# ON THE POSSIBILITY OF MEASURING THE DISTRIBUTION OF PERSONAL INCOME

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The income distribution statistics which are based on income for a single year show a far larger inequality of income than actually exists. The distribution of annual incomes differs from the distribution of lifetime income partly because of short run fluctuations because of such things as sickness, unemployment, and unusual gains, and partly because different individuals are at different points in their life cycles. The vertical distribution of income can be considered to be the distribution of lifetime income. The horizontal distribution can be considered to be the differences arising in the current period due to short run fluctuations and differences in the age-income cycle of persons. The observed annual income distribution statistics are a mixture of the vertical and horizontal distributions. The estimation of the lifetime income distribution implies discounting, and also raises questions as to the treatment of transfers, subsidies, public investments and taxes. However, statistics based upon a mixture of the horizontal and vertical distributions of income are of no interest.

1. Most summary papers on the distribution of income are based on income for a single year. All income assessments from the tax returns are tabulated, and in these tables the time dimension of the assessed income is disregarded, i.e., the dependence of the income on the age of the person concerned and on income fluctuations.

To justify this method of calculation, a concept of inequalities of income is needed which requires statistics on only one year's income (whether tax incomes or total incomes). This is, however, not possible. Incomes are, as everybody knows, partly subject to short fluctuations—as a consequence of loss of income in connection with illness and unemployment and of the dependence of business incomes on uncertainty and risk—and partly subject to a long-term increase from youth to middle age, and a fall in old age.

Therefore we may have incomes which for a long period, perhaps the whole period of life, are equal and nevertheless the annual statistics will show a considerable inequality. What is the point of demonstrating such inequality?

I think we must use two different expressions for the distribution of income or inequality of income, whenever we assess inequality of income and levelling of income. We must distinguish between the *horizontal* and the *vertical* distribution of income or inequality of income. The horizontal distribution of income expresses the current differences of annual income due to the short fluctuations and age differentials which I have just mentioned, whereas the vertical inequality of income indicates the differences between the total income referred to a certain age. The horizontal distribution of income for a person can only be expressed by means of a curve or a table, and no single expression can be had showing the difference between these curves. The difference in the vertical distribution of income can be expressed in one figure indicating the difference in life incomes.

2. It would be convenient in illustrating the horizontal as well as the vertical income distribution to make two different calculations: one exclusively the primary incomes (income from work, capital and risk), and the other including all transfer payments either in cash or in price reductions of public services.

In the latter case taxes should be withdrawn and pensions, cost of hospital services, education, special care, etc., added. This would give an adjusted income distribution—horizontal and vertical—showing the effect of taxes and transfer payments to compare with a "free" income distribution.

In comparing the income in different occupations—the occupational income distribution—a differentiation between the horizontal and the vertical income distribution likewise is necessary. Because of the different horizontal income distribution in indifferent trades the average income for each trade is of no interest in these comparisons.

Income statistics based on a mixture of the horizontal and vertical inequality of income, as is the case with statistics based on tax statistics and used to elucidate differences in occupational income, cannot provide an answer to any sensible question. Therefore, it seems to me that such statistics are useless or even detrimental as they show a far larger inequality of income than actually exists.

The conception of inequality of income is closely connected with the notion of time, i.e., differences of a certain duration. It is the differences in standard of living you have in mind and you don't get any picture of these differences if you consider wealthy business men's casual 0 incomes as an indication of the existence of a population group with no income. Such income groups are non-existent, and a statistic showing this existence is simply misleading.

To indicate how large a share every tenth of the population has of total taxable income (see example below from Danish statistics) is a method which is much employed in income distribution statistics but nevertheless not very valuable.

Distribution of Personal Income
1955–1966[1]
(Percentage of total assessed income)

| Lowest decile | 1955 | 1966 |
|---|---|---|
| 1st „ „ | 1·4 | 1·7 |
| 2nd „ | 3·1 | 3·7 |
| 3rd „ | 4·7 | 4·9 |
| 4th „ | 5·9 | 6·4 |
| 5th „ | 7·5 | 7·7 |
| 6th „ | 9·4 | 9·5 |
| 7th „ | 11·3 | 11·1 |
| 8th „ | 13·1 | 13·2 |
| 9th „ | 16·2 | 16·0 |
| 10th „ | 27·4 | 25·8 |

[1]Kjeld Bjerke: "Forskydninger i den personlige indkomstfordeling 1939 til 1964," *Socialt Tidsskrift* 1965. The figures for 1965 and 1966 are calculated on the basis of *Stat. Efterretninger*, 1967, No. 16, and 1968, No. 28.

Theoretically it is not impossible that the inequality indicated above, showing a mixture of horizontal and vertical inequality of income, might be compatible with an egalitarian vertical distribution of income. But in the real world inequality in income distribution due to age and shorter fluctuations would be too small to explain the disparities shown in the table. The figures indicate an inequality but they measure neither the vertical nor the horizontal inequality of income.

It follows from this that you cannot conclude from the table above, as the board of the Danish Economic Council has done, that the increase in the lower income brackets and the corresponding reduction in the higher prove that a levelling of income has taken place.[2] Consequently, you must decide in this as in other cases whether you want to explain the vertical or the horizontal inequality of income and give up all mixtures.

Even though the question of inequalities of income is a question of inequalities in the standard of living, the appropriate length of the period to be taken into consideration is not clear. To my mind the most rational period would be the life span but special supplementary studies may be added dealing with the standard of living of specific groups (students, old age pensioners, invalids, etc.)

3. Until now investigations of the distribution of income have only been concerned with differences in the money value of the incomes plus collective services and other price-reduced public services. This is obviously only a first approximation to an economic investigation, which also must include differences in the disutility of work in different occupations. With perfect mobility of labour almost all differences in wages would be equalized and the resulting nominal inequalities would express complete equality. If pleasant clean work with social prestige is better paid than unpleasant work, this is an indication of equality of distribution. Even if it is difficult to distinguish between equalizing and real differences it is none the less necessary to keep these welfare aspects in mind, when interpreting the differences in money terms.

4. Both the vertical and horizontal distributions of income relate to the time dimension. Is it possible to use the existing income statistics based upon income in one year by age groups to evaluate the horizontal and the vertical income distributions? This would be possible only if the differences between incomes in each occupation and each age were constant through life for all persons. But this is not the case.

*Bjerke's*[3] investigations of the distribution and composition of wage income show a considerable deviation for all age groups. If similar investigations were made of all incomes on the basis of an analysis of the tax returns according to age, similar or rather greater deviation would appear. Now the very fact that there are deviations from the average does not indicate of course per se that the income curves could not be parallel through life for different persons, but it is highly improbable. So we may either make calculations for each age based on the average of each occupation or industry assuming that

[2] "Formandskabet for Det ekonomiske Råd," *Indkomststatistik 1968*, Copenhagen, 1968, p. 60.

[3] Kjeld Berke, *op. cit.*

the deviations are random fluctuations neutralizing each other in the long run, or we may assume that the deviations reflect a difference which manifests itself throughout life.

In this way we get a minimum and a maximum for the horizontal inequality of income. This is also important when estimating the vertical inequality of income. Up to now the calculation made of this inequality has been based on average income for each age group and occupation. This may be legitimate when estimating the return to higher education, but it indicates neither the minimum nor the maximum of the vertical inequality of income.

If you want to go a step further, you must make longitudinal investigations, i.e. you must follow the individual person over a certain period to see how his income changes from year to year. If the period investigated is very long, e.g. throughout the lives, of the individuals in the sample, the result is a historical description which is not very important in explaining contemporary conditions. If you choose 10 years, for example, you get an impression of what might be called the structure of the fluctuations of income. If you eliminate deviations due to illness and unemployment, the remaining differences—or most of them—are the more systematic differences which are the outcome of differences in ability and chance. On the basis of this you might work out more detailed statistics of the horizontal and vertical inequality of income and get an explanation of the disparities.

From the above it appears that a prerequisite for obtaining statistics of the distribution of personal income in society is that incomes can be distributed according to age and industry and that longitudinal investigations can be made; and furthermore, that a distinction is made between factor incomes and transfer incomes. Such information can be extracted from most tax returns.

5. Many investigations of income are concerned with not only some loosely defined inequalities of income at a certain time, but also with the changes in the distribution of income from one time to another. The question may now be asked whether it is possible to use statistics of yearly income as a substitute for statistics of life income, as one wants to elucidate changes in the distribution of income over a certain period.

Such a substitution is possible on the following conditions: (a) the possible change in life income must have been the result of a shift of level of the curves of life income of the factor incomes in such a way that the relation between the income curves for the categories of income has not changed. (b) The age-composition in society and within each group of income must not have changed. (c) The relative number of persons within the various industrial categories must have been constant. (d) Changes in taxes and subsidies must only be included in the statistics of annual income as far as they indicate a change in the vertical distribution of income.

If e.g. a supplementary pension is introduced proportional to the payment of premiums which in its turn are proportional to income, this will not affect the vertical distribution of income, but result in a rise in small incomes in the statistics of annual income. In the statistics of annual income it looks as if a levelling of income has taken place, whereas this has not been the case. If a general rise of an income-independent or income-dependent old age pension or disablement pension financed by a progressive or proportional rise in taxes is carried out, a vertical levelling of income has thereby taken place, but the result of this in the statistics of annual income does not give any impression of the vertical levelling of income. The annual statistics will show a higher degree of levelling than actually has occurred. For cash transfers one must therefore assume that no changes have occurred.

On the other hand, if a rise in the price reduction of services, e.g. hospital services or collective services, takes place, income statistics on the basis of annual income—less taxes + subsidies—will show a levelling of income and this levelling will also have taken place in the vertical distribution of income provided that these benefits are distributed per head of population.

As conditions (a)–(d) cannot possibly be fulfilled, the statistics of annual income do not give any impression of the vertical shift of income which has taken place through a certain period and therefore cannot be used.

6. As the curve of life income as mentioned above varies with every single person and with the different occupations, a comparison must imply discounting.

This discounting raises special problems. The less important is connected with the rate of interest. As the *ex ante* real rate of interest in Denmark for more than one hundred years has been 5 per cent (though at present it is probably somewhat lower) 5 per cent ought to be used.

All discounting of the income to a certain age means that the curve of life income is converted to a straight line. For this to make sense it must be assumed that equal incomes throughout life give optimal utility. This is far from the case. The utility of an income of 100 for families with children equalizes an income of less than 50 at the pensionable age. I will not go into detail here. This involves, however, that we must choose a form of the life income curve which maximizes utility through life and discounts the incomes in proportion to this. Consequently it will be deviations from this curve that must be discounted and not deviations from the average.

7. The next question is how public individual cash transfers affect the vertical inequality of income. This is a question of old age pension, widow's pension, disablement pension, unemployment compensation, sickness benefits and finally student stipends, only to mention the most essential.

This raises certain fundamental difficulties. If the alternative for comparison is a state where no transfers exist at all, we cannot assume that factor incomes would be independent of this. If there were no old age pensions, for example, people would go on working longer, they would save more and live on interest, on the support from the family or by begging. As long as this interdependence between public transfers and factor incomes exists, it is impossible to give anything like an exact indication of the extent of transfer expenditures. If old age pensions were proportional to factor incomes and all persons—in the case of non-existence of a pension—had voluntarily secured for themselves a similar income at the pensionable age through work or saving, the old age pension would only have replaced factor incomes, and it would therefore be impossible to calculate the distributive effects of the transfers. As we do not know to what extent public transfers replace private measures, the net effect of public transfers cannot be calculated. At any rate it is far smaller than the gross effect. This being the case the value of these estimates may rightly be disputed. Instead of such summary statements at a given time you might calculate the vertical effects of changes in transfers from one time to another. These marginal calculations may perhaps also be the best answer to the questions asked.

8. If after all you want to make gross calculations at a given time, you have to find out how the distribution of transfer expenditures influences the vertical income distribution. As the minimum old age pension is to the benefit of everybody irrespective of income, these pensions must be distributed among the various incomes in proportion to the number of taxpayers within each income bracket. In calculating the distributive effects of that part of the old age pension which is liable to income reductions you must estimate the income at which the productive age declines to the extent that they are entitled only to income graduated old age pension. You may here choose a certain income limit for persons in productive life and distribute the old age pension below this limit in such a way that the amount falls with increasing income, corresponding to the assumption that persons with small industrial incomes also will have small industrial incomes or capital incomes after the age of 67 and therefore will get larger old age pensions than persons with higher income in productive age.

As far as widow's pension is concerned similar principles of calculation can be applied. The disablement pension is to the benefit of all groups of population as a possibility irrespective of income. It therefore has to be distributed in the same way as the minimum old age pension. Stipends should be added to life income for academics. With regard to the distribution subsidies to public services available for the entire population there is nothing of special interest from the point of view of life income.

9. Even if it does not concern the question of distribution of life income I want to make a few remarks about agricultural subsidies. It is rather arbitrary or politically determined which part of the subsidies to agriculture are given in the form of direct subsidies and which through indirect subsidies by fixing of minimum prices. It seems therefore somewhat irrational, not to include the effects of this price fixing to show how these subsidies affect personal income within the various categories of farmers.

As part of subsidies are given to people according to their occupational position (or position in the occupation) or their position as tenants or owners of one family houses it is a question whether it would not be appropriate to make special inquiries into the resulting effect on the personal distribution of income both within and between various occupations and between tenants and owners respectively. Because the characteristic feature of recent social developments is that such new criteria for subsidies have been introduced it seems to me that supplementary inquiries, e.g., subsidies to farmers compared with subsidies to workers and subsidies to owners compared with subsidies to tenants of residential dwellings, should be undertaken.

The same applies to the distribution of life income between single persons (or married without children). One ought to see which part of the expenditures for education, children's allowance, housing subsidies, expenditure on kindergarten, day nurseries, etc., is borne by single persons and married people without children.

10. In the report of the board the costs of public investments have been distributed in two ways, partly proportional to the number of persons in each income bracket and partly proportional to the total income in each bracket without coming to a decision as to which distribution is to be preferred. You therefore get two different results of the distribution of personal income. This question therefore ought to be more closely examined.

First I do not think that all expenditures for public investments can be distributed in the same way. The reason is that these expenditures benefit the individual members of society in a different way. Expenditure on roads is paid by gasoline taxes which vary proportionally to the use of roads. They therefore have no distributive effects and ought to be left out by inquiries of this kind. Investments that are short-term in the way that they are a precondition for the increasing supply of public personal services should be distributed in the same way as the expenditure on services—disregarding the fact that investments for the time being are a burden.

If we are faced with very long-term investments, as, e.g., investments in higher education, which do not yield profit before 10 to 40 years, and if you furthermore are in a period where a considerable increase of these investments takes place, you cannot distribute these expenses among the citizens according to the benefit they derive from this. For the time being the effect on utility must be wholly ignored. These investments constitute a burden which probably ought to be distributed as a negative subsidy proportional to total taxes or only to income taxes.

11. We may proceed to consider the distribution of taxes. If subsidies have to be seen from the point of view of life income the same point of view must of course be applied to taxes.

Irrespective of differences in the shape of the life income curves proportional taxes will lead to the same burden of taxation[4] whereas progressive taxes would fall heavily on the fluctuating and rising incomes and lead to an inequality between persons or groups of persons with otherwise identical economic positions. In cases where life income curves are similar the distributive effects of proportional and progressive taxes would be the same. As it is impossible to see in the annual tax statistics to which extent high or low income coincides with equal life income, it is not possible on the basis of these statistics to get an impression of how tax progressivity affects life income.

I think the problem must be solved by estimating the life income curves and trying to calculate what the taxes on income would amount to, when you apply the rates of taxation on these incomes.

The question is then how real property taxes should be distributed. Of course you must take into account to what extent these have been shifted to the prices of land and to what extent they influence the costs of production, i.e. whether they have an effect on marginal cost or not. This has been neglected

[4]The same would apply to personal taxes (poll taxes) if the time factor is not taken into account.

in all inquiries into the distribution of income. This question is, however, too big to be dealt with here.

12. Even when the supplementary inquiries mentioned above are included in an elucidation of the problems you may ask: Have you got an expression covering to an adequate extent the total effect of public subsidies and price interventions in the life income? This is, of course, not the case. The advantage has been obtained that the distribution of personal income has been linked up with a notion of inequality of income which is relevant to investigations of this kind, but you are told nothing about the horizontal distribution of income; you get no impression, for example, of how old age pensioners, disabled pensioners, disabled persons and widows are situated, and it is obvious that information about this must be just as significant as an inquiry into the effects of life income. Thus, there is nothing to do but making special inquiries into the horizontal distribution of income including the standard of living for the above mentioned groups.

By using the procedure mentioned above you have clearly separated the questions resulting from a completely different factor than that which underlies inequalities in the horizontal distribution. To repeat: Statistics based upon a mixture of the horizontal and the vertical distribution of income are in most situations of no interest.