Review of Income and Wealth
Series 40, Number 1, March 1994

USE AND MISUSE OF NATIONAL ACCOUNTS FROM A MODELING PERSPECTIVE

BY JOSEF RICHTER

National accounts aggregates are not only abused as welfare indicators, there is also a considerable misuse in economic analysis and in modeling. Characteristics of national accounts—such as consistency, homogeneity and comprehensiveness—may turn into major disadvantages in the case of improper use. The main sources of misuse are the confusion of concepts, inadequate statistical units, the role of aggregation and what might be called "modeling on the basis of the results of modeling." A plea is made for different data sets for different analytical purposes, for separate treatment of descriptive data, analytical data and modeling results, correct labeling and for a more open information strategy.

1. INTRODUCTION

National accounting has to serve two main purposes. It has to measure the past and it should provide the empirical material for analysis and modeling. As regards "measurement," national accounts aggregates are still misused as welfare indicators. The present paper, however, does not address the use and misuse of national accounts aggregates as welfare indicators. It is devoted to the closely connected aspect of use and abuse of national accounts data in economic analysis and in modeling.

Most of the considerations presented in this paper have already been raised several times, even in the early days of quantitative economic analysis. Nevertheless, in many cases some of these considerations are still neglected. This "lack of awareness" leads to severe misuse of national accounts data. The release of a new SNA is a good opportunity to reconsider some of these basic aspects.

The first chapter of the paper is devoted to a short discussion of some sources of misuse of economic data in general. The following main part of the contribution concentrates on misuse of national accounts data in particular: Some of the problems are the same as in the case of misuse of economic data in general. However, some problems are "national accounts specific." Characteristics of national accounts—such as consistency, homogeneity and comprehensiveness—which are usually seen as advantages of the system, may turn into major disadvantages in the case of improper use. A few final paragraphs of conclusions, contain suggestions for the design and the presentation of national accounts.

Note: Revised version of a paper presented at the Twenty-Second General Conference of the International Association for Research in Income and Wealth, Flims 1992. The author is grateful to Alfred Franz, Hans Werner Holub, Norbert Rainer and an anonymous referee for valuable comments and criticism. All errors, shortcomings and the opinions expressed are the author's own.

2. Use and Misuse of Ecomonic Data in General

One of the basic problems of economic analysis and modeling is choosing the right variables to test a theory or to estimate parameters. "The model builder who is concerned with the empirical substance of his model is rarely fortunate enough to have sufficient resources to organize the collection of the theoretically precise data needed" (Arrow and Hoffenberg, 1959, p. 93). He has to work with "what is available" and has to try to select the most adequate variable.

Lack of information can be responsible for a number of cases of misuse of economic data. Two fields, in which insufficient information causes serious problems are basic concepts and adequate statistical units. Both problem areas are of relevance in general, but particularly important in the case of national accounts data. In the case of national accounts we either have to accept the concepts embodied in the system and the statistical units chosen there or to abstain from the use of national accounts.

2.1. *The Confusion of Concepts*

Quite often there is a substantial discrepancy between the theoretical concept and the concept of what is really measured by the available data. Similar expressions and notions are used for quite dissimilar phenomena. Some of the problems are semantic in nature, but there are also problems of a different type.

Quite often theory rests on variables, which cannot be observed directly or cannot be observed at all. Working with "observational variables" instead of working with "true variables" leaves the possibility that we might be trying out the theory on facts for which the theory was not meant to hold, the confusion being caused by the use of the same names for quantities that are actually different" (Haavelmo, 1944, p. 7).

A typical example in this context might be seen in the use of observed values in the place of expected values. Due to the difficulties of measuring the variables (in this case "expectations") consistent with theory, "proxies" are introduced into the modeling process. The central problem to which extent the nature of estimated parameters is changed because of the use of proxies usually is neglected. Little attention is paid to the sensitivity of the results of an analysis with respect to the selection of alternative proxies.

Even more important than the use of proxies is the lack of awareness regarding what might be called the "theory content" of variables. Any description of the real world with the help of statistical methods is at least implicitly based on some theoretical considerations and leads to a simplified model of reality. All these theoretical concepts which are embodied in any statistical data also limit the range of meaningful applications of this information. A prominent example in this respect is the decision in favour of a specific statistical unit.

2.2. *The Problem of Adequate Statistical Units*

Different analytical concepts are only meaningful when information is derived from the adequate statistical units. There is no "ideal statistical unit" which

provides all the necessary information for all different kinds of analysis (e.g. Bloem, 1990; Franz, 1985; Richter, 1987). In contrary, the trade-off between the homogeneity (in all its manifold aspects) of a reporting unit and the number and kind of characteristics we can observe has to be taken into account. If we insist in homogeneity regarding technology, we cannot expect to observe all the characteristics typical for the enterprise as a whole.

Regarding the arguments of investment functions, such variables as sales, financial status etc. belong to the sphere of enterprises or decision units according to the terminology proposed by Postner (1986). Current and past output or utilization of capacity, obviously belong to the establishment level. In the case of capacity utilization the level of single production processes is the only relevant one, as far as bottlenecks in production are concerned.

If we are interested in the analysis of production and in the implications of production on environment we need one type of narrowly defined statistical unit. If we focus on the measurement of income by sectors we need a different type of statistical unit. The aim of the investigation determines which kind of classification scheme should be adopted, which degree of disaggregation has to be achieved, etc.

2.3. *The Information Problem*

What is needed for each single piece of data is a full documentation of concepts, definitions, statistical units, sample, etc. Access to the basic questionnaire is indispensable. Information on the coverage, the rate of response, the homogeneity of the sample etc. is also essential. In most cases direct contact with the statisticians who have designed and elaborated a survey is the only way to avoid misinterpretation and misuse.

Unfortunately, econometricians and economic analysts have lost essential communication with the compilers and synthesizers of their data. "As a consequence, popular discourse, policymaking and basic principles of economics have suffered inordinate confusion" (Eisner, 1989, p. 2). The key problem is, that according to the statement of Arrow and Hoffenberg formulated decades ago, "There is no such thing as a level of output, of prices or of interindustry flows independent of the statistical operations involved in its measurement. These are statistical constructs that are only operationally meaningful through the levels of aggregation, of valuation, of basic units of count and of weighting schemes used" (Arrow and Hoffenberg, 1959, p. 96). The level of aggregation, valuation, statistical units and weighting schemes are, however, determined by some theoretical background and some analytical aim in mind.

A considerable part of the information problem stems from the fact that the theoretical background and the analytical orientation are not made public explicitly. Under favourable circumstances the producers of data provide the user with definitions, aggregation schemes and the like. However, even under such favourable circumstances the user himself has to derive the analytical orientation *indirectly* from the given bulk of definitions. The most prominent example of this type of "information problem" is the SNA 1968 (United Nations, 1968).

3. Use and Misuse of National Accounts in Particular

The system of national accounts, as we know it nowadays, has been influenced by a number of different factors: There is an eminent theoretical background (Keynesianism, neo-classical theory, traditional welfare-economics, etc.), there is the wish to provide comparability on an international level, the aspect of availability of data in different countries, etc. Since it is by no means easy to achieve consistency among those factors, the present system consequently is the result of a number of compromises. Despite all these "tensions" in the system, national accounts data probably are the most frequently used economic data.

The "popularity" of national accounts data in quantitative economics cannot be explained solely by the dominant role of macroeconomics. One main reason is that national accounts provide a *consistent* and *coherent* picture of the economic processes within a period. The complexity of reality is "stylized and reduced to quantifiable simplicity in accordance with a set of definitions and definitions equations which in turn are based on underlying economic theories" (Bloem, 1990, p. 275). The system seems to offer internal consistency and comparability and to offer a broad variety of data for different purposes.

Some users assume it can be used for the analysis of production and employment as well as for the analysis of income generation and income use. Many of them are not aware that the range of meaningful applications is *determined* by the economic theories which have led to the basic definitions of the system. The conventions concerning what has to be considered as production and what is defined as consumption (just to mention two prominent examples) embodied in the system make national accounts data ideal for certain types of analysis for which they were designed. On the other hand these conventions necessarily limit the meaningful applications.

The question whether we consider the system to be consistent and coherent can also only be answered with respect to a specific theory in mind. Haavelmo's statement "The adequacy of a model is relative to the data to be explained and to the uses to which the results are to be put" (Haavelmo, 1944) also holds vice versa. Any use which does not take the "theory content" into account probably will lead to misuse of national accounts data.

On the more "pragmatic side" the problems of different definitions in different sectors, of underreporting, of reconciliation etc. all have already been solved—in one way or the other—by national accountants. The user is confronted with what he *assumes* is a standardized, homogeneous data set. International comparability is an additional advantage.

Another reason why national accounts data are so popular might be seen in the fact, that the information problem mentioned above does not seem to exist. Most users assume that they are well informed about the concepts and definitions of national accounting. Compared to other statistical sources national accounts are quite "well-documented."

Despite all these nice characteristics the problems mentioned in the context of the use and abuse of economic data in general are also present in the case of national accounts data. There is the obvious danger of confusion of concepts, the "theory content" of national accounts and the issue of choosing the right indicator

(e.g. Harrison, 1990). Closely related is the problem of the adequate statistical unit and, last but not least, a very specific "information problem."

Some additional problems are, however, "national accounts specific." They are caused by properties of national accounts, which are usually considered as favourable ones: The completeness and comprehensiveness on the one hand and the homogeneity of the data on the other hand. The following discussion concentrates on two of the "national accounts specific" issues, on the role of aggregation and on using model results as the basis for modeling.[1]

3.1. *The Role of Aggregation*

National accounts data are derived from elementary statistical observations by means of a number of steps of classification, transformation and reconciliation. Among the steps of transformation various aggregation procedures are probably the most relevant ones for the result. Aggregation always means a loss of information and different aggregation procedures are appropriate for different purposes. The sensitivity of the outcome of analyses (with respect to aggregation) is also considerably dependent upon the *type* of analysis carried out.

Although the aggregation problem always was considered among the most tricky ones in economic research, national accounts usually provides only one prefabricated solution. The "outsider" normally has little information about the consequences of the various steps of transformations on the resulting aggregate data. He normally cannot choose between alternative aggregations, although different models would call for the use of specific aggregation criteria.

Aggregate data as published by national accountants is frequently used in connection with micro-theory, which raises the problem of "confusion of concepts" again and touches the intensively discussed field of the micro-foundation of macro-economics. The estimation of production functions on the basis of aggregate data is a prominent example. The theory of production deals with narrowly defined commodities, with narrowly defined production processes. When Solow started work with an aggregate production function he was very skeptical about this device himself and the first paragraphs of his 1957 article are thoroughly ambivalent about the use of aggregate data on inputs and outputs (Solow, 1988, p. 313). "There is considerable difficult in passing from the theoretical model dealing with individual commodities to a model suitable for statistical analysis of aggregate data" (Arrow and Hoffenberg, 1959, p. 34). In those "early days" there was a long series of theoretical debates on the micro/macro link with respect to production functions (for an overview see e.g. Lave, 1966). The possible bias introduced because of the use of aggregate data was also explicitly treated or at least mentioned in earlier studies such as Domar (1961), Griliches and Jorgenson (1967), Star (1974). Many doubts were expressed whether the concept of a production function on the meso or macro level is a meaningful one.

Although it seems that few of the theoretical problems have been solved, the discussion faded away. Most production functions are estimated on the basis of highly aggregate data. The only hint that there might be a problem which is given

[1]The aggregation problem is of course present in the case of all types of aggregate data also. It is of special relevance with respect to national accounts data, because we always use aggregate data.

to the reader of such studies often consists in the explicit statement: "We assume a cost minimizing producer." Implicitly it is assumed that the macro data on output and inputs may be used as "proxies" for the hidden variables. The relation between the unknown variables and the macro data is neither analyzed nor even mentioned.

Of course, prominent exceptions can be found. In his Nobel Memorial Lecture, Solow reminded his colleagues "that every piece of empirical economics rests on a substructure of background assumptions that are probably not quite true. For instance the total-factor-productivity calculations require not only that market prices can serve as rough-and-ready approximation of marginal products, but that aggregation does not hopelessly distort these relationships" (Solow, 1988, p. 314).

The estimation of production functions is one example. Another prominent example is the empirical analysis of consumers' behaviour. Most contributions in this field start with the statement: "We assume a utility maximizing consumer." Then they turn immediately to a well-elaborated model, based on the hypothesis of the utility maximizing consumer. The empirical part then makes use of aggregate national accounts data and only in very few cases the problem of the adequacy of the data with respect to the model is even mentioned. Again, the only tribute paid to this eminent problem might be found in formulations such as "we take consumption data as provided by national accounts as proxies . . ."

Aggregation of data of different reliability and quality can also be seen as a "national accounts specific problem." In order to present a consistent and coherent picture, information on the properties of various elements is usually not made available to the public. Users are left with the illusion of a homogeneous data set. Most of them are quite happy with this illusion.

3.2. *Modeling on the Basis of the Results of Modeling*

The present SNA contains three different categories of elements, descriptive data, analytical data and modeling results. The set of descriptive data is by far the most important one. The elements of a descriptive data set are characterized by the fact that a straightforward link to direct statistical observations can be established. The notion of a "descriptive data set" has much in common with the "core concept" as proposed by van Bochove and van Tuinen. The wish to avoid any arbitrary valuation implies that the central system, the core, has to be restricted to flows which are directly connected with market transactions and for which a price can be observed (van Bochove and van Tuinen, 1986).

In addition to descriptive data, analytical elements are also present in the SNA. The treatment of services provided by insurance companies is one example. In this case (and in all cases of analytical data) observed information is transformed and modified with a specific analytical viewpoint. Final demand at producers' prices, as shown in input–output tables, is another example. The overruling argument for producers' values instead of purchasers' values comes from the theoretical side (Reich, 1986). In this case the analytical goal of homogeneous valuation leads to the redefinition and reallocation of distributive margins.

The wish to provide *consistency* (as already mentioned a major aspect in the design of the system) also leads to such "analytical data sets." If supply and demand of commodity accounts should balance, the need occurs to estimate distributive margins by commodities, although such margins are hardly directly observable.

The wish to provide a *coherent* and *complete* system (with a specific analytical goal in mind) even led to the integration of "model results" into the system.[2] The treatment of public services, for example, results from a combination of a specific hypothesis and observed data. In the case of constant price calculations for government production there is no equivalent to a market price. Consequently, constant price calculations have to rely directly on assumptions on the change in productivity and on a few additional pieces of information. Such estimations obviously belong to the category of modeling exercises. One example, in which the integration of such modeling results and other imputations is quite relevant for the results, is the analysis of productivity.

In his survey of productivity comparisons Kravis made a distinction between aggregate comparisons on the one hand and sectoral and industry comparisons on the other hand (Kravis, 1976). As regards the first type of comparisons he argues that the quality of the comparison of GDP per head is critically affected whether exchange rates or Purchasing Power Parities are used and by the quality of the expenditure data. On the other hand such an eminent expert interpreted comparisons of GDP per head as a measure of productivity and even calls this type of comparisons welfare-type comparisons in contrast to efficiency-oriented comparisons. The different nature of the various building blocks of GDP and the influence of their relative size on overall results is not mentioned.

In his survey article on the estimation of labour productivity Maddison (1987) also provides a long list of very prominent economists who have used total GDP as the output measure in the process of calculating labour productivity. However, he also offers a list of other researchers who have—at least—excluded the government sector. He himself used GDP pointing out that the housing sector and the government sector are rather special. He emphasizes the fact that "income flow from housing is virtually all a return on capital. Controversially, with government activity, as conventionally measured, virtually all income flow is from labour" Maddison (1987, p. 653). Maddison argues that the exclusion of for example housing and government services from national aggregates should not be a matter of controversy "as long as the aggregate used is the same for all the countries in the comparison" (Maddison, 1987, p. 655).

A comparison of growth rates of constant prices GDP does not only reflect the differences in "performances" between countries, but also the different role of e.g. the government sector in each country and—last but not least and worse—the different modeling approaches used by the national accountants in each country. What is compared are methods and relative shares and not efficiencies as is usually intended.

[2]It is not easy to draw a clear distinction between analytical data and model results in this context. The difference is a gradual one.

Quite a number of researchers were aware of this type of problem. In their frequently quoted study Griliches and Jorgenson (1967) have excluded the government sector from their analysis of productivity change on the basis of national accounts data. The specific nature of the contribution of "Other producers" to GDP is also one reason why many investigations focus on manufacturing only (e.g. Maddison and van Ark, 1989).

Some of the problems with modeling results may, however, also appear on a sectoral level. Unless the imputation is eliminated, any comparison of labour productivity in construction, for example, reflects to a significant degree the difference in the level of household activities in this sector and the differences in the estimation procedure among countries. The results tell little about what is usually meant by the notion of "labour productivity." Unfortunately few users are in a position to eliminate imputations. Most publications do not show them separately.

A variety of other examples for "modeling model results" could be added. Among them are:

1. Input–output coefficients as they are published by Statistical Offices (either in commodity by commodity or in industry by industry classification) do not reflect direct statistical observations of technical relationships. They result from a number of transformations of the basic statistical material and are based on hypotheses such as industry or commodity or even hybrid technology. The average user analyzing such coefficients usually has no information regarding the sensitivity of the coefficients as regards the various transformation processes and with respect to the various assumptions embodied in the estimation process of these coefficients.

2. The situation is even more complicated when "updating procedures" are used to compile input–output tables on the basis of incomplete information for the year of reference. The average researcher interested in e.g. the stability of coefficients is usually left ignorant to which degree the figures presented reflect changes in reality, differences in the availability of data in different years, changes in the assumptions in the updating procedures or even changes in the method of updating.

The last paragraphs do not imply that technology assumptions should not be applied or that updating or reconciliation methods should not be used at all. The main argument brought forward is that the use of such modeling approaches limits the number of meaningful applications of the results. Such results cannot, for example, serve as the empirical basis for testing alternative hypotheses as regards the changes of coefficients. One assumption concerning the change in coefficients has already gone into the estimation procedure. Applications, which rely on the same set of hypotheses might, however, be meaningful.

4. Consequences for National Accounts

Evidence on the frequent misuse of economic data in general and of national accounts in particular should seriously be taken into account in the process of designing and presenting national accounts. The "confusion with concepts" and the need to work with the "adequate statistical units" lead to the need for different data sets for different analytical aims.

4.1. *Need for Different Data Sets for Different Purposes*

One of the major problems of the current and the future SNA is that it has to serve so many different analytical goals. It has been pointed out several times (*inter alia* Holub, 1981; Holub, 1983; van Bochove and van Tuinen, 1986; Sunga, 1988) that the multitude of purposes necessarily leads to conflicting demands and to compromise solutions, which do not serve one of the aims in an optimal way.

The adequacy of a certain way of bookkeeping, a certain concept of valuation or a certain system of classification cannot be discussed in a meaningful way without having previously defined the purpose of the accounting system. That is why part of the discussion on the extension of the present accounting system is so misleading and sometimes even confusing: The discussants concentrate on *how* to treat specific elements in the system, whereas their basic disagreement results from *what* should be accomplished with the system. Their preference for one or the other analytical goals can often only be identified in a very indirect way.

Given the interdependencies between modeling and the design of the accounting framework the answer is rather simple: National accounts should provide different data sets for different purposes. Much can be said in favour of a flexible system along the lines proposed by van Bochove and van Tuinen (1986). As long as the link to the central core can be established different building-blocks serving different analytical goals can be established. The same information can appear in various building blocks (or modules) in different ways, classifications, etc. according to the specific analytical viewpoint. The ideas to establish different satellite-accounts for different analytical purposes are—despite all the differences to the core-modules approach in detail—steps in the same direction.

The new computing facilities could play an important role in this respect. Why should Statistical Offices not offer two sets of investment by industries, just to give an example? For one purpose (production related analysis) investment could be classified by users and should aim at establishment-type units. For other purposes investment could be classified according to the owner principle. In this case we should aim at the more (as regards aspects of financing) adequate enterprise-type units.[3] To show investment in fixed capital assets by sectors would also be relevant. All that is needed to accomplish such an extended information system is a well established register and mighty computing facilities.

4.2. *Separate Treatment of Descriptive Data, Analytical Data and Model Results*

In order to cope with the problem of "modeling model results" a clear distinction between observational data and model results has to be drawn. Elements of a descriptive data set are characterized by the fact that the link to elementary statistical observations can be established.

Analytical data sets are derived from descriptive data sets with some specific analytical goal in mind.[4] The estimation of such data sets always involves simple

[3]In the chapter on social accounting matrices of the Revised SNA a presentation of this kind is elaborated.

[4]As regards the distinction between "descriptive" and "analytical" data sets, see Rainer (1989) and Rainer and Richter (1992).

hypotheses. In the case of analytical data, the descriptive "raw material" should also be made available to the qualified user.

Since the crucial role of institutional regulations must be comprehended in order to understand the content of the data, van Bochove and van Tuinen (1986) stress that the core "must be parsimonious in the use of constructions that are intended to capture the reality behind the perceptions of the economic agents" (p. 141). The concepts of the core should be free from the influence of hypotheses. Imputations, such as total output of public services, as already mentioned, result from a combination of hypotheses and observed data. These aggregates belong to the category of model results.

One might well argue that any description of the real world with the help of statistical methods contains some elements of "modeling". The basic decisions such as the selection of units and characteristics, the classification, etc. are at least implicitly based on some theoretical considerations and lead to a simplified model of reality. The notion of "results of analysis" and "modeling results" should nevertheless not be mixed up with "statistical observations."

Special attention should also be given to the role of estimation. Although the techniques used might be very similar or even be the same, a clear distinction should be drawn between the following.

— Estimation of elements which are of descriptive nature. Here we have to cope with problems arising from missing observations, underreporting, need for reconciliation, etc. Under more favourable statistical circumstances direct observation would be possible.

— Estimation of elements which belong to the category of model results and for which direct observation never will be possible.

Using the terminology coined by Richard Stone in his Nobel Memorial Lecture 1984 (Stone, 1986), we should always be aware whether our figures still belong in the box called "Facts" or whether they should not be included in the box termed "Model." This "Model" is the result of combining the facts (organized in a coherent set of accounts) and theories.

The different nature of the various elements in the accounting system is of specific relevance in the case of aggregation. Under all circumstances aggregation of dissimilar entities, some of them belonging to the sphere of facts, others to the category of "model results," should be avoided. All of them might be expressed in identical units (e.g. monetary terms). Nevertheless they are not "ready for aggregation."[5] For a number of analytical purposes such aggregation might be as misleading as aggregation over different units such as tons and meters.

4.3. *Correct Labeling, Need for a New Information Strategy*

In disseminating and presenting their results national accountants should provide a maximum of information on the pros and cons and on the limits of their products. Such information could reduce the confusion of concepts

[5]Examples, among others, can be found in some of the environmental/economic accounting systems discussed recently. Many parts of the proposed Draft SEEA (United Nations, 1990) have the characteristics of simulations under given norms, or preconditions, which *did not* prevail in the period under consideration. Such elements should not be aggregated with data based on observations.

considerably. In addition to a well elaborated documentation for the highly qualified users (which to some extent does exist) a short compendium of the main characteristics (including at least some remarks on the theoretical background) of the product for the "standard user" should also be disseminated.

In order to facilitate the interpretation and the proper use of the aggregates, building blocks of different nature (as described in the previous chapter) should strictly be separated in all publications. The clear distinction made between "Industries" and "Other producers" in the SNA 1968 is a good example.

Especially in the case of more complex accounting systems such as SNA Satellite System for Integrated Environmental and Economic Accounting (SEEA, United Nations, 1990) such a clear distinction between elements of different nature would be extremely helpful to avoid further misunderstanding and misinterpretation. The problem of "false signals" (as termed by Bartelmus, 1987) should be taken seriously. The issue of "inadequate or even misleading basis for analysis and modeling" is equally relevant. Correct labeling can be a major contribution to avoid misuse of national accounts data in modeling exercises.

A more aggressive and more open information strategy should at least cover the following aspects:

- separate identification and presentation of all elements in the system which are based on direct statistical observation,
- separate identification and presentation of all "provisional data,"
- separate identification and presentation of data of different reliability and quality,
- provisions for alternative ways of aggregation,
- documentation of all "updated information" included in the system,
- documentation of all the statistical sources, the different reliability of the various sources and resulting building blocks,
- information on the size and properties of samples used,
- documentation of the entire reconciliation process (adjustments factors, hierarchies of adjustment, etc.),
- documentation of the main hypotheses which have gone into the compilation process.

The availability of information of such types can be seen as a precondition for the adequate use of national accounts data by the well-informed analyst. National accountants cannot prevent users from misuse of the data they have compiled, obviously they could do a lot to reduce the number of excuses put forth by analysts in cases of improper use of national account data.

Bibliography

Al, P. and van Bochove, C., A Synoptic Structure of the System of National Accounts, *The Review of Income and Wealth*, 34(1), 45-70, 1988.

Arrow, K. and Hoffenberg, M., *Time Series Analysis of Interindustry Demands*, North-Holland, Amsterdam, 1959.

Bartelmus, P., Accounting for Sustainable Development, United Nations, Department of International Economic and Social Affairs, Working Paper No. 8, New York, 1987.

Bloem, A., Units in National Accounts and the Basic System of Economic Statistics, *The Review of Income and Wealth*, Series 36(3), 275-288, 1990.

Domar, E., On the Measurement of the Technological Change, *The Economic Journal*, 71, 709–729, December 1961.
Eisner, R., Divergences in Measurement and Theory and Some Implications for Economic Policy, *The American Economic Review*, 79, 1–13, March 1989.
Franz, A., National Accounts Sectoring and Statistical Units of Reporting and Classification, 19th General Conference of the IARIW, Noordwijkerhout, 1985.
Griliches, Z. and Jorgenson, D., The Explanation of Productivity Change, *Review of Economic Studies*, 34, 249–283, July 1967.
Haavelmo, T., The Probability Approach in Econometrics, *Supplement to Econometrica*, 12, July 1944.
Harrison, A., Major Changes Proposed for the Next SNA: An Overview, *The Review of Income and Wealth*, 36(4), 335–352, 1990.
Holub, H. W., Some Reflections on a Universal System of National Accounting, *The Review of Income and Wealth*, 27(3), 333–338, 1981.
Holub, H. W., Some Critical Reflections on Measures of Net Economic Welfare, *The Review of Income and Wealth*, Series 29(3), 317–321, 1983.
Kravis, I., A Survey of International Comparisons of Productivity, *The Economic Journal*, 86, 1–44, March 1976.
Lave, L., *Technological Change: Its Conception and Measurement*, Prentice-Hall, Englewood Cliffs, N.J., 1966.
Maddison, A., Growth and Slowdown in Advanced Capitalist Economies: Techniques of Quantitative Assessment, *Journal of Economic Literature*, 25, 649–698, June 1987.
Maddison, A. and van Ark, B., International Comparisons of Purchasing Power, Real Output and Labour Productivity: A Case Study of Brazilian, Mexican, and U.S. Manufacturing, 1975, *The Review of Income and Wealth*, 35(1), 31–55, 1989.
Postner, H., Microbusiness Accounting and Macroeconomic Accouting: The Limits to Consistency, *The Review of Income and Wealth*, 32(3), 217–244, 1986.
Rainer, N., Descriptive versus Analytical Make-Use Systems; Some Austrian Experiences, in Miller, R., Polenske, K. and Rose, A., (eds.), *Frontiers of Input–Output Analysis*, pp. 51–64, Oxford University Press, New York, Oxford, 1989.
Rainer, N. and Richter, J., Some Aspects of the Analytical Use of Descriptive Make and Absorption Tables, *Economic Systems Research*, 4, 159–172, 2/1992.
Reich, U.-P., Treatment of Trade and Valuation of Flows in Input-output Tables, in Franz, A. and Rainer, N., (eds.), *Problems of Compilation of Input–Output Tables*, pp. 333–353, Orac, Wien, 1986.
Richter, J., Die ideale statistische Einheit—Stein der Weisen für Wirtschaftsstatistiker and Volkseinkommensrechner? *Österreichische Zeitschrift für Statistik und Informatik*, 17, Jahrgang, 196–212, Heft 3, 1987.
Solow, R., Growth Theory and After, *The American Economic Review*, 78, 307–317, June 1988.
Star, S., Accounting for the Growth of Output, *The American Economic Review*, 64, 123–135, March 1974.
Stone, R., The Accounts of Society, *Journal of Applied Econometrics*, 1, 5–28, 1/1986.
Sunga, P., Conceptual Incongruity in the National Accounts, *The Review of Income and Wealth*, 34(4), 393–409, 1988.
United Nations, *A System of National Accounts* (*SNA*), Studies in Methods, Series, F.2, Rev. 3, New York, 1968.
United Nations Statistical Office, *SNA Handbook in Integrated Environmental and Economic Accounting*, Preliminary Draft of the Part I: General Concepts (SEEA), New York, 1990.
Van Bochove C.A. and van Tuinen, H. K., Flexibility in the Next SNA: The Case for an Instrumental Core, *The Review of Income and Wealth*, 32(2), 127–154, 1986.