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INTER-COUNTRY COMPARISONS OF THE NATIONAL ACCOUNTS AND THE WORK OF THE NATIONAL ACCOUNTS RESEARCH UNIT OF THE ORGANIZATION FOR EUROPEAN ECONOMIC CO-OPERATION

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I. INTRODUCTION

THE point of departure for this paper is the practical need to compare the economic structure and performance of different countries. Such comparisons are involved in almost any international economic co-operation. When an international organization is established the question of financial contributions arises and it is usually decided that rich countries should contribute more than poor ones. If aid is to be allocated, some rules are needed as a basis and these rules are likely to take account of needs. The continuation of such grants must bear some relationship to performance and the contributions of different countries to a common effort must depend in some sense on ability to pay. In addition to these practical administrative needs there is the further fact that partners in a common enterprise will wish to be kept informed of one another's situation and progress, for in this way dangerous situations and costly mistakes may be avoided. Just as a private business of any size requires the services of an accountant, not to take the decisions but to see that certain essential information is at the disposal of those who do, so a national government or an international organization must, if it is to formulate and operate economic policies, have corresponding information at the national or international level.

But what is meant by riches, needs, performances, ability to pay, situation and progress, and how are they to be measured and compared? These indeed are hard questions which have only in part been answered and then only in a provisional way. Some comparisons are easier to make than others and are less subject to arbitrariness on the one hand or vagueness on the other.

Some of these questions require more information than do others, and in most cases approximate answers and comparatively crude methods can be made to serve until a better approach is practicable. Some questions are difficult to answer

because it is hard to formulate a suitable set of concepts. In other cases concepts which appear to be suitable can be formulated but it turns out to be difficult to specify their empirical correlates. In yet other cases the empirical correlates can be specified, but the data needed to construct them are only in part available or are lacking altogether.

Since some questions are more difficult to answer than others, and since the level of sophistication of the answer may vary greatly, it seems best to approach this whole subject by working step by step from the known to the unknown. Experience shows that it is possible to draw up for a single country a set of concepts for describing the economy of that country in terms of transactions and also that it is possible to specify and measure the empirical correlates of these concepts in a way and to a degree of accuracy that makes them useful for purposes of economic policy. From a comparative point of view the problem here is not that the task cannot be completed but that it is completed in different countries in different ways. The approach therefore must be to remove these differences by relating the estimates of the different countries to a given standard system and by adjusting the countries' own estimates so as to conform as closely as possible to this standard. The standard may be specified either in broad outline or in considerable detail.

An attempt is made in this paper to set out some of the problems to be faced in comparing the national accounts of different countries, and a brief account is given of the work of the National Accounts Research Unit of the Organization for European Economic Co-operation. It is assumed in the approach adopted here that many useful comparisons can be made without attempting to say whether one country is better off than another. The assessment of economic welfare would require a knowledge of the relative amount of final goods and services of all kinds available in two countries, a type of information which represents the most that is sought in the approach adopted here. But it would also require a knowledge of many other things. Among these is a common basis of valuation to be employed in the comparison. This common basis raises two difficulties; first, that the commodities consumed in any two countries are not identical in character and quality, and second, that the scale of relative values as reflected by prices is likely to be different in any two countries. Thus an international com-

parison of real income which is not simply based on converting money figures by means of the rate of exchange must essentially be based, even with perfect data, on a group of final commodities common to both countries, and the valuation employed is unlikely to be equally appropriate in both countries. But even if these difficulties prove unimportant or can be overcome there remain others to be considered before welfare comparisons can be made. Thus differences of situation due to say climatic differences may greatly alter human needs, so that a different amount of certain commodities may be needed by a given individual for him to feel the same amount of well-being in different situations. Again, the organization of society in two countries may be so different that a definition of final goods which seems satisfactory in either country, taken singly, may not be equally acceptable when the two countries are being compared. Furthermore, comparisons of welfare require that some account be taken of the effort required to produce a given output and of the distribution of rewards that accompanies a given system of production.

If the problem of comparison is tackled from the other end it is possible to distinguish several stages each of which, when attained, will permit certain questions to be answered. The first stage is to draw up a standard accounting system for the main aggregates. If this can be done for a number of countries then a great deal is already possible. Even if for statistical reasons there are still a number of items in the accounts for different countries which cannot properly be compared, it will still be possible to make similar analyses for the different countries separately where these are not highly dependent on the precise definitions used. This will frequently be the case, particularly in analyses involving year-to-year changes, and in this way comparative analyses of inflationary gaps, for example, and their contributing causes may be possible. If the statistical content of the transactions for different countries can be made more nearly uniform, it will also be possible to carry out a number of comparisons involving ratios such as the proportion of total product devoted to asset formation or the proportion of total saving supplied by public authorities. The second stage is to attempt a more detailed classification on uniform lines of the main aggregates in the standard accounts. This stage permits a more detailed comparison of economic structure to be made,

such as an allocation of total product to the various industries in which it is generated or an allocation of total asset formation to the various industries in which it is taking place or to the various products in which it is embodied. If this stage can be reached the percentages derived from the first stage will be much more useful, since in fact they do not tell a great deal unless they can be subdivided in some detail. Furthermore, much valuable information will be provided for econometric model building since simple transaction models, of which the Leontief model and foreign trade matrix models are examples, employ only information on money transactions expressed in current prices. The third stage is to construct price and quantity indices for each of the different countries, so that the movement over time of the various aggregates can in each case be expressed in terms of constant prices. When this is done it is possible to make certain comparative statements about the real growth of the different economies and their component parts. The fourth and last stage considered here is to attempt to reduce the money estimates for the different countries to a common currency unit. This step involves great conceptual and practical difficulties but, if achieved, permits a closer comparison of the relative magnitude of different economies and their components.

It is important to realize that these steps are worth taking even if the conceptual problems encountered cannot always be resolved without conventions and that the main obstacle to useful results is the lack of relevant statistical material of sufficient reliability. The analogy with the private accountant holds here. His task is to provide factual material which is relevant for business decisions. The directors and managers who make use of these facts in their work do not specify in minute detail how every item in an accounting statement is to be defined and measured. They recognize that accountants have to base their work on certain principles and conventions. They may however reasonably expect a warning if, under changed conditions, measures based on certain principles fail to reflect the underlying situation as reliably as in the past. This may happen if, for example, conventions based on the assumption of a stable price level which, at one time may have been reasonable, are applied under conditions of great secular movements of prices, a problem which is being faced at the present time in connection with the valuation of provisions for depreciation.

The economic statistician may regard his task in much the same light. He can improve the suitability of his concepts and data and gradually extend the range of questions that can be answered reliably, undeterred by the fact that there are many questions which at present he cannot answer and some which perhaps he will never be able to resolve. Provided that he understands the theory of his subject and the assumptions and conventions with which he is working, he is likely to do more in the long run on the question of welfare comparisons than those who begin and end their work at the purely theoretical level.

The arrangement of the remainder of this paper is as follows. Section II is concerned with the concepts employed in national accounting and their translation into empirical correlates, that is, into objects which are capable of measurement and for which the procedures required for measurement can be written down. Section III takes up the second stage in the process of measurement, namely the translation of the empirical correlates into actual estimates. The main feature here is the important influence which the statistical sources actually available have on the measurements that can be made in practice and the differences that arise from reliance in different countries on different sources of data. On the basis of these two sections an attempt is made in Section IV to sketch out the main features of a good system of accounts intended to meet the needs of international as well as purely domestic analysis. Section V contains some brief remarks on the information needed for comparisons in real terms over time within a single country, and Section VI contains some even briefer remarks on the problem of comparisons in real terms between countries. Finally in Section VII a description is given of the work of the National Accounts Research Unit of the Organization for European Economic Co-operation in furthering the comparability of the national accounts statistics of the participating countries.

II. CONCEPTS AND EMPIRICAL CORRELATES

The first point to be made is that there is an almost unending number of purposes for which national accounts information is used with the consequence that the concepts adopted should be framed with the object of providing useful building blocks which can be rearranged for different purposes. Thus, in defining fixed asset formation, it seems desirable to adopt the common busi-

ness practice of charging maintenance and repair, except in special cases, directly against revenue from current operations, and of defining the capital expenditure to be charged on the resting account in a comparatively narrow way so as to include only new pieces of equipment and major alterations to existing equipment. It may be objected that from the viewpoint of investment planning this treatment of asset formation is too narrow, because it is necessary to consider requirements for maintenance and repair as well as for new equipment since similar materials and industries are involved in each. There is no doubt some truth in this, but the conclusion does not follow that for investment programming all that is needed is information on asset formation defined in as gross a way as possible. For with such information no distinction is made between the inputs needed to maintain existing capacity and those to be used to extend capacity, with the consequence that with gross figures a given percentage cut in allocations may have very different effects on different industries. If, for technical reasons, it is necessary to consider repair and maintenance expenditure along with new additions to wealth, then the building blocks should contain estimates of these expenditures and they should not be lost in the general category of operating expenses.

In the second place it is possible to imagine various systems of accounts drawn up from different points of view. Thus an attempt might be made to keep the accounts in a way which reflected as closely as possible, subject to some rearrangement of the items, the actual accounts kept by the different transactors. In practice this plan could never be strictly carried out since many transactors, notably households, do not keep accounts at all, and it would be necessary either to compile an aggregate account for them from official statistics or to impose a uniform accounting system on them by means of a family budget inquiry. There would also be difficulties due to the fact that different transactors would almost certainly record their external transactions in different ways, though it may be doubted whether in practice such difficulties would be very serious. The main problems, and this indeed would be the principal purpose of the exercise, would arise because of the different principles on which internal transactions such as profit, depreciation and other operating provisions, stock changes and saving were calculated by different transactors. The definitions here would

intentionally not be uniform, so that the accounts would reflect the position as the transactors saw it themselves. Such a picture would be of considerable interest since decisions, insofar as they are based on accounting information, are affected by the definitions and conventions actually in use, which may differ from one transactor to another. The reason why such a scheme is not employed is that it does not lend itself very conveniently to aggregation, since the various transactions are not even in principle defined on a uniform basis.

A second possibility, and the one usually adopted to a greater or less extent in practice, is to keep the national accounts not from the point of view of actual transactors but from that of a hypothetical 'reasonable transactor' who adopts the principles and conventions which the investigator thinks desirable (and statistically manageable) in keeping his accounts. It is mainly for these purposes, namely the increased homogeneity of aggregations and the fact that in the opinion of the investigator the resulting accounts are more meaningful, rather than simply to permit aggregation at all, that various uniform definitions are proposed for income, depreciation and the like.

The final possibility is to attempt to keep the national accounts so that they reflect the costs and benefits of various operations to the community as a whole and not simply to the individual reasonable transactors whose accounts are being aggregated. In simple cases, as when a factory pours out smoke over the surrounding district, it can be seen that the consequential consumption of soap and laundry services by the local inhabitants may be regarded, from the community's point of view, as a cost of the factory's operations, although it is charged, in private accounts, not against the factory but against the householders. Much has been said on the desirability of keeping accounts on these lines, but it is found, on investigation, that the complications become so formidable that little or nothing has been achieved in practice. It is likely, however, that something would have to be done if a serious attempt were made to compare the national accounts of highly dissimilar economies, one highly industrialized and the other a primitive subsistence community.

Once these broad issues have been faced it is usual to look to economic theory to provide a framework and a set of concepts. This theory will, for example, indicate: distinctions between different forms of economic activity; the relationships between

these forms and terms such as income, consumption and saving; definitions of these terms; and, following from this, equations connecting them. It will also show that if a certain 'normal' environment is assumed in which, for example, competition is perfect and consumers' behaviour 'rational', then the parts of the conceptual system will fit together in a particularly neat way and various aggregations can be justified in theoretical terms.

The guidance of economic theory is useful, although in the actual world many situations arise which at the theoretical level are assumed away and despite the fact that the definitions of theory are not expressed in operational terms, that is to say they do not take the form of prescriptions for the empirical correlates of the theoretical concepts. In framing a conceptual system for use in applied work it is therefore necessary to supplement theory in two ways. First, a choice must be made in many matters of classification on which theory has little or nothing to say, and second, it is necessary to state precisely what operations are to be used in measuring the empirical correlates.

Theory contributes very little to the formation of institutional or product classifications. It can of course say that only things which are homogeneous in some sense should be grouped together, as when conditions are laid down for the grouping of commodities in the analysis of consumers' behaviour, but the main guidance in the matter of grouping must come from a knowledge of institutional, technical and legal conditions which make it desirable and practicable to put certain transactors or transactions into the same class.

In specifying in detail the empirical correlates of the theoretical scheme drawn up on the basis of these varied considerations resort must inevitably be made to conventions which can only rarely be dignified with the name of principles. The main object of these conventions is to indicate the precise method of treatment in cases which are not considered at the theoretical level. Thus, in practice, competition is not perfect and monopoly gains arise in certain industries. In private industry it is usually impossible to say how much of the profit in any industry represents monopoly gains and so it is agreed that no distinction should be made in such a case. Some kinds of activity are organized, however, in government enterprises, and in some of these, as in alcohol and tobacco monopolies, price fixing is used so as to yield a very substantial revenue which in other countries

is obtained by levying indirect taxes on products sold by private enterprise. It thus becomes necessary to consider whether certain profits should not be treated as indirect taxes and if it is agreed that they should then it is necessary to state in a way which will cover any case how the distinction is to be made. In such a situation it is possible to proceed in several ways. First it may be decided to leave the matter as it is, which in this case will mean that gains from economic operations will be treated as profit independently of the circumstances in which they arise. This course is an easy one to adopt but it may lead to a very heterogeneous concept of profit. A second course is to drop the distinction between indirect taxes and profits because of the difficulty of handling marginal cases such as this one. This course is also easy to adopt and will not lead to the same sort of heterogeneity as the last, but it will mean that profit (which of course may be given a different name) will be far removed from any idea of gain to proprietors from economic operations and so will not be useful where such a concept is appropriate. The third course is to introduce a convention which will preserve the distinction and specify the treatment of marginal cases. This course seems to be the right one if (i) the distinction is worth preserving and (ii) a convention can be framed which does not result in a spread of arbitrary distinctions through the system. This situation is essentially in the nature of a dilemma. If one decides that one will never make arbitrary distinctions, then one will soon find that it is hard to make any distinctions at all. If, on the other hand, one decides to make all the distinctions that seem desirable at the theoretical level, then one must remain undeterred in the face of an immense number of arbitrary distinctions.

It is extremely hard to devise criteria for resolving difficulties of this kind. The usual procedure is to consider in any problem the various borderline cases that arise and to decide in each case by weighing up the various considerations involved. Wherever possible it is of course desirable that there should be some objective distinguishing feature which permits the elements of two classes which are to be kept separate to be recognized. For example, most investigators would like to make a distinction between indirect and direct taxes since in the 'normal' world of theory the first do and the second do not affect relative prices. In practice it is not very easy to discover what effect tax changes

have on relative prices and so some associated criterion must be used. The distinction usually made is between taxes assessed on goods and services which appear as operating expenses of the enterprises from which they are collected and taxes assessed on income which can be determined only after income has been obtained as the surplus on the operating account and which may therefore be treated as debits on the appropriation account. If cases arise which cannot be settled on this basis, reference may be made to the fact that in the case of indirect taxes it is unusual in their assessment for any account to be taken of the individual circumstances of the tax-payer, whereas direct taxes can usually be distinguished by the fact that such circumstances are usually taken into account. By such means the theoretical distinction is translated into a distinction between ascertainable features of the transaction.

A number of devices for assisting or checking up on this process of translation have been proposed and these are to a greater or less extent in use. In the first place a formal approach may be adopted based on a number of relationships between carefully defined transactions. If this approach is employed then distinctions of the kinds not recognized at the outset are not subsequently made. In this way formal precision is given to solutions which are mainly along the lines of reducing drastically the number of distinctions made. In practice many comparatively harmless conventions and compromises which would help to make the estimates more useful are ruled out in advance, while certain other distinctions which are thought to be essential are preserved even if in principle the most suitable definition is very much in doubt. Desirable though it is to have elegance and precision in a system of concepts, there seems little doubt that a tidying-up process of this kind should follow and not precede the formulation of classifications and definitions.

In the second place there is always the possibility of deciding in favour of definitions which are found by experience to give rise to greater stability in relationships of a kind which are thought to be useful in analysis. Thus in defining the direct taxes to be charged against appropriation accounts it may seem desirable to attempt a distinction between those which may be supposed to fall upon income and those which may be supposed to fall upon capital. The object of making such a distinction is that both for the individual and for the private sector of the

economy the charging of capital taxes against income may result in a very irregular relationship between income and saving. If this is considered a good reason for attempting such a distinction, then workable empirical correlates to the two types of taxes may be found by distinguishing in the first place between taxes assessed on income and those assessed on capital and by then considering for special treatment cases which fall into both or neither categories.

This appears to be a useful type of guide and to some extent it is used. But in practice it is often not possible to test the hypothesis of simple relationships against observations until many years after the date when some provisional decision has to be taken. Furthermore, it is by no means certain that all relationships will be improved by devices of this kind which are usually proposed with one particular relationship in mind. Thus if individuals who have to pay capital taxes do not allow this greatly to affect their spending habits in relation to their income, while the governments which receive these taxes tend to treat them as income and to spend what they receive, then the different treatment of the two kinds of tax may improve the private income-saving relationship but make the corresponding relationship for public authorities less regular. At least this will be the case if the receipt and payment of the tax are treated symmetrically in the accounting system. It is always possible not to treat them symmetrically and the result will then be, in this case, that saving is not equal to asset formation but to this plus capital taxes. It is usually thought that this sort of asymmetry should be avoided as far as possible, but the experience of using alternative systems which could perhaps help to decide the matter is in most cases not available.

Another criterion which frequently comes up in discussions of definitions, but which is usually considered to be a bad one, turns on the intentions of one of the transactors. In fact, cases where this criterion has to be considered and even acted on are numerous. For example, it is usual to define the sector 'enterprises' (in distinction to the activity 'production') by reference to the profit-making character of certain transactors. By this is meant not that the transactors in question do invariably make profit, but that they conduct their affairs so that they may expect to make a profit or at least recover their operating expenses from the proceeds of their sales. In a private enterprise

economy it is clear that a large number of transactors come within this definition, but there are always borderline cases, especially in connection with government agencies. Thus railway companies are usually regarded as enterprises and their rates are usually fixed so that they yield a return on the capital invested in them. But in the case of state railways the rates are sometimes fixed so that the yield is usually negative. It would be generally agreed that state railways should not be treated as a part of general government on that account. It might be thought necessary to revise the definition of enterprises by some reference to charges being made in relation to services rendered and in this case the treatment of enterprises as profit-making institutions, though modified, would not be abandoned. A second example of the use of this criterion which immediately follows from the first arises in deciding whether the state railways considered above should be deemed to make a loss or to receive a subsidy. Inasmuch as the amount to be paid to the railways is not fixed in advance in relation to the units of service provided, it is probable that in such a case the railway deficit would be treated as a loss and not as a subsidy. If this is done there results the class of enterprises that intend to make losses which is a contradiction in terms of the original definition.

III. EMPIRICAL CORRELATES AND DATA

The discussion so far has been concerned with theoretical and other concepts and their empirical correlates which, by definition, are in principle capable of measurement in the sense that a prescription for performing the measurements can be devised. It is necessary now to consider the link between these empirical correlates and the data actually available. Many things which are measurable in principle are not in fact measured, and in practice the types of sources used in making the estimates have an immense influence on them. The main difficulty in making international comparisons lies not in conceptual differences in different countries though these exist, nor even, if the economies are institutionally similar, in the conventions used in settling borderline cases where there is some freedom of choice in framing the conventions, but rather in the restrictions placed on the investigator by the nature of the data available. Given time, the sources of data can of course be changed, but in a subject as all-embracing as the national accounts any such changes

may well involve a large part of the structure of national statistics.

Differences in available data have the obvious effect that some countries can compile far more complete and detailed estimates than is possible in other countries. In the case of Switzerland[1], for example, detailed estimates are available of the components of the national income, but almost nothing is known about the components of the national expenditure. Even where many items in the national accounting framework can be filled in, many countries rely, and most countries have relied at one stage in their work, on estimates obtained as residuals in one or other of their accounts. Thus in the case of India[2] a simple accounting structure is presented based on (i) estimates of net value added, including depreciation, in different branches of activity, (ii) a consolidation and classification of the accounts of all public authorities, and (iii) a detailed analysis of the items of a current and a capital nature entering into the balance of payments. No estimates are however available at present of private consumption, private domestic gross asset formation, private provisions for depreciation or personal saving. These four flows cannot be obtained as residuals since they take place between three accounts, the domestic product account, the private appropriation account, and the consolidated resting account. The items on the government appropriation account and the account for the rest of the world are made to balance without residuals and so add no information for the present purpose. From the three accounts that do contain residuals, at most two items can be obtained from the accounting restrictions, which means that two of the unknown items must be estimated before the system of estimates can be completed even with the use of residuals. It can be seen that one of the two items to be estimated directly must be either private domestic gross asset formation or private provisions for depreciation, since both these flows take place between the domestic product account and the consolidated resting account.

In the case of Denmark,[3] to take another example, three

[1] *National Accounts Studies: Switzerland.* This report was prepared by the National Accounts Research Unit of O.E.E.C. and was published by the Organization, Paris, 1951.

[2] *First Report of the National Income Committee,* Ministry of Finance (Department of Economic Affairs) of the Government of India, Delhi, April 1951.

[3] *National Accounts Studies: Denmark,* National Accounts Research Unit of O.E.E.C., Paris, 1951.

residuals are obtained though one of these, net foreign lending which is derived from estimates of the current items in the balance of payments, can largely be checked through an annual census of foreign assets and liabilities. The remaining two items are the income distributed from enterprises to households, which is a residual on the current account of enterprises and the saving of households and private non-profit institutions which is a residual on the current account of these transactors.

In the case of the United Kingdom[1] the position is slightly different. The only residual is personal saving which is obtained by difference on the appropriation account for persons (households and private non-profit institutions). Domestic gross asset formation, which was formerly obtained as a residual on the national income and expenditure account, has for some years now been estimated directly. The account on which this residual was formerly obtained is still presented so as to show a balance without any statistical discrepancy. This result is achieved by allocating any discrepancy that appears on a trial balance among the various items and, in fact, to those which are known to possess a considerable element of uncertainty. Thus it cannot be said that any one component of the national income and expenditure is obtained as a residual, but the final estimates of several items are influenced by the whole body of data which enters the account.

In the United States[2] personal saving is likewise obtained as a residual, but it can be checked against the estimates of the Securities and Exchange Commission[3] which are made by adding up changes in assets and claims. In the national income and product account all items are directly estimated and a statistical discrepancy is shown. At one time consumers' expenditure was obtained as a residual.

The two countries last mentioned illustrate the case in which on one account all items are directly estimated, but not from such homogeneous sources that the estimates satisfy the accounting constraint automatically as happens, for example, in any proper analysis of the government accounts. If margins of error can be attached to the component estimates, then a statistical

[1] *National Income and Expenditure of the United Kingdom*, 1946–50, April 1951, Cmd. 8203, H.M.S.O.

[2] National Income and Product of the United States, 1949, *Survey of Current Business*, Vol. 30, No. 7, July 1950, pp. 5–35.

[3] *Volume and Composition of Individuals' Savings*. This series of statistical releases is issued regularly by the Securities and Exchange Commission.

adjustment can be performed.[1] A more comprehensive treatment of this problem in which allowance is made for systematic errors and for the simultaneous adjustment of the estimates over a series of years will shortly be given.[2]

Differences in the scope of available statistics are easily recognized. A more insidious influence on the comparability of estimates for different countries and one which is harder to detect, since it involves a greater knowledge of the basis of the different estimates, arises from the different kinds of statistical source on which reliance is placed.

In general there are at present three main methods used in compiling national accounts estimates. The first makes use of estimates of income based mainly on tax statistics, but supplemented in some cases by statistics of employment and earnings. The second relies on estimates of value added in different branches of activity based mainly on production statistics. The third attempts an estimate of final expenditures based on statistics of production, retail sales, government expenditures, capital expenditures, foreign trade and the like. In most cases it is found that countries rely on one of these methods to provide one of the basic aggregates and then obtain the others by piecing together such information as is available and by deriving what remains as residuals. In many cases the different sources may, of course, be checked against each other and discrepancies are usually evened out before publication. In what follows a critical examination of these methods will be made and a brief comment given on the most important classifications of the national aggregates.

In judging the relative merits of the three methods it will naturally be necessary to keep some standard in mind. It is hardly necessary for this purpose, however, to define in detail what this standard is; it is sufficient to say that it corresponds roughly to the national income and product as defined in the United Nations Report[3] or the Report of the National Accounts Research Unit.[4] These concepts cover broadly what is aimed at in most national income statistics.

[1] Richard Stone, D. G. Champernowne and J. E. Meade: The Precision of National Income Estimates, *The Review of Economic Studies*, Vol. IX, No. 2, Summer 1942, pp. 111–25.

[2] J. Durbin and H. R. Fisher, *The Adjustment of Observations with Applications to National Income Statistics*. To be published.

[3] *Measurement of National Income and the Construction of Social Accounts*, United Nations, 1947; reprinted 1950.

[4] *A Simplified System of National Accounts*, O.E.E.C. National Accounts Research Unit, 1951.

In countries with a well-developed income tax it will generally be found that tax authorities and business accountants have started to define an income concept before national accountants entered into the field and it is, therefore, one of the tasks of the latter to examine such concepts and test them against economic theory. With some notable exceptions which are mentioned below it will generally be found that, apart from some necessary rules of thumb, this concept will not deviate considerably from the one that is desired.

The important differences are, first, that tax authorities often include certain capital gains and losses in income. This will almost always be the case as regards speculative trading in real or financial assets and very often also as regards profits obtained by the revaluation of stocks. Secondly, the depreciation concept of the tax authorities is usually based on original cost rather than on replacement cost. This means, that statistics of taxable income will generally produce a net figure, that is, a figure net of the depreciation actually allowed as a deduction. If these deductions are not recorded, it will be extremely difficult from this source to make estimates of income before or after charging depreciation on a replacement cost basis.

The main weakness of statistics of taxable income is, of course, that owing to the purpose for which the information is collected it is influenced by tax evasion which may be of widely different importance in different forms of business organization and in different countries. Further, the use of tax statistics is often hampered by the fact that owing to exemption limits, special exceptions and the like, many incomes may not be recorded completely or may be entirely left out. As between different countries there can be little doubt that the income concept of the tax authorities may differ appreciably, for example, in the distinction between current and capital expenditure.

Estimates of national product based on the value added in different branches of activity do not suffer from these weaknesses of tax statistics, except as regards depreciation which is not usually obtained by this method. The method has the advantage of giving a relatively clear gross concept which might be adjusted by information from other sources, though in fact this adjustment is often made extremely difficult by problems arising from the treatment of repairs and maintenance.

The method has, however, weaknesses of its own. Probably

the most important of these are that production in small manufacturing firms, in trade and distribution and in several service trades can only be estimated with very considerable difficulty, and that incomes arising in non-profit institutions can in practice only be covered efficiently through tax statistics and may easily be overlooked in the present method. Furthermore, the information directly supplied by censuses at best shows 'value added' in a census sense and it is necessary to make still more deductions in respect of office expenses, advertising costs and numerous other services since these costs are usually not recorded. Other expenditure frequently charged to business account, such as meals in restaurants, cars mainly operated for business purposes, etc., will similarly have to be deducted. Information about all these deductions from 'value added' is usually very scarce and difficult problems arise in making allocations between private consumption and business expenditure.

For these reasons it will often be found that this method gives a comparatively high estimate of national product. The extent to which this happens will be seriously affected by the character of the information about small enterprises.

Estimates based upon statistics of expenditure suffer to some extent from the difficulties just mentioned. Thus many of the problems of allocating goods and services between consumption and business expenditure will necessarily arise, as also will many questions connected with the treatment of non-profit institutions. In addition, several difficulties are encountered in estimating asset formation, in the first place because it is difficult, except through production statistics, to obtain a good coverage of total domestic asset formation, and secondly, because it is necessary to estimate changes in stocks, an item which, of all those in the national accounts apart perhaps from depreciation, probably has the weakest statistical foundation.

In addition to the points already mentioned some others which are not related to any specific method may be indicated. One of these is the extent to which imputations are included in the national income and the ways in which these are estimated. The reliability of these items is likely to vary considerably from country to country. Other difficulties may be caused by the need to adjust from a cash basis to a receivable-payable basis as in the cases of the public accounts and the balance of payments. Except as regards the items specifically concerned, these adjust-

ments are hardly likely to cause any considerable lack of comparability.

As a consequence of these factors it is not easy at present to obtain comparable estimates of the national aggregates. Countries using tax statistics are likely to obtain a comparatively low estimate while countries using production statistics will, in most cases at any rate, obtain a comparatively high estimate. Countries using expenditure statistics are more difficult to place; on the whole they will probably obtain a higher estimate than countries using tax statistics while the outcome of a comparison with the second group is more uncertain.

It follows from the character of the deficiencies mentioned that the actual position of a given country in this rank is extremely uncertain, because it is difficult to evaluate whether the estimates of a country are influenced by these factors and, if so, to what extent. In particular this is unfortunately true when comparisons are made of net concepts, whether of product or of asset formation. It is obviously insufficient to base such comparisons on estimates which are only net of the depreciation provisions actually allowed for tax purposes, because these may differ considerably from country to country and from time to time owing to differences and changes in tax regulations.

It is therefore necessary to obtain estimates on a gross basis and then to deduct an estimated depreciation provision on a replacement cost basis. But in fact it is often impossible to do this even with tax statistics because in many cases no information is available about actual depreciation allowances. In view of the difficulties in adjusting depreciation provisions to a replacement cost basis, these estimates, as published by many countries, probably differ considerably both in coverage and in concept.

It therefore seems safe to conclude that the estimates of net product, etc., as they are made at present are rather dangerous for comparative purposes except where relatively rough figures are sufficient. Other comparisons might be made with greater advantage on the basis of a reasonable gross concept. Even this is at present difficult because of the variations in the 'grossness' of available estimates, especially as regards the treatment of repairs and maintenance. On the whole, however, it would seem easier to adjust the estimates to an acceptable gross concept (preferably gross asset formation excluding repair and maintenance) than to obtain comparable net figures.

When countries are in a position to use two or more methods for obtaining their estimates the reliability will usually be somewhat improved. The strength of this argument may easily be over-estimated, however, for the following reasons.

First, it is often found that the two calculations are not entirely independent of each other. Thus it is often impossible to check estimates which are rather weak, such as those for repair and maintenance. Secondly, the two calculations will produce totals which differ conceptually and which can be adjusted for these differences only on a more or less arbitrary basis. Finally, though this is of some importance, it will frequently be found on closer inspection that many sources of discrepancies remain and that adjustments have not, and perhaps cannot be made. As a result, relatively small differences between two estimates may be of a rather incidental character.

The difficulties of obtaining comparable aggregates are, of course, transmitted to the various components of the aggregates, such as distributive shares, final expenditures and industrial classifications, and since, in these, they will generally influence a relatively smaller flow the distortion may easily be considerable. This is particularly true as regards asset formation which is heavily influenced by the grossness of the concepts adopted and by the difficulties of estimating changes in inventories.

These classifications may be further impaired for comparative purposes by any mistakes in classifying the various components. Thus, for example, the allocation of motor-cars between personal and business use will influence the levels of consumption and asset formation.

These distortions are particularly likely to arise when components are derived as residuals and cannot be checked against other information. In many cases this will affect the estimates of profits on the income side and of consumption and/or stock changes on the expenditure side.

In the published estimates these various difficulties are only seldom disclosed; statistical discrepancies (of whatever origin) are usually adjusted away before publication and their existence, size and location is not indicated. Similarly the estimates are not shown in such detail that it is possible to see how individual items have been classified. For many purposes it is, of course, helpful to have adjusted figures, but for others it is desirable to know something about the nature of the adjustments.

So far in this section the statistical basis of final estimates has alone been considered. The need for up-to-date information has however resulted, in many countries, in the preparation of the national accounts estimates in several stages. Final estimates, compiled with the fullest use of available sources, can as a rule only be completed with a considerable time-lag, amounting to at least one year and in many cases even two or three years. In addition, some parts of the basic statistical data are only compiled intermittently. Thus, for example, censuses of trade and distribution are only taken every five or ten years in many countries, and similarly production in enterprises below a certain size is seldom regularly reported. When the estimates are made for a distant period in the past this deficiency may not be too serious because it will be possible to make reasonable interpolations between census years, but when up-to-date information is required this opportunity is not open. As regards postwar years, countries have only gradually resumed the taking of comprehensive censuses of production and distribution and the results of these have only gradually been forthcoming over the last year or two.

For these reasons countries have been forced into adopting various procedures for carrying forward their latest 'reliable' estimates. The somewhat scattered information which is available about these purposes suggests that they display considerable variety from country to country, since they depend on the amount of currently available statistics and on the speed with which 'final' estimates are provided.

Even if rough, these methods of extrapolation are often good enough to give an acceptable picture of the development of the country in question, but still it can probably be safely assumed that the comparability of the national income estimates is further reduced through these procedures. For one thing the indicators used for the year-to-year movements may have various biases. For example, an index of industrial production may be based on indicators for only a few trades, may reflect the increasing number of firms above a certain size or may measure production only in relatively large enterprises. In a similar way price indices often record price quotations which vary considerably from the prices at which the greater part of contracts are concluded.

Another difficulty in using these provisional estimates is that

the knowledge made available on the details of the calculations is not sufficient to permit the adjustment of the figures to other concepts and classifications.

Several estimates, especially of components, are often obtained more or less directly as residuals. In most provisional estimates the amount and importance of items obtained as residuals is generally much larger than in final estimates, and the possibilities of checking, even if only broadly, the level and year-to-year changes in the residuals are much smaller than in the case of final estimates.

Unless ample information is given about the methods of making provisional estimates, comparisons involving such estimates must be made with considerable caution. This is not to say that the differences actually existing between the final estimates of the countries are necessarily magnified in the compilation of provisional estimates, but rather that the margin of uncertainty is substantially increased, particularly as regards some of the components in the national aggregates.

IV. DESIRABLE FEATURES IN A STANDARD SYSTEM OF NATIONAL ACCOUNTS

In this section criteria for a good standard system will be suggested and in this way the scattered conclusions of the last sections will be brought together and amplified. It is not easy to compile such a list and the one given here is certainly not exhaustive or free from overlapping. The items are grouped, somewhat arbitrarily perhaps, into purely formal properties which may be associated in the main with the accounting aspect of the system, concepts and their specification which may be associated with the economic aspect of the system, and actual observations which may be associated with the statistical aspect of the system.

Thus, in the first place, it is necessary to record a number of formal properties of a system of national accounting, though it is unlikely that there will be much disagreement about them. Five in particular may be mentioned.

(1) There should be an accounting structure, even if only a simple one, which distinguishes between different sectors or institutions and between different forms of economic activity.

(2) Any account in the structure should be presented in consolidated form.

(3) The transactions should be recorded on a receivable-payable basis, account being taken of accruals, debtors and creditors.

(4) The accounting structure should be articulated, that is to say, each flow should have its separate counterpart elsewhere in the system so that the interrelationships of the transactions may be quite clear. It may not always be possible to retain this feature in all cases when actual estimates are made, but it should be part of the theoretical structure. If possible the basic structure should include balance sheets for the sectors as well as accounts containing flows.

(5) Concepts and terms should be so framed and used that transactions are invariant under addition. Thus the sum of the products (on some basis of valuation) of individual transactors in an economy should equal the total product (on the same basis) of that economy, and the sum of the products (on the same basis) of all economies in the world should equal the total product of the world.

The second group of desirable features in a system of national accounts relates to the concepts used, which are mainly to be derived from economic theory, and to the process of forming empirical correlates of these concepts. Nine in particular may be mentioned.

(6) The accounts should be kept from the standpoint of a reasonable transactor. This means that the entries in the individual accounts which, whether they are available or not, are aggregated notionally to form the national accounts must be assumed before aggregation to be adjusted to a standard set of definitions. These accounts are, however, still to be thought of as kept from the point of view of the individual transactor and as reflecting the costs and benefits which accrue to him and not those which accrue to the community at large as a consequence of his operations.

(7) The system must contain a clear concept of income from economic activity defined, for a closed economy, as equal to the net value of product and a clear concept of the division of this product between consumption and asset formation. These concepts are needed if the distinctions between (1) above are to be made. In drawing up these concepts it will be found necessary, among other things, to define internal provisions and transfers such as profit, provision for depreciation, increase in stocks and saving.

(8) Activity may be 'economic' or otherwise. Many types of activity can be fairly easily allocated to one class or the other. 'Living' in the sense of organizing one's domestic and private life is in many respects hard to classify. In most work relating to monetized, industrial economies it is assumed that 'living' can be separated out and that it is not a form of economic activity. This idea, though not wholly precise, may be regarded as an amplification of (7) which permits many difficult imputations to be ignored. The fact that in many primitive economies this distinction is not even roughly drawn makes it particularly difficult to compare these economies with highly developed economies or, indeed, with one another.

(9) In the valuation of goods and services, market prices should, in general, be accepted as a guide. Once a valuation on this basis has been obtained it will for many purposes be necessary to adjust to a factor cost basis of valuation by the addition of subsidies and the subtraction of indirect taxes.

(10) The system must contain a distinction between the economy under investigation and the rest of the world. It should also contain the distinction between 'domestic' and 'national' concepts since, to give one reason, the former is more appropriate as a basis for constructing a measure of real product. This requirement is not independent of (5) above.

(11) The system must contain a distinction between transactions which involve goods and services and those which do not. This requirement is probably implicit in (7) but is mentioned separately because of its importance in con-

nection with adjustments for price changes. Transactions involving goods and services can be adjusted for price changes by relating the quantity of goods and services of which they represent the value to the corresponding value in some base period. Among transactions involving goods and services a distinction must be made between the services of the factors of production and the rest.

(12) Transactions not involving goods and services must also be further subdivided. The principal distinction is between transfers, or unilateral transactions, and transactions involving claims. If capital gains and losses, whether realized or not, are to be included in the system then they should be kept separate from other transactions.

(13) In classifying transactors regard should be had to homogeneity of response which may arise from technological factors or from similarities of the influences taken into account in reaching decisions. This last consideration provides, perhaps, the main reason for the usual distinction between the private and public sectors of the economy. Within 'industry' in the ordinary sense of the term it is homogeneity in input-output relationships, which is dependent largely on technical considerations, that provides perhaps the soundest basis for classification.

(14) In settling borderline cases in the various classifications the use of conventions cannot be avoided. These should be related whenever possible, however, to some ascertainable characteristic of the transaction and not to the supposed intention of the transactor or other such subjective factor which may not be ascertainable. The improvement of regularities in relationships may be a useful guide in allocating borderline cases. It is doubtful, however, whether anything useful can be gained by limiting, on technological grounds and in advance of experience, the kinds of distinction that are to be taken into account.

The third group of desirable features relates to the availability and use of data, the effect of this on the empirical correlates to be chosen and the descriptions given of the resulting estimates.

(15) It is obvious that the elements of the system chosen must be capable of being estimated in practice and this in itself

will impose numerous simplifications on the treatment that can be adopted. If a system is to be used as a basis for international comparisons, then it must not invite misleading comparisons due to differences in sources in different countries and it should be framed with this kind of limitation in mind. As sources change, the implications of this restriction will change also.

(16) Imputations sometimes have to be made to improve comparability, for example between those who rent their houses and owner-occupiers. Lack of exact information may prevent imputations being made which would otherwise be desirable, since it may be better to have no imputation than a highly uncertain one. This is particularly likely to be the case if the imputed item is simply a constant or a trend. Thus on practical grounds it will usually be found difficult or impossible to treat consumers' durable goods as assets. The reason for this is not merely that most individuals do not make provision for the depreciation of their durable goods, but also that information on the stock and mortality rates of such goods is almost never available, so that the estimates would be very rough and probably not very comparable over countries.

(17) Finally, and this is a point of a rather different kind, the main sources used in estimating the elements of the system should be stated explicitly together with the adjustments made. Residuals should in all cases be indicated and an attempt should be made to assess the reliability of the different estimates. Without this kind of information it is not easy to interpret the estimates nor to compare them. Reasons have already been given for thinking that in practice it is differences in basic sources that lead to the most serious difficulties in making international comparisons at least between highly developed and fairly homogeneous economies.

V. REAL COMPARISONS OVER TIME

No attempt will be made in this section to treat the many difficulties of making real comparisons over time; the purpose of it is, rather, to indicate a general point of view in approaching

this work and some of the consequences that it has for desirable features in an accounting system.

The first point to be made is that the collection of price and quantity data and the construction of price and quantity index numbers are complementary procedures and should be carried out on a common plan. The older idea that price index numbers, and especially wholesale price index numbers are intended to measure, in some sense not clearly defined, changes in the value of money, is giving way among official statisticians[1] to the idea that these index numbers should be constructed so as to relate to some significant aggregate of transactions. Thus, with sufficient data, complementary price and quantity index numbers could be constructed which would multiply out to the change in the value of related transactions.

In the second place it has been generally recognized since the outstanding work of Geary[2] that, in constructing an index of output by summing the value added in each trade, it is necessary in principle to take account of the quantity changes in inputs as well as in outputs and that the former can only be neglected if it can be assumed that it varies proportionately to the quantity of output. It will readily be recognized that a similar principle must be observed in constructing price indices if the object is to deflate not output but value added.

On this basis a comprehensive scheme for the construction of price and quantity index numbers can be set out as follows. A matrix notation is used because what is sought is a large system of interrelated index numbers. Without it only simplified examples could be given instead of the general case and, even so, the notation would be more involved and the algebra would be more tedious than is necessary.

Suppose there are N accounts and m products. Define an $Nm \times N$ quantity matrix $\mathbf{q}$ as a matrix with N columns, each of which contains the goods and services bought by one account from the others, and with m rows for each account, each one of which contains the sales of one product by the given account

[1] H. Bartels and G. Furst, Preisindices im volkwirtschaftlichen Guterkreislauf, *Wirtschaft und Statistik*, 1st year, New Series, No. 9, December 1949, pp. 261–8. Also J. Stafford, Indices of Wholesale Prices, *Journal of the Royal Statistical Society*, Series A (General), Vol. CXIV, Pt. IV, 1951, pp. 447–59.

[2] R. C. Geary, The Concept of the Net Volume of Output with Special Reference to Irish Data, *Journal of the Royal Statistical Society*, Vol. CVII, Pts. III–IV, 1947, pp. 251–51 and 290–2.

to all other accounts. Thus if q_{rs}^{k} denotes the quantity of product k sold by account r to account s, then

$$\mathbf{q} = \begin{Bmatrix} 0 & q_{12}^{1} & \cdots & q_{1N}^{1} \\ \vdots & \vdots & & \vdots \\ 0 & q_{12}^{m} & \cdots & q_{1N}^{m} \\ q_{21}^{1} & 0 & \cdots & q_{2N}^{1} \\ \vdots & \vdots & & \vdots \\ q_{21}^{m} & 0 & \cdots & q_{2N}^{m} \\ \vdots & \vdots & & \vdots \\ q_{N1}^{1} & q_{N2}^{1} & \cdots & 0 \\ \vdots & \vdots & & \vdots \\ q_{N1}^{m} & q_{N2}^{m} & \cdots & 0 \end{Bmatrix} \qquad (1)$$

The zeros indicate that the accounts are in consolidated form, that is the transactors do not buy any product from themselves. The possibility is envisaged in (1) that every account might sell each product. In fact, of course, this will not be the case and the great majority of the rows of (1) will contain nothing but zeros. If there was one-one correspondence between accounts and products, then m−1 of the m rows for each account would contain nothing but zeros, and so these rows could be removed from the matrix which would thus reduce to an $N \times N = m \times m$ square matrix.

In correspondence with **q**, let **p** be defined as an $Nm \times N$ price matrix in which the zeros of **q** are replaced by the prices of the products to which the rows in question relate and in which the remaining elements of **q** are replaced by zeros. *See* p—(2) p. 128.

No differentiation is made here between the N values of p^{k} since it is assumed that any product which is sold by several industries will be sold at the same price by each one.

The structure just described relates, as in the Leontief system, to a complete, closed system of transformation processes. For the sake of simplicity it may be assumed that the first N−1

$$\mathbf{p} = \begin{Bmatrix} p^1 & 0 & \cdots & 0 \\ \vdots & \vdots & & \vdots \\ p^m & 0 & \cdots & 0 \\ 0 & p^1 & \cdots & 0 \\ \vdots & \vdots & & \vdots \\ 0 & p^m & \cdots & 0 \\ \vdots & \vdots & & \vdots \\ 0 & 0 & \cdots & p^1 \\ \vdots & \vdots & & \vdots \\ 0 & 0 & \cdots & p^m \end{Bmatrix} \qquad (2)$$

accounts are the operating accounts of N−1 industries in the ordinary sense and that the Nth account is a consolidated account of everything else, which again for the sake of simplicity may be assumed to relate to households and to contain their purchases of consumers' goods and services and their sale of factor services. In fact, this account may be given a much more general connotation as will become apparent. No account balances by definition, since only transactions involving goods and services are under discussion.

In conformity with the terminology of a previous article[1], the goods and services transaction matrix for the economy may be denoted by $\mathbf{w}_{rs}$ or, more briefly for present purposes, by $\mathbf{w}$. This is an N×N matrix of inter-account sales and purchases of goods and services. Thus

$$\mathbf{w} = \mathbf{p}'\mathbf{q} \qquad (3)$$

where $\mathbf{p}'$ is the transpose of $\mathbf{p}$, that is the N×Nm matrix obtained by interchanging the rows and columns of $\mathbf{p}$. Each element w_{rs} of $\mathbf{w}$ contains the sum of the sales proceeds obtained from the selling of various goods and services by account r to account s. Thus, writing $\mathbf{1}=\{1, 1, \ldots, 1\}$,

[1] Richard Stone, Simple Transaction Models, Information and Computing, *The Review of Economic Studies*, Vol. XIX (2), No. 49, pp. 67–84.

$$\mathbf{w}\,\mathbf{1}=\mathbf{p}'\,\mathbf{q}\,\mathbf{1} \tag{4}$$

is the column vector of total sales proceeds of each account, and

$$\mathbf{w}'\,\mathbf{1}=(\mathbf{p}'\,\mathbf{q})'\,\mathbf{1} \tag{5}$$

is the column vector of the purchases of goods and services by each account. If factor services are left out of the summations in (5) then, since these appear in the final column of $\mathbf{w}'$, the multiplier is not $\mathbf{1}$ but $\{1, \ldots, 1, 0\}$ here denoted by $\hat{\mathbf{1}}$. Then

$$\mathbf{w}'\,\hat{\mathbf{1}}=(\mathbf{p}'\,\mathbf{q})'\,\hat{\mathbf{1}} \tag{6}$$

is the column vector of the purchases of goods and services, other than factor services, by each account.

The matrices $\mathbf{p}$ and $\mathbf{q}$ may be established for different time periods, t, and denoted by $\mathbf{p}_t$ and $\mathbf{q}_t$ respectively. In accordance with the usual symbolism of index numbers t will here take the values 0 and 1. Thus

$$\mathbf{w}_{01}=\mathbf{p}_0'\,\mathbf{q}_1 \tag{7}$$

is the goods and services transaction matrix of quantities transacted in period 1 valued at the prices ruling in period 0. Then, the quotient of two-column vectors, denoted by $\mathbf{x}/\mathbf{y}$ where $\mathbf{x}=\{x_1, \ldots, x_N\}, \mathbf{y}=\{y_1, \ldots, y_N\}$ being defined here to be the column vector with elements $x_1/y_1, \ldots, x_N/y_N$,

$$\mathbf{w}_{01}\,\mathbf{1}/\mathbf{w}_{00}\,\mathbf{1}=\mathbf{p}_0'\,\mathbf{q}_1\,\mathbf{1}/\mathbf{p}_0'\,\mathbf{q}_0\,\mathbf{1} \tag{8}$$

is the column vector of base-weighted gross output index numbers of the N accounts, while

$$\mathbf{w}_{01}'\,\hat{\mathbf{1}}/\mathbf{w}_{00}'\,\hat{\mathbf{1}}=(\mathbf{p}_0'\,\mathbf{q}_1)'\,\hat{\mathbf{1}}/(\mathbf{p}_0'\,\mathbf{q}_0)'\,\hat{\mathbf{1}} \tag{9}$$

is the column vector of base-weighted input index numbers (excluding factor services) of the N accounts. Accordingly

$$(\mathbf{w}_{01}\,\mathbf{1}-\mathbf{w}_{01}'\,\hat{\mathbf{1}})/(\mathbf{w}_{00}\,\mathbf{1}-\mathbf{w}'_0\,\hat{\mathbf{1}})=$$

$$=[\mathbf{p}_0'\,\mathbf{q}_1\,\mathbf{1}-(\mathbf{p}_0'\,\mathbf{q}_1)'\,\hat{\mathbf{1}}]/[\mathbf{p}_0'\,\mathbf{q}_0\,\mathbf{1}-(\mathbf{p}_0'\,\mathbf{q}_0)'\,\hat{\mathbf{1}}] \tag{10}$$

is the column vector of base-weighted net output (value added) index numbers of the N accounts.

If the elements in the column vector representing a net output matrix are summed then all the intermediate products will cancel out. Thus if $\dot{\mathbf{1}}$ denotes $\{0, \ldots, 0, 1\}$, then

$$\mathbf{1}'(\mathbf{w}_{01}\mathbf{1}-\mathbf{w}'_{01}\hat{\mathbf{1}})=\mathbf{1}'\mathbf{w}_{01}\dot{\mathbf{1}} \tag{11}$$

or in other words the value of the aggregate of net outputs of the N−1 'industries' is identical to the value of the aggregate of gross outputs of final goods. This is obviously true whatever prices are taken, and so

$$\mathbf{1}'(\mathbf{w}_{01}\mathbf{1}-\mathbf{w}'_{01}\hat{\mathbf{1}})/\mathbf{1}'(\mathbf{w}_{00}\mathbf{1}-\mathbf{w}'_{00}\hat{\mathbf{1}})=\mathbf{1}'\mathbf{w}_{01}\dot{\mathbf{1}}/\mathbf{1}'\mathbf{w}_{00}\dot{\mathbf{1}} \tag{12}$$

Thus the same result is obtained by making a net output index for all operating accounts (industries) as for making a gross input index for all other accounts (final output).

It is convenient to define a price index corresponding to any quantity index in such a way that their product is equal to the change in value of the corresponding transactions. If in some sense there is a bias in either, these biases will be offsetting. In the above notation these corresponding price indices are obtained by changing the suffixes in the matrices. Thus

$$\frac{\mathbf{1}'\mathbf{w}_{01}\dot{\mathbf{1}}}{\mathbf{1}'\mathbf{w}_{00}\dot{\mathbf{1}}}\cdot\frac{\mathbf{1}'\mathbf{w}_{11}\dot{\mathbf{1}}}{\mathbf{1}'\mathbf{w}_{01}\dot{\mathbf{1}}}=\frac{\mathbf{1}'\mathbf{w}_{11}\dot{\mathbf{1}}}{\mathbf{1}'\mathbf{w}_{10}\dot{\mathbf{1}}}\cdot\frac{\mathbf{1}'\mathbf{w}_{10}\dot{\mathbf{1}}}{\mathbf{1}'\mathbf{w}_{00}\dot{\mathbf{1}}}=\frac{\mathbf{1}'\mathbf{w}_{11}\dot{\mathbf{1}}}{\mathbf{1}'\mathbf{w}_{00}\dot{\mathbf{1}}} \tag{13}$$

or, as is well known,

$$\Lambda P=L\Pi=W \tag{14}$$

where Λ and Π denote Laspeyres and Paasche index numbers of final products, L and P denote Laspeyres and Paasche index numbers of final product prices and W denotes the change in value of expenditure on final products over the period of comparison. It can be seen that a similar duality runs all through the index numbers discussed here and that for example

$$\frac{\mathbf{1}'(\mathbf{w}_{01}\mathbf{1}-\mathbf{w}'_{01}\hat{\mathbf{1}})}{\mathbf{1}'(\mathbf{w}_{00}\mathbf{1}-\mathbf{w}'_{00}\hat{\mathbf{1}})}\cdot\frac{\mathbf{1}'(\mathbf{w}_{11}\mathbf{1}-\mathbf{w}'_{11}\hat{\mathbf{1}})}{\mathbf{1}'(\mathbf{w}_{01}\mathbf{1}-\mathbf{w}'_{01}\hat{\mathbf{1}})}=\frac{\mathbf{1}'(\mathbf{w}_{11}\mathbf{1}-\mathbf{w}'_{11}\hat{\mathbf{1}})}{\mathbf{1}'(\mathbf{w}_{00}\mathbf{1}-\mathbf{w}'_{00}\hat{\mathbf{1}})} \tag{15}$$

exhibits the fact that the sum of a set of net output (value added) index numbers each multiplied by the corresponding index number of net output prices is equal, by (11), to the change in the value of final products. Similarly, the index number of the net output of any operating account multiplied by the corresponding index of net output prices is equal to the change in the value of the net output of that account. Thus given $\mathbf{p}_0$, $\mathbf{p}_1$, $\mathbf{q}_0$ and $\mathbf{q}_1$ a completely consistent system of price and quantity index numbers relating to value added and total sales of each

operating account and the aggregate of all operating accounts can readily be constructed.

No special reference has been made so far to the prices and quantities of factor inputs, many of which are extremely difficult to measure. The column vector of these factor inputs for each operating account is represented in the above scheme by

$$\mathbf{w}'\dot{\mathbf{1}}=(\mathbf{p}'\mathbf{q})'\dot{\mathbf{1}} \tag{16}$$

and it can be seen, since $\hat{\mathbf{1}}+\dot{\mathbf{1}}=\mathbf{1}$, that (5)=(6)+(16). Thus if the relevant prices and quantities could be defined and measured

$$\frac{\mathbf{1}'\mathbf{w}_{01}'\dot{\mathbf{1}}}{\mathbf{1}'\mathbf{w}_{00}'\dot{\mathbf{1}}}=\frac{\mathbf{1}'(\mathbf{p}_0'\mathbf{q}_1)'\dot{\mathbf{1}}}{\mathbf{1}'(\mathbf{p}_0'\mathbf{q}_0)'\dot{\mathbf{1}}} \tag{17}$$

would give a measure of the change in the aggregate quantity of factor input in the economy. The ratio of the change in the net output of all operating accounts, which as has been seen is the same as the change in the gross output of all final products, to the change shown in (17) would provide a definition of the change in the productivity of the entire economy. This ratio could, of course, be calculated with base or with current weights. Any attempt to remove this inherent 'index number' uncertainty from the comparison would require that a hypothetical set of 'desirable' and consistent weights should be constructed. Even if this could be done the resultant set of weights would presumably not be unique, so that a range of uncertainty would still remain.

It was assumed above, in order to assist a common sense appreciation of the equations, that the Nth account contained simply the purchases and sales of goods and services by the factors of production consolidated in an account called 'households'. It is not difficult to see that the interpretation of this account can be widened to include all other non-operating activities. Thus if capital transactions are included in the Nth account, the final column will contain gross asset formation as well as consumers' goods and services, but the final row will be unaffected since the finance of asset formation does not involve goods and services. The factor services will of course include those devoted to asset formation.

If government current expenditures are included in the Nth column it is possible to proceed without any formal change, but more meaningful and statistically more manageable calculations will result if an attempt is made to distinguish between the final and intermediate products of government. This would involve a new operating account, or set of operating accounts, for government operating activity which would show, in the columns, the purchasing transactions of government involved in producing the 'services to industry' and in the rows the 'sales' (at cost) of these services to the industries which benefited from them. Taxes of all kinds would not affect the picture; all transactions, whether in final products, intermediate products or factor services, would have to be valued at market prices, except in cases where there was no market when they would be valued at 'cost' or at factor cost.

Again, the introduction of foreign trade does not make any substantial difference. The essential feature is that exports are a part of final output, whereas imports are a part of input, and so it will be desirable to have another m rows and a column in the matrices and a slightly different partition of the adding multiplier **1** in some of the equations.

When the procedures actually used to obtain estimates expressed in terms of constant prices are examined it is seen that very few countries have managed to get as far as has been indicated here. As in the estimates expressed in current prices, a considerable range of estimates are found ranging from the rough deflation of a national aggregate by means of a cost-of-living index number to the more refined methods recently used in the United Kingdom and the United States. In addition, even less information is usually given about the methods of deflation than is available about the compilation of data in current prices.

The technique outlined here will, if it is to be applied in practice, require a vast amount of factual information which at present very few countries are able to provide. On the other hand it is, in fact, a very simple way of indicating the whole complex of problems connected with methods of deflation, and can conveniently be used as a point of departure even when the methods actually employed fall considerably short of the ideal.

Thus, for one thing, it emphasizes the important rôle played by price index numbers in this process. As mentioned above, it

is often found that the material on prices collected by various official bodies and used for the construction of price indices are, though they may be useful for some purposes, of little relevance for the present purpose. The reason is partly that they are weighted in accordance with other criteria, partly that the price data may have a rather loose connection with the transactions taking place within the accounting period, as is frequently the case with the price quotations used in wholesale price indices. In both cases the deflated series may often be considerably distorted.

Secondly it employs the Geary formula, with its emphasis on the separate deflation of input and output elements, and thus establishes the logical connection between the various methods which may be employed when the complete approach is ruled out. What has been described here in fact amounts to deflating all entries in an input-output table. Even if that cannot be done in practice it should be possible to establish a deflation of the expenditure on final goods and services and/or of the net product in the various industries (obtained by deflating output and input separately) and these two estimates may then be compared.

Recently both these methods have been used in two highly detailed investigations, unfortunately not for the same country, into the measurement of changes over time in real product. The first of these has been undertaken by a group at Cambridge and relates to changes in the domestic product of the United Kingdom since 1946, estimated by means of a complete set of net output index numbers. The results of this inquiry have appeared and are still appearing in a series of papers by Reddaway[1] and by Carter.[2] The second project relates to changes in the national product of the United States since 1929, estimated by means of a complete set of gross final product index numbers or the corresponding index numbers of the prices of final goods in

[1] W. B. Reddaway, Some Problems in the Measurement of Changes in the Real Geographical Product, *Income and Wealth Series I*, Bowes & Bowes, for the International Association for Research in Income and Wealth, 1951, pp. 267–92. Also Movements in the Real Product of the United Kingdom, 1946–49, *Journal of the Royal Statistical Society*, Series A (General), Vol. CXIII, Pt. IV, 1950, pp. 435–55. Also The Real Product of the United Kingdom, 1946–49, *Bulletin of the London and Cambridge Economic Service*, August 1950, pp. 79–83.

[2] C. F. Carter, The Real Product of the United Kingdom, 1946–50, *Bulletin of the London and Cambridge Economic Service*, August 1951, pp. 75–77. Also Index Numbers of the Real Product of the United Kingdom, *Journal of the Royal Statistical Society*, Series A (General), Vol. CXV, Pt. I, 1952, pp. 82–126.

association with estimates of expenditures on these goods. A brief account of the methods employed has been published.[1]

As is also apparent from the algebraic treatment above, the method described has been designed simply for the construction of series of 'quantities' of goods and services. From another point of view it is customary instead to conceive of 'deflation' as a means of expressing the value in real terms of the income of a person or a group of persons. On a national scale this requires that account be taken of the effects of changes in the terms of trade of the country as well as of the changing purchasing power of its income from foreign investments.[2] When the economic position of different groups, such as different groups of households or different countries, is examined this type of analysis assumes even greater importance, but on the other hand, this approach will before long lead into questions of needs, tastes, income distributions, etc., that is, into problems of welfare economics which will not be discussed here.

VI. REAL COMPARISONS OVER SPACE

The general problem of making these comparisons can be set out in terms of the scheme given in the last section. The suffixes 0 and 1 now relate not to two time periods but to two countries. When the matter is set out in this way then, even if the detailed comparisons of industrial net outputs are not required, it can be seen that this stage in the making of international comparisons involves formidable difficulties. For the relevant parts of the matrices (1) and (2) must be comparable, which implies that the classification systems in the two countries are substantially the same in a very detailed way. Furthermore, differences in valuations between countries are likely to be much greater than the corresponding differences over time, unless the time period is a very long one, so that $\mathbf{p}_0$ and $\mathbf{p}_1$ will be much more dissimilar for countries than for time periods, with the result that the comparison will be much affected according to which set of prices is used as weights.

In practice, no attempts have ever been made to work with

[1] G. Jaszi and J. W. Kendrick, Estimates of Gross National Product in Constant Dollars, 1929–49, *Survey of Current Business*, Vol. 31, No. 1, January 1951, pp. 6–11.

[2] W. B. Reddaway, Movements in the Real Product of the United Kingdom, 1946–49, *loc. cit.*

so elaborate a scheme. A project is, however, now in hand at the Department of Applied Economics, Cambridge, in which comparisons are being attempted between the level of final products in a number of countries, such as the United States, the United Kingdom, Eire, Sweden and the Netherlands, which are relatively homogeneous and for which fairly detailed estimates are available. The easiest part of this kind of inquiry relates to consumers' expenditures, and some interesting work on the relative positions of the United States, the United Kingdom and Canada has been reported.[1] A check on this kind of calculation is possible if the inter-country comparison can be made at two dates and if within-country comparisons can be made in each case between these dates. In this way a closed circuit of comparisons is established, the ratios in which are restricted by the fact that they must multiply out to unity. This check is being employed in the Cambridge study just mentioned.

The need for comparisons in real terms combined with the lack of statistical information has led to the use of various short-cut devices. The most obvious of these is the use of exchange rates to adjust estimates, say of national product, expressed in local currencies. This method was used by Stone[2] and on an altogether more comprehensive scale by the United Nations.[3] It is evident that this method is likely to give better results under conditions of free exchanges than under conditions of exchange control. Accordingly in making post-war comparisons the Economic Commission for Europe made inter-country comparisons for 1938 and carried these through to 1948 by the use of estimates of the change in real product within the different countries.[4] This device, however, requires that comparatively accurate and uniform measures of the changes in real product are available in a number of countries.

Another possibility of dealing with this problem is to use 'free' exchange rates, such as the rates quoted on the Swiss exchange market after the war, when such rates are available.

[1] *The Impact of the War on Civilian Consumption in the United Kingdom, the United States and Canada*, H.M.S.O., 1945.

[2] Richard Stone, The Measurement of National Income and Expenditure: a Review of the Official Estimates of Five Countries, *The Economic Journal*, Vol. LVII, No. 227, September 1947, pp. 272–98.

[3] National and Per Capita Incomes of Seventy Countries in 1949 expressed in U.S. Dollars, *Statistical Papers*, Series E, No. 1, Statistical Office of the United Nations, October 1950.

[4] *Economic Survey of Europe in 1948*, United Nations Economic Commission for Europe, Geneva, 1949. See Appendix A, pp. 229–40.

But these rates are in general so influenced by the legal regulations in force in the countries operating exchange controls, as well as by speculative transactions, that they can hardly be assumed to give a 'true' picture of the relationships between the currencies.

A final possibility is then to calculate theoretical exchange rates on the basis of exchange rates in a year which is supposed to be fairly 'normal' and the changes in prices, wages, productivity, etc., which have taken place since this base year. The margin of error in this procedure is, however, very considerable because the amount of statistical data available is quite insufficient.

Furthermore, even when relatively free rates of exchange are in operation the results of such a calculation must be used with the greatest caution. Thus the exchange rates reflect not only differences between price levels in local currencies but also differences in the level of employment, international capital movements, customs tariffs and similar regulations of foreign trade. Besides, the adjustment of the internal price levels of the countries to the external value of the currencies is a rather slow process, particularly in the case of rents and similar payments. As a result the exchange rates primarily reflect differences in price levels of goods which, actually or potentially, are traded internationally and not the differences in prices of the much wider range of goods and services which enter into the total national product. In time, wage rates and profit margins throughout the economy may adjust themselves to the exchange rate, but the period of adjustment may be extremely prolonged.

There is another source of data for this kind of inter-country comparison which deserves consideration. International organizations and the foreign offices of many countries are faced with the problem of adjusting salary scales in different countries so as to yield a similar standard of living to officers in the same grade in different parts of the world. In some cases elaborate inquiries have been made for this purpose though, so far as is known, no results have been published. Interesting as this information would be, it has obviously severe limitations since the standard of living of diplomats is obviously unrepresentative, partly because of their very public life, partly because they are foreigners in the countries to which they are accredited and so, presumably, live in an untypical way, and partly because

they have special immunities and privileges such as freedom from customs duties and special supplies from their own country. Furthermore, the relative rates of remuneration of these officers are likely to be fixed to some extent on political and personal grounds. Thus while the detailed information collected for this purpose would be useful, it is unlikely that much could be inferred from such information on salaries and expenses as is made public.

VII. THE WORK OF THE NATIONAL ACCOUNTS RESEARCH UNIT

The National Accounts Research Unit of the Organization for European Economic Co-operation was established in the summer of 1949. Its object is to assist the work of the Organization by providing more ample information about the concepts and methods used by the Participating Countries in the compilation of their national accounts and about the reliability of the estimates made and by helping in the provision of more comparable information.

The problems of the Unit are therefore very much the same as those set out in the earlier sections of this paper. The first requirement was a standard to which the estimates of the different countries could be adjusted and in terms of which the actual content of these estimates could be described and judged.

It was thought best in the first instance to provide a simpler system of accounts containing only the elements needed in building up the main national accounting aggregates, but showing by means of a fully articulated system the precise nature of the component flows. No attempt was made at this stage to specify classifications of the main aggregates such as national product, consumers' expenditures, asset formation and so on, because it was thought that more experience was necessary before standard classifications could usefully be proposed.

A report entitled *A Simplified System of National Accounts*[1] was completed in April 1950 and was used as a basis for compiling the *National Accounts Studies* for different countries described below. Comments on the Simplified System were received from many quarters, and these comments together with the experience gained in preparing the country studies have

[1] *Op. cit.*

provided a basis for a revised standard system which is due to be discussed shortly after this conference.

In preparing the Simplified System it was recognized that differences in sources might easily lead to a lack of true comparability even in flows which in principle had the same content. Accordingly an attempt was made to give rigorous definitions to the concepts employed in the hope that this would help to bring differences to light. It was also recognized that the System would probably require modification in the light of experience gained in using it. It was hoped that in this way, by an interplay of theory and practice, it would be possible to evolve a system of definitions and presentations which would be adopted for comparative purposes by the various countries. It was expected that many countries with highly developed statistics would require more elaborate, or even slightly different, systems for their own internal purposes.

Two of the country studies[1] have so far been published and from the first of the series, which relates to Denmark, a clear idea can be gained of the plan of the work. Thus wherever possible the available information and the adjustment of this to the definitions of the Simplified System is set out in eight sections as follows.

(1) A preliminary account is given of the sources, terminology and basic concepts used in the country. This section enables the general approach and procedures to be understood before the innumerable details of classification and estimation are introduced.

(2) The accounting structure, as set out in the Simplified System, is completed for each of the years 1938 and 1946 onwards. The entries are adjusted so as to conform as closely as possible to the definitions of the Simplified System. A brief account is given of the methods used to balance the accounts with a note of any items which are obtained as residuals.

(3) This section contains detailed comments on the entries in the tables of Section (2) and sets out the adjustments required to pass from the items in the country's own accounts to the corresponding items in the above tables.

[1] Reports for Denmark and Switzerland, *op. cit.*

(4) Since, as has been stressed in this paper, the sources available exercise a considerable influence on the estimates, a brief account of the methods of compilation and the reliability of the estimates is given. This is a subject which could be treated at very great length and partly for this reason is often not treated at all. Consequently even a short treatment is useful.

(5) Since the main tables contain relatively little subdivision of the main aggregates, detailed classifications, wherever available, are given in this section. As already mentioned, no attempt has been made in the studies so far completed to present these on a uniform basis, although of course they would be more useful if this could be done. The number of items that can be classified in detail and the dates for which this can be done vary from country to country.

(6) This section contains a description of the methods, in use in many countries, in constructing short-term forecasts of the national accounts and also tables showing the current forecasts adjusted as far as possible to the standard definitions. Although the tables of forecasts prepared in different countries have a similar appearance, the objectives and assumptions which underlie their construction vary from country to country and must be taken into account if the estimates are to be understood and compared.

(7) Some estimates in fixed prices are usually available in each country, but the extent of these and the methods used vary enormously. A brief account is given of the deflated series available and of the method of estimation adopted.

(8) A concluding section sets out what is known of new developments in the preparation of the national accounts and in the sources available for this purpose.

Apart from the two country studies already published, similar reports have been completed for France and the Netherlands. Work on reports for Germany, Italy, the United Kingdom and Sweden is already in an advanced stage. It is intended that these studies should be published in due course and that work should be put in hand on studies for the other Participating Countries.

In the new version of the Simplified System mentioned above an attempt has been made to get somewhat further in the matter of classification by including among the tables of the revised System a series of explanatory tables showing classifications of all important national aggregates. It is hoped that it will be possible later to obtain agreement on a relatively detailed set of definitions of these flows and thus in time provide users with a considerable number of building blocks of use for analytical purposes. These explanatory tables are, however, necessarily limited by the fact that many Participating Countries still lack many data required for the construction of more detailed accounts.

Another matter on which work at the Unit has been proceeding recently relates to the extension of the above System. Several countries have already started working on more elaborate systems showing among other things input-output tables, national balance sheets, purchases and sales of financial assets, etc. Since these developments are likely to spread to other countries it seems useful to attempt, at an early stage, to assist uniformity in the compilation and presentation of these data (even if existing knowledge about the potential uses of these estimates imposes a limit to the standardization that is possible and desirable), and also to make available to countries which are taking up work on these problems the experience gained in other countries. As regards input-output analysis, reference may be made to empirical work in the United States,[1] Denmark[2] and the Netherlands[3] and to a recent paper on the relationship of this information to the national accounts.[4] In the matter of balance sheets for countries or for large sectors, recent studies have appeared in the United States[5] and in the Netherlands.[6]

[1] W. W. Leontief, *The Structure of American Economy, 1919–1939*, 2nd edition, 1951.

[2] Nationalproduktet og Nationalindkomsten 1930–46, *Statistiske Meddelelser* 4–129–5, 1948. Also Nationalproduktet og Nationalinkomsten 1946–49, *Statistiske Meddelelser* 4–140–2, 1951.

[3] De Nationale Jaarrekeningen 1948, *Statistiche en Econometrische Onderzoekingen*, Vol. 6, No. 1, 1951, pp. 38–43.

[4] Richard Stone and J. E. G. Utting, *Input-Output Relations*, 1953. A volume containing papers delivered at a Conference on Input-Output Relations held at Driebergen, the Netherlands, September 1950, under the auspices of the Netherlands Economic Institute.

[5] *Studies in Income and Wealth*, Vol. 12, N.B.E.R., New York, 1950. This volume is devoted entirely to papers dealing with various aspects of the measurement of wealth.

[6] H. Rijken van Olst, B. Korn and C. A. Oomens, Het Verbund Tussen de Nationale Balans en het Stelsel der Nationale Jaarekeningen, *Statistische und Econometrische Onderzoekingen*, Vol. 5, No. 3, 1950, pp. 107–15.

A short critique of the latter work has been made by F. Sewell Bray,[1] and a recent study by accountants and economists in the United Kingdom which may be useful for conceptual and terminological purposes has also appeared.[2]

As regards adjustment for price changes very little work has so far been done at the Unit beyond the brief examination of deflation methods needed for the country studies and some calculations aimed at reducing the national incomes of the Participating Countries to a common currency. It is intended in the near future to make a more searching examination of within-country deflation methods and in particular to attempt to discover the probable biases introduced by the short-cut methods which are still much in use.

[1] F. Sewell Bray, A National Balance Sheet, *Accounting Research*, Vol. 2, No. 3, July 1951, pp. 279–300.

[2] *Some Accounting Terms and Concepts*, Cambridge University Press, 1951. This is a report of a Joint Exploratory Committee appointed by the Institute of Chartered Accountants in England and by the National Institute of Economic and Social Research.