THE IMPACT OF SKEWNESS OF THE INCOME DISTRIBUTION ON LOCAL EDUCATIONAL EXPENDITURES

Dissertation for the Degree of Ph. D.

MICHIGAN STATE UNIVERSITY
PHILLIP PAUL CARUSO

1977

This is to certify that the

thesis entitled

THE IMPACT OF SKEWNESS OF THE INCOME DISTRIBUTION ON LOCAL EDUCATIONAL EXPENDITURES

presented by

Phillip Paul Caruso

has been accepted towards fulfillment
of the requirements for

Ph.D. degree in Economics

Major professor

Date May 19, 1977

ABSTRACT

THE IMPACT OF SKEWNESS OF THE INCOME DISTRIBUTION ON LOCAL EDUCATIONAL EXPENDITURES

By

Phillip Paul Caruso

The amount of local educational expenditures is determined by a vote of the elegible voters in the school district in which a simple majority rules. Although researchers attempting to estimate the determinants of these expenditures have generally included some measure of average income as one of the determinants we also expected that the distribution of income of the school district would affect the tax rate that the decisive voter would prefer. We argue that previous researchers treated the role of the income distribution as a determinant of local educational expenditures inadequately; either by ignoring it, or by assuming it away, or by measuring it in an inappropriate way.

We analyze the way in which the parameters of the distribution of income might affect the tax rate that a simple majority of the voters would support, the equilibrium tax rate, by hypothesizing some alternative relationships between the preferred tax rate and income and

then trying to deduce the effects of changes in the parameters. With a proportional tax system we conclude that whether or not changes in these parameters affect the tax rate depends upon the shape of the tax preference curve. We conclude that changes in the degree of skewness of the income distribution would affect the tax rate unless the tax preference curve is nonmonotonic. When we allow the tax system to be nonproportional, we find that changes in skewness would affect the equilibrium tax rate unless the tax preference curve is linear.

Having concluded that the degree of skewness of the income distribution could affect the equilibrium tax rate, we estimate the empirical relationships between the tax rate and the degree of skewness using data for 494 school districts in the State of Michigan for 1970. We formulate a regression equation which includes as independent variables median income and variance and skewness of the income distribution. We also include such nonincome variables as proportion of students attending private schools and percentage of property that was nonresidential.

Our regression results reveal that the coefficient of the skewness variable is statistically significant at the one percent level. The importance of skewness is estimated in two other ways. First, the sample of school districts is divided into two subsamples on the basis of the degree of skewness and a test is performed that

suggests that the two subsamples are structurally different. Second, the method of interaction variables is employed and the evidence suggests that a large part of the effect of skewness is due to its association with some of the other independent variables. We conclude that the variation in skewness between school districts is sufficiently large and important that failure to consider skewness would result in omission of a statistically significant effect on the tax rate.

We also recalculate the regression equation first substituting mean income for median income and then substituting the property tax rate for the income tax rate. The first substitution produces little difference in results while substitution of the property tax rate results in lower coefficients of determination for all three sample sizes and lower significance levels in two of them.

THE IMPACT OF SKEWNESS OF THE INCOME DISTRIBUTION ON LOCAL EDUCATIONAL EXPENDITURES

By

Phillip Paul Caruso

A DISSERTATION

Submitted to
Michigan State University
in partial fulfillment of the requirements
for the degree of

DOCTOR OF PHILOSOPHY

Department of Economics

1977

ACKNOWLEDGEMENTS

No dissertation is written without significant help and encouragement from others. This dissertation is no exception to that rule. In addition to his patience, Professor Byron Brown as Chairman of the Guidance Committee, provided me with guidance without which this research would not have been completed. He read many drafts and provided many suggestions and criticisms. I am sure that an attempt to add up the value of his time in foregone alternatives would yield depressingly large numbers. Indeed, I doubt on an ex post basis that society is better off, even though I most assuredly am.

In the time he was on the Committee, Professor Paul Ginsburg was also very helpful in providing suggestions and ideas. Professors Aaron Gurwitz, John P. Henderson and Milton Taylor also deserve my gratitude for the time spent reading the many drafts of this research.

Those who read this research will quickly realize that its completion required significant amounts of computer time. I owe thanks to the Michigan State University Computer Center for this time and the help they provided me. The amount of time used was less than it otherwise would

have been because of the generous help of Katherine E. Ely and Jacquelin Grossman of the Agricultural Economics Department who helped me to eliminate programming errors encountered while assembling the data base. The people who allowed me to have access to this data also deserve much gratitude. Professor Brown had spent many hours making the original data from the 1970 Census School District Data Tape compatible with the CDC 6500 and in addition to making it available to me, also spent time helping me to write the programming statements to copy it from his tape. Professor Leanna Stiefel allowed me to use the property data she had recalculated to fit the school district data. Collection of comparable data would have consumed considerably more time without their cooperation.

Although the advice and help of these people eliminated many mistakes I am fully responsible for the remaining errors.

At times the task of writing this dissertation seemed to be an impossible task. Without the emotional support of my wife, Jini, I would most certainly have given up long ago.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

CHAPTER I

INTRODUCTION

The purpose of this research is to examine how the income and income distribution of a community affects the willingness of the community to impose taxes on itself to finance public education. A number of authors have dealt with related issues, but all except one have ignored parameters of the income distribution other than mean or median income. The lone exception[1] pointed out the possible importance of the distribution parameters but then assumed a special case which eliminated their importance. After reviewing the most relevant research in this Chapter, in Chapter II we will analyze how the distribution of income can affect the equilibrium tax rate. In Chapter II we will also analyze how nonincome and nonprice characteristics of the community might affect the equilibrium tax rate. These will include such variables as the percentage of children attending private schools and the percentage of voters without children. In Chapter III we shall specify

[1]Thomas E. Borcherding and Robert T. Deacon, "The Demand for the Services of Non-Federal Governments," The American Economic Review LXII (December 1972): 891-901.

a framework with which we can estimate the extent to which these characteristics affect the behavior of communities in approving tax rates. In Chapter IV we will present and interpret our empirical results. Finally, in Chapter V we will summarize what we have found.

The amount and kind of goods that are financed by taxes on the community are chosen, directly or indirectly, by a vote of the members of the community with a simple majority ruling.[2] If income affects the willingness of an individual to buy a good, then the income distribution in the community may affect the outcome of the community decision. Looking specifically at decisions about educational expenditures, we can see that although the decisions about education are made by the voters' representatives, the voters of the community decide on the local millages to be imposed and the amount of the bonds to be issued to finance their schools. Consequently, the expenditures on education at the local level appear to be expenditures over which citizens have the most direct control and would appear to provide an excellent opportunity to analyze how the community voting process works and to estimate the relationships between the expenditures decisions and the economic characteristics of the community.

---

[2]The decision may be indirect in the sense that a community may choose a representative who is presumed to support the voters' preferences, but many of the finance decisions with respect to education are made directly by the voters.

In addition to providing an opportunity to examine the effects of the community voting process, local educational expenditures are also important in themselves because of the linkages between education and income. Previous research has indicated that those who have a relatively large number of years of education will generally have larger expected income streams. We also know that education beyond high school has become necessary in obtaining jobs, and that it seems to be less accessible to those whose parents receive average or below average income. Some have argued that the increase in educational requirements is not necessary for the performance of many of the jobs, but is due to employer preferences.[3] In any case, the effect is that those who receive relatively larger amounts of education in one generation are not only likely to receive higher incomes but their children are even more likely to receive relatively large amounts of education.

Thus, recently we have observed much controversy over the existence or non-existence of equal opportunity for education. One of the economic issues involved in this controversy is the effect of the system of financing education on the opportunity for education. Some opponents of financing local education by property taxes have argued

---

[3]Richard Perlman, The Economics of Education (New York: McGraw-Hill Book Company, 1973), 75, 97, 98, and 104.

that it is a regressive tax system and thus prevents, or at best, inhibits equal opportunity.[4]

A Summary of the Literature on Voting and Public Choice[5]

In 1943, Howard R. Bowen published "The Interpretation of Voting in the Allocation of Economic Resources."[6] According to our search of the literature, this was the first twentieth century article devoted to analyzing the effects of voting on public choice. Bowen tried to adapt conventional economic theory to the problems relating to production and consumption of public goods. He derived the maximum amount the community would pay for an additional unit of the good (the total marginal satisfaction for the community) and assuming symmetrically distributed individual marginal satisfaction curves and equal taxes argued that voting would yield the socially optimum output when the good is produced under constant or decreasing costs.[7] Bowen then attempted to salvage

---

[4]Robin Barlow, "Efficiency Aspects of Local School Finance," Journal of Political Economy 78 (September/October 1970): 1028-1040.

[5]Also see Dennis C. Mueller, "Public Choice: A Survey," Journal of Economic Literature XIV (June 1976): 395-433.

[6]Howard R. Bowen, "The Interpretation of Voting in the Allocation of Economic Resources," Quarterly Journal of Economics 58 (November 1943): 27-28.

[7]Bowen's conclusion hinges upon a condition which is questionable. He states that one of the conditions for maximum human satisfaction is that: "...the output of

something from the increasing cost case by suggesting a new tax procedure. In the increasing cost case the marginal cost to each voter was the total marginal cost divided by the number of members in the community. The tax on each voter was equal to this average marginal cost and thus would rise and fall along with marginal cost. The procedure suggested by Bowen established a "price" per unit to the voter that was independent of the level of output and the same for all voters.[8] Thus, each voter would face the same marginal cost and this marginal cost would be independent of output. The "price" would then be voted on by the community and eventually, in a frictionless, zero transaction cost world, it would approach the price which would yield optimum output.

Finally, Bowen considered the possibility of choosing a tax equal to the benefits each voter received.[9]

---

each constant- or increasing-cost industry is adjusted so that the price of the product is equal to average cost, and the output of each decreasing-cost industry is adjusted so that the price of the product is equal to marginal cost..." Bowen, ibid., p. 28. He appears to be arguing that in decreasing cost industries the price equals marginal cost solution would yield a price below average cost and since revenues would not cover costs this cannot be the optimum quantity. Arguing further that the modal vote reveals only the output where p, the average tax rate, equals the average or modal marginal cost, Bowen concluded that voting reveals the optimum output only when costs are decreasing or constant.

[8]Bowen, ibid., pp. 38-40.

[9]Bowen, ibid., p. 44.

He rejected this as unworkable because the information about individual benefits would have to be obtained from the voter through his vote and that this would either require assuming he voted without knowledge of the cost or the information would be unreliable as the voter adopted voting strategies. Bowen argued that at least with equal distribution of costs, variations in amounts for which individuals vote will only depend upon differences in individual marginal rates of substitution. However, if individuals have unequal access to the good and thus receive unequal benefits (such as where families have different numbers of children in public schools) then, Bowen argued that the benefit principle of taxation becomes more practical.

A few years after Bowen, two authors, Duncan Black and Kenneth J. Arrow began publishing their works analyzing group decision-making.[10] They in turn were followed by the work of Anthony Downs[11] who applied economics to the decisions by citizens on whether or not to vote as well as decisions by candidates to office in determining their

---

[10]Duncan Black's writings include "On the Rationale of Group Decision-Making," Journal of Political Economy 56 (February 1948): 23-34 and "The Decisions of a Committee Using a Special Majority," Econometrica 16 (July 1948): 245-261. For the work of Kenneth Arrow see his Social Choice and Individual Values, 2nd ed. (New York: John Wiley and Sons, Inc., 1963). Pages 92 to 120 of Arrow's book contain a review of the literature written in response to the first edition.

[11]Anthony Downs, An Economic Theory of Democracy (New York: Harper and Row, 1957).

positions. Although the research of Black, Arrow and Downs has had a major effect on the current research in public choice, their research, at best, only touches on the purposes of this paper so we will not summarize their works here.

Beginning in 1964 with Otto Davis' "Empirical Evidence of Political Influences Upon the Expenditure Policies of Public Schools"[12] economists began publishing empirical articles attempting to assess how citizen preferences, as represented by their economic status, influence the public choice decisions. Davis introduced what he referred to as "special interest variables" to measure differences in benefits and costs that accrue to individuals. For example, he asserted that those who had children attending public schools would generally be expected to receive relatively large benefits and those who did not own property might anticipate bearing relatively small costs when a property tax is used to raise revenues. His data were rather unusual in that they were a sample of communities with population below 25,000. The special interest variables generally performed significantly and the results were consistent with the hypotheses in the tests conducted.

---

[12]Otto A. Davis, "Empirical Evidence of Political Influences Upon the Expenditure Policies of Public Schools," in Julius Margolis, ed., The Public Economy of Urban Communities (Baltimore: Johns Hopkins Press, 1965), pp. 92-111.

Following this article Davis collaborated with James L. Barr to write "An Elementary Political and Economic Theory of the Expenditures of Local Governments."[13] They used standard theory of consumer behavior to derive the implications of rational calculation of voters on expenditures of local government. They added government expenditures to the utility function and then modified the budget constraint to include the condition that each property owner pay his share of the expenditures based upon his share of the community's assessed property value. Using simple regression analysis based upon data from some Pennsylvania counties, they found that per capita expenditures and the percentage of the electorate owning houses were significantly inversely related in some of their regressions. The relationship was more likely to be significant for expenditures over which the local community had more control. They did not consider school expenditures in their research. Although these two articles considered the effects of special interest variables as we shall do, they did not consider the effect of income distribution as distinct from average income.

---

[13]James L. Barr and Otto A. Davis, "An Elementary Political and Economic Theory of the Expenditures of Local Governments," Southern Economic Journal XXXIII (October 1966): 149-165.

James Q. Wilson and Edward C. Banfield also analyzed voting behavior and its effect on municipal expenditures under the assumption that voters are rational.[14] They analyzed differences in voting behavior between renters and homeowners, and concluded: "...non-homeowners show more taste for public expenditures that are to be financed from property taxes than do homeowners."[15] They also analyzed differences in voting behavior for income levels and some ethnic groups and concluded: "...voters in some income and ethnic groups are more likely than voters in others to take a public-regarding rather than narrowly self-interested view of things...."[16] They did not consider expenditures on education in their analysis.

Anna R. Horowitz also attempted to interpret public choice decisions under the assumption that each voter would consider his own self-interest in voting on the amount of expenditures his state would make. Her contributions were threefold.[17] First, she used a

---

[14]James Q. Wilson and Edward C. Banfield, "Voting Behavior on Municipal Public Expenditures: A Study in Rationality and Self-Interest," in Julius Margolis, editor, The Public Economy in Urban Communities (Baltimore: Johns Hopkins Press, 1965), pp. 74-91.

[15]Wilson and Banfield, ibid., p. 76.

[16]Wilson and Banfield, ibid., p. 86.

[17]Anna R. Horowitz, "A Simultaneous-Equation Approach to the Problem of Explaining Interstate Differences in State and Local Government Expenditures," Southern Economic Journal XXXIV (April 1968): 459-476.

simultaneous-equations model in an attempt to consider the intercorrelations of some of the variables. Second, one of the variables was a measure of the Gini coefficient for each state to estimate how income inequality influences the amount of public services purchased. Third, she incorporated a measure of tax effort[18] and tried to distinguish between "need" and demand for public services. Tax effort was consistently significant in her two stage least squares estimates but the income inequality variable was generally significant only in models where employment rather than expenditures was the dependent variable. This may be due to the degree of aggregation, in that differences in the degree of inequality between states may be insignificantly less than between communities within a specific state. Furthermore, an income distribution can be unequal and still be a symmetrical distribution and one distribution can be more unequal than another and still have the same degree of skewness. We will argue that skewness is the important variable in a voting situation.

William C. Birdsall was concerned with estimating the demand for public goods. He used the percentage of yes votes on 26 state-wide referenda for the State of New York over a period of six years as his dependent variables and 52 independent variables in attempting to estimate

---

[18]Horowitz defined tax effort as taxes collected relative to personal income per capita. Horowitz, ibid., pp. 460-461.

what factors were significant in determining the results of the referenda. He used both stepwise and standard regression techniques. Only three of Birdsall's variables are relevant for this study: the percentage of students enrolled in private schools, the percentage of families with children under 18 years of age, and the percentage of population over 65 years. The last variable did not prove to be significant. The statistical results of the private school variable implied that parents of private school students may be less willing to impose taxes on themselves to provide public school education and that parents with children of school age were more willing to bear taxes to support education.[19]

In 1970 Robin Barlow published "Efficiency Aspects of Local School Finance."[20] He investigated the extent to which the use of a property tax system to finance local schools resulted in voters supporting an inefficient level of output. After indicating the importance of the median voter in deciding the level of output, Barlow specified an individual demand curve as a function of income and price. He began by assuming that each individual's demand curve possessed constant income and price elasticities of demand.

---

[19]William C. Birdsall, "A Study of the Demand for Public Goods," in Richard A. Musgrave, ed., Essays in Fiscal Federalism (Washington, D.C.: The Brookings Institution, 1965), pp. 235-294.

[20]Barlow, "Efficiency Aspects of Local School Finance," pp. 1028-1040.

Thus, the share of income people would be willing to spend on education, the equilibrium tax rate, was assumed to be independent of income and the distribution of income.[21] With this assumption Barlow developed an expression for individual marginal benefits and then after estimating income and price elasticities from Michigan local school cross-sectional data and borrowing some previous estimates of income and property tax burdens in Michigan, he estimated benefit-burden ratios for different classes of income. He concluded the benefit-burden ratio was less than one, leading to an inefficiently low level of output. Inclusion of business property reduced the inefficiency but did not eliminate it. His data did not allow him to estimate the effect of differences in tastes for education that might have been caused by differences in religious affiliation or the number of children in the households.

Barlow's article served as a catalyst for five articles in the January/February 1973 Journal of Political Economy. Noel Edelson extended Barlow's treatment to consider the effects of different assumptions about

---

[21]Barlow does indicate that he realized this assumption might be restrictive. He also assumed that there were no extra local externalities in order to get the social demand curve equal to the sum of the individual demand curves.

business property taxes.[22] He treated three cases allowing business property taxes to be equivalent to: (1) a tied lump-sum grant; (2) a matching grant with a perfectly inelastic tax base; and (3) a matching grant with variable rates due to the elasticity of the business tax base. He also allowed for the existence of voters who receive no direct benefits from public education. In cases 1 and 3 he concluded that output would be below Pareto optimal. He also concluded that the presence of non-users would not sufficiently reduce per pupil expenditures to offset the users incentive to vote for higher per pupil expenditures, since non-users bear part of the burden unless virtually all high income voters are non-users. His category of non-users includes parents of children attending private schools, aged couples, and unrelated individuals. He also mentions the case of unequal benefits accruing to voters with different family size.[23]

Yoram Barzel was concerned with Barlow's implicit assumption that schooling is provided only by the public sector.[24] He argued that those with income substantially

---

[22]Noel M. Edelson, "Efficiency Aspects of Local School Finance: Comments and Extensions," Journal of Political Economy 81 (January/February 1973): 158-173.

[23]Edelson, ibid., p. 168.

[24]Yoram Barzel, "Private Schools and Public Finance," Journal of Political Economy 81 (January/February 1973): 174-186.

above the median income will attempt to obtain more education than that which the median voters will support by turning to private education. Barzel demonstrates that this increases the estimate of the benefit-burden ratio for the median income voter to greater than one, implying a greater than optimal level of output.

The last of these papers relevant to our concern is Theodore Bergstrom's "A Note on Efficient Taxation."[25] He proved mathematically that Barlow's claim for inefficiently low level of output with property taxation required the assumption that median income is less than mean income. He demonstrated that if instead the median income were larger than mean income, Barlow's model would imply an output in excess of the Lindahl equilibrium quantity.

This series of articles served as a stimulus for an article by Borcherding and Deacon.[26] They attempted to estimate the demand for services provided by non-federal governments. Using a Cobb-Douglas production function they derived a horizontal supply curve whose level was determined by the level of the wage rate of the community. The amount received by the median voter was specified to be dependent on the degree to which the good was a public good. Assuming that the method of taxation was

---

[25]Theodore Bergstrom, "A Note on Efficient Taxation," Journal of Political Economy 81 (January/February 1973): 187-191.

[26]Borcherding and Deacon, ibid., pp. 891-901.

non-discriminatory they derived the demand function for the median voter as a function of the marginal tax price and income. The marginal tax price was in turn dependent upon the wage rate and the degree of publicness of the good. They then specified the individual demand function as a log-linear function of the tax price and individual income. Borcherding and Deacon argued that the median voter was the deciding voter under a majority rule system and then proceeded to estimate the demand of the median voter by using average income as the sole income variable that would influence the median voter. They ignored the possibilities that the median voter might not be the voter with income at or near the mean income and that factors other than income might influence the decision of the median voter.

Borcherding and Deacon used data collected by the Census Bureau on local expenditures by states for eight expenditures categories. The expenditures categories included local education, higher education and highway expenditures. In addition to measuring income and price elasticities, they tried to measure the effects of the dispersion of population on expenditures and the degree to which the voters perceive the services purchased to be public or private goods. The states were broken into two groups on the basis of estimates of the percentage of costs accounted for by labor in the production of the particular

service. This was undertaken to capture the effect of differences in production functions and cost structures. in the states. They estimated the price elasticity of demand for local education to be approximately -1.3 and the income elasticity to be approximately .94. Although their results indicated that people perceive the services as private goods, Borcherding and Deacon were cautious in pointing out that there were other explanations that would be consistent with their statistical results.

Bergstrom and Goodman[27] followed the lead of Borcherding and Deacon and estimated the demand curve for the median voter utilizing median income. However, they were more explicit about the roles of the variation in income elasticities, differences in income distributions between communities, and the benefit characteristics of communities in the final outcome of the decision. They began by assuming that the price to each individual for public goods was his share of the costs of the public good and the quantity supplied by each community would be equal to the quantity demanded by the median income voter. These assumptions allowed them to treat the expenditures of a community as an observation on the demand curve of the consumer with median income. They did recognize that the quantity observed may not be on the demand curve of

---

[27]Theodore C. Bergstrom and Robert P. Goodman, "Private Demands for Public Goods," American Economic Review LXIII (June 1973): 280-296.

the individual with median income if the sign of the income elasticity of demand for public goods depends upon the level of income. After admitting that if the quantity observed differs frequently and significantly from the quantity desired by the voter with median income then the use of median income "... would not be expected to give reasonable estimates of the income elasticity of demand..."[28] They proceeded to ignore this possibility. Although their income elasticity estimates are always positive and significant this does not preclude the possibility that the quantity demanded by the median voter may be unrelated to the quantity demanded by the voter with median income.

Bergstrom and Goodman also conceded that if individuals do not bear proportionate shares of taxes then the observed quantity is not likely to be the quantity demanded by the consumer with median income.[29] That is, their observed values will not correspond to points on the community demand curve. Attempting to get around this problem the authors developed a proof showing that if the income distributions of communities are proportional to each other the use of median income as the only income variable will yield income elasticity estimates.[30]

---

[28]Bergstrom and Goodman, ibid.

[29]Ibid.

[30]Ibid., pp. 286, 294-295.

Since incomes of communities also differ in their degrees of skewness, if these differences affect the decisions of the communities then their estimates will be less accurate.

To estimate the relationships of their theory Bergstrom and Goodman employed dependent variables of general expenditures of municipalities, municipal expenditures on police and municipal expenditures on parks and recreation. These expenditures data were collected for municipalities for ten states. The independent variables that are of special interest to this study included income elasticity, percentage of dwellings owner occupied, and percentage of population over 65 years of age.

The estimates of income elasticity were generally found to be positive and significant. Twenty-nine of the 30 estimates of income elasticity were positive and 19 of these were significant. The relationship between expenditures and percentage owner occupied turned out to be negative in 22 of the 30 regressions and significantly negative in ten of these. This is consistent with the hypothesis that renters do not believe that the property tax is fully passed on. The independent variable, the percentage of population over 65, had estimated coefficients that were positive 22 times but significantly positive only seven times. The variable of municipal expenditures on police did not yield a significantly positive coefficient.

The Question of Exploitation

There has been some discussion as to whether suburban areas receive more benefits from the nearby city than they pay in taxes to the cities. Researchers have used the term "exploitation" to describe such subsidization. William B. Neenan attempted to assess the extent to which Detroit is exploited by its suburbs.[31] Unfortunately, there is a disagreement as to how to define the benefits a suburb receives from the city.[32] The most restrictive definition of benefits is that which defines benefits as being equal to the cost of services provided by the city and consumed by the suburb. Even with this restrictive definition there appears to be evidence that "exploitation" occurs.[33] The existence of such exploitation suggests that the benefit-burden ratio of expenditures by the city is smaller than for the suburbs and that an argument could be made for a metropolitan taxing authority. Although this is an important issue in the financing of education, we will concentrate on the extent to which the

---

[31]William B. Neenan, "Suburban-Central City Exploitation Thesis: One City's Tale," National Tax Journal XXIII (June 1970): 117-139.

[32]Peter G. Brown, "On 'Exploitation,'" National Tax Journal XXIV (March 1971): 91-96. See also William B. Neenan, "On 'Exploitation': A Comment," National Tax Journal XXIV (March 1971): 97-99.

[33]Brown argues that the subsidy is "... very small..." but he indicates no criteria for making such a judgment. Brown, ibid., p. 93.

degree of concentration of people below the average income in a community has an effect on the tax rate they support. Whereas those writing on exploitation are concerned about the distribution of benefits and taxes between adjacent communities, we are concerned with the impact of the distribution of income on the behavior within a community.

A Summary of the Literature on Income Distribution

The traditional tool used in the analysis of income distribution is the Lorenz Curve. Many of the basic textbooks in Economics explain carefully how the area between the Lorenz Curve and the line of perfect equality indicates the degree of inequality of income in an economic group.[34] Other books and articles extend this into a calculation of a Gini coefficient.[35] None of these measures however take into consideration other dimensions of the income distribution. Bronfenbrenner,

---

[34]For example, see Roger Leroy Miller, Economics Today-The Micro View (San Francisco: Canfield Press, 1974), pp. 258-262.

[35]See for example, US Bureau of the Census, Income Distribution in the United States by Herman P. Miller (A 1960 Census Monograph) U.S. Printing Office, Washington, D.C., 1966, pp. 23-26 and 220-221; and Martin Bronfenbrenner Income Distribution Theory (Chicago: Aldine-Atherton, 1971), pp. 43-75. A recent article by Morton Paglin indicates that because of the age profile of income the Lorenz Curve ought to be adjusted for the age-income relationship and that doing so has the effect of reducing the Gini coefficient as well as suggesting that previous research indicating the degree of inequality has not fallen over time is wrong. Morton Paglin, "The Measurement and Trend of Inequality: A Basic Revision," American Economic Review LXV (September 1975): 598-609.

for example, points out that a rise in a Lorenz Curve concentration ratio does not distinguish whether it occurred because of a reduction in incomes in the lower tail of the distribution or a rise in incomes in the upper tail of the distribution.[36] Research by Charles Metcalf begins by recognizing that incomes are unequal and thus distributed with some mean and variance and may exhibit some degree of skewness. He then tries to analyze how economic variables affect these dimensions of the income distribution. This leads him to find ways to measure these parameters of the income distribution. In his book he carefully assesses the advantages and disadvantages of the various techniques of transforming asymmetrical distributions such as income distributions into lognormal distributions.[37]

Summary and Conclusions

In the above literature, most of the researchers assumed that the shape of income distribution is not important and all have assumed that income elasticity is the same for all income levels. That is, the voters want to spend a fraction of income on education that is independent of the level of income. We will argue below

---

[36] Bronfenbrenner, ibid., p. 49.

[37] Charles E. Metcalf, An Econometric Model of the Income Distribution, Institute for Research on Poverty Monograph Series (Chicago: Markham Publishing Co., 1972), especially pp. 8-39 and 109-140.

that if these assumptions do not hold, the conclusions need to be modified. Furthermore their work suggests a number of unresolved issues which we will investigate in this dissertation.

First, in which direction and to what extent does income affect the willingness of voters to support taxes for public education? Is the relationship between tax rates linear or nonlinear?

Second, if the median voter is the crucial voter in deciding the amount of public funds spent on public education, and if income is an important factor in determining the median voter, do differences in the income distribution affect the decisions of the community?

Third, under what conditions is the median voter also the voter with median income?

Fourth, assuming that the consumption of education by a community produces private benefits as well as spillover benefits for its members, under what circumstances and to what extent will the presence of citizens who are non-users affect the community's decision as to the tax rate imposed on members?

Fifth, the present system of financing public schools by the property tax does not, in general, impose the same burdens on each member of the community. Under what circumstances and to what extent does a property tax affect the tax rate the citizens are willing to impose on themselves?

In Chapter II we shall begin with the assumption that individuals are rational and analyze the effects of differences in the characteristics of the income distribution, the presence of low-benefit or high-burden voters, and the structure of taxes on the tax rate the community is willing to levy upon itself to finance its schools. We shall also examine the effect of allowing the relationship between the preferred tax rate and income to be nonmonotonic. In Chapter III we shall use Michigan data to estimate these relationships, in Chapter IV we shall present our results and interpretations, and in Chapter V we will summarize and present our conclusions.

CHAPTER II

THE ANALYTICAL FRAMEWORK

Introduction

The purpose of this chapter is to assemble an analytical framework to help us analyze the demand for public education as it is filtered through the community voting process and how the property tax rate is affected by the community's income distribution, property distribution and the existence of voters who receive unusually low or high benefits or experience unusual costs relative to their income. We will begin by considering how a utility maximizing individual's decisions about the quantity of education are affected by the individual's income and the income of the community. Since the tax rate approved by the community as a whole is the outcome of a vote on one or more expenditure proposals, we will then turn to an analysis of how differences in the distribution of the community's income will affect the tax rate that receives a majority vote. This analysis will be undertaken with the assumption that individuals in the community are identical in all respects except for income. We will then examine how differences in nonincome characteristics might affect

the outcome of the community decision. Finally, we will examine how the property tax system might affect the outcome.

A large part of the educational services consumed in the United States is produced in the public sector and financed by taxes on individuals. This financing takes the form of federal, state and local taxes levied on the individuals through a voting process where a simple majority decides the issue. We argue that the local tax and expenditure programs are the ones over which the individual voter has the most control and that the local public expenditures decisions thus offer a relatively good opportunity to examine the relationship between the individual and the community. We shall therefore concentrate on expenditure decisions at this level. We offer two reasons for asserting that citizens have the most control over local decisions. First, the local tax and expenditure considerations are most likely to be presented to the voters as separate issues rather than as part of the platform of the candidates. Second, the total number of voters is smaller in local elections so that an individual makes up a larger percentage of the total votes and may feel that his vote is more important.

Behavior of the Individual

We will assume in this research that each voter will vote on expenditure proposals so as to maximize his

satisfaction. Further, the voter is assumed to be confronted by the decision of how to allocate income between education and all other goods. Although other variables will obviously influence the decision we will begin by ignoring them.

Suppose the individual's utility is a function of the amount of education the individual receives in dollars, E_i, and the amount of private goods he purchases, G_i. For the i-th individual the utility function could be written as:

$$(1)\quad U_i = f(E_i, G_i)$$

The i-th individual's budget constraint could be written as:

$$(2)\quad Y_i = E_i + P_g G_i$$

where Y_i is the i-th individual's income and P_g is the price of private goods. The amount of education provided by the community is a function of the tax rate and the tax base. If we assume that this tax is a tax on income then the community will spend E dollars where E can be expressed as:

$$(3)\quad E = t \sum_{i=1}^{n} Y_i$$

where the community contains n members and t is the tax rate on income for the community. What fraction of these dollars of education each individual receives depends upon

the degree to which education is a public good.[1] If the good is a purely public good then each individual will receive the same number of dollars of education since consumption of the good by one individual does not decrease what the others may consume. If the good is a purely private good then consumption by one individual precludes consumption by any other and each individual will receive a fraction of total community output which is dependent upon the ability of the individual to consume education. If each individual has the same ability to consume education[2] then this fraction would be (1/n). In a more precise manner we can say that the i-th individual will receive:

$$(4)\quad E_i = (1/n^{\alpha})\ t \sum_{i=1}^{n} Y_i$$

where α equals unity when education is a purely private good that is equally distributed and zero when education is a purely public good. In the special case where α equals unity equation (4) can be rewritten as:

$$(5)\quad E_i = t\ \bar{Y}$$

However, the amount that the individual will spend on education will be the product of the community tax rate

---

[1]This section borrows heavily from Bergstrom and Goodman, ibid., p. 282 and Borcherding and Deacon, ibid., p. 893.

[2]The amount that an individual will receive, for example, will depend upon the number of children the voter has.

and the individual's income so we can rewrite the budget constraint (equation 2) as:

$$(6)\quad Y_i = tY_i + P_g G_i$$

Substituting the value of t obtained from equation 5 we can obtain:

$$(7)\quad Y_i = \left(\frac{Y_i}{\bar{Y}}\right) E_i + P_g G_i$$

The ratio of Y_i to $\bar{Y}$ can be interpreted as the price of education to the i-th individual. For a given tax rate an increase in average community income, $\bar{Y}$, with the i-th individual's income constant will result in the same taxes on the i-th individual while the community spends more on education. Under our assumption that the good is distributed equally the individual will receive larger amounts of education for the same dollars of taxes. Thus an increase in community income, ceteris paribus, will lower the price of education to the i-th individual. The optimum value of E for the i-th individual can be determined by maximizing the utility of the individual subject to the budget constraint involving the two goods. That is, the optimum value of E_i can be obtained by maximizing Z where Z is:

$$(8)\quad Z = f(E_i, G_i) + \lambda(Y_i - P_g G_i - (Y_i/\bar{Y})E_i)$$

The first order condition for Z to be a maximum is:

$$(9)\quad \frac{\frac{\partial Z}{\partial E_i}}{\frac{\partial Z}{\partial G_i}} = \frac{(Y_i/\bar{Y})}{P_g}$$

which requires that the marginal rate of substitution of G for E be equal to the ratio of the price of E to the price of G. Since the marginal rate of substitution is a function of E and G we have the following condition:

$$(10)\quad h(E_i, G) = Y_i/(P_g\bar{Y})$$

The optimum value of E_i can then be obtained by solving equations (7) and (10) simultaneously for E_i. Solving these equations would result in the following demand function for education by the i-th individual:

$$(11)\quad E_i = d(Y_i, \bar{Y}, P_g)$$

If education is a superior good, E_i will rise as Y_i rises relative to $\bar{Y}$.[3] If we interpret the ratio of Y_i to $\bar{Y}$ as the price of education to the i-th individual, then we can see that an increase in $\bar{Y}$ with Y_i constant lowers the price of education to the i-th individual. We would expect the substitution effect of such a price decrease to dominate the income effect leading to the individual voting for larger expenditures, although the tax rate may decline.

---

[3]Technically, a change in Y_i necessitates a change in $\bar{Y}$ but the change in an individual's income with all other individual's incomes constant will have a trivial effect on $\bar{Y}$ if the size of the community is large.

Thus either an increase in Y_i or $\bar{Y}$ is expected to lead to an increase in the expenditures an individual wants.

Variables other than price and income are likely to influence the individual's voting decision. Individuals may possess different characteristics besides income that may result in their receiving different levels of satisfaction from the same amount of education and thus result in differences in the equilibrium tax rate for the individuals. A closer look at the way in which consumers receive benefits from education may illustrate this point. The citizen will receive direct benefit from education of his offspring and might benefit from education of children of other citizens. The first benefit is a function of the size of family and whether the offspring will or do attend public schools. To the extent that certain aspects of the educational program are more likely to be used by those with high income the benefits may be a function of income and/or occupational status of the voter. Examples of such aspects of the educational program might be school theater programs and debate classes. Similarly, certain programs may lead to benefits only for those planning on attending college. It is also possible that the aspirations of citizens for a higher income and/or higher socioeconomic status might lead to voters adopting voting behavior of the group to which they aspire. Further, the citizen may feel a social obligation to

support expenditures even though benefits may not warrant such support.[4] Although we will begin by assuming that people have the same tastes we will later examine how differences in tastes might affect the decisions of the community.

Although it is relatively easy for the individual to purchase the optimum quantity of private goods the decision as to the amount of education that will be consumed by the community is made through a voting process with eligible voters having equal voice. Consequently, the decision of the community need not yield the equilibrium quantity for an individual. Such an individual has the option of moving from the community to obtain the equilibrium quantities of public and private goods.[5] Such an adjustment is a long run adjustment on the part of an individual while our analysis is a short run analysis. To the extent that the individual's original choice of residence was influenced by the educational services of the community the degree of disequilibrium would be smaller.

---

[4]Edelson comments on the "social contract" voter. Edelson, ibid., p. 169. Wilson and Banfield interpret their results on ethnic influence on voting as being due to some ethnic groups taking a "public regarding" view. Wilson and Banfield, ibid., pp. 86, 87.

[5]For an analysis of the importance of geographic mobility in the public goods market see: Charles M. Tiebout, "A Pure Theory of Local Government Expenditures," Journal of Political Economy 64 (October 1956), 416-424 and James M. Buchanan and Charles J. Goetz, "Efficiency Limits of Fiscal Mobility: An Assessment of the Tiebout Model," Journal of Public Economics 1 (April 1972), 25-43.

In any case, the frequency of mobility solely for adjusting individual consumption of publicly provided goods is probably diminished by the costs of mobility. For instance, in addition to the transaction costs of buying and selling houses or moving the family's possessions, mobility may also require a change of job and possibly loss of pension rights or increased job commuting distances. Restricting choice to communities within commuting distances of a job may drastically reduce the range of choice except in metropolitan areas. Also, there may be racial and income barriers to mobility which restrict choice to certain groups of people.

Before proceeding to analyze the community's demand for education we need to analyze the possible relationships between the tax rate the individual would be willing to pay and the individual's income. On the basis of the individual demand function above we can express the willingness of the i-th individual to pay taxes for education, a tax preference function, as:

$$(12)\quad t_i = B(Y_i/\overline{Y},\ Y_i,\ P_g)$$

Assuming that the desired tax rate and income are related a number of possible relationships exist. The figures below illustrate some of these relationships between t_i, Y_i and $\overline{Y}$. Figure 1 below shows the circumstance where as Y_i grows the individual is willing to spend more dollars on education but only at the same tax rate, while

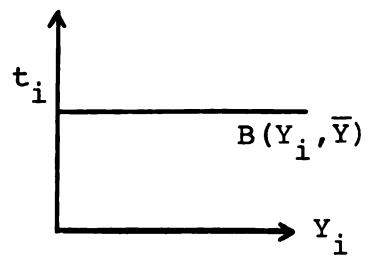

Figure 1.--A Horizontal Tax Preference Function.

Figure 2 with its upward sloping tax preference function indicates that the individual is willing to vote for higher tax rates as well as greater expenditures.

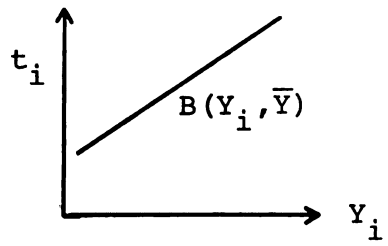

Figure 2.--An Upward Sloping Tax Preference Function.

Figure 3 shows a negatively sloped relationship which indicates that the individual wants lower tax rates as Y_i rises. In this case the individual may also want lower

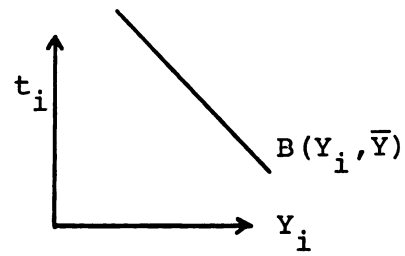

Figure 3.--A Downward Sloping Tax Preference Function.

total expenditures but this is not a necessary outcome. The first three figures illustrate what the tax preference curve would look like if it were monotonic. Figures 4 and 5 illustrate what the tax preference curve might look like if it were nonmonotonic.

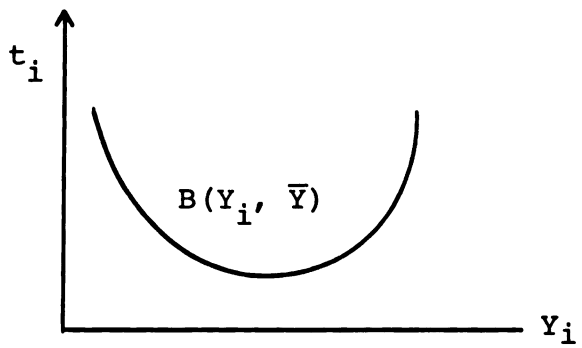

Figure 4.--U-Shaped Tax Preference Function.

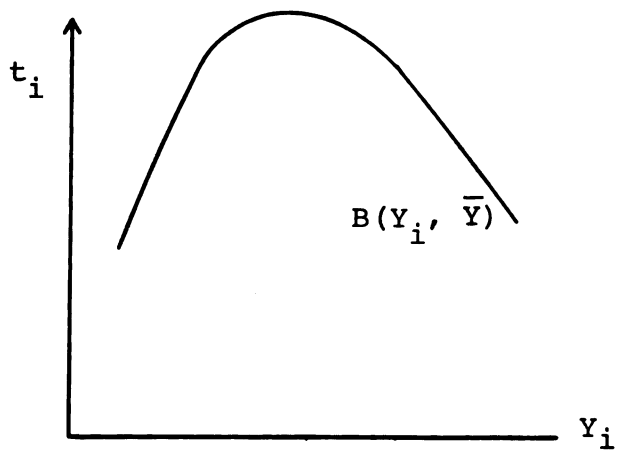

Figure 5.--Inverted U-Shaped Tax Preference Function.

If a change in $\overline{Y}$ has any effect on the tax rate the individual would support, it must be shown as a shift in the tax preference curves shown in the figures above. When $\overline{Y}$ changes, the tax revenues and expenditures that

result from a given tax rate on the individual change in the same direction. Thus as community income rises, the individual will discover that the same expenditures are available at a lower tax rate or that the price of education to the individual has fallen. Interpreting the ratio $Y_i/\overline{Y}$ as the price of education to the i-th individual we conclude that the equilibrium tax rate for the i-th individual is expected to be inversely related to $\overline{Y}$ and we would show the effect of an increase in $\overline{Y}$ as an upward shift in the tax preference function.

The Community

The decision on the community tax rate is made by a vote of the people. Under a simple majority rule, the side which receives more than 50 percent of the vote will rule the decision and thus, if voters are ordered according to their preferences, the middle or median voter would decide the issue. In the case of a vote on the tax rate we will assume that if more than a simple majority is in favor of a tax rate, then higher tax rates will be proposed in the future until only a simple majority is satisfied while, if less than a majority is in favor of a tax rate, then lower tax rates will be proposed until a tax rate is found which meets the approval of a simple majority. The tax rate that just satisfies a simple majority is the equilibrium tax rate. Abstention of

voters may change the equilibrium tax rate.[6] We should also mention that some researchers have argued that the tax rate does not reflect what voters really want.[7] Without more general evidence we will assume that voters do choose the equilibrium amount.

We mentioned above that the demand for education by individuals may be different if the individuals have different benefit characteristics.[8] In order to isolate

---

[6]Voters may abstain because preference for the outcome is not strong enough to compensate for the costs of voting. Thus, abstaining voters may not prefer an outcome much different than the actual outcome. For a more complete discussion of rational abstention see Downs, ibid., pp. 260-276.

[7]They argue that pressures put on the school boards result in "incorrect" proposals or veiled threats by business that taxes will result in lost jobs persuade voters not to approve the taxes. These researchers argue that such influence will hold the tax rate lower than otherwise. Their evidence is in the form of individual case studies and there is no evidence that this occurs outside of these cases. For examples of this research see: Ralph Kimbrough, Political Power and Educational Decisionmaking (Chicago: Rand McNally and Co., 1964), especially p. 131. See also Floyd Hunter, Community Power Structure (Chapel Hill, North Carolina: University of North Carolina Press, 1953) and Harr L. Stearns, Community Relations and the Public Schools (Englewood Cliffs, New Jersey: Prentice-Hall, 1955).

[8]Even with identical preferences, increases in family size, for example, will shift the preference function upward as in Figure 6, resulting in higher tax rates for the same income level. If there were two individuals, A and B, with A having three children and $5,000 income and B having two children and $10,000 income, we can see they might vote for the same tax rate. Thus the distribution of family benefits due to differences in family

the effect of income and the distribution of income on the equilibrium community tax rate we will assume for simplicity that each individual has identical benefit characteristics as well as identical preferences. With the assumptions of identical preferences and identical income and nonincome characteristics we can represent the willingness of the community to support taxes for education with a single tax preference curve. However, as long as individuals do not have identical income, the distribution of income will possess some variance. Furthermore, the distribution of income may not be symmetrical but, instead, exhibit a degree of skewness, either negative or positive. One of our purposes is to examine how the parameters of the distribution might affect the outcome of a vote. We will first analyze the effect of differences in mean and median income assuming symmetrical distributions and then analyze the effects of variance and skewness.

Figures 7 through 12 illustrate the possible importance of the shape of the tax preference function.

---

size may cancel out the effects of differences in income which is our concern at this stage.

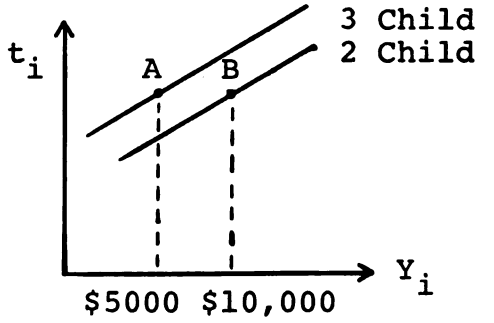

Figure 6.--Two Tax Preference Curves for Different Family Size.

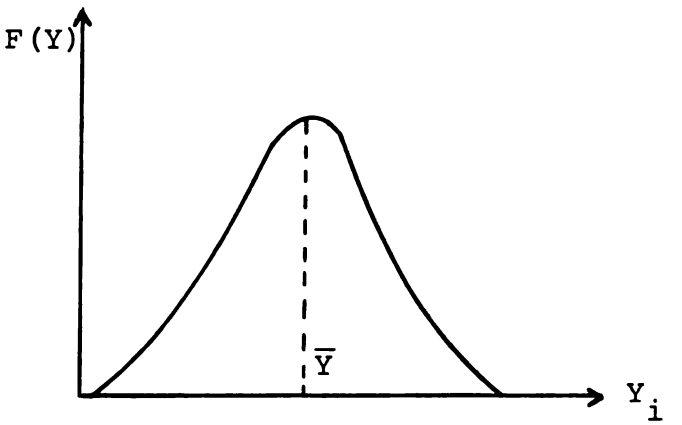

Figure 7.--Symmetrical Income Distribution.

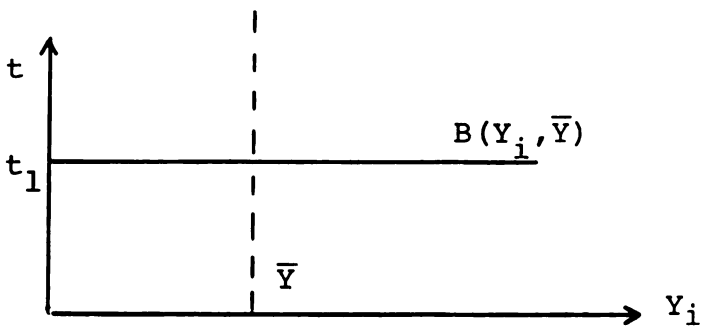

Figure 8.--Horizontal Tax Preference Curve.

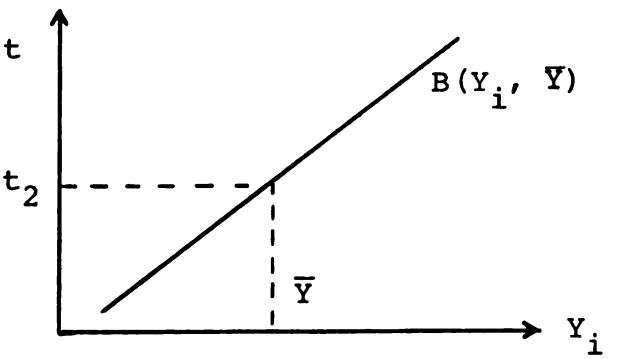

Figure 9.--Upward Sloping Tax Preference Curve.

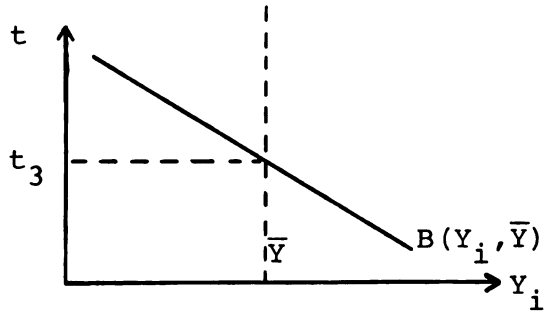

Figure 10.--Negatively Sloped Tax Preference Curve.

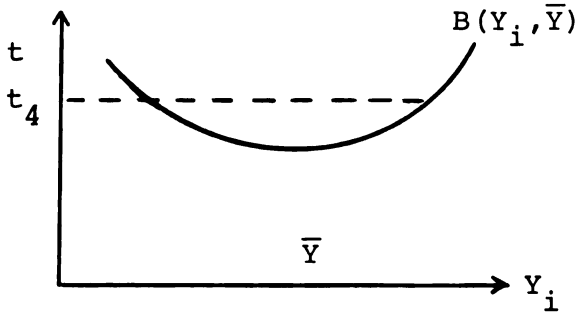

Figure 11.--U-Shaped Tax Preference Curve.

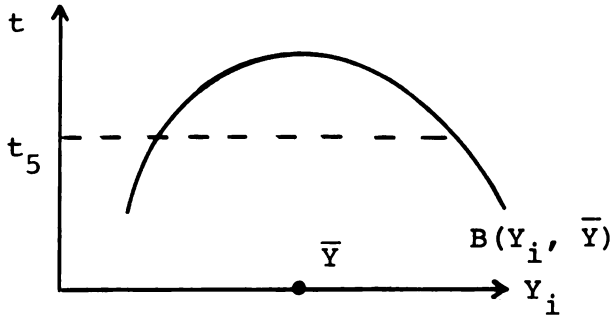

Figure 12.--Inverted U-Shaped Tax Preference Curve.

Figure 7 depicts a symmetrical distribution of income and Figures 8 through 12 show five possible tax preference curves. Each curve is sketched assuming a fixed community average income and with each voter assumed to have equal nonincome benefit characteristics and preferences. If the tax preference curve is horizontal as in Figure 8, the community would unanimously support a tax rate of t_1. If the tax preference curve were as shown in Figures 9 and 10, then the approved tax rate would be t_2 and t_3 respectively with support coming from voters with below median and above median income respectively. Figures 11 and 12 indicated U-shaped and inverted U-shaped preference curves. Where the preference curve is inverted U-shaped as shown in Figure 12, the support for the equilibrium tax rate comes from the voters in the middle of the income distribution and includes support of the voter with the median income. In this case, the voters in either tail of the income distribution will vote against the tax rate. However, where the preference curve is U-shaped as shown in Figure 11, a different conclusion obtains. In this case, the support for the equilibrium tax rate will come from the voters at either end of the income distribution and the voter with median income will not be in the majority.[9]

---

[9]In the nonmonotonic cases we assume that voters exist at the income levels in the rising and falling portions of the curve. If this is not the case then only one

The Effect of Changes in Mean and Median Income

To analyze the effect of changes in mean and median income on the equilibrium tax rate for the community we will compare the equilibrium tax rate that results from two symmetrical income distributions identical in all respects except for mean and median income. Two such distributions are shown in Figure 13. If we assume an increase in the mean income for the community will lead to an upward shift in the tax preference curve, then the tax preference curve that corresponds to distribution B will be above that for distribution A. When the tax preference curve is positively sloped the increased mean will lead to a higher tax rate. When the tax preference curve is negatively sloped the results are uncertain. We know that an increase in each individual's income would lead to a lower desired tax rate and we have assumed that an increase in the mean and median values of income would lead each individual to want a higher tax rate. Which of these effects will dominate is unknwon. Figure 15 shows the increases in $\bar{Y}$ leading to an increase in the equilibrium tax rate.

---

side of the curve is relevant and consumers would behave as if their preferences were monotonic.

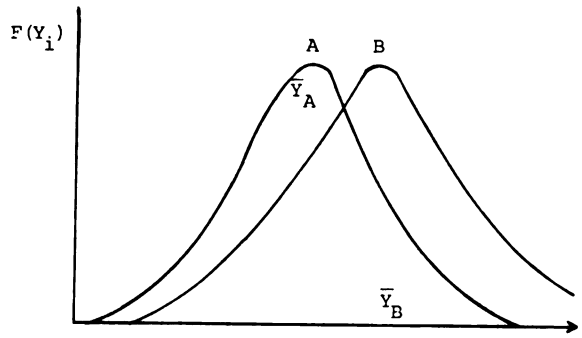

Figure 13.--Two Symmetrical Income Distributions.

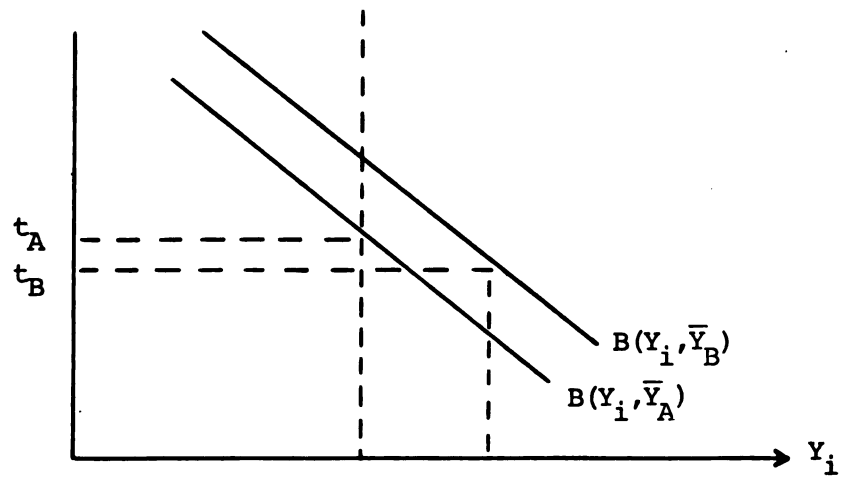

Figure 14.--Negatively Sloped Preference Curves at Different Community Average Incomes.

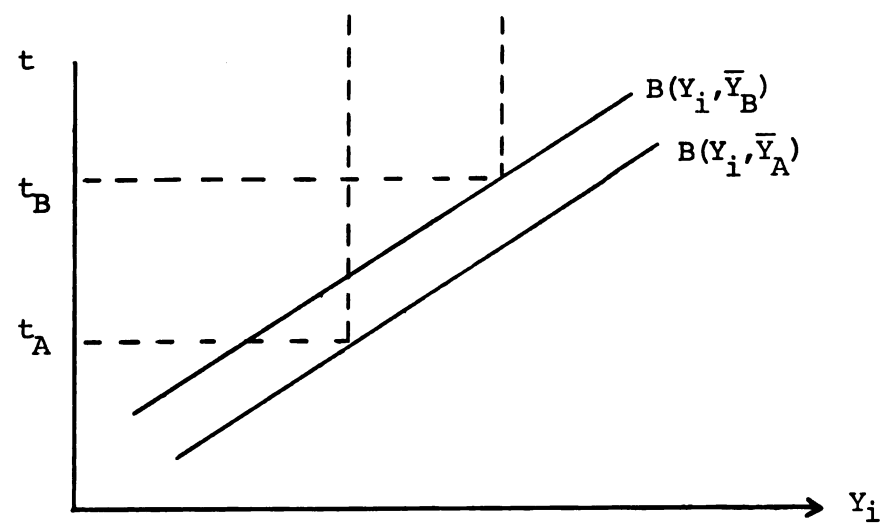

Figure 15.--Two Positively Sloped Preference Curves at Different Community Average Incomes.

When the tax preference curve is nonmonotonic we find similar conclusions. An increase in mean income combined with a U-shaped tax preference curve will lead to an increase in the tax rate, however, the result is uncertain when the tax preference curve is inverted U-shaped. If the tax preference curve did not shift as mean income rises, the effect would be a reduction in the equilibrium tax rate while the upward shift in the curve by itself would lead to an increase in the tax rate. Which effect would dominate is not clear.

The Effect of Changes in Variance

If the distribution of income is symmetrical, then a change in the variance of the distribution will have no effect on the tax rate as long as the tax preference curve is monotonic. With monotonic preference curves an increase in dispersion, by itself, will not change the level of median income and the voter with median preference is also the voter with median income. However, a change in the variance will lead to a change in the equilibrium tax rate when the preference curve is nonmonotonic. Figures 16 and 17 illustrate this point. Figure 16 indicates two symmetrical distributions of income with equal means but different variances and Figure 17 depicts a U-shaped preference curve. Because of its larger variance, distribution B has a higher density of voters in each of the tails of the distribution. With a U-shaped preference

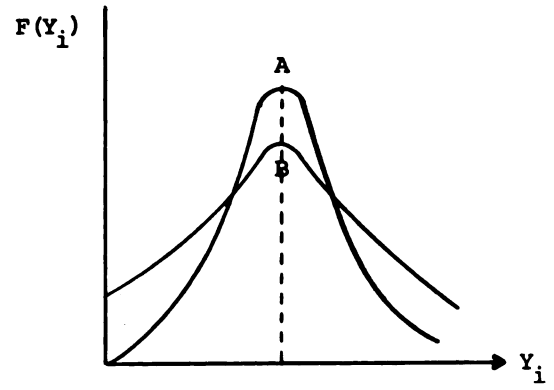

Figure 16.--Two Symmetrical Income Distributions With Different Variance.

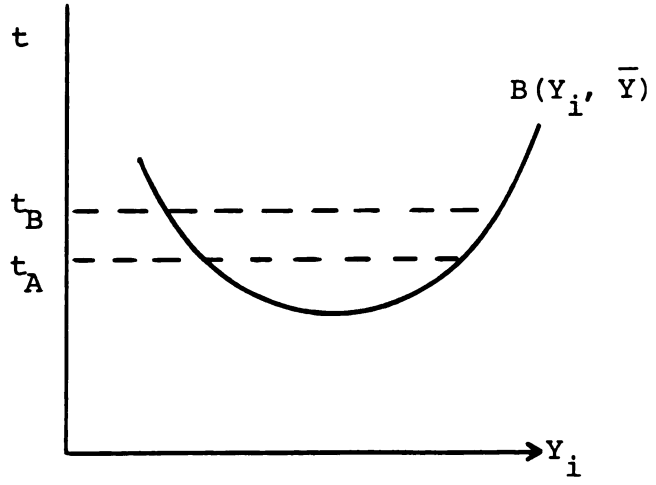

Figure 17.--U-Shaped Tax Preference Curve.

function the existence of more voters in the tails will increase the number of voters supporting a particular tax rate and result in a higher equilibrium tax rate. Thus, if distribution A possesses a smaller variance and yields an equilibrium tax rate of t_A then distribution B will result in a tax rate of t_B. Similarly it can be shown that if the tax preference is inverse U-shaped an increase in variance will lower the equilibrium tax rate.

The Effect of Changes in Skewness

Another way in which distributions of income can be different is in their degrees of skewness. One measure of the degree of skewness is the ratio of difference of mean and median to the variance. The assumption of symmetry used above made the degree of skewness zero. To isolate the effect of skewness we would like to examine the equilibrium tax rate that would result from two income distributions identical except for skewness. By changing the difference between the mean and median values we can change the degree of skewness of the distribution.[10] As noted earlier the decision of the individual is a function of his income as well as the community average income so if we compare the effects of skewness by changing mean with median constant our preference curve will be shifting. However, we can change median income, keeping mean income the same without shifting the preference curve.[11] Figure 18 below illustrates three income distributions that are assumed to have the same mean income but different values of median income. Distribution A has identical mean and median values while distribution B has a median income

---

[10] However, such a change in the median income relative to the mean will also change the standard deviation and the variance and it is not clear that the conclusions we obtain are not due to the effects of changes in these other parameters.

[11] Alternatively, if tax preferences were a function of Y_i and median income but not $\bar{Y}$, then a change in $\bar{Y}$ would not shift the tax preference curve.

that is less than its mean value. Thus distribution B is positively skewed while A has zero skewness. Combining Figure 18 with Figures 19 and 20 we can easily see that when the tax preference curve is positively sloped the effect of a lower median income is to lower the equilibrium tax rate while when the preference curve is negatively sloped the tax rate will rise. Distribution C is assumed to have the same mean income but a larger median than that of distribution A. Thus distribution C is negatively skewed. Distribution C will lead to a higher tax rate than distribution A when the tax preference curve is positively sloped and a lower tax rate when the tax preference curve is negatively sloped. Therefore we can generalize and say that when the tax preference curve is positively sloped the equilibrium tax rate is inversely related to the signed value of skewness while when the tax preference curve is negatively sloped the relationship is direct.

The effect of skewness on the tax rate is more difficult to see when the tax preference curve is nonmonotonic. Again comparing distributions A and B in Figure 18 we can see that if we assume that the areas underneath each of the distributions is the same[12] then distribution B can only be more skewed if it has higher frequencies in

[12]This would be the case if the vertical axis of the diagram showing the distributions were relative frequencies rather than the absolute number of occurrences of each income level. Also note that if the areas of the distribution are not the same then B could be underneath A everywhere and still be more skewed.

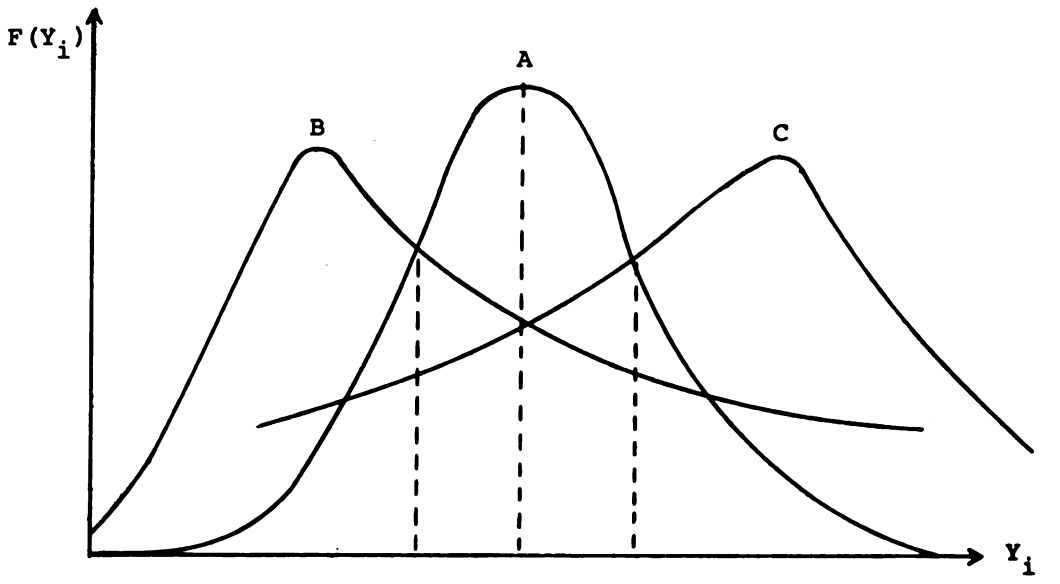

Figure 18.--Three Distributions with Different Skewness.

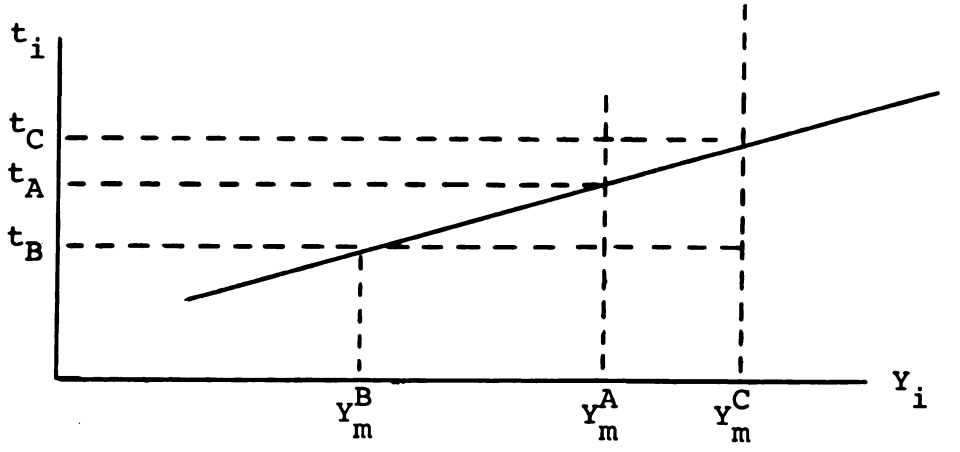

Figure 19.--A Positively Sloped Preference Curve.

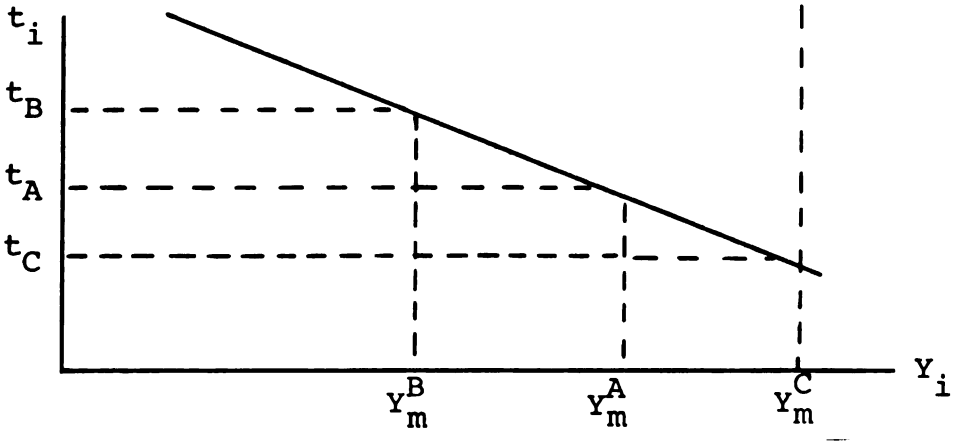

Figure 20.--A Negatively Sloped Preference Curve.

each of the tails of the distribution.[13] Consequently under these assumptions we know that increased skewness has the effect of increasing frequencies at each end of the income distribution at the expense of frequencies in the center of the original distribution (A). If the tax preference curve is U-shaped the increased skewness in absolute value will have the effect of raising the tax rate. Similarly, an increase in skewness when the tax preference curve is inverse U-shaped will have the effect of lowering the tax rate. Thus when the tax preference is U-shaped the equilibrium tax rate is directly related to the absolute value of skewness and when the tax preference curve is inverse U-shaped the relationship is inverse.

Table I below summarizes the generalizations about the effects of changes in the parameters of the distribution of income on the equilibrium tax rate.

Benefit Characteristics

Although the level and distribution of income may affect the willingness of a community to support taxes for education, the community and its citizens will possess other characteristics which will affect the benefits they receive from education and therefore the equilibrium

---

[13] Obviously a larger frequency in the left tail of B is necessary to make the median of B smaller than the median of A. Similarly B must have a larger frequency than A somewhere in the right tail in order to keep the mean of the distributions the same.

Table II-1.--Direction of the relationship between equilibrium community tax rate and the parameters of the income distribution when the tax preference function contains Y_i and $\bar{Y}$.

Tax Preference Function	Mean Income*	Variance	Skewness**
Positively Sloped	+	0	-
Negatively Sloped	-	0	+
U-shaped	+	+	+***
Inverse U-shaped	-	-	-***

*Directional effects derived with symmetrical distributions and the tax preference function positively related to changes in $\bar{Y}$.

**Directional effects derived by comparing two distributions with equal means and different medians. Skewness is defined as:

$$\frac{\bar{Y} - Y_m}{s}$$

where Y_m is the median of the distribution and s is the standard deviation.

***Directional effects derived with skewness defined in absolute value for nonmonotonic tax preference functions but with signed values for monotonic functions.

tax rate. The characteristics mentioned above included family size, offspring attending private schools, and age. Both the values of these characteristics and their distribution can affect the equilibrium community tax rate.

The lower the values of these benefit characteristics in a community, ceteris paribus, the lower the tax

preference curve will be and the lower the equilibrium tax rate. This generalization is independent of the shape of the tax preference curve. Thus, we would expect that the larger the proportion of offspring attending private schools in a community the smaller the level of benefits a community will receive from public education and the lower the tax rate the community will support.

Even if two communities possessed identical average levels of benefits, the benefits could be distributed differently. In one community, for instance, each citizen might receive equal benefits while in the other the benefits might be concentrated in a small proportion of the population. This could affect the tax rate the communities were willing to support. Whether this would have any affect on the equilibrium tax rate depends upon the shape of the preference curve and whether the voter with median income is affected. As an illustration consider the following case as shown in Figure 21. Let us denote the average benefit characteristics of the community by $\bar{C}$. Then the preference curve for a community assuming each citizen receives equal benefits can be shown as $B(Y_i, \bar{Y}, \bar{C})$. If instead the benefits were distributed inversely to income so that higher income citizens receive fewer benefits, then the correct relationship would be shown as $B(Y_i, \bar{Y}, C_i)$ where C_i are the benefit characteristics that correspond to the i-th income level. Under

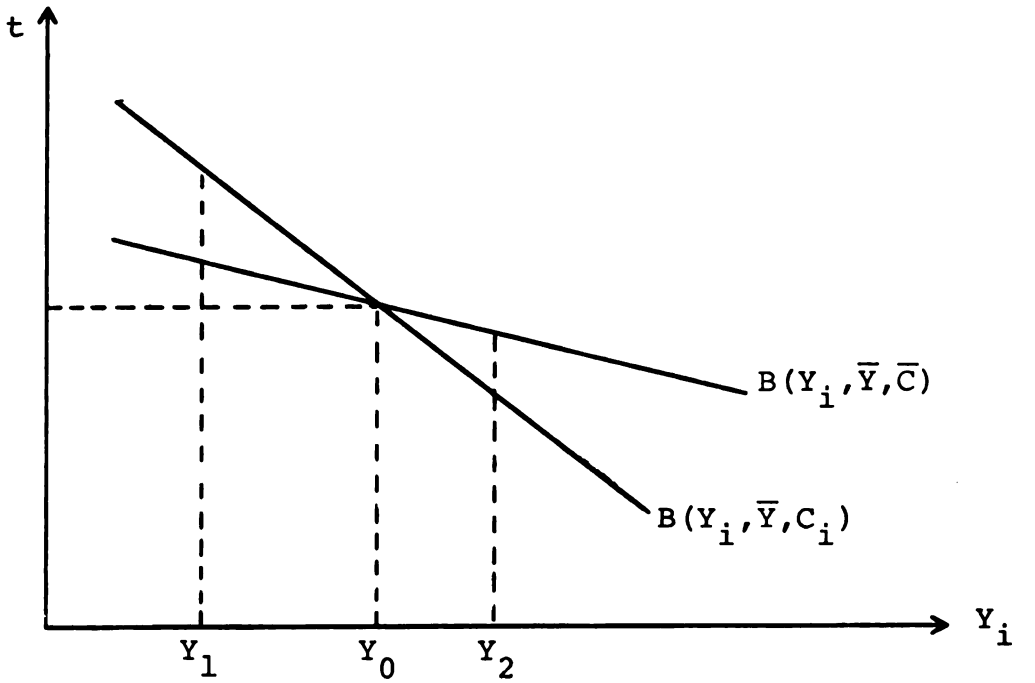

Figure 21.--Tax Preference Curves with Different Distributions of Benefit Characteristics.

the assumption of an inverse relationship between C and Y the $B(Y_i, \bar{Y}, \bar{C})$ will be less steep than that of $B(Y_i, \bar{Y}, C_i)$. With the negatively sloped tax preference curve illustrated the median income voter rules so that if the median income is Y_1 then the equilibrium tax rate would be the same as it would if benefits were equally distributed. However, if the median income were Y_1 or Y_2 the tax rate would be higher or lower respectively. Thus there appears to be no clear generalization about the effect of the differences in the distribution of benefits on the tax rate.

The Effect of Unequal Tax Rates

Up until now we have assumed that the expenditures on education were financed by a tax rate on income that was the same for all voters. It would be more realistic to assume that the tax is levied as a single rate on the assessed value of property holdings and to allow the tax rate on income to vary with the level of income, as well as the incidence of the tax on property, the distribution of the property, and the assessment practices of the community.[14] Furthermore, since the perceived incidence

---

[14]Our concept of tax incidence of property taxes does not follow the current approach of many of those writing in the theory of tax incidence. Current researchers are using a general equilibrium approach which considers not only the effect of the tax on the price of the good but also the effect of the tax on uses of resources in the industries taxed and ultimately the effect on the incomes of resource owners. For instance, it is argued that taxes on improvements on land decrease the quantity demanded of resources in the construction industry as householders consume less housing and either users of nonresidential property pay some of the tax and decide to use less building space and/or owners of buildings pay some of the tax and discover lower rates of return on their assets and decide to demand less new construction. For examples of research using the general equilibrium approach see: Peter M. Mieszkowski, "On the Theory of Tax Incidence," Journal of Political Economy, 75 (June 1967), 250-262 and George F. Break, "The Incidence and Economic Effects of Taxation" in Alan S. Blinder, et al., The Economics of Public Finance (Washington, D.C.: The Brookings Institution, 1974), pp. 119-139 and 154-168. For research using our concept of tax incidence see Dick Netzer, Economics of the Property Tax (Washington, D.C.: The Brookings Institution, 1966) and Joseph A. Pechman and Benjamin A. Okner, Who Bears the Tax Burden? (Washington, D.C.: The Brookings Institution, 1974). For a survey of the research prior to 1971 see Horst C. Reckten-wald, Tax Incidence and Income Redistribution, An Introduction (Detroit: Wayne State University Press, 1971), especially pp. 50-52 and 173-178.

of the tax on rental property may be different from the actual property we may find that behavior of those living in rented property may differ from the behavior of those who own their dwellings.[15] Such an argument is advanced by Davis:

> ...it is to be expected that non-property owners will presume that they can receive benefits while bearing less than their proportionate share of the costs.[16]

Recognizing such arguments and evidence suggests that we at least examine the implications of differences in tax rates on the outcome of the community decision.

If there is a relationship between the assessed property value and income, then even with a single property tax rate the tax rate on income could still vary with income. For example, if voters tend to spend a larger proportion of income on housing as their income rises and assessments were always a constant proportion of market value then a single property tax rate would be progressive in terms of income. Similarly, if voters tend to spend decreasing proportions of income on housing as income rises, the single property tax rate would be regressive in terms of income. The relationship between

---

[15]Davis, ibid., pp. 94-100. Davis also argues that the presence of absentee property owners who are not qualified to vote increases the willingness of the community to support tax programs.

[16]Davis, ibid., p. 96.

the tax rate on income and income would then look like lines A and B respectively in Figure 22 for a given property tax rate, t_{po}. The case of a constant tax rate on income can then be shown to require that the proportion of income people spend on housing be the same for all levels of income or that differences in the proportion spent on housing be exactly offset by differences in assessment practices.

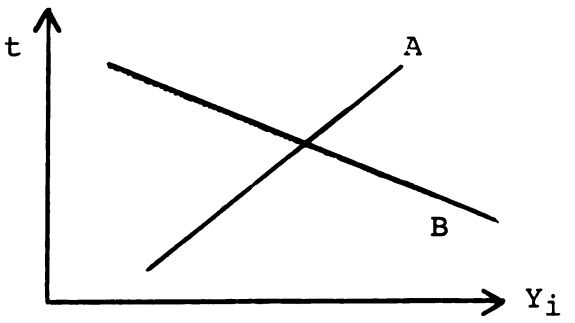

Figure 22.--Two Tax Structure Curves. Line A indicates a progressive tax on property while B indicates a regressive tax on property.

A single tax rate on property can also result in different tax rates on income if the ratio of assessed to market value is not the same for different income levels. For example, if the ratio of assessed value to market value systematically declines with increased income then the property tax would be more regressive than otherwise and the tax curve would have a smaller slope (in signed value).

Because the property tax is levied on the property owner rather than the property user and because the property owner may not be able to pass on the full amount of the tax to the user the decisions of the users may be affected. In the case of owner-occupied houses the user will bear the initial burden of the tax. Furthermore, the owner-user may also experience a capital loss on the value of the dwelling. If the additional services purchased with the larger taxes have no value, then the increase in taxes on property will shift the demand for new and old houses to the left lowering the equilibrium price of housing and imposing a capital loss on owners of existing housing. The higher the value that property owners and potential property owners place on these additional services the smaller the decline in the equilibrium price of housing. Indeed, the additional services could be valued highly enough that the price of houses could rise. The values of rental property will fall more, the less able the owners are to pass on the tax by raising rents. The rental property owner will absorb all of the initial burden of the tax if there is a rent control system. Even without rent control, each rental property owner will have an incentive to absorb an amount of the tax to the extent the demand is elastic. Since the price of owning a house will also be rising due to the increased property tax, the demand for rental units will be shifting

to the right.[17] Furthermore, since all owners of rental property in the community will be experiencing the tax increase they may recognize that if they simultaneously raise rents each of them would experience a smaller reduction in quantity demanded. Finally, even if the tax is passed on to those renting the dwellings they may still feel they do not bear any of the tax.

Thus it can be seen that the sufficient conditions for our horizontal tax with its proportional tax rate on income are that the proportion of income spent on housing is constant, that assessment practices result in constant assessed value to market value ratios and that renters perceive taxes on property as being fully passed on. The possibility of nonproportional tax structures raises a large number of pairs of tax preference curves and tax structure curves. Since we will be unable to incorporate different tax structures in our empirical section we will summarize briefly some of the effects of different tax structures.

---

[17] Figure 23 illustrates this argument. Let D_A be the demand for apartments with R as the monthly rental and with P_{h0} and P_{h1} as the monthly costs of owner occupied housing before and after the property tax. The diagram shows that an increase in the monthly rent from R_0 to R_1 would decrease the quantity demanded of apartments from Q_0 to Q_1. However, as the tax increases, the costs of owner occupied housing on balance will also rise. Thus a new demand curve for apartments becomes relevant so that R_1 will yield a smaller reduction in quantity

Of all of the many combinations of shapes of tax structure and tax preference curves the simplest non-trivial case is where the two curves are both linear and either negatively or positively sloped. Under these assumptions we find that our conclusions are changed very little. As before changes in mean and median income together will affect the equilibrium tax rate in the same direction and variance and skewness will not affect the tax rate. However, it is possible that the source of the support for the tax proposals may change to the opposite side of the income distribution. Figure 24 illustrates this point with a negatively sloped tax preference curve and a linear and regressive tax structure. If the tax structure were proportional the support would come from voters with below median income but if the tax structure is linear and sufficiently regressive as shown the support will come from the voters with income above the median

---

demanded such as Q_2. The demand curve labelled D is more inelastic.

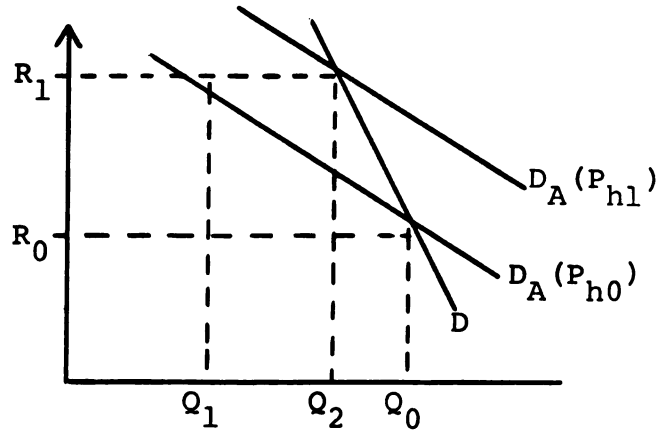

Figure 23.--The Effect of a Change in Property Taxes on Apartments.

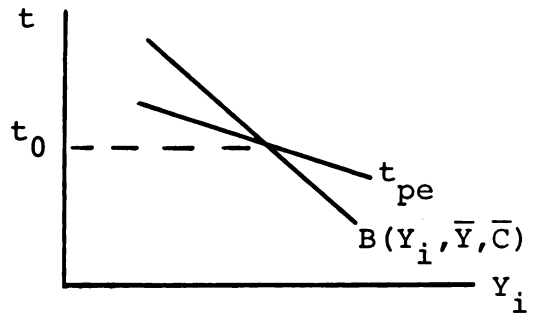

Figure 24.--A Negatively Sloped Tax Preference Curve with a Linear and Regressive Tax Structure.

level. The expenditures voted for by the voter with median intensity of preferences, here assumed to be the voter with median income, will remain the same. The voters will choose the property tax rate t_{pe} which will yield equilibrium for the voter with median income with an income tax rate on the median income voter of t_0. However, relaxing the assumption of linear tax structure invalidates even these conclusions. Figure 25 illustrates the circumstance of a negatively sloped, nonlinear tax structure and a linear, negatively sloped tax preference curve. In this case we can see that the variance and skewness of the income

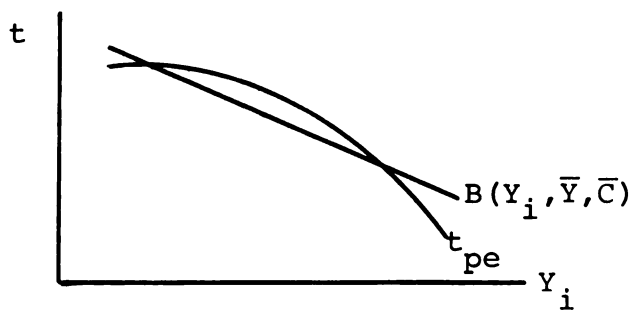

Figure 25.--A Negatively Sloped Tax Preference Curve with A Nonlinear Negatively Sloped Tax Structure.

distribution will affect the equilibrium tax rate as the equilibrium tax rate will receive support from people in both ends of the income distribution. Our conclusions are also modified when the nonproportional tax structure is combined with a nonmonotonic tax preference curve. Figure 26 below indicates a case of a linear but negatively sloped tax structure combined with a U-shaped preference curve. Under such assumptions only the lower end of the income distribution is relevant if either the preference curve intersects the tax rate axis (or there are no voters at the lower end of the distribution). In this case, the median voter becomes the pivotal voter and variance and skewness would only affect the equilibrium tax rate to the extent that the median income were also changed.

These cases are sufficient to illustrate the degree to which our conclusions are sensitive to the tax structure. Since the number of possible cases is large

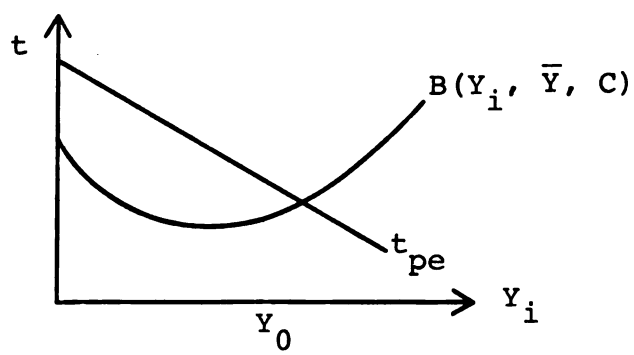

Figure 26.--A Regressive Tax Structure and a Tax Preference Curve that Intersects the Tax Rate Axis.

and since the scope of this study does not include estimation of the tax structure we will not explore other cases. Although those doing research in the area of property taxation generally agree that the property tax is regressive[18] there is less evidence as to whether the relationship of the property tax rate and income is monotonic or even linear. Netzer does provide us with some evidence as to how the relationship varies with income. After examining the results of other studies, Netzer concludes that "... nonresidental property taxes as a percentage of income trace a U-shaped curve...."[19] His

---

[18]For example, research by Dick Netzer suggests that the tax on property is regressive in terms of income with estimated tax rates on income being 8.49 percent for renter occupied housing and 6.43 percent on owner occupied for income less than $2,000 and rates of 1.35 percent and 2.29 percent respectively for those with income of $15,000 or over. Netzer, ibid., pp. 49-53, especially Tables 3-7 and 3-8. For a discussion of assessment practices see Netzer, ibid., pp. 77-83 and James A. Maxwell, Financing State and Local Governments, Revised Edition (Washington, D.C.: The Brookings Institution, 1969), pp. 139-146. The regressivity of the property tax depends upon the degree to which it can be shifted. The more it can be shifted from landowners to final consumer the more regressive it becomes. Pechman and Okner show that if all of the property taxes were borne by landowners the tax is progressive. Pechman and Okner, ibid., p. 59. Similar conclusions are reached by Rectenwald. Rectenwald, ibid., pp. 173-178. A more recent empirical work by Henry Aaron concludes that the property tax on renter occupied housing is regressive but that the property tax on homeowners is "... slightly but significantly progressive...." Henry J. Aaron, Who Pays the Property Tax, A New View (Washington, D.C.: The Brookings Institution, 1975), pp. 18-54, especially p. 37.

[19]Netzer, ibid., p. 43.

evidence for residential property taxes is not as conclusive. In all but one of six previous studies he cited, the tax is regressive throughout the income range while in that one study the tax becomes progressive for the highest income bracket.[20] Thus we can see that we have limited evidence for the hypothesis of a linear tax structure while our hypotheses aobut the effect of income distribution parameters on tax rates are sensitive to the structure of the tax system. However, it is still possible to empirically measure the extent to which the tax rates that communities support are related to median income, variance and skewness of the income distribution.

Summary

In this chapter we have attempted to analyze the economics of the voting process as it applies to the purchase of education. At first we followed the lead of previous researchers and assumed monotonic preference curves that imply income elasticities that are either negative or positive but not both. We added the explicit assumption that benefits were equally distributed to citizens, and we concluded that the median income voter would decide the equilibrium tax rate. With these restrictive assumptions, the observed values of the variables would correspond to points on the community

---

[20]Netzer, ibid., Table 3-4, p. 46.

demand curve. Relaxing the assumption of monotonic preference curves, and therefore allowing the sign of income elasticity to change as income changes, we found that the median income voter was no longer the crucial voter and that the observations from the real world would no longer correspond to points on the community demand curve. Once we allowed the tax preference curve to be nonmonotonic, we also found that changes in variance and skewness of the distribution of income affect the equilibrium tax rate.

The preceding analysis was based upon the assumption that the tax structure was proportional. We discovered that our conclusions were sensitive to changes in assumptions about the tax structure. Indeed, we found that the above conclusions would hold only if the tax structure is restricted to being linear.

Our analysis has revealed that the variables of median income, income distribution parameters and the level of benefits characteristics can affect the equilibrium tax rate for a community. We have isolated some of the conditions under which these variables will affect the equilibrium tax rate but we do not know which of these conditions exist in the real world. That is, we do not know what peoples' preferences are like. In the next sections of this research we will try to examine these

relationships empirically. Specifically, we want to answer the following questions:

1. Are the income distribution parameters other than mean and median important in explaining the willingness of voters to finance education?

2. How important are differences in benefit characteristics between communities in explaining differences in tax rates levied to finance education? To what extent are people willing to subsidize others? Is there evidence of behavior consistent with the hypothesis of an "intergenerational social contract"?

CHAPTER III

EMPIRICAL PROCEDURES

People in communities vote to decide which tax rate they wish to impose on themselves with the vote being conducted under a majority rule. In the previous chapter we isolated the assumptions under which the voter who provides the majority is also the voter with median income. To summarize briefly, we found that with identical preferences, a horizontal tax structure and a monotonic tax preference curve the median voter turns out to be the voter with median income. Under these circumstances, changes in variance and skewness of the income distribution of the community will not affect the equilibrium tax rate. When the assumption of monotonic tax preference curve is relaxed the deciding voter will not have median income and changes in variance and skewness are predicted to affect the equilibrium tax rate. Thus the question of the effect of income distribution parameters is an empirical question and we now turn to estimation of the relationships.

For the community the equilibrium tax rate (t) can be written as a linear function of measures of the variables described in Chapter II. Specifically, the equation of such a function could be expressed as follows:

$$\text{III-1} \quad t = B_o + \sum_{i=1}^{22} B_i X_i$$

where:

t = the tax rate on income in dollars of tax per thousand dollars of income

X_1= median income for the school district

X_2= median income squared

X_3= standard deviation of income for the school district

X_4= the skewness of the income for the school district

X_5= the proportion of families with children

X_6= the proportion of families with heads 65 or over

X_7= the proportion of students in private schools

X_8= the proportion of voters renting

X_9= the proportion of population that is Black

X_{10}=the proportion of population that is native born

X_{11}=thousands of dollars of state equalized valuation per family

X_{12}=thousands of dollars of nonresidential property per family

X_{13}=dollars of Title I aid per thousand pupils

X_{14}=dollars of other federal aid per thousand pupils

X_{15} = proportion of property that is nonresidential

X_{16} = unemployment rate for the school district

X_{17} = number of resident members in the school district

X_{18} = an index of the socioeconomic status of the population of the school district

X_{19} = 1 if the school district is located in metropolitan core with population of 50,000 or more
0 if school district is not so located

X_{20} = 1 if school district is a city with population of 10,000 to 50,000
0 if school district is not

X_{21} = 1 if school district is a town with population of 2,500 to 10,000
0 if school district is not

X_{22} = 1 if school district is in the urban fringe or is a suburb
0 if school district is not

The source of the raw data for all but the property variables was the 1970 Census School District Data Tape for the State of Michigan compiled by the U.S. Census Bureau. This data tape contains census data recompiled by the Bureau of the Census to correspond to school districts rather than the traditional divisions into SMSA's, urbanized areas and places. Since much of the data describing the characteristics of the population are obtained by sampling techniques the data possess sampling errors.[1]

---

[1]For a more complete description of these errors see, for example, U.S. Bureau of the Census, Census of Population: 1970, GENERAL SOCIAL AND ECONOMIC CHARACTERISTICS, Final Report PC(1)-C24 Michigan.

Data for the property variables are obtained from Professor Leanna Stiefel. She recompiled other census data to correspond to the school districts to obtain these data.

A brief discussion of the expected relationships between the tax rate and the independent variables and the problems of measuring these relationships follows.

The dependent variable is the tax rate on income. Its values are obtained by forming the ratio of property taxes collected and the level of income for the school district. This measure gives us the average tax rate for the school district. To the extent that the tax rate varies over income levels this single tax rate will not reflect the tax rates considered by the individual. We will interpret the observed tax rate as the one that would just be approved by 51 percent of the voters, that is, the equilibrium tax rate. Obviously if it is not the equilibrium tax rate the estimates of the relationships will be in error. Since the usual tax proposal is for an increase in the tax rate rather than a decrease and since the old tax rate (the one it is proposed to replace) received a majority vote the rejection of the new tax rate would only indicate that the increase was too large and not that the old tax rate was the equilibrium one.[2] Therefore, at

---

[2]However, substantial changes in the composition of the community from one vote to another may result in the observed rate being higher than equilibrium.

any time, the observed rate will generally be less than or equal to the equilibrium rate. However, our empirical work will not include a measure of the degree of disequilibrium and this source of error in estimating the relationships will remain.

The first independent variable included in the equation above is a measure of the median level of income for the school district. Unlike measures of mean income which are merely ratios of total income and some measure of total population and thus are relatively free of errors that would lead to bias, the measures of median income involve calculation of the income of the 51st percentile person of the community. Typically, median income is calculated by a method that may result in bias and therefore errors in estimation. Usually the data for the calculation are presented as the number of people in each of a series of income intervals. The median income is then calculated by proportioning the income in the interval over the population of the interval.[3] To the extent that the distribution of income is not rectangular over this interval, errors will occur. The error in the measure of median income will also result in errors in any variable

---

[3]To elaborate, suppose we wanted the income of the n+kth person where n people had income of Y_1 or lower and m people had income of Y_2 or lower. The income of the n+kth person would be:

$$Y_1 + \frac{k}{m-n} (Y_2 - Y_1)$$

that is based upon the calculation of median or on the basis of the interval data. One of these measures is the measure of skewness. For our measure of skewness we will use the Pearson coefficient of skewness[4] which is the ratio of the difference between the mean and the median to the standard deviation. Since both the median and the standard deviation of income are calculated from the interval data they will contain errors. For the purpose of our study we will assume that these errors do not lead to any bias in our estimates. We do not have hypotheses about the relationships of these variables with the tax rate. Our goal is to find out whether these variables are significantly associated with the tax rate.

The variable that would best capture the possible effect of private school enrollment on the willingness of people to support taxes for the public schools would be the percentage of voters who have children attending private schools. These data are unavailable. The measure we have is the percentage of children enrolled in private schools. This measure will yield incorrect relationships if the average size of family of those whose children attend private schools is different from that of those whose children attend public schools. If families with children attending private schools tend to be larger, then

---

[4]For example, see Ya-Lun Chou, Statistical Analysis (New York: Holt, Rinehart and Winston, Inc., 1969), p. 108.

the measure we will use will overestimate the percentage of voters with children attending private schools. However, if the percentage of families with children attending private schools is closely correlated with the percentage of children attending private schools then our measure will be a good proxy. With no information to the contrary we will assume that this correlation is sufficiently high to yield good estimates of the relationship and thus we expect that the higher the percentage of children enrolled in private schools the larger the percentage of voters who will receive unusually low benefits and thus the lower the equilibrium tax rate.

The variables measuring the proportions of families with children and families with heads 65 years or over are intended to capture the effect on the tax rate of segments of the population which experience relatively high and low benefits of education due to the presence or absence of offspring who attend school. It is possible that those voters whose children are presently attending schools may behave differently than those whose children are not yet of school age. Similarly those who do not have children but are intending to have children may behave differently than those who are not or those who are past child bearing age. If these groups of people do vote differently then our estimated relationship will depart from the true relationship. We hypothesize that the percentage of

families with children will be positively related to the tax rate.

The members of the community who are retired may vote differently from those working for two reasons. First, retired persons will generally have fixed incomes and may be concentrated at the low end of the income distribution. Second, retired persons are highly unlikely to have offspring using the schools and thus their families will receive relatively small direct benefits from the educational program. We do not have a measure of retired persons in our data source; only a distribution of population by age. Although we would expect that most retirements would occur after 65, the choice of age is arbitrary. Similarly, the choice of age when all of the offspring will be out of the school system is arbitrary. We have chosen 65 and over as our age for both categories. Furthermore, the ideal measurement would be the proportion of eligible voters in our age category. Instead, we have the proportion of families headed by persons 65 or over. Obviously, two communities with identical proportions of families headed by persons 65 or over could have different proportions of voters in this age category. We would expect that this measure of the extent to which the community is composed of retired persons will be negatively related to the tax rate. We would also expect large intercorrelation of this measure of older persons with the median income variable.

We have included four variables to estimate the possible importance of the ability of voters to tax property owners who either cannot vote or who can vote but bear a disproportionate burden by not being able to pass the taxes on to the final users of the property. These are the variables state equalized valuation of property per family, dollars of nonresidential property per family, the proportion of property that is not residential and the proportion of voters who are renters. The variable measuring state equalized valuation per family is a measure of the average property wealth of families in the school district and consequently is a measure of the ability of the community to pay taxes much like our measures of income. To the extent that the value of the property of families in the school district may be more closely related to the permanent income than is the observed value of income, state equalized valuation of property may even be a better measure of the willingness of people to support taxes for education. If people make decisions about the amount of property they buy on the basis of permanent income, then state equalized valuation of property per family may be a better measure of wealth than current income in years where the unemployment rate is unusually high and therefore current income unusually low. We would expect that people would be willing to make larger expenditures on education the larger their permanent

income or wealth. However, even in a year in which current income were close to permanent income, the real relationship between the tax rate and state equalized valuation per family is uncertain since lower tax rates need not imply lower expenditures.

We do not know whether voters perceive nonresidential property wealth as a source of burdenless tax revenues. Even if they do, however, it is not clear whether the presence of such property would lead them to higher or lower tax rates. With the presence of nonresidential property, voters could choose lower tax rates and still larger total tax revenues. Consequently we have no hypotheses about the relationships between the nonresidential property variables and the tax rate. We would expect that expenditures would be positively related to the presence of nonresidential property wealth in the school district.

It is possible that those who rent rather than own property may also perceive that property taxes are not passed on to them. If this is so, the arguments and predictions employed with respect to nonresidential property wealth would also be valid here. That is, we expect that expenditures and the proportion of renters would be positively related but have no hypothesis about the relationship between the proportion renting and the tax rate. However, we have no independent measure of how renters

perceive the property tax and if the renters perceive these taxes to be passed on we would expect them to behave much like nonrenters.

The effect of the unemployment rate on tax rates is uncertain. An unemployment rate for a community could be broken into three parts: frictional unemployment, structural unemployment and cyclical unemployment. Assuming that frictional unemployment is much the same in the communities, differences in unemployment rates between communities would be due to differences in their structural and cyclical unemployment rates. Structural unemployment is that part that is generally present in the community while cyclical unemployment would be the deviation from that base of structural unemployment and frictional unemployment. Although our measure of the unemployment rate does not allow us to distinguish between these types it will be illuminating to briefly indicate the possible effect of each type of unemployment on the tax rate.

The degree to which people will support a tax rate is expected to be inversely related to the burden of the tax. Those who live in publicly provided housing will bear little or none of the costs of the property taxes and are likely to be relatively willing to support higher tax rates. Since qualifying for public housing typically requires that the income per family member be low, public housing may contain a relatively high

proportion of people classified as structurally unemployed. We do not have any information about the percentage of the community living in public housing and cannot test for this behavior, however, if differences in unemployment rates between communities are due to a large extent to differences in structural unemployment, then we would not be surprised to find a positive association between unemployment rates and tax rates.

Cyclical unemployment rates present other problems. If, in a given year, a community is experiencing unemployment rates that are high relative to their previous experience, the income of the community would be unusually low. That is, current income in the community would be below "permanent income." Since tax rates are not easily adjusted downward, the tax rate on current income would be unusually high for that community.[5]

Since we are estimating the relationships by cross-section data, the differences in the unemployment rates between communities would be differences in structural unemployment rates if either the year of the observations were a year of no cyclical unemployment or if the cyclical unemployment rate were the same for all communities.

---

[5]Another question is the extent to which the voters choose the tax rate on the basis of current income or permanent income. In either case, if taxes cannot be adjusted downward easily then the tax rate calculated on the temporarily low income will be higher than the equilibrium tax rate.

Unfortunately, the year of our observations is a year in which Michigan was experiencing cyclical unemployment and the cyclical portion of the unemployment rate was probably not the same for all communities.[6]

The variables measuring the proportions of the population that are Black and native born are included to estimate the extent to which racial or ethnic segments of the population behave differently. We have no hypothesis about the relationships. To the extent that school districts with high percentages of Blacks and/or lower percentages of native born are also communities with dense population and high percentages of residents living in

---

[6]The average unemployment rate for the school districts in our sample for 1970 was 7.2 percent while the unemployment rate for the state of Michigan in 1970 was 6.1 percent. In contrast, the unemployment rates for the state of Michigan in 1968 and 1969 were 3.0 percent and 3.2 percent respectively. Thus the unemployment rate for 1970 was roughly double what it was in years just prior to 1970. Furthermore there is some evidence that the rise in the unemployment rate in 1970 was not similar from school district to school district. The state of Michigan is a heavy producer of automobiles and the output of automobiles was 30 percent and 27 percent lower in 1970 than it was in 1968 and 1969 respectively. Indeed, output of automobiles in 1970 was 26 percent lower than the average output for the previous seven years. Similarly, the employment in the automobile industry in Michigan in 1970 was down 16 percent from 1969 and 12 percent from 1968 and 8 percent from the average of the previous seven years while total employment in Michigan was down 2.6 percent from 1969, up 1.4 percent from 1968 and up 8.3 percent over the previous seven years. (SOURCE: Michigan Statistical Abstract, Division of Research, Graduate School of Business Administration, Michigan State University, 14th ed., 1976, pp. 260-261. Thus we conclude that the deviation of current income from permanent income was much larger for the automobile producing cities than for the nonautomobile producing cities.

rental units, we may observe high intercorrelations of these variables with the variable measuring the proportion of voters renting.

Federal contributions to communities in the form of Title I aid are intended to be additions to locally financed educational expenditures and are not intended to be used as a substitute for local tax effort. It may be possible for communities to use this outside aid for other purposes than for which they are intended. That is, the communities may not use the Title I funds solely for expenditures on "educationally deprived" students and may instead reduce other expenditures. Moreover, it is difficult to know what the communities would have spent in the absence of the federal programs so that the communities may even increase expenditures but by less than they would have if there were no outside aid. For these reasons, the federal aid to education variables may not be associated with the tax rate.

Advocates of community control of schools have argued that large cities are prone to produce inferior education due to the lack of control by the parents over school practices.[7] If this is correct then the size of the school district ought to be inversely related to the tax rates as parents, dissatisfied with education

---

[7]For a discussion of the issues with respect to community control of schools see Henry M. Levin, editor, Community Control of Schools (Washington, D.C.: The Brookings Institution, 1970).

in the public schools, remove their children from public schools, or support fewer increases in tax rates, or do both. To estimate the possible relationships between the tax rate and measures of size and type of the school district we included two independent variables. As a measure of size we included the number of resident members in the school district.[8] In order to estimate the possible effect of the type of community in which the school district is located each school district was classified as whether it was located in a metropolitan core with population of 50,000 or more or whether it was a city with population of 10,000 to 50,000, a town with population of 2,500 to 10,000 located in the urban fringe or a suburb, or a rural area with population of less than 2,500. A dummy variable with values of zero and one was established for each of the first four of these so that the coefficients of these variables would then be estimates of the extent to which the school districts classified as metropolitan core, for example, choose different tax rates than rural school districts.

At this point we have assembled a function whose parameters we want to estimate and a set of data which at

---

[8]If there are economies of scale in education then the relationship between the tax rate and the size of a community may be positive due to the effect of lower per unit costs in bigger cities with bigger schools. For research that argues such economies of scale exist see John Riew, "Economies of Scale in High School Operation," Review of Economics and Statistics XLVIII (August 1966): 280-287.

least approximate the values of the variables in the function. In the next chapter we will proceed to present and analyze the estimates of these parameters. Since the importance of the income distribution parameters is our primary concern we will look in detail at estimates of the relationships of the tax rate with these variables and examine alternative ways to estimate the importance of skewness. We will also present the results of regressions with median income replaced by mean income and the tax rate on income replaced by the tax rate on property to see how sensitive our estimates are to substitution of variables.

CHAPTER IV

EMPIRICAL RESULTS

The goal of this chapter is to present and discuss the results of estimates of the parameters of equation III-1 above. To facilitate discussion we will present that equation and the list of variables again.

$$\text{IV-1} \qquad t = B_0 + \sum_{i=1}^{22} B_i X_i$$

where:

t = the tax rate on income in dollars of tax per thousand dollars of income

X_1 = median income for the school district

X_2 = median income squared

X_3 = standard deviation of income for the school district

X_4 = the skewness of the income for the school district

X_5 = the proportion of families with children

X_6 = the proportion of families with heads 65 or over

X_7 = the proportion of students in private schools

X_8 = the proportion of voters renting

X_9 = the proportion of population that is Black

X_{10}= the proportion of population that is native born

X_{11}= thousands of dollars of state equalized valuation per family

X_{12}= thousands of dollars of nonresidential property per family

X_{13}= dollars of Title I aid per thousand pupils

X_{14}= dollars of other federal aid per thousand pupils

X_{15}= proportion of property that is nonresidential

X_{16}= unemployment rate for the school district

X_{17}= number of resident members in the school district

X_{18}= an index of the socioeconomic status of the population of the school district

X_{19}= 1 if the school district is located in the metropolitan core with population of 50,000 or more
0 if school district is not so located

X_{20}= 1 if school district is a city with population of 10,000 to 50,000
0 if school district is not

X_{21}= 1 if school district is a town with population of 2,500 to 10,000
0 if school district is not

X_{22}= 1 if school district is in the urban fringe or is a suburb
0 if school district is not

In presenting the results of the estimation of the coefficients of equation IV-1 we will concentrate on the first four independent variables since our primary concern is with the effect of income and income distribution parameters on that tax rate that results from the

decisions by majority vote. The analysis in Chapter II centered on the role of the measures of income distribution on influencing the tax rate. Variables measuring the standard deviation of income and skewness of each school district are included to obtain estimates of these influences. The variable of the squared value of median income will allow us to investigate whether the tax preference curve might be nonlinear. Furthermore, by comparison with results when some of these income variables are excluded we will be getting an idea of how omission of these variables might have affected estimates of income elasticities of the tax preference curve obtained by previous researchers. After presenting the results of the income variables we will turn to a discussion of the estimates of the coefficients of nonincome variables.

The Subsample Approach

Table IV-1 indicates the simple correlations of the variables included in our results while Table IV-2 shows the means and standard deviations of the variables for all of the school districts and for two subsamples of the school districts. The subsamples were chosen by separating the school districts by the degree to which their income distributions are skewed. It was discovered that using a degree of skewness of .1, the sample could be divided into a group of 216 school districts with skewness less than .1 and 278 school districts with skewness

Table IV-1.--Simple Correlation Matrix for all Observations.

Variable	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26
1. Income Tax Rate	1.0																									
2. Property Tax Rate	-.01	1.0																								
3. Median Income	-.18	.36	1.0																							
4. Median Income Squared	-.14	.35	.98	1.0																						
5. Mean Income	-.20	.30	.94	.94	1.0																					
6. Mean Income Squared	-.15	.27	.85	.92	.96	1.0																				
7. Std. Dev. of Income	-.15	.21	.76	.78	.81	.76	1.0																			
8. Skewness	-.16	-.11	.10	.14	.41	.46	.31	1.0																		
9. % Families w/Children	-.17	.19	.52	.43	.41	.30	.15	-.12	1.0																	
10. % Fam. Headed by Older Pers.	.14	-.35	-.69	-.60	-.59	-.45	-.31	.06	-.81	1.0																
11. % Private Sch. Enrollment	-.08	.06	.31	.31	.31	.29	.25	.12	.13	-.18	1.0															
12. % Renters	.01	.06	-.01	-.02	.02	.00	.13	.07	-.03	-.08	.09	1.0														
13. % Black	.14	.00	-.05	-.05	-.01	-.03	.03	.10	-.02	.01	.03	.32	1.0													
14. Socioeconomic Status	-.10	.24	.61	.64	.61	.59	.57	.13	.17	-.33	.15	-.08	-.36	1.00												
15. Resident Members	-.01	.08	.16	.15	.15	.12	.14	.03	.03	-.10	.15	.20	.33	-.01	1.0											
16. SEV per Family	.77	-.30	.13	.16	.15	.15	.16	.07	.00	-.04	.05	.03	.12	.09	.03	1.0										
17. Dollars Nonres. Prop. per Fam.	.47	-.30	.12	.09	.11	.05	.07	.02	.16	-.14	.09	.16	.24	-.02	.04	.76	1.0									
18. Dollars Title I	.11	-.17	-.46	-.42	-.41	-.33	-.29	.01	-.33	.41	-.02	.03	.18	-.32	.03	-.03	.01	1.0								
19. Dollars Other Federal Aid	.08	-.08	-.17	-.13	-.15	-.11	-.10	.00	-.07	.04	-.03	.46	.25	-.17	.12	.01	-.04	.07	1.0							
20. % Property Non-Residential	-.07	-.17	-.01	-.08	-.05	-.12	-.07	-.09	.20	-.11	.04	.19	.16	-.14	.02	.06	.62	.03	-.03	1.0						
21. Unemployment Rate	.32	-.25	-.57	-.50	-.51	-.40	-.37	-.03	-.39	.48	-.23	-.04	.00	-.34	-.03	.10	-.11	.31	.11	-.21	1.0					
22. % Native Born	-.16	-.18	-.06	-.13	-.10	-.16	-.04	-.10	.28	-.15	-.10	-.07	.04	-.12	-.10	-.03	.05	-.12	-.13	.26	-.10	1.0				
23. Metrocore	.07	.07	.00	-.01	.02	.00	.10	.04	-.10	.01	.19	.37	.43	-.17	.42	.04	.24	.11	.19	.14	-.02	-.05	1.0			
24. City	-.02	.02	.00	-.01	.03	.01	.09	.09	-.06	-.02	-.11	.26	.07	.03	.04	-.01	-.02	.01	.06	.05	-.01	-.03	-.04	1.0		
25. Town	-.08	-.08	-.03	-.05	-.05	-.06	.00	-.04	-.03	.05	.07	.09	-.06	.06	-.05	-.06	.04	-.04	-.03	.05	-.05	-.04	-.09	-.11	1.0	
26. Urban Fringe	.00	.29	.60	.58	.56	.50	.33	.11	.33	-.49	.26	-.09	.04	.30	.09	.17	.11	-.28	-.05	-.16	-.31	-.22	-.10	-.12	-.27	1.0
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26

Table IV-2.--Means and Standard Deviations for Variables.

Variable	Whole Sample	More Skewed Subsample	Less Skewed Subsample
Income Tax Rate $ per 1000	36.006 (15.868)	35.581 (14.114)	36.553 (17.893)
Property Tax Rate $ per 1000	25.749 (5.589)	25.104 (5.238)	26.581 (5.920)
Median Income	10,039. (2,298.)	10,120. (2,611.)	9,935. (1,781.)
Mean Income	10,919. (2,759.)	11,401. (3,249.)	10,298. (1,781.)
Standard Dev. of Income	7,098. (1,662.)	7,660. (1,754.)	6,375. (1,198.)
Skewness of Income	.116 (.103)	.161 (.108)	.058 (.058)
Prop. of Families with Children	.604 (.061)	.596 (.064)	.614 (.056)
Prop. of Families with Older Heads	.136 (.054)	.139 (.058)	.132 (.050)
Prop. of Students in Priv. Schools	.076 (.076)	.081 (.080)	.070 (.072)
Prop. of Voters Renting	.185 (.077)	.196 (.089)	.170 (.054)
Prop. of Population Black	.022 (.070)	.024 (.068)	.020 (.072)
Prop. of Native Born	.845 (.084)	.842 (.081)	.850 (.087)
1,000's of $ of SEV per Family	15.434 (7.680)	16.287 (8.141)	14.334 (6.908)
1,000's $ of Nonres. Prop./Family	6.817 (4.850)	6.898 (4.871)	6.713 (4.831)
$ Title I Aid per Pupil	11.372 (10.040)	11.328 (10.282)	11.430 (9.742)
$ Other Federal Aid per Pupil	10.098 (19.641)	11.187 (23.911)	8.696 (12.018)
Prop. of Property Nonresidential	.437 (.158)	.422 (.158)	.457 (.157)
Unemployment Rate	.072 (.040)	.071 (.040)	.072 (.040)
No. Resident Members	4,184.28 (13,961.66)	5,070.95 (18,200.59)	3,043.11 (4,226.30)
Socioeconomic Status	49.792 (2.664)	50.226 (2.914)	49.234 (2.185)
Metrocore	.030 (.172)	.043 (.204)	.014 (.117)
City	.046 (.211)	.072 (.259)	.014 (.117)
Town	.202 (.402)	.216 (.412)	.185 (.389)
Urban Fringe	.225 (.418)	.198 (.399)	.259 (.439)
Rural	.497 *	.471 *	.528 *
Number of Observations	494	278	216

*Since the variable rural was not included in the regressions, it's standard deviation was not calculated. It's mean is one less the sum of the means of the four other community types.

greater than or equal to .1. This will provide us with some additional information on the effect of skewness on the estimates.

Table IV-3 presents the coefficients and standard deviations for the coefficients of the variables above. From Table IV-3 we can see that both the median income variable and the squared value of median income possess significance. The median income variable is significantly negative at better than the one percent level in all three regressions while the squared value of median income possesses a significantly positive coefficient in two of the three regressions, although only at better than the five percent level. Further, we can see that the variable measuring the skewness of the income distributions is significantly negative at better than the one percent level in all three regressions. The variable measuring the standard deviation of income turns out to possess consistently negative coefficients but turns out to be significant only in the whole sample regression and then only at better than the ten percent level.

Table IV-3 shows that the R^2 for the less skewed subsample is .86 while that of the more skewed subsample is only .81. This suggests that the subsamples might be different. To provide a more precise picture of the difference we can use the test employed by Gregory Chow

Table IV-3.--Regression Results with the Tax Rate in Dollars Per Thousand Dollars of Income.

Independent Variable	Whole Sample	More Skewed Subsample	Less Skewed Subsample
Intercept	75.348 (15.304)***	28.931 (18.231)	125.210 (25.598)***
Median Income ($1000)	-4.188 (1.055)***	-3.065 (1.100)***	-9.256 (2.739)***
Median Income Squared	.092 (.038)**	.044 (.037)	.270 (.124)**
Standard Deviation of Income	-.712 (.410)*	-.173 (.467)	-.868 (.872)
Skewness of Income Distribution	-.307 (.036)***	-.171 (.041)***	-.454 (.111)***
Prop. of Families with Children	-26.928 (10.654)**	-2.853 (12.780)	-34.152 (16.350)**
Prop. of Families with Older Heads	-62.829 (14.584)***	-23.136 (18.393)	-83.608 (21.518)***
Prop. of Students in Private Schools	-7.596 (5.157)	-8.825 (6.237)	5.592 (7.826)
Prop. of Voters Renting	-6.691 (6.098)	-2.004 (6.712)	3.705 (11.274)
Prop. Population Black	31.189 (6.510)***	10.786 (8.742)	31.925 (8.602)***
Proportion Native Born	-23.548 (5.065)***	-7.865 (6.422)	-24.318 (7.503)***
1,000's $ of SEV per Family	2.512 (.128)***	1.991 (.168)***	3.100 (.208)***
1,000's $ of Nonres. Property/Family	-1.897 (.261)***	-1.205 (.359)***	-2.387 (.375)***
$ Title I Aid per Pupil	-.023 (.040)	.047 (.048)	-.121 (.060)**
$ Other Federal Aid per Pupil	-.013 (.021)	-.031 (.022)	.028 (.046)
Prop. of Property Nonresidential	23.578 (5.100)***	13.325 (7.165)*	25.855 (6.615)***
Unemployment Rate	10.209 (11.635)	-1.619 (13.909)	-12.930 (17.618)
Number of Resident Members	-.052 (.028)*	-.038 (.026)	.236 (.167)
Socioeconomic Status	.236 (.189)	.379 (.219)*	-.055 (.302)
Metrocore	4.993 (2.584)*	9.476 (2.797)***	-2.123 (5.142)
City	1.385 (1.778)	1.744 (1.778)	2.566 (4.288)
Town	-.474 (.950)	-.715 (1.128)	-1.049 (1.435)
Urban Fringe	.874 (1.262)	1.665 (1.632)	-.854 (1.806)
Number of Observations	494	278	216
R^2	.79	.81	.86
Mean Squared Error	54.397	42.092	48.006

*Significant at less than 10 percent level.

**Significant at less than 5 percent level.

***Significant at less than 1 percent level.

for comparing sets of coefficients in two linear regressions.[1] Chow was using a test for determining whether there are structural changes in the relationship being estimated over the period of time involved. Our question is whether there are significant differences between the two subsamples other than those captured by the independent variables. Of course, the test employed by Chow does not allow us to test whether there is a significant difference between coefficients of the same variable in the same regression equation. The values needed to perform the test for our regression results are shown in Table IV-4.

Table IV-4.--Table of Values for Testing Subsamples for Structural Differences.

	Entire Sample	More Skewed Subsample	Less Skewed Subsample
SSE	25,620.99	10,733.41	9,625.11
Number of Observations	494	278	216
Number of Independent Variables	17	17	17

[1]See Gregory C. Chow, "Tests of Inequality Between Sets of Coefficients in Two Linear Regressions," Econometrica 28 (July 1960): 591-605 and Edward J. Kane, Economic Statistics and Econometrics (New York: Harper and Row, Inc., 1968), pp. 339-342.

Interpolating the numbers in an F table we can arrive at the critical value of F for 18 and 458 degrees of freedom at the one percent level. This number is approximately 1.997. The information produces an F value of 5.476. Thus the F value for our data is much larger than the critical value obtained from a table of the F statistic. The evidence suggests that there is a structural difference in the two subsamples that is not captured by the independent variables.

In addition to the results of this test and the point made above that the skewness variable is significantly negative at better than the one percent level in all three regressions, we can also see that the number of variables with significant coefficients varies over the three regressions. Table IV-5 lists the variables that have coefficients that are significant at the 10 percent level or better. Even this difference in the numbers of significant does not indicate the full extent to which the variables are significant in both subsample while eight more are significant in just one of the subsamples. Apparently, the separation of the samples reveals a part of the relationship between skewness and these variables that is not otherwise evident.

The Interaction Variable Approach

An alternative approach to assessing the effect of the degree of skewness on the tax rate is to use

Table IV-5.--Variables with Coefficients Significant at the 10 Percent Level or Better.

Whole Sample	More Skewed Subsample	Less Skewed Subsample
Median Income	Median Income	Median Income
Median Income Squared		Median Income Squared
Standard Deviation of Income	Standard Deviation of Income	Standard Deviation of Income
Skewness of Income	Skewness of Income	Skewness of Income
Proportion of Families with Children		Proportion of Families with Children
Proportion of Families with Older Heads		Proportion of Families with Older Heads
Proportion of Population Black		Proportion of Population Black
Proportion of Population Native Born		Proportion of Population Native Born
Thousands of Dollars of Nonresidential Prop. per family	Thousands of Dollars of Nonresidential Prop. per family	Thousands of Dollars of Nonresidential Prop. per family
Thousands of Dollars of SEV per Family	Thousands of Dollars of SEV per Family	Thousands of Dollars of SEV per Family
Proportion of Property Nonresidential	Proportion of Property Nonresidential	Proportion of Property Nonresidential
		Dollars of Title I Aid per Pupil
Number of Resident Members		
	Socioeconomic Status	
Metrocore	Metrocore	

"interactions terms."[2] This approach involves forming new variables that are the products of two of the explanatory variables and adding these variables to the linear regression equation. In our specific case we can include as explanatory variables the product of skewness and other variables. Inclusion of the interaction variables allows us to test whether or not skewness is specifically related to the level of the other variables by examining the coefficients of the interaction variables. When interaction variables are not included some of the effect of the interaction of the variables will be included in the coefficients of the separate variables. This can lead to over- or underestimation of the separate effects. By inclusion of the interaction variables an estimate of the joint effect of the two variables can be isolated yielding a better estimate of the separate effects.

To see if the interaction variable approach would yield different conclusions about the effect of skewness on the tax rate we took the equation for which results are shown in Table IV-3 and formed interaction variables for skewness and ten other explanatory variables. Table IV-6 indicates the results for this equation with the interaction terms and the original equation for the whole sample. Table IV-6 shows that the inclusion of the

---

[2]For example, see Jan Kmenta, Elements of Econometrics (New York: The Macmillan Company, 1971), pp. 455-456.

Table IV-6.--Regression Results With and Without Selected Interaction Variables With Dependent Variable of Tax Rate in Dollars per Thousand Dollars of Income.

Independent Variable	Without Interaction Variables	With Interaction Variables
Intercept	75.348 (15.304)***	79.425 (16.645)***
Median Income ($1,000)	-4.188 (1.055)***	-5.007 (1.066)***
Skewness* Median Income		-.061 (.043)
Median Income Squared	.092 (.038)**	.015 (.043)***
Standard Deviation of Income	-.712 (.410)*	-1.639 (.820)**
Skewness* Standard Deviation of Income		.112 (.048)**
Skewness of Income	-.307 (.036)***	-1.179 (1.009)
Proportion of Families with Children	-26.928 (10.654)**	-14.947 (16.719)
Skewness* Prop. Families with Children		.316 (1.189)
Proportion of Families with Older Heads	-62.029 (14.584)***	-27.847 (23.076)
Skewness* Prop. Families with Older Heads		-1.006 (1.644)
Proportion of Students in Private Schools	-7.596 (5.157)	-20.257 (7.902)**
Skewness *Prop. Students in Private Schools		1.086 (.589)*
Proportion of Voters Renting	-6.691 (6.098)	-5.081 (11.327)
Skewness* Proportion of Voters Renting		-.053 (.728)
Proportion of Population Black	31.189 (6.510)***	28.659 (8.540)***
Skewness* Prop. Population Black		.008 (.446)
Proportion of Population Native Born	-23.548 (5.065)***	-20.267 (8.166)**
Skewness* Prop. Native Born		.297 (.592)
1,000's $ of SEV per Family	2.512 (.128)***	2.680 (.162)***
Skewness* SEV per Family		-.021 (.010)**
$ Title I Aid per Pupil	-.023 (.040)	-.021 (.037)
$ Other Federal Aid per Pupil	-.013 (.021)	-.027 (.019)
Proportion of Property Nonresidential	23.578 (5.100)***	4.756 (7.152)
Skewness* Prop. Property Nonresidential		1.275 (.570)**
Unemployment Rate	10.209 (11.635)	-15.050 (18.665)
Skewness* Unemployment Rate		.796 (1.479)
Number of Resident Members	-.052 (.028)*	-.044 (.025)*
Socioeconomic Status	.236 (.189)	.137 (.177)
Metrocore	4.993 (2.584)*	5.036 (2.344)**
City	1.385 (1.778)	1.614 (1.623)
Town	-.474 (.950)	-.698 (.867)
Urban Fringe	.874 (1.262)	1.479 (1.163)
R^2	.78	.83

*Significant at less than 10 percent level.

**Significant at less than 5 percent level.

***Significant at less than 1 percent level.

interaction variables reduces the degree of significance of the skewness variable from better than the ten percent level to only better than the 24 percent level. Apparently much of the significance of the skewness variable comes from the interactions of skewness with the other independent variables. However, only four of these interaction variables possess significant coefficients; the standard deviation of income, the percentage of students enrolled in private schools, the percentage of property that is nonresidential and the dollars of state equalized valuation per family. We observe that the coefficient of three of these four variables gets larger in absolute value when the interaction term is included. They are the standard deviation of income, the percentage of students enrolled in private schools and the dollars of state equalized valuation per family. In these three cases exclusion of the interaction variables yields underestimates of the separate effects of these variables while apparently leading to a larger coefficient for the variable of skewness. A look at the coefficients of the interaction terms reveals that the signs are opposite of those of the separate variables so that increases in these variables have smaller effects on the tax rate when the level of skewness of the income distribution is higher.[3]

---

[3]One of these results is especially interesting. Our private school enrollment includes enrollment at the relatively low priced private schools operated by churches

The coefficient of the other variable, the proportion of nonresidential property, is of the same sign as the coefficient of the corresponding interaction variable. This suggests that an increase in the percentage of nonresidential property will increase the tax rate more when the income distribution is highly skewed than it will when the distribution is less highly skewed.

The interaction approach has provided us with another way to assess the effect of skewness on the tax rate. Both approaches, as shown in Table IV-6 indicate that skewness has a significant effect on the tax rate. To compare the results of the approaches we have solved the regression equations implied by Table IV-6 for the tax rate in terms of skewness with the mean value of each variable substituted for each other variable. For the regression without interaction variables we obtain:

IV-2 $t = 39.75 - 33.24*SK$

---

as well as the higher priced ones that are not church related. Enrollment in the latter is probably highly related to income. Since skewness and median community income are positively related it may be that these enrollments are thus related to skewness and that the voters whose children attend the higher priced schools are less reluctant to vote to pay taxes that produce benefits for others than are those whose children attend the low price private schools. Thus the coefficient of the interaction variable may be telling us that in communities with higher skewness, increases in the proportion of private school enrollment, primarily at the more expensive schools, are associated with smaller reductions in the tax rate.

where SK is the degree of skewness. When the interaction variables are used for the ten variables the equation becomes:

IV-3 $t = 31.81 - 30.68^{*} SK$

Thus the use of interaction variables seems to decrease the effect of skewness slightly such that an increase in skewness leads to a slightly smaller reduction in the tax rate. Later as we discuss the performance of each of the variables in the regressions we will point out why we might expect each variable to be more important in some of the samples than for others. The important conclusion at this point is that skewness is an important variable both as an independent variable in the regression and as a criterion for separating the samples as well as for explaining how some of the independent variables affect the tax rate.

The Tax Preference Curve

Another concern of this paper is to investigate the shapes of the tax preference curve and the corresponding relationship between expenditures and income. The inclusion of the squared value of median income will allow us to estimate whether the tax preference curve might be U-shaped or inverse U-shaped rather than linear. The coefficient of the squared value of income is positive in all three regressions and significant in two of them.

This evidence suggests that the tax preference curve turns up at some value of median income. The question naturally arises whether the influence of the squared term becomes strong enough to cause the tax preference curve to turn upward at levels of income relevant for the observed values of median income in our sample. To find the answer to this question we substituted the average sample values for all of the variables other than median income and median income squared. The result is the estimated tax preference curve that would exist with all other variables at their mean values. Table IV-7 indicates the resulting equations with the symbol Y denoting median income in thousands of dollars and t denoting the tax rate in dollars of tax per thousand of dollars of income.

Table IV-7.--Three Estimated Tax Preference Curves. The following equations are the tax preference curves for the regression equations shown in Table IV-3 with mean values substituted for all independent variables other than median income. Y denotes income in 1,000's of dollars and t denotes the tax rate in dollars of tax per 1,000's of dollars of income.

Sample	Equation	Y and t for which t is a minimum	
Whole Sample	$t=68.154-4.188\ Y+.092Y^2$	Y=$22.62	t=$20.78
More Skewed Sample	$t=62.004-3.065\ Y+.044Y^2$	Y=$35.06	t= $8.64
Less Skewed Sample	$t=95.513-9.257\ Y+.270Y^2$	Y=$17.17	t=$16.17

Referring to Tables IV-6 and IV-8 we can see that only for the whole sample and the less skewed subsample does the minimum tax rate occur at an income inside the range of the sample. Furthermore, examination of Table IV-2 reveals that the standard deviation of median income is sufficiently low that the minimum tax rates occur at a value of median income that is more than two standard deviations above the mean value for each sample.

Table IV-8.--Critical Income Values for the Three Sample Sizes.

Sample	Minimum Value of Median Income	Average Value of Median Income	Maximum Value of Median Income
Whole Sample	$ 4,263	$10,039	$24,485
More Skewed	4,263	10,121	24,485
Less Skewed	5,888	9,935	18,922

The equations in Table IV-9 indicate that the relationship between the tax rate and income is an inverse one for most of the levels of income observed from the samples. However, a lower tax rate on a higher income need not result in lower local expenditures on education. To estimate how expenditures are related to the level of income we can multiply the equations in Table IV-7 by income. Table IV-9 indicates the resulting equations.

Table IV-9.--Three Expenditure Equations.

Sample	Expenditure Equations Y = income in 1,000's of dollars t = tax rate in dollars per 1,000's of income
Whole	$t \cdot Y = 68.154*Y - 4.188*Y^2 + .092* Y^3$
More Skewed	$t \cdot Y = 62.004*Y - 3.065*Y^2 + .044* Y^3$
Less Skewed	$t \cdot Y = 95.513*Y - 9.257*Y^2 + .270* Y^3$

Figures 27 and 28 show diagrams of the tax preference curves and expenditures curves for the whole sample and the less skewed subsample to illustrate more clearly how these relationships look. From these equations we can see that the estimated tax preference curves generally result in rising expenditures as income rises. For the whole sample there is a positive relationship for all income levels. However, for the less skewed subsample the level of expenditures rises, falls and then rises as income rises from the minimum to maximum values of the subsample. Specifically, the minimum value of income for the subsample is $5,888 while the maximum value is $18,922 and the average is $9,935. From an income level of about $7,800 to $15,000 the expenditures level declines.

Elasticity of the Tax Preference Curve

The reader will recall that Bergstrom and Goodman argued in their article that if the distributions of

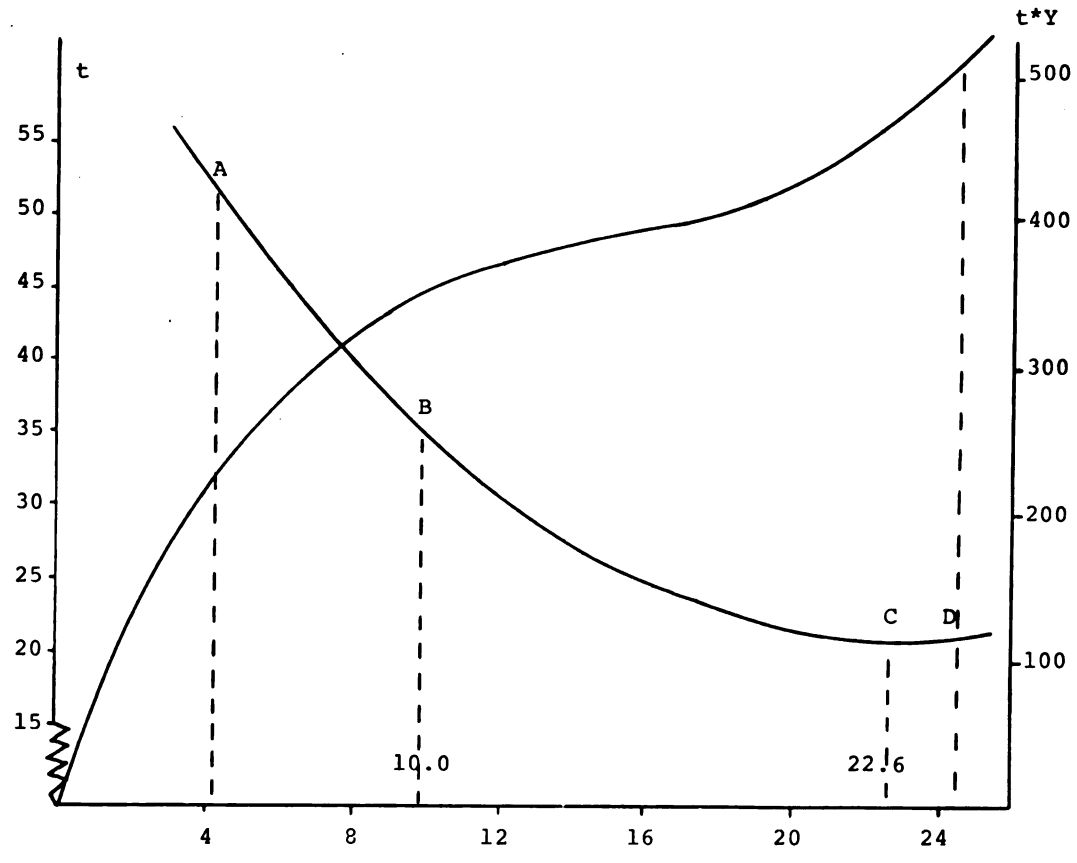

Figure 27.--The Whole Sample Tax Preference and Expenditure Curves. The figure shows the tax preference curve and the corresponding expenditures curve for the whole sample regression equation. The plotted values are obtained by substituting the mean values for all variables other than median income and median income squared. The tax rate is dollars of tax per thousand dollars of income, and the income is measured in thousands of dollars. Points A, B and D indicate the points on the tax preference curve for which income is at the minimum value for the sample (A), at the average value for the sample (B) and at the maximum value for the sample (D). Point C indicates the value of income for which the tax rate is at a minimum.

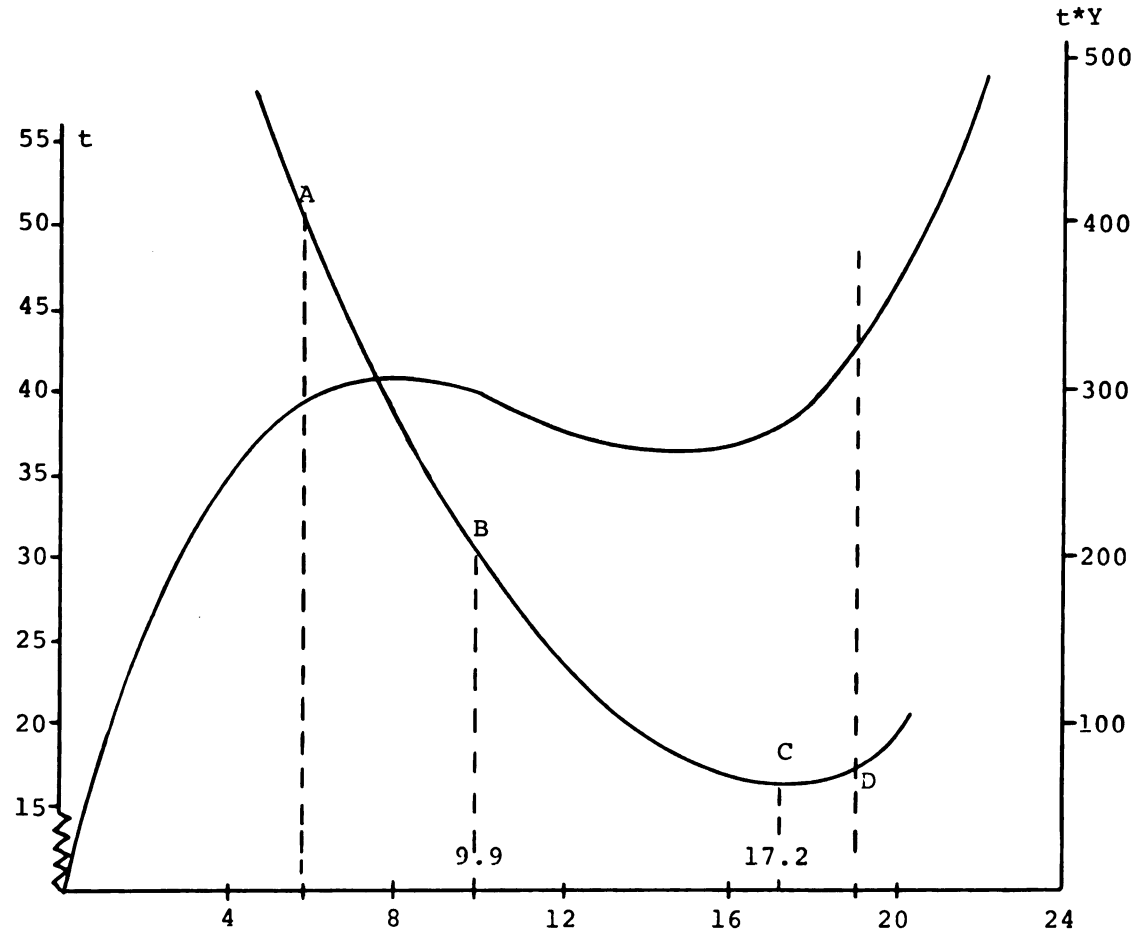

Figure 28.--The Less Skewed Subsample Tax Preference and Expenditure Curves. The figure shows the tax preference curve and the corresponding expenditures curve for the less skewed subsample regression equation. The plotted values are obtained by substituting the mean values for all variables other than median income and median income squared. The tax rate is dollars of tax per thousand dollars of income and the income is measured in thousands of dollars. Points A, B and D indicate the points on the tax preference curve for which income is at the minimum value for the sample (A), at the average value for the sample (B) and at the maximum value for the sample (D). Point C indicates the value of income for which the tax rate is at a minimum.

income were assumed to be proportional that income elasticities could be estimated with just median income as a measure of the distribution of income.[4] Our data allow us to assess the importance of the parameters of the income distribution other than the median income in determining the tax rate of a community. Table IV-10 below indicates the expenditures curves for various samples with all income variables and with some income variables deleted. The Table indicates that the elasticities show some sensitivity to inclusion of these other income distribution parameters and to assumptions about the shape of the tax preference curve. Unfortunately, we are not able to test whether these sensitivities are significant.

The coefficients of the income variables seem to tell us that communities with higher average community income support lower tax rates although sometimes higher total local expenditures. The coefficient of the skewness variable implies that as the difference between mean and median income gets bigger the tax rate generally declines. It may be that the people with high income in a community prefer higher tax rates but are dominated by those with lower income in communities with more positively skewed income distributions leading to lower tax rates. An alternative explanation of this relationship between skewness and tax rates is that some of the high income

---

[4]Bergstrom and Goodman, ibid., p. 287.

Table IV-10.--Expenditure Equations for Two Sample Sizes Under Various Assumptions.

Sample and Variables	Expenditures Equation	Shape
	Whole	
Y	$t*Y = 62.293*Y - 2.55*Y^2$	rises up to Y=12.2
Y, SDY, SKP	$t*Y = 54.95*Y - 18.30*Y^2$	rises for Y up to 15.0
Y, Y^2, SDY, SKP	$t*Y = 68.154*Y - 4.188Y^2 + .092*Y^3$	rises for all Y
Y, Y^2	$t*Y = 69.08*Y - 3.70*Y^2 + .0456*Y^3$	rises for Y < 12.0
	Less Skewed	
Y	$t*Y = 65.273*Y - 2.96*Y^2$	rises for Y $\leq$ 11.2
Y, SDY, SKP	$t*Y = 72.34*Y - 3.63*Y^2$	rises for Y $\leq$ 10.0
Y, Y^2, SDY, SKP	$t*y = 95.513*Y - 9.256*Y^2 - .27*Y^3$	declines for Y between 8.0 and 15.0
Y, Y^2	$t*Y = 124.67*Y - 13.5*Y^2 + .46*Y^3$	declines for Y between 7.6 and 12.4

people in the highly skewed income communities prefer higher tax rates but finding they cannot obtain them under majority rule, enroll their children in private schools and then vote for low tax rates. This explanation is consistent with the correlation between skewness and private

school enrollment of +.12 and that of +.31 between median community income and private school enrollment.

The Non-Income Variables

At this point we will turn to the interpretation of the estimated relationships between the tax rate on income and the non-income variables. The first group of non-income variables that we want to consider is the group that includes the variables that measure the extent to which there are sizable percentages of people which receive unusually high or low benefits from public education. These variables are the proportion of families with children, the percentage of families with heads 65 years or over, and the percentage of students in private schools. As indicated earlier the approach of single equation estimation presents some difficulty, especially with respect to the variables measuring benefit differences. Although this estimation problem is discussed above in Chapter III, a brief review is merited at this point.

The problem arises in that the single equation estimation approach we have employed does not allow us to estimate the extent to which people choose their residence on the basis of differences in the mixture of public to private goods between communities. The reader will recall that Tiebout suggested that people can "vote with their feet" as well as at the ballot box.[5] At best, our

[5]Tiebout, ibid.

procedure of statistical estimation allows us to estimate the combined effect of these two methods of voting. Consequently, our method does not allow us to estimate the importance of the choice of residence as an equilibrating mechanism. Consider the following example. Upon retirement people may locate in a community with a low tax rate in terms of income. While in that community they may continue to vote for low tax rates. The statistical relationship that we obtain between the percentage of older heads and the tax rate will only reveal whether the tax rate is related to the age composition of the heads of families not whether they moved to the community because of the low tax rate or vote for the low tax rate after moving or both. Again, although our methods and data unfortunately do not allow us to test the Tiebout Hypothesis, the results are still useful for the more general purpose of estimating the effect of the older people on the tax rates approved by the communities.[6]

The results show that the percentage of families with children has a negative coefficient in all three regressions in Table IV-3 and that coefficient is

---

[6]The methods of estimating the separate effects of these two methods of voting would involve finding some variable which would provide information about the relocation of people. In the case of the retired, we would need information about the relationship between the tax rates in their school district (relative to other school district tax rates) at the time of their first move after retirement. We do not have such data. Even if such data were available it would only provide an upper bound to the relationship since people do relocate for other reasons.

significant in two of them. This suggests that of families with the same income, those with children prefer a lower tax rate. The proportion of families headed by older people seems to be even more negatively related to the tax rate. Its coefficient is also negative in all three regressions but its t-value is larger in all of the regressions than the t-value on the coefficient of the proportion of families with children. Indeed, the coefficient of the proportion of families with older heads is significant at better than the one percent level in two of the regressions. This result suggests that families with older heads do prefer lower tax rates on income in balloting to determine school taxes. Since these families receive smaller direct benefits it is not surprising that they prefer lower tax rates nor that they appear to have even stronger preference for lower tax rates than those families with children.[7] Although the

---

[7]A caution is in order here about interpretations of these coefficients. The existence of high multicollinearity makes the parameters estimates sensitive to model specification and yields high standard errors for the coefficients. Thus when multicollinearity exists we cannot have as much confidence in our tests of the significance of these parameters. (See, for example, Kmenta, ibid., pp. 380-391.) A look at the correlation matrix in Table IV-1 reveals the degree of intercorrelation of our variables. Using the correlation of plus or minus .5 as an arbitrary benchmark we can observe that the measures of average community income are highly correlated with the proportion of families with children, the proportion of families headed by people 65 years or older, socioeconomic status, the unemployment rate and whether or not the community is characterized as urban fringe. Similarly, the

variable measuring the proportion of students attending private schools has a negative coefficient in all three regressions, as expected,[8] none of the coefficients are significant at the 10 percent level or better. (Indeed, the levels of significance for the private student variable are 14.1 percent, 15.8 percent, and 47.6 percent.

The next group of variables that we want to consider is the group that measures the socioeconomic makeup of the community. The variables that we have classified in this group are the proportion of population that is Black, the proportion of population that is native born and an index of socioeconomic status of the community. The proportion of the population that is Black show a positive relationship in all three regressions that is significant at better than the 1 percent level in two of the regressions. This suggests that Blacks are willing to pay larger tax rates on income than the nonblack population. It may be that Black families see education as being a more

---

standard deviation of income is correlated with the proportion of households headed by old people and this in turn is highly correlated with the unemployment rate. Finally, it is no surprise to find that the variables measuring the characteristics of property wealth are highly correlated.

[8]A similar result has been obtained by other authors. For example, Booms and Hu found that per capita expenditures on education were inversely related to the percentage of private school enrollment. Bernard H. Booms and Teh-Wei Hu, "Toward a Positive Theory of State and Local Public Expenditures: An Empirical Example," Public Finance 26 (Number 3, 1971): 419-436.

important way of changing their economic status and are thus willing to make larger sacrifices. Or, it may be that Black families have different preferences for education. The correlation matrix also reveals that communities with higher proportion of Blacks also appear to receive more federal aid on the basis of positive simple correlations with the variables measuring Title I aid and other federal aid (+.18 and +.25 respectively). It is also interesting to note the low simple correlation of the proportion Black variable with median and mean income variables of +.02 and +.03 respectively. Intuitively, we would have expected a negative simple correlation. Since our income concept is income per family, communities with higher proportion of Blacks may have lower per capita income. Our data does not provide us with such information.

The variable measuring the proportion of the population that is native born has a negative coefficient in all three regressions and is statistically significant at better than the 1 percent level in two of them. This suggests that the proportion of foreign born would be positively related to the tax rate on income. In contrast, Wilson and Banfield reported results indicating that the larger the percentage of foreign stock the smaller the percentage of "yes" votes on noneducational municipal

issues.[9] They also examined the behavior of specific ethnic groups which we did not.[10] Although this may suggest that our results are inconsistent with theirs, it is important to note that they were attempting to estimate the extent to which voters of foreign stock are "public-regarding." Our data are for behavior with respect to tax rates to support education. The increased willingness of the foreign born to support higher tax rates that is shown by our research may not tell us whether the foreign born are more public-regarding since they may be motivated by private returns from education while not seeing such benefits from noneducational expenditures. Therefore, our study may not be inconsistent with the Wilson and Banfield results.

Finally, the variable measuring the socioeconomic status of school district is significant in only one regression; the regression for the more skewed subsample. In that regression the coefficient is significant at better than the ten percent level. Its positive sign in that regression suggests that those communities with higher socioeconomic status are willing to make somewhat larger sacrifices for education.

Another group of nonincome variables that we want to consider is the group that may measure the extent to

---

[9]Wilson and Banfield, ibid., p. 82.

[10]Wilson and Banfield, ibid., pp. 84-86.

which the voters of the community may experience lower costs than suggested by the tax rates. These are the variables that measure the proportion of voters renting, the proportion of property that is nonresidential and the dollars of nonresidential and residential property per family. These variables were included in these regressions to facilitate comparison with later regressions with the tax rate on property as the dependent variable. The amount and composition of property a community has is expected to be related to the tax they impose on property, but we would expect that the tax rate on income would be related to these measures only to the extent that the income of people and their property wealth are related. However, since the tax is imposed on all property even if the income and the property in the community are highly related, as the proportion of nonresidential property rises the effective tax rate will fall relative to our measure of the tax rate. Table IV-1 does show that the simple correlation between state equalized valuation of property per family and the median income is +.16 but the interpretations of the results for this group of variables will be less clear than they will be in regressions to be presented later. Again, there is a high degree of multicollinearity between the property variables.

The variable measuring the proportion of residences being rented has a negative coefficient in all three

regressions suggesting that as the proportion of renters increases, the tax rate on income falls. However, the coefficient is not significant in all three regressions.[11] This evidence suggests that renters do not behave significantly differently than nonrenters. Of course, this result does not tell us whether renters perceive the taxes to be passed on or not.

The variable measuring the dollars of state equalized valuation of property per family turns out to be significantly positive in all three regressions suggesting that the higher the property wealth the community possesses per family the higher the tax rate on income. The level of significance is better than the 1 percent level. As indicated above, the average unemployment rate for the school districts was high relative to recent years and had risen more for some communities than for others.[12] Thus, current income was lower than permanent income for communities and the tax rates on current income were higher than tax rates on permanent income. This deviation of current income from permanent income may partially

---

[11]The variable measuring the proportion of renters is more significantly related to the property tax rate. These results are shown below.

[12]As we will explain below when the property tax rate is substituted for the income tax rate the variable measuring total property wealth retains its significance although its coefficient possesses a negative sign while the dollars of nonresidential property variable becomes insignificant but also changes sign in some of the regressions.

explain the positive relationship between the tax rate on current income and state equalized valuation per family.

A look at the coefficient of the variable of the dollars of nonresidential property per family reveals that it is also highly significant in all three samples, but the coefficient is negative.

The last of these four measures of property that we have included is the proportion of nonresidential property for the school district. This variable has a positive coefficient that is significant in all three regressions. This suggests that increases in the proportion of property that is not residential are associated with higher tax rates on income. Since this coefficient is the estimate of the effect of changes in the proportion of nonproperty wealth with other variables constant, including variables of total property wealth and dollars of nonresidential wealth, it is not clear how it should be interpreted.

The variables included in the regressions to estimate the effect of outside aid were ESEA aid and all other federal aid on a per pupil basis.[13] The results in Table

---

[13] ESEA funds are funds given under Title I of the Elementary and Secondary Education Act passed in 1965 to improve the educational opportunities of educationally deprived children. It is the largest program in dollars to provide federal aid to education. For an explanation of the program see, for example, U.S. Department of Health, Education and Welfare, Office of Education, Parental Involvement in Title I ESEA, Why? What? How? U.S. Government Printing Office, 1972.

IV-3 indicate that Title I funds are significantly related to the tax rate on income only in the less skewed subsample and in this case the relationship is inverse. Thus there may be some substitution of Title I aid for local tax effort. This result is consistent with those of other researchers.[14] Since Title I funds are aimed at children classified as "educationally deprived" it is not surprising to discover that Title I aid has a simple correlation with median income of -.46. The result that Title I funds have a significant relationship only in the less skewed subsample may be due to the possible concentration of the "educationally deprived" in school districts that have both relatively homogeneous income distributions as well as relatively low average incomes. Since the federal aid other than Title I aid is given for a variety of reasons, it is also not surprising that other federal aid has a simple correlation with median income that is smaller in absolute value (-.17) than does the variable Title I aid and that the coefficients of the variable were insignificantly different from zero in all three regressions.

---

[14]George A. Bishop obtained similar results and refers to other studies with similar results. He found that each dollar of state aid was associated with an increase in expenditures of between 40 and 80 cents. See George A. Bishop, "Stimulative versus Substitutive Effects of State School Aid in New England," National Tax Journal 17 (June 1964): 133-143.

The coefficient of the variable measuring the unemployment rate is also insignificantly different from zero in the three regressions. Further, the sign of the coefficient varies. For each of the subsamples the coefficient of the unemployment rate variable is negative while, for the whole sample, the coefficient is positive. The lack of significance of this variable could be accounted for by the use of current income as the base for the tax rate on income. As explained above, the current income will reflect the effect of changes in the unemployment rate but the tax rate is not easily and quickly adjusted so that the current income might be low due to increases in the unemployment rate but the taxes will remain high and thus the tax rate on income will be higher. Reenforcing this conclusion that the high unemployment rate had a significant effect on the level of income in the school districts is that the simple correlations between the unemployment rate and median income and the unemployment rate and the tax rate were -.51 and +.32 respectively. We will later show that similar results are obtained when the property tax rate is substituted for the income tax rate and we argue that similar logic can be used to explain the results.

The variable measuring the number of resident members was incorporated in the regression equations to estimate the effect of size of the community on the tax

rate. Table IV-3 indicates that in only the whole sample regression was the coefficient of this variable significant and in that regression the coefficient was negative indicating that the larger school districts did appear to have lower tax rates on income. Since we have no measure of the costs of providing education, this lower tax rate could be either the result of demand or supply factors. That is, the lower tax rate could be due to preferences of voters or economies of scale.

Finally, the variables used to measure the effect of the type of community on the tax rate were generally insignificant. The reader will recall that zero-one variables were created for types of community, excluding the rural category, so that the coefficient of each variable only indicates the extent to which types of communities in our sample perform differently than rural communities. Only the school districts located in the metropolitan core appear to have significantly different tax rates than rural areas and, even then, only for the whole sample and the more skewed subsample. In the more skewed subsample, for example, the results suggest that school districts in the metropolitan core tend to impose taxes on income that are higher by slightly more than nine dollars per thousand dollars of income than taxes imposed by rural areas.

Tax Preferences with Property Tax Rates as Dependent Variable

We have developed the analysis in the preceding Chapters on the basis of the behavior in terms of income and our initial regressions were all with the tax rate on income as the dependent variable.[15] We have also computed three other regressions with the tax rate on property as the dependent variable. The purpose of this was twofold. First, people vote on the tax rate as an assessment on property values and they may consider this rate to the exclusion of the tax dollars they pay relative to income. Secondly, although people will have different preferences for property as compared to other forms of wealth, property may be a better measure of the ability of the individuals to pay taxes. The income measure we have is only for a single year and it might differ from permanent or expected income. Indeed, looking at the correlation matrix in Table IV-1, we do see a very low simple correlation between the tax rate on property and the tax rate on

---

[15] We argued that people will place more importance on their income when making tax decisions than they will on the value of the property they possess. Instead of looking at the number of mills of property tax they would impose on themselves we assumed that they would look at the dollar cost of the proposal. Furthermore, even though property is wealth and therefore might be more closely related to taxes voters will impose on themselves, the divergence of current income from permanent income may be smaller than errors in assessed values. Finally, since the tax rate on property reflects all property including non-residential property this tax rate may not reflect the burden of the property tax to the individual voter or even the average voter.

income (-.01). Since the tax rate on income is defined as local revenues divided by total income in the school district and the tax rate on property is defined as local revenue divided by the state equalized valuation of property in the school district, this low correlation is really the indication of a low correlation between total school district income and state equalized valuation. Thus the two dependent variables do not appear to be much alike. Some of this low correlation is due to the deviation of current income from permanent income which is due in turn to the relatively high unemployment rate for 1970. However, we have no estimate of how much influence the relatively high unemployment rate had on current income. Another possible cause of the low correlation might be due to errors in methods used to equalize property values across school districts.

Now we shall turn to the comparison of the regression equations with the property tax rate as dependent variable to those with the tax rate on income as dependent variable. The coefficients of the regressions with the property tax rate as dependent variable are shown in Table IV-11. Clear differences emerge. The R^2 of the property tax rate regressions are consistently lower by more than 34 percentage points. Furthermore, the number of significant coefficients changes from 12, 6 and 11 to 8, 7 and 5. Thus only in one of the new regressions

Table IV-11.--Regression Results with the Tax Rate in Dollars per Thousand Dollars of Property as Dependent Variable.

Independent Variable	Whole Sample	More Skewed Subsample	Less Skewed Subsample
Intercept	45.393 (9.196)***	16.428 (11.220)	83.872 (17.307)***
Median Income ($1000)	-.616 (.634)	-.710 (.677)	-1.641 (1.852)
Median Income Squared	.037 (.023)	.025 (.025)	.096 (.084)
Standard Deviation of Income	.118 (.246)	.635 (.287)**	-.523 (.590)
Skewness of Income	-.091 (.022)***	-.053 (.025)**	-.141 (.075)*
Prop. of Families with Children	-6.067 (6.402)	10.707 (7.865)	-29.896 (11.054)***
Prop. of Families with Older Heads	-33.825 (8.764)***	-14.818 (11.320)	-52.791 (14.548)***
Prop. of Students in Private Schools	-8.541 (3.099)***	-5.251 (3.839)	-3.430 (5.291)
Prop. of Voters Renting	3.248 (3.664)	7.411 (4.131)**	4.144 (7.622)
Prop. of Population Black	7.888 (3.912)**	6.912 (5.380)	8.897 (5.816)
Prop. of Native Born	-14.577 (3.043)***	-4.927 (3.952)	-18.057 (5.073)***
1,000's of $ of SEV per Family	-.243 (.077)***	-.179 (.103)*	-.475 (.140)***
1,000's $ of Nonres. Prop./Family	-.061 (.157)	-.136 (.221)	.177 (.253)
$ Title I Aid per Pupil	-.003 (.024)	-.020 (.030)	-.014 (.041)
$ Other Federal Aid per Pupil	-.021 (.125)*	-.026 (.013)*	.006 (.031)
Prop. Property Nonresidential	-3.405 (3.065)	-1.702 (4.410)	-5.948 (4.472)
Unemployment Rate	-8.252 (6.992)	-12.196 (8.560)	-6.099 (11.911)
Number of Resident Members	-.021 (.017)	-.019 (.016)	.161 (.113)
Socioeconomic Status	.192 (.114)*	.269 (.135)**	.037 (.204)
Metrocore	3.576 (1.552)**	4.011 (1.721)**	-.561 (3.476)
City	.653 (1.069)	-.091 (1.100)	3.324 (2.899)
Town	-.776 (.571)	1.084 (.694)	-.736 (.970)
Urban Fringe	1.183 (.758)	1.701 (1.004)*	.070 (1.221)
Number of Observations	494	278	216
R^2	.40	.46	.44
Mean Squared Error	19.642	15.942	21.944

*Significant at less than 10 percent level.

**Significant at less than 5 percent level.

***Significant at less than 1 percent level.

is the number of significant coefficients as large or larger. A look at the variables which are significant in Table IV-11 reveals even more of a difference. Median income loses its importance when the property tax rate is substituted as neither median income nor median income squared are significant in any of the regressions in Table IV-11. The two variables which are estimates of the distribution of income also generally appear to be less significant. While the standard deviation of income had only been significant in the whole sample case before and then with a negative sign, in the property tax regressions, the standard deviation of income is significant only in the more skewed subsample and then with a positive sign. The variable measuring skewness of the income distribution retains the same sign (negative) but loses some of its degree of significance in the two subsamples. This lends support to our choice of income and the income tax rates as a strategic variable in the decisions of the community.

Looking at the variables which measure the extent to which the communities are inhabited by people who receive unusually low or high benefits from public education, we can see that the variable measuring the percentage of families with children is significant in one of the regressions whereas it was significant in two regressions before. The coefficient again possesses a negative sign in all of the regressions. This suggests a negative

association of families with children with the property tax rate as well as the income tax rate for the less skewed subsample. The variable measuring the percentage of families headed by those 65 years or older again is significant and negative in the whole sample and less skewed subsample regressions. A significant change in the importance of this group of variables occurs with the variable measuring the percentage of students attending private schools. The coefficient of this variable was not significant when the income tax rate was used as a dependent variable. When the property tax rate is substituted for the income tax rate the coefficient of the private school variable remains insignificant for the two subsamples but becomes significant and negative at better than the 1 percent level for the whole sample. Thus property tax rates do appear to be inversely related to the proportion of private school enrollment suggesting that parents of private school students prefer relatively low property tax rates. More information on the characteristics of voters with offspring attending private school would be useful in trying to explain these results. However, it may be that parents of private school students possess large amounts of property relative to income and prefer relatively low tax rates in terms of property and are less concerned about taxes in terms of income.

Whereas each of the variables in the group of property variables was significant in each of the regressions calculated with the income tax rate, some significant changes can be noticed when the property tax rate is substituted.[16] The variables measuring the extent of nonresidential property in a school district in dollars and in percentage seem to be unrelated to the tax rate on property while they were positively and negatively related to the tax rate on income. Although the variable dollars of state equalized valuation per family was positively related to the income tax rate it is negatively related to the property tax rate. An explanation as to why the two nonresidential property variables perform differently with the two dependent variables is suggested by the lack of correlation between the dependent variable which we have argued above may be due to the divergences of current income from permanent income for some of the communities.

The negative sign of the variable measuring the dollars of property wealth per family suggests that increases in property wealth are associated with lower property tax rates. The reader will recall that when the income tax rate was used the coefficients of median income

---

[16]We remind the reader that the simple correlation between the dollars of nonresidential property per family and state equalized valuation per family is +.76 while the correlation between the dollars of nonresidential property per family and the percentage nonresidential property is +.62 suggesting a multicollinearity problem.

suggested that the higher the median income the lower the tax rate on income. If we classify income and property wealth as two alternative measures of ability to pay then we can say that these two regression results suggest that the larger the ability to pay the smaller the tax rate people are willing to pay on the measure of that ability to pay.

The fourth property variable included in the regressions was the variable measuring the proportion of renters. When the property tax rate is used as the dependent variable the coefficient of the renters variable is only significant in the more skewed subsample while with the income tax rate as dependent variable the coefficients were all insignificantly different from zero. As shown in Table IV-11, in the more skewed subsample the coefficient of the variable is positive implying that communities with higher proportions of voters renting tend to vote for higher tax rates. Thus in this one regression equation we see evidence that is consistent with the hypothesis that renters may feel that tax rates on property are not fully passed on to them and thus are more willing to vote for higher tax rates.

The variables measuring the socioeconomic characteristics of the school districts perform much the same with either of the tax rates as dependent variable. In only one of the cases is the sign of the coefficient different,

the coefficient of the socioeconomic status variable in the less skewed subsample, and the coefficient in that regression is not significant. The variable measuring the percentage of Black loses significance in the less skewed subsample while socioeconomic status gains significance in the whole sample and the more skewed subsample.

Turning to the variables measuring outside aid to the school districts we find that when the property tax rate is the dependent variable the coefficient of Title I aid loses what little significance it possessed in the earlier results. These results along with the low simple correlation of Title I aid with property wealth (-.03) and high correlation with Title I aid with income (-.46 with median income) adds more support for the idea that the criteria for "educationally deprived" are highly related to measures of income. While the coefficient of Title I aid loses significance when the property tax rate is substituted for the income tax rate the variable of dollars of other federal aid per pupil increases in significance with a significantly negative sign in the whole sample and more skewed subsample regressions. Again, where the coefficients of the subsidy variables are significant, their signs are negative suggesting that aid goes where the school district imposes relatively low tax rates on itself. However, some of the non-Title I aid is given to compensate school districts for the

"impact" of location of transient federal employees in their school district. The high correlation of non-Title I aid with proportion of renters (+.46) is consistent with this.

The unemployment rate variable continues to have coefficients that are insignificantly different from zero when the property tax rate is substituted for the income tax rate. Since tax rates and assessed values do not change quickly we would only expect a negative relationship between the unemployment rate and tax rates on property if the unemployment rate were close to the normal rate for the school district or if the unemployment in the school district followed a cyclical pattern so that the observed unemployment rate was anticipated.

Table IV-11 reveals that there is little evidence that size of the community measured in number of resident members has any influence on tax rates on property. Similar conclusions were reached with the income tax rate regressions. The coefficient of the variable resident members was significant and negative in one of the three regressions with the income tax rate but is insignificant in all three regressions with the property tax rate as dependent variable.

Finally, looking at the variables included to measure the effect of the type of community on the tax rate we see that the school districts classified as

metropolitan core seem to prefer tax rates on property that are significantly higher than those preferred by rural areas. This is consistent with results for this variable that are shown in Table IV-3 when the income tax rate was the dependent variable. When the property tax rate is the dependent variable we also observe that towns appear to prefer slightly higher tax rates than those people in rural areas, at least for the observations in the more skewed subsample.

In summary, we see from Tables IV-3 and IV-9 that the substitution of the property tax rate for the tax rate on income reduces the number of variables that are significant and the percentage of variation for which the independent variables account. This provides support for our choice of income as the crucial variable in determining tax rates rather than the amount of property a community has.

Tax Preferences with Mean Income As Independent Variable

The regressions in Table IV-12 involve the tax rate on income as the dependent variable with the mean income substituted for median income. Our analysis in Chapter II centered on the importance of the median voter in a voting system where a simple majority rules so we stated our regression equation in terms of the median income. If the distribution of income were symmetrical,

Table IV-12.--Regression Results with the Tax Rate in Dollars per Thousand Dollars of Income as Dependent Variable and Mean Income as Independent Variable.

Independent Variable	Whole Sample	More Skewed Subsample	Less Skewed Subsample
Intercept	75.828 (14.376)***	30.213 (17.433)*	121.374 (28.107)***
Mean Income ($1000)	-4.241 (.805)***	-3.516 (.832)***	-8.644 (3.645)**
Mean Income Squared	.708 (.018)***	.048 (.018)**	.228 (.165)
Standard Deviation of Income	-.294 (.447)**	.382 (.547)	-.448 (.785)
Skewness	-.163 (.044)***	-.026 (.054)	-.235 (.106)**
Prop. of Families with Children	-26.273 (10.618)**	-2.432 (12.728)	-34.333 (16.468)**
Prop. of Families with Older Heads	-66.146 (14.542)***	-25.974 (18.253)	-83.115 (21.660)***
Prop. of Students in Private Schools	-8.674 (5.128)*	-8.974 (6.214)	-5.154 (7.762)
Prop. of Voters Renting	-6.744 (6.063)	-2.208 (6.675)	3.039 (11.276)
Prop. Population Black	31.302 (6.468)***	12.067 (8.711)	31.934 (8.612)***
Proportion Native Born	-24.282 (5.049)***	-7.783 (6.336)	-24.839 (8.011)***
1,000's of $ of SEV per Family	2.523 (.128)***	1.996 (.167)***	3.114 (.212)***
1,000's $ of Nonres. Prop./Family	-1.904 (.260)***	-1.206 (.357)***	-2.411 (.377)***
$ Title I Aid per Pupil	-.023 (.040)	.044 (.048)	-.119 (.060)*
$ Other Federal Aid per Pupil	-.016 (.021)	-.034 (.021)	-.032 (.047)
Prop. Property Nonresidential	23.597 (5.092)**	13.135 (7.145)*	26.055 (6.608)***
Unemployment Rate	9.806 (11.481)	-3.573 (13.778)	-10.962 (17.608)
Numer of Resident Members	-.050 (.027)*	-.039 (.026)	.239 (.171)
Socioeconomic Status	.210 (.187)	.367 (.217)*	-.059 (.300)
Metrocore	5.117 (2.565)**	9.476 (2.775)***	-2.198 (5.159)
City	1.546 (1.769)	1.821 (1.778)	2.541 (4.293)
Town	-.416 (.943)	-.619 (1.122)	-1.116 (1.448)
Urban Fringe	1.083 (1.259)	1.983 (1.638)	-.760 (1.780)
Number of Observations	494	278	216
R^2	.80	.81	.86
Mean Squared Error	53.900	41.726	48.254

*Significant at less than 10 percent level.

**Significant at less than 5 percent level.

***Significant at less than 1 percent level.

then the mean and median values of income would be equal. Thus, we were curious whether the median income would perform better than mean income. Table IV-12 shows the regression results with mean income. The value of R^2 for the regressions in Table IV-12 are less than one percentage point different than those shown in Table IV-3 and the number of significant coefficients rises by one for the more skewed subsample while falling by one for the less skewed subsample. Since the simple correlation between the two measures of average income is +.94 this is not surprising. Comparing the coefficients in Table IV-3 with those in Table IV-12 we can see that only one of the coefficients is of different sign, the coefficient of the standard deviation of income in the more skewed subsample. However, neither coefficient is significantly different from zero.

The significance of the income variables changes somewhat when mean income is substituted for median income. The ratios of the coefficients of mean income to their standard deviations are larger than those for median income in the whole sample and the more skewed subsample but smaller in the lew skewed subsample. The variable of the squared value of mean income turns out to be significant in the more skewed subsample while median income squared was not. However, mean income squared is not significant in the less skewed subsample while the

coefficient of median income is. Also the significance level of the standard deviation of income rises to better than 5 percent in the whole sample when mean income is used. Finally, the variable measuring skewness becomes insignificant in the more skewed subsample and declines in significance in the less skewed subsample from better than 1 percent to just better than 5 percent. One pattern emerges from these numbers. In terms of the average income and average income squared variables mean income performs better in the more skewed subsample and the whole sample while median income performs better in the less skewed subsample. This is not what we would have expected since this suggests that the importance of median income is larger than mean income only in the sample where median income and mean income are less divergent. Of the other variables we can notice that when the mean income is used as an independent variable the percentage of private school enrollment becomes significant at better than the 10 percent level and is negative while it was insignificant in all of the regressions in Table IV-3.

Summary and Conclusions

In this chapter we have presented a number of estimates of relationships with the tax rate supported by communities. In the next chapter, we will summarize what we have tried to do and what we have found. Then we will indicate some implications of our research.

CHAPTER V

SUMMARY AND CONCLUSIONS

The primary concern of this research has been the effect of the distribution of income on the demand for public education by school districts. In assessing the appropriateness of the present method of financing public schools, previous researchers have assumed either that the distribution of income was unimportant, or that the income distributions of school districts were not significantly different from each other, or used the Gini coefficient as a measure of the income distribution. For reasons we will indicate below, none of these is a satisfactory treatment of the role of the distribution of income in influencing the tax rate that a simple majority of the people are willing to support. As compared to these efforts, we wanted to analyze how the distribution might theoretically affect the preferred tax rate, and then assess whether measures of the income distribution and the tax rate are empirically related.

We noted at the beginning that the taxes that provide local financing for public education are approved

by a vote of the people in which a simple majority of the voters decides whether the tax rate is acceptable. Thus, there is a citizen whose vote is crucial. We have called this voter the median voter. The vote of the median voter is influenced by many factors, one of which is likely to be income. To capture the influence of income on the vote of the median voter, and therefore to estimate the determinants of the demand for education, it has been customary for researchers to include either the average or median income of the community as a variable.

It does not surprise us to find that previous authors have found average income to be important in influencing the tax rates that are approved, especially to the extent that the income distributions of school districts are symmetrical. For an income distribution to be symmetrical requires that the proportion of people be equal for each pair of values of income equally above and below the mean value of income. If this were the case, the mean income and the median income would be the same, and the behavior of the median voter could be described by either variable. Then, if all voters received equal benefits and had the same preferences, the voter with mean income would be the voter who decided whether the tax rate would be approved.

Although the assumption of symmetry is consistent with an unequal distribution of income, it is not

consistent with a distribution whose median is different from its mean. But such a situation occurs when the income distribution is skewed, and incomes in a community are typically observed to be distributed with some degree of skewness as well as being unequally distributed. We argued that with a majority voting system, if income affects the tax rates that a school district is willing to support, then the shape of the distribution of income might also affect the tax rate. Our look at the literature revealed that the authors of only two articles had considered the effect of the distribution of income on the tax rate. One author used the Gini coefficient as a measure of the inequality of income and found that the Gini coefficient was not statistically related to per capita expenditues on publicly-provided goods. Although the Gini coefficient is influenced by the amount of skewness, the income distribution can be unequal without being skewed. Again the extent to which the income distributions are skewed may make a difference in the outcome of the vote.

The other research which considered the distribution of income proved that the median income was the appropriate measure to capture the influence of income on the demand when the distributions of income of communities are proportional to each other and then assumed that the distributions were proportional when estimating

the demand for education. This assumption of proportional income distributions requires that distributions of income of school districts be equally skewed. This is clearly an unrealistic assumption. However, even if it is unrealistic, the differences in skewness that do exist may not have a statistically significant effect on the tax rate.

In Chapter II we proceeded to analyze how skewness of the income distribution might affect the tax rate. We found that our conclusion depended upon the nature of the tax system, which might be proportional, regressive, progressive, or a combination of the three, and the relationship between the level of income and the tax rate that individuals would prefer, what we called the tax preference curve. When we assumed that the tax system was proportional, we found that the degree of skewness of the income distribution would affect the tax rate if the tax preference curve were nonmonotonic, that is, if the preferred tax rate were not always falling as income rises or not always rising as income rises. When we allowed for the possibility that the tax system might be progressive or regressive, we found that the degree of skewness of the income distribution would affect the tax rate unless the tax preference curve was linear. Of course, either of these assumptions about the tax

preference curve is restrictive, and there is no reason to believe that the tax preference curve is linear or even monotonic.

We also recognized that not all members of the community would receive the same benefits and bear the same costs of the taxes levied by the community. For instance, those without children would receive relatively low direct benefits from elementary and secondary education, while those who own relatively large amounts of property might bear relatively high costs. We analyzed how the presence of people receiving unusual benefits or bearing unusual costs might affect the tax rate. On the basis of our analysis, we decided to include variables in our regression such as the proportion of private school enrollment, the proportion of families headed by older people, and the proportion of property that is nonresidential.

Since our analysis suggested that the degree of skewness of the income distribution might affect the equilibrium tax rate,[1] it remained to assess whether and how the degree of skewness affects the tax rate. In Chapters III and IV we presented the relationships between the tax rate and skewness as well as those between the tax rate and the variables measuring the benefit

---

[1]The equilibrium tax rate is that tax rate which would just be approved by a simple majority of the voters.

characteristics of the voters in the community. To estimate the relationships, we used cross-section data for 494 school districts in the State of Michigan for 1970.

We attempted to estimate the effect of skewness in three different ways. First, a measure of skewness was included as an independent variable in a linear regression equation. This revealed that the higher the degree of skewness, that is, the more the families were concentrated below the mean family income, the lower the tax rate the community appeared to be willing to support.

Second, the sample of school districts was divided into two subsamples on the basis of the degree of skewness. A degree of skewness was chosen arbitrarily and 278 communities whose skewness was greater than or equal to .1 were formed into what was called the more skewed subsample and 216 communities with skewness less than .1 were formed into a subsample called the less skewed subsample. Two separate regressions were calculated revealing that, as before, the coefficient of the skewness variable was significant. Furthermore, the regression for the less skewed subsample yielded more variables with significant coefficients, and the variation in the independent variables seemed to be more closely associated with the variation in tax rates in that subsample. (The coefficient of determination was .86 for the less skewed subsample while it was .81 for the more skewed subsample.) A

statistical test also suggested that the two subsamples are structurally different.

The third approach employed to test for the influence of skewness was the use of interaction variables. The results suggested that the primary effect of skewness is through its effect on the other variables since the relationship between the tax rate and skewness became insignificant, while the relationships between the tax rate and four of the ten interaction variables were significant.

At this point we concluded that there was good evidence to support the conclusion that the school districts whose income distributions were more skewed tended to support lower tax rates. That is, school districts with relatively large proportions of people below the average income level for their district appear to support lower tax rates. However, consistent with results of previous research, we found that school districts with relatively low median income appear to support higher tax rates, spending a larger proportion of their income on public education. Thus, our evidence suggests that the effects of skewness and the level of median income on the tax rate are in the opposite direction.

Looking at the variables measuring the extent to which the voters will receive unusually high or low benefits from public education, we found that the school

districts with relatively large proportions of families with heads of households 65 years or over appear to vote for lower tax rates. However, there appeared to be no evidence that the presence of parents whose children attend private schools had a statistically significant effect on the tax rate. Similarly, the proportion of families with children was significantly and inversely related to the tax rate even though such families are presumed to receive relatively high benefits. Some of this inverse relationship might be accounted for by the positive intercorrelation of the variable of proportion of families with children with the variable of median school district income and the inverse relationship between median income and the tax rate on income. Thus, families with children are likely to have higher family income and may spend more on public education even at the lower tax rate on income.

Those who live in rented housing may feel that property taxes are borne by the owners of the property and not by the occupants. Indeed, they may be right. As a result, it is argued that renters may be relatively willing to support property taxes. We included a measure of the proportion of renters as a variable to estimate its possible influence. Our evidence suggested that renters do not behave differently, although we cannot tell whether this is because renters think they bear part of the tax or not.

Since public schools are typically financed locally by the property tax, we examined the relationship between tax rates on income and various measures of property. We obtained mixed results. We found that those communities with higher dollars of property wealth per family appeared to be willing to support higher tax rates on income, and that those with higher proportions of property classified as nonresidential were also willing to support higher tax rates while those with higher dollars of nonresidential wealth per family appeared to be less willing to support tax rates.

Of the variables included to measure the impact of noneconomic characteristics of the voters, we found evidence that suggested that communities with larger proportions of Black families and those with larger proportions of foreign born tend to support higher tax rates. However, this latter result need not imply that foreign born are more public-regarding since they may be receiving relatively large private returns to education.

Finally, we found that the unemployment rate did not have a statistically significant effect on the tax rate on income. We concluded that this might have resulted from measuring the tax rate in terms of current income. Since the year to which the data correspond was a year of unusually high unemployment we argued that current income might have been unusually low.

Although skewness did turn out to be an important variable as hypothesized, we found little support for our contention that median income was a more appropriate variable than mean income. We replaced the values of median income in our regression equation with those of mean income, keeping all other variables and values the same, and estimated the coefficients. Comparison of the two regression results revealed that mean income performed slightly better in the two samples in terms of the numbers of significant coefficients while the values of the coefficient of determination were essentially the same for the two regressions. Mean income also appeared to perform better in the more skewed subsample, while median income performed better in the less skewed one. It is possible that the high correlation between the values of mean and median income might have caused this lack of difference in performance. Perhaps samples with greater skewness might have revealed bigger differences in performance.

The main purpose of this research was to assess the importance of the effect of skewness of the income distribution on the tax rate that the people in a school district will support. We will close by presenting a brief summary of our findings on this issue.

Since we have no direct estimate of either the tax preference function or the tax structure that exists in the school districts, we cannot say whether the negative

relationship that we found between skewness and the tax rate is caused by a positively sloped tax preference curve or a regressive tax structure. However, our data suggest that the variation in skewness of income distributions between communities is sufficiently large and important that failure to consider skewness directly as an independent variable or indirectly through inclusion of variables it affects would have resulted in ommission of a statistically significant effect on the tax rate voted by communities. The evidence suggests that assuming that income distributions of communities are proportional to each other, as one piece of research does, is not realistic, and therefore, using median income as the only variable is likely to lead to erroneous estimates of demand curves for publicly provided goods and their elasticities.

At present, communities choose a single tax rate on property which may result in differences in tax rates on income due to differences in property to income ratios for different income levels or due to assessment practices. For a given median community income, the negative relationship between skewness and the tax rate is consistent with low income voters being less willing to vote for high tax rates. However, it is also consistent with such voters being willing to vote for higher tax rates than high income voters, but being confronted by a regressive tax system that would impose tax rates that are even higher

at their income level. If the property tax is a regressive tax and if this is the appropriate explanation, then a modification in the tax system that would make it less regressive would result in a higher equilibrium tax rate.

SELECTED BIBLIOGRAPHY

SELECTED BIBLIOGRAPHY

Books

Aaron, Henry J. Who Pays the Property Tax, A New View. Washington, D.C.: The Brookings Institution, 1975.

Arrow, Kenneth. Social Choice and Individual Values, 2nd edition. New York: John Wiley and Sons, Inc., 1963.

Bronfenbrenner, Martin. Income Distribution Theory. Chicago: Aldine-Atherton, 1971.

Chou, Ya-Lun. Statistical Analysis. New York: Holt, Rinehart and Winston, Inc., 1969.

Downs, Anthony. An Economic Theory of Democracy. New York: Harper and Row, 1957.

Hunter, Floyd. Community Power Structure. Chapel Hill, North Carolina: University of North Carolina Press, 1953.

Kane, Edward J. Economic Statistics and Econometrics. New York: Harper and Row, Inc., 1968.

Kimbrough, Ralph. Political Power and Education Decision-making. Chicago: Rand McNally and Co., 1964.

Kmenta, Jan. Elements of Econometrics. New York: The Macmillan Company, 1971.

Levin, Henry, editor. Community Control of Schools. Washington, D.C.: The Brookings Institution, 1970.

Maxwell, James A. Financing State and Local Governments, revised edition. Washington, D.C.: The Brookings Institution, 1969.

Metcalf, Charles E. An Econometric Model of the Income Distribution. Chicago: Markham Publishing Company, 1972.

Miller, Roger LeRoy. Economics Today-The Micro View. San Francisco: Canfield Press, 1974.

Netzer, Dick. Economics of the Property Tax. Washington, D.C.: The Brookings Institution, 1966.

Perlman, Richard. The Economics of Education. New York: McGraw-Hill Book Company, 1973.

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

Rectenwald, Horst C. Tax Incidence and Income Redistribution, An Introduction. Detroit: Wayne State University Press, 1971.

Stearns, Harr L. Community Relations and the Public Schools. Englewood Cliffs, New Jersey: Prentice-Hall, 1955.

Articles and Periodicals

Barlow, Robin. "Efficiency Aspects of Local School Finance." Journal of Political Economy 78 (September/October 1970): 1028-1040.

Barr, James L., and Davis, Otto A. "An Elementary Political and Economic Theory of the Expenditures of Local Governments." Southern Economic Journal XXXIII (October 1966): 149-165.

Barzel, Yoram. "Private Schools and Public Finance." Journal of Political Economy 81 (January/February 1973): 174-186.

Bergstrom, Theodore C. "A Note on Efficient Taxation." Journal of Political Economy 81 (January/February 1973): 187-191.

Bergstrom, Theodore C. and Goodman, Robert P. "Private Demands for Public Goods." American Economic Review LXIII (June 1973): 280-296.

Birdsall, William C. "A Study of the Demand for Public Goods." In Essays in Fiscal Federalism, pp. 235-294. Edited by Richard A. Musgrave. Washington, D.C.: The Brookings Institution, 1965.

Bishop, George A. "Stimulative versus Substitutive Effects of State School Aid in New England." National Tax Journal 17 (June 1964): 133-143.

Black, Duncan. "On the Rationale of Group Decision-Making." Journal of Political Economy 56 (February 1948): 23-34.

_____. "The Decisions of a Committee Using a Special Majority." Econometrica 16 (July 1948): 245-261.

Booms, Bernard H., and Hu, Teh-Wei. "Toward a Positive Theory of State and Local Public Expenditures: An Empirical Example." Public Finance 26 (Number 3, 1971): 419-436.

Borcherding, Thomas E., and Deacon, Robert T. "The Demand for the Services of Non-Federal Governments." The American Economic Review LXII (December 1972): 891-901.

Bowen, Howard R. "The Interpretation of Voting in the Allocation of Economic Resources." Quarterly Journal of Economics 58 (November 1943): 27-48.

Break, George F. "The Incidence and Economic Effects of Taxation." In Blinder, Alan S., et al. The Economics of Public Finance. Pp. 119-240. Washington, D.C.: The Brookings Institution, 1974.

Brown, Peter G. "On 'Exploitation.'" National Tax Journal XXIV (March 1971): 91-96.

Buchanan, James M., and Goetz, Charles J. "Efficiency Limits of Fiscal Mobility: An Assessment of the Tiebout Model." Journal of Public Economics 1 (April 1972): 25-43.

Chow, Gregory C. "Tests of Inequality Between Sets of Coefficients in Two Linear Regressions." Econometrica 28 (July 1960): 591-605.

Davis, Otto A. "Empirical Evidence of Political Influences Upon the Expenditure Policies of Public Schools." In the Public Economy of Urban Communities. Pp. 92-111. Edited by Julius Margolis. Baltimore: Johns Hopkins Press, 1965.

Edelson, Noel M. "Efficiency Aspects of Local School Finance: Comments and Extensions." Journal of Political Economy 81 (January/February 1973): 158-173.

Horowitz, Anna R. "A Simultaneous-Equation Approach to the Problem of Explaining Interstate Differences in State and Local Government Expenditures." Southern Economic Journal XXXIV (April 1968): 459-476.

Mieszkowski, Peter M. "On the Theory of Tax Incidence." Journal of Political Economy 75 (June 1967): 250-262.

Mueller, Dennis C. "Public Choice: A Survey." Journal of Economic Literature XIV (June 1976): 395-433.

Neenan, William B. "Suburban-Central City Exploitation Thesis: One City's Tale." National Tax Journal XXIII (June 1970): 117-139.

_____. "On 'Exploitation': A Comment." National Tax Journal XXIV (March 1971): 97-99.

Paglin, Morton. "The Measurement and Trend of Inequality: A Basic Revision." American Economic Review LXV (September 1975): 598-609.

Riew, John. "Economies of Scale in High School Operation." Review of Economics and Statistics XLVIII (August 1966): 280-287.

Tiebout, Charles M. "A Pure Theory of Local Government Expenditures." Journal of Political Economy 64 (October 1956): 416-424.

Wilson, James Q., and Banfield, Edward C. "Voting Behavior on Municipal Public Expenditures: A Study in Rationality and Self-Interest." In The Public Economy in Urban Communities. Pp. 74-91. Edited by Julius Margolis. Baltimore: Johns Hopkins Press, 1965.

Public Documents

Michigan Statistical Abstract, Division of Research, Graduate School of Business Administration, Michigan State University, East Lansing, Michigan: Michigan State University Press, 14th edition, 1976.

U.S. Bureau of the Census, Census of Population: 1970, General Social and Economic Characteristics. Final Report PC(1)-C24 Michigan.

U.S. Bureau of the Census. Income Distribution in the United States. By Herman P. Miller (A 1960 Census Monograph). U.S. Printing Office, Washington, D.C., 1966.

U.S. Department of Health, Education and Welfare. Office of Education. Parental Involvement in Title I ESEA, Why? What? How? U.S. Government Printing Office, 1972.