

INCOME DISTRIBUTION THEORY

BY RICHARD RUGGLES

Yale University

This paper introduces two special issues of the *Review* devoted to income distribution theory and its empirical implementation. Most of the papers that will appear in these two issues were prepared for a special session on income distribution held during the Eleventh General Conference of the International Association for Research in Income and Wealth, held at Nathanya, Israel, in August 1969. The present issue contains theoretical papers; the following one will present more empirical work. This introductory paper is intended to indicate the relationships among the papers that follow, and to suggest possible future directions for work in this area. In the latter connection, the author discusses the use of microanalytic models applied to microdata sets dealing with individuals and households.

It is quite appropriate that the International Association for Research in Income and Wealth should concern itself with the study of the income distribution. A number of papers on income distribution theory were presented at the Eleventh General Conference of the Association held in August 1969, and at that time it was decided to present these papers in a special issue of this *Review*. The basic question with which these papers are all concerned is whether the observed distribution of income can be considered to be satisfactory in terms of economic and social welfare. The approaches of the various authors are, however, very different indeed, and reflect major differences in both the conceptual framework used to analyze the income distribution and the welfare objectives of the study.

This issue of the *Review* presents theoretical treatments of the problem. The next issue will be devoted to empirical work on measuring income distributions in different countries. Some of these papers were presented at the conference; others have been prepared since that time. It is hoped that in the future the *Review* can serve as an outlet for both theoretical and empirical work in this area going on in different countries.

Tinbergen's positive and normative theories

In the next paper in this issue, Tinbergen is concerned with developing both a positive and a normative theory of the income distribution. The positive theory is designed to relate the distribution of income to the demand for and supply of the factors of production. The normative theory seeks to construct an optimal income distribution which has as its basis the maximization of social welfare. Tinbergen is also concerned with the problem of redistributing income, so as to alter the distribution which would result from the demand and supply considerations in the direction of the optimal distribution, in the sense of maximum social welfare.

Although Tinbergen's discussion is cast in terms of the labor market and deals with the relative prices which would be paid for labor of given types, he

views the theory as much broader than this, applying in fact to all the factors of production including capital and land. In such a context the term "job" on the demand side merely means the use to which a factor of production is put by the organizer of production, and its price reflects what he is willing to pay for that contribution. On the supply side, the concept of "job" not only includes the labor of an individual but also the services of other assets which the individual owns. Tinbergen views the factor market as compartmentalized into such jobs. Each job in turn is described in terms of a set of attributes reflecting the characteristics, skills, abilities, of other qualities which are required or can be supplied. The market is viewed as a mechanism which matches the demand for factors against the supply of factors, such that the incomes paid reflect the scarcity of skills available relative to the skills required. The desirability of jobs is taken into account implicitly in the postulate that additional supplies of the requisite skills will be forthcoming at higher rates of compensation. In other words, individuals having the skills that are required may be willing to contribute them to less agreeable jobs only if they are paid more on those jobs.

The concept of attribute in Tinbergen's model is relatively clear when considered as a skill required to perform a specific task. Thus the ability to translate a foreign language, training in a specific profession such as law or medicine, or skill in a trade such as carpentry or mechanics all are fairly clear attributes for which there is a demand and a supply. But generalization of the concept, even for labor, does run into difficulties. Thus I.Q., one of the attributes Tinbergen suggests, has many different dimensions, not all of which are applicable to or available for any given job. Less tangible qualities such as the ability to get along with people, personal appearance, or social background all may be attributes which are "required" for a job, but it may be difficult or impossible to identify or observe them except in terms of the fact that those receiving higher compensation appear to be those having such traits.

In other words, a serious identification problem arises. It is assumed that the market adequately matches skills which are required against skills which are available, and that non-economic factors affecting the compensation of specific individuals are unimportant. There are, however, major institutional considerations which can only be brought in by defining the skills required in a taxonomic or tautological sense. Thus for example, while higher pay for seniority may in some cases reflect higher productivity of those workers who are experienced in their jobs, in many instances the seniority reflects a cultural and institutional system of remuneration which is in fact quite contrary to actual productivity. This is especially true at higher salary levels, where more senior executives are frequently given relatively unimportant jobs and high remuneration in order to remove them from strategic places in the organizational structure. The principle that an individual rises to his level of incompetence may be more pertinent than the principal of matching job skills and abilities. Similarly, to the extent that individuals obtain jobs as a consequence of their socio-economic status, this status becomes one of the determinants of income even though in any real sense it is a requirement not for doing the job but rather for getting it. Basic institutional factors which affect the distribution of income other than the operation of the free market system will be omitted from the Tinbergen model.

In determining the pattern of staffing and relative incomes paid in government and large corporations, Parkinson's law may be more relevant than the law of profit maximization.

For non-labor income, the problem is even more acute. Tinbergen takes as given the initial asset endowment of individuals as income recipients. However, this asset endowment in turn is a function of the income distribution, and to state that wealthy people who have assets will have high incomes does not seem to be highly illuminating from the point of view of income determination. One would like to know to what extent institutional inheritance factors, stochastic elements such as capital gains, and other unearned income affect the income distribution, compared with earned income and saving. Just to include the present distribution of wealth as an attribute on the supply side reduces the potential meaning of the income distribution model.

To make his model more mathematically operational, Tinbergen has had to introduce a number of other restrictive assumptions. Specifically, it is assumed that the attributes on both the supply and demand sides are uncorrelated, and that job and skill distributions are log-normally distributed. Although Tinbergen feels that this is not a serious inconvenience with regard to labor, he does recognize it as a problem with respect to assets.

With respect to the normative distribution of income, Tinbergen's model considers that each individual has a set of needs related to the job which he fills, his skills, and his family characteristics. His utility function is a combination of these elements taking into account the relative attractiveness of the job which the individual is performing. Thus factor payments to individuals with the same skills but in different jobs will differ by the difference in the compensation for "tension" connected with the different jobs which they take. This aspect of Tinbergen's theory is very interesting indeed, since there has been little discussion in the literature of the disutility of work which an individual performs to obtain his income. Tension in this context means the distaste which a person has for doing a given type of work, for which he must be compensated. A highly paid job that was disagreeable might in fact be equal in social welfare to an agreeable low-paid job. Unfortunately, in the actual world, highly paid jobs tend to be agreeable and low paid jobs disagreeable, with the consequence that in fact the income distribution is far more unequal in welfare terms than in money terms. In this context, also, it would be necessary to take into account the positive utility that some people attach to their jobs. Not everyone dislikes his job; some "live for their work" and would willingly do the work at lower pay.

It would certainly be useful to take these elements into account insofar as possible, but in the present state of our knowledge building an optimal distribution of income seems very remote. Indeed, in welfare terms it may be quite irrelevant. It is interesting to note that in the practical case governments worry about only the two extremes. The poverty group suffers both in terms of present welfare and of their ability to attain higher levels of welfare for themselves and their families in future periods. The extremely wealthy receive income, especially from sources other than earnings, which seems unjustified from an ethical point of view; particularly unjustified is the accumulation of wealth over generations such that future generations may hold wealth unrelated to their own contribution

to society. It seems clear that the income distribution can be improved substantially without getting involved in many of the considerations which Tinbergen raises with respect to the normative distribution of income; the interesting and operational questions are either excluded from the model or buried in the assumptions.

Finally, the analysis of the redistribution of income again seems excessively formal. By definition, lump-sum taxes cannot affect the distribution of income in any way which is systematically related to income. Presumably the objective of redistribution is to remove income from those who have it and give it to those who have less. Since by definition in the model those who do not earn income do not have the attributes necessary to earn income, one cannot tax potential skills as long as those skills are merely potential and do not yield income. It is therefore difficult to see what mechanism of redistribution can be used. Interpersonal comparisons of welfare still pose insuperable obstacles, which Tinbergen's model does not appear to have overcome.

The literature on income distribution theory

Bjerke's survey of the literature on income distribution points out that the skewness of the size distribution of income has provided a challenge for statisticians, economists, and sociologists. The economists and statisticians have generally attempted to explain the income distribution in terms of stochastic processes related to the underlying attributes of skills and other personal characteristics. In contrast the sociologists emphasize the importance of a large number of different factors together with the institutional characteristics of the system and the existing state of the society.

In many ways Tinbergen's positive theory of the income distribution comes out of the theoretical-statistical school. His concern with attributes and their distribution and the role that they play in the supply of the factors of production is directly related to the work of Roy, Mandelbrot, and others which Bjerke describes. For the most part, however, the theoretical-statistical school was concerned solely with the supply side of the question, without considering the nature of demand. Like Tinbergen, they give relatively little explicit attention to the existing distribution of wealth, or to institutional arrangements relating to the income distribution such as pensions and transfer payments.

The sociological school views the income distribution in a historical and institutional context. They do not offer a coherent, integrated theory of the income distribution, so much as point out a great many factors which affect it. Little systematic theory is provided as to the nature and importance of these various influences. Some of the empirical studies of the income distribution have attempted to measure socio-economic factors, but while these are suggestive, they still do not provide the basis for a theory.

Unfortunately, the situation is well summarized by Champernowne, who said that the theoretical model must be either unrealistically simplified or hopelessly complicated. The theoretical-statistical approach tends toward the former, the sociological-institutional approach the latter.

The distribution of income and welfare

The remaining articles in this issue are primarily concerned with the relation between the distribution of income and the distribution of welfare among individuals. Economists have generally been content to assume that the distribution of income is highly related to the distribution of welfare. Although this is not explicitly stated, for instance, in Tinbergen's model, it is more or less implied that the observed distribution of income would be related to the distribution of welfare.

In analyzing the social significance of the income distribution statistics, Bentzel concerns himself with the questions of (1) how the distribution of income is related to the distribution of consumption, and (2) how the distribution of consumption is related to the distribution of welfare. With respect to the income-consumption relationship, Bentzel points out that many low income individuals belong to special categories such as students, soldiers, apprentices, and new entrants, for whom consumption is not necessarily highly related to income. Similarly, consumption may well exceed income for such groups as farmers or individuals living with relatives. As a result Bentzel concludes that for over 40 per cent of the population income is a poor measure of consumption.

In part, Bentzel's observations are due to the failure of the money income measures to include income in kind provided by the government or others to specific individuals. To correct for these omissions, it would, of course, be necessary to include transfers among individuals so that deductions from income as well as additions are covered. Consumption may also exceed income through the using of past accumulated assets; this is especially true of older and retired people. Although Bentzel does not mention it, it is of course also true that income which exceeds consumption contributes to welfare by providing a sense of security and satisfaction which they prefer to spending the same money on luxuries. It is not necessarily true, therefore, that consumption is in all cases a better proxy for welfare than income.

In considering the distribution of consumption relative to that of welfare, Bentzel points out that needs of different individuals differ widely in terms of age, marital status, family composition, etc., and that public consumption is an important element in the welfare of an individual. On this basis he proposes to create a welfare measure based on the assumption that all individuals have identical welfare functions and declining marginal utility. With these assumptions, of course, an equal distribution of consumption taking into account the difference in needs would yield maximum utility. An overall measurement of the actual distribution of welfare could be obtained by applying the proposed utility function to actual consumption, and the ratio of maximum utility which could be obtained under equal distribution to actual utility would yield a measure of the inequality of the income and consumption distribution.

The points raised by Bentzel in expressing his dissatisfaction with the income distribution as a measure of welfare are quite convincing and valid. The misuse of the income distribution as a welfare measurement is considerable, and the suggestions for improvement are well taken. But the procedures Bentzel proposes to measure welfare do not in fact seem operational. Apart from the

operational problems, furthermore, the proposed measure leaves out many other elements such as the disagreeableness of particular ways of earning income.

The problems and puzzles of the income distribution raised by Nicholson bear directly on the questions Bentzel discusses. Nicholson is concerned with adjusting income for various types of household units or individuals so that it would be comparable in welfare terms. He points out that the needs of the household in relation to size and composition are different at different income levels. In other words the relationship between the household composition and its needs is not constant. Nicholson suggests that having children may not only increase the household needs, but may also have some bearing on household welfare. He also points out that other problems of measurement such as the treatment of social security contributions, social services received or used by individuals, and the treatment of both realized and unrealized capital gains need to be considered.

In comparing income distributions over time, Nicholson raises the question of standardization for demographic change. Thus for example, the age composition of the population may change, and the proportion of retired people with low income may increase substantially. In one sense, this might result in an income distribution showing a much larger proportion of the population with low incomes. On the other hand, if the income distribution were standardized for age distribution, it might turn out that there was less inequality than previously.

Dich's article is primarily concerned with the fact that the observed distribution of annual income by size is a mixture of what he terms the horizontal and vertical distribution of income. Short run fluctuations of income caused by such things as sickness, unemployment, and other stochastic elements affect the income of specific individuals, and at the same time incomes are reported for individuals who are at different points in their life cycles. In essence, Dich has two major points. (1) Stochastic processes distort the income distribution since over time for any one individual gains and losses tend to balance each other; the average distribution of income is more equal than the distribution of income in any one year. (2) If incomes were standardized for the distribution of individuals over their life cycles, the apparent inequality of income would again be substantially reduced. Both of these points may well be true, but they do not alter the fact that specific individuals in any given year may have low incomes, even though their lifetime incomes may not be low. The concept of lifetime income, while attractive from a theoretical point of view, does not seem highly relevant. It is obvious that events 20 or 30 years ago are likely to be quite unrelated to present economic conditions, and particularly unrelated to economic conditions 20 or 30 years hence. At best, lifetime income is an artificial creation which is dependent upon a large set of *ceteris paribus* assumptions. Few of us have any assurance of what the future holds in the way of income.

The future of income distribution theory

Income distribution theory as discussed in the papers in this issue does not present a very encouraging picture of the subject. It is apparent that the problem of explaining the income distribution is a topic which holds a great deal of fascination for economists. They have sought to explain the shape of the income size distribution by deriving a relatively small number of factors to account for

its nature. Yet it is also apparent that a wide range of institutional, historical and sociological factors are directly related to the overall distribution of income, although it is not possible to specify precisely how these operate or what their relative importance is.

One of the difficulties with the topic is that a single-scaled distribution of income which is statistically derivable is quite inadequate for describing the other dimensions that must be included in any adequate analysis of the distribution of income. Thus for example, such things as household composition, type of income received, differences in expenditure needs, stage of the earnings cycle, etc., are all submerged by aggregation. Furthermore, the attempt to disaggregate by cross-tabulation results in an unwieldy body of data in which the interrelationships among the various elements are still obscured.

The theory which Tinbergen presents, and in large measure the discussion of the other authors, is essentially concerned with microanalytic models of the individual or household. It seems highly appropriate, therefore, that the basic information relating to the distribution of income should be a microdata set which can be directly related to such a microanalytic model of individuals and households. In Tinbergen's terms, it would also be necessary to present a microanalytic model treating the demand for factors of production, as well as their supply. Although such a model is not difficult to construct from either a statistical or a conceptual point of view, there are severe barriers to including in the model on either the supply or demand side the sorts of variables contained in the Tinbergen model. On the demand side, it is difficult to specify all factor uses in terms of sets of attributes. In part this is a weakness of the Tinbergen theory, in that it does not permit factor payments for reasons other than profit maximization in which the marginal product of the factor is equated with its payment. In practice it is very difficult to define what job requirements in terms of attributes are, especially in the case of higher income payments, and if one is interested in explaining the relative differences among income recipients it is precisely this that must be explained. Nevertheless, a microanalytic model relating to employers would provide the basis for analysis of labor markets in which spacial as well as other characteristics could be taken into account.

For analyzing individual and household income, a microanalytic model of household behavior is required. For this purpose it would be useful to construct a microdata set of individuals and households, giving the various characteristics of the household including the patterns of income and expenditures as well as its other characteristics such as age of the members, education, labor force participation, and occupations. Such a microdata set could then be used to test different models of income behavior, and to see what impact various kinds of social changes or economic policies might have on the distribution of income under various assumptions. The technique of analysis proposed is simulation based upon specific microanalytic models and applied to microdata sets.

An example of a study employing such an approach is the analysis of the factors affecting the income distribution of the aged population of the United States over the next 20 years undertaken by James Schulz.¹ Any aggregative

¹James Schulz, "The Future Economic Circumstances of the Aged: A Simulation Projection, 1980", *Yale Economic Essays*, Vol. 7, No. 1, Spring 1967.

model addressed to this problem, even based upon consumer behavior, would have to be very complex indeed to yield a satisfactory technique of projection, and because of the aggregation problems involved it would be quite difficult to analyze the impact of any individual factor. In tackling this problem, Schulz constructed a microdata set based on the Bureau of the Census 1-in-1,000 sample of the U.S. population in 1960. For each household he created on the basis of information from this and other sources an income statement and a balance sheet. A microanalytic model of the life process of the household was developed to move each case in the sample forward in time. The model was stochastic, such that the occurrence of an event in any household was based on probability. For example, for any given time period the first question asked was whether the head of the household died within the period. In order to determine this, life expectancy tables were consulted, taking into account the age, education, race, and sex of the individual. Given the probability, a random number was selected and if this number fell within the indicated probability range a death was considered to have occurred. If it fell outside the range, the individual lived for the period in question. Other events such as members of the household becoming unemployed, entering the labor market, retiring, etc., were handled similarly. During each period the household accumulated goods and its members accumulated pension rights depending upon their individual situations. After the simulation had proceeded over a period of 20 years, a census of the remaining population was taken to determine the patterns of income distribution for specific groups.

In such a model, it is of course necessary to make basic assumptions with respect to such things as the trend in wage rates over time, the cost of living, increases in social security taxes and benefits, and the changing role of private pension plans. But because of the nature of the model, it is possible to alter such assumptions and see what impact different assumptions would have on the income distribution. From the point of view of public policy, wider ranges of options can be introduced to study the nature of the social security system or the effect of the introduction of such measures as negative income taxes. Or it is possible to compare the impact of the existing social security system with those of other countries, applied to the same population.

Such a microanalytic model is still partial. It does not take into account the impact of changes in the household sector upon other parts of the economy. To take these factors into account, it may be possible to introduce some of the macroeconomic relations of more general macroeconomic accounting systems, imbedding microdata sets within the national income accounts. A microdata set for households, for example, when aggregated should equal the control totals of the household income and expenditure account of the national accounts.

The construction of microanalytic models requiring the manipulation of microdata sets would not be possible without the aid of the computer and the availability of large sets of data. On the other hand, both of these are now becoming more widely available. Many central statistical offices already have well-ordered sets of information on households, establishments, and companies, and computers which can handle such large datasets. In the United States, the 1970 Census will generate six 1-in-100 samples (approximately 2 million individuals each) which will provide information on individual households. Other

related microdata sets are also coming into being. The tax model prepared by the Internal Revenue Service provides tax return data on 100,000 individuals. A sample of social security records now exists, and special samples on poverty groups or panels of individuals over time are being developed.

With such basic data it becomes feasible to construct microanalytic models which can both be tested against the wealth of information available, and be used as a basis for simulations analyzing the impact of social policy upon the income distribution. Many of the questions raised in the various papers in this issue can be successfully attacked in this context. Thus for example the relationship of the distribution of income to the distribution of consumption can be examined more critically, taking into account how differences in consumption patterns are related to household incomes. For studying the consumption of social services a microanalytic model is also useful, since in many cases it is possible to identify the characteristics of households using specific social services. A family with school age children uses schools. Health and medical services are provided differentially to families of different characteristics, and the aged may get special services. Simulation techniques can also provide partial answers to Dich's problem of horizontal and vertical distributions, making it possible to compute average income over time for households at different stages in their life cycles.

Historical, institutional, and sociological factors can be brought into a simulation model far more satisfactorily than into aggregative models. With respect to historical factors, the existing stock of wealth, the relationship among generations of households (to indicate inheritance patterns), and even the past history of individual households can be included as part of the data which affect current status and future behavior of specific households. Institutional factors such as the level of inheritance taxes, minimum wage laws, and seniority rights can all be introduced explicitly into the model. Sociological differences such as ethnic or racial background which affect employment or migration patterns can also be explicitly dealt with.

In summary, it must be recognized that progress in the field of income distribution theory is dependent upon analytical techniques and empirical information as well as upon the theoretical models themselves. Until there is an interaction between the theory and the data, the theory itself cannot proceed. On the other hand, a formal microanalytic theory is required if one is to proceed with empirical research. The use of microanalytic models for simulation in conjunction with microdata sets provides the economist with a powerful tool for understanding the nature of the income distribution.