factor, the first on a labour force basis, the second on an establishment basis.

² Labour productivity indices are also calculated for selected industries.
Yugoslavia

Official title of the series. Index of labour productivity in industry (Indeks produktivnosti rada u industriji).

Responsible body. Federal Institute for Statistics (Savezni Zavod za Statistiku).

Base year, periodicity and scope. The index (1964 = 100) \(^1\), has been calculated annually since 1952; a chain index is also calculated; the index covers mining and quarrying, manufacturing, and the production of electric power. Printing and publishing have been included only since 1954 and shipbuilding only since 1957.

Method of computation. Ratio of the index of the volume of production to the index of numbers employed.

Index of the volume of output. The Federal Institute for Statistics, on the basis of monthly reports of industrial establishments, computes an index representing approximately 95 per cent of the value added and based almost entirely on physical quantities produced, with the exception of services (repairs, finishing, etc.) and the products of precision mechanics, expressed in terms of hours of work, as well as the production of pharmaceutical goods and various wooden articles, measured in terms of value. The production of national defence undertakings, handicrafts and home-workers is not included. The general index is a weighted arithmetical average. The weighting system, which has varied from year to year since 1957, is based on wages and other labour costs as well as on the rate of depreciation.

The monthly indices are not adjusted to eliminate seasonal variations of fluctuations due to the number of working days per month.

Index of numbers employed. The average annual number of persons employed, as ascertained from the monthly figures on persons actually employed on the last day of each month, covers all persons employed in industrial activities, including those absent on grounds of leave, sickness, etc. Persons engaged in commercial and other non-industrial activities are not counted.

The figures are taken, as for the production index, from establishment reports. The production indices, however, are not fully comparable with those of the numbers employed because of differences in the criteria by which establishments are classified: the production indices are based on information supplied by establishments classified by branch of actual activity, whilst those for the number of persons employed are classified according to the main branch of activity. Adjustments are not made since the lack of comparability makes very little difference.

Publication. Statistički Godišnjak SFRJ (statistical yearbook of the Socialist Federal Republic of Yugoslavia), Belgrade, Savezni Zavod za Statistiku, e.g. 1966 edition, p. 176; the introductions, information on methodology, titles and headings of the tables have been translated into English and French.

For more detailed information on methodology, see Studije, analize i prikazi (studies, analyses and summaries), No. 9, Savezni Zavod za Statistiku, Belgrade.

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\(^1\) The index has also been published for other base years.
APPENDIX 2

INDICES OF LABOUR PRODUCTIVITY, 1956-68

(The indices have been recalculated on the base year 1963 by the International Labour Office. Detailed descriptions of the scope and method of computation of each index are given in Appendix 1 to this study.)

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## A. LABOUR PRODUCTIVITY FOR THE NATIONAL ECONOMY AS A WHOLE

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(f) **Final gross production, at market prices, per man-hour**

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(g) **Gross national or domestic product, at market prices, per man-hour**

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(h) **Gross domestic product, at factor cost, per man-hour**

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(i) **Net national product, at market prices, per man-hour**

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* Provisional. Figures not available. Data not yet received.

¹ Computed according to estimates of the number of "permanent workers". Hours actually worked. Hours paid.
### B. LABOUR PRODUCTIVITY IN THE INDUSTRIAL SECTOR

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| **(b) Gross production per wage earner** |
| Bulgaria¹           | 72   | 71   | 75   | 80   | 83   | 90   | 96   | 100  | 108  | 116  | 121  | 131  |      |
| Czechoslovakia¹     | 69   | 73   | 79   | 84   | 91   | 96   | 100  | 100  | 104  | 110  | 115  | 122  | 127  |
| Germany (Eastern)²  | 61   | 64   | 69   | 75   | 82   | 88   | 94   | 100  | 107  | 115  | 123  | 131  | 139  |
| Rumania             | 61   | 66   | 69   | 74   | 82   | 87   | 93   | 100  | 110  | 118  | 128  | 139  |      |
| USSR                |      |      |      |      |      |      |      |      |      |      |      |      |      |

| **(c) Gross production per man-day (wage earners)** |
| Czechoslovakia¹     | 69   | 74   | 78   | 84   | 90   | 97   | 101  | 100  | 104  | 111  | 123  | 136  | 146  |

| **(d) Gross production per man-hour (wage earners)** |
| Czechoslovakia¹     | 66   | 73   | 77   | 83   | 89   | 96   | 100  | 100  | 104  | 110  | 119  | 130  | 139  |
| Germany (Eastern)²  | 57   | 62   | 68   | 76   | 82   | 88   | 95   | 100  | 107  | 114  | 123  | 133  | 142  |

| **(e) Net production per person employed or per employee** |
| Austria             | 76   | 79   | 81   | 86   | 92   | 94   | 95   | 100  | 108  | 112  | 118  | 122  | 132* |
| Belgium             | 75   | 75   | 74   | 80   | 85   | 88   | 95   | 100  | 107  | 111  | 116  |      |      |
| China (Taiwan)²     | 66   | 69   | 70   | 75   | 82   | 88   | 95   | 100  | 107  | 123  | 140  | 150  |      |
| Finland             | 74   | 78   | 78   | 83   | 87   | 92   | 96   | 100  | 106  | 111  | 114  | 120  | 124* |
| Germany (Fed. Rep.)³| 75   | 77   | 78   | 84   | 90   | 93   | 96   | 100  | 108  | 112  | 114  | 119  | 133  |
|-------------------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|
| Ghana             |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |
| Hungary           | 63   | 72   | 77   | 81   | 87   | 93   | 98   | 100  | 104  | 102  | 105  | 121  |      |      |      |
| Israel            | 64   | 66   | 68   | 74   | 82   | 87   | 95   | 100  | 103  | 110  | 121  | 128  |      |      |      |
| Italy             | 66   | 69   | 72   | 78   | 85   | 88   | 95   | 100  | 103  | 110  | 120  | 126  |      |      |      |
| Japan             | 58   | 63   | 63   | 70   | 79   | 88   | 91   | 100  | 112  | 116  | 131  | 152  | 174  |      |      |
| Netherlands       | 73   | 75   | 78   | 84   | 90   | 92   | 95   | 100  | 109  | 114  | 121  | 132  | 149  |      |      |
| Norway            | 75   | 77   | 79   | 84   | 88   | 91   | 94   | 100  | 106  | 112  | 115  | 118  | 123  |      |      |
| Philippines       | 75   | 79   | 84   | 90   | 90   | 92   | 95   | 100  | 100  | 100  | 106  | 110  | 115  |      |      |
| Spain             |      |      |      |      | 76   | 85   | 91   | 100  | 107  | 117  | 129  | 134  | 144  |      |      |
| Sweden            | 83   | 85   | 85   | 90   | 94   | 96   | 100  | 107  | 109  | 110  | 114  | 122  |      |      |      |
| United Kingdom    |      |      |      |      | 83   | 87   | 94   | 100  | 107  | 116  | 121  | 130  |      |      |      |
| Yugoslavia        |      |      |      |      | 83   | 87   | 94   | 100  | 107  | 111  | 117  | 118  |      |      |      |

(f) Net production per wage earner

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(g) Net production per man-day (wage earners)

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(h) Net production per hour of work of all employed persons

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* Provisional. Figures not available. Data not yet received.

C. LABOUR PRODUCTIVITY IN MANUFACTURING

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(d) Net production per wage earner

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(e) Net production per man-day (wage earners)

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(f) Net production per hour of work of all employed persons

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(g) Net production per man-hour (wage earners)

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* Provisional. Figures not available. ... Data not yet received.
1 State industry. * Computed according to estimates of the number of "permanent workers".
A. Definition of Labour Force and Employment

In 1954 the Eighth International Conference of Labour Statisticians adopted a resolution laying down international standards for statistics of the labour force, employment and unemployment. The Conference established the following definitions:

**Definition of Labour Force**

4. The civilian labour force consists of all civilians who fulfil the requirements for inclusion among the employed or the unemployed, as defined in paragraphs 6 and 7 below.

5. The total labour force is the sum of the civilian labour force and the armed forces.

**Definition of Employment**

6. (1) Persons in employment consist of all persons above a specified age in the following categories:

   (a) at work: persons who performed some work for pay or profit during a specified brief period, either one week or one day;

   (b) with a job but not at work: persons who, having already worked in their present job, were temporarily absent during the specified period because of illness or injury, industrial dispute, vacation or other leave of absence, absence without leave, or temporary disorganisation of work due to such reasons as bad weather or mechanical breakdown.

   (2) Employers and workers on their own account should be included among the employed and may be classified as “at work” or “not at work” on the same basis as other employed persons.

   (3) Unpaid family workers currently assisting in the operation of a business or farm are considered as employed if they worked for at least one-third of the normal working time during the specified period.

   (4) The following categories of persons are not considered as employed:

      (a) workers who, during the specified period, were on temporary or indefinite lay-off without pay;

      (b) persons without jobs or businesses or farms who had arranged to start a new job or business or farm at a date subsequent to the period of reference;

      (c) unpaid members of the family who worked for less than one-third of the normal working time during the specified period in a family business or farm.

   Among data that should be collected from time to time are those concerning:

      (a) persons included among the employed in a specified period who were not at work, classified by cause of absence from work;

      (b) employed persons classified according to the number of hours worked per week.
II. DEFINITION OF HOURS WORKED

In 1962 the Tenth International Conference of Labour Statisticians adopted a resolution concerning statistics of hours of work applying to wage earners and salaried employees. Paragraph 5 of this resolution defines hours actually worked in the following terms:

5. (1) Statistics of hours actually worked should include—
(a) hours actually worked during normal periods of work;
(b) time worked in addition to hours worked during normal periods of work, and generally paid at higher rates than normal rates (overtime);
(c) time spent at the place of work on work such as the preparation of the workplace, repairs and maintenance, preparation and cleaning of tools, and the preparation of receipts, time-sheets and reports;
(d) time spent at the place of work waiting or standing by for such reasons as lack of supply of work, breakdown of machinery, or accidents, or time spent at the place of work during which no work is done but for which payment is made under a guaranteed employment contract;
(e) time corresponding to short rest periods at the workplace, including tea and coffee breaks.

(2) Statistics of hours actually worked should exclude—
(a) hours paid for but not worked, such as paid annual leave, paid public holidays, paid sick leave;
(b) meal breaks;
(c) time spent on travel from home to work and vice versa.
A. **SHORT DEFINITIONS OF THE MAIN AGGREGATES OF NATIONAL ACCOUNTS**

_Gross national product at market prices_ is the market value of the product before deduction of provisions for the consumption of fixed capital, attributable to the factors of production supplied by persons normally resident in the given country. It is identically equal to the sum of consumption expenditure and gross domestic capital formation, private and public, plus net export of goods and services and the net factor incomes received from abroad.

_Gross domestic product at market prices_ is the market value of the product, before deduction of provisions for the consumption of fixed capital, attributable to factor services rendered to resident producers of the given country. It is identically equal to the sum of consumption expenditure and gross domestic capital formation, private and public, and the net exports of goods and services of the given country. It differs from the gross national product at market prices by the exclusion of net factor incomes received from abroad.

_Net domestic product at factor cost_ is the value at factor cost of the product, after deduction of provisions for the consumption of fixed capital, attributable to factor services rendered to resident producers of the given country. It differs from the gross domestic product at market prices by provisions for domestic fixed capital consumption and the exclusion of the excess of indirect taxes over subsidies.

_Net national product at factor cost_ is the value at factor cost of the product, after deduction of provisions for the consumption of fixed capital, attributable to the factors of production supplied by the normal residents of the given country. It is identically equal to the national income.

_National income_ is the sum of the incomes accruing to factors of production supplied by normal residents of the given country before deduction of direct taxation.

B. **NOTE ON THE MEASUREMENT OF AN INDUSTRY'S CONTRIBUTION TO GROSS NATIONAL PRODUCT**

The contribution of an industry to gross national product (at factor cost) may be defined as the unduplicated aggregate value of the goods and services produced in the industry during a period of time including the increase in the value of work in progress, less the value of the goods and services bought from other industries and used up in the process of production. The contribution to net national product is obtained if the cost of maintaining capital intact is also subtracted. The precise implications

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2 See [203, pp. 51-52].
of the definition are discussed in technical treatises on the concepts of national income and gross national product. The following list of items that must be deducted from the gross value of output of an industry to obtain its contribution to gross national product (at factor cost) may be considered sufficient for practical purposes:

1. costs of materials and fuels used and of work given out;
2. printing, stationery and other office supplies;
3. advertising and other selling expenses;
4. business insurance premiums;
5. postage, telegraph and telephone payments;
6. expenses for banking, legal, accounting, auditing and similar business services;
7. cost of small repairs, maintenance and servicing carried out by outside contractors;
8. cost of materials and parts required for small repairs and maintenance work carried out by the establishment's employees;
9. property taxes and water rates;
10. excise and sales taxes, if these have not already been deducted from gross value of production (less subsidies, if any, received from the Government).

Items 3 and 6 refer only to outlay on services bought from other industries. The raw materials and services bought from other enterprises should be valued according to the same principles as the goods and services produced. If the contribution to gross national product is to be expressed in current prices, both the gross value of output and the cost of raw materials and services should be valued on that basis to avoid inclusion of capital gains or losses due to price fluctuation.

With respect to certain items of expenditure, it is necessary to decide whether they should be considered as the current business costs or as outlay on capital goods. In the former case, the items should be included in the above list of deductions. There are various definitions possible of indirect taxes and of government subsidies; but the differences are in general slight. For a discussion of these and similar problems reference is made to the technical literature on national income and capital formation.

The contribution of an industry to gross national product is equal to the aggregate income paid to the factors of production which contributed to the productive process plus the cost of capital used up. Therefore, it is equal to the total of the following items:

1. (a) wages and salaries;
   (b) other labour income;
2. income of unincorporated enterprises;
3. corporate profits before taxes;
4. net interest;
5. net rents on lands and buildings, including royalties;
6. allowances for depreciation and obsolescence.

Wages and salaries include employees' contributions to social insurance and pension funds, income in kind, commissions, tips, bonuses, etc. Other labour income includes employers' contributions to social insurance and pension funds, pensions and compensations paid if no social security or pension funds exist, etc. Income of unincorporated enterprises and corporate profits exclude capital gains and losses, and dividends received from other enterprises. Corporate profits, allowances for depreciation and obsolescence and other items will have to be defined in accordance with the detailed treatment of various items in the first list. Rent paid on lands and buildings might be considered as part of income originating in the real estate industry. If this treatment is adopted, the item should be included in the list of items to be deducted from the gross value of output.
APPENDIX 5

SUITABILITY OF AVAILABLE DATA FOR INTER-COUNTRY PRODUCTIVITY COMPARISONS

Tables 15 and 16 indicate, for the period 1950-60 and for five countries chosen in five different regions of the world, and for a sample of sectors and industries, the suitability of existing national and international data for inter-country productivity comparisons. All five countries are relatively advanced or industrialised and have data collection and statistical reporting systems that are comparatively well developed and modern. For this reason, the possibilities of using available data for productivity comparisons may be contemplated with some optimism. This would not be at all the case if a different sample were used representing the developing countries. On the other hand, a sample drawn exclusively from, say, the OECD countries, where there is considerable standardisation in accounts and reporting, would suggest a more favourable picture, as would data relating to recent years.

Table 15 indicates, for each of the five countries, the basic input and output data which are needed to compute indices of labour productivity in ten sectors and industries and which have been published or are easily obtainable. Thus under the heading “all sectors” it indicates that estimates of the gross national product at constant prices can be obtained for countries A, B and D—which is not the case for countries C and E. Sometimes information on output takes the form of an industrial production index (IPI); sometimes it is expressed in terms of physical units produced.

Input data are given in two forms: one based on man-years (either of employees or of all employed persons), the other based on man-hours. The table, however, does not assess or give assurance of the inter-country comparability of the data, except in a very general way. The difference is clear when in one country the data relate to hours actually worked, whilst in another they relate to hours paid, but differences also exist when the indicators used are apparently similar. For example, countries A, B and D all use IPI to measure the output of mining and quarrying; however, this index is computed differently in each country since the number and category of the component series, the formulas and weight bases, etc., are not the same. Again, the definition of the term “employee” varies from one country to another as regards the treatment of part-time workers or the minimum size of establishments.

Table 16 summarises, for each country and each sector included in the sample, the types of productivity measures that can be prepared from the data listed in table 15. The entry “yes” indicates that a measure of the level of, or the change in, labour productivity over time can be constructed for the given country or sector. An asterisk indicates in addition that this measure can be constructed on a man-hour as well as on a man-year basis.

It would seem from this table that the possibilities of making even rough productivity comparisons between countries with comparatively good data are still somewhat limited, especially if one considers the fact that the available data do not always cover the entire period 1950-60. Of the ten sectors and industries, inter-temporal productivity changes can be compared for all five countries only in the case of tobacco manufacturing. Comparisons among four of the countries are possible for four industries, and among three of the countries for three industries. For two of the ten industries, comparisons can be made between only two countries. The possibilities of comparing levels of productivity are still more restricted.
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(See notes at end of table, p. 155.)
### TABLE 15 (concl.)

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<td>Output measure</td>
<td></td>
<td>—</td>
<td>Employees</td>
<td>Employees</td>
<td>Hours worked</td>
<td>Employees</td>
</tr>
<tr>
<td>Input &quot;&quot; (a)</td>
<td></td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Input &quot;&quot; (b)</td>
<td></td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Petroleum refineries</td>
<td>321 and 321.1</td>
<td>—</td>
<td>—</td>
<td>Quantities</td>
<td>Quantities</td>
<td>—</td>
</tr>
<tr>
<td>Output measure</td>
<td></td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Input &quot;&quot; (a)</td>
<td></td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Input &quot;&quot; (b)</td>
<td></td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Hard coal mining</td>
<td>110.1</td>
<td>Quantities</td>
<td>Workers</td>
<td>Quantities</td>
<td>Quantities</td>
<td>—</td>
</tr>
<tr>
<td>Output measure</td>
<td></td>
<td>Quantities</td>
<td>Employees</td>
<td>Employees</td>
<td>Hours worked</td>
<td>Hours paid</td>
</tr>
<tr>
<td>Input &quot;&quot; (a)</td>
<td></td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Input &quot;&quot; (b)</td>
<td></td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Motor vehicles</td>
<td>383</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>Quantities</td>
</tr>
<tr>
<td>Output measure</td>
<td></td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>Quantities</td>
</tr>
<tr>
<td>Input &quot;&quot; (a)</td>
<td></td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>Employees</td>
</tr>
<tr>
<td>Input &quot;&quot; (b)</td>
<td></td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>Hours paid</td>
</tr>
</tbody>
</table>


GNP = gross national product, at constant prices. IPI = industrial production index.

"Quantities" indicate measurement in physical units of output.

Except for country A, the input measures "hours worked" and "hours paid" cover wage earners only. For country A all workers are covered.

Absence of an entry indicates that the information is not available.

Except for the measure "IPI", all measures in this table indicate that the data are available in actual units, for example: tons of sugar, value of gross national product, number of employees.

The period 1950-60 is not always fully covered.
### TABLE 16. SUMMARY OF THE POSSIBILITIES OF COMPARING PRO-INDUSTRIES

<table>
<thead>
<tr>
<th>Economic sector</th>
<th>All sectors GNP (1-9)</th>
<th>Mining and quarrying (1)</th>
<th>Manufacturing (2-3)</th>
<th>Crude petroleum and natural gas (13 and 130)</th>
</tr>
</thead>
</table>

Country A:
- Change in time Level: yes, yes*
- Level: yes, yes*

Country B:
- Change in time Level: yes, yes*
- Level: yes, yes*

Country C:
- Change in time Level: yes*, yes*

Country D:
- Change in time Level: yes, yes*
- Level: yes*, yes*

Country E:
- Change in time Level

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* Indicates that measurement is possible on a man-hour as well as on a man-year basis. Where there is no asterisk, measurements are available only on a man-year basis.

"Yes" beside the category "change in time" indicates that for the country and industry in question the data enable intertemporal productivity changes to be measured and, consequently, permit comparisons with similar measurements, when these exist, for other countries.
DUCTIVITY IN FIVE COUNTRIES, FOR A SAMPLE OF SECTORS AND (1950-60)

<table>
<thead>
<tr>
<th>Tobacco manufacturing (22 and 220)</th>
<th>Manufacture of paper and paper products (27)</th>
<th>Sugar factories and refineries (207)</th>
<th>Petroleum refineries (321 and 32.1)</th>
<th>Hard coal mining (110.1)</th>
<th>Motor vehicles (383)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>yes</strong></td>
<td><strong>yes</strong></td>
<td><strong>yes</strong></td>
<td><strong>yes</strong></td>
<td><strong>yes</strong></td>
<td><strong>yes</strong></td>
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<td><strong>yes</strong></td>
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<td><strong>yes</strong></td>
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<td><strong>yes</strong></td>
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<td><strong>yes</strong></td>
<td><strong>yes</strong></td>
<td><strong>yes</strong></td>
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</tr>
<tr>
<td><strong>yes</strong></td>
<td><strong>yes</strong></td>
<td><strong>yes</strong></td>
<td><strong>yes</strong></td>
<td><strong>yes</strong></td>
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</tr>
<tr>
<td><strong>yes</strong></td>
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<td><strong>yes</strong></td>
<td><strong>yes</strong></td>
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<td><strong>yes</strong></td>
<td><strong>yes</strong></td>
<td><strong>yes</strong></td>
<td><strong>yes</strong></td>
<td><strong>yes</strong></td>
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<tr>
<td><strong>yes</strong></td>
<td></td>
<td><strong>yes</strong></td>
<td><strong>yes</strong></td>
<td><strong>yes</strong></td>
<td></td>
</tr>
<tr>
<td><strong>yes</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

"Yes" beside the category "level" indicates that the data enable the level of productivity to be measured and, consequently, permit comparisons with similar measurements for other countries.

When nothing is indicated, no measure can be constructed from the available data.

The period 1950-60 is not always fully covered.
APPENDIX 6

RECOMMENDATIONS OF THE WORKING GROUP ON PRODUCTIVITY STATISTICS

At its session held in Geneva from 29 June to 3 July 1964, the Working Group on Productivity Statistics made a certain number of recommendations to countries compiling series on labour productivity. These recommendations are summarised in section V, paragraphs 64-72, of the final report:

SUMMARY OF RECOMMENDATIONS TO COUNTRIES

The Working Group recommends that countries should, if possible, compile at annual intervals:

(a) an index of labour productivity for industry as a whole, defined as mining and quarrying, manufacturing, electricity, gas and water supply (groups 110-339 and 511-521 of the ISIC);

(b) indices for as many as possible of the twenty-three industrial groups corresponding to ISIC major groups 11-38 and 511 (major groups 14-19 and 25-26 being taken together), provided they are of sufficient importance in the country to warrant separate treatment.

When national index numbers of industrial production are used as the numerator in a productivity index, they should be compiled in accordance with the recommendations of the Working Group on Industrial Statistics and the coverage of the labour input series should correspond to that of the production indices.

Countries are also requested to compile, at annual intervals, labour productivity indices for the following sectors:

<table>
<thead>
<tr>
<th>Sector</th>
<th>Recommended definition in terms of ISIC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agriculture</td>
<td>Major group 01</td>
</tr>
<tr>
<td>Construction and public works</td>
<td>Division 4</td>
</tr>
<tr>
<td>Wholesale and retail trade</td>
<td>Major group 61</td>
</tr>
<tr>
<td>Transport, storage and communications</td>
<td>Division 7</td>
</tr>
</tbody>
</table>

If these indices are derived from national accounting data, it is suggested that, if possible, countries also compile a separate index for industry on the same basis, in order to arrive at a comparable set of indices for the different sectors. The Working Group agreed that the problems involved in the compilation of such a set of consistent productivity indices should be further considered at the next session.

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2 For the text of the ISIC see United Nations: Statistical Papers, Series M, No. 4, rev. 1, op. cit.
Countries are also requested to compile combined productivity indices covering agriculture (including forestry, hunting and fishing), industry (as defined above), construction and public works, wholesale and retail trade, and transport, storage and communications.

It is also suggested that countries consider compiling productivity series relating to the whole economy, both by building up a system of sector indices and by experimenting with indices of domestic product (as defined in SNA), or national income (as defined in MPS), at constant prices, per labour unit. In the case of indices derived from data on domestic product, it is left to countries to decide whether the product series used for this purpose is gross or net of capital consumption and whether it is valued at factor cost or at market prices.

It is recommended that countries publishing general or sectoral indices indicate which components are assumed to have fixed or uniform rates of change in productivity and that they show the weights of each of these components.

The labour input series to be used in productivity indices for the whole economy should include all persons employed, i.e. employers, workers on their own account, wage earners and salaried employees, family workers and members of producers' co-operatives. At lower levels the series should preferably include all persons employed or, failing that, all salaried employees and wage earners; the coverage of the series based on all persons employed should correspond, as closely as possible, to the definition drawn up by the Eighth International Conference of Labour Statisticians. In so far as possible, the calculations should be based on average monthly employment rather than on a single figure for employment during the year. The treatment of persons working in more than one economic activity needs further study.

Countries are also encouraged to compile productivity indices per man-hour (particularly for the industrial sector), using the definition drawn up by the Tenth International Conference of Labour Statisticians.

In order to show the effect on productivity of shifts in employment between wage earners and other persons employed, it may be desirable to compile indices relating to wage earners only, as well as indices relating to all persons employed. These indices, however, will not be internationally comparable because of differences in the concept of "wage earners" in various countries.

Countries are urged to publish methodological descriptions of their indices, including information on the weights used, with a view, inter alia, to facilitating assessment of the effects of structural changes on the indices.
APPENDIX 7

LIST OF BIBLIOGRAPHICAL REFERENCES

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*For national sources, see also Appendix 1.

*Signed works are listed under the names of their authors.*
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