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STATISTICAL SOURCES AND METHODS IN NATIONAL ACCOUNTS ESTIMATES AND THE PROBLEM OF RELIABILITY

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I. INTRODUCTION

As the title of this paper is not self-explanatory, I should say that it is not my intention to describe the methodology used in the preparation of the United States national accounts. That would require more time than can be taken here, and besides the Department of Commerce has just issued a fairly lengthy report concerned with that subject.[1] What I want to do, however, is to give some impetus to the discussion of methodology by treating three questions: (1) the purpose to be served by descriptions of sources and methods, (2) what they can contain to give the users of the data some understanding of the reliability of the estimates, and (3) the elements that have contributed to raising the reliability of estimates in the United States.

In the short time I have been working with the national accounts statistics of more than one country, I have had a decided change of mind about the emphasis that is required to secure greater international comparability of these measures. Perhaps I should say, greater similarity of national income measures, rather than comparability, since I mean only the formal measurement of income and product flows in national currency units, and not comparisons in real terms. Up to now, practically all the effort of those concerned with this problem has been put on questions of concepts, definitions, and forms of presentation. This work is necessary, of course, and I would not want to imply that it has reached the limit of its usefulness.

But I do believe it is necessary that much more attention be given to differences in the estimates of various countries that arise from the use of differing sources and methods of estimation. In the long run, I feel that a careful examination and comparison of sources and methods, and of the reliability of the results they produce, will contribute at least as much to inter-

[1] National Income Supplement – 1951, *Survey of Current Business*, U.S. Department of Commerce.

national comparability and to the improvement of national accounts statistics as the further discussion of theoretical issues. A change of emphasis in this direction would also be of considerable practical assistance to countries with less developed national accounts material.

An international forum, such as is provided by this Association, is almost a requirement for a productive exchange of ideas and experiences on the problems of sources and methods. Within any one country there are generally only a few persons in the government service with sufficient background to participate actively, and most of these are apt to have experience only with the techniques used in their own country. Hence, to broaden the field and to make it possible to discuss the relative usefulness of alternatives, the contributions of persons from different countries are essential.

II. NEED FOR THE STUDY OF METHODOLOGY

It seems to me also that we are reaching the stage where the examination of sources and methods is needed even to increase our knowledge about the conceptual differences which exist among the measures of various countries. We have fairly well catalogued those which appear on the surface of estimates, arising from differences in the formal definitions used. What remains, however, is to understand the conceptual differences which arise because they are implicit in the use of different sources and methods, and which will come into view only as we know more about the methodology employed.

It is interesting to ask why the material issued on methodology has been rather limited. Certainly the greatest single demand heard from users of the statistics is precisely for an explanation of how the estimates were obtained and what degree of reliability they possess. And yet it is quite evident that national income estimators have shied away from meeting these demands.

The primary reason, probably, is that writing about sources and methods is an extremely tedious and time-consuming matter. Nor does it have the same intellectual attraction as the conceptual and theoretical aspects of national accounts - either for the writer or for the reader, whether he admits it or not. Our experience is that we receive almost no comment on

descriptions of methodology, but that a discussion of theoretical issues always arouses a lively interest.

There is, however, another reason behind the limited discussion of sources and methods. This is that any adequate description of national accounts statistics necessarily involves revealing the skeletons in the closet, pointing to the areas where the estimates are weak and where dubious estimating techniques or guesses had to be used to fill the gaps left by inadequate statistical sources. In other words, when the show-down comes, one has to admit the weaknesses of the estimates. I am sure there is a great natural reluctance to do this, particularly after much work and ingenuity has gone into their preparation. One is always hesitant about arming one's potential critics.

I would like to urge very strongly against such self-consciousness, for it seems to me another instance in which the best defence is to attack. It is entirely wrong that national income statisticians should take responsibility for weaknesses in the estimates due to inadequacy of the statistical sources available to work with. They should not assume such responsibility themselves, and should not allow such responsibility to be thrust upon them. It must be understood that all one can do is to make the best use of the sources there are, and perhaps to point out where sources are weak. But it should be made clear that reliability is basically a question of having good sources, and that the real effort required to improve national accounts data must begin with their statistical underpinning.

Another impediment to writing about methodology is that there has not been developed any generally accepted viewpoint or standard for this kind of work, unless it be that of straight description. There is not a common way of tackling the job, or recognized objectives as to what is supposed to be accomplished by methodological reviews.

I may say that some years ago we, in the United States, decided that once and for all we would meet the continuous demand for material of this kind. In an effort to be perfectly frank with the users of the estimates, we began to prepare complete descriptions of all the estimates we make, to show in detail the sources upon which each figure rested, and the methods by which it was derived. We thought even that the reviews should be detailed enough to allow an outsider to reproduce the estimates. Of course, this proved to be impossible,

but nonetheless we did prepare lengthy descriptions for most of the income items and issued them in mimeographed form. They turned out to be not only very long, but rather boring manuscripts. For example, the section describing the estimates of wages ran to 100 single-spaced pages of mimeographed material.

One thing that was proved by this effort was that such a straightforward, detailed description of methodology will have very few readers – even in a statistically minded country like the United States. Another thing we found was that it took so long to prepare the various sections that the first ones finished were out of date before the later ones were completed, and that it would be quite impossible to get all the sections ready to be published at one time in a single volume. I personally came to feel, too, that a detailed description of procedure of this kind was likely to fail to tell you a lot of the things you really wanted to know. This was partly because the trees tended to hide the wood, and partly because it resulted almost inevitably in a certain stiff style of exposition which did not allow the writer much freedom in expressing opinions and judgments.

Our other attempts to meet this demand have been short descriptions of methodology in articles on various components of the national accounts. These were not intended to do much more than indicate the procedure that was followed and the major sources that were used. From the standpoint of readability they have been more successful, but it must be admitted that they could have been of only limited real value to the users of the estimates.

What I believe is needed in these accounts of sources and methods, if they are to be made interesting to ourselves as well as to our readers, is a more analytical and critical approach to the whole matter. Since it is literally impossible to tell all, we have to decide what purposes we intend them to serve, and, therefore, what elements in them have to be given prominence. The purposes will also be a guide to the amount of detail they should contain.

The purposes which seem important to me are the following:

(1) The primary objective should be to indicate the reliability of the estimates. I believe this is the only aspect of methodology which is really interesting to the general users of the data—even

among professional economists. Furthermore, I think it is only by an adequate discussion of sources and methods that the question of reliability can be illuminated. This implies, of course, that the description of methodology should include a description and appraisal of the kinds of sources upon which the estimates rest.

(2) The second purpose should be to reveal the state of statistical sources, and their adequacy for our purposes, to those responsible for their collection and dissemination. It is apparent that the national accounts estimator is in a peculiarly advantageous position to look upon the various bits and pieces of statistical data as part of a system, and to judge their adequacy from that standpoint. Reviews of methodology can be very helpful to those responsible for particular areas of statistical data if they provide this broader perspective.

(3) The third objective, and perhaps the one to emphasize here, is to make possible an exchange of experience among those who have the job of making estimates. Hence, descriptions of methodology should provide a file from which one can find what methods have been useful to estimators, what kinds of sources they have used, and what adjustments they have made because of the inadequacies or biases of various sources. They should note also what kinds of material have been rejected, and why, what kinds of checks have been used to test the results, and in general give a picture of the problem of estimation from the standpoint of the estimator.

The pursuit of these objectives would give much more point to methodological descriptions, and I believe too, make it much more interesting to produce them.

III. ELEMENTS IN THE APPRAISAL OF RELIABILITY

I will turn now to the question of the character of the problem of reliability and what can be said about it. The suggestion that estimators of national income should indicate the degree of reliability of the estimates is continuously being made. The latest I have noticed is in the interesting volume by Professor Morgenstern, *On the Accuracy of Economic Observations*.[1] He criticizes statisticians for largely ignoring this problem, and indeed, goes so far as to say that quantitative estimates of error

[1] Oskar Morgenstern, *On the Accuracy of Economic Observations*, mimeographed version, 31st May 1949.

should be required from all agencies that publish statistics of major importance. This kind of suggestion is very easy to make, but it is quite significant that it is seldom accompanied by much guidance as to how the job might be done, and even this little turns out to be rather suspect. It seems to me, in fact, to be somewhat lacking in real insight into what reasonably can be expected. To require a quantitative measure of accuracy would either drastically reduce the amount of statistics, or produce a lot of *pro forma* margins of error, since in all honesty most agencies would have to say they do not know the answer.

In considering this problem recently in connection with the description of the estimates of the United States, I concluded that the reliability of the data could not usefully be indicated by assigning quantitative measures of the margin of error to the various components and aggregates. The standard error of estimate has a clear mathematical basis in sampling and can be easily interpreted. But when it is applied to national accounts estimates all this simplicity is lost, and I doubt that it can be interpreted at all by users of the data. Reviewing the attempt made by Professor Kuznets[1] to assign margins of error to the various parts of the national income, for example, I was somewhat at a loss myself to know exactly what they meant, and I doubt that they could have provided a very helpful guide to many readers. Of course, they are presented only as informed judgments. It would, however, be more interesting to clarify the basis of the informed judgments and the factors that were taken into account in making them than simply to sum them all up into a series of numerical margins of error.

I would summarize my objections in the following points:

(1) First of all, I think it must be said that we simply do not know the size of the margins of error in the estimates with enough accuracy to quantify our judgments. The reason is that in the complex of factors that might lead to inaccuracy of the statistics, there are no measures of the errors arising out of most of them, and hence no way to assign them weights so as to arrive at a combined margin of error. For any single survey, one can usually measure the probable sampling error but it is in very few cases indeed that the error in the responses from

[1] Simon Kuznets, *National Income and its Composition*, N.B.E.R., New York, 1941, Vol. II, pp. 501–37, for years 1919–35.

other factors can be indicated. With estimates of the components in the national accounts, the case is much worse because they are seldom based on a single survey.

(2) There are very wide differences of opinion among persons familiar with the series as to the possible margins of error, which make it impossible to give a meaningful concensus of opinion in quantitative terms. They are apt to be due as much to the degree of scepticism of the judges as to the possible errors in the series judged.

(3) The margins of error assigned will be very much influenced by the size of the cells chosen and the opportunity given for offsetting errors.

(4) As there are many differences in the accuracy of estimates over time, it is an over-simplification to assign a single margin of error to the series as a whole. This matter is so complex that, if one tried to assign different margins of error over time, one would find the use of informed judgments inadequate to draw the necessary distinctions. Furthermore, one is often more interested in the changes shown by time series than their absolute level.

(5) It is misleading to assign margins of error unless there is an equal probability of over or under-estimate within the range of the percentage that is chosen. I believe, however, that for any given group of sources and complex of procedures there might be a definite bias one way or the other, rather than an equal chance for a plus or a minus error. For the sources and methods used in estimating the United States national income, I would say that the probability is all toward under-estimates, and that there is little likelihood of the major components or the totals being over-estimated.

The reason for this is that the method used is essentially that of adding up various components which depend for their level on the net aggregates reported in benchmark enumerations. Hence, I believe we tend to get into the series as much of any given flow as has been counted. Although allowances may be made for under-coverage in benchmark enumerations, even these allowances depend upon the amount of under-coverage that can be demonstrated by comparison of basic reported sources. Looking at the procedure as a whole, it is hard to see how there could be a significant over-reporting of either income

or product, while it is much more likely that areas of economic activity could be under-reported. All components of the national income and product estimates are not alike in this respect but, the tendency is sufficiently general to make it less than accurate to imply that the estimates are subject to random error. I would be interested in knowing what others think about this matter, particularly those having experience with the value-added method of estimating. It has seemed to me that a procedure starting from gross values of output and working down to net values, might have a greater possibility of over-estimation, other things being equal.

What I think can be done to give users of the data an understanding of the reliability of the estimates is, therefore, only a critical review of what they are and how they were derived. In the end, this will amount to an impression of whether the various components have a more or less solid basis in statistical fact, distinguishing the areas of the economy and the income and product flows about which there is relatively good knowledge, from those for which our information is rather sketchy. This kind of review is difficult to do, and it is probably only through repeated efforts that a good standard can be reached. In this respect it is much like the process of estimating itself.

The following aspects of the estimates would have to be highlighted to indicate their relative reliability.

1. Differences in the components of national income and product from the standpoint of conceptual clarity.

2. Quality of the records kept by the economic units from whom the basic data are collected.

3. The kind of reporting system by which the basic source data are collected.

4. The estimating process that is required to pass from the data in the basic sources to the final estimates.

5. The change over time in the source data upon which any estimated series rests.

A few comments may be made on each of these points.

By the first, I mean the difference in accuracy that attaches to items that are represented by easily defined transactions as against those which only emerge from a complicated and more loosely defined accounting process. The difference between

wages and profits from this standpoint, for example, or between sales and inventories is what needs to be clarified. There is also the greater chance of error in an item like the change in inventories because small errors in the measurement of stocks at the beginning or the end of the period can produce large errors in the measurement of the change. Of course, if uniform accounting rules were used by all economic units and there was a collection system that assured that all decisions made in the computation of income were reflected in the computation of consumption and investment, we would at least avoid inconsistencies that are now likely to arise because these measures are made more or less independently. But theoretical problems about such components as depreciation, net capital formation, profits, and inventory change would remain. And there would be more scope for difference in applying the rules than in the case of more easily defined transactions. Since there is considerable lack of uniformity in accounting conventions used for such items, however, the possibilities of deviations from the desired concepts are much larger. The difference between measures in current and constant values is also one which depends partly on the inherent nature of the concepts, and particularly needs emphasis. In this case the difference in possible inaccuracy between the series is certainly one of kind as much as one of amount.

The quality of record keeping in the sectors of the economy and the care exercised in reporting systems are, of course, fundamental in judging the accuracy of results. We have tried to bring out such things as whether the data were obtained from units which keep accurate or scanty records, whether uniformity in the accounting system was likely (or in some cases imposed), the difference between censuses and samples, the size and quality of sampling, whether the returns are policed, whether the character of the reporting is likely to lead to biases and, if so, what has been done to correct them.

In order to give the reader a more concrete impression of the influence of strong and weak sources and methods in the major components of the national accounts, we tried to construct special tables showing the proportions of the particular component by their source. In the case of wages and salaries, for example, a table shows that 80 per cent of the total is based on social security records and 15 per cent additional on records of government payrolls. A further table shows that over 98 per

cent of the estimate based on social security records is reported data while only about 1.5 per cent has to be estimated. As both the social security and government sources are described as excellent, the reader is easily able to see our judgment of the entire wages figure. Similarly, in the case of consumers' services (apart from rent) the table of the classification of the estimates by sources shows that almost four-fifths of the benchmark estimates are derived from censuses or similar comprehensive enumerations, while a surprisingly small portion depends upon miscellaneous unreliable sources and guesses. From the text the reader will see that the greater weakness of the estimates is in the scanty data available for extrapolations rather than in the benchmarks.

The importance of the quality of the source is so great that almost always when there are two ways of measuring a given item, one will clearly be more preferable than another. In his monograph on *The Role of Measurement in Economics*,[1] Mr. Stone suggests that it is desirable to have reports from those on both sides of the various transactions so that results can be checked. In practice, however, I believe they rarely provide a check, but that one will be clearly preferable. For example, much more accurate data on wages can be obtained from employers than from employees, and more accurate data on taxes from the government than from the taxpayer.

There is an interesting instance from our work on consumers' expenditures for commodities which reflects the differences in reliability arising from both these aspects of statistical data. We have been able to build up these estimates from three sources; consumers' budget data, the census of distribution, and the censuses of production. Thus, the first derives from sampling of economic units that as a rule do not keep records; the second from the stage in economic process where there are many small units to be covered by the census with records of not too high equality; the third from the sector of the economy where there are the best records and where the large units account for the major portion of output. Despite the fact that the third method involves the most complicated statistical procedure – distinguishing between intermediate and final products, adding distribution margins and transportation, adjusting for changes in inventories and for imports and exports – it has thus far given the most

[1] Richard Stone, *The Role of Measurement in Economics*, Cambridge, 1951.

reliable results. Budget studies are clearly the least satisfactory from the standpoint of over-all accuracy. But it may be that in time the distribution census will prove a more reliable basis for the estimates as its coverage is improved and as distributors' records are improved.

The need to describe the estimating process need hardly be stressed. Apart from the adjustments that are made to source data to correct for coverage and biases, there are often serious differences between what is measured by the source data and the item required in the national accounts. And, unfortunately, the data available for making such adjustments are usually less adequate. Hence, although the purpose of the estimating process is to make the data more accurate by the standard of the definitions used in national accounts, too often it adds an unknown element of unreliability to that of the basic original sources. The best that can be done to clarify the matter for the users of the data is to make all the assumptions used in the estimating process as explicit as possible.

It goes without saying that the estimates could be immensely improved if the source data were better adapted to their needs. However, I do not believe that the use of roundabout methods of estimating could be largely eliminated, as has been suggested, by changing to a system of sampling of the precise items required. Data collected for other purposes, such as administrative statistics, will in some cases always have certain advantages arising from the quality of records kept and the greater reliability of the reporting system.

The changes in the sources underlying any given estimate over time is an aspect of reliability that is little understood. It is because of this that there is continuous complaint about revisions of estimates – and usually from those who raise questions about accuracy. It should be rather clear that with all the data existing at any one time, the estimates which are based on benchmark enumerations will be the most reliable, while extrapolations to more current periods that are based on less complete data will be less reliable. On the other hand, as one goes back over time, the data available for making either benchmark estimates or extrapolations was much more limited. Therefore, before the most recent benchmark year for any given series, the estimates are likely to be less reliable than the estimates for more recent periods. In addition to increasing the accuracy of the

major aggregates, however, the important result of improving statistical sources has been to allow you to do things that could not be done in earlier periods, either in providing more detail in the estimates or in providing them more currently.

Because of a failure to recognize the changes in sources available at different times, some of the observations on the reliability of national income statistics made by Morgenstern[1] are rather pointless. For example, he compares Kuznets'[2] estimates for the period 1929–38 with those of the Department of Commerce (as shown by Marvin Hoffenberg in 1943[3]), saying that they have both drawn on the same fundamental information and that the differences, apart from conceptual differences, are the result of using different methods. The differences were very small in the earlier years but were 2 per cent in 1936 and 1938 and 3.2 per cent in 1937.

Although Morgenstern considers this a high degree of agreement, I would consider the differences quite large for an aggregate like national income where there is lots of scope for offsets among the series, if the estimates were in fact based on the same information; particularly as Kuznets' work was made fully available to the Commerce Department staff. However, the fact is that Kuznets' estimates were made before the 1939 censuses were available – population, manufactures, mining, business, and agriculture – whereas the Commerce estimates were made afterwards. Hence, the later years of his series were extrapolations based on limited data, while the Commerce series were interpolations between firm benchmarks.

Much the same applies to the comparison he uses of the Commerce Department series before and after the revision issued in the *National Income Supplement* of July 1947. The statistical revision for the period 1929–40 averaged less than $0.4 billion per year and the largest was only $0.8 billion. This means no more than that there was little new information available when the revisions were made that was applicable to years so far removed. For the later years, however, the source data were constantly growing and the revisions were accordingly somewhat larger. This still does not tell us much about relative

[1] Morgenstern, *op. cit.* pp. 112–16.
[2] Simon Kuznets, *National Income and its Composition, op. cit.*
[3] Marvin Hoffenberg, Estimates of National Output. Distributed Income, Consumer Spending, and Capital Formation, *Review of Economic Statistics*, Vol. XXV, p. 158, May 1943.

accuracy. So far as the 1940's are concerned, in fact, we will not have reasonably definitive revisions until the results of the recent censuses are available and incorporated into the estimates, as no censuses were taken from 1939 to 1947.

IV. IMPROVEMENT OF ACCURACY

As mentioned above, one of the purposes of exposing the weaker areas in national accounts estimates is to stimulate efforts to improve their reliability. To this end it is helpful to review the elements that have contributed to past progress. Although I can speak only of the experience we have had in the United States, I believe some aspects of this experience have more general applicability.

I have suggested already that national accounts estimates can be made at the present time with greater reliability than was the case, say, ten years ago. This may not be so for all the minor components in the whole complex of the national accounts, but it is true generally both for benchmark and for current estimates. The elements which have contributed to this improvement may be grouped into five categories.

1. *Work of Division of Statistical Standards*

I put this first since its influence has been exercised over the entire field of statistics and not confined to particular areas. The Division, which is in the Bureau of the Budget, has a general supervisory function over statistics in the Federal Government, with respect to both standards of statistical practice and the planning of the Federal statistical programme. While it is required to see that duplication of effort among agencies is avoided, its viewpoint need not be negative, because its programming function requires it to give weight to the needs of consumers of statistics. As the Division is in a position to influence the decisions about budgets, its views are of obvious importance to the statistical agencies· and since it is not itself a statistical collection agency, it is in a good position to be impartial.

Without under-emphasizing the initiative of statistical agencies themselves, I do think that an important impetus to the adequacy and reliability of statistics has been obtained by having an agency charged with this responsibility. Observing the work of the statistical agencies as a whole, it is able to see the

lacunae in the data available, as well as to spread the use of better techniques and methods. In a large country like the United States, where many agencies of government must be engaged in statistical work because of the diversity of administrative needs and interests, it is difficult to see how over-all standards with respect to either programme or methods would be achieved unless some agency was given the assignment.

2. *Improvement and extension of administrative statistics*

Better administrative statistics have had more importance in improving national accounts estimates than any other factor – perhaps because they have so many aspects and cover such a wide range of data. While the changes have been made possible in some cases for reasons not connected with statistics, there has been a quite conscious effort to make such data more meaningful both for administrative purposes and as information of general interest. This is reflected in the statistical data the agencies collect as well as in the tabulations they prepare and make available.[1] The following are the more significant developments:

(*a*) Data on wages and employment provided by the social security system. The Social Security Board has made excellent use of the statistical potentialities of the programme and from the beginning recognized the wider uses of the data it could produce. Hence, it has been concerned not only with receipts and outlays under the programme, but with total wages and employment in covered industries, and with such statistical questions as degree of coverage, classification, accuracy of reporting, and prompt issuance of data. The reporting system under the programme is not only comprehensive in its coverage, but its accuracy is high because it has public support, regularity of reporting, standardized accounting, and the reporting on individual employees and their wages is done in a way that assures a minimum of physical errors and omissions.

As the social security records contain a virtually complete list of establishments with one or more employees, they are used by a purely statistical agency like the Census Bureau to assure completeness of its lists of establishments. Such cross-checking also helps produce similarity of classification between the census and social security tabulations.

[1] I believe rather strongly that much more can be gained in improving national income statistics by developing administrative statistics than by creating extensive sampling systems as is advocated by some writers, e.g. J. R. N. Stone, *The Role of Measurement in Economics*, *op. cit.*, pp. 57–60.

(*b*) Income tax data for unincorporated business. The potentiality for improving these data arose from the fact that the increase in the level of income has meant that virtually all firms have had to file returns, thus providing for almost complete coverage of non-farm unincorporated business. To take advantage of this potential source of data, the Bureau of Internal Revenue has adopted a biennial schedule of tabulating the returns. This frequency of tabulation has in itself become feasible because the Bureau is using probability sampling to cope with the huge number of returns. Thus, data are made available now at fairly frequent intervals which extend down through the lower-size classes of firms. Of course, the problem of under-reporting in data from income tax source remains, but even this problem will be reduced as the extensive auditing programme of the Bureau becomes effective.

(*c*) Corporate income tax data. The weakness of these data formerly was an unknown bias from under-reporting. Recently, however, the Bureau of Internal Revenue has made available tabulations of the additional revenues that have been assessed as a result of auditing the income tax returns. The increase in income assessed each year is divided according to the year in which the original tax return was filled, thus allowing a systematic correction of the tabulations from the original returns.

(*d*) Data on government activities. The inadequacies of government accounts from an economic viewpoint is an old problem. While there has not been a fundamental change in the system of accounts, several important improvements may be noted:

(1) To overcome the difficulty of extracting information on payrolls and employment from the regular government accounts, a separate reporting system for these data has been established by the Civil Service Commission. The National Income Division formerly tried to gather this information itself through direct contact with the various agencies, but the results were much less satisfactory than the present system both with regard to timing and accuracy.

(2) A separate reporting system has been established for overseas transactions of government agencies. This information is now regularly and accurately available, whereas formerly the situation was quite chaotic.

(3) Since the passage of the Federal Reports Act (1943) there has been a marked improvement in the reports of Federal Corporations, as data on their activities are now much more complete and more regularly available. This has gone a long way toward removing the mystery which formerly surrounded the activities of these bodies.

(*e*) Building permits data. These data have been the basic source for estimates of residential construction for many years. As they relate to intentions to build, however, they were not too satisfactory a source for estimating construction put in place, as required in the national accounts. The possibilities of measuring construction activity more accurately were studied carefully by an interdepartmental committee. But in the end it was decided that, considering the small-scale character of the industry and its wide dispersion, permits issued by local authorities provided a firmer base from which to begin than any other reporting system that could be devised at reasonably comparable cost. Hence, improvements in the estimates have come through a series of special statistical studies to establish more accurately the relation between permit data and construction activity. I mention this case particularly because it illustrates the thesis that administrative data often provide the most feasible basis for statistical estimates and that improved reliability can be achieved more easily by building on them than by turning to an entirely new reporting system.

(*f*) State sales tax data. As many of the States having sales taxes are tabulating their returns promptly and with an adequate classification system, these data have proved very helpful in extrapolating the benchmark estimates of retail sales and consumers' expenditures.

3. *Improved sampling methods*

Sample data are used extensively in the preparation of the more current national accounts estimates, the benchmark estimates largely being based on comprehensive enumerations. The change in the quality of sample data has been rather remarkable. It has come about not only because of the invention of new sampling techniques and a better knowledge of sampling methods, but through a change in attitude by some of the leading statistical agencies toward sampling. There was formerly a belief that only tabulations of reports received should be

published and that the statistical collection agencies should not make estimates on the basis of the sample data. Unfortunately, this attitude was combined with a lack of interest in the representativeness of the sample information. This attitude has completely changed and a high standard in sampling methods is now the rule. The following sample series which reflect this improvement are the most important from the standpoint of national accounts estimates: retail trade, wholesale trade and inventories, manufacturers' sales and inventories, capital outlays, corporate profits, payrolls and other financial data of State and local governments, gross receipts and incomes from professional practice, and the monthly report on the labour force which periodically includes data on income and rents.

4. *Standardized classification*

Another important factor which has increased reliability, since various sources must be used jointly in the estimating process, is the adoption of the standardized codes of industrial and commodity classification by all the important statistical agencies. The use of the same system by the Census Bureau, the Bureau of Internal Revenue and the Social Security Board has been particularly helpful. A recent substantial revision of the standard industrial classification is at present causing some difficulties in establishing comparability with estimates for previous years, but this problem should be lessened as data on the new basis become available for a longer time period. The major difficulty remaining is that of the incomparability arising between data classified by establishments and data classified by firms, to which no easy solution is possible.

5. *Estimating methods*

Finally, it may be said that reliability has been increased by more precise and more careful preparation of the estimates. In large measure this has occurred just with the passage of time as the various parts of the estimates have been gone over by several research workers. Each time a thorough review of sources and methods has been made by competent personnel there has been an opportunity to add refinements in techniques, to understand the sources better, to check alternative sources, and to make use of additional minor sources.

In addition, however, more specific improvements in estimating methods may be mentioned. One of these has been the

substitution of direct estimates for residuals. Estimates derived as residuals must always be suspect as they can reflect the compounding of errors in the components estimated directly. Since the time that consumers' services and personal saving have been estimated directly, it has not been necessary to rely on residuals for any major component in the United States national accounts. We have retained the residual saving estimates in the accounts largely to avoid the inconvenience of a statistical discrepancy between the debit and credit sides of the personal account. However, the user of the data is told to refer to the direct estimates of saving when dealing particularly with this flow.

Another improvement in methods has been to make the estimates in greater detail by using more detailed classifications of industries, incomes, and products in the estimating process. The classifications we use for estimating purposes are actually much more detailed than those in which the results are published, because it has been found that tests for reasonableness and comparisons of alternative sources can be made more effectively when the cells are as homogeneous as possible. Greater detail also allows one to separate the stronger from the weaker estimates and thus to concentrate efforts to improve the latter.

This result has been promoted also by preparing the estimates in accordance with a well-developed system of national accounts. The help that is gained in securing consistency and avoiding hidden assumption in the estimates by an accounting system has often been stressed. It is, however, also a means toward greater accuracy because in many cases the only feasible check upon the estimates on one side of an account is the compilation of the items on the other side. For this reason, we have prepared accounts for sectors of the economy which we have not made explicit in our published accounting system, such as rental property, owner-occupied houses, and non-profit institutions. The agricultural estimates are also built up in the form of a balanced account. We have not as yet used input-output estimates for this purpose, but it is apparent that the integration of an input-output matrix into the national accounts would help statistical accuracy, and I understand this has been found to be the case in several countries. The extended use of balanced accounts both in the estimating process and in the collection of statistics must play an important part in further improvement of accuracy.