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A METHOD OF ESTIMATING THE DISTRIBUTION OF PRIVATE WEALTH AMONG AMERICAN FAMILIES, 1973

The University of Oklahoma PH.D. 1980

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THE UNIVERSITY OF OKLAHOMA

GRADUATE COLLEGE

A METHOD OF ESTIMATING THE DISTRIBUTION OF PRIVATE WEALTH AMONG AMERICAN FAMILIES, 1973

A DISSERTATION

SUBMITTED TO THE GRADUATE FACULTY

in partial fulfillment of the requirements for the

degree of

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BY

DAPHNE THORNTON GREENWOOD

Norman, Oklahoma

1980

A METHOD OF ESTIMATING

THE DISTRIBUTION OF PRIVATE WEALTH AMONG

AMERICAN FAMILIES, 1973

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THE DISTRIBUTION OF PRIVATE WEALTH AMONG AMERICAN FAMILIES, 1973

CHAPTER I

THE STUDY OF WEALTH AND ITS DISTRIBUTION

Introduction

The distribution of wealth has long been an area of interest for the study of three diverse economic problems: the degree of concentration of economic power, relative inequalities in economic welfare, and the potential market for financial assets. The banking sector has had a long-standing interest in knowledge of the distribution for its use in analyzing this market. Large banks financed a few early studies, and the Federal Reserve Board sponsored the most comprehensive wealth survey of the twentieth century. Critics and defenders of the American economic system have focused on the distribution of wealth, relative to other nations or to earlier periods of American history.

One approach to studying economic concentration is to look at the structure of major industries and analyze the

degree of monopoly which exists within them and in the business sector as a whole. An alternative is to study the distribution of wealth among persons or families. A large proportion of corporate wealth is personal wealth (the remainder is held by pension funds or non-profit foundations) and we find that it is a major component of the wealth of the very wealthy.

The distribution of wealth is of use for purposes other than the study of economic concentration. Wealth is a means of providing economic security, and a measure of independence and control over one's life. Assets which provide income or are readily saleable are income stabilizers in times of unemployment or heavy financial burdens. Families who own no significant amount of financial assets will find it difficult to borrow, and tend to pay more for the loans which they do acquire. Thus, ownership of wealth is an important aspect of economic welfare.[1]

Banks, savings and loan associations, brokerage houses, and mutual funds are all interested in the distribution of financial assets, the extent of home ownership, and other portfolio information which detailed wealth estimates yield. Some surveys have been aimed exclusively at higher income and wealth groups and have dealt with the motivations

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[1]For an extensive analysis see Burton A. Weisbrod and W. Lee Hansen, "An Income - Net Worth Approach to Measuring Economic Welfare," American Economic Review 58 (December 1968) 1315-19.

for holding different types of assets in the portfolio.[2]

A recent empirical study indicates no major changes in the share held by the top wealthholders over the last fifty years.[3] In spite of the significant structural changes which have occurred in the economy, along with changes in tax policies and an increasing rate of inflation, the share has remained virtually stable. The income distribution, however, appears to have altered over this same time period, with upper-middle class groups gaining at the expense of the lower three deciles and the highest decile.[4] Changes in the distribution of wealth among lower and middle wealth groups are not known.

A distribution of wealth for the entire wealthholding population is necessary for answering questions about redistribution via taxes, inflation, or other economic forces and addressing many social and economic issues. Estimates based on estate tax methods have been limited to the upper few percentiles of the population by the filing requirement of $60,000 in gross wealth. A recent modification of the estate tax law by Congress raises this limit to $250,000,

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[2]For example, see Robin Barlow, Harvey Brazer, and James Morgan, Economic Behavior of the Affluent, Washington, D.C.: The Brookings Institution, 1966.

[3]James D. Smith and Stephen D. Franklin, "The Concentration of Personal Wealth, 1922-1969", American Economic Review 64 (May 1974): 162-167.

[4]Lester C. Thurow, Generating Inequality: Mechanisms of Distribution in the U.S. Economy. New York: Basic Books, Inc., 1975, p. 3.

limiting the use of the returns as a data base even more severely. In addition, the use of trusts and gifts in anticipation of death cause a downward bias in wealth estimated from estate tax returns, tending to understate the concentration of wealth.[5]

The most recent surveys of wealth are the 1962 Survey of Financial Characteristics of Consumers and the 1967 Survey of Economic Opportunity.[6] Both yielded valuable information about the distribution and composition of wealth, but did not arrive at a complete distribution of wealth, due to problems of incomplete asset coverage, inaccurate reporting, and non-response. The Survey of Income and Program Participation will collect information on tangible wealth and some financial assets for the U.S. Department of Health, Education and Welfare in the early 1980's.

A Review of the Methodology and Organization

Estimates of the distribution of wealth have been based in the past on (1) estate tax returns, (2) surveys of wealth, or (3) income capitalization. There are problems inherent in both the methodology and the data available for each of these methods. Chapter II reviews the literature regarding studies

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[5]John A. Brittain, Inheritance and the Inequality of Material Wealth, Studies in Social Economics, Washington, D.C.: The Brookings Institution, 1978, pp. 4-5.

[6]See Chapter II of this work, pp. 12-13 and 32-33.

of the distribution of wealth in the United States, their methodology, and their findings. The method used here, outlined in Chapter III, combines income capitalization with information from estate tax returns and survey data in order to arrive at a complete distribution of wealth. By using a sample of income tax returns merged with observations from the Current Population Survey, the OTA file, it covers virtually the entire population.

Dividends for each family unit were capitalized into the value of corporate stock owned, and interest into the value of debt instruments owned. Survey data were analyzed to test the validity of varying rates of return with income level. Property tax paid divided by the effective property tax rate yielded estimates of the value of real estate owned. These three components of wealth were directly estimated by capitalization. Chapter III explains the calculation of effective property tax rates by state and the analysis of information regarding differential rates of return.

In order to estimate the value of <u>total</u> wealth less debts held, the relationship between <u>net</u> wealth and the above three components of wealth was estimated by regression methods from estate tax return data. Combining the parameters estimated from the estate tax returns with the components estimated from each individual family record yielded an estimated value of net wealth for each family. A frequency distribution of wealth by wealth classes was

then constructed. Chapter IV outlines the regression analysis based on estate tax records with which net wealth may be estimated from the gross value of corporate stock, debt instruments, and real estate. The estate tax data and the income tax and survey data which comprise the OTA file are discussed. The results of the wealth estimation are presented, and related to income and age of family head.

The strengths of this new method of estimation lie in its reliance upon a broad data base and its combination of income capitalization with data available from other sources. A simple capitalization approach cannot include wealth which does not produce income, and has difficulty dealing with debt and certain types of wealth which are hard to estimate by capitalization. In Chapter V the method and results of this estimate are compared to other wealth estimates. Possible ways of improving the data and future estimates are addressed.

Definition of the Wealth Concept

Net wealth, as defined in this estimate, includes all items of durability and realizable market value, less all debts held by the economic unit. It is equivalent to the estate tax measure of wealth, and broader than most survey concepts because it includes all debt, as well as personal possessions and the value of equity in life insurance, annuities, and retirement funds. It does not include any

capitalization of earnings into "human capital" or the value of individuals' contingent rights to social security or other pension funds.

The possibility of including these flows of income has been discussed by a number of economists in recent years.[7] The inclusion of these items in any formal estimate has not been pursued due to both data problems and the conceptual difficulties of treating human and non-human wealth in one measure.

From a philosophical point of view, it is hard to find merit in the position that physical and human capital are equivalent. A very basic difference is that tools are made to serve human beings. Treatment of the individual as a commodity indistinguishable from inanimate commodities is in violation of both religious and humanistic values. In fact, some see the emphasis on human capital as primarily "one of the more interesting efforts to restore capital theory to full health and integrity" in the wake of serious attacks on the capital concept in neoclassical theory.[8]

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[7]Martin Feldstein, "Social Security, Induced Retirement, and Aggregate Capital Accumulation", Journal of Political Economy 82:5 (September/October 1974); John W. Kendrick, "The Accounting Treatment of Human Investment and Capital", Review of Income and Wealth 20:4, (December 1974); and Brittain, Inheritance and Inequality, pp. 5-13.

[8]R. B. Melton, "Schultz's Theory of Human Capital", Social Science Quarterly 46:3 (December 1965): 264, see also Alfred S. Eichner and J. A. Kregel, "An Essay on Post-Keynesian Theory: A New Paradigm in Economics," Journal of Economic Literature 13:4, Dec. 1975, pp. 1293-1314.

Aside from these controversies, there are important differences in the markets for labor and for capital which constrain investments in each differently, and prevent the sale of "human capital". Thus, the market for physical capital is in stocks, while the market for human capital is in flows of labor services. Psychic or "consumption" factors are a much greater influence in human capital investment and use, due to the long-observed phenomenon that persons must be a part of the surroundings in which their human capital is developed or utilized. The liquidity and ease of transfer which mark many assets do not exist in the human capital case. In addition, time places a restriction on possible investments in human capital whereas the accumulation of physical capital may be unlimited.[9] All of these important distinctions suggest that human and non-human wealth may not realistically be treated as additive.

A distribution of human capital would obviously be more equal than one of physical capital since it would primarily reflect the already known distribution of income which in turn reflects the distribution of marketable skills. The upper limit on skills acquisition and use which time places would also push this distribution towards relatively greater equality. A comparison between the distribution of income and the distribution of wealth seems to be more fruitful than an attempt to force the two into one measure. The fact that

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[9]For an interesting discussion of these differences see Thurow, Generating Inequality.

the distribution of marketable skills, as reflected in the distribution of income, does tend so much more towards equality raises the question of why heavy concentrations of non-human wealth are generated.

Accumulations in social security or private pension funds are not included, unless they provide for a sum to be transferred to heirs at death. Proponents of including them argue that their inclusion would tend to greatly equalize the distribution of wealth, which is not surprising. The validity of doing so is debatable, however. While they are a substitute for private saving, which is measured, they do not offer liquidity until quite late in the life-cycle and cannot be withdrawn in toto in most cases. Pension-rights are often lost through job transfer or compulsory early retirement, and social security payments are contingent upon a maximum level of earned income by the recipient. In case of early death, they may not be consumed at all. For these reasons and others they cannot be measured with the same accuracy as other forms of wealth.

Income, wealth, and social security or retirement benefits are all components of economic welfare. Wealth stands out as an index of economic power. Given the theoretical and empirical problems of combining these measures, it seems best to treat them separately. Wealth distribution has not received the attention which income has. It is in this area that an improved measure can be most meaningful.

CHAPTER II

A SURVEY OF THE LITERATURE ON THE DISTRIBUTION OF WEALTH IN THE UNITED STATES

Introduction

Two central themes of early economics were the size of a nation's wealth and the causes of its growth. The measurement and analysis of the distribution of wealth came later. The awareness that wealth, and its corresponding economic power, could affect the workings of the economic and political system motivated inquiry into its distribution. The major focus of Ricardo's economic analysis was on the laws governing the distribution of the social product between the three social and productive classes of landowners, laborers, and capitalists. In the writings of Marx, this distribution is explicitly tied to production and to the development through time of the economic system. Veblen also emphasized the importance of the distribution of wealth, or capital, to the overall performance of the economy.

The maintenance of democratic systems and competitive markets have been held to be dependent upon a diffusion of economic and political power. Thomas Jefferson warned against the establishment of an aristocracy of wealth in America in

the early days of the republic. Great inequalities of wealth were considered detrimental to the functioning of a capitalistic economy by major economic thinkers such as Alfred Marshall, John Maynard Keynes, and R. H. Tawney.[1]

Liberal capitalism, beginning with Adam Smith, promised efficiency through the market mechanism, and increasing prosperity for persons of all social strata. By the late 1800's, its defenders were responding to the Marxian attacks with claims of increasing diffusion of property ownership, particularly in the United States. It was held that a wide distribution of wealth, and opportunities to obtain wealth, were basic to the American economic system. They spurred productivity and innovativeness, increased labor and entrepreneurial mobility, and contributed to social stability.[2]

The purposes of the early studies of wealth distribution were to determine the degree of concentration which existed, observe the secular trend of property ownership, and provide information on savings, capital formation, and consumer behavior. Studies of the distribution of wealth have followed three basic

---

[1]See Thomas Jefferson, The Jefferson Cyclopedia, John P. Foley, ed., New York: Funk and Wagnalls Co., 1900, pp. 935-936; Alfred Marshall, Principles of Economics 7th edition, London: McMillan, 1916, pp. 609-628,689-722; and R. H. Tawney, Equality, New York: Harcourt, Brace & Co., 1931, pp. 150-156.

[2]W. I. King, Wealth and Income of the People of the United States, New York: MacMillan & Co., 1915, pp. 53-61.

approaches: (1) inventories of personal wealth, (2) estate-projections, and (3) income capitalization. These have been used, in various combinations, to estimate the distribution of wealth in America.

An inventory of wealth, by census or sampling, has the intuitive appeal of directness. An official census of wealth was taken in the United States in 1860.[3] In the latter half of the nineteenth century, data on the distribution of farm property collected by the Department of Agriculture was used to make inferences about the property holdings of the general population.[4] The Survey of Financial Characteristics of Consumers, sponsored by the Federal Reserve Board, contains detailed wealth information on a sample of about 2,500 families for 1962, and the 1967 Survey of Economic Opportunity conducted for the Office of Economic Opportunity includes similar information from a panel of 30,000 households.[5] The Survey Research Center at the University of Michigan has

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[3]Lee Soltow, "The Wealth, Income and Social Class of Men in Large Northern Cities of the United States in 1860," in James Smith, ed., The Personal Distribution of Income and Wealth, New York: Columbia University Press, 1975.

[4]See the discussion of Holmes, Ingalls, and King, pp. 19-24, below.

[5]Conducted by the Bureau of the Census, U.S. Department of Commerce, for the Office of Economic Opportunity. Interviews with approximately 30,000 households included income information for 1966 and supplemental financial and demographic data.

collected information on specific asset holdings in numerous studies.[6] These surveys have yielded a great deal of information, but tend to be limited to particular types of property and to be subject to errors of nonresponse or inaccurate reporting of information.

The estate-projection method utilizes information from probate records or estate tax returns to project the total value of estates held by the living. Early studies in America used state probate information, while more recent work has relied on the national estate tax returns.[7] Estate taxes existed in England before their enactment in the United States. The estate-multiplier technique of estimating personal wealth holdings from estate-tax returns was first used by Bernard Mallet in 1905 to make estimates of the distribution of wealth in England.[8]

The estate-multiplier method is based on the assumption that decedents of a given age are a random sample of the living persons of that age, regarding the size and composition of their wealth. Inferences about the total wealth of an age group can then be made by multiplying the wealth of each decedent by the inverse of the mortality rate for a person of his

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[6] Surveys of Consumers (formerly, Survey of Consumer Finances) Ann Arbor, Michigan: Institute for Social Research, University of Michigan.

[7] See pp. 19-24 and 28-35, below.

[8] Bernard Mallet, "A Method of Estimating Capital Wealth from Estate-Duty Statistics," Journal of the Royal Statistical Society of London, LXXI, March 1908, pp.64-84.

or her age. The general formula is

$$W_a = \sum_{i=1}^{n} w_i \times \frac{P_a}{D_a}$$

where W_a = total wealth of the age group

w_i = wealth of the ith decedent in the age group

P_a = living population of the age group

D_a = number of deaths in the age group

and $\frac{P_a}{D_a}$ = the inverse of the mortality rate in the age group

The accuracy of the mortality rates used is critically important to the success of the estate-multiplier technique, as they are the basis of the estate-multipliers. Since mortality differs within an age group depending on sex, social class, and marital status, the accuracy of the estimates is improved when such breakdowns of the population can be made.

White mortality rates, although lower than overall mortality rates for the United States, are generally considered too high for use with the estate tax group.[9] Numerous studies have shown that persons of wealth, or in high-paying occupations, have substantially lower mortality rates than the average white American, up through their late seventies.[10]

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[9]This is true of the federal estate-tax returns, but not always of state or local estate-tax samples. Washington, D.C., which is 75% black, had mortality rates higher than the national average. See pp. 40-41, below.

[10]See I.M. Moriyama and L. Guralnick, "Occupational and Social Class Differences in Mortality," in Trends and Differentials in Mortality, New York: Proceedings of the Annual Meeting of the Milbank Memorial Fund, 1955; and Evelyn M. Kitagawa and Philip Hauser, Differential Mortality in the United States, Cambridge: Harvard University Press, 1973.

The application of separate mortality rates for each age-sex group is first found in G. H. Knibbs' estimate of the distribution of wealth in Australia for 1915. Daniels and Campion introduced social-class mortality rates into their estimates of the distribution of wealth in England and Wales in the early Twentieth Century. "Selected-risk" mortality rates used by life insurance companies have been used to approximate the lower mortality rates of the wealthy in studies of the distribution of wealth in America.[11]

The United States estate-tax law allows deductions for debts, property acquired through taxable gift or inheritance in the five years preceding death, charitable and public gifts, and funeral expenses. Data from the original returns, before audit, is published in Statistics of Income by the Treasury Department.[12] Understatement of the true value of property is likely to occur on real estate, tangible personal property, interest in unincorporated businesses, and ownership of unlisted or untraded stock. These assets are difficult to value, and estates generally have an economic

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[11] G. H. Knibbs, The Private Wealth of Australia and Its Growth, Melbourne: McCarron, Bird, & Co., 1918; Daniels, G. W. and Campion, H. The Distribution of National Capital, Manchester: Manchester University Press, 1936; Mendershausen, Lampman, and Smith, pp. 28-32,34-35, below.

[12] Internal Revenue Service, Department of the Treasury, Statistics of Income - Estate Tax Returns, 1922 - present, annually.

interest in a low reported value. Declared value of estates is further reduced by gifts inter vivos, costs of last illness, and various forms of evasion.

C. L. Harriss studied a special tabulation of estate tax returns before and after audit and found that an average understatement of 10% of estate value existed before audit. A different, usually higher, tax was required in 56% of the cases. Of those reported as non-taxable, 5% were classed as taxable after audit.[13]

While underestimation of the value of property biases downward estate-multiplier estimates of wealth, it is partially offset by the fact that many smaller estates may not file. Their exclusion from the estimates tends to overestimate the concentration of wealth in the highest group.[14]

Estimation with this technique has the advantage of detailed wealth information on the tax returns, but at the national level has been limited to persons with $60,000 or more in gross wealth. The high minimum filing requirement has recently been raised to $250,000. As a result, estate-multiplier estimates are limited to the top several percentiles of the wealth distribution, and can be generalized to

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[13]C. L. Harriss, "Wealth Estimates as Affected by Audit of Estate-Tax Returns," National Tax Journal, December 1949, p. 316.

[14]See pp. 21-24, below, for the views of several researchers on this issue.

the population at large only by means of extrapolation or arbitrary assumptions such as the assignment of estate value by annual income at lower levels.

Income capitalization uses information available on income tax returns to estimate the ownership of wealth. It thus has the advantage of relying on a much broader data base. The extension of the federal income tax to lower and lower levels of income has increased this base far beyond what it was for the early studies which used this method. A key advantage is its use of data from living persons, who will not have reduced their estate before death for tax purposes.

Ownership of various assets such as real estate, corporate stocks, and corporate or government bonds, is indicated by the receipt of annual revenues from them. These may be capitalized to indicate the present value of the asset. The choice of a capitalization rate, or rates, is critical to this type of estimation.

Capitalized values may overstate concentration in prosperous periods (and understate in recessions) because they include intangible asset values where national inventory aggregates do not. The retention of profits in closely held corporations will mean that capitalized dividend income may underestimate such stock holdings.

The greatest drawbacks to income capitalization as a method of estimation are its exclusion of non-income-yielding

property and property on which the income is not taxable, and the problem of allocating wealth to persons below the minimum filing requirement. This latter group may be accounted for by the use of supplementary information, such as agricultural or financial statistics. Extrapolation of the results, assignment of the residual, or the calculation of a relationship between net income and net wealth for the lowest wealth group, are other possible supplementary methods.

Income capitalization was used by many researchers in the early twentieth century, in conjunction with inventory, probate, or estate tax data. Combination with estate tax information makes possible the inclusion of non-taxable and non-income-yielding property in wealth estimates.[15]

The remainder of this chapter surveys studies of the distribution of wealth in America from 1890 to the present, along with related research into patterns of asset ownership and holdings of income-yielding wealth. Recent studies of the distribution of wealth at the state and local level are reviewed. Particular attention is given to the data used in the various studies, the methodology adopted, and the problems encountered. General results of major studies are also cited in brief.

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[15]See Lehmann and Stewart, pp. 26-28.

Early Studies In America

The earliest studies of the distribution of wealth in America relied on combinations of methods and data sources. The first was published by G. K. Holmes in 1893.[16] He used farm and home proprietorship data and information on indebtedness to classify families into wealth categories, along with assumptions about the number of farms and families occupying non-farm houses. Arbitrary allowances for other assets of each category were used to arrive at each family's total wealth. Census estimates of total tangible property in 1890 were used to approximate the total wealth figure.

Holmes estimated that 9% of the families in the United States owned approximately 71% of total wealth, leaving the remaining 91% with 29% of personal wealth. He used the New York Tribune's estimate of 4,047 millionaires in the United States to make a further breakdown. By allocating an average wealth of $3 million to each millionaire, Holmes estimated that this .03% owned 20% of personal wealth.

Three years later, C. B. Spahr published estimates of the distribution of wealth in the United States based on estates probated in New York State in 1892.[17] He inferred the distribution of wealth among the living from the distribution

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[16] G. K. Holmes, "The Concentration of Wealth," Political Science Quarterly Vol. III, 1893, p. 589.

[17] C. B. Spahr, The Present Distribution of Wealth in the United States, New York: Crowell, 1896.

of wealth reported for estates, with some adjustments made regarding underreporting of large estates.

Spahr constructed a frequency distribution of wealth holdings, which showed great concentration of wealth in the highest groups. However, as death is not a random sample of the living, but one biased toward older (and consequently wealthier) persons, the use of estates to reflect the actual distribution of wealth results in overestimates of concentration. In addition, the New York data used by Spahr could not be accepted as representative of the United States.

W. I. King used data on estates probated in Massachusetts and Wisconsin[18] as the basis for "the pioneer work in the field of the distribution of wealth and income by size in the United States."[19] The Wealth and Income of the People of the United States[20], published in 1915, contained a distribution of estates of men dying for the two states, but did not attempt to generalize it to the nation at large. Comparisons with similar

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[18]Twenty-fifth Annual Report of the Massachusetts Bureau of Labor; and The Distribution of Wealth in Six Wisconsin Counties, M.O. Lorenz, unpublished manuscript, cited by King, Wealth & Income.

[19]C. L. Merwin, "American Studies of the Distribution of Wealth," Studies in Income and Wealth Vol. III, New York: National Bureau of Economic Research, 1939.

[20]King, Wealth and Income.

data from Prussia, France, and Great Britain were made.

The Massachusetts data ranged from 1829 to 1891, but showed almost no change in distribution over that period. The distribution of estates in Wisconsin was for 1900. It was very similar to that found in Massachusetts, with only slightly less inequality.

King classified the population into four groups for his analysis of the distribution of estate wealth:

(1) the poor - persons possessing no property other than personal belongings - constituted 65% of the population

(2) the lower middle class - persons with small property holdings (roughly $1000) - constituted 15% of the population

(3) the upper middle class - persons with a substantial share of income from property (from $2-40,000) constituted 18% of the population

(4) the rich - persons possessing sufficient wealth to live solely on property income (over $50,000) constituted 2% of the population.

The fraction of total estate wealth belonging to each class was tabulated from the probate records. The results from different periods in Massachusetts were very similar to each other and to those from Wisconsin. The poorest 65% owned 5-6% of total wealth, the lower middle class around 4%, the upper middle class approximately 32%, and the rich almost 60%.

The use of probate records to estimate the distribution of wealth among persons at the end of their careers was criticized by W. R. Ingalls, who charged that King and others had

overstated the concentration of wealth in the United States.[21] He suggested that a great many small estates were never probated, and that a significant amount of real estate was held by husband and wife in joint title, thus requiring no court action at the death of either party. For these reasons, a great many small estates were left out of the calculations, biasing them toward greater concentration than actually exists, King alleged.

The method of capitalizing income reported on tax returns in order to estimate holdings of wealth was first suggested by Ingalls. A subsequent study by King estimated aggregate national wealth and its distribution by a combination of income capitalization and the use of aggregate statistics.[22] The wealth of the non-farm population was estimated with information from Statistics of Income on rents, interest, and investment income, and profits from the sale of real estate, stocks, or bonds. With these, King calculated distributions of holdings in corporate stocks and bonds, funded debt, and government bonds.

Urban owner-occupied homes and other consumption goods were distributed according to the current money income of

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[21] W. R. Ingalls, Current Economic Affairs, York, Pa.: G. H. Merlin Co., 1924, pp. 142-161.

[22] W. I. King, "Wealth Distribution in the Continental United States at the Close of 1921" Journal of the American Statistical Association, Vol. XXII, 1927.

the various sectors. Miscellaneous wealth was distributed on the basis of the data on profits. With all of the above, King compiled an estimate of wealth among non-farmers by income classes. He then devised a method to transfer the data to wealth classes.[23]

The wealth of farm owners and farm tenants was estimated separately from Census records giving the value of farm property in farms having various acreages and the number of farms in each size class. Farm wealth and non-farm wealth for each wealth class were then added together.

King found the distribution of wealth among property owners less equal than that of income, but more equal than the distribution of estates. By his estimates, the highest tenth of wealthholders owned 50% of personal wealth, and the lower half owned about 4%.

This distribution of estates for the United States compiled by King was patterned after his earlier work with Massachusetts and Wisconsin data, but used a Federal Trade Commission report titled National Wealth and Income on estates probated in twelve widely scattered states and the District of Columbia in 1912-23. The resulting distribution was very similar to those which he had found within the two states at

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[23]Merwin, "American Studies of the Distribution of Wealth", pp. 16-17, outlines the method used by King.

an earlier date, leading King to note "the remarkable tendency of probate records at different times and places to have similar distributions."[24]

Robert R. Doane also used probated estates and tax payment information appearing in federal government publications to estimate the distribution of wealth by income classes in 1932.[25] His analysis was based on the assumption that an individual's real property is some multiple of his tax payments. Doane's study therefore excluded persons not filing tax returns.

Income tax statistics were used as indicators of the ownership of other forms of wealth such as homes and bank deposits which might not be income-yielding. The method of allocation of tax payments to income classes was not made clear in many cases, and the method of ascertaining and distributing the number of wealthholders was not specified. Holdings of securities, life insurance, and savings deposits were distributed without taking into account multiple holdings by one individual, biasing his results substantially.[26] Doane's demostration of increasing diffusion of wealth between 1880 and 1930 seems to

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[24] King, "Wealth Distribution in the United States," p. 145.

[25] Robert R. Doane, "Summary of the Evidence on National Wealth and its Increasing Diffusion," Annalist, July 26, 1935, cited by Merwin.

[26] Merwin, "American Studies of the Distribution of Wealth," p. 28.

have been based on manipulation of some of the earlier data with which he compared his results. He was criticized as an apologist by contemporaries for using such techniques.[27]

The ownership of income-yielding property by income-tax classes was estimated in the 1920's by Maxine Yaple using a pure income capitalization approach.[28] The purpose of the study was to measure the actual progressiveness of direct taxation on different income classes.

Net estate for the various income classes was estimated by capitalizing interest, rent, fiduciary, and dividend income, adding the value of wholly and partially tax-exempt bonds, and deducting specific exemptions. Lack of official data on the value of insurance owned by income class prevented its inclusion in the estimates.

A key problem in an income capitalization estimate is the rate of capitalization to be used. Rates were determined separately for the various major sources of income, and each was based on average yields over a business cycle. The amount of each source capitalized was also an average for 1928-32 of the average yearly return in any one class. Yaple found that

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[27] Ibid., p. 20-23.

[28] Maxine Yaple, "The Burden of Direct Taxes as Paid by Income Classes," American Economic Review, Vol. 26, December 1936, pp. 691-710.

the one-half million highest income recipients owned $140 billion in income-yielding property, or approximately 2/5 of total private wealth.[29]

A major contribution to the use of income capitalization was made by Fritz Lehmann, who used it in conjunction with estate tax data to estimate the distribution of all private wealth among income tax payers.[30] Persons reporting more than $5000 income on federal tax returns were classified into four income classes:

(1) multimillionaires - over $1,000,000

(2) millionaires - $100,000-$1,000,000

(3) the rich - $10,000-$100,000

(4) the well-to-do - $5000-$10,000

The value of corporate stock held by each of the income classes was estimated by capitalizing income from dividends shown on the tax returns at the rate of 5%, which was the average yield on common and preferred stock in 1930.

From the estate tax returns, the relationship between the value of corporate stock owned and the value of net estate was

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[29] Charles Stewart, "Income Capitalization as a Method of Estimating the Distribution of Wealth by Size Groups," Studies in Income and Wealth Vol. III, New York: National Bureau of Economic Research, 1939, p. 106.

[30] Fritz Lehmann, "The Distribution of Wealth," in Max Ascoli and Fritz Lehmann, eds., Political and Economic Democracy, New York: Norton, 1937.

estimated for each class. Based on assumptions relating estate wealth to income, Lehmann matched each income class with the wealth class holding the same average amount of stock. Estimates of corporate stock per income class were multiplied by the ratios of total wealth to corporate stock holdings for each of the four wealth classes, in order to derive an estimate of total wealth held by persons with incomes over $5000.

According to Lehmann's estimate, this 1.1% of the adult population owned 36% of total personally held wealth. He found that the distribution of national wealth remained about the same throughout the 1920's, although the total increased substantially during the same time period. During the early depression years, there was increasing inequality of distribution shown in Lehmann's estimates. Due to the lack of national wealth estimates, Lehmann had to rely on extrapolation to cover the portion of national wealth not estimated from the income tax returns.

Smaller holdings of corporate stock were found on the estate tax data than from capitalization of dividend income in some cases, probably due to gifts inter vivos designed to reduce tax on the estate at death. Lehmann speculated that other types of wealth are probably underestimated by estate tax data for the same reason.

Lehmann's method includes both income-yielding and non-income-yielding wealth, which makes it superior in some respects

to either a direct capitalization or an inventory estimate. In addition, it is simple enough to employ for estimates of year-to-year changes in the wealth of the higher wealth groups.[31] Deficiencies in the estate and income tax data and their exclusion of lower income and wealth classes were a further limitation on the estimates. However, the expansion of the income tax to lower income groups would make this less serious today than it was in the original estimation.

Recent Studies in America

Several studies since the Second World War have used the estate-multiplier method to estimate the distribution of wealth. The first application of the estate-multiplier method in the United States was made by Horst Mendershausen, who estimated the distribution of wealth among the top wealthholders, and their holdings by type of asset.[32]

Mendershausen used preferred-risk mortality rates from Metropolitan Life Insurance statistics to approximate the mortality rates of the well-to-do. There was insufficient data on the sex of the decedents to allow the use of separate male and female mortality rates.

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[31]The accuracy of this method for determining year-to-year changes is discussed by Milton Friedman, W. L. Crum, Fritz Lehmann, and Charles Stewart, in a section following the previously cited paper by Stewart.

[32]Horst Mendershausen, "The Pattern of Estate-Tax Wealth," in Raymond Goldsmith, Dorothy Brady, and Horst Mendershausen, eds. A Study of Saving in the United States, Part III, Princeton: Princeton University Press, 1956.

Corrections were made for the value of insurance recorded on estate tax returns in order to reflect the cash value before death. Mendershausen constructed a set of "reduction factors" from additional information found in the 1944 returns. The reduction factor for each age group was the ratio of insurance equity to face value. These ranged from 7% for policyholders in the 20-40 age group, up to 81% for those 85 and above. Estate value of insurance multiplied by the appropriate reduction factor yielded the estimated cash value of insurance before death. For 1944, the use of these reduction factors diminished insurance wealth by 82% and total estate tax wealth by 10%.

A special tabulation of returns filed in 1945 included information on the size of gross estate and the age of the decedent cross-tabulated with various asset holdings and the number of returns. Mendershausen calculated the relationship between asset-type, age, and size of gross estate from this data. He found a direct relationship between the size of gross estate and the percentage of it held in government bonds, corporate stock, and intangible property. The percentage held in real estate, mortgages, notes, cash, and insurance fell with increasing size of estate.

With the use of various asset-price indices, Mendershausen made comparisons of the distribution of wealth among the top 1% of wealthholders over the period 1922-46, and found that economic estate per wealthholder rose steadily over the period in current dollars, except for a sharp fall in 1941 which was due, in part, to the relatively low asset prices of that year. Mendershausen compared his estimates with those made by Charles Stewart in 1922 (using Lehmann's method),[33] and an unpublished study done by Mary Painter in 1940 which used dividend capitalization.[34] There was substantial variation among the estimates, which was attributed in part to the choice of preferred-risk mortality rates by Mendershausen, and to the age distribution of decedents in the particular years studied.

The next estimate of the holdings of top wealthholders was by Robert Lampman for 1953.[35] The availability of national balance sheet estimates of aggregate national wealth made possible the first calculation of the share of top wealthholders in personal wealth. Lampman improved the accuracy of the multipliers by using age-sex specific mortality rates. He adjusted for the lower

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[33]Stewart, "Income Capitalization," pp. 112-116; also see Stewart, Charles, "Method of Estimating the Influence of the Personal Income, Gift, and Estate Taxes upon Savings and the Distribution of Wealth," Social Research Vol. 5, Supplement 1, Appendix A, 1938, pp. 91-98.

[34]Mary Painter, cited in Mendershausen, "The Pattern of Estate Tax Wealth," p. 388.

[35]Robert J. Lampman, The Share of Top Wealthholders in National Wealth, 1922-1956, Princeton: Princeton University Press, 1962.

mortality rates of the well-to-do by using a composite of rates for upper level occupations and rates for the holders of preferred-risk insurance policies.

For 1953, Lampman found 1.6% of all adults to be in the top wealthholder group of over $60,000 in gross assets. This group held 25% of all personally held wealth and over half of all business assets, 80% of all corporate stock, virtually 100% of all state and local bonds, and from 10-35% of other types of property. They represented about 2.3% of all families in the United States.

Historical comparisons made by Lampman showed that the top 2% of wealthholding families held 33% of private wealth in 1922, and 29% in 1953. He concluded, however, that the reductions in inequality had occurred in the 1930's and 1940's, but the trend had reversed in the post-World War II era.[36]

Following the estate-multiplier estimates by Mendershausen and Lampman, James Smith estimated the wealth of top wealthholders by age, sex, and type of asset, and the annual income accruing to each of the top wealthholder classes.[37]

Income flows of three types were imputed to top wealthholders. Direct returns to capital such as rent, dividends,

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[36] Ibid., p. 24.

[37] James D. Smith, "Income and Wealth of Top Wealthholders in the United States, 1958" (Ph.d. dissertation, University of Oklahoma, 1966).

interest, and business income were estimated by the average rate of return on capital. Capital gains, both realized and unrealized, were estimated by the relative change in a price index for each type of asset. Wage and salary income was estimated by the use of means of ratios of wage and salary income to asset holdings for persons with $60,000 or more in gross assets, as determined from a Federal Reserve study and Census data which was available. Income from trust funds and unsettled estates was not included.

Smith estimated that the top wealthholders received 24% of the income going to individuals in 1958. They were 1.5% of the population, and their estimated share of wealth was 32%. This result supported Lampman's conclusion that the share of top wealthholders had been increasing since 1949.

The Survey Research Center of the University of Michigan, with the support of the Board of Governors of the Federal Reserve System, has made estimates of income, wealth, savings, and debt of families.[38] These have been based on personal interviews. A detailed study was carried out in 1963 by the Board of Governors.[39] Data was collected from a national sample of 2,557 consumer units, with oversampling among the

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[38]Ibid.

[39]Dorothy S. Projector and Gertrude S. Weiss, Survey of Financial Characteristics of Consumers, Board of Governors of the Federal Reserve System, Federal Reserve Technical Paper, 1966.

highest income groups. Special attention was given to the components of wealth and debt and their diffusion throughout the economy, the variation in patterns of asset ownership, and the apparent determinants of the size of wealthholdings per individual

The Survey was dependent on the voluntary co-operation of respondents for its information, this reliance affected its accuracy, particularly among the highest wealth and income units. It omitted the cash value of life insurance, annuities, and retirement funds, consumer durables other than automobiles, and miscellaneous items such as jewelry and works of art and so could not yield complete wealth estimates.

The 1967 Survey of Economic Opportunity[40] included 30,000 households from the Census Current Population Surveys. This is a much larger sample than the previously cited survey contained, with greater detail of information in many cases. But like the previous study, it does not include information on miscellaneous assets such as art works (which are chiefly owned by the wealthy) and it had a high rate of nonresponse, particularly in the highest wealth groups. While it can provide valuable information not available from other sources, its application is limited by the problems mentioned here.

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[40] Ibid.

A later publication by Smith focussed on those individuals with net worth over $60,000,[41] a group he called the "super-rich" after Ferdinand Lundberg.[42] Microdata tapes of federal estate tax returns filed in 1962, 1965, and 1969 were made available for research purposes by the Internal Revenue Service, with information which made possible this conceptually more satisfying classification.

The mortality rates used in the 1969 study by Smith were similar to those used earlier by Lampman, except for the addition of marital status differentials. Nine other sets of mortality rates were compiled by Smith in order to test the sensitivity of the estimates to the different rates. His conclusion was that estimates are extremely sensitive to the rate chosen.[43] No one set of mortality rates can confidently be applied to the estate tax payers. He chose a set of rates which split the difference between white rates adjusted for occupational mortality differentials and preferred-risk life insurance policy rates.

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[41]James D. Smith, "The Concentration of Personal Wealth in America, 1969," Review of Income and Wealth 20:2, June 1974, pp. 143-179.

[42]Ferdinand Lundberg, The Rich and the Super-Rich, New York: Stuart, 1968.

[43]Smith, "The Concentration of Personal Wealth," p. 163.

A subsequent paper by Smith and Stephen Franklin examined in greater detail changes in the personal concentration of wealth from 1922 to 1969.[45] The share of wealth held by the richest 1% and .05% was estimated by the estate multiplier technique and compared with the total. On the basis of these estimates, Smith and Franklin concluded that the distribution of wealth had become more equal in the 1930's and 1940's, but had remained essentially unchanged since then.

> "Observable point-to-point differences in the estimated concentration of wealth since 1945 are due to inconsistencies and inadequacies in IRS data, sampling errors, short-run stock market variations, and a valuation bias in the basic data which understates the wealth of the rich in declining market periods by permitting estates to select between the most beneficial of two valuation dates."[46]

The estate-multiplier estimates and the federally sponsored surveys have provided most of the current information on the distribution of wealth in the United States. There is still a need for better information on the various types of wealth and the amounts held by those below the estate tax limit. In addition, estate tax wealth will not be as high as the true wealth of the living top wealthholders where the use of trusts is prevalent. Further research into the effect of trusts on wealth estimates would be highly useful.

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[45]James D. Smith and Stephen D. Franklin, "The Concentration of Personal Wealth, 1922-1969," American Economic Review Vol. 64, May 1974, pp. 162-167.

[46]Ibid., p. 164.

Recently, Stanley Lebergott has estimated the distribution of wealth among consumer units by income class for 1970.[47] He allocated aggregate estimates of components of household wealth (from Flow of Funds accounts) among income classes, in accordance with the distribution of income flows, and some other supplementary data. Estimates were first made using IRS income tax returns, and then converted to consumer units using calculations of wealth per dollar of income, by income level, and applying these to census family income data. Lebergott found the wealth-income ratios to be very stable for incomes between $6,000-20,000 (ranging only from 3.2 to 3.9). Below $6,000 the wealth-income ratio declined as income rose, from 8.7 to 4.7. Above $20,000 there was a sharp and steady increase in wealth-income ratios. For incomes above $50,000 the average was 12.8; over $500,000 the average was 18.7.

The initial method of estimation of wealth per IRS income class was as follows. On the assumption that capitalization rates for dividends do not vary with income, the Flow of Funds corporate stock total was allocated among income classes in accordance with the percentage of total dividends received by each class. Debt instruments and currency were allocated on the basis of interest received. Property ownership was allocated on the basis of real estate taxes paid by each class. Lebergott

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[47]Stanley Lebergott, The American Economy - Income, Wealth, and Want, Princeton: Princeton University Press, 1976, pp. 215-247.

relied on two studies which found that assessment ratios and median effective tax rates were not affected by income level.[48] Business equity was allocated in accordance with tax return data on net profit of business, profession, farm, or partnership. Automobiles and other consumer durables were also included, by a method based on Census Survey findings.

According to Lebergott's estimates, the top 1% of consumer units in the income distribution held 17% of total personal wealth, 36% of privately held corporate stock, 13% of short-term claims (which included bank deposits, bonds, mortgages, notes, and currency), 5% of real estate and 25% of business equity. Wealth is also estimated for 13 income classes. Comparability with estimates of the wealth of top wealthholders is unfortunately limited since wealth is estimated for income classes. The strengths of this approach lie in its extensive coverage of the population and its reliance on readily accessible data.

Studies of Regional Distribution

Although the earliest wealth studies in America relied heavily on state data sources, there was a subsequent shift to the use of federal income and estate tax returns when these

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[48]David Black, "The Nature and Extent of Effective Property Tax Rate Variations Within the City of Boston," National Tax Journal, June 1972, p. 207; and E. Scott Maynes and J. N. Morgan "The Effective Rate of Real Estate Taxation: an Empirical Investigation," Review of Economics and Statistics, February 1957, p. 18.

became available. In recent decades, researchers have used state and local information to study the distribution of wealth within states and localities.

The pattern of financial asset ownership in Wisconsin was analyzed by Thomas R. Atkinson from information found in a sample of Wisconsin state income tax returns.[49] Wisconsin law requires that the source of corporate dividends and corporate or foreign government interest payments be specifically named. This made possible the use of more accurate capitalization rates, rather than an average as Lehmann had used, and the analysis of holdings of speculative issues, closely held or untraded stocks, and large bonds.

Atkinson found that the average return on stock was substantially higher for the income group of $50,000 and over, due to their substantial holdings of speculative issues. Estimates were made of the distribution of untraded stock and large bonds. Atkinson concluded that

> "Ownership of closely held or seldom traded corporate issues is enormously important in the total equity picture and is to a very great extent concentrated in the topmost income groups. Moreover, it is largely

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[49] Thomas R. Atkinson, The Pattern of Financial Asset Ownership, Wisconsin Individuals, 1949. Princeton: Princeton University Press, 1956.

> concentrated with individuals who receive wages or salaries from the issuing corporations; such persons held nearly two-thirds of the total values of untraded stock."[50]

An estimate of total wealth in Wisconsin, and its distribution, could not be made due to the nature of the data used. Many pensioners with significant asset holdings would fall below the income level for filing the return. In addition, a substantial number of financial assets were not required to be listed on the return. These included cash, demand deposits, life insurance, federal government obligations, stock not paying dividends, real estate outside Wisconsin, federal and state pensions, mineral and timber leases, and the value of ownership in unincorporated businesses. This study was, in any case, a major contribution to the literature on wealth estimation, because of the information it revealed on the different kinds of assets held at various income levels. Similar data does not exist for any other state, or at the national level.

Richard French used the estate-multiplier technique to estimate personal wealth and its distribution in Oklahoma in 1960.[51] His has been the only such estimate that has been made at the state level. The low filing requirement of $100 in Oklahoma resulted in a much more extensive coverage of the

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[50]Ibid., p. 7.

[51]Richard French, "An Estate-Multiplier Estimate of the Personal Wealth of Oklahoma Residents, 1960" (Ph.d. dissertation, University of Oklahoma, 1967).

population than is possible at the national level.

French found that the top 1% of Oklahoma wealthholders held 43.5% of the total estimated wealth in Oklahoma, a greater concentration than has been estimated for the United States at large. Wealth was concentrated in the metropolitan areas surrounding Tulsa and Oklahoma City. The age of decedents was not required information on the return. The Oklahoma Department of Health provided this information, along with mortality rates for persons residing in Oklahoma.

James Smith used the estate-multiplier technique to estimate total wealth and its distribution for Washington, D. C. in 1967.[52] The major data sources were estate tax returns filed in the District of Columbia and death certificates for District of Columbia residents filed in the District or at the place of death.

Washington also has its own estate tax, with a filing requirement of $1000 in gross assets. Information regarding the decedents age, sex, occupation, and marital status is requested, along with the itemization of all assets except the cash surrender value of life insurance policies and the owner-

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[52]James D. Smith, "White Wealth and Black People: The Distribution of Wealth in Washington, D. C. in 1967," in James D. Smith, ed., The Personal Distribution of Income and Wealth, New York: Columbia University Press, 1975.

ship of real estate outside the District. The latter were excluded from the wealth estimate.

Mortality rates used to calculate the multipliers were age-sex-race-marital status specific, adjusted for occupational class mortality rates. An estimate of total wealth was made by fitting log-normal functions to the estate-multiplier estimates and extrapolating them into the lower tail of the distribution for blacks and non-blacks.

Smith found a mean net worth of $19,300 for non-blacks residing in Washington, D. C., which was quite close to his estimate of the mean value for the United States as a whole. Blacks, who were 67% of the District's population, held a mean net worth of $1000. Composition of assets and holdings of various types were analyzed in relation to sex, race, age, and level of net worth.

Atkinson, French, and Smith were able to achieve greater depth and breadth of result in some aspects of their estimations because the particular data sources they used were superior in certain respects to those available for the United States as a whole.

Conclusion

Interest in the distribution of wealth in America dates back at least a century. The techniques, as well as the basic data available, for estimating the distribution have improved substantially during that time.

Early studies used combinations of various methods and types of data. State probate information was used to make inferences about the national distribution, and data on farm property and debt was used to estimate the total distribution of property. Census data, income and estate tax returns, and large amounts of common observation were relied upon. Inventories, income capitalization, and the distribution of estates at death were the methodologies used. A promising application of income capitalization to the estimation of national wealth was made by Fritz Lehmann, who combined it with estate tax information to estimate total wealth held by the wealthy.

Recent studies have used the estate-multiplier technique to estimate the share of wealth held by the estate tax payers and its distribution among them. The development of better mortality rates has contributed to improving the accuracy of these estimates. The existence of national balance sheet estimates of total wealth has made possible comparisons with this independent estimate.[53]

The estate tax payers represent a rather small, though significant, portion of the United States population. A lower

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[53]Raymond W. Goldsmith, The National Wealth of the United States in the Postwar Period, Princeton: Princeton University Press, 1962; and Goldsmith and Lipsey, Studies in the National Balance Sheet of the United States, Princeton: Princeton University Press, 1963.

filing requirement on the federal estate tax, such as Washington, D. C. or Oklahoma require, would make possible estate-multiplier estimates of the wealth of greater numbers of the population.

Another possible method of estimating the wealth holdings of a substantial part of the population is that of income capitalization, in combination with supplementary methods of estimating non-income wealth. Lebergott's method combines capitalization of major income flows and use of national aggregates. The extension of the federal income tax to low levels of income has broadened the coverage of capitalization techniques, and greater detail in the specification of the origin of dividends (as on the Wisconsin state income tax returns) would enable more accurate capitalization of dividends to stock holdings.

In this study, income from interest and dividends, along with property taxes paid, are used in the estimation of family wealth from income and Census data.

CHAPTER III

DETERMINATION OF CAPITALIZATION AND PROPERTY TAX RATES

Introduction

While detailed studies of wealth distribution among the top wealthholders have made significant advances in expanding the state of knowledge regarding the very wealthy, attempts to estimate the entire distribution of wealth have been few and far between. The recent availability of large microdata files which include extensive financial and demographic information for each observation makes possible the use of individual family income and asset data to model the unknown variable, wealth.

Family wealth levels are estimated in this study using gross values of real property, debt instruments,[1] and corporate stock as the independent variables in a linear regression model. These are important components of the stock of wealth which must themselves be estimated from financial flows (dividends,

[1] Debt instruments refers to all assets yielding interest income to the owner, including corporate and foreign bonds, U. S. government securities, loans and mortgages, state and local bonds, and all savings deposits and credit union accounts.

interest, and property taxes). Data on these flows comes from the personal income tax returns of members of the family and Current Population Survey reports, through the 1974 OTA file (Office of Tax Analysis, Department of the Treasury) in which these are merged by family. The characteristics of this file and the merging techniques are discussed in Chapter IV.

In this chapter, the choice of a rate of return and rate of interest to be used when capitalizing dividends and interest income is analyzed empirically from survey data, following a review of the literature on differences in rates of return between income classes. Based on this information, a single rate is used across all income classes, as there is no clear relationship between income and rate of return. Average property tax rates are calculated for each state, based on a combination of available Census data, since these are found to vary more between states than within states.

The Accuracy of Reported Dividends and Interest

A central part of this method of wealth estimation is the capitalization of income flows from stocks and debt instruments, as reported on federal income tax returns, into estimates of the value of those assets. The income tax has been extended over the years, so that population coverage of income recipients is quite good. The adequacy of coverage on the federal tax return of dividends and interest is discussed in the following paragraphs.

Underreporting of dividend and interest income occurs for a variety of reasons. In some cases, the income of the recipient is below the minimum filing requirement.[2] The dividend exclusion of $100.00 per person probably results in the failure to report small amounts of dividends on many returns. Although regulations require corporations, banks, and other institutions to file reports with the Treasury department listing the recipients of dividends or interest paid out, these figures are rarely cross-checked with individual income tax filings. Sample audits by the Internal Revenue Service provide a basis for estimating the degree of underreporting which occurs, and the income groups in which it is most frequent.

Some stock, particularly in closely-held corporations, is non-dividend paying. Shareholders of small business corporations also have the option of being taxed as partnerships, thereby eliminating the listing of their receipts as dividends. When stock is held in trust, dividends are paid directly to the trust and the individual reports trust income separately. For these reasons, some stock ownership will not be revealed by dividends received.

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[2] A great many of these persons are minors.

The gap between aggregate reported dividends and actual total dividends was estimated by Daniel Holland in the late 1950"s and by Blume, Crockett, and Friend in the 1960's. Holland concluded that 5-10% of total dividends were not reported by individuals. Errors in interest income reporting appeared to be of greater magnitude. Previous audits which he examined indicated that underreporting was most prevalent in the middle income group.[3] Blume, Crockett, and Friend used an estimate of 2% of reported dividends to account for illegal underreporting, on the basis on unpublished IRS studies which have shown a substantial reduction since 1959.[4] The remainder of the dividend gap (which amounted to 5.8% of reported dividends) was assumed to be due to non-filers or persons below the legal exclusion limit.

According to an earlier study, approximately 5% of total corporate stock did not pay dividends in 1960. Only 2% of New York exchange listed stocks did not pay dividends, whereas 10% of the stock which was unlisted or was listed on other exchanges did not pay dividends during that year.

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[3]Daniel Holland, Dividends Under the Income Tax, Princeton: Princeton University Press, 1962, p. 5.

[4]Marshall E. Blume, Jean Crockett, and Irwin Friend, "Stockownership in the United States: Characteristics and Trends," Survey of Current Business 54:11, November 1974, p. 20.

Since there is an inverse correlation between the income of a stockholder and the importance of New York exchange listings in his portfolio, higher income returns probably have a greater percentage of stock which is not captured through dividend capitalization.[5]

Underreporting is most common in the middle income group because small amounts of interest or dividends are often received. Interest from savings accounts is probably the most seriously underreported, also for this reason. Underreporting in the high income group is probably due for the most part to the holdings of stocks in trust and the ownership of non-dividend paying stock.

The Choice of an Appropriate Capitalization Rate for Dividends

The average rate of return on common stock for 1973 was 3.4%, according to Moody's Investors Service. In this section, the appropriateness of adjusting that average rate for different income classes will be discussed. Given the structure of the federal income tax, it is commonly expected that persons of higher income will prefer capital gains to dividend income. Their measureable average rate of return (dividends/value of stock) would therefore be lower than that of middle income investors, even though their eventual total profit might be much greater. It has been suggested, however,

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[5]Jean Crockett and Irwin Friend, "Characteristics of Stock Ownership," Proceedings of the Business and Economics Statistics Section of the American Statistical Association, 1963, p. 148.

that high dividend payout and increased stock value are often positively related rather than being alternatives in investment.[6]

Furthermore, age, occupation, and many other motivational forces may affect investment goals sufficiently to offset any pattern in rates of return by income class. A survey conducted under the auspices of the Brookings Institute dealt considerably with the motivations behind investment decisions and portfolio composition, and found that tax considerations were not as important as economists often assume them to be.[7]

Investment outcomes, which are measured in part by current rates of return, are not necessarily the investment goals of the individuals. It has been argued that higher income individuals have greater access to information and so might come closer to attaining investment goals than other investors. The recent literature on efficient capital markets suggests that with the exception of specialists and a very small group of corporate insiders, there has been no group (or method) which has systematically outperformed the market, since stock prices adjust quickly to reflect all available information.[8]

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[6]Holland, pp. 38-56.

[7]Robin Barlow, Harvey E. Brazer, and James N. Morgan, Economic Behavior of the Affluent, Washington, D.C.: The Brookings Institution, 1966, pp. 151-170.

[8]Eugene F. Fama, "Efficient Capital Markets: A Review of Theory and Empirical Work," Journal of Finance, vol. 25, May 1970, pp. 384-87.

Recent Literature on Rates of Return by Income Class

The long-range study of stock ownership characteristics which is ongoing at the Wharton School of Finance supplies some empirical information on differential rates of return by income class. A stratified sample of returns used by the Internal Revenue Service for Statistics of Income -- Individual Income Tax Returns[9] in 1960 was further limited to persons reporting dividend income. Within this group, a subsample was taken, with higher sampling ratios in the upper income brackets. The 1960 price-dividend ratio of the paying corporation, as identified on Schedule A, was used to capitalize the receipts to a market value figure.[10]

Average price-dividend ratios (the inverse of the rate of return concept used here) were relatively constant for incomes under $50,000 but rose steadily for higher income classes. This may have been due to a much stronger preference which lower income stockholders [11] showed for telephone and communications stock (particularly AT&T), electric and gas utilities, and investment companies. Bank and insurance stocks were equally popular with all income groups. These four industry areas combined

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[9]Internal Revenue Service, Department of the Treasury, Statistics of Income -- Individual Income Tax Returns, 1919 -- present, annually.

[10]Crockett and Friend, pp. 147-48.

[11]It is worthwhile to note that lower income stockholders are generally not lower income persons.

accounted for 40% of total stock owned in the under $10,000 group of stockholders, an average of 25% in the $10-150,000 group, and less than 20% in the over $150,000 group.[12]

In the Wharton study, the importance of industrial stocks in the portfolio increased steadily with income. Upper middle income stockholders held, relatively, the highest proportion of stock in family or closely-held corporations, while persons in the highest income brackets held the greatest proportion of stocks in trust, according to the 1960 study. Friend and Crockett proposed that the heavy preference of lower income stockholders for utility stocks might be evidence of risk-aversion or a result of widespread employee-stock ownership plans and a greater familiarity of the public at large with utility stocks than with industrials.[13]

In order to include stock which did not pay dividends in their estimates, Friend and Crockett made the assumption that a particular income class would hold the same proportion of all non-dividend paying stock of a particular status and industry as it held of all dividend paying stock of that type. For this reason, they accompanied their estimates of the distribution of stock by income class with the following caution.

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[12] Ibid., pp. 158-61.

[13] Ibid., p. 161.

> ". . . the ratios for high-income classes are almost certainly somewhat too low, since these groups would be expected to hold a higher proportion of non-dividend paying than of dividend paying stock of a given type, in view of the tax advantages of substituting capital gains for dividend income."[14]

In a subsequent study, it was estimated that for 1971 the highest 1% of families and unrelated individuals in the personal income distribution received 47% of dividend income and held 51% of the market value of stock owned by all families, while the highest 10% received 71% of dividend income and held 74% of the market value of stock.[15] The tendency of upper income investors to hold low rate of return (high price-dividend ratio) stock was more pronounced in 1971 than in 1960, although the overall rate of return including capital gains did not differ significantly among income groups.

The Wharton studies found that rate of return and income were inversely related at very high level income levels. This was explained in part by differences in portfolio composition as income rose. Utilities, including telephone and communication stocks, were much more important in the portfolios of lower and middle income stock owners than were industrials. As a

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[14]Ibid., p. 155.

[15]Blume, Crockett, and Friend, p. 17.

general rule, they pay higher dividends per dollar of stock but do not confer the capital gains which "growth" stocks often do.

Analysis of Rates of Return from Survey Data

In order to further analyze the relationship which might exist between average family rate of return on stock and family income level, data from the Survey of Financial Characteristics of Consumers[16] was utilized in this study. For each family in the sample, the value of publicly traded stock and the value of closely-held stock was available, along with the value of dividends received for each type. Average rates of return were calculated for twenty income classes as follows.

First, total annual income was calculated for each family and the families were ranked in ascending order by income level. The sample was then divided into twenty income strata, each containing approximately 127 observations. The survey over-sampled the wealthy, so that roughly the top ten of the twenty strata represent "high-income" respondents. In addition, since the concept of total income used included farm and small business income there are observations with substantial negative income in the lowest stratum who also have a high wealth rank.

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[16]Dorothy S. Projector and Gertrude S. Weiss, Survey of Financial Characteristics of Consumers, Board of Governors of the Federal Reserve System, Federal Reserve Technical Paper, 1966.

Within each stratum, total dividend receipts were summed across the group and divided by the sum of total value of stock held, in order to arrive at the average rate of return for the strata. In this manner, observations were weighted by their economic importance in calculating the average rate of return. In addition, this eliminated the problem of an artificially high variance in average family rates of return caused by the fact that the survey recorded the sum of dividend income flows over the year, but asked for stock ownership as of December 31, 1962. Thus, some families reported dividends but no stock, or vice versa, due to the fact that transactions had occurred during that year. Calculation of the average rate of return may be expressed as:

$$(1) \quad r_i = \Sigma D_i / \Sigma S_i$$

where r_i represents the average rate of return on all corporate stock in the ith stratum

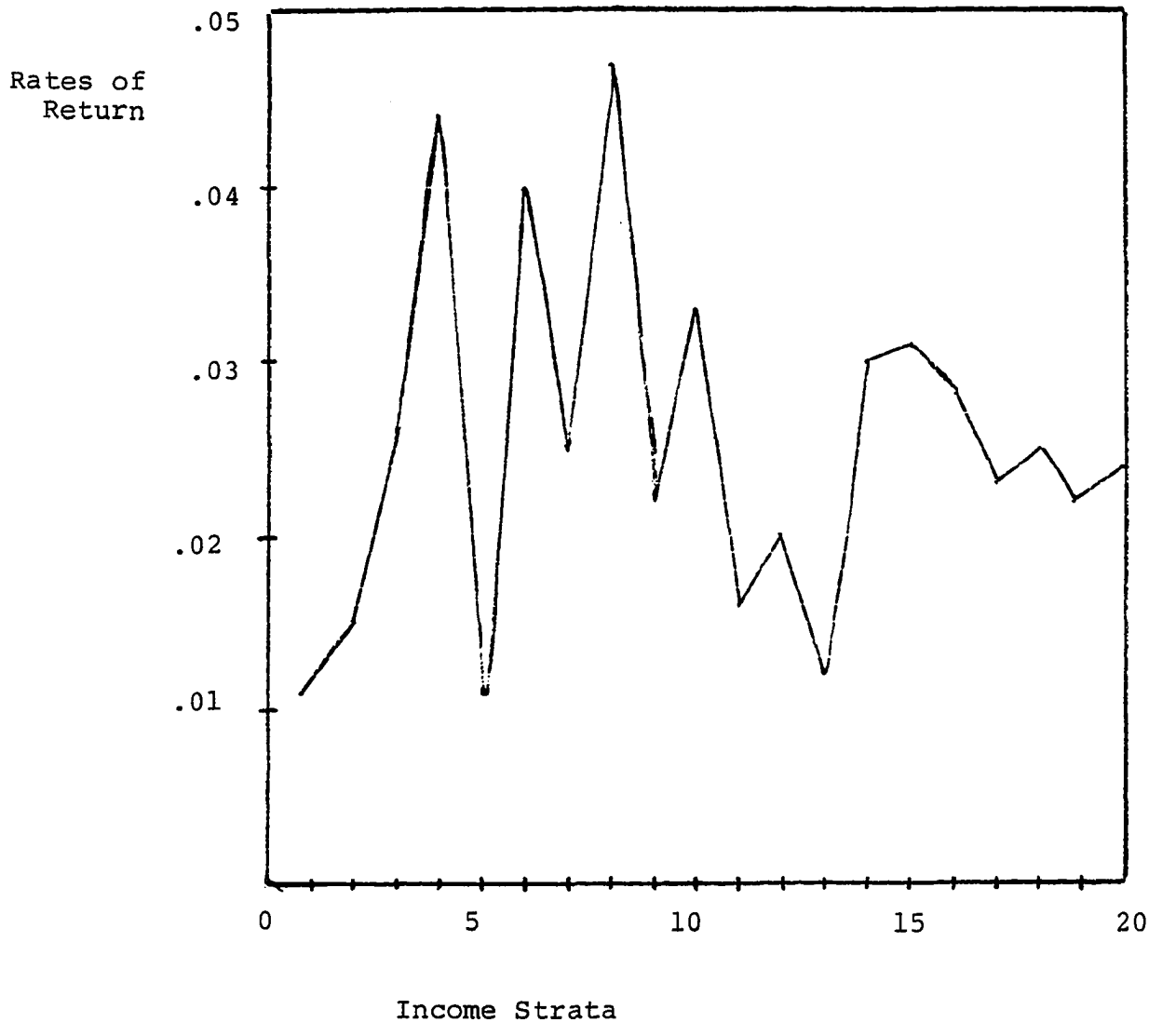
D_i represents dividends received by families in the ith stratum

S_i represents value of stock owned by families in the ith stratum

Average rates of return, as calculated from the sample data, may be seen in Figure 1, page 55, and in Table 1 on page 56. They range from roughly 1% in the first, fifth, and thirteenth strata to over 4% in the fourth and eighth strata. No consistent pattern between the average rate of return and income strata seems to be present, other than the pronounced reduction in the

Figure 1

AVERAGE RATES OF RETURN ON CORPORATE STOCK
BY INCOME CLASS, 1962



SOURCE: Compiled using microdata from the Survey of Financial Characteristics of Consumers. See equation (1), p. 54.

TABLE 1

Average Rates of Return on Corporate Stock and Debt Instruments by Income Strata

Stratum	Avg. Rate of Return Corporate Stock	Avg. Rate of Return Publicly Traded Stock	Avg. Rate of Return Closely-Held Stock	Avg. Rate of Interest Debt Instruments
1	0.011	0.012	0.001	0.020
2	0.015	0.015	0.000	0.039
3	0.026	0.039	0.000	0.034
4	0.044	0.043	0.454*	0.033
5	0.011	0.023	0.000	0.021
6	0.040	0.044	0.000	0.032
7	0.025	0.025	na	0.032
8	0.047	0.050	0.000	0.029
9	0.022	0.033	0.000	0.023
10	0.033	0.036	0.000	0.023
11	0.016	0.029	0.002	0.038
12	0.020	0.019	0.020	0.031
13	0.012	0.012	0.005	0.039
14	0.030	0.035	0.002	0.030
15	0.031	0.033	0.027	0.032
16	0.028	0.035	0.013	0.039
17	0.023	0.034	0.007	0.028
18	0.025	0.032	0.011	0.037
19	0.022	0.027	0.015	0.030
20	0.024	0.025	0.021	0.032

Source: Rates of return and interest have been calculated from the Survey of Financial Characteristics of Consumers data on family income and assets for 1962, as described on pp. 52-61.

* This figure is assumed to be due to errors in reporting the value of closely-held corporate stock. In Figure 2 it has not been plotted.

dispersion of average rates for the higher income classes. Average rates of return on publicly traded stock were very similar to those for all stock, primarily because it is much more important than closely-held stock in most portfolios. Figure 2 shows the average rates of return on publicly traded and closely held stock for the twenty income classes used here.

$$(2) \quad rpt_i = \Sigma DPT_i / \Sigma SPT_i$$

where rpt_i represents the average rate of return on publicly traded stock in the ith stratum

DPT_i represents the dividends from publicly traded stock received by families in the ith stratum

SPT_i represents the value of publicly traded stock owned by families in the ith stratum

For closely held stock, the seventh income class was the sole case in which no family held any of that type of asset. Eleven other classes had average rates of return of zero or less than 1%. Discounting the abnormally high value for the fourth stratum, the information yielded by the data suggests that higher income persons tend to receive a higher rate of return on stock in closely held companies. The importance of these in the total stock portfolio is small enough, however, that the overall rate of return is not significantly affected. Valuation of closely held stock is a difficult matter, and the

results of this analysis must be accepted with far less confidence than the preceding discussion of rates of return on publicly traded stock.

(3) $rch_i = \Sigma DCH_i / \Sigma SCH_i$

where rch_i represents the average rate of return on closely-held stock in the ith stratum

DCH_i represents dividends from closely-held stock received by families in the ith stratum

SCH_i represents the value of closely-held stock owned by families in the ith stratum

The average rate of return on closely-held stock is plotted for the twenty income strata in Figure 2 on page 59 and is also listed in Table 1 on page 56.

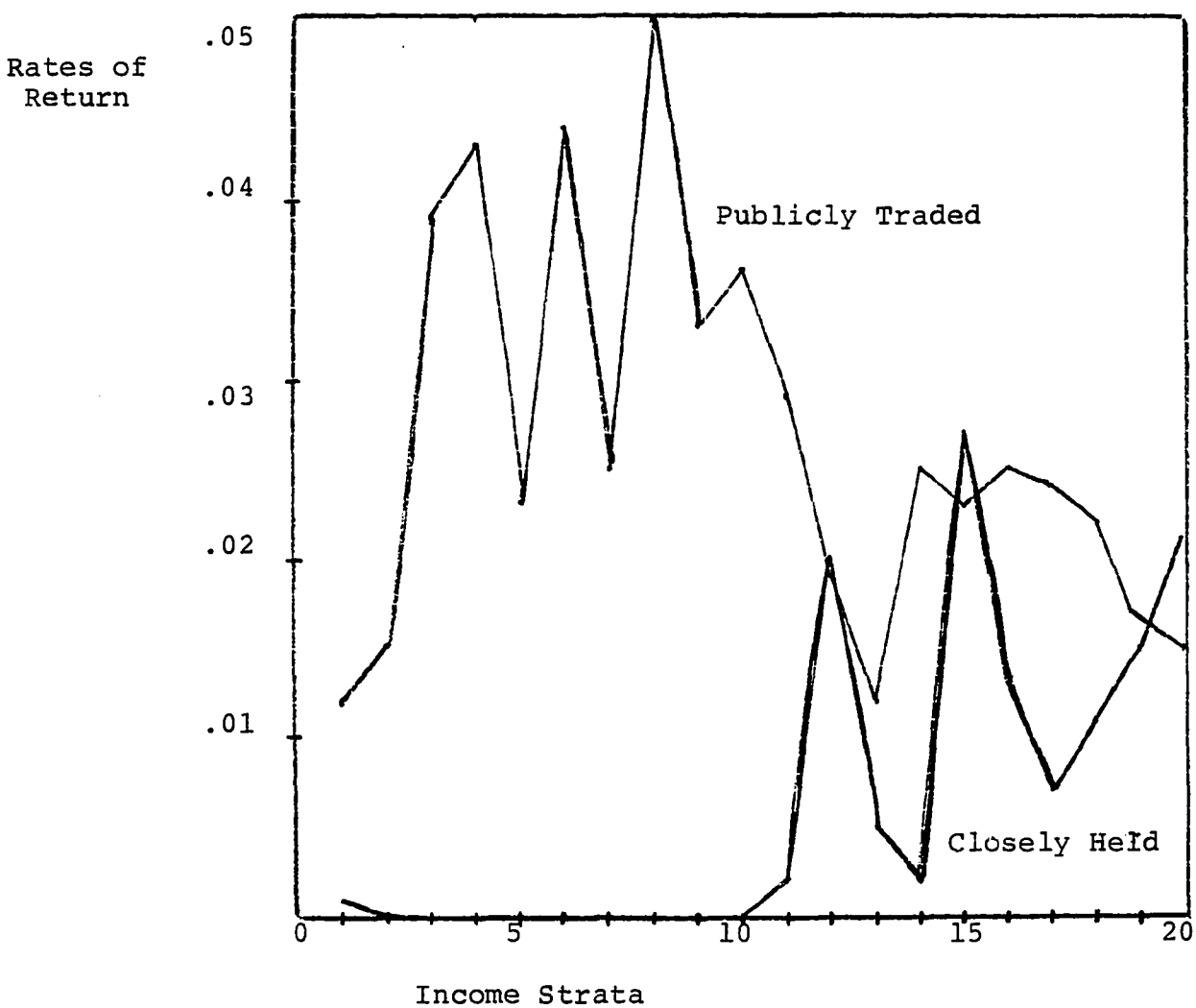
An analysis of the average rate of return using the survey data from 1962 does not support the hypothesis that the price-dividend ratio, or rate of return (ignoring capital gains) will vary consistently with income class for publicly traded stock or overall stock ownership. The variation in class means is less as income class rises, but the mean rate of return on stock is still the best predictor of the rate of return of any stockholder, regardless of his/her position in the income distribution.

This result does not diverge significantly from the conclusions of the Wharton study, which did not find a negative

Figure 2

AVERAGE RATES OF RETURN ON PUBLICLY TRADED AND CLOSELY HELD STOCK

BY INCOME CLASS, 1962



SOURCE: Compiled using microdata from the Survey of Financial Characteristics of Consumers. See equations (2) and (3), pp. 57-58.

relationship between the rate of return and income below incomes of $50,000. In the sample data the three top strata include some families with incomes above that level. There was no indication of a lower rate of return for this group using the survey data on assets and dividends. This difference of result may be due to the use of different data bases, one survey answers and the other tax returns, or to the difference in the years studied.

For the purpose of this estimate, the survey results will be accepted with reservations, and a single rate of return (the average on common stock) will be used to capitalize the dividend income of any recipients on the tax file. Such a method will tend toward some overstatement of the holdings of lower income stockholders, and understatement of the corporate stock held by the higher income groups, since studies such as the Wharton one previously reviewed indicate a lower rate of return, on average, for very high income persons. The major purpose of estimating stock here is to use it, along with debt instruments and real estate, to estimate net wealth. As the next section will discuss, the bias in stock estimation mentioned as a possibility here is likely to be balanced off by the nature of the estimation of debt instruments.

The Choice of An Appropriate Capitalization Rate for Interest Income

Since interest income is the sum of interest paid on conventional savings accounts, certificates of deposit, all types of bonds, and privately held loans and mortgages, a variety of interest rates must be considered when we attempt to capitalize income into the value of debt instruments. An evaluation of survey or estate tax data shows that the importance of all types of large denomination bonds in the portfolio, and of loans and mortgages, rises with income and wealth. Conventional savings accounts are relatively more important at lower levels.[17] The distribution of different types of debt instruments, which yield varying rates of interest, is not equal across income classes.

For the purpose of analyzing the average rate of interest received by different income classes, data on the value of debt instruments owned and the amount of interest income received in the Survey of Financial Characteristics of Consumers file was used to calculate an average rate of interest for each of twenty income classes. Using the same basic method as with rates of return, the average rate of interest for each income class was defined as the sum of interest income across a stratum

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[17] Ibid.; and, James D. Smith, "The Concentration of Personal Wealth in America, 1969," Review of Income and Wealth 20:2, June 1974.

divided by the sum of all debt instruments held by families in the stratum.

$$(4) \quad \rho i = \Sigma I_i \; / \; \Sigma DI_i$$

where ρi represents the average rate of interest for the ith stratum

I_i represents interest income received by families in the ith stratum

DI_i represents debt instruments owned by families in the ith stratum

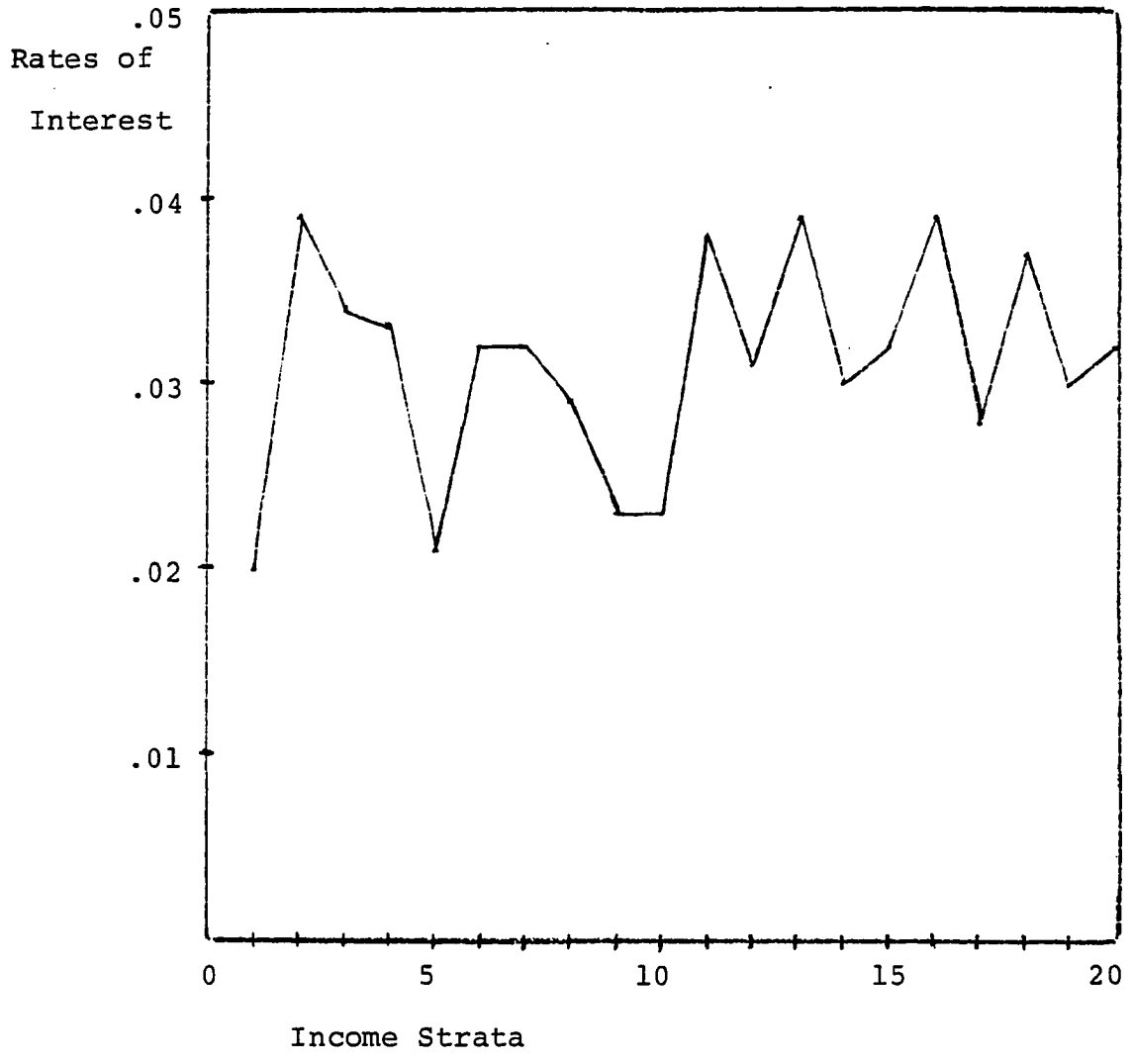
Average rates of interest for each strata are plotted in Figure 3, page 63 and listed in Table 1 on page 56. They exhibit more of a positive relation with income level than do average rates of return on stock. The dispersion of mean rates of interest narrows as income class rises, as it does with corporate stock rates. Average rates of interest range from 2.02% in the lowest stratum to 3.94% in the second. The overall average rate of interest for the entire sample of 3.13% suggests that using the rate paid on conventional time deposits is a good approximation of the average. In 1962, the year of the survey, 55% of Federal Reserve Member banks paid 3% or less on conventional accounts, 25% paid an interest rate of 3½% and 20% paid as high as 4%.

Table 2, page 64, lists the average rates of interest on the major types of debt instruments for 1962 and 1973. Rates paid on

Figure 3

AVERAGE RATES OF INTEREST ON DEBT INSTRUMENTS

BY INCOME CLASS, 1962



SOURCE: Compiled using microdata from the Survey of Financial Characteristics of Consumers. See equation (4), p. 62.

TABLE 2

A COMPARISON OF MONEY MARKET RATES FOR 1962 and 1973

Debt Instrument	Avg. Rate 1962	Avg. Rate 1973
Corporate bonds	4.62	7.79
Short-term business loans (bank rates)	5.00	7.40 (May) 10.10 (Nov.)
Municipal bonds	3.14	5.22
U.S. Govt. Securities		
3 month bills	2.77	7.03
9-12 month	3.02	7.30
3-5 years	3.57	6.92
10 or more years	3.95	6.30
Time deposits -- maximum rate paid	4.00	5.00*
New home mortgages -- FHA insured	5.50	8.19

Source: Statistical Abstract of the United States, 1965, pp. 470-4, and 1974, pp. 463-5.

* Certificates of deposit paid from 5% to 7½% depending on the term and the denomination in 1973.

loans and mortgages refer to those held by financial institutions, and may not be representative of those held by individuals. It is apparent that by 1973 bonds were offering a far higher relative rate of return than they were at the time this survey data was collected. Municipal (state and local) bonds, which are held primarily by the highest wealth group due to the large denominations in which they are sold and the tax-free income which is most valuable to that group, pay a relatively low rate of interest which is generally close to the rate paid on ordinary time deposits. Fortunately, state and local bonds may be included in the debt instrument concept in this analysis although interest from them is not reported on federal tax returns, due to imputations which have been made by the Office of Tax Analysis for this special tax file. [18]

The inclusion of state and local bond interest in interest income probably accounts, in part, for the small positive relationship between income strata and average rate of interest in the survey data , shown in Figure 3, page 63 . The relative difference between the return on corporate bonds and savings accounts, for example, was much greater by 1973 than it had been in 1962. In using the survey results shown in Figure 3, the actual trends present in the 1973 data may be understated. It is possible that the average rate of interest was more highly correlated with income in 1973 than in 1962, and that therefore the use of the rate of interest paid on

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[18] For a more detailed explanation see Chapter IV, pp. 90-92 below.

savings accounts to capitalize all interest income . may overestimate the value of debt instruments held by higher income groups. Fortunately, this bias is in the opposite direction from that which occurs when all dividends are capitalized using the average rate of return. Since lower income stockholders probably owned relatively more utility stocks than industrials, and for 1973 the average rate on utilities was 7% versus 2.9% for industrials, and an average of 3.4%, corporate stock ownership in lower income groups will tend to be overestimated in contrast to that of debt instruments.

Estimation of Average Effective Property Tax Rates by State

In this section, the estimates of statewide property tax rates will be explained. These rates will be used to estimate the value of real estate held using property taxes paid, as listed on the income tax returns of family members. The state is the most detailed level of location information available for families in the sample. Since effective tax rates vary more between states than within states, it is useful to calculate average tax rates by state.

Nominal tax rates range from 0.7% in Owensboro, Kentucky to 29.2% in Charleston, South Carolina. Where nominal rates are low, however, assessments of property value generally reflect almost the full market value. As nominal rate

rates rise the ratio of assessed value to full market value declines, so that the effective rate paid is lower than the nominal.

Effective property tax rates are calculated as the total tax paid divided by the market value of the property, or the nominal rate time ratio of assessed value to sales price. The 1972 Census of Governments[19] contains median effective rates for 2,002 jurisdictions, based on samples of measurable sales taken over a six-month period in 1971. Rates range from 0.1% in Jackson, Mississippi to 5.7% in Trenton, New Jersey, with a national average of 2.1%.

The Census of Governments data includes all counties which are in Standard Metropolitan Statistical Areas (SMSA's), in addition to all others with populations of over 50,000 and a random sample of remaining counties. Sales of over $500,000 were excluded from the survey, on the assumption that such transfers do not occur frequently and are not likely to be representative. Sales of new houses were also excluded, since the assessed value on the local tax roll was generally based on the land value only. Single-family

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[19]U. S., Department of Commerce, Bureau of the Census, Census of Governments, 1972, vol. 2, part 2, Assessment-Sales Price Ratios and Tax Rates.

nonfarm residences accounted for 63.9% of the measurable sales which made up the survey. In some localities, there was insufficient data on sales prices, either because of errors in collection or low turnover of property, so that estimates could not be included in the published data.[20]

In order to estimate an average effective property tax rate for each state from the rates which were listed for counties, cities, and portions of counties, local rates were weighted by the number of housing units within the locality. The median effective rate on all property as listed in the 1972 Census of Governments was used. In the majority of cases it is identical to the effective rate on single-family housing.

(5) $rpt_j = \Sigma(rpt_i * u_i / \Sigma u_i)$

where rpt_j represents the effective rate of property tax in the jth state

rpt_i represents the rate in the ith locality within the jth state

u_i represents the number of housing units in the ith locality

Table 3, page 69 , contains the average effective property tax rates which were calculated using the method and data described above. Rates were generally

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[20] Ibid.

TABLE 3

EFFECTIVE PROPERTY TAX RATES BY STATE, 1971

State	Average Effective Tax Rate (%)	No. Of Localities in the Sample
Alabama	0.6	12
Alaska	2.1	*
Arizona	1.4	7
Arkansas	1.1	6
California	2.3	79
Colorado	2.1	12
Connecticut	2.4	16
District of Columbia	1.5	1
Delaware	2.2	1
Florida	1.3	22
Georgia	1.6	9
Hawaii	0.4	2
Idaho	1.6	2
Illinois	2.4	27
Indiana	2.2	15
Iowa	3.0	12
Kansas	2.5	7
Kentucky	0.9	6
Louisiana	0.6	7
Maine	2.8	1
Maryland	3.4	1
Massachusetts	4.1	22
Michigan	2.3	23
Minnesota	2.0	8
Mississippi	0.1	1
Missouri	1.7	6
Montana	2.0	3
Nebraska	2.5	4
Nevada	1.3	3
New Hampshire	2.9	2
New Jersey	4.5	11
New Mexico	1.5	2
New York	2.2	13
North Carolina	1.3	11
North Dakota	1.9	2
Ohio	1.5	32
Oklahoma	1.2	11
Oregon	2.5	7
Pennsylvania	2.1	15
Rhode Island	2.6	4
South Carolina	1.2	3
South Dakota	2.5	3
Tennessee	1.6	6
Texas	1.6	21
Utah	1.4	6
Vermont	2.1	*
Virginia	1.3	10
Washington	1.6	9
West Virginia	0.6	4
Wisconsin	3.7	10
Wyoming	2.1	*

* No sample data was available from the Census of Governments of 1972 regarding these states, so the national average effective rate was used.

SOURCE: Compiled using data from the 1972 Census of Governments. See equation (5), p. 68.

lower in the southern states, and highest in the North Central and Northeastern sections of the country. The original data show a tendency for rates to be highest in medium-sized cities, and lowest in very large cities and in unincorporated areas.

Information on housing units, for the weighting factor, came from the County-City Data Book for 1970.[21] For some smaller towns, and for cities which are in two different counties, the housing unit series was not sufficient. In these cases, the General Characteristics of the Population[22] series for 1970 provided data of sufficient detail on population. Where 40% of the population of a city was in County A, that same proportion of the housing units of the city was assumed to be in County A. Where a city occupies two different counties, the effective tax rates will often differ between the sections. Therefore, if a city or town contained 10% of the population of a county it was assumed to contain 10% of the housing units in cases where a published breakdown was not available. For the majority of cases, however, data on housing units was published. Although this series is highly correlated with population it is probably a more accurate weighting factor, and was used to weight most of the observations.

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[21] Bureau of the Census, U.S. Department of Commerce, County-City Data Book, A Statistical Abstract Supplement, 1972.

[22] U. S. Department of Commerce Bureau of the Census, Census of Population, 1970, vol. 1, parts 2-52, Characteristics of the Population.

Conclusions

The method of wealth estimation which will be used here requires the capitalization of dividends into stock, interest income into debt instruments, and property tax paid into the value of real estate held. The rate or rates which should be used in each case have been the focus of the discussion in this chapter.

The results of the analysis of the average rate of return in different income classes using Survey of Financial Characteristics of Consumers data, and the Wharton studies reviewed here, indicate that the average rate of return on stock is probably the best estimate of the rate of return of any individual observation, regardless of income level. While this rate may overstate the holdings of lower income stockholders, any bias will be counterbalanced by the estimation of the value of debt instruments using the reciprocal of the rate of interest paid on savings accounts, which tends to overstate the holdings of the higher income groups. Since the final estimate of net wealth is the object of this study, and the components of stock and debt instruments are inputs into the function which estimates net wealth, this method is the best available solution.

Effective property tax rates have been estimated by state, since the variation between states is much greater than the variation within states. Each observation in the tax file

has property tax capitalized by the value of the average effective rate for the state of residence.

In the following chapter, a relationship between net wealth and the ownership of corporate stock, debt instruments, and real estate will be estimated from the 1972 estate tax return sample. Using the coefficients from this estimate and actual values for the components from the 1973 income tax file, net wealth will then be estimated and a frequency distribution constructed.

CHAPTER IV

THE ESTIMATION OF NET WEALTH FROM INCOME TAX DATA

Introduction

In this chapter, the method of estimating net wealth from the value of corporate stock, debt instruments and real estate held is reviewed. The nature of the estate tax return data which is used to estimate the wealth-asset relationship is discussed, and the assumptions necessary to apply this method of wealth estimation to the final set of data on the OTA (Office of Tax Analysis) file are stated.

The properties of the 1973 OTA file, the sample on which this estimate is based, and the methodology for merging of microdata sets is reviewed in sections 3 and 4, pages 83-92. The results of this wealth estimate are then summarized, including the percentage of total private wealth held by respective proportions of family units. Two key variables which explain differences in wealthholding are age and income level. The distribution of income among wealthholders is illustrated here, as well as the distribution of

wealth between and within six age groups. Lorenz diagrams of wealth, income, and assets by both wealth and income classes show the relative concentration of these variables through the population.

The Nature of the Estate Tax Data

The 1973 estate tax return sample, provided by the Internal Revenue Service, consists of over 54,000 returns selected out of 175,000 filed during that year.[1] Where the gross estate, before debt, of any citizen or resident alien exceeded $60,000, the executor or administrator was required to file with the Internal Revenue Service, generally within nine months of death. The IRS sample of these returns is stratified, with returns over $300,000 selected at a 100% rate, and the remainder selected at a 20% rate.

Sample returns were selected before audit of any of the returns. The market value of gross estate at the date of death was the basis for filing the original return, although an alternative valuation date of six months later could be used for tax purposes where the executor so desired. The gross estate measure includes all property or interests in property before reduction by debts, mortgages, or administrative expenses. Property over which the decedent held a

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[1] Internal Revenue Service, Dept. of the Treasury, Statistics of Income - 1972 Estate Tax Returns, describes the full sample from which the IRS magnetic tape used here is derived.

general power of appointment, gifts of property which the decedent retained the right to alter, amend, revoke, or terminate, the decedent's interest in annuities received by a surviving beneficiary, and inherited property were included. Gifts made within three years prior to death were assumed to have been made "in contemplation of death" and are reported as part of gross estate.

The decedent's portion of community property or jointly-owned property was added into the gross estate measure. Death benefits paid by Social Security for funeral expenses, and the proportionate share of all post-death benefits attributable to the decedent's contribution to annuities or similar contractual agreements were included. For qualified pension, profit-sharing, and stock bonus plans the employer's contribution to the annuity were excludible from gross estate.

The corporate stock figure includes all issues of listed and unlisted corporate stock, domestic or foreign, including stock in closely-held corporations. Also included were certificates of deposit issued for stock, stock scrip, and dividends accrued on all stocks.

The debt instrument measure includes the total value of all bonds, corporate or government, domestic or foreign, regardless of their tax-exempt status for income tax purposes. Thus, state and local bonds, all Federal issues

(including savings bonds) and accrued interest on any of the above were accounted for. The value of cash in checkings and savings accounts, savings and loans deposits, bank notes, safety boxes, or otherwise on hand was included. Any loans or debts due the decedent, including promissory notes, mortgages, trust deeds, contracts to sell land, and any accrued interest were added to the above for a full measure of interest-bearing assets.

The real estate figure included the full value of personal or noncorporate business real property such as land, buildings, improvements, and natural resources, owned or under contract by the decedent whether here or abroad, and accrued rents.

In addition to corporate stock, debt instruments, and real estate, all tangible and intangible personal property (such as household effects, royalties, patent and mineral rights, cemetery lots, automobiles), life insurance received by the estate or over which the decedent had power to change the beneficiary, cancel an assignment, or borrow on the policy were included. Noncorporate business assets, farm and non-farm, were incorporated into the measure.

To arrive at a net wealth measure, gross estate valued at the date of death less all debts and mortgages was computed. The latter included claims against the estate for medical expenses, unpaid mortgages plus accrued interest,

unpaid debts, unsecured notes, accrued property taxes, unpaid gift taxes, and policy loans against life insurance.

Thus, the estate tax concept of wealth used in this estimate is inclusive of virtually all wealth, unlike many survey wealth concepts. Chapter II provides a thorough discussion of these alternate measures on pages 12-13 and 32-33.

Constructing a Sub-sample of Estate Tax Returns

In order to utilize the estate tax return data for estimating the relationship between net wealth and asset ownership, a sub-sample of returns was drawn from the available data. Due to the great variability in size of net wealth within this group, a large stratified sample was deemed appropriate, with optimal allocation employed in determining which observations would be sampled. A total sample size of 300 was selected on the judgment that this was large enough to allow sufficient sampling within the various strata, but of a reasonable size for computation purposes.

It has been demonstrated that the method of optimum allocation minimizes the portion of error due to sampling variability where there are substantial differences in the sizes of the strata and the variances within each stratum.[2]

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[2]William G. Cochran, Sampling Techniques, 2nd ed. (New York: John Wiley & Sons, 1963), p. 97. Proportional sampling is a special case of this situation and is optimal if variances are equal in each of the strata.

For a given sample size, n, the equation (6) below, indicates the appropriate apportionment of the sample.

$$(6) \quad n_h = n \sum_{h=1}^{L} \frac{N_h s_h}{N_h s_h}$$

where n_h = number to be chosen from a given strata

N_h = population of a given strata

s_h = standard deviation within the strata

L = number of strata employed

Since the primary purpose of this model is to estimate wealth across all wealth levels (rather than focussing on the very rich) observations with net wealth of more than $300,000 were deleted from the large sample before subsampling was performed. Persons with negative net wealth were also deleted although their inclusion did not materially affect results.[3]

Estimation of the Wealth-Asset Relationship

In order to estimate a relationship between net wealth (NW) and corporate stock (V), debt instruments (DI), and real estate (RE), a large number of models were postulated and fitted in both linear and log-linear form to the sample of estate tax data. Each model was run with and without an intercept, on data grouped into age 65 and over

[3]Appendix A, p. 155, shows the sampling procedure in greater detail.

versus rest of the population, and on stockholders versus non-stockholders. No significant improvement in significance of the models was realized by either of the latter two grouping methods, and the models discussed here were all estimated without grouping. Use of an intercept term was found to lower the estimated value coefficients so substantially as to make the model not meaningful in almost every specification.

Two basic assumptions have been made in using the estate tax data to estimate a relationship which will be applied to observations on the OTA file:

(1) The composition of wealth will not be substantively different among the estate tax payers than among all living persons of the same wealth levels, although the size of total estate may be diminished by gifts, trusts, etc., in anticipation of death.

(2) Composition of family wealth will not differ substantively from composition of individual wealth. Therefore, the regression estimate from individual estate tax returns may be applied to family unit data and yield sensible results.

The models have been fitted to data from individuals who died owning at least $60,000 in gross wealth, and net

wealth which is positive but no greater than $300,000. These are persons at the far upper end of the wealth distribution. Some models fit this upper segment well, but applied to all of the population yield total net wealth which is unrealistically high (or low) relative to national balance sheet estimates of over $3 trillion. Table 4, page 81, summarizes the major types of models used and how they performed on the criteria used to select the final model. In addition to the R^2, the mean square error, the significance of the t-statistics, and the pattern of the residuals, each equation was tested on the OTA file to determine the sum it would yield for total personal net wealth when wealth of all families is aggregated.

Models with squared independent variables yielded either extremely high sums for net wealth (in spite of the very low coefficients on the squared values) or negative values where the squared value and the raw value were both included in the equation. The coefficient of the cross-product of stock and debt instruments was estimated with a negative sign where stock and debt instruments were included separately in the model also. F- and t-statistics were high in all models (significant at the .0001 level in almost all cases) and are not listed here. R^2 was highest on the logarithmic models, but these did not yield reasonable net wealth estimates when tested on the OTA file.

TABLE 4

Results of Major Regression Models Estimated*

	Model	R^2	MSE	ΣNW (trillions)	Residuals
1.	NW = 1.041*V + 1.484*DI + 0.808*RE	.86	5334	2.6	Not correlated with size of NW, underprediction with very high debt instruments
2.	NW = 96.6 + 0.67*V + 0.76*DI + 0.41*RE	.52	2794	1.3	Positively correlated with size of NW, random with respect to V, DI, RE except at high levels
3.	NW = 1.25*V + 1.63*DI + 0.78*RE - .006* DISTK	.87	5022	-8.2	Underprediction only at very high levels of DI or V
4.	NW = 1.29*V + .007*SQDI + 0.953*RE	.79	5054	9.6	Variance of residuals increases with size of NW
5.	NW = 117.4 + .671*V + .004*SQDI + .372*RE	.50	2794	54.9	Positively correlated with NW, underprediction with high DI
6.	LNW = .372*LV + .687*LDI + .589*LRE	.94	1.67	439.0	Errors negatively correlated with size of debt instruments
7.	LNW = .186*LSQV + .343*LSQDI + .295*LSQRE	.94	1.67	434.0	Errors tend to be positive, some correlation with DI
8.	LNW = .372*LV + .343* LSQDI + .589*LRE	.94	1.67	434.0	Errors are random, some correlation with DI
9.	LNW = 4.45 + .099*LV + .082*LDI + .062* LRE	.25	0.162	17.6	Errors positively correlated with size of NW
10.	NW = 1.5*V + 1.41*DI + 0.719*RE - .002* SQV	.88	5061	-3.1	No correlation with NW, negatively correlated at high levels of debt and RE

* where L denotes the natural log of a variable and SQ denotes the square of that variable, NW = net wealth, V = corporate stock, DI = debt instruments, RE = real estate, and DISTK = cross product of corporate stock and debt instruments.

The model selected is listed first in Table 4. It has an R^2 of .86, and all coefficients are significant at the .0001 level. A pattern of residuals with independent variables is detectable only at very high wealth levels (in the case of debt instruments), estimates of the coefficients are sensible, and the total net wealth is reasonably comparable to survey and national balance sheet estimates of recent history.

The coefficient is less than one on real estate, which typically carries sizeable debt along with it. It is roughly one on corporate stock, and is over 1.4 on debt instruments. These assets represent mainly savings accounts and certificates of deposit (with a small proportion of corporate or municipal bonds, and any privately held notes). No debt is associated with them, and the model suggests that the size of other types of wealthholdings (which we capture only indirectly) are most strongly tied to this variable. These would include life insurance, business proprietorships or partnerships, and interest in property held in trust. The relative sizes of the coefficients thus seems very reasonable in terms of what we know about portfolio behavior. Net real estate wealth probably averages far less than 80% of gross real estate, but the value of consumer durables and other personal possessions is highly correlated with home values and raises this coefficient. Level of debt instruments

is probably a very good indicator of many other types of wealth which we must measure indirectly. For example, surveys of financial behavior, such as those mentioned in Chapter II, pages 32-33, indicate that ownership of proprietorships or partnerships is associated with higher than average savings rates.

Thus, the coefficients on gross asset values appear highly reasonable in model 1, and its predictive capability may be judged good. Other models tested were either weaker statistically, or yielded coefficients or predictions which are not reasonable in light of other available knowledge.

A Brief History and Explanation of Merged Microdata Sets

The data base for the wealth estimates is the 1973 file produced by the Office of Tax Analysis (OTA), in the Department of the Treasury from a sample of 50,160 observations from the Current Population Survey (CPS) and 45,030 tax records from the 1973 Individual Income Tax Model. Although most of the information used in this estimate is from the income tax record, the use of the OTA file extends the sample to observations not required to file a tax return, makes possible the estimation of a distribution in family units rather than tax filing units, and provides information on head of household age where the income tax record would not. In addition, imputations of state and

local bond interest received by a family unit were added by OTA, along with estimates of property taxes paid by non-itemizers. Construction of the file will be reviewed in greater depth in a subsequent portion of this chapter, following a discussion of the general history of data base merging.

The merging of two or more microdata sets into one involves either the exact matching of records through some unique identifier or the synthetic linking of non-identical records in a manner which correctly simulates the characteristics of the population. Through this linking of data sets, a much more extensive body of data is available for analysis.

Exact matching of income tax records, Current Population Survey responses, and Social Security history has been underway at the Social Security Administration since the early 1960's. Using the social security number as the primary identifier[4] a substantial proportion of records may be matched with their respective tax returns. This method necessitates a computerized search through the tax returns for records matching the sample survey records. For roughly 10-20% of the survey households no tax return can be located and matches must be made statistically, on the basis of certain decision criteria. Even when records are matched by

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[4]The Census Bureau began collecting social security numbers in CPS interviews in late 1963.

social security number the overlapping information is often non-identical. Income figures may differ due to reporting error, the use of different concepts of income, or varying time periods, for example. The question of which file is the "best" source of income information on these exact matches has been addressed extensively at the Social Security administration.

Synthetic, or statistical, matching was used in the 1960's by Daniel B. Radner and Edward C. Budd at the Commerce Department's Office of Business Economics (OBE)[5] and by Benjamin A. Okner at the Brookings Institute. During the 1970's it was further developed by Scott Turner at the Office of Tax Analysis of the Treasury Department (with Ralph Bristol, Gary Gilliam, Gary Robbins, and Richard Barr) in a series of matches, by Nancy and Richard Ruggles at the National Bureau of Economic Research (NBER) and by Horst Alter at Statistics Canada.[6]

Statistical matching can be more efficient than exact matching due in part to reduced computer search time. The files to be matched must be samples from very similar populations, but are not necessarily the same reporting units.

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[5]Now the Bureau of Economic Analysis (BEA).

[6]For a brief discussion of the history of merging microdata bases see Benjamin A. Okner, "Data Matching and Merging: An Overview," Annals of Social and Economic Measurement 3 (1974) 347-52.

Rather than relying on a unique identifier, records are matched on the basis of common attributes (such as age, race, sex, and earned income), and the problem of violating confidentiality is not raised. For purposes of analysis, the relevant properties of the files are preserved and a new sample including more extensive information about the population is thereby simulated.

While exact matching might seem to be less fraught with error, there are many cases in which a tax record cannot be found where the available survey information indicates that there ought to be one in existence. According to Okner,

> "Regardless of whether exact or synthetic linking is used, there are several problems common to all work in this area. These include data comparability, missing data, specific techniques for linking and and data manipulation, and the definition and evaluation of goodness of a match."[7]

The MERGE file which Okner produced at Brookings was built from the 1966 IRS sample of 87,000 individual returns and the 1967 Survey of Economic Opportunity (SEO) which covered 30,000 households. By combining these data sets a file was created which encompassed the non-tax filing portion of the population and could correct for the nonresponse at high income levels with which surveys are generally plagued. This file was then used to study tax incidence, and the results were published in the Brookings monograph Who Bears

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[7] Ibid., p. 348.

the Tax Burden?[8]

Radner and Budd matched March 1965 CPS data with the 1964 Individual Income Tax Model at OBE for the purpose of improving the quality of income data.[9] Supplemental information from the Survey of Financial Characteristics of Consumers and an IRS audit study of 1963 was also utilized in the match. In this merge, all CPS records were used and each was matched with one (but no more than one) tax record. Common information between the files was used wherever possible.

The 1973 OTA Merged File

The file which was used in this wealth estimation is comprised of approximately 45,000 individual income tax returns (a subsample of the annual sample used for Statistics of Income - Individual Income Tax Returns) drawn from 15-20 income strata and 50,000 observations from the Current Population Survey. This survey is conducted monthly by the Census Bureau for the primary purpose of collecting unemployment statistics, but in March includes a series of questions regarding income of the family unit and individuals within it.

The combination of Census survey data and income tax records (through statistical merging) results in a file

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[8]Joseph A. Pechman and Benjamin A. Okner, Who Bears the Tax Burden? Washington, D.C.: The Brookings Institution, 1974.

[9]Edward C. Budd, "The Creation of a Microdata File for Estimating the Size Distribution of Income," The Review of Income and Wealth 7:4 (December 1971): 317-333.

superior to either of these separately, due in part to differences in coverage.[10] The survey contains demographic and financial information on families, where the tax record is based on the tax-filing unit, which may be a single return, a married couple filing jointly, or a married person filing separately. Little demographic information is reported on a tax return, but the quality of the financial information is widely accepted as superior to Census figures. If a distribution of wealth was based on income tax returns, however, it would be neither a distribution of family wealth nor of individual wealth. Use of the Census data makes possible the merging of individual returns into families, where appropriate, and the inclusion of age of head of household information for the family. The more reliable tax return information on dividends, interest, and property taxes may thus be utilized at the family level.

The method of accomplishing the statistical merge was similar to previous techniques discussed, but is superior in that the statistical properties of both files are preserved through constrained matching (in contrast to prior unconstrained matches). For two microdata files with variable weights in each file and an unequal number of records, the

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[10]Census surveys do not include capital gains in the "Census money income" concept, for example, but do include all non-taxable transfers of income which tax records exclude. Low-income families who have not filed a tax return may be included in the survey, while persons abroad or in the military may file a return, but are not included in the sample frame.

constrained merging problem may be thought of as one of determining the set of values which minimize the after-match aggregate "distance" between the records in one file and their corresponding matched records in the other file.[11] This is, in fact, a "transportation" problem, and the classical transportation model of linear programming may be applied to its solution.[12]

Use of the transportation model permits a record in either file to be split or matched with more than one record in the other file, with the weight apportioned among the otherwise identical split records. Thus, the marginal and joint distributions of each file's variables are preserved and the means and variance-covariance matrices of items in each file are preserved.

In order to match CPS family units with one or more appropriate income tax returns, potential tax returns were created from the survey records and matched with the income tax returns. For households which appeared to fall into the non-filer category, dummy tax records were created in the

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[11]J. Scott Turner and Gary B. Gilliam, "Reducing and Merging Microdata Files"; Joseph Kadane, "Statistical Problems of Merged Data Files"; and Richard S. Barr and J. Scott Turner, "A New Linear Programming Approach to Microdata File Merging," Compendium of Tax Research, OTA Papers. Washington, D.C.: U.S. Department of the Treasury, Office of Tax Analysis, 1975-78.

[12]David G. Luenberger, Introduction to Linear and Nonlinear Programming, Reading, Mass.: Addison-Wesley Publishing Co., 1973.

tax sample. Records were matched with other records within $1000 of their AGI(adjusted gross income) based on an attribute function containing wage and salary income, property income and business income, and a penalty function which compared data on age, race, sex, and family size with data in the Census record.[13] Tax records were then combined into the appropriate Census family units.

While the merged file included both Census and IRS income concepts, for purposes of this wealth estimation the dividends and interest came solely from the tax records. They were stated, however, in terms of family units which means that the distribution may be expressed in family units. In addition, age of head of household has been taken from the CPS record in order to analyze the distribution of wealth between and within different age groups.

Imputations made by OTA staff where data is missing have also served to make this a richer data base. In this wealth estimate imputed state and local bond interest is added to taxable reported interest for use in arriving at an interest figure from which debt instruments may be estimated, and property tax payments for non-itemizers are used in estimating the value of their real estate.

State and local bond interest was imputed using the total amount of these bonds held by individuals as a

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[13]Social security numbers were previously used to obtain demographic information for the tax returns.

control figure, and the average interest rate on these obligations, to estimate total tax exempt interest received in 1973. Families were classified into one of nine classes based on adjusted gross income (AGI). For each class, a given percentage of returns was randomly selected and allocated a mean amount of tax exempt interest. Below $10,000 no returns had such interest imputed. The percentage of returns receiving interest was increased from .029% in the $10-15,000 AGI class to .46% in the over $100,000 AGI class. The mean amount per return also increased with class. An internal OTA memorandum summarizes this process.

Homeowners tend to be itemizers due to the provision in the tax code for deduction of mortgage interest. However, some older persons who no longer hold a mortgage and whose other potential deductible expenses are too low in relation to income to cause them to itemize still own real estate of moderate value. Imputations of property tax paid by standard deductors such as these have been included along with reported property taxes and are part of the real estate estimates.

These imputations are a part of a full set estimated for standard deductors (which included other items such as medical expenses, state and local gasoline tax, etc.) at OTA. The estimation relied on a technique of within-file

imputation called the Turner soft-link method.[14]

Itemizer records were matched with non-itemizer records on the basis of a linkage function of similar characteristics such as filing status and the ratios of AGI along with taxpayer race, sex, and year of birth, which had been brought from social security records to the tax record to aid in matching.

Using the full set of itemizers as a "donor file," data items passed through a transformation function as they moved from the donor file to the recipient file of non-itemizers. This function reduced the dollar amount of deductible items so that the total relative to AGI would no longer cause the filer to benefit by itemization. Since itemizers tend to have higher AGI than non-itemizers, transformation had to reduce the size of potential deductibles substantially. A total of $1,631,000 in property taxes was imputed to sample observations relative to $14,000,000 from tax records.

Methodology of the Wealth Estimate

Using the data for the 45,030 families on the merged OTA file, values of corporate stock were capitalized from dividends, debt instruments from interest reported,

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[14] Peter K. Cook, "The Turner Soft-Link Method," Memorandum to OTA Professional Staff, Office of Tax Analysis, U.S. Department of the Treasury, Washington, D.C., November 18, 1976. (Typewritten.)

and real estate from property taxes paid, as outlined in Chapter III, pages 66-72. Net wealth was then calculated for each family, with the regression coefficients estimated from the estate tax return sample. Thus, for each family their estimated net wealth was calculated by equation (7):

$$(7) \quad NW_i = 1.041*V_i + 1.484*DI_i + 0.808*RE_i$$

$$(17.27) \quad (19.76) \quad (18.98)$$

In order to analyze the concentration of wealth in this distribution (weighted by sampling fractions to approximate the population distribution) the Lorenz curve and the Gini coefficient were utilized. Price inflation and economic growth limit the usefulness of dollar estimates and distributions with boundaries constructed to correspond with round dollar figures (i.e., $10-20,000). The Lorenz curve pictures the proportionate distribution of wealth among percentiles of the population, using cumulative values of each.[15] It is recognized as highly useful for comparison of the distribution of different variables at one point in time, the distribution of a variable in two different countries, and the comparison of distributions at different points in time. Figure 4, page 93, illustrates the concept of the Lorenz curve and the Gini coefficient of concentration which may be calculated from it. The horizontal axis represents cumulative percentages of the population (families,

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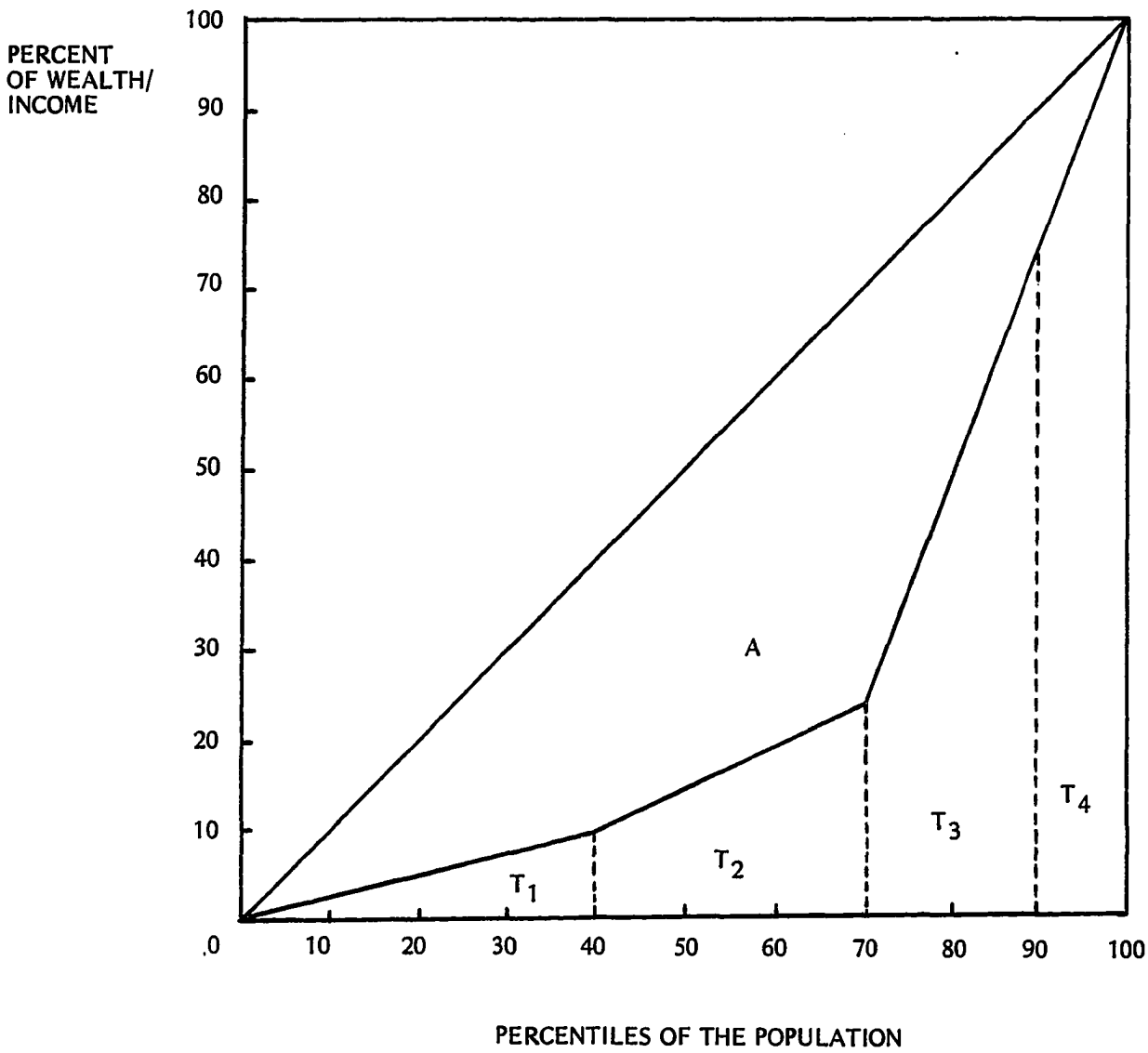
[15]Max O. Lorenz, "Methods of Measuring the Concentration of Wealth," Journal of the American Statistical Association 70 (June 1905), 209-19.

Figure 4

ILLUSTRATION OF THE RELATIONSHIP BETWEEN THE LORENZ CURVE AND THE GINI COEFFICIENT



in this case) and the vertical axis represents cumulative percentages of the measured variable (wealth, income, etc.). The 45° line is the comparison standard of complete equality of distribution, where 10% of the population holds 10% of the variable, 50% holds 50% of the variable, and so forth. In every distribution the end points of the Lorenz curve will coincide with the 45° line at 0 and 100.

The Gini coefficient was first developed by the Italian econometrician Coronado Gini in the early 1900's as a summary measure which might be used to compare distributions.[16] It measures the ratio of the area between the Lorenz curve and the 45° line to the total area below the 45° line. The closer to one is the measured Gini coefficient (G), the higher the degree of concentration, and the closer to zero the more equality. From Figure 4 we can see that the area between the Lorenz curve and the 45° line may be calculated as $A = \frac{1}{2} - \sum_{i=1}^{n} T_i$ and G is A divided by $\frac{1}{2}$. Appendix B, page 157 outlines the method of computation of the Gini coefficients in this analysis in greater detail.

To fully describe the distribution of wealth among families, we will look at its distribution among income

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[16]For discussions of the Gini coefficient and its history see Joseph L. Gastwirth, "The Estimation of the Lorenz Curve and the Gini Index," The Review of Economics and Statistics 54 (August 1972) 306-16; and Dwight B. Yntema, "Measures of the Inequality in the Personal Distribution of Wealth or Income," Journal of the American Statistical Association 28 (December 1933):423-33.

classes, as well as wealth classes, and use the age of the head of household to group families into broad age categories so as to analyze the distribution of wealth, income and major assets within and between these different age groups. Wealth is importantly related to income and position in the life-cycle, although not in a systematic manner. Some families may hold high wealth throughout their life cycle and some never attain any substantive wealth. At very low income levels, part of the population consists of retired persons with modest sums of wealth who derive all of their income from this wealth, thus have a high ratio of wealth-to-income.

In order to develop population estimates of the wealth and income distribution, families were arrayed in ascending order by level of wealth (and subsequently, income) and percentile boundaries were determined using a computerized routine designed for this purpose. The T'th percentile, Y, is defined as a weighted average aimed at X(N*P) as below in equation (8), where N*P is equal to J+G.[17]

$$(8) \quad Y = (1 - G)*X(J) + G*X(J + 1)$$

where $P = T/100$ for the T'th percentile, Y

N = number of non-missing observations

X_i = ordered values of the variable

J = integer portion of N*P

G = fractional part of N*P

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[17]This procedure is documented in the SAS Supplementary User's Guide, Kingsport, Tennessee: Kingsport Press for SAS Institute Inc., 1977.

The values computed from this procedure represent the upper boundaries of each percentile. Table 5, page 98, lists values for 18 wealth groups, each consisting of five percentiles of the wealth distribution, with the exception of the first group (including the 35 lowest percentiles which hold zero wealth) and the last five wealth groups, which consist of only one percentile each. The 100th percentile represents the highest percentile of the distribution, and includes all families with wealth of over $502,066 in 1973.

Within each wealth class, values were first weighted by their respective sample weights and summed both within the class and cumulatively. Appendix C, page 158, includes programs used to weight and sum the variables within classes. Net wealth (and other variables analyzed here) were first multiplied by the unique weight attached to that family, and then summed across the class. Cumulative percentages represent the summing across the distribution divided by the sum of weights up to that point.

For the income distribution, the same procedure was followed, using 12 income classes calculated by the same computer routine. Table 6, page 99, lists the upper boundaries of these income classes, based on the Census money income of the total family unit. The 100th, or highest, percentile includes all families with combined income of over $61,941 in 1973. The classes represent deciles up to the highest decile, in which the 90th-95th percentiles are

TABLE 5

UPPER BOUNDARIES OF NET WEALTH CLASSES, 1973

Wealth Percentiles		Level of Wealth
Lowest 35	-	$ 0.00
35-40		1,088.27
41-45	-	3,429.69
46-50	-	6,463.64
51-55	-	9,595.00
56-60	-	13,033.40
61-65	-	16,713.90
66-70	-	21,279.30
71-75	-	26,978.80
76-80	-	35,624.30
81-85	-	50,836.40
86-90	-	75,797.10
91-95	-	137,098.00
-96	-	164,041.00
-97	-	205,055.00
-98	-	283,913.00
-99	-	502,066.00
100	-	Greater than 502,066.00

NOTE: These were computed for the OTA file using equation (8), page 96.

TABLE 6

UPPER BOUNDARIES OF THE CENSUS MONEY INCOME DISTRIBUTION, 1973

Income Percentiles		Level of Income
0-10		$ 2,365.00
11-20		4,201.00
21-30		6,137.00
31-40		8,284.00
41-50		10,412.00
51-60		12,669.00
61-70		15,138.00
71-80		18,318.00
81-90		23,881.00
91-95		30,421.00
96-99		61,941.00
100	Over	61,941.00

NOTE: These were computed for the OTA file using equation (8), page 96.

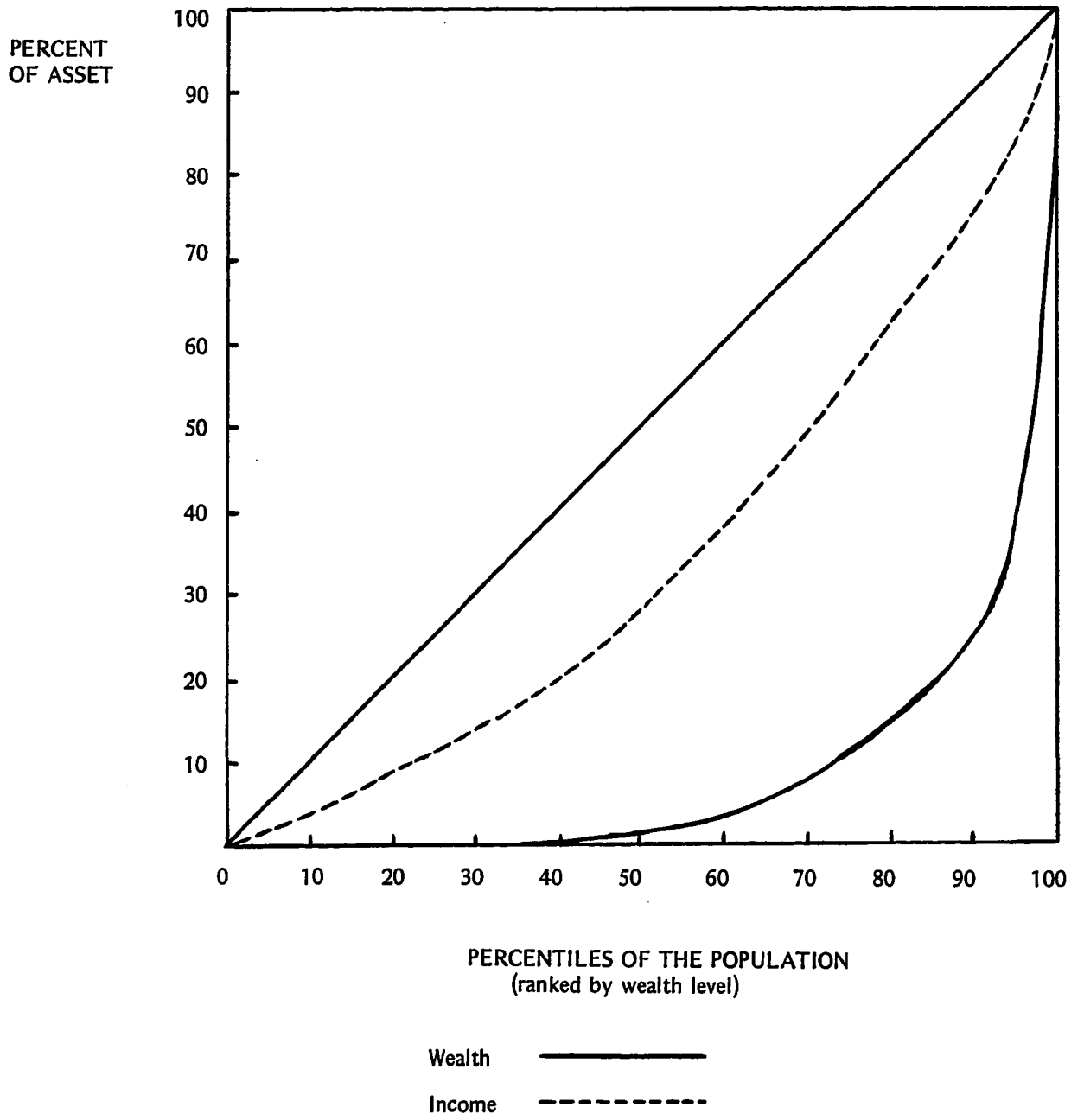
grouped as one class, and the 96th-99th represent the next to highest class.

Distribution by Wealth Class

The cumulative distribution of wealth and income by wealth classes is portrayed in the Lorenz diagram in Figure 5, page 101. As one would expect, the wealth distribution is substantially more concentrated than is income by wealth class. Figure 6, page 102, shows the set of Lorenz curves representing the cumulative distribution of corporate stock, debt instruments, and real estate by wealth class. While real estate is significantly less concentrated than is total net wealth, corporate stock is clearly considerably more concentrated. Debt instruments are distributed more equally in the lower half of the distribution than net wealth. The first 35 percentiles of the wealth distribution, representing approximately 24.6 million families, hold no measureable wealth, contrasted with 16.8% of Census money income. The lower half of the distribution holds 1% of net wealth, 0.2% of corporate stock, 1% of debt instruments, and 1.8% of real estate but 28.5% of income. The lower three-fourths of American families who hold 55.4% of income own only 11.2% of wealth. Almost one-third of privately held real estate rests with this group, but less than 2% of corporate stock.

Figure 5

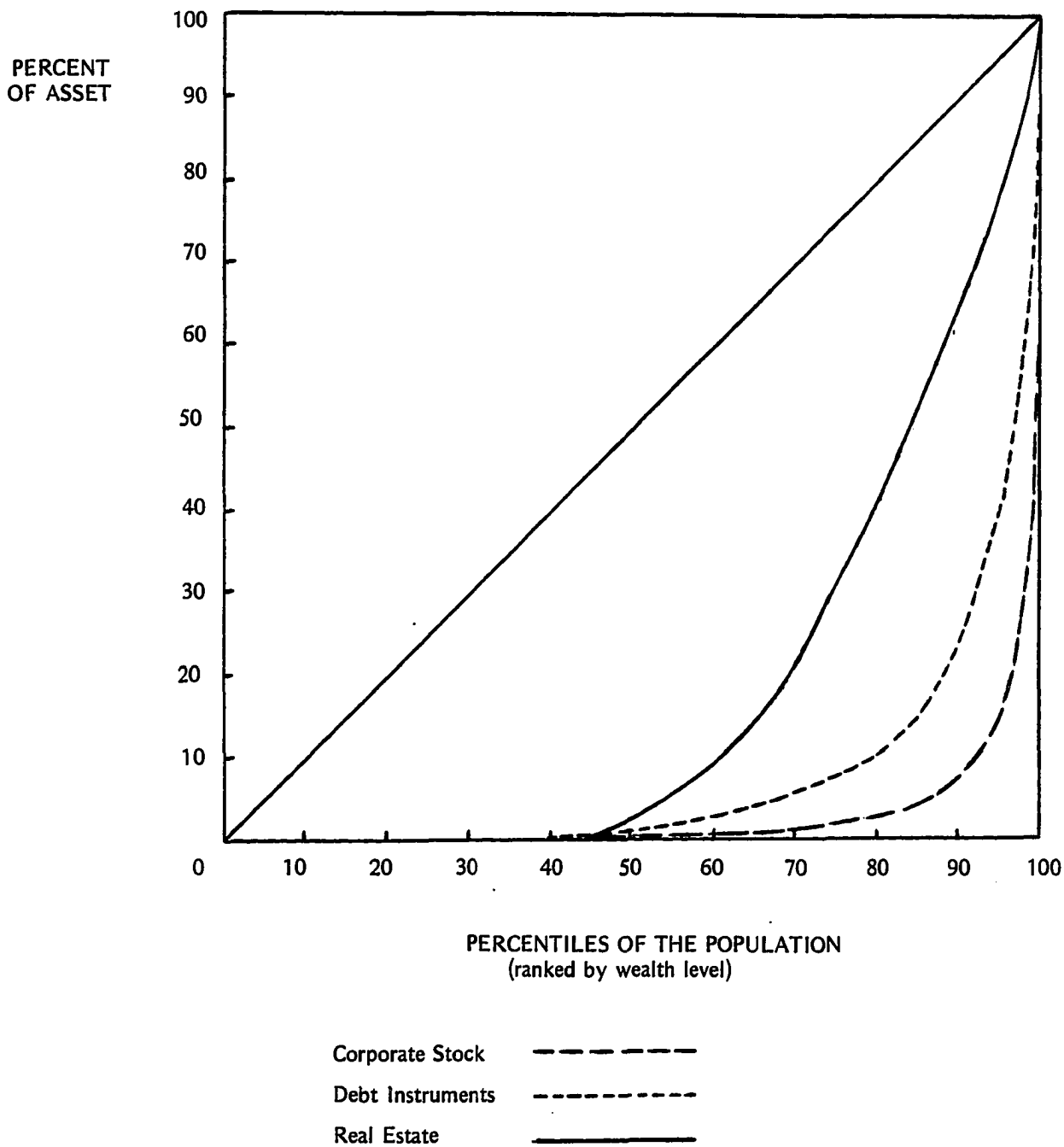
LORENZ CURVES OF WEALTH AND INCOME
BY WEALTHCLASS, 1973



Source: Derived from the OTA file, as documented on pp. 92-100

Figure 6

LORENZ CURVES OF CORPORATE STOCK, DEBT INSTRUMENTS, AND REAL ESTATE BY WEALTHCLASS, 1973



Source: Derived from the OTA file, as documented on pp. 92-100

In Table 7, page 104, the cumulative percentages used to construct Figure 5 and 6 are listed. The percentage of real estate held rises more rapidly than that of debt instruments, and particularly than corporate stock, with a reversal of this trend in the upper decile. Table 8, page 105, contains the simple percentages held by each wealth class. The highest 1% of the wealth distribution holds an estimated 32.6% of net wealth, although receiving only 8.7% of income. They own 60.3% of privately held corporate stock, 29.4% of debt instruments, and 8.4% of real estate. The upper 5% of the distribution holds 57.5% of net wealth, 85.3% of corporate stock, 59.4% of debt instruments and 22.7% of real estate, while receiving 16.8% of income on a Census basis.

A picture of highly concentrated wealth emerges from the figures, with only the upper 15% of families holding shares of wealth at least comparable to their share of population. Each of the middle wealth classes represents 5% of total families, but not until the 61-65th percentiles does share of real estate rise above 5%. Above the 80th percentile, share of debt instruments approaches 5%. Share of corporate stock does not rise above proportionate importance in the population until the 90th percentile has been passed. As a result, share of wealth and of these assets is far above share of the population at the top.

TABLE 7

CUMULATIVE PERCENTAGES OF NET WEALTH, INCOME, AND ASSETS HELD BY WEALTH CLASSES, 1973

Net Wealth Percentile	Net Wealth	Corporate Stock	Debt Instruments	Real Estate	Census Money Income
0-35	0.0	0.0	0.0	0.0	16.8
36-40	0.1	0.0	0.1	0.0	20.0
41-45	0.3	0.1	0.5	0.4	24.1
46-50	1.0	0.2	1.0	1.8	28.5
51-55	2.1	0.4	1.8	4.5	33.3
56-60	3.6	0.6	2.7	8.7	38.3
61-65	5.5	0.8	3.7	14.6	43.6
66-70	8.0	1.1	5.1	21.9	49.4
71-75	11.2	1.6	6.9	30.9	55.4
76-80	15.3	2.5	10.0	41.0	61.7
81-85	20.9	3.9	14.9	52.7	68.4
86-90	29.2	7.1	24.2	64.3	75.5
91-95	42.5	14.7	40.6	77.3	83.2
96	46.4	17.5	45.6	80.2	84.9
97	51.3	21.1	52.0	83.3	86.6
98	57.6	28.0	59.5	86.7	88.5
99	67.4	39.7	70.5	91.6	91.3
100	100.0	100.0	100.00	100.0	100.0

SOURCE: Derived from the OTA file, as documented on pages 92-100 of this chapter.

TABLE 8

SIMPLE PERCENTAGES OF NET WEALTH, INCOME,

AND ASSETS HELD BY WEALTH CLASSES, 1973

Net Wealth Percentiles	Net Wealth	Corporate Stock	Debt Instruments	Real Estate	Census Money Income
0-40	0.1	0.0	0.1	0.0	20.0
41-45	0.3	0.1	0.4	0.3	4.1
46-50	0.6	0.1	0.5	1.4	4.4
51-55	1.1	0.2	0.8	2.7	4.8
56-60	1.5	0.2	0.9	4.2	5.0
61-65	2.0	0.2	1.0	5.9	5.3
66-70	2.5	0.3	1.4	7.4	5.7
71-75	3.2	0.5	1.9	9.0	6.1
76-80	4.1	0.8	3.0	10.1	6.2
81-85	5.6	1.5	4.9	11.7	6.7
86-90	8.2	3.1	9.3	11.6	7.1
91-95	13.3	7.6	16.4	13.0	7.7
Top 1%	32.6	60.3	29.4	8.4	8.7
Top 5%	57.5	85.3	59.4	22.7	16.8
Top 10%	69.8	92.9	75.8	35.7	24.5

SOURCE: Derived from the OTA file, as documented on pages 92-100 of this chapter.

The Gini coefficient of wealth by wealthclass is .81, while income by wealthclass is .36. The greater concentration of corporate stock is indicated by its coefficient of .94, relative to .85 for debt instruments and .63 for real estate. The concentration of total wealth is lessened by the relative diffusion of real estate and other forms of wealth relative to corporate stock. These Gini coefficients summarize the information provided graphically by the Lorenz curves in Figures 5 and 6 which were discussed on page 103.

In Table 9, page 107, the percentage of families in each wealthclass who hold any amount of each of these assets is listed. Debt instruments are most widely dispersed by this measure, due no doubt to bank savings accounts and credit union deposits of small savers. They appear to be more popular at low wealth levels (85.2% of families reported interest in the second wealth class versus 54.2% at the midpoint of the wealth distribution), rising again in importance in the highest quadrant of the distribution. Over 80% of the families owned real estate in the 60th-75th percentiles of the distribution, and in the upper 1%. Below the 45th percentile less than 30% owned real estate, while in the upper quadrant roughly 75% were property owners. Some corporate stock was held by 8.4% of the lowest wealth-holding class, and slightly over 10% of median families. Incidence of ownership increases slowly through the lower 75% of the wealth distribution. Within the upper quadrant

TABLE 9

PERCENTAGE OF FAMILIES HOLDING CORPORATE STOCK

DEBT INSTRUMENTS, AND REAL ESTATE

BY WEALTH CLASSES, 1973

Wealth Percentile	Corporate Stock	Debt Instruments	Real Estate
Lowest 35	0	0	0
36-40	8.4	85.2	9.3
40-45	8.3	74.7	29.1
45-50	10.9	57.6	55.9
50-55	10.5	54.2	67.1
55-60	12.0	59.5	75.2
60-65	13.1	61.8	80.2
65-70	15.3	68.0	82.9
70-75	19.6	74.0	83.0
75-80	28.2	83.5	78.9
80-85	37.7	90.0	76.9
85-90	45.7	95.6	70.1
90-95	58.4	97.3	68.2
96	70.0	97.2	64.8
97	70.7	98.5	74.6
98	78.4	98.0	69.7
99	85.7	97.8	76.2
100	89.5	99.5	83.3

SOURCE: Derived from the OTA file, as documented on pages 92-100 of this chapter.

it increases more rapidly; 58.4% of families in the 90-95th percentiles and 89.5% of the highest wealth percentile owned corporate stock.

These figures do not tell us the proportionate distribution of these assets, but simply what share of families in that wealthclass have nonzero holdings of net wealth and of each type of asset measured directly here.

Distribution by Income Class

Income is closely related to wealth, since it consists in part of a flow of financial services accruing from certain types of wealth (dividends from corporate stock, interest from all types of debt instruments, etc.). In addition, it is a primary prerequisite for acquiring wealth. Without inheritance or luck in the lotteries, persons depend upon investing a portion of the income above and beyond that necessary to satisfy basic needs (however defined) in order to accumulate wealth.

The relationship between income and wealth is often inferred in consumption theory, where wealth is assumed to be correlated with income. Theories such as Milton Friedman's "permanent income" hypothesis attempt to compensate in part for the incompleteness of using only a current income figure to describe a family or individual's financial position.[18] While future streams of income to a family may only be

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[18]Milton Friedman, A Theory of the Consumption Function, Princeton: Princeton University Press for National Bureau of Economic Research, 1957:20-31.

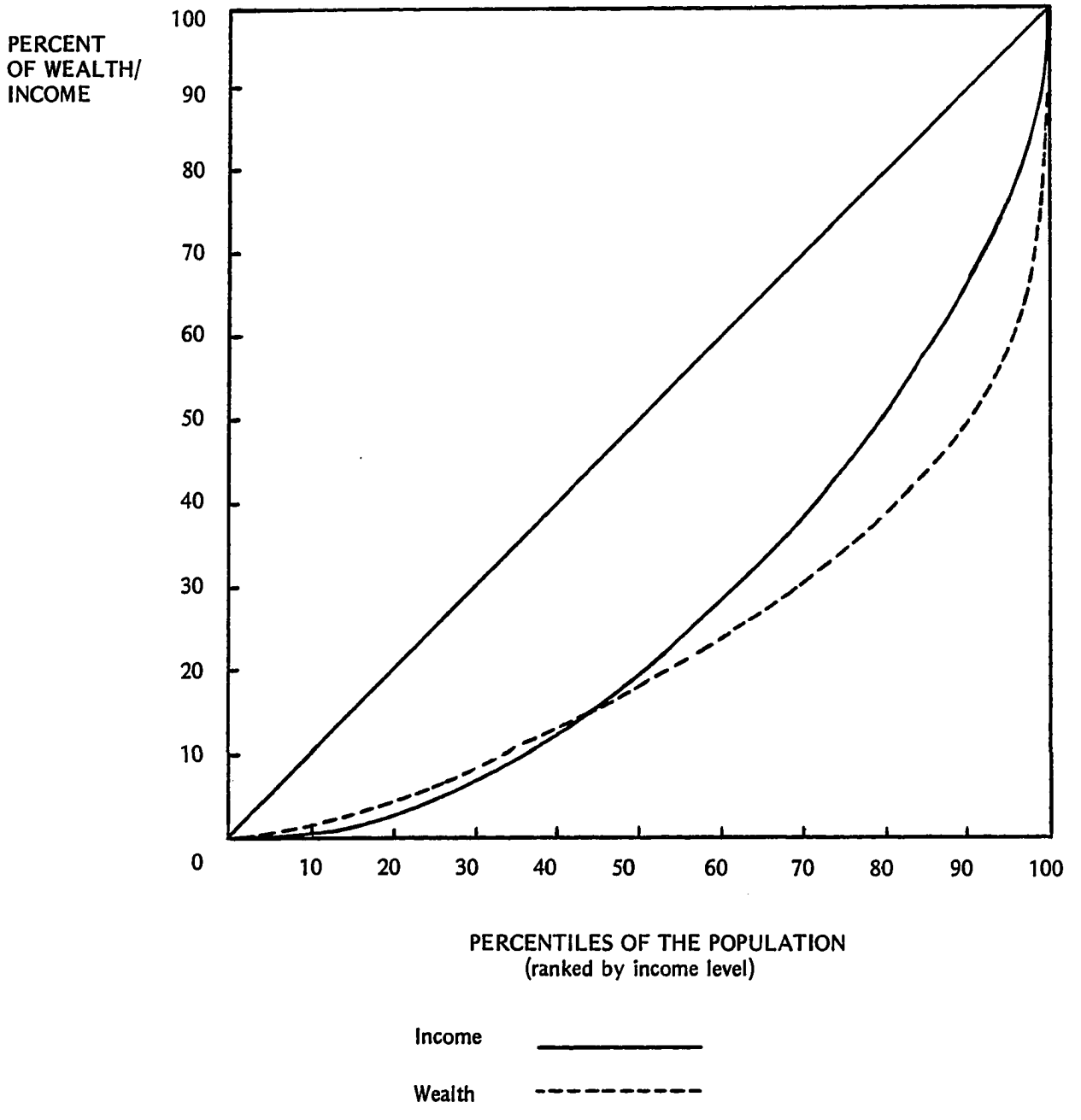
hypothesized (and generally the data is too scanty to serve as a valid basis for any hypothesis) the joint use of income and wealth enriches our knowledge of the total financial position of the family substantially.

For these reasons we will look at the distribution of wealth by income classes in much the same manner as was done by wealthclasses, and will be able to compare it to the much more familiar concept of income distribution.

In Figure 7, page 110, the Lorenz curves showing the cumulative distribution of wealth and income by income class indicate that the lower 50% of American families, ranked by total family income, receive 19.2% of income and hold an estimated 17.9% of net wealth. At low income levels, the proportion of wealth held exceeds the proportion of income held, indicating that some of these families derive a large part of that income from their wealth. Figure 8, page 111 represents the distributions of assets by income classes, and the cumulative percentages of wealth, income, and assets of these income classes are listed in Table 10, page 112. The lower 90% of families receive 66.7% of income and hold an estimated 49.9% of net wealth. Corporate stock is heavily concentrated in the upper 5% of the income distribution, just as it is in the wealth distribution. Debt instruments are more heavily represented than is real estate at lower income levels.

Figure 7

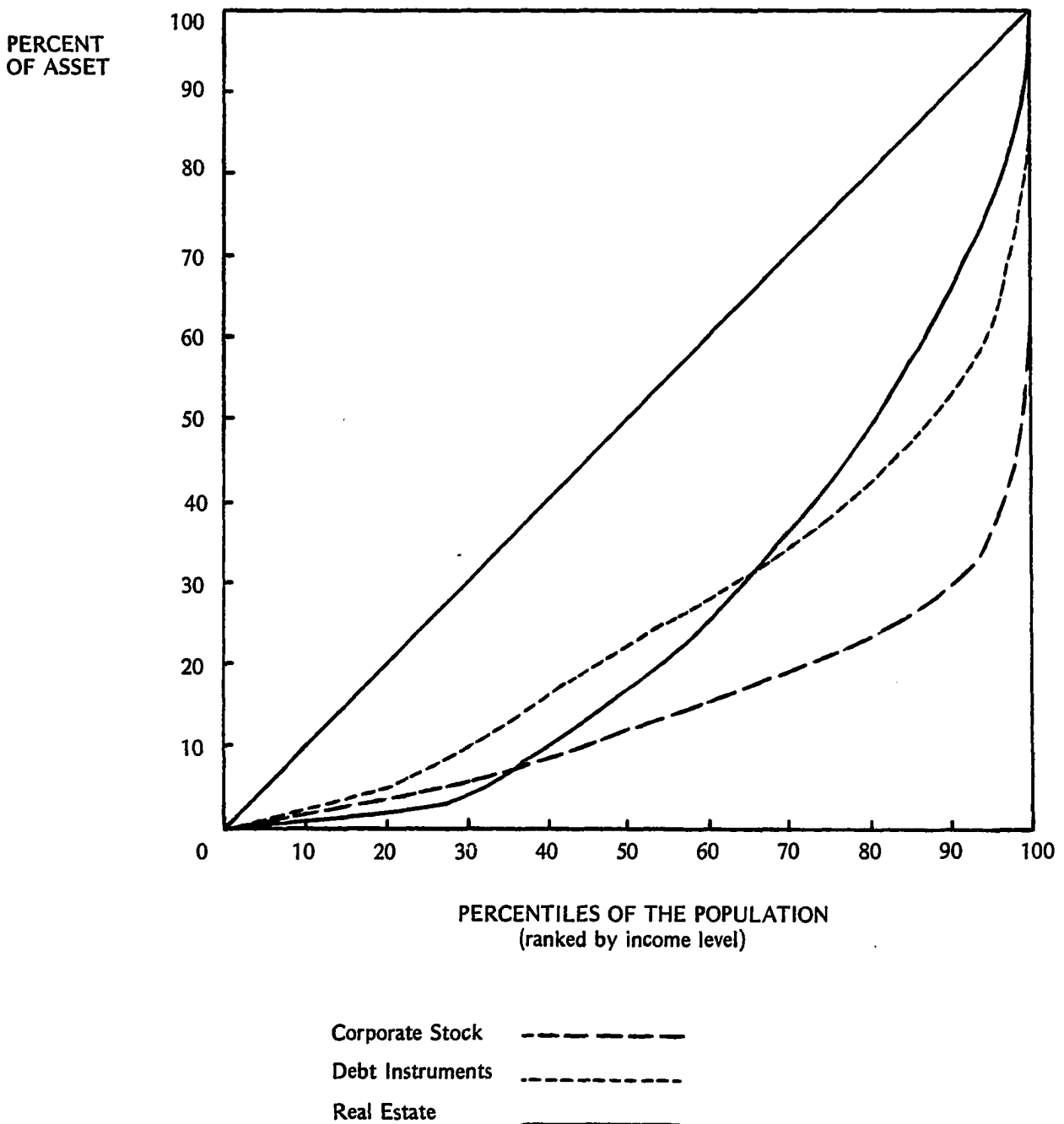
LORENZ CURVES OF WEALTH AND INCOME BY INCOME CLASS, 1973



Source: Derived from the OTA file, as documented on pp. 92-100

Figure 8

LORENZ CURVES OF CORPORATE STOCK, DEBT INSTRUMENTS, AND REAL ESTATE BY INCOME CLASS, 1973



Source: Derived from the OTA file, as documented on pp. 92-100

TABLE 10

CUMULATIVE PERCENTAGES OF NET WEALTH, INCOME,

AND ASSETS HELD BY INCOME CLASSES, 1973

Census Income Class	Census Money Income	Net Wealth	Corporate Stock	Debt Instruments	Real Estate
0-10	0.5	1.8	1.9	2.1	1.2
11-20	2.9	3.6	3.2	4.4	2.3
21-30	6.8	7.4	5.4	9.6	4.7
31-40	12.3	12.4	8.1	16.2	9.3
41-50	19.4	17.9	11.6	22.0	16.2
51-60	28.1	23.8	15.3	27.7	24.9
61-70	38.6	30.2	18.5	33.9	35.3
71-80	51.1	38.4	22.6	41.9	48.6
81-90	66.8	49.9	29.1	52.8	66.7
91-95	76.9	58.8	36.6	61.4	78.0
96-99	88.8	75.7	52.8	80.0	91.9
100	100.0	100.0	100.0	100.0	100.0

SOURCE: Derived from the OTA file, as documented on pages 92-100 of this chapter.

Table 11, page 114, includes the simple percentages of wealth, income, and assets held by each income class, and Table 12, page 115, lists the proportion of families in each class owning nonzero amounts of each. Share of wealth is higher than share of income in the highest 5% of the income distribution, where 23.2% of income and 41.2% of wealth is concentrated. This group owns 63.5% of corporate stock, 38.7% of debt instruments, and 22% of real estate. In the middle of the distribution (percentiles 31-70) each decile of 7.3 million families holds around 3% of total corporate stock and 6% of debt instruments, but the proportion of real estate increases from 4.7% in the fourth decile to 10.4% in the seventh. The highest decile has over four times the wealth of the group immediately below it, while only slightly more than twice the income.

The proportion of persons in each income class holding wealth, and particular assets measured directly here, rises steadily with income. All of the families in the highest 1% of the income distribution are wealthholders, while less than 3% of the families in the lower two deciles hold positive net worth. In the middle of the income distribution, at the fifth decile, 66% of families have positive net worth, but only 12% own corporate stock. Over 40% hold debt instruments and/or real estate. By the ninth decile, representing family income in 1973 dollars of roughly

TABLE 11

SIMPLE PERCENTAGES OF NET WEALTH, INCOME, AND ASSETS HELD BY CENSUS MONEY INCOME CLASSES, 1973

Census Class	Net Wealth	Census Money Income	Corporate Stock	Debt Instruments	Real Estate
Lowest 10	1.8	0.5	1.9	2.1	1.2
11-20	1.8	2.5	1.4	2.4	1.1
21-30	3.7	3.9	2.2	5.2	2.4
31-40	5.1	5.5	2.7	6.5	4.7
41-50	5.5	7.1	3.5	5.8	6.9
51-60	5.9	8.7	3.6	5.7	8.7
61-70	6.4	10.5	3.2	6.2	10.4
71-80	8.3	12.6	4.1	8.0	13.3
81-90	11.4	15.7	6.5	10.9	18.1
91-100	50.1	33.3	70.9	47.2	33.3
Top 1%	24.3	11.2	47.2	20.0	8.1
Top 5%	41.2	23.2	63.5	38.7	22.0

SOURCE: Derived from the OTA file, as documented on pages 92-100 of this chapter.

TABLE 12

PERCENTAGE HOLDING NET WEALTH, CORPORATE STOCK, DEBT INSTRUMENTS, AND REAL ESTATE BY INCOME CLASS, 1973

Income Percentile	Percentage of Class Holding			
	Net Wealth	Corporate Stock	Debt Instrument	Real Estate
0 - 10	15		13	4
11 - 20	26	6	22	7
21 - 30	44	11	36	15
31 - 40	56	11	40	30
41 - 50	66	12	44	41
51 - 60	75	13	51	50
61 - 70	81	15	57	57
71 - 80	88	20	67	65
81 - 90	93	28	74	74
91 - 95	97	41	84	80
96 - 99	98	59	91	83
Highest 1%		81	97	88

SOURCE: Derived from the OTA file, as documented on pages 92-100 of this chapter

$24-62,000, 93% of families were wealthholders, with 28% owning some corporate stock. In the highest decile, over half of all families held corporate stock, more than 90% held debt instruments, and over 85% owned real estate.

The Gini coefficients computed by income class show wealth more concentrated than income, at .56 versus .46 for income, but the difference is not as extreme as when looking at the wealth distribution. Corporate stock is most heavily concentrated, with a Gini coefficient of .72, while debt instruments is less concentrated than wealth at .51 and the coefficient for real estate is .49.

Distribution by Age Class

Since wealth tends to be low early in the life-cycle and peak prior to retirement, according to economic theories of accumulation, information about the ages of persons holding wealth is highly important to our analysis of its distribution. Ideally, one would trace persons (or families) through the life-cycle, measuring their wealth at various points in time. If age explained a great deal of the variation in wealth levels then we might conclude that this variation is not of fundamental social importance. This study deals with a cross-section of families at one point in time, but assigns each family to an age class based on the reported age of the head of household (see Table 13) to aid in determining the wealth-age relationship. A number

of interesting aspects of differences by age class are revealed. Below age 45 families held a share of wealth less than proportional to their share of the population, as a group, but a greater share of income. The reverse was true above age 55. In the 46-55 year age group the shares of aggregate wealth and income were both greater than the weight of this group in the population.

TABLE 13

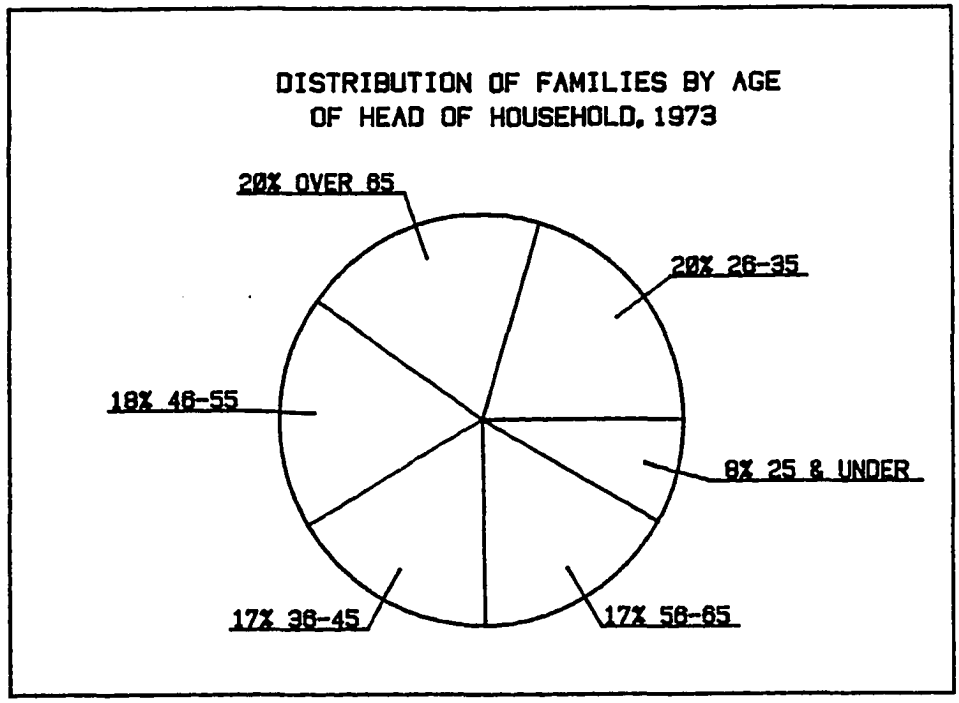
AGE CLASSIFICATION OF FAMILIES, 1973 OTA FILE

Age of Head of Household	Class
Under 25	1
26-35	2
36-45	3
46-55	4
56-65	5
Over 65	6

NOTE: Families classified for purposes of summing by classes

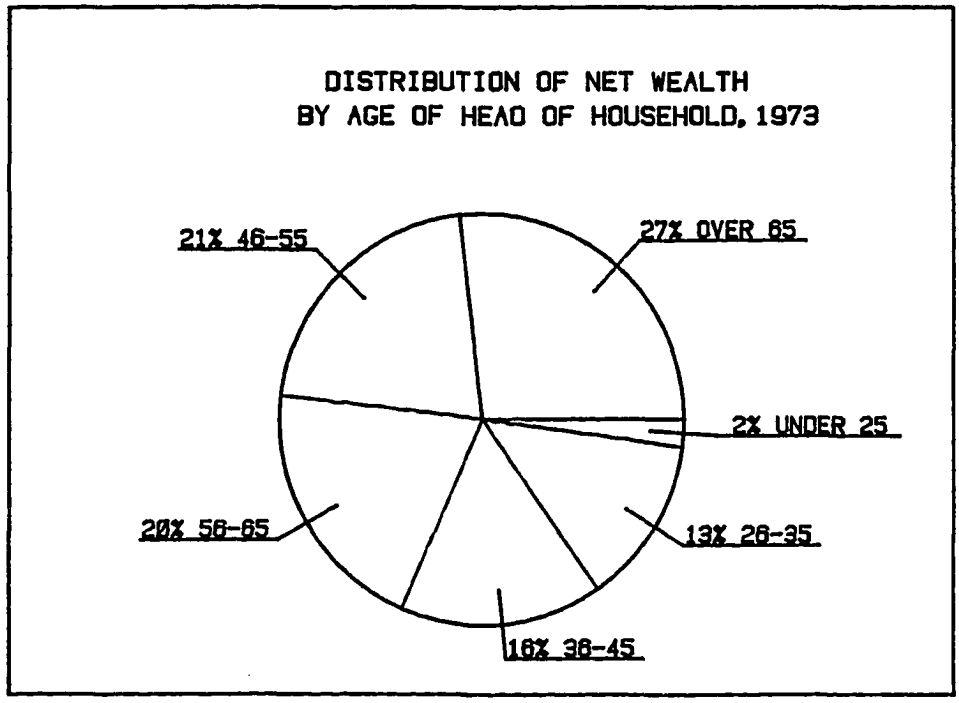
Figure 9, page 118, pictures the proportionate distribution of families using this classification. Only 8% were headed by persons age 25 or less. Within this group, 77% had zero net wealth and 1.9% fell in the high wealth category of $60,000 or over in net assets. The second age group, of

Figure 9



SOURCE: Derived from the OTA file, as documented on pages 92-100.

Figure 10



SOURCE: Derived from the OTA file, as documented on pages 92-100.

families headed by persons 26-35 years of age, represented 20% of families. Only 36% of these had zero net wealth (almost the same proportion as of the total population), and 5.1% were in the high wealth category. The groups representing the middle years of the life cycle, 36-45 and 46-55, accounted for 17% and 18% of total families, respectively. In the former, 30% were zero wealthholders and 10% were high wealthholders, while in the latter, 26% had zero wealth and 14% had wealth of $60,000 or over. Within the 56-65 year age group, representing the peak of the accumulation cycle, 26% had zero wealth and 20% were high wealthholders. This group also accounted for 17% of families. The over 65 group represents 20% of American families (many of whom will be single person households), 52% of whom had zero net wealth and 21% of whom had wealth of $60,000 or over. Within this group there were the highest proportion of wealthy persons, and (with the exception of families headed by persons 25 or under) the highest proportion of wealthless persons.

Table 14, page 120, provides a summary of the variation with and between these age classes, with reference to net wealth and Census money income. Mean net wealth rises steadily with age, while mean income peaks in the 46-55 year group and falls sharply thereafter. Relative variation is calculated as the ratio of the coefficient of variation $(\frac{\sigma^2}{\mu})$ within the age class to the coefficient of variation

TABLE 14

VARIATIONS IN WEALTH AND INCOME BETWEEN AGECLASSES, 1973

Age Class Of Head Of Household	Net Wealth				Census Money Income	
	Mean	Relative Variation*	% With Zero Net Wealth	% In Top Wealth Holder Group	Mean	Relative Variation*
1. 25 and Under	9,750	1.1	.77	1.9	8,432	.14
2. 26-35	24,084	2.6	.36	5.1	13,331	.71
3. 36-45	36,418	1.3	.30	10.0	16,317	.75
4. 46-55	43,575	.9	.26	14.0	17,280	.64
5. 56-65	48,023	.4	.26	20.0	13,914	.97
6. 65 and Over	50,847	.5	.52	21.0	8,225	2.90
TOTAL	37,675	1.0	.35		13,245	1.0

*Relative variation is the ratio of the coefficient of variation σ^2/μ within the age class to the coefficient of variation of the statistic over the entire distribution.

SOURCE: Data derived from the OTA file, as documented on pages 92-100 of this chapter.

of the statistic over the entire distribution.[19] Thus, a value greater than one indicates greater than average variability from the group mean, and a value less than one indicates less than average variability. Variability of wealth is greatest in the 26-35 year group, where presumably some families are experiencing rapid accumulation and others are not. Variability is lowest among families headed by persons age 56 and over. Relative variability of income follows almost the opposite pattern, very low in the youngest group and almost three times the average in the oldest group.

Figures 10-14 (pages 118,122, and 123) illustrate the percentage distribution of dollars of net wealth, corporate stock, debt instruments, real estate, and Census money income by the age groups listed in Table 13. Table 15, page 124, summarizes these, along with the relative importance of each group in the population. As one would expect, the share of wealth, income, and each of the assets is significantly lower in the youngest group of families than is their weight in the population. For the second age group, headed by persons 26-35, share of real estate and share of income are close to their relative weight, but corporate stock, debt instruments, and net wealth are significantly lower. Relative share of net wealth, debt instruments, and corporate

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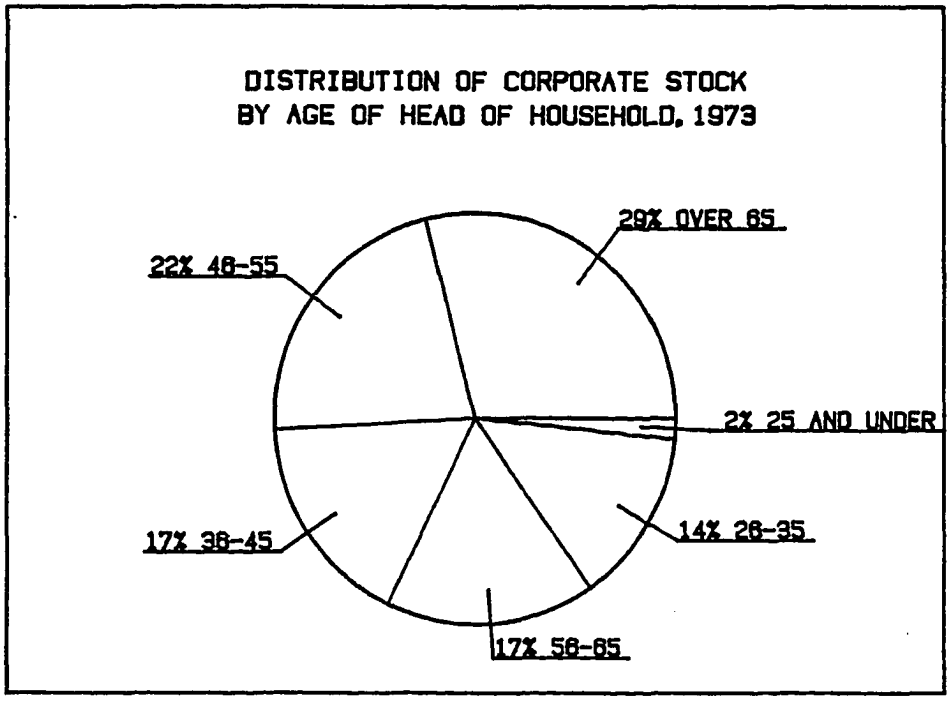
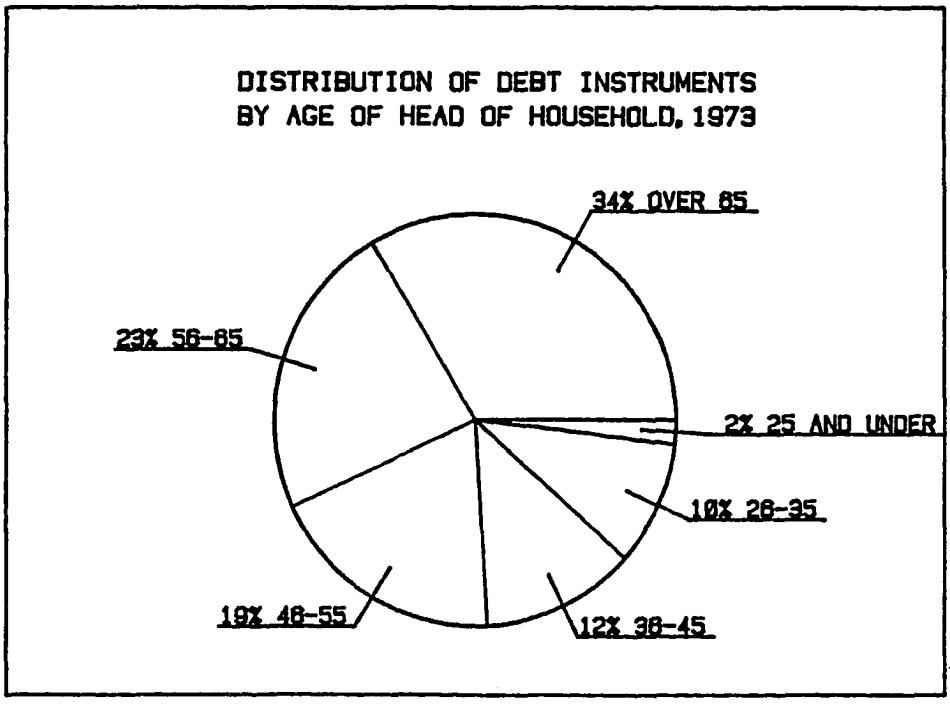
[19]Appendix D lists the program developed to calculate variances of the distribution and specific age classes within it.

Figure 11



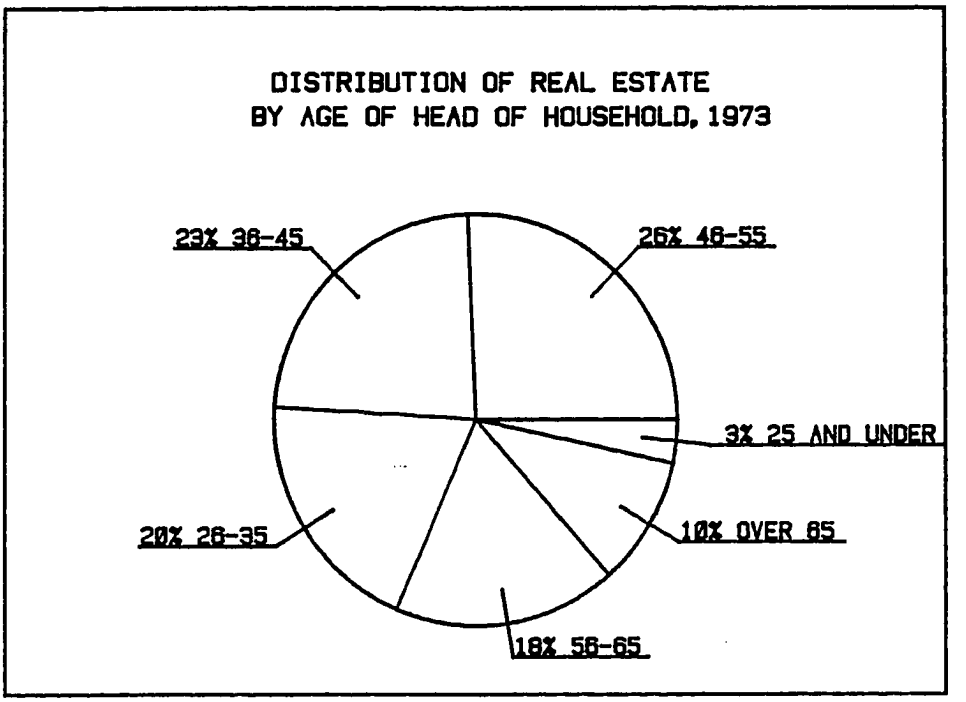
SOURCE: Derived from the OTA file, as documented on pages 92-100.

Figure 12



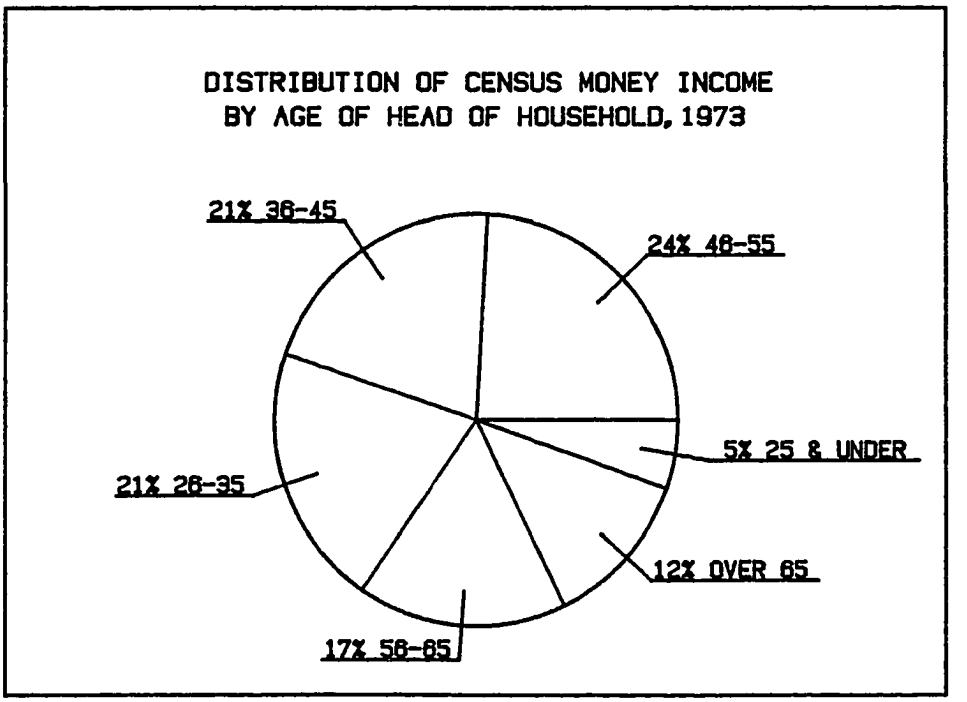
SOURCE: Derived from the OTA file, as documented on pages 92-100.

Figure 13



SOURCE: Derived from the OTA file, as documented on pages 92-100.

Figure 14



SOURCE: Derived from the OTA file, as documented on pages 92-100.

TABLE 15

PERCENTAGE DISTRIBUTION OF NET WEALTH, INCOME AND ASSETS

BY AGE OF HEAD OF HOUSEHOLD, 1973

	Age Class	Percent of Families	Percentage of Net Wealth	Census Money Income	Corporate Stock	Debt Instruments	Real Estate
1.	25 & Under	8.0	2.0	5.0	2.0	2.0	3.0
2.	26-35	20.0	13.0	21.0	14.0	10.0	20.0
3.	36-45	17.0	16.0	21.0	17.0	12.0	23.0
4.	46-55	18.0	21.0	24.0	22.0	19.0	26.0
5.	56-65	17.0	20.0	17.0	17.0	23.0	18.0
6.	Over 65	20.0	27.0	12.0	29.0	34.0	10.0

SOURCE: Derived from the OTA file, as documented on pages 92-100.

stock is highest in the over 65 group, with real estate the most heavily concentrated in the 46-55 year age group. Family patterns explain part of this early peaking of real estate wealth relative to other forms of wealth, with income also playing a role. Relative share of income is also highest for the 46-55 year age group, and it has most to gain from tax-subsidization of mortgage debt and can thereby afford more real estate investment. For the older groups, share of income drops along with share of real estate.

The analysis above deals with variation within and between families at different points in the life-cycle. An alternative way to approach the wealth-age relationship is to look at the distribution of age of family heads within each wealthclass. The proportion of each belonging to one of the six age groups used here is listed in Table 16, page 126. Within the non-wealthholding group (percentiles 0-35), there is a higher representation of families headed by persons over 65 (28.6%) and of families headed by persons under 25 (12%) than there is in the total population. That these would be low wealth groups is not surprising, given the assumption that little accumulation or inheritance occurs before age 25, and that over 65 decumulation through consumption or transfers to heirs is likely to occur. This does not explain zero wealth for older families, however, and the results indicate that not only are many older families income-poor, they are also wealth-poor. Many of these low-income

TABLE 16

RELATIVE IMPORTANCE OF AGE CLASS WITHIN WEALTH CLASS, 1973

(Percentages may not add to 100 across a class due to rounding)

Wealth Percentile	Percent in Age Class					
	25 and under	26-35	36-45	46-56	56-65	Over 65
0-35	12.0	20.0	13.8	13.4	11.6	28.6
36-40	18.9	30.1	16.4	13.9	11.8	8.8
41-45	14.3	27.9	16.3	17.1	13.6	10.9
46-50	11.9	26.8	17.8	17.8	16.2	9.5
51-55	9.9	26.3	19.4	20.7	15.2	8.5
56-60	7.2	26.3	21.1	22.3	14.9	8.3
61-65	5.7	24.4	23.6	23.0	14.4	8.9
66-70	5.4	24.3	23.3	21.8	16.5	8.7
71-75	3.6	21.7	22.5	24.6	18.0	9.7
76-80	2.4	19.6	20.0	25.1	20.2	12.7
81-85	1.7	13.7	17.1	27.2	22.9	17.4
86-90	1.7	12.7	17.5	23.6	23.6	20.9
91-95	1.1	7.8	13.3	21.1	26.4	30.2
96	2.3	5.6	11.3	17.3	27.8	35.8
97	0.7	4.7	8.2	15.6	28.1	42.7
98	0.4	5.3	8.4	14.7	27.8	43.4
99	1.5	4.5	7.0	17.9	24.5	44.5
100	1.8	10.8	18.7	22.2	16.8	29.7
Total	8.0	20.0	17.0	18.0	17.0	20.0

SOURCE: Derived from the OTA file, as documented on pages 92-100.

families would take the standard deduction rather than itemizing, so that the deduction of property tax from which we calculate real estate ownership would be missing. The OTA file does include imputations of property tax for an appropriate group of standard deductors, however, as discussed on pages

In the lowest wealth group, we find a higher proportion of younger families (49% with a head of household 35 years of age or less) and only 8.8% from the over 65 group. The proportionate importance of young families declines fairly steadily as wealthclass rises, up to the highest percentile of wealthholders. Conversely, the proportionate importance of the over 65 group varies between 8-11% through the third quartile and then rises steadily up to the highest percentile. In the intermediate age groups, the proportionate importance in each wealth class shows considerable variation. The 36-45 group constitutes 17% of the overall population of families, but are a greater share of wealthclasses in the middle of the distribution. Above the 90th percentile they are a smaller share of each wealthclass, except for the highest. The 46-55 group are 18% of all families and are more heavily in the 50th-95th percentiles. The 56-65 group are also 17% of families, and are disproportionately in the upper quartile of the distribution.

The wealth-age relationship appears to be relatively positive in the middle and upper wealthclasses, although the

highest wealth percentile does not follow this pattern. The percentage of families over 65 in this group (those with over $.5 million in net assets) is 20.7%, significantly less than in the rest of the uppper decile. Just as interesting is the fact that the proportion of young families (headed by persons 35 or under) is substantially higher than in the rest of the upper decile. The results support the notion that the life-cycle model explains a significant part of wealth distribution within the "middle classes" but very little among the poor or the wealthy. The former are important because there are so many of them and the latter because they hold so much of America's wealth.

Summary of Results

Based on the estimating procedures outlined throughout this chapter, net wealth was estimated at the family level for 45,030 units on the OTA file. Population estimates were derived by multiplying the wealth (or income) of each family by the unique weight associated with it, constructing percentile boundaries within the distribution, and summing within these boundaries. From these percentages of wealth or income held by each class were constructed, and used to plot Lorenz curves of concentration. The Gini coefficients computed from this data are summarized in Table 17, page 129.

TABLE 17

THE GINI COEFFICIENTS OF CONCENTRATION, 1973

Variable	Wealth Distribution	Income Distribution
Net Wealth	.81	.56
Census Income	.36	.46
Corporate Stock	.94	.72
Debt Instruments	.85	.51
Real Estate	.63	.49

Source: Computed for data derived from the OTA file, as documented on pages 92-100.

As one would expect, wealth and each of the assets is more concentrated by wealth class than by income class. Corporate stock shows a high degree of concentration, viewed from either perspective, however, at .94 by wealth class and .72 by income class. Income by wealth class is the least concentrated of any of the measured variables, with a Gini of .36.

The top 1% of wealthholding families in the United States held an estimated 32.6% of net wealth and received 8.7% of income in 1973, while the top 1% of families in the income distribution held 24.3% of wealth and received 11.2% of income. The highest wealth percentile held 60.3% of corporate stock. 29.4% of debt instruments, and 8.4% of real estate, while the highest income percentile held 47.2%

of corporate stock, 20% of debt instruments, and 8.1% of real estate.

Only 1% of net wealth rests with the lower half of the wealth distribution. The lower three quartiles owned approximately one-third of privately held real estate, but less than 2% of corporate stock. As one would expect, composition of wealth changes with position in the distribution, as modest savings accounts are prevalent at lower levels, growing amounts of real estate are seen in the middle levels, and corporate stock becomes important at very high levels. The same trends are apparent in the composition of wealth in different income classes. Although there are low-income families with wealth from which they draw some of that income, only 3% of families in the lower two income deciles show positive net worth. Over 97% of families in the highest income decile (those earning $23,881 or more) were wealth-holders, and they owned more than half of all personally held net wealth.

Although mean net wealth rose with age of head of household, and the relative variability of wealth declined,[19] over half of all families in the over 65 group showed zero net wealth. While in the middle ranges of the wealth distribution one can see a significant positive relationship between age and wealth, this does not apply to very low or

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[19] See Table 14, page 120.

zero wealth groups or to the highest wealth group which has holdings of over $502,000 per family.

The addition of wealth and age data to our knowledge of a family's income enhances the quality of any relationships we wish to posit between income and consumption or investment behavior and of our evaluation of the economic and political systems which generate the distributions of income and wealth. The last chapter will address the question of the reliability of various types of wealth estimates, and compare the results derived here with those of recent major estimates in areas where this is possible.

CHAPTER V

ANALYSIS AND COMPARISON OF EMPIRICAL WEALTH ESTIMATES

In this last chapter, the estimates of the distribution of personal wealth derived from income tax information on the OTA file are compared with prior findings of major studies based on surveys, estate-tax multipliers, and income capitalization. Due to the differences in coverage of the various methods, in addition to varying data and methodologies employed, no strict comparisons can be made. The strengths and shortcomings of the various methods are reviewed here, and areas in which further research would be meaningful are discussed.

Relation to Prior Wealth Estimates

Share of wealth held by the top wealth-holder group has been computed at intervals over the post-war period on an individual basis. For 1969, Smith showed the top 1% of individuals holding 24.9% of net wealth and the top 4% (those with net wealth of over $60,000) holding 33% of the total.[1] This same group was estimated to hold 53% of corporate stock and 23% of real estate. Totals were adjusted national balance sheet figures. Prior estimates of share of the top 1% in

[1]James D. Smith, "The Concentration of Personal Wealth in America, 1969," Review of Income and Wealth 20:2 (June 1974), p. 148.

prior years, by Lampman and Smith, ranged from 24.9% to 33%.[2]

The top 1% of families are estimated by this study to hold 32.6% of all personal wealth. That family wealth would be more concentrated than individual wealth is not surprising, since many members of a family may possess wealth. The top 4% of families, which includes all those with wealth of greater than $164,000 in 1973, are estimated to hold 53.6% of net wealth, 82.5% of corporate stock, 54.4% of debt instruments, and 19.8% of real estate. The concentration of wealth and corporate stock is greater in the distribution of families than the distribution of individuals at the upper end of the distribution, while concentration of real estate appears to be slightly lower. Totals are computed in this study by summing the product of each sample family's net wealth (or asset value) times the sampling weight.

The total value of corporate stock estimated for families in this study was $669.2 billion, relative to $761.5 billion estimated as an aggregate in the flow of funds accounts. Total interest paying assets were estimated here as $892.6 billion versus $632.4 billion in time deposits and other savings plus $247.7 in credit market instruments in the flow

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[2]James D. Smith and Stephen D. Franklin, "The Concentration of Personal Wealth, 1922-1969, American Economic Review 64:2 (May 1974), p. 166.

of funds accounts for 1973.[3] Total personally held real estate was estimated at $774.2 billion for 1973. While the former two estimates are quite comparable with aggregate estimates, the latter appears to be on the low side, although no strictly comparable figures exist. Total net wealth was estimated at $2.6 trillion, lower than the adjusted national balance sheet figure for 1972 of $3.5 trillion. Surveys have generally produced lower total estimates than the national aggregates and this appears to be a characteristic of this method also. The discrepancy in corporate stock totals may be due to non-reporting of small amounts of dividends or to ownership of non-dividend paying stock. The low total for real estate is probably due to non-reporting of property taxes (rather than underestimation of property values) with only 32.5% of families reporting such taxes through itemization, and another 10.7% to whom property taxes were imputed.

Special tabulations from the 1962 SFCC study show 24% of net wealth held by the upper 1% of consumer units.[4] The concept of consumer unit is fairly close to that of the census family used on the OTA file. The wealth concept used in the 1962 study is less inclusive, however. Debts were deducted

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[3]Statistical Abstract 1973, Table 712, p. 446.

[4]Dorothy S. Projector and Gertrude S. Weiss, Survey of Financial Characteristics of Consumers, Federal Reserve Technical Paper, Washington, D.C.: Board of Governors of the Federal Reserve System, 1966.

from gross wealth only if they were secured by assets covered in the survey, and no business debts were included although the values of businesses and professional practices were treated as assets. Therefore we cannot unequivocally say that concentration among the top 1% increased over the decade to 32.6% although this is what the data indicate.

In a recent estimate of wealth by income class, Lebergott estimated that the top 1% of family units in the income distribution held 17% of net wealth, 35.8% of corporate stock, 12.7% of short term claims (including all credit market instruments yielding a fixed interest return, plus currency) and 4.9% of real estate in 1970.[5]

In this estimate, we find the top 1% of income-receiving families holding a greater share of net wealth, 24.3%. Estimates of each asset share are significantly higher also. The top 1%, in 1973, are estimated to have held 47.2% of personally held corporate stock, 20.0% of debt instruments, and 8.1% of real estate. Wealth appears to be somewhat more concentrated than the Lebergott estimates indicated when estimated from microdata rather than aggregates.

The distribution of wealth among age groups in 1973 may be compared with a similar distribution constructed in the

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[5]Stanley Lebergott, The American Economy, Income, Wealth, and Want, Princeton: Princeton University Press, p. 246.

1962 SFCC study.[6] Tables 18 and 19 compare the estimates of the two years. The survey measured equity in owned home whereas the real estate measure in the present estimate includes the gross value of all real property, including investments. While it is probable that large real estate investments are incorporated for tax purposes, there is still a significant difference between these two concepts. A significantly larger percentage of real estate is owned by the under 35 group in the 1973 study, and a significantly lower percentage by the over 65 group, than in the 1962 survey. The gross value concept in 1973 versus the net value in 1962 explains a great deal of this. It is also plausible that a real shift did occur, however, with changes in the age distribution of the population, the perception of real estate as an investment good, and the advent of the two-income household among young families.

Liquid assets included checking accounts and time deposits, as well as U. S. government bonds in the survey estimate, where debt instruments included all interest-paying assets (such as corporate or municipal bonds, government securities, and mortgage assets). The 1973 estimate shows a higher percentage being held by the under 35 group and a lower percentage by the 56-65 group than does the survey.

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[6]Projector and Weiss, p. 12.

TABLE 18

SFCC Distribution of Wealth
Between Age Groups, 1962
(Percentage Held)

Age Of Head Of Consumer Unit	Under 35	35-44	45-54	55-64	65 & Over	All Units
Net Wealth	7	16	22	28	28	100
Equity in Owned Home	6	18	27	26	23	100
Liquid Assets	5	12	20	28	35	100
Investment Assets	3	10	17	31	39	100

Source: Survey of Financial Characteristics of Consumers, P. 12.

TABLE 19

DISTRIBUTION OF WEALTH BETWEEN
AGE GROUPS, 1973
(PERCENTAGE HELD)

Age of Head of Household	35 and Under	36-45	46-55	56-65	Over 65	All Families
Net Wealth	15	16	21	20	27	100
Corporate Stock	16	17	22	17	29	100
Debt Instruments	12	12	19	23	34	100
Real Estate	23	23	26	18	10	100

Note: Percentages may not add to 100 due to rounding.

Source: Data derived from OTA file, as documented on pp. 92-100.

"Investment assets" in the survey included not only corporate stock but mortgage assets, investment real estate and other miscellaneous forms of liquid investment. It cannot really be compared to any of the categories used in this study since it includes portions of all three.

Review of the Strengths and Weaknesses of Major Estimating Techniques

The method of wealth estimation presented here represents a highly useful alternative to the survey method of collection of wealth data. At present, there exists no reliable source of wealth data except for the estate tax returns. These are on an individual rather than a family basis, are limited to persons with an estate of $250,000 or more, and are biased by the incidence of transfers of wealth inter vivos, particularly through trusts. While detailed analysis of wealth by type among top wealthholders are highly useful in that they represent a large percentage of personal wealth, a knowledge of the entire wealth distribution is required when we wish to analyze wealth effects on the "middle class" of inflation, tax policy, changes in valuation in the stock market, etc.

The 1962 Survey of Financial Characteristics was the most thorough example of a wealth-measuring survey, and yielded a great deal of useful data, some of which was utilized here in analyzing rates of return on financial assets

by income class. Due in part to the substantial time and money required to replicate such a survey, it still stands as a major data source, although it has been 18 years since it was taken. Problems of nonresponse, particularly among high wealth or income families, along with the large commitment of time and funds required, are major drawbacks to relying on surveys for regular wealth estimates. A more efficacious method of making regular wealth estimates has been based on aggregated income tax data, and yields estimates of the distribution of wealth by income class. However, it cannot be used to develop wealth by wealth class due to the aggregation of the basic data.[7]

The method presented here in Chapters 3 and 4 is based on microdata which is much more flexible and may be grouped by income, wealth, or age level, in addition to many other variables. Wealth is estimated directly for each family unit and the frequency distribution of wealth or income is constructed from these estimates. Imputations, where appropriate, are made at the level of the individual family, based on differentiating characteristics of the family. Examination of demographic and financial characteristics is thus possible at the family level, such as the breakdown of age class within wealth class discussed in Chapter IV.[8]

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[7] Lebergott, pp. 215-246.

[8] See pp. 125-28 ,above.

The synthetically merged microdata base offers a myriad of possibilities for further analysis of wealthholders and their characteristics. The creation of such data sets is becoming more prevalent as the techniques discussed on pages 83-91 are developed, and a later wealth estimate based on similar methodology (which may then be compared to this 1973 estimate) would be a meaningful contribution, in allowing some comparison over time. Given the volatile nature of returns in the stock market and the substantive changes in real estate values which have occurred during the last seven years, another estimate would be interesting to compare with this one. In particular, any one-year estimate must be appraised in light of the fact that the value of stock can change radically from year to year. In 1973 there was a decline in stock market prices, as the market value of stocks on the New York Stock Exchange fell 17.3% and the Dow Jones Index of 65 stocks fell 10.2%,[9] influencing distribution.

Stronger estimates of asset values could be made if access to the IRS's Schedule A forms on each family were permitted, as in the Wharton study referenced in pages 50-53. This would allow the use of specific capitalization rates on dividends from separate companies and avoid the problem of potential bias in use of the average rate of return for all stockholders. However, the analysis done in this study

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[9]1974 Statistical Abstract, Tables 782 and 784, p. 477.

of rates of return by income class found no basis for adjusting the rate of return at different income levels. The Wharton studies did suggest that at very high levels of income rates of return would be lower, and therefore the probable nature of bias in this estimate is to underestimate the share of stock held by high income families. Whether the share of high wealthholders is underestimated is really a separate question, since not all of these families are high-income.

While the preponderant source of interest income for American families has been time deposits at commercial banks, credit unions, or savings and loans, a minority of families hold state and local, U.S. government, or corporate bonds. Since we do not have access to Schedule A, we are unable to separate these receipts and capitalize them separately. The maximum rate paid on commercial bank savings, 4½% , has been used to capitalize all interest received by the family, including imputed state and local bond interest.[10] The average rate of interest paid on the latter was 5.2% in 1973, very close to the average used here, but mortgages and other personally held loans may have carried higher or lower rates depending on the date and circumstances in which they were contracted. Corporate or foreign bonds would have paid significantly higher rates. While most corporate bonds are held by institutions such as banks, life insurance companies, etc., Smith's 1972 estimates show $94.8 billion in total

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[10]See Table 2, page **64** , for a comparison of average interest rates paid on a variety of debt instruments.

bonds held by the top 1% of the population. For these families, the value of debt instruments is overstated when the lower interest rate is used for capitalization on high return bonds.

Real estate has been estimated here by multiplying property taxes paid times the reciprocal of the average effective tax rate in the family's state of residence. Income tax itemizers have an incentive to report all of these property taxes, as they lessen the federal tax burden, but for standard deductors we have had to rely on imputed taxes added by OTA to the file. The majority of "homeowners" actually own only a percentage of the equity in their home(s), and since interest on the mortgage debt is also deductible they tend to be itemizers. Thirty-three percent of the families on the OTA file were itemizers reporting property taxes, and slightly over ten percent had property taxes imputed to them although they were standard deductions. Presumably their potential itemizations were too low to warrant claiming them.

In addition to potential reporting problems, we again have the question of accuracy of the capitalization rates. The average effective tax rate for each state was calculated from Census of Government data on median rates by county or township within each state. Coverage of local districts was more extensive in some states than in others, and a potential for improvement in basic data exists there also.

CONCLUSIONS

When trying to estimate wealth, that most fundamental of economic forces, there are always problems of accuracy and coverage. Not all assets have a readily known market value, privately held businesses being a prime example. Many persons have difficulty ascertaining the sum total of their wealth, and some feel that doing so is an invasion of their privacy. Wealth surveys are limited by these understandable human attitudes. Other data on wealth is not systematically collected, so that economic discussions of wealth distribution have been based on a great deal of supposition below the level of the estate tax filers, to date.

By combining the best available data that currently exists to create family wealth data across the entire distribution, this study extends the empirical analysis of wealth and its distribution to lower and middle wealth classes. Its basis in microdata makes possible the analysis of wealth by income and age classes also. The critical steps in the method are 1) the choice of asset capitalization rates, 2) the regression equation linking net wealth to a subset of assets and, 3) the reliance on the accuracy of the basic data.

Without more specific knowledge of the particular portfolio of securities generating the flows of dividends and interest there is no solid empirical basis for using anything other than the average rate of return to capitalize

these streams of income, but the potential for bias exists. From what we know about portfolio composition, we would be most likely to err in the direction of underestimating the stock ownership of high wealthholders and overestimating the dollar value of their debt instruments. Conversely, we may overestimate stock ownership for lower wealth groups and underestimate the dollar value of their interest bearing assets. Estimates of real property ownership are similarly dependent on an average effective tax rate for the state in which the family resides. These will tend to be closest to the actual rate for urban and suburban families living in neighborhoods with a reasonable rate of turnover in homes. The rates published by the Census of Governments are based on samples in non-rural counties market value and property tax bills for homes sold in the year 1971. Where very few homes are traded appraisal values are typically less accurate.

The linear relationship between net wealth and the gross value of these three assets used to arrive at each individual family's wealth was estimated from estate tax returns filed for persons leaving a total gross estate of $60,000 or more in 1972. While the statistical properties of the equation used and the inherent reasonableness of the estimated coefficients suggest that it yields good estimates, the net wealth estimate of any one family is obviously dependent on the appropriateness of the estimating equation as well as the accurancy of the asset value estimates.

Data from five major sources (the Survey of Financial Characteristics of Consumers, the Census of Governments, estate tax returns, income tax returns, and the Current Population Survey) was used in developing these wealth estimates. The OTA file, a statistically merged set of CPS and income tax data, was the primary basis of the actual wealth estimates. The accuracy of the end results are in large a product of these data sources used to produce the results, and the quality of each of these sources appears to be quite good. While problems of response levels and measurement exist in any data base, each of these sources provides fairly reliable data, subject to the caveats we have discussed in each section.

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APPENDIX A

The data was assigned to strata, as listed in Table 20 below, and the variance and other necessary information was computed on each stratum to satisfy equation (6), below:

$$(6) \quad n_h = \frac{N_h s_h}{\sum_{h=1}^{L} N_h s_h}$$

as referenced in Chapter 4. The sample standard deviation, s_h, has been substituted for the actual standard deviation, σ_h.

TABLE 20

CONSTRUCTION OF ESTATE TAX STRATA

	Strata	N_h			$N_h s_h$	$N_h s_h^2$
1.	NW $\leq$ \$0	52	1635.3			
2.	0 < NW $\leq$ \$60,000	751	11.9	141.6	8,937.0	106,342
3.	60,000 < NW $\leq$ \$80,000	7180	5.6	31.4	40,208.0	225,452
4.	80,000 < NW $\leq$ \$100,000	5833	5.7	32.5	33,248.0	189,573
5.	100 < NW $\leq$ \$150,000	8854	13.9	193.2	123,071.0	1,710,593
6.	150 < NW $\leq$ \$300,000	8514	44.1	1,944.8	375,467.0	16,558,027
7.	NW > \$300,000	4296	4638.8			
	$\sum_{L=2}^{6}$	31,132	81.2	2,424.7	580,931	18,683,645

The following set of program statements selected the appropriate number from each of stratum 2 - 6 by systematic sampling. Observations were posted by size of net wealth, and classified by S (Strata).

```
IF FIRST. S  THEN N = 0;
N + 1;
IF S = 2 AND MOD (N,150) = 0 THEN GO TO NEXT;
IF S = 3 AND MOD (N,342) = 0 THEN GO TO NEXT;
IF S = 4 AND MOD (N,343) = 0 THEN GO TO NEXT;
IF S = 5 AND MOD (N,138) = 0 THEN GO TO NEXT;
IF S = 6 AND MOD (N,44) = 0 THEN GO TO NEXT;
DELETE;
NEXT;
```

This yielded a sample of 300 estate tax returns containing 5 observations from stratum 2, 20 from stratum 3, 17 from stratum 4, 64 from stratum 5, and 194 from stratum 6.

APPENDIX B

COMPUTATION OF THE GINI COEFFICIENTS

The Fortran program below was developed for the purpose of computing Gini coefficients, using the percentages of net wealth, income, corporate stock, debt instruments, and real estate held by wealth and income classes. This is the same data used to plot the Lorenz curves in Figures 6 - 9. AREAUC is equal to T_i, where the area of the triangle $T_i = y*\frac{x}{2}$ and the remaining $T_i = x*\frac{(y_1 + y_2)}{2}$ (See Figure 4, page 93, for a graphical exposition). The area above the Lorenz curve and below the 45° line, A, is equal to 0.5 - AREAUC, and G, the Gini coefficient, is one-half of A.

```
      DIMENSION X(50),Y(50),TITLE (20)
      ICASE=0
    1 READ (5,1000) TITLE,N
      IF (N.EQ.0) STOP
      ICASE=ICASE+1
      READ (5,1001) (X(I),Y(I),I=1,N)
      WRITE (6,2003) TITLE
      WRITE (6,2000) ICASE,N
      WRITE (6,2001) (I,X(I),Y(I),I=1,N)
      AREA = AREAUC(X,Y,N)
      A=0.5-AREA
      GINI= A/0.5
      WRITE (6,2002)  GINI,A
      GO TO 1
 1000 FORMAT (20A4,/,I5)
 1001 FORMAT (10F5.3)
 2000 FORMAT (' CASE ',I3,'. NUMBER OF POINTS=  ',I3,/)
 2001 FORMAT (5X,I5,2F10.3)
 2002 FORMAT (5X,' GINI COEFFICIENT =  ',F7.5,'   AREA=',F7.5)
 2003 FORMAT (1X,20A4)
      END
      FUNCTION AREAUC(X,Y,N)
      DIMENSION X(N),Y(N)
      AREAUC=0.0
      IF (N.LT.2)RETURN
      AREAUC=X(1)*Y(1)
      IF (N.EQ.2)GO TO 11
      J = 2
      DO 10 I=3,N
      AREAUC=AREAUC + ((X(I)-X(J))*(Y(I)+Y(J)))
      J =I
   10 CONTINUE
   11 AREAUC=AREAUC*0.5
      RETURN
      END
```

APPENDIX C

CALCULATION OF SUMS AND MEANS BY WEALTH CLASSES

The program below outlines the estimation of sums and means by wealthclass. A similar program was used to sum within income and age classes.

```
*ESTIMATION OF NET WEALTH BY WEALTHCLASS;
*INDIVIDUAL VALUES ARE MULTIPLIED BY WEIGHTS PRIOR TO SUMMING;

   WNW = NW * WT;
   WCMI = CMI * WT;
   WV = V * WT;
   WDI = DI * WT;
   WRE = RE * WT;

*CLASS SUMS ARE SET TO ZERO AT THE BEGINNING OF EACH CLASS;
 IF ^FIRST.WCLASS THEN GO TO COUNT;
       AGE1 = 0;
       AGE2 = 0;
       AGE3 = 0;
       AGE4 = 0;
       AGE5 =  0;
       AGE6 = 0;
       NNW = 0;
       NV = 0;
       NDI = 0;
       NRE = 0;
       CSWNW = 0;
       CSWV = 0;
       CSWDI = 0;
       CSWRE = 0;
       CSWCMI = 0;
       CWT = 0;
*CUMULATIVE AND CLASS SUMMATIONS OF WEIGHTED VALUES;
 COUNT:
       IF NW > 0 THEN NNW + WT;
       IF V > 0 THEN NV + WT;
       IF DI > 0 THEN NDI + WT;
       IF RE > 0 THEN NRE + WT;
       IF AGECLASS = 1 THEN AGE1 +WT;
       IF AGECLASS = 2 THEN AGE2 + WT;
       IF AGECLASS = 3 THEN AGE3 + WT;
       IF AGECLASS = 4 THEN AGE4 + WT;
       IF AGECLASS = 5 THEN AGE5 + WT;
       IF AGECLASS = 6 THEN AGE6 + WT;
       CWT + WT ;
       CSWNW + WNW;
       CSWV + WV;
       CSWDI + WDI;
       CSWRE + WRE;
       CSWCMI + WCMI;
       SUMWNW + WNW;
       SUMWV + WV;
       SUMWDI + WDI;
       SUMWRE + WRE;
       SUMWCMI + WCMI;
 IF ^LAST.WCLASS THEN RETURN;
 NWMEAN = CSWNW/CWT;
 CMIMEAN = CSWCMI/CWT;
```

APPENDIX D

CALCULATION OF VARIANCES

The programs below outline the computation of variances for the total distribution and within each age class.

```
* COMPUTATION OF NW AND CMI VARIANCES;

  Y = ((CMI-13245)**2)*WT;
  X = ((NW-37675)**2)*WT;
       SUMY + Y;
       SUMX + X;
       SUMWT + WT;
IF _N_=45030 THEN CMIVAR= SUMY/(SUMWT-2);
IF _N_=45030 THEN NWVAR = SUMX/(SUMWT-2);


*COMPUTATION OF VARIANCES BY AGECLASS;
IF ^FIRST.AGECLASS THEN GO TO NOT1ST;
       SUMVNW = 0;
       SUMVCM = 0;
 *MEANS OF NW ARE ASSIGNED BELOW ON BASIS OF PRIOR ROUTINE;
 IF AGECLASS = 1 THEN MNW = 9749.89;
 IF AGECLASS = 2 THEN MNW = 24084.21;
 IF AGECLASS = 3 THEN MNW = 36418.47;
 IF AGECLASS = 4 THEN MNW = 43575.17;
 IF AGECLASS = 5 THEN MNW = 48023.26;
 IF AGECLASS = 6 THEN MNW = 50846.88;

*MEANS OF CMI ARE ASSIGNED BELOW ON BASIS OF PRIOR ROUTINE;
IF AGECLASS = 1 THEN MCMI = 8432.03;
IF AGECLASS = 2 THEN MCMI = 13331.20;
IF AGECLASS = 3 THEN MCMI = 16316.91;
IF AGECLASS = 4 THEN MCMI = 17280.44;
IF AGECLASS = 5 THEN MCMI = 13913.59;
IF AGECLASS = 6 THEN MCMI = 8225.16;
RETAIN MNW MCMI SUMVNW SUMVCM;

NOT1ST:
VNW = ((NW-MNW)**2)*WT;
VCM = ((CMI-MCMI)**2)*WT;
SUMVNW + VNW;
SUMVCM + VCM;
IF ^LAST.AGECLASS THEN RETURN;

VARNW = SUMVNW/(CWT-2);
VARCMI = SUMVCM/(CWT-2):
```