LECTURE 2

A THEORY ON ACTUAL AND EQUITABLE INCOME DISTRIBUTION

2.1. The role of welfare or utility in positive and normative theory

If we agree that a complete theory of income formation and hence of income distribution has to be based on supply of and demand for production factors, let us then consider the determinants of these two sides of the factor market. In so doing I am going to concentrate on the labour markets since the markets for capital, in the restricted sense, and natural resources have been dealt with extensively by earlier writers. Moreover, the relevance of these two factors for income distribution in advanced countries has shown to be restricted. In contradistinction, labour, by far the most important

production factor at this stage of our societies, has been relatively neglected. For a long time labour has been considered as one factor, suggesting a certain degree of homogeneity, which is very far from reality. The unrealistic treatment of labour in economic theory also led to models where the supply of labour was seen, first of all, as a *quantitative* concept, expressed in the time worked as the main choice for the supplier to make. In fact, working time for a large majority of the labour force is almost given by social legislation, and hardly an element of individual choice. Far more important is the *qualitative* aspect, that is, the type of labour supplied and the intensity or speed of work. This qualitative aspect, to be sure, can and must also be quantified and an enormous amount of work has been invested in *job evaluation* in the last decades. Only recently, however, have traces of this information penetrated into econometrics. The preceding remarks imply that we must discuss the labour market as a complex of market compartments with as many dimensions as the characterization of labour requires. Since job evaluation for the simpler jobs has worked, for quite some time, with twenty or thirty aspects, these numbers may be the number of dimensions needed; perhaps more if all jobs have to be included. Fortunately, on closer consideration, several aspects appear to be highly interrelated and so we may already gain considerable insight with many fewer aspects: three or four.

A basic observation, however, is that we cannot restrict ourselves to a characterization of jobs only, but that we must use a *dual set* of figures: one set of the degrees or intensities of the aspects *required* for each job (or compartment of the labour market), and a parallel set of the degrees or intensities of the aspects *available* in the persons applying or considered for each job.

Every economist will agree that a supply function of labour of any category has to be derived from the *utility* functions of the individuals relevant to that category. In order to facilitate communication with practice and with other social sciences we had better replace the word utility by the broader concept of *welfare,* so as to avoid too narrow interpretations of utility. We do have to avoid the word happiness, I think, since that depends on subtle elements such as friendship, love, religion and so on and we had better stick to things 'within reach' of a socioeconomic system. The phrase 'welfare' usually covers about that: things which can be affected by social organization in the wide sense. In the economist's mind an individual's supply to the labour market compartments he is interested in can be derived from the maximization of the individual's welfare function, and hence we have to specify and possibly measure this function.

We will speak of welfare functions of individuals or of households, depending on the objects of observation available. When speaking of households

we assume there is a decision-making mechanism in each one.

For the specification of a welfare function it seems appropriate first to sum up the three groups of elements entering into a welfare function and only identify individual elements as a second step. I will introduce variables, parameters and coefficients. By *variables* I mean elements which for a given individual or household can change their value, whether or not such a change is under control of the individual household. Examples are changes in society, usually not under its control, such as wage scales or school fees; whereas a change under its control is a change in job or place of residence.

By *parameters* I mean elements whose values characterize the individual household considered. They may refer to *productive characteristics* such as IQ, years of schooling completed, experience – in brief, the degrees or intensities of some aspects relevant to his work. They may also refer to the *needs* of the household considered, such as number of household members, their ages and their health, or also needs arising from the training received (professional needs), or, finally, cultural needs.

Clearly some of these parameters are only *approximately* constant: they may change over time, but usually do so slowly. For individuals still involved in a training process they may change more quickly, a subject dealt with in an elegant way by

Hartog (1974) and others. These individuals are not usually a large proportion of the total active population, if they are part of it; and so our treatment of parameters as constants will not generally be damaging to our results.

Assuming, then, that variables and parameters together determine a household's welfare, their impact on welfare depends on the mathematical formula with whose aid welfare can be determined. Such a formula has a mathematical shape and contains coefficients. The latter may be said to indicate the impact of variables and parameters on welfare. This presupposes that welfare can be measured, a question to which I will return soon. Assuming this for a while, a further methodological point I want to stress is that mathematical shape and coefficients *are the same for all human beings*. If somebody wants to deny this and pretends that he can show a certain coefficient to be different for differing households, I can answer that his coefficient is a parameter. We shall meet examples of this situation.

Once welfare functions have been established for the households to be included in our theories, they are instrumental for three purposes. First, we can estimate the household's *supply behaviour* on the labour market. Here each household is supposed to maximize its welfare, taking into account the values of the variables beyond its control and its parameters, but maneuvering with the variables it can

choose. The main choice to be made is the choice of the job of the household's head; further choices may be the jobs of other members of the household. Depending on how the situation is described – by which theoretical style – the maximization problem will be posed and will have to be solved in different ways. I shall come back to this aspect in section 3.4.

The second use we can make of welfare functions is to define *equity or justice* in distribution. In fact we should not speak about income distribution, but rather distribution of income, jobs and education (as far as education has not been completed). My proposal is dead simple: why don't we define equity as *equality of welfare*? I am in agreement here with Kolm (1972). It will be clear that the definition can only be used if we consider welfare measurable. Moreover, it has to be stated immediately that the definition of equity does not imply that we know political instruments to *attain* equity, without giving up other desirable aims of a socioeconomic policy or of a socioeconomic system. I hope to deal with that problem in my fourth lecture (in particular, section 4.4).

The third use we can make of individual welfare functions is the construction of a *social welfare function.* Here anyone engaging in this venture has to pass a value judgement: the first one we encounter, since I maintain that so far I have not passed any such judgement. My own preference here is to

use a symmetrical function Ω of the individual welfare functions ω_i for all individuals $i \in (1, ..., I)$. Among these the simplest function again would be the unweighted sum, hence

$$\Omega = \sum_{1}^{I} {}^{i}\omega_i \, .$$

After a choice of Ω we are able to define a (static) *social welfare optimum* as the maximum of Ω, taking into account a number of constraints such as production functions, balance equations and others.

As I have shown in my recent book (Tinbergen, 1975, p. 131) in some cases the social welfare optimum may imply equity; but this is not necessarily always so. If not we may determine the Ω-optimum under the further *constraint* of equity.

What I said about equity also applies to the social welfare optimum. An agreed scientific definition does not imply our knowledge of the means to attain the optimum.

2.2. *Measurement of utility: Total vs. partial measurement*

In my preceding argument I assumed that welfare can be measured. This assumption is not shared by all my colleagues – which, as you know, is an under-

statement. I am not going to repeat my arguments in favour of my position but prefer to summarize it very briefly. To those who maintain that welfare or utility cannot be measured my answer is that I can only agree that thus far it has not very often been measured. A few of us have done some work on utility measurement in recent years and what I propose to discuss are only the differences in approach chosen. The pioneer in this field is Van Praag (1968, 1971, 1973). In his inquiries with about 3,000 Belgian and 3,000 Dutch consumer union members he asked the individuals concerned (heads of households) to express their degree of satisfaction by one of the ten descriptions we all know from school scores, from 'very bad' to 'excellent'. He attached numbers to that scale by dividing our school scores by ten, hence running from 0.1 to 1.0, where 0.8 stands for 'good'. Van Praag asked this question not only for their actual income, but also for incomes which, given their parameters, would make them feel very bad, bad, etc., up to excellent. The interesting feature of the answers was the relative regularity in the income scales so obtained, which enabled him to propose a mathematical function of their income as a utility function holding for all, although, of course, with shifts for the parameters. Van Praag's procedure, if accepted, makes it possible to perform a *total* measurement. The type of procedure used is to take people's opinion about a situation differing from their actual situation as

correct. This procedure, as is well known, stands at variance with another statistical method, namely to observe behaviour as distinct from opinion. My own approach[3] is based on this latter procedure, but leads only to a *partial* measurement. In principle I take groups of households supposed to have the same parameters and therefore to be able to exchange positions (in particular job and income variables). Within each group I find people having chosen different jobs, yielding different incomes. The income differences must then reflect only a *compensation* for differences in effort needed to do different jobs, supposedly all open to members of the group. The measurement can only be made within each group with the same parameters: an exchange of position between people with different parameters is not possible: one cannot, as an act of choice, have one's parameters changed. A comparison of welfare between individuals with different parameters can only be made either by Van Praag's complete measurement or by additional *assumptions* – at least as long as we cannot, by some medical operation, transfer somebody from one parameter group into another. A few additional remarks follow about both possibilities. A reasonable assumption would seem to me to be that people with higher scores for intelligence, creativity, leadership,

[3] The idea came to me as the result of a discussion with Derksen (1970).

etc., will not feel less satisfied than those with lower scores. This assumption, however, only sets a *lower limit* to that satisfaction or welfare – which will, however, be of some value, since it sets an upper limit to income differences, which according to our criterion are equitable.

Changes of parameters do occasionally take place as a consequence of accidents, illness, and so on. It seems too cruel to recommend systematic use of this method.

From the preceding argument it may have become clear that the essence of my own method consists of making a distinction between, on the one hand, *strict parameters* and, on the other hand, variables *strictly open to deliberate choice* of the individual (or household). The simplest illustrations I have produced so far, to test the workability of the method, consist of cases where I assume one parameter only, reflected in years of schooling completed, and one variable under control, the job. In a two-entry table, columns give incomes of people with the same schooling, and rows give people in the same class of jobs. Put that way, vertical income differences are essentially compensatory and hence equitable, whereas horizontal differences are not. Rather, they cause, if I assume people with different parameters as equally satisfied, other things equal, undue differences in income to be interpreted as *scarcity rents*, which are not in themselves equitable.

I think it is of some use to dig a bit more deeply here. As I already observed I introduced extremes of strict parameters and strict choice variables. In actual fact, there is rather a whole *spectrum* of human qualities, from completely innate to completely adaptable qualities. Most qualities will *partly* rest on some innate elements, combined with elements subject to the individual's willingness to make an effort. To recognize the existence of two components is interesting, I think, both to the economist and to the educator. For the economist it is useful to know that certain qualities can be influenced by incentives, whilst others can't. If they cannot be stimulated, there is no point in having, in our socioeconomic system, incentives for stimulating them. For the qualities which can be stimulated, we want to have incentives – at least if we like the qualities they enhance. For the educator alike it is important to know where to insist and where to accept. Unfortunately our knowledge about which qualities can be improved at will and which cannot is limited. There exist some where we agree that either you have that quality or you don't. But for many other qualities we can't be so sure. And what about willpower itself?

Let us return to some illustrations of innate or almost innate qualities to be listed in our two-entry table along the horizontal axis. Instead of years of schooling, some authors were able to collect material on IQ, or even childhood IQ. The degree of in-

heritance of IQ has been the subject, as I said, of several American inquiries, and Husén (1968, 1975) also collected data concerning this relationship. To the extent that some authors use the socioeconomic status (SES) of the person's parents as explanatory variables of income, this certainly must be considered as representing some 'innate' quality (in the sense that it surely cannot be changed any more by that person).

Other examples of effort may be seen in years of schooling up to a point – which then means a completely alternative use of that element. It is also conceivable to estimate some component of years of schooling, for instance the residual left after correlating it with the innate components such as IQ, SES of parents, etc.

Age, usually considered a dummy for *experience* on the job (after deduction of schooling years, plus five or six), appears to have an explicit impact on income scales, and may be considered a dummy for all sorts of qualities where experience matters.

As in job evaluation, a series of qualities have some relationship to a person's ability to take independent decisions, in short, '*independence*'. It is generally felt to be an important co-determinant of income and here it is justified to ask whether independence can be learned or is inborn. I presume it is innate to a considerable extent, and in some of my experiments I treated it as such with considerable success.

There is no difficulty in working with several parameters, also in the two-entry table, since the heading of the table can be a multiple one.

The assumption I made about the impact of education as a parameter, namely a zero impact on welfare, is possible to test with Van Praag's material and has been confirmed (Bouma, Van Praag and Tinbergen, forthcoming).

I tried out one other method to determine, also with the aid of my general approach, the influence of the schooling parameter on an individual's welfare. This method consisted of the introduction into the utility function of another correction on income, alongside the correction for effort, namely what I called a *tension compensation.* It consisted of a function of tension between the quality (in this case: schooling) required for the job and the actual quality. I assumed that both a positive and a negative value of the difference between the two is unpleasant for the individual and should therefore be compensated for in income. In a number of cases it turned out to be a possible determinant of income, but the size of the compensation estimated from people's behaviour appears to be very uncertain.

One difficulty experienced at the time I made the first attempt was that no explicit data for the Netherlands on schooling required was available to me. I then added the assumption that schooling required coincides with the *upper quartile* of the fre-

quency distribution of observed actual schooling. Later I obtained material for a few hundred employees of a large firm on both required and actual schooling. This material supports my assumption reasonably well.

Another difficulty experienced, in an attempt to use material of the American Census of Population of 1960 (taken from Dougherty (1971)), consisted of limited knowledge on the two-entry table of incomes for different schooling and different job categories (Tinbergen, 1975, pp. 69–75). I only knew the row and column averages and total frequencies, but not those for the individual cells. The heroic assumption I made was that the cell figures were optimal in the sense that the jobs to be filled had been filled by the American economy at the lowest cost in terms of years of education. This enabled me to estimate all the cell values. Census material for 1970 was more complete in that all the figures in the individual cells were published (U.S. Census of Population, 1973). This permitted a test of the frequencies estimated with the aid of my optimality assumption as compared with actual frequencies. The correlation coefficient was 0.79.

To close this part of the discussion I want to admit that Van den Doel (1975) is quite right that the coefficients found with the aid of my first attempts to apply the method are still diverging so much that in fact they are parameters, and further research is desirable to determine real coefficients.

The impact of schooling alone in the simplest theory without tension (Tinbergen, 1975, p. 74) varies from 0.091 to 0.144 for seven American states as against 0.075 for the Netherlands, still showing merely a same order of magnitude.

2.3. Production functions as the background for demand

Most work on the demand side of the labour (and capital) market has been done by the group which I indicated (cf. section 1.7) as the education planning school. In the well-known way, they derive demand from the assumption of competition among the organizers of production, leading to the equality of marginal product and labour (or capital) income before tax. Empirical research has been conducted in order to estimate various types of production functions, distinguishing between a number of types of labour. Production functions have been used varying from the old limitative picture, where all types of labour are used in quantities dependent on the volume of product, to functions with substitution possibilities of various types. The simplest type here is the Cobb–Douglas production function; a very popular type today is the CES production function, where various levels of agglomeration of the factors considered have been considered, especially by Dougherty (1972). Some authors have

used VES functions; and recently the translog production function, as a different generalization, was used by Berndt and Christensen (1974).

In my own recent work I used another generalization of the Cobb–Douglas production function, combining labour with the same actual level of schooling but different required schooling as one factor.

Finally, work on demand for labour can also be done without specifying a production function (cf. section 3.4). In a recent discussion with Bowles (1969), Dougherty (1972), Psacharopoulos and Hincliffe (1972) and Kuipers (1973), I tried to make two points. One is that two sorts of substitution of labour should be distinguished: *education substitution* and *job substitution*. In the former case, on the same job two people with different education are interchanged; in the latter case, two people with the same education exchange jobs. Moreover, *short-term* and *long-term* effects of relative wage changes on the relative demand can be different. The second point I tried to make is that the estimates so far offered could be biased for lack of proper *identification* of the relations tested. Here I saw a revival of an old discussion around the attempts to test demand and supply relations. In two attempts to use the material of Bowles and that of Dougherty for what I felt to be a better specification, I found substitution elasticities of university-educated workers for all others to be

closer to minus one. In a continued discussion between Kuipers (1975) and myself (Tinbergen, 1975a) we agreed that more research has to be done. Kuipers tried out equations with demand factors different from the ones I had chosen (the portion of active population in the services sector) to characterize the industrial structure by the size of the sector using by far the larger part of university-trained manpower. Also he took a different measure of relative salaries. As a consequence he found elasticities closer to −2, but, as other authors including myself, with a considerable dispersion. I still feel that my specifications are to be preferred, but I won't go into too much detail now. The interested reader may be referred to my last two publications (Tinbergen, 1975a, 1975b) and forthcoming further discussions.

2.4. Market and social structures

Some arguments have been raised against a purely economic demand–supply theory of income formation. Thus, supply may not show free competition because of the *monopoloid* coalitions: trade unions generally, or restrictions to market access as practiced by some of the liberal professions, such as dentists. Social structures may also impede free access to the market. The clearest example here is the *caste system,* but there are numerous examples

of lesser importance in many countries. I do recognize the existence of all these phenomena. But we may include them in our theory not only by using the word scarcity in the purely economic sense, we can add consciously organized scarcity – if you like, '*artificial*' *scarcity* – to our scarcity concept, provided that its influence is reflected in the supply factors. Often it will already be reflected in that, for instance, the numbers of academically trained persons already reflect whatever limitations of access to the university exist. The problem is then shifted back to the study of that access. The type of study required can be formulated to be the study of *unused reserves* in manpower qualifying for a university education. De Wolff (1963) made such a study for the Netherlands; recently Dresch (1974) presented one for the United States. There are many more such studies.

2.5. The race between technological development and access to education

In an attempt to understand the long-term tendencies of the market for third-level educated (alternatively, for university-trained) labour I found some figures for the United States and the Netherlands for the period from 1900 on, with extrapolations up to 1990 (Tinbergen, 1975, pp. 97–106). Adding some assumptions, among these the substitution

elasticity of −1 of that type of labour vis-à-vis other types, I arrived at figures showing a substantial relative decline in third-level incomes as a percentage of average incomes. The decline would have been less, but not absent, if the elasticity, in absolute figures, had been higher.

The two preponderant forces at work are *technological development*, which made for a relative increase in demand and hence in the income ratio (third-level to other labour) and *increased access to schooling*, which made for a relative decrease. In this 'race', education won the battle from technological development and made for considerably less inequality among the categories here considered. This leaves open the question of whether technological development cannot *purposely* be changed — a question to which I shall return (cf. section 4.3).

Bearing in mind that we found *independence* to be another important factor of scarcity and hence of relatively high incomes, we may venture the additional working hypothesis that an equalizing tendency may have worked in this field as well. The basis for such a hypothesis could be two subassumptions. One is that independence is innate and that the portion of the population showing this characteristic has therefore not changed. The other is that increasing centralization as well as decolonization have reduced the demand for independent decision makers. A list of question marks

is justified, however. But the assumptions, if accepted, would lead to another component of equalization: decreased demand meeting with constant supply. I hope these are challenges to dig more deeply into this aspect of the matter.