REVISED DRAFT

August 1972

THE DISTRIBUTION OF INCOME IN CANADA

by

RODNEY DOBELL and MICHAEL WOLFSON

The authors are respectively Professor of Economics at the University of Toronto, currently on leave in Ottawa, and graduate student in Economics at Cambridge University, formerly a student at the University of Toronto. There are several people in Canada better qualified than the authors to write this paper; among them are Gail Oja, Jenny Podoluk, and Simon Goldberg at Statistics Canada, or Colin Hindle and Doug Hartle at the Treasury Board Secretariat, all of whom have more intimate knowledge of these topics than we do. But they are busy, and we have enjoyed this opportunity to clarify some of our own debates by writing this paper during the 1971/72 academic year. Occasionally we have leaned heavily on ideas of the above-named experts, and also on the suggestions or assistance of Richard Arnott and Brian Molloy of the Department of Finance, or Mario Nuti, Julio Piekarz, and Adrian Wood of Cambridge University, but all opinions or conclusions expressed, whether erroneous or not, are solely the responsibility of the authors; they have not been reviewed or approved by any agency with which the authors are associated. Technical assistance from staff of the Department of Finance is gratefully acknowledged.

1. Introduction

One could write a book about income distribution in Canada, and indeed there have been some.* This brief paper obviously cannot offer the exhaustive coverage of a full-length monograph or a detailed statistical analysis. Its goal is simply to flag a number of conceptual points and suggest some directions for further study. Particularly with growing public interest in measures like the negative income tax and the problems of poverty, and with improving taxation data or a recent census, economic analysis can play an increasing role in highlighting features otherwise buried in a mass of statistics. Such features of the distribution of income, with their obvious links to material standards of living, are of central importance both to the welfare of individual Canadians and in the consideration of social alternatives.

Everyone has some notion of what is meant by income, and recognizes that the generation and distribution of income are crucial issues in an exchange economy. These considerations affect the well-being of individuals and families by determining the goods and services they can acquire.

Indeed, in efforts to sharpen their analysis, economists have taken the above observation to define income as increased

---

* See [14] and the references there cited.

command over resources, over the output produced by the community. Whether that income is used immediately for consumption or is saved to increase a store of wealth available as purchasing power in the future does not matter; the measure of an income flow is the extent to which it enables the individual or family to exercise a command over goods and services currently or in the future.

For analytical purposes it is necessary to distinguish two forms of income, namely transfers and earnings. The former represent receipts of income not matched by any services rendered, whereas earnings are explicitly payments in exchange for services. Since income transfers (gifts, pensions, or welfare payments, for example) are directly a result of individual or social decisions reflecting non-economic motives - they are matters of individual or social preference - there is little point in seeking in traditional economic theory for an explanation of the forces determining their size or distribution.

Earnings, on the other hand, are payments for services of productive factors. These payments are made to the owners of the assets which render the services. Thus, in order to explain the distribution of "earned" income one has to explain two things: the forces that dictate the size of the payment different services can command, and the forces that dictate how ownership of assets is attained and transmitted.

Looked at from the other side, an asset is simply a tangible claim on an income stream. Membership in a family gives rise to claims on some incomes, such as gifts; membership in a nation gives rise to claims on others, such as pensions or welfare payments. Transfer payments thus must be explained by theories which describe how families or societies elect to treat their various members. Earnings, on the other hand, accrue to those who have title to assets yielding productive services, and one must explain how such claims on earnings streams come to be obtained, and how they are held or passed on.

Because transfer income is becoming more important in determining the distribution of purchasing power, emphasis has swung somewhat from explanations of what determines earnings to simple descriptions of the distribution of income and discussion of possible programs for redistribution. In the present paper, therefore, the first section sketches very briefly the issues economists have considered in attempting to explain the earnings accruing to various assets. (This discussion is not intended to be a rigorous account of an air-tight theory; it aims only to suggest the flavour of two or three of the main arguments. Students wishing to pursue the history of the controversy should refer to the readings cited in the bibliography.) The statistical background corresponding to these aggregate or macroeconomic theories is found in the division of national income into its components, and has been widely discussed, so we do not pursue that question at all.

Rather, we switch in the second section to describe the distribution of income across individuals, and to some explanation as to how these incomes are affected by age, income source, or sex. Finally, in the third section, we look briefly at the question of mobility among income classes and outline a possible explanation of observed income distributions based upon statistical models of income mobility.

2. Earnings

There are a number of different ways, historically, that the determination of "earned" incomes has been approached. Since earnings, in a capitalist society, derive from the participation of individuals in production, either directly through labour, or indirectly by their ownership of private property (machines and land), an obvious starting point would seem to be the functional distribution of income--that is, the division of income into rent, wages, and profits. This division corresponds with the three main categories of resources used for production: land, labour, and capital (alternatively machines or a fund of investable resources). These returns may be determined in the short run by the relative sizes of the stocks of various resources (including labour), the range of alternative ways these resources can be combined to produce final output, and the satisfactions individuals derive from alternative final consumption possibilities. In such a general equilibrium theory of factor prices, the resulting distribution of incomes clearly depends on the initial distribution (or endowments) of assets. In general, under this scheme, "to him

that hath (resources) shall be given (income)", and the scarcer the resources relative to the demand for the goods they produce, the higher will be the associated income. For Leon Walras (1870), the main early proponent of this theory, it was in fact possible to separate the moral problem of the initial distribution of assets from the economic problem of determining the resulting incomes (prices and outputs as well).

But insofar as the functional distribution of income corresponded to existing social classes - landowners, workers, and capitalists - Walras' analysis abstracted from observations (particularly the alienating institution of wage labour) that were central to the earlier theories of Ricardo and Marx. Here, the focus was on the extension of agriculture to land of poorer quality or on the impact of the accumulation of capital. With the incomes of workers (wages) fixed at subsistence level, the productivity of land at the margin of cultivation could explain the division of the remaining income between profits and rent. Alternatively, the tendency of capitalism to create a "reserve army of the unemployed" and the drive to accumulate profits by continually investing in newer and more productive physical capacity could explain the growth, "by fits and starts", of capitalist production, and the cyclical pattern of wages. Also, in contrast to Walras, for Marx the separation of production and distribution into two distinct areas of enquiry was impossible. Both were explained and determined by the "social relations of (capitalist) production".

According to a more contemporary view,* whether one brings Ricardo and Marx within the framework of dynamic general equilibrium by concentrating on one resource or another, or emphasizes the additional constraints - social rather than analytical - flowing from class structure and the conditions of production is not really the issue. The key point is that when income distribution is determined through the participation of individuals in production, directly or through ownership of property, that distribution of income is determined by the prevailing distribution of assets (including labour skills, which cannot be redistributed). General equilibrium theory and the "paradigm" of constrained optimization give strong motivation for the belief that efficient allocation of resources requires that these resources receive returns - or at least that their services be priced and rationed - according to their value in various productive uses. Such pricing of factor services is important in achieving effective use of resources, and we may wish to retain the advantages of such pricing procedures as a signalling and rationing device.

But such efficiency pricing may not accord with our notions of justice. Since such notions relate to the personal

---

* This is the view following more in the tradition of Walras. The differences between Walras and Marx, mentioned briefly above, are not just a matter of history. They are closely related to the growing body of recent literature that is critical of contemporary economic theory, particularly as it appears in introductory texts. The interested reader will find a good introduction to this ongoing controversy in [9].

distribution of income - the incomes that individuals or households are actually seen to receive - and since this in turn is determined primarily by the underlying distribution of wealth, there are essentially only three policies available to correct apparent injustices in income distribution. First, the prices of the relevant factor services could be altered (possibly at the expense of efficiency in resource allocation); income-yielding wealth could be redistributed (perhaps through inheritance taxes or manpower training programs); or the desired redistribution could be accomplished directly through a system of taxes and transfer payments.

Any such change, however, is an intervention in a complex and interrelated system, which will have repercussions throughout. As a first step towards an understanding of that system, our analysis is focused upon the personal distribution of income, described in the following section.

3. Incomes

The theoretical discussion up to this point may appear to be dealing with quite tangible objects of study; when we come to examine the data, however, these objects appear less tangible and more fuzzy, and their significance threatens to vanish altogether. The problems are both conceptual and statistical, relating both to the definition of income and to the choice of the units among whom its distribution is to be measured.

Conceptually the difficulties arise because we wish our analysis to tell us something about the equity or justice of particular social policies. (This objective, however, does not warrant our being vague or imprecise in our analysis; on the contrary, it demands that we select unambiguous, measurable magnitudes which are acceptable as indicators of movement in some aspects of human welfare, or as measures of tangible power to satisfy human needs. The needs themselves may be ill-defined, and their satisfaction impossible to measure, but we still require a well-defined yardstick of the ability of individuals to meet some of these needs through the use of income.) For this purpose we desire an income measure which corresponds to increasing command over goods and services in the market, recognizing that this is in no sense a comprehensive measure of welfare. Omitted are many non-marketed items such as services provided without charge by various levels of government or other organizations, some imputed incomes received in kind or as services from one's own property, or from land (the environment) held in common, and - perhaps most crucially - all the contributions to individual welfare stemming from personal relationships and associations, services freely given and received in exchanges unfettered by a market mechanism. This last consideration also suggests the problem associated with the choice of units - is the welfare significance of income associated more closely with its distribution over individuals, over families, or over clusters of families (an extended family unit or a co-op sharing the same house, for example)?

A serious attempt to grapple with these issues can be found in the already-classic statement by the Royal Commission on Taxation (the Carter Commission); we can do no more here than refer the student to one excerpt and the references listed there.*

(i) The observed income distribution and changes over time.

We duck the conceptual issue by referring to the statistical question, in part because there is - for our present purposes - no point in developing an attractive income concept if there are no numbers attainable to measure it. The main sources of such numbers are census data, surveys conducted by Statistics Canada, and samplings of personal income tax returns. Most of the analysis below is based on publications relating to this last source. Some difficulties arising out of the simple issue of definition are illustrated by the first chart, which displays two estimates of income distributions for the same year (1969), one from Statistics Canada survey data and the other from tax data. Offhand, we should expect the tax data to underestimate the number of individuals with low incomes because they are not generally required to file tax returns, but in fact it is the SC data that show fewer low-income units and more high-income units. The main explanation, of course, is that most income recipients file individual tax returns, whereas, in the Statistics Canada data used in Chart 1, the incomes of all relatives living

---

* Royal Commission on Taxation, Vol. 1, pp. 3-30. Ottawa, Queen's Printer, 1966.

in the same dwelling are grouped into one family income. Thus, one $12,000 observation in the SC data might appear as one $8,000 and one $4,000 observation in the tax data.

In addition, the income concepts in the two series differ somewhat, with a considerable portion of transfer payments being excluded from tax data, but included in the SC series. (The latter thus correspond more closely to the ideal enunciated by the Carter Commission for a comprehensive income concept.) Since the importance of transfer payments is greatest at low incomes, this difference also helps to account for the apparent discrepancy between the two observed distributions.

Finally, we realize that changing family structures might alter the observed distributions, particularly those from Statistics Canada data, in misleading ways. If Opportunities for Youth programs and higher old age pensions permit more young people to become independent earlier, and more elderly couples to remain independent longer, the income distribution may show a shift to low incomes. But would welfare be increased by forcing all these independent units to remain in families headed by individuals in their higher-earning middle years? On the other hand, in order to draw any conclusions about the "adequacy" of incomes, some unit other than the individual seems essential. Working with family income data for these purposes may well be the most satisfactory procedure, provided one takes steps to account adequately for changes in family composition over time.

For the remainder of this paper, however, we confine ourselves to data from taxation statistics, recognizing the limitations of these data as indicators of welfare.

At any rate, given these basic concepts and statistical limitations, two types of graphs will be used to present the data, a distribution curve as in Chart 1 and a Lorenz curve as in Chart 3. (It should be noted in passing that the distribution curve severely understates the size of the highest incomes. Because the number of individuals with such incomes is relatively small, the curve comes very close to the horizontal axis and it is convenient to cut off the graph at incomes of, say, $25,000 per year. But if Chart 1 were to show an individual with an annual income of $500,000 (there were 1,700 with reported incomes, excluding capital gains, over $100,000 in 1969), the horizontal axis would have to be extended more than 12 feet to the right!). The Lorenz curve is intended to emphasize the equality or inequality of a given income distribution. A square is drawn, individuals in the population are put in order of increasing income, and on the horizontal axis we plot the percentage of the total population of income recipients as the variable x. Along the vertical axis we plot, for each value of x, the proportion of total income going to the lowest x per cent of income recipients. Clearly, if everyone received the same income, no matter in what order individuals were considered, the first 10% would receive 10% of the income, the first 20% of receipients would receive 20% of total income, and so on. But if there is

any inequality, the first 10% of the ordered list of income recipients would receive less than 10% of total income, and conversely, the top 10% would receive more than 10% of total income. (In fact, in 1969, the bottom 20% of recipients received only about 6.3% of total income while the top 5% received about 16%.) Thus it should be apparent that the Lorenz curve always lies below the diagonal going from the lower left to the upper right corner.

A frequently used summary statistic based on the Lorenz curve is the Gini coefficient, which measures the ratio of the area between the Lorenz curve and the diagonal to the area under the diagonal. Only when there is complete equality will this coefficient be equal to zero; otherwise, it is a positive fraction.* An advantage of the Lorenz curve is that it allows comparisons of distributions without requiring that they be in the same units. This is useful in international comparisons. But we should still be extremely cautious with such comparisons because of the strong likelihood of substantial differences in statistical definitions used in different sources. (And, of course, if the two Lorenz curves cross, it is difficult to say which represents a preferred distribution of income.)

Now that we have a rough idea of the recent distribution of income and an acquaintance with the graphical techniques, one

---

* A number of recent studies have commented upon limitations of the Gini coefficient as a measure of the welfare significance of income inequality; the Atkinson paper [1] is particularly interesting in this regard.

obvious question to ask is, "How has the income distribution changed over time?" In Charts 2 and 3 we have four historical collections of graphs based on tax-filers with taxable returns (not all tax filers) extending back to 1948. (For the data to be comparable, we must assume that there have been no changes in the tax laws which would significantly alter the composition of tax-filers* or the definition of total income used in the tax law during this period.) Chart 2-A presents the raw data. But there are two obvious adjustments that should be made, for population change and for price inflation. The first is easily accomplished by converting to percentage distributions, and these are shown in Chart 3. The second is more difficult, given the limited data. The technique used was first to convert the money values of the points between income categories to 1968 dollars using the consumer price index, and then to apply the assumption that income recipients were uniformly distributed within each category. The raw data could then be adjusted by shifting the appropriate propostion of each income class up to the next income category. In spite of the coarseness of the procedure and of the data, we can see (in Charts 2-B and 3-B) that even after correcting for price inflation, the curve has apparently moved to the right, suggesting a general increase in

---

* The appearance among tax-filers of substantial numbers of second earners - for example, married women - from single families is one illustration of the way the composition of tax-filers might alter, leading to underestimates of the gains in family incomes over time. A second change, as Robert Stanfield has recently emphasized, is due to the effects of inflation upon incomes subject to tax - if exemption levels stay fixed while money incomes rise due to inflation, low-income individuals find themselves moving into the population of tax-filers even though their real income has not risen. Our adjustment for inflation does not account adequately for this effect.

"real" income. But we cannot tell if the shape of the distribution has changed significantly.

(ii) Differing distributions by income source.

Along with the highly aggregated historical information described above, published tax data provide a fairly detailed account of the sources of income in any one year. Referring to Charts 4-A and 4-B, the most striking feature is the unequal distribution of dividend income relative to income from wages and salaries.* While the top 5% of income recipients received about 15% of total wages and salaries, they received almost 65% of total dividend income. (This information itself probably understates the inequality of the distribution of property income, since capital gains are not included. If capital gains were proportional to dividends and were included, the curve would not change shape. But insofar as capital gains tend to be associated with larger and riskier investments, and these types of investments tend to be held by wealthier individuals, capital gains will not be proportional to dividends and will probably be even less equally distributed - though there are arguments to the contrary, particularly with respect to capital gains on real estate.)

It might also be noted that property income other than dividends is not as unequally distributed: "only" about

---

* Note that the individuals represented in Chart 4-B have been ordered by their total income, and not, for example, by their dividend income alone.

33% goes to the top 5% of individuals. But this is a more diverse category of income which includes rental income, bond and bank interest, and annuity and estate income. Similarly, the category "other earned income" includes commissions, and business, farming, fishing, and professional income.

(iii) Age-earnings profiles.

The idea of a more "equal" distribution of income has crept into the above discussion. But if we think carefully about that concept, we see that it is very difficult to give the idea any precise definition. There is an obvious difference between equality of opportunity and equality of incomes; indeed, the former might well give rise to more income inequality! Income recipients are a heterogeneous group; one of their more obvious distinguishing attributes is age. Individuals generally do not expect to receive the same income all their lives, and there is a relatively uniform pattern that has been observed. If an equal distribution of income implied only that everyone had identical age-income profiles like the one shown in Chart 6-A, then even if the population were uniformly distributed over different ages, the overall distribution of personal incomes would not appear equal. In fact, the data presented in Charts 5-A and 5-B show that income is more equitably distributed within given age groups than for the population in general. It is also obvious that there is a striking difference between women and men (in case you hadn't already noticed). The underlying social reality

of the nuclear family is part of the motivation for considering "households" as the more appropriate income recipient unit. But then our conceptual difficulties with "equality" become greater. In addition to the age-income profile, it becomes necessary to consider the much broader range of possible patterns of marriage and childbearing.

Recognition of the significance of age in determining incomes forces one to interpret statistics on income distribution more carefully. In a growing population the number of younger individuals is larger; apparent inequality in income distribution might therefore reflect to some extent simply the fact that a large and rising segment of the population has yet to reach peak earnings. Changing population structures could cause changes in statistics related to income distribution even when no change in the underlying age-earnings profiles has occurred. The combination of movements among income classes with changing age structures may thus make the task of defining the desired shape of income distribution curves quite complex.

(iv) The impact of the tax system.

One of the main social instruments we have for altering the distribution of income is the income-tax system. Our tax system is intended to be progressive, in that the ratio of tax liability to income increases with gross income. The intended result is a more equal distribution of after-tax income, as

illustrated in Chart 6-B, for the population of tax-filers having taxable returns. The three curves in the graph correspond to different stages in the application of the rules of the tax system:

1) total income for filers with taxable returns,
2) taxable income for filers with taxable returns,
3) after-tax income for filers with taxable returns.

We expect the second curve to be less equally distributed than the first because of the system of personal exemptions. But as a result, and with application of progressive tax rates, the last distribution--computed by deducting the tax assessment from income, not from taxable income--should yield a more equal distribution of income. Clearly, from the chart, the tax system has some impact, but hardly a dramatic one in this respect.

Interpreting this result is difficult, however. The only tax system which would yield perfect equality, and thus a Lorenz curve lying along the diagonal, is one that taxed all income above the national average at 100% rates, and supplemented all incomes below the national average to bring them up to the average. But if these supplements occurred in the form of government services directly rendered, or even as income transfers not entering income tax declarations, the appearance of inequality could remain. Obviously, the only meaningful exercise of this sort must deal with estimates of the individuals' total purchasing

power after all taxes and transfers have been included. And thus we are again back at the difficulty of imputing appropriate values to the benefits the individual enjoys as a result of unpriced government services or, indeed, unpriced benefits such as the pleasures of a quiet life in a rural setting or a coastal town.

Another feature of the income tax, reflected in Chart 6, is that more tax revenue, proportionally, tends to come from middle-aged tax filers than from younger or older ones. This result is explained in part by the typical age-income profile combined with the progressive rates. Average earnings are highest in middle age so they encounter the highest tax rates. The result, reinforced by the distributional impact of government expenditure on such things as education and pensions, is a net inter-generational transfer from middle-aged income recipients to both their children's and parents' generations. However, observation of Chart 6-B seems to indicate that the general impact of the tax system on income distribution is not very great, as has been noted before. Even with an allegedly "progressive" income tax system in existence for many years, The Report on Poverty* is led to claim that 25% of all Canadians can be said to be living in poverty. Whether strengthened taxes on the transmission of accumulated wealth would be more effective

---

* Poverty in Canada, A Report of the Special Senate Committee on Poverty, Ottawa: Information Canada, 1971.

than taxes on the flow of returns to that wealth may be a question worth study (though federal tax law has moved in the opposite direction in giving up estate taxes altogether).

4. Stochastic Processes, Income Mobility, and Transition Data

The previous pages alluded in a most sketchy way to theories of the functional distribution (corresponding to national accounts categories) of income associated particularly with Ricardo, Marx, and Walras, and then moved on to more detailed study of the personal distribution of income.

As opposed to the rather aggregate or deterministic analyses described in Section 2, study of individual incomes leads one to consider the role of chance events. The personal distribution of income is one striking example of what can be seen as the outcome of a stochastic process. Even though most individuals have different incomes from year to year, in a way that seems to be at least partially random, the pattern shown in Chart 1 seems to persist.

One of the first to note this phenomenon was Pareto, who in 1896 published an observation which has come to be knwon as Pareto's "law". This law assets that the curve representing the number of people in each income category does retain the same shape (even though individuals are continually moving between income categories) and, more specifically, indeed, that there exist constants - call them a and b - such that the number of

people N receiving an income not less than Y satisfies the rule

$$\log N = a + b \log Y.$$

(More technically, this relationship says that the cumulative income distribution function is "linear in logs".)

A number of hypotheses might be suggested to account for this apparent stability. One postulates that income is related to a number of factors or characteristics, each of which is normally distributed in the population as a whole, and which reinforce each other in a proportionate way. A second is based upon Gibrat's law - the "law of proportionate effect" - which asserts that random changes in income are more likely to be proportional to the level of income than independent of it. Either or both of these hypotheses might account for the observed shape of the income distribution, and in this sense might "explain" the persistence of the observed pattern of incomes.* But it is obviously not a valid conclusion that the resulting distribution is in any sense just, or that the underlying processes generating them are unchangeable.

A further development of the hypothesis relating to income changes is illuminating. This approach is motivated by

---

* For further discussion of this topic, one can refer to Champernowne [4] or Steindl [16].

observation of data such as that in Tables 1 and 2 which show the movement of individual tax filers among income categories between 1968 and 1969. Instead of talking only about the probability of being in any given income category in a particular year, we consider the probability of being in a given income category in 1969 in terms of the income we had in 1968. If we take each row of Table 1, find its sum, and then divide each entry by the row sum, we can interpret the table that results (Table 2) as an indication of the probability of some income in 1968 giving rise to another income in 1969. Such a probability is called a transition probability. For example, the probability from Table 2 of moving from an income between $2-3,000 in 1968 to an income between $3-4,000 in 1969 is 25 per cent (as shown by the entry in the second row and third column of the 1968/69 portion portion of Table 2).

If we assume that these transition probabilities are relatively stable over time, we define a stochastic process describing income mobility and the resulting income distribution each period. Random events are an inherent part of the process, but they follow general tendencies as characterized by the set of transition probabilities. In fact, this particular stochastic process is called a first-order Markov process, first-order because the income distribution in year t+1 is directly dependent only on the income distribution in year t. These processes have been studied extensively and have been found to have some interesting

properties. First, we can make the rather simple observation that if we know the income distribution in some year t, and we know the transition probabilities, we can find the income distribution in year t+1. If the transition probabilities remain constant, we can continue finding the income distribution for years t+2, t+3, ... When the transition probabilities are organized into a square pattern of numbers, the result is called the transition probability matrix. It has the characteristics that every element is a magnitude between zero and one, and that the sum of the elements in any row is equal to one.

The second observation is that if the process of repeatedly applying the transition matrix to some initial income distribution is carried out long enough, the resulting income distribution will tend to a stable equilibrium distribution that will continue to repeat itself. This property can be demonstrated with the simplified example of a transition matrix shown at the right. This matrix embodies the assumption, for example, that 12% of the individuals earning $0-5,000 in year t will be earning $5-10,000 in year t+1. If you started earning $0-5,000 in year t, the probability that you will earn something in year t+1 is the same as the probability that you will earn either $0-5,000 or $5-10,000 or over $10,000, which is obviously 100% = 80% + 12% + 8%. Thus, the rows sum to one. For this transition

t \ t+1	0-5	5-10	10
0- 5	.80	.12	.08
5-10	.20	.70	.10
10	.05	.10	.85

matrix, there is a unique distribution of income which forms a stable equilibrium for the stochastic process represented. You can check that if you assume that the distribution in year t is (36%, 27%, 37%), the distribution in year t+1 will be identical. Moreover, this distribution will result from a sufficient number of applications of the transition matrix to any initial (economically plausible) income distribution.

The important point is that the equilibrium or "steady-state" distribution does not arise because individuals stay in the same income category year after year. Rather it results because the number of individuals leaving any particular income category is exactly balanced by the number of individuals entering that category. In the example above, 20% of the individuals in the first category (12% + 8%) leave each year; in the steady state distribution this amounts to 20% of 36% or 7.2% of the total population. But at the same time, 20% of the 27% in the second category plus 5% of the 37% in the third category move into the first category, a total of 5.4% plus 1.8% (with a little rounding). There is one special matrix that represents the case of no mobility, the "identity matrix". This is a matrix with ones along the diagonal and zeros everywhere else. Thus, we can get an impression of the amount of income mobility from the values of the off-diagonal elements of the transition probability matrix. The larger these values, the more mobility there is.

A third observation is that we can find a particular transition matrix that has as its steady-state distribution a

distribution obeying Pareto's law. A particularly interesting feature of this matrix is that the transition probabilities are chosen so that a form of Gibrat's law, the law of proportionate effect, is implied. The basic idea is that if income categories are defined so that their widths are in the same proportion, then the probability of moving up one category, for example, is the same for all categories. An example of proportional income categories would be $0-1,000, $1-3,000, $3-7,000, $7-15,000, ... Then if the probability of moving up or down any given number of categories was the same for any category, the transition matrix would have the property that the elements along any diagonal from upper left to lower right would be identical. Note that both a special definition of the income categories and the transition matrix is required for this special example. Even more sophisticated analyses have been done that relax the assumption, so far implicit, that the original number of individuals remains unchanged. Birth and death processes in which individuals have particular probabilities of being born into a given income category, and probability of dying related to their income have been studied, for example, in the Champernowne paper [4] listed in the bibliography.

It seems, however, to be a rather crucial assumption to make that the transition probabilities will remain constant over long periods of time,* while, on the other hand, long time

---

* The questionable nature of this assumption can be illustrated by comparing the blocks of Table 2 corresponding to different years. Differences in successive blocks are set out in Table 3.

periods are of course required for the distribution to converge to its steady state. But transition probability matrices do offer some possibility of comparing the structure of mobility for different components of personal income or within different sub-groups of the population. To begin, we can note a number of general concepts that are associated with particular aspects of the form of a transition matrix. First there is the polar case where mobility is restricted to only a part of the overall range of possible incomes. A transition matrix representing this situation would have self-contained blocks along the diagonal. The transition probabilities are such that anyone who came to have an income within the range covered by such a block would have no chance (zero probability) of ever leaving that income range. The proposition that poverty is a "vicious circle" might thus be examined by using a sociological definition of poverty that did not rely on income to contrast the income transition matrices of those classified as "poor" and "not-poor".

A second characteristic of the transitions matrix concerns the rapidity with which individuals move among income categories, as indicated by the size of the off-diagonal elements. (We would expect individuals to move around (in the income distribution) more quickly when the off-diagonal elements of the matrix are greater.) In this way, we could compare income mobility of different geographical regions, occupations, or for different sources of income. In the case of income sources, we might also

want to consider the proposition that property income tends to become more concentrated than wage and salary income. If this were so, the matrix for property income would reveal that the elements above the diagonal were generally greater in magnitude than those below, leading to more upward than downward movement in the particular income component. These possible characteristics of transition probability matrices are helpful in thinking about the myriad aspects that make up the actual personal distribution of income. Unfortunately, data for this type of analysis are not yet readily available, although this situation is improving.

5. Concluding Comments

That Canada can afford to alleviate poverty is suggested in a rough way by the observation that average personal income (in the national accounts sense) in 1969 (which does not include corporate profits or replacement of worn-out equipment, but does include substantial imputed components as well as some income flows not directly received by persons) was just under $3,000 per person or $12,000 for a family of four. If the minimum guaranteed income were to be set at $2,000 per person, there would remain sufficient surplus for half the population to receive an average of $4,000 per person - but there could not be many individuals receiving $20,000 per year, or more. The spread between the lowest incomes and the highest would be greatly reduced.

And so would the increment in income that could be gained by working. This point brings us to the crux of the

matter. If any significant attempt were to be made to alleviate poverty, it would require much more basic changes in our society than some fiddling with the tax rates. Perhaps the most important change required would be one in our attitudes; we would have to be prepared for a much more limited connection between work and income, and hence a decreased reliance on material incentives to motivate people to participate in the production process. If this decreased reliance in turn requires curtailing or circumscribing private ownership of the means of production and the accumulation of large fortunes, it follows that there is a basic conflict between the goal of alleviating poverty, and the continuation of uncontrolled private enterprise. If it means foregoing the monetary inducements that encourage individuals to participate in the burdensome work of production, manpower assignment procedures may replace freedom of choice in occupation or location.

The wealth of a nation includes the skills and strength of its people, the equipment they work with, the resources of the land they inhabit, and the structures which make it possible to develop and use those resources. It is this wealth which generates a flow of goods and services to meet human needs. Some of these needs may be material, some aesthetic; some laudable, some deplorable; but all represent claims on resources for fulfillment of individual aspirations.

Changing tastes will not remove the desires of the individual for education, health services, shelter, transportation, and recreational vehicles, even if it succeeds in simplifying life styles or reducing their material trappings. We meet these needs by drawing on the productive capacity of the nation's human and physical resources - so successfully thus far that some people claim the fundamental problem of scarcity has been solved. That is, with existing capital stocks and investment rates, and with 94% of the labour force employed, perhaps we can produce a sufficient flow of goods to ensure an adequate living for all individuals in the community. It is easy to design a tax or transfer mechanism which statically (in any one year) will redistribute this flow of income (and hence goods or services) to any desired pattern. But this mechanism breaks the link between participation in production and command over goods which has been basic up until now; it obliterates the signals which have been trusted to direct resources where they are most wanted. And the question is, what will be the consequences for decisions to participate in the labour force, to add to stocks of equipment, to augment facilities for developing and bringing to market the natural resources of the country? Will the problem of scarcity remain solved if participation in the labour force declines to the fraction of the population that finds work pleasant enough and satisfying enough to undertake voluntarily without much financial incentive? Is the efficiency of decisions in the public sector demonstrably great enough to permit public investment decisions to substitute adequately for private investment if returns to private investment fall too far? Everyone has his own opinions

on these questions; perhaps the limited information available about the Chinese experience leads one to be optimistic that such incentives can be replaced with others, or perhaps recent reform moves in the Soviet Union and Eastern Europe lead one to conclude that such incentives are essential. We cannot answer such questions; our purpose here is simply to note that deep issues of social organization are involved in apparently straightforward questions of redistribution and income transfer. Resolution of the problems of poverty and income inequality will not come without searching assessment of the whole mechanism which links material rewards to ability or economic activity as measured by the yardstick of an existing and distorted market structure.

BIBLIOGRAPHY

1. ATKINSON, A.B., "On the Measurement of Inequality", Journal of Economic Theory, 2 (1970), pp. 244-265.

2. BRONFENBRENNER, M., Income Distribution Theory, Chicago: Aldine-Atherton, 1971.

3. BUDD, E.C., (ed.) Inequality and Poverty, Norton, 1967.

4. CHAMPERNOWNE, "Economic Journal", 1953.

5. CHOMSKY, N., "IQ and Income Distribution", Ramparts, August 1972.

6. FERGUSON, C.E. and E.J. NELL, "Two Review Articles on Two Books on the Theory of Income Distribution", Journal of Economic Literature, X(2), June 1972.

7. FREEDMAN, R., (ed.) Marx on Economics, Penquin, 1961.

8. HOROWITZ, D., (ed.) Marx and Modern Economics, Monthly Review Press 1968.

9. HOUGHTON, R.W., (ed.) Public Finance, Penquin, 1970.

10. HUNT, E.K., and J.G. Schwartz, A Critique of Economic Theory, Penquin, 1972.

11. KALDOR, N., "Alternative Theories of Distribution", Review of Economic Studies, 1956, pp. 83-100.

12. MILL, J.S., Principles of Political Economy, 1848.

13. PEN, J., Income Distribution, Penquin, 1971.

14. PODOLUK, J., Incomes of Canadians, Census Monograph (1961), Ottawa: Queen's Printer, 1968.

15. RICARDO, D., Principles of Political Economy and Taxation, R.M. Hartwell, ed., Penquin 1971.

16. STEINDL, Random Processes and the Growth of Firms, London: Charles Griffin and Co. Ltd.,, 1965.

17. SUITS, D., Principles of Economics, Harper and Row,

18. WALRAS, L., Elements of Pure Economics, Wm. Jaffé (transl.), George Allen and Unwin, Ltd., 1954.

INCOME CATEGORIES

FOR TABLES 1, 2 AND 3

All the transition matrices have the same layout, as presented in the figure below:

t \ t+1	under $2000	$2000-$3000	$3000-$4000	$4000-$5000	$5000-$7000	$7000-$10000	$10000-$15000	$15000-$25000	Above $25000
under $2000									
$2000-$3000									
$3000-$4000									
$4000-$5000									
$5000-$7000									
$7000-$10000									
$10000-$15000									
$15000-$25000									
Above $25000									

TABLE 1

TRANSITIONS AMONG NINE INCOME CLASSES FOR YEARS 1966/67 - 1969/70

	975766	349574	155114	60273	34968	8104	1973	558	147
	199801	433564	287731	81064	46560	9375	1732	338	52
	80595	118044	447995	304716	95115	15300	2703	459	70
1966/67	32442	42073	94596	397186	374378	27420	3747	591	50
	19830	23551	44881	99648	918940	317598	14332	1844	228
	5484	5339	8504	13471	80213	513551	114126	5207	494
	1676	1162	1473	2182	7246	31086	172954	34096	1564
	516	256	332	375	1121	2859	11321	62043	11365
	152	39	52	61	167	351	877	4310	32107
	1033784	336070	159220	61617	38448	8726	2322	681	166
	207638	396903	270623	80055	51860	11138	1844	326	60
	92789	120219	427548	293153	99582	19003	3018	532	78
1967/68	40076	47531	94896	365196	378484	33382	4294	609	104
	26859	29395	52724	102434	937532	397519	16729	1940	233
	7837	7266	11357	17387	88449	637667	153136	5790	551
	2429	1587	2228	2972	9962	37927	222907	43613	1872
	684	357	451	515	1486	3836	14287	75958	12849
	180	51	78	77	239	418	1168	5407	39193
	1025032	339246	176619	76447	50868	11969	3314	861	220
	196050	365538	247342	88596	65446	16080	2445	469	74
	92121	114737	390354	285224	113134	25682	4165	607	109
1968/69	43079	45833	88309	327482	368759	43253	5512	823	126
	32239	32283	54527	102370	890050	467814	22949	2409	349
	10350	8918	13446	20578	107235	760297	221251	7460	680
	3044	1994	2680	3479	11337	45497	290683	59866	2319
	892	429	559	614	1762	4150	16118	94488	16807
	241	66	92	101	233	523	1359	6199	46641
	1046554	315392	167810	77738	52386	13933	3730	970	251
	207349	340127	221426	86045	68080	18687	2803	480	94
	101912	117914	350604	259216	108676	29888	4917	641	114
1969/70	50204	51595	94173	313494	330330	50082	6677	860	127
	38064	38107	62057	110294	845217	469432	29835	2585	320
	11259	11059	17157	26300	134550	887312	270858	8593	718
	3142	2198	3201	4023	13928	63847	400847	71760	2189
	926	466	573	713	2008	5263	22250	122761	17656
	286	89	112	113	276	586	1797	8339	55448

TABLE 2

TRANSITION PROBABILITIES (PERCENTAGE) AMONG NINE INCOME CLASSES FOR YEARS 1966/67 - 1969/70

1966/67

42	22	10	4	2	1	0	0	0
19	41	27	8	4	1	0	0	0
8	11	42	29	9	1	0	0	0
3	4	10	41	38	3	0	0	0
1	2	3	7	64	22	1	0	0
1	1	1	2	11	69	15	1	0
1	0	1	1	3	12	68	13	1
1	0	0	0	1	3	13	69	13
0	0	0	0	0	1	2	11	84

1967/68

63	20	10	4	2	1	0	0	0
20	39	27	8	5	1	0	0	0
9	11	40	28	9	2	0	0	0
4	5	10	38	39	3	0	0	0
2	2	3	7	60	25	1	0	0
1	1	1	2	10	69	16	1	0
1	0	1	1	3	12	68	13	1
1	0	0	0	1	3	13	69	12
0	0	0	0	1	1	2	12	84

1968/69

61	20	10	5	3	1	0	0	0
20	37	25	9	7	2	0	0	0
9	11	38	28	11	3	0	0	0
5	5	10	35	40	5	1	0	0
2	2	3	6	55	29	1	0	0
1	1	1	2	9	66	19	1	0
1	0	1	1	3	11	69	14	1
1	0	0	0	1	3	12	70	12
0	0	0	0	0	1	2	11	84

1969/70

62	19	10	5	3	1	0	0	0
22	36	23	9	7	2	0	0	0
10	12	36	27	11	3	1	0	0
6	6	10	35	37	6	1	0	0
2	2	4	7	53	29	2	0	0
1	1	1	2	10	65	20	1	0
1	0	1	1	2	11	71	13	0
1	0	0	0	1	3	13	71	10
0	0	0	0	0	1	3	12	83

TABLE 3

ABSOLUTE DIFFERENCE IN PERCENTAGE TRANSITION PROBABILITIES, ROUNDED TO NEAREST PER CENT

1966/67 vs. 1967/68

1	2	0	0	0	0	0	0	0
2	2	1	0	1	0	0	0	0
1	0	2	1	0	0	0	0	0
1	1	0	3	1	1	0	0	0
0	0	0	0	4	3	0	0	0
0	0	0	0	1	0	1	0	0
0	0	0	0	0	1	0	0	0
0	0	0	0	0	0	0	0	1
0	0	0	0	0	0	0	0	1

1967/68 vs. 1968/69

2	0	1	1	1	0	0	0	0
0	2	1	1	2	1	0	0	0
0	0	2	0	2	1	0	0	0
1	0	0	2	1	1	0	0	0
0	0	0	0	4	4	0	0	0
0	0	0	0	0	3	3	0	0
0	0	0	0	0	1	1	1	0
0	0	0	0	0	0	1	1	1
0	0	0	0	0	0	0	0	0

1968/69 vs. 1969/70

1	1	0	0	0	0	0	0	0
2	1	2	0	1	0	0	0	0
1	1	2	1	0	1	0	0	0
1	1	1	1	3	1	0	0	0
0	0	0	1	2	0	0	0	0
0	0	0	0	1	1	1	0	0
0	0	0	0	0	0	2	2	0
0	0	0	0	0	0	1	2	2
0	0	0	0	0	0	0	1	1

CHART 1

INCOME DISTRIBUTION 1969

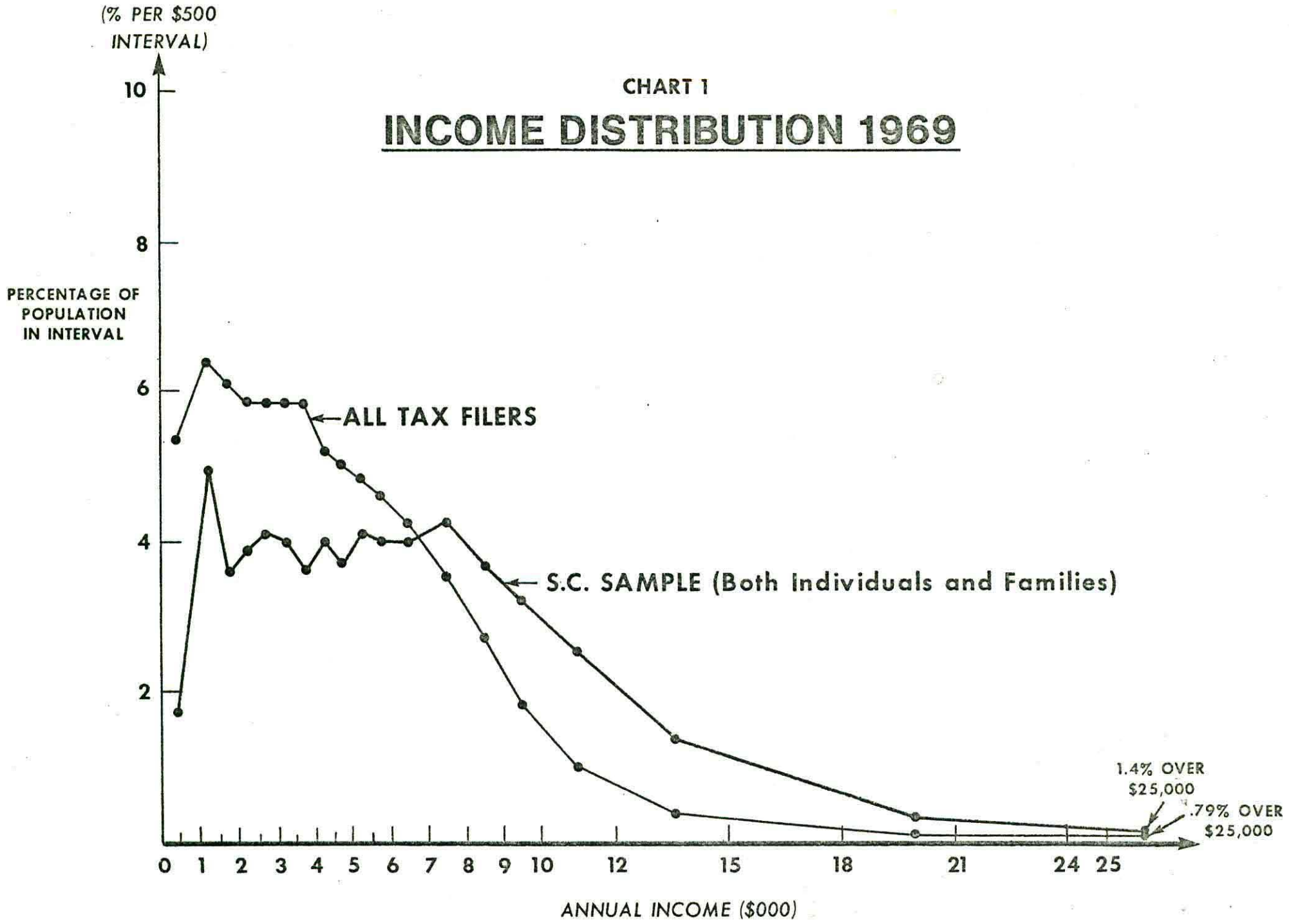


CHART 2

HISTORICAL DISTRIBUTIONS 1&2

(Total numbers in each income class)

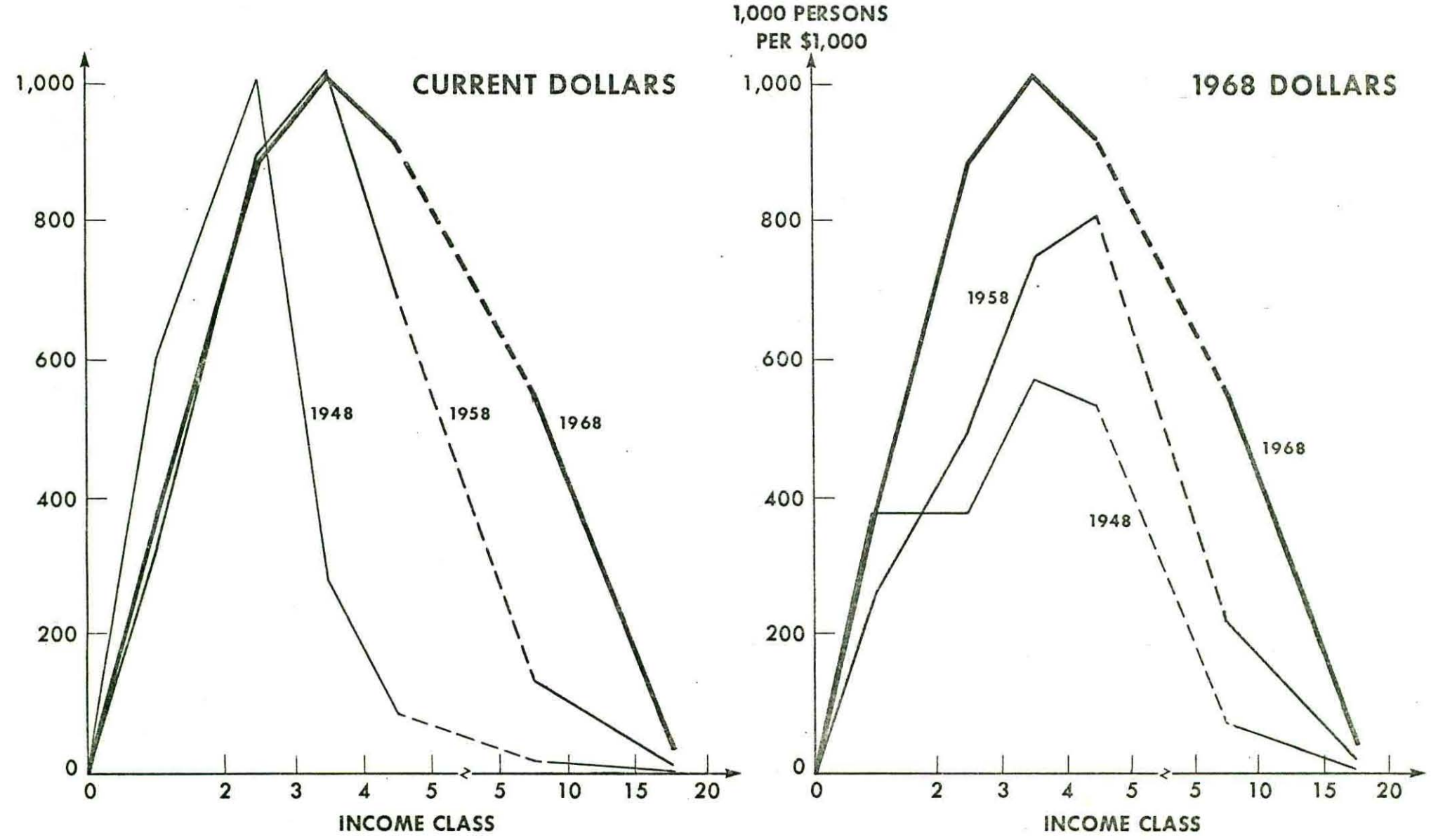


CHART 3

HISTORICAL DISTRIBUTIONS 3&4

(Percentage of population in each income class)

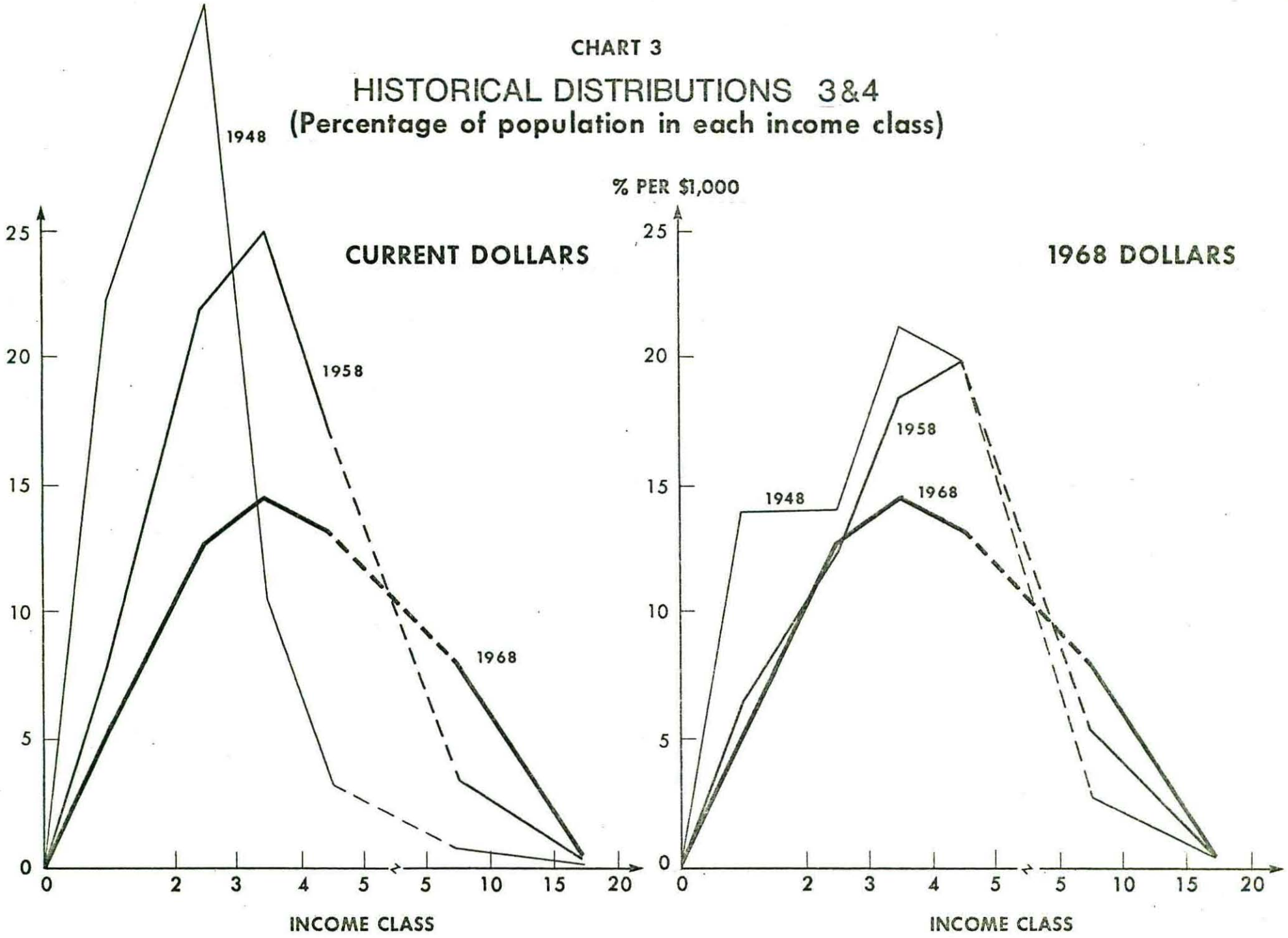
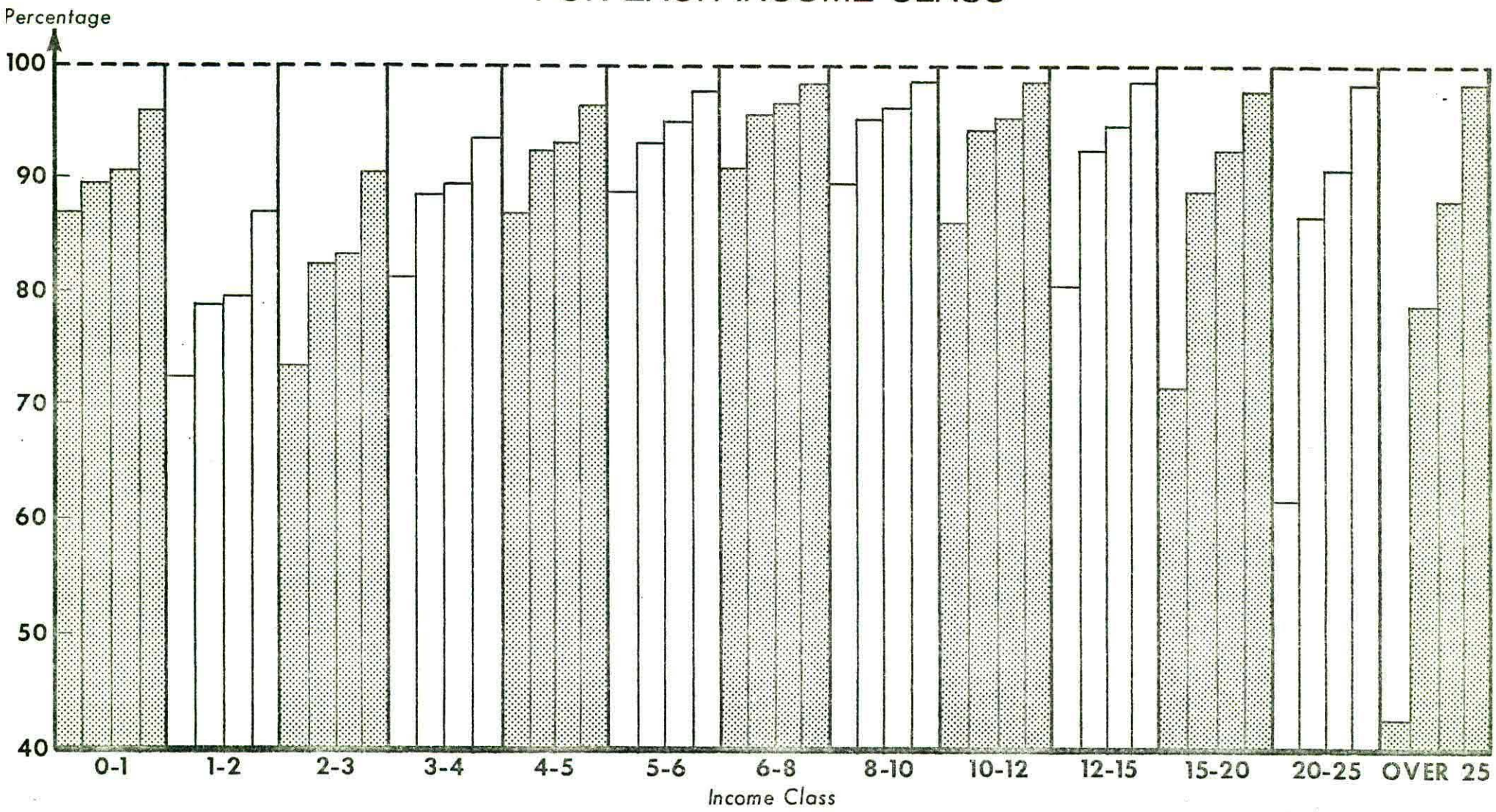


CHART 4-A

PERCENTAGE OF INCOME BY SOURCE FOR EACH INCOME CLASS



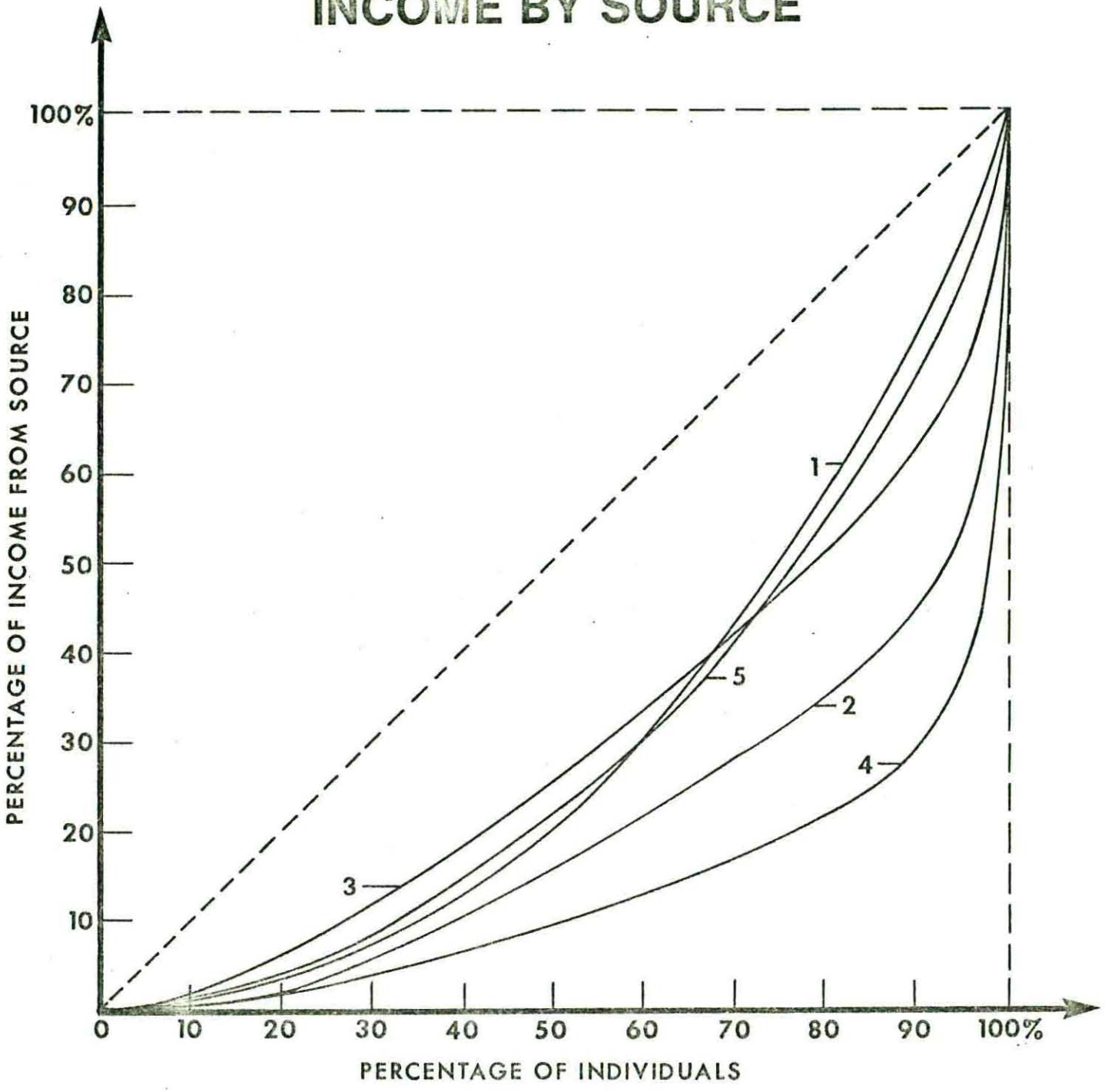
For each income class, a cumulative bar chart indicating the percentage of income obtained from, in turn,

- *Wages and Salaries*
- *Other Earned Income*
- *Gross Dividends*
- *Property Income*

is constructed, with the residual being due to 'other' income sources.

CHART 4-B

DISTRIBUTION OF INCOME BY SOURCE



(1) WAGES & SALARIES
(2) OTHER EARNED INCOME
(3) PROPERTY INCOME
(4) GROSS DIVIDENDS
(5) TOTAL ASSESSED INCOME

CHART 5-A

INCOME DISTRIBUTIONS FOR SELECTED AGE GROUPS

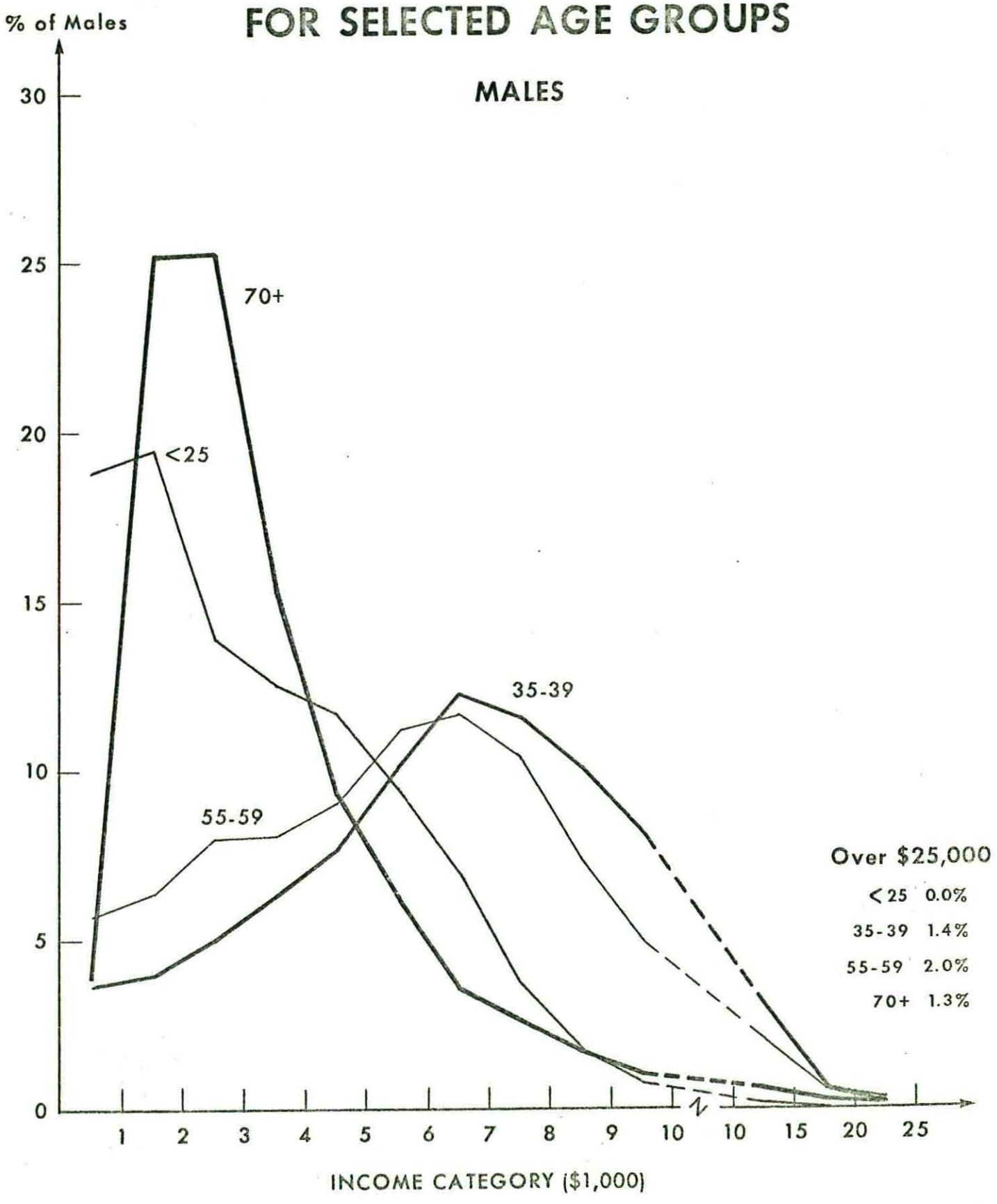


CHART 5-B

INCOME DISTRIBUTIONS FOR SELECTED AGE GROUPS

FEMALES

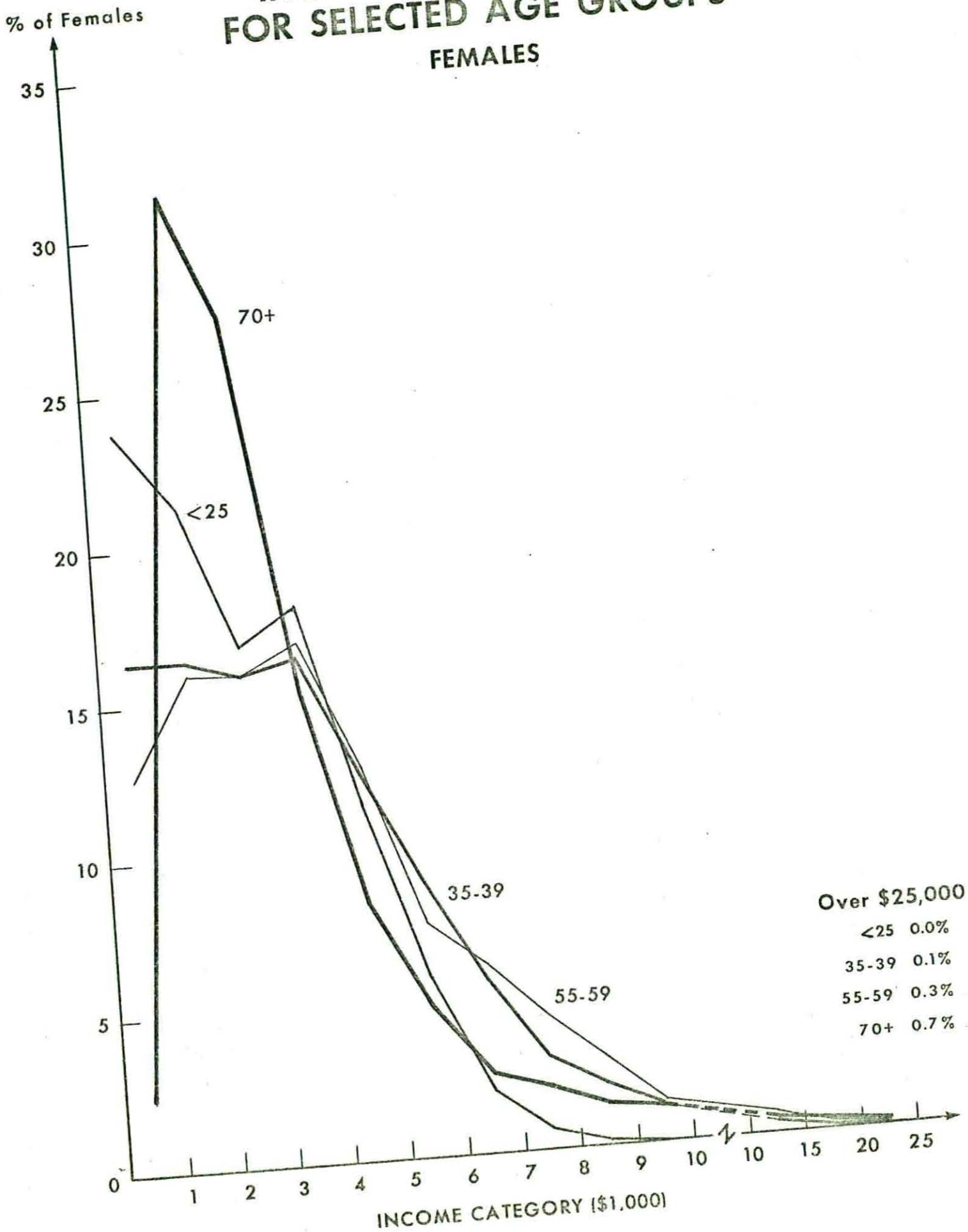


CHART 6-A

BEFORE and AFTER TAX INCOME BY AGE GROUP

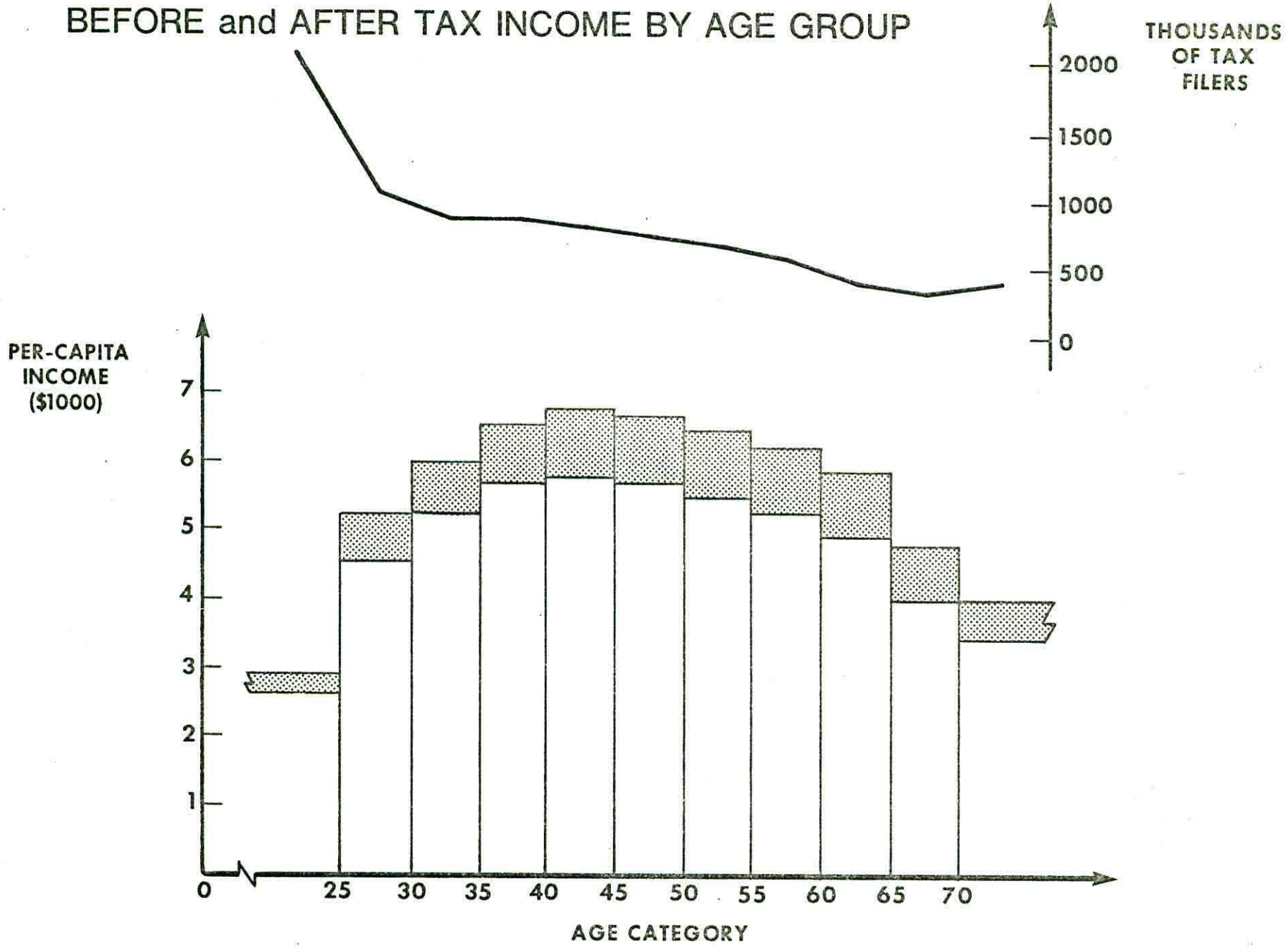
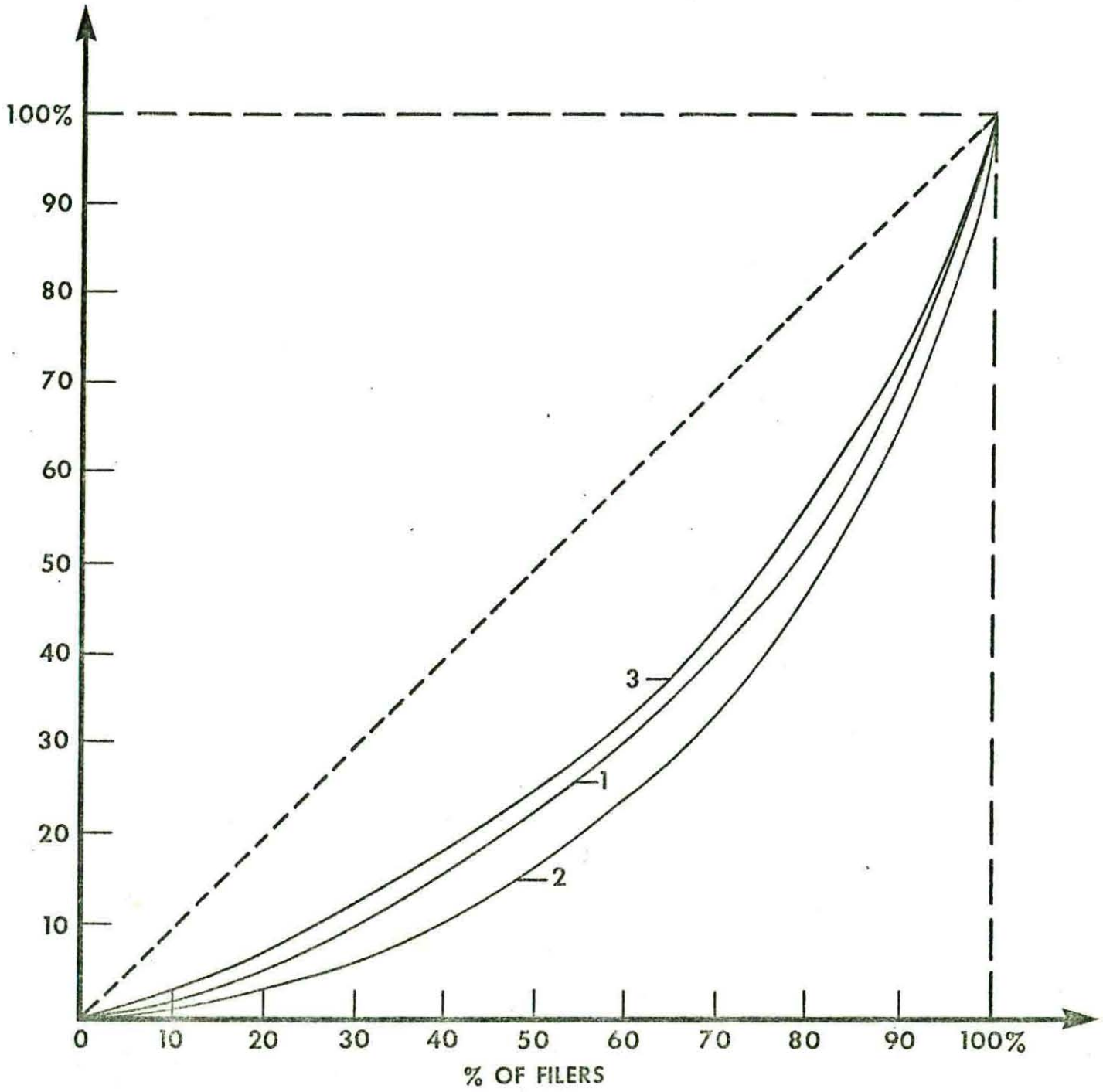


CHART 6-B

DISTRIBUTION OF INCOMES BEFORE AND AFTER TAX



(1) % OF TOTAL ASSESSED INCOME

(2) % OF TAXABLE INCOME

(3) % OF DISPOSABLE INCOME