AN EMPIRICAL INQUIRY INTO THE EFFECT OF DIRECT AND INDIRECT VOTING STRUCTURES ON THE EFFICIENT PROVISION OF PUBLIC GOODS

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PREFACE

This study is concerned with analyzing the effect of different voting structures upon the efficient provision of a public good. The primary objective is to determine, empirically, whether benefit-cost ratios for public elementary and secondary education will differ between indirect and direct political voting systems. A one-way analysis of variance is used in the analysis which covers four separate time periods within the two polities selected for study.

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CHAPTER I

THE RESEARCH PROBLEM

Introduction

Public economists Richard and Peggy Musgrave (30) describe the fiscal functions of government as falling within the confines of three broad areas: allocation, distribution and stabilization. The first of these areas encompasses those governmental procedures which determine the level of resources devoted to providing social goods such as national defense or public highways.

Through acts of budgetary planning, the government also takes steps to alter society's income distribution patterns to arrive at what decisionmakers deem a "fair" state of distribution.

The stabilizing function of government encompasses those actions undertaken to maintain economic stability, whether it be through encouraging high levels of employment, minimizing increases in prices or stimulating productive growth.

Of the three aforementioned functions, the first, that of allocation, is the concern of this paper. While the field of taxation is often mentioned in league with the two other fiscal functions (i.e., using tax policy as a redistributive tool of income or as a stabilizing factor in economic management), it must be pointed out that taxation, in its very simplest construct, serves as a revenue source for the governmental provision of social goods.

The taxpayer, under the allocative framework, plays the dual roles of both producer and consumer: serving not only as the supplier of the tax revenues that purchase social goods but also as the consumer of the social goods so provided.

The nature of social goods is such that, as will be explained shortly, the private marketplace cannot provide them; rather, such goods must be funded through a political voting framework. This paper attempts to determine whether differences in the political voting structures under which the individual/producer provides tax revenues result in differences in the costs of the social goods to the individual/consumer.

The intent of this paper is to examine the efficient use of scarce resources by the public sector; to determine what impact political structure has upon this efficient use of resources. More specifically, the task is to isolate a voting system that is efficient in terms of setting tax expenditure levels for social goods.

Social Goods

Social goods are those that offer the consumer nonrival consumption benefits: an individual's partaking of a social good does not reduce, or rival, the amount of the good available to others. Frequently, social or public goods also share the characterization of being nonexcludable; that is, the costs of restricting access to social goods may be larger than the costs of maintaining such goods on an available to all basis.

As an example of a social good, let us look at the national park system in the U.S. One person's hiking through a forest does not reduce (barring vandalism) the amount of national forest left for a subsequent hiker to enjoy. Similarly, the costs associated with restricting entry to the forest (hiring additional rangers for enforcement of restrictions or constructing physical barriers to limit entry) may prove greater than operating the forest as an open preserve.

The basic economic market structure with its accompanying supply and demand tenets is well suited to the provision of private goods.[1] The structure is founded on exchange, a process which can occur only where exclusive title to property exists. However, the rights to social goods, such as the benefits received from highway construction or water treatment facilities, are not exclusive to any one individual. In the absence of vested property rights, the economic marketplace breaks down.

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[1]Those goods to which property rights, or exclusivity of ownership and rivalness of consumptive benefits may be assigned.

Or, as the Musgraves (30) put it:

> Since the benefits [from social goods] are available to all, consumers will not voluntarily offer payment to the suppliers of social goods. The linkage between producer and consumer is broken and the government must step in to provide such goods (p. 8).

In the provision of social goods, the political process acts as surrogate for the marketplace. Purchase of goods with greenbacks is replaced by purchase with votes and decisionmaking through the ballot box substitutes for preference revelation through the market. With the knowledge that they must comply with the collective decisions reached through the ballot box, individuals will find it in their interest to vote for the option closest to their own choices, revealing, in this way, their personal preferences.

Voting as Preference Revelation: The Political Science Approach

Political scientists have spent much time documenting that preference for social goods is revealed through the act of voting. Typically, researchers such as Wilson and Banfield (53) have illustrated the types of public goods demanded by specific groups of voters by focusing on voter actions in referenda elections. A profile of the individual voter emerges when socioeconomic characteristics of the voting population are linked to election outcomes.

While the political scientists have focused on defining the mix of public goods preferred by voters of stipulated socioeconomic backgrounds, their studies have devoted little time to assessing the efficiency at which the public sector provides such goods or, for that matter, to assessing the effectiveness of the social goods so provided.

Effectiveness and Efficiency of Social Goods Provision

Researchers, in assessing the effectiveness of the public sector's provision of social goods, have focused on the procedures through which voter-determined expenditures are transformed into public goods of a specified quality. For example, the effectiveness of a state-run hospital might be assessed by comparing its success rate on certain operations (or conversely, its mortality rate) with that of private hospitals operating under similar budget constraints.

Such attempts at determining the effectiveness of social goods do little, however, to quantify the efficiency of government's provision of such goods. To fill this void, economists have done much research into the efficient provision of social goods.

In its simplest construct, efficiency in the funding of public goods characterizes the process through which monies are assigned to those public projects which will produce dollar benefits in excess of their dollar costs. Where more than one project competes for public funds, the efficient decisionmaker will commit funds to the project providing the highest rate of return, *ceteris paribus*.

Thus, like those dealing with effectiveness in public goods provision, studies on efficiency have focused on public expenditures in what might be termed an ex-post ballot box approach. Both areas assume that the political voting structure from which funding decisions emerge is not a determining factor in the amount of funding available for public goods, or, in other words, the studies assume that the voting structure can be held constant for purposes of analyzing the application of voted funds to the procurement of public goods.

The political scientists, in contrast, viewed the sociological background of the individual voter as a determining factor in both the quantity and type of public goods made available through voting. In this ex-ante ballot box approach, the voting structure is agin regarded as invariant: acting only as a political medium through which individual desires in the guise of votes become transformed into concrete public projects.

Nature of the Problem

None of the three areas of study heretofore mentioned has dealt with the political voting structure itself as being a possible determinant of the level of expenditures for public goods. Indeed, the only area of research to give mention to the political voting structure was that done by the political scientists, who typically selected referenda elections for their study. In their research, the referenda structure was of interest only because it simplified the correlation of socioeconomic characteristics of the voters with the object of expenditure. No attempt was made here (nor in the other two areas surveyed) to question whether a difference in the political voting structure itself through which decisions on the provision of public goods were made would affect the efficiency of providing such goods.

That a change in the political voting structure does affect the level of expenditures for public goods was demonstrated quite recently by Proposition 13 in California. There, property tax rate-setting authority was assumed by the voters, through an initiative action. Where the determination of tax rates had previously been a function of the legislature, the initiative action of Proposition 13 made it a function of the citizenry directly. Proposition 13 has been seized on by many in the media as a very clear illustration of the differences in expenditure levels (funded by property taxes) that can result when the political voting system concerned with tax rate-setting is altered from that of an indirect democracy to that of a direct democracy.

In effect, the voters in California, under a political structure which allowed them to vote directly on the issues, established a level of property taxation different from that previously chosen by their state legislators. While much effort has been spent detailing the "goods" and "bads" of the hypothesized after-effects of Proposition's 13's passage (the spending of state surplus funds delaying any real measurement of the after-effects until fiscal 1980-81) and in listing the "causes" of the initiative action, little time has been spent on examining the initiative process as a vehicle through which the individual voters may exercise the same tax-setting responsibilities (and hence, the same setting of funding levels for public goods) as the legislators.

The initiative itself is a political process by which the voters themselves determine the content of a ballot issue and, through a petition process, place it on the ballot for voter approval or disapproval. The initiative is permitted by the constitutions of twenty-one states (12, p. 243).

The referendum refers to a political process in which a legislative body determines the contents of a ballot issue and places the issue on the ballot for voter approval or disapproval. The constitutions of twenty-one states provide for compulsory referenda for such issues as debt issuance or state constitutional amendments (19, p. 125). Referenda issues tend to appear with more frequency than those of the initiative, perhaps because the former do not require petition signatures of voters for placement of the issue on the ballot and, in addition, are legally mandated.

Both the initiative and the referendum processes, however, share the distinction of being political structures which enable the individual voter to participate directly in the political process. The voter, in a sense, is given the opportunity for self-legislation; citizen sentiment which may be given only indirect reflection through the legislative process has the theoretical possibility of being voiced directly through the initiative/referendum processes.

Through direct voting on a taxing scheme, the individual voter may indeed have a greater possibility of influencing the outcome of the electoral process than might be true had the issue been decided by legislators. The legislative process is, after all, an indirect means of expressing the public's desires: legislators are elected under the premise that they will represent the desires of their constituents; whether their subsequent actions in office truly represent those desires may often depend on whose opinion is solicited.

The prospect of any choice being made available to the individual as to the level of expenditures for public goods may be contingent upon that person's ability to make her or himself heard (i.e., to express preferences) within the confines of the political structure.

As the political scientists have illustrated, voter preference for collective goods is revealed through election results. However, the political scientists focused only on referenda election results. It should be pointed out that in a differently constructed polity, that is, in one where the expenditure levels are determined by the legislature, the individual's choice of public goods becomes a two-step process: through voting, the taxpayer chooses a representative (ideally, one whose preferences coincide with those of the voter) who in turn selects the level of government expenditures on public goods.

The question then becomes: if the voters are allowed to select directly the level of taxation desired (and by so selecting, fix the level of expenditures for public services provided by those tax funds), will they select a level different from that which would be selected by their representatives? And secondly, will the level of benefits received from those public goods provided under a direct voting political system differ from those received under an indirect system?

The process of answering such questions is greatly aided by identifying an area of public goods provision where it is relatively easy to trace tax dollars to their object of expenditure. One situation where this occurs is in the area of education. The earmarking of tax revenues to supply the specific public good of education makes the task of assessing political system efficiency much more feasible.

Objective of This Study

It is the objective of this study to determine the efficiency of providing a specific public good, that of public elementary and secondary education, through differently constructed political voting systems. An efficiency criterion will be determined independently of ex-ante calculations of lifetime earnings attributable to education, thus minimizing some of the weaknesses heretofore inherent in efficiency studies on public education.

Need for This Research

Support of education consumes an enormous portion of the public sector budget. In 1977, public sector expenditures for education totaled $110.6 billion and accounted for over 27% of total public expenditures other than defense (47, p. 27).

Education, as Cohn (10, p. 3) points out, is "the largest single industry in the U.S." In 1977, it employed 2.4 million teachers, involved over 59 million pupils (51, p. 6) from kindergarten through college and spent nearly 8% of the nation's resources, or GNP (51, p. 27).

Given the magnitude of both the monetary and physical investment in the field of education, any analysis directed towards improving the efficiency of providing this public good could result in a substantial savings of scarce resources.

This study will empirically determine whether differences in political voting structures result in differences in the efficient provision of public elementary and secondary education. The study may offer confirming or contradicting support to the much touted ill effects of a direct democractic system (the system often mentioned in conjunction with taxpayers' revolts).

In addition, this study may illustrate the need for accountants to become more involved in the area of policy-making within the field of taxation. Too often, accountants have resigned themselves to the position of being policy-takers in the area of taxation--implementing rules legislated by other professions and inquiring into the economic effects of such legislation only after its passage into law. Tax accountants might be better advised to spend less time arguing about the proper way to administer previously established ends of an economic policy such as taxation and to spend more time in learning how to structure the economic and political means such that desired ends can be achieved.

Study of the political systems under which taxing policies are presently being administered is but one variable in developing an accounting approach to the planning of tax policy; it is evident that much more work in tax policy needs to be done if accountants are to serve as more than Code-interpreters.

Limitations of the Study

In terms of limitations, it must be pointed out that this study is not designed to be applicable on a national scale. Since the research was undertaken on a county-wide basis within two mid-western states, extensions of the research may be limited to those states which finance their public elementary and secondary schools at the local level through property taxes and to those states which can be identified as having different local political structures.

Extension of the methods of this study also depends on the ability of the researcher to trace tax revenues to their objects of expenditures. Such earmarking of tax revenues to expenditures as was evident in this study for the public good of education may not be present in situations where public goods are financed by general funds, for example.

Lastly, this study concentrates on developing a state to state comparison of efficiency and, as such, ignores intra-state differences that may exist in both the ability to fund public education and the need to provide for it.

Overview of Subsequent Chapters

Chapter II of this study details three approaches taken by other researchers in their study of the provision of public goods and concludes with a statement of the approach to be followed in this study.

The research hypotheses and the research methodology are contained in Chapter III; while Chapter IV details the empirical results of the research.

As the final chapter, Chapter V contains a summary of the research effort, presents the conclusions reached by this author and offers suggestions for further research in the field.

CHAPTER II

THE LITERATURE REVIEW

Introduction

Past research efforts focusing on the provision of public goods have tended to take one of three approaches: (1) a behavioristic approach, in which election results (voter behavior) are explained by reference to certain socio-economic characteristics of the voters; (2) an industrial approach, in which a production function delineates the rate at which inputs (expenditures) for public goods become transformed into outputs (public goods) and gauges the effectiveness of such a process (a cost-quality comparison); (3) an economic approach, in which present dollar expenditures for public goods are compared with the projected dollar benefits expected to be obtained from such goods.

This chapter details some of the research efforts previously conducted in each of the three aforementioned areas. The focus of this review is on those studies which, like this paper, concern themselves with the public good of education.

The Behavioristic Approach

The problem of estimating individual demands for collective goods may be approached by examining voter behavior on referenda for such goods.

Voting outcomes on the referenda are presumed to reflect the desires of the median voter, a concept which was advanced in 1943 by Bowen (8). Utilizing an analytical framework, Bowen (8) held as constant each community member's share of the total cost of a public good, which guaranteed that an individual's preferred level of output for that good would occur at the point where that person's marginal valuation and tax cost for the good were equivalent.

In Bowen's (8) treatise, the final outcome of successive ballot issues offering incremental increases in outlays for a public good was at the median of the individually preferred levels of output. Thus, the equilibrium level of public spending would exactly satisfy the public service demand of the median voter.

Black (7), in The Theory of Committees and Elections, stressed that a majority rule of voting would produce an equilibrium outcome when voter preferences were single-peaked in nature. This equilibrium outcome, in turn, would exist at the median of the individually preferred outcomes.

Despite the apparent severity of the assumptions Black (7) employed in his median voter public choice model (requiring all political issues to be presented in a bivariate manner, so that individual preference curves would always be single-peaked), the model did provide a vehicle for analyzing collective consumption patterns in terms of personal demands. As a result, most demand oriented public expenditure studies have been built upon the median voter premise (14, p. 210).

Both Bowen (8) and Black (7) relied upon the familiar economic market behavior assumption that the individual will behave in a rational manner in the decision-making process, i.e., would act to maximize self-interest. This self-interest assumption of the private sector was challenged by Wilson and Banfield (53, p. 869), who empirically found that voter behavior of certain classes of individuals tended to be more public-regarding and less private-regarding than that of others.

In testing the hypothesis that self-interest (defined as the maximization of family income) could successfully explain voting behavior on municipal public finance referenda, Wilson and Banfield (53) obtained certain anomalous results (in particular, finding that high income voters favored the provision of welfare services). These observations led the pair to introduce the notion of "public regardiness" as an attribute of certain classes of voters which induced them to vote against their self-interest.

Much of the evidence Wilson and Banfield (53) advanced in support of the public regardiness concept appears vague at best; it is difficult to specify what constitutes public-regarding behavior in specific instances. Later work done by Frey and Kohn (18, p. 803) refuted the public regardiness concept: "The rich do not exhibit a significantly larger percentage of yes votes than the middle or low income class". Levy's (24, p. 433) 1975 article seconds Frey and Kohn (18) by noting that wealthy persons' conservative tendencies outweighed their willingness to help those in need.

On balance, existing evidence in support of the self-interest view in public choice has been sufficiently convincing to most researchers to induce them to adopt it as axiomatic (14), (13), (37).

Subsequent research on voting behavior has adhered to the methodology employed by Wilson and Banfield (53): utilizing a mix of socioeconomic factors in a regression format to explain public choice behavior, with the latter expressed either in terms of election returns or as expenditure levels for public goods.

Birdsall (6), for example, in a study on bond finance referenda, utilized the percentage of voters favoring a referendum as a measure of the intensity of preference for the public services involved. He then related these preferences to a set of socioeconomic characteristics of the general population to obtain a voter profile.

In his 1977 work, Barkume (3, p. 583) noted that his regression model for two high school district tax rate elections "explained a substantial proportion of the observed voting pattern." Barkume's (3) study was a cross-sectional analysis which used household characteristics relating to demand for public education as independent variables in explaining tax rate election results.

Neufield (34), Deacon and Shapiro (13), Levy (27) and Mariotti (28) have also viewed voting outcomes on referenda as reflections of the demand for public goods and have used ordinary least-squares to regress socioeconomic characteristics of the population upon the election results.

While voter behavior studies have for the most part concentrated on explaining election results or the expenditures for public goods by referring to personal attributes of the voters, their reliance on certain data sources may have several shortcomings.

The socioeconomic variables of the voter behaviorists are usually derived from societal measures (i.e., U.S. Census data). The voting results from a particular election, however, may reflect the preferences of only a fraction of society. In other words, if the persons who actually cast ballots are not a representative sample of the population at large, the use of socioeconomic data on populations to analyze voting patterns may be inappropriate.

In addition, reliance on Census data as a source for demographics may "freeze" the independent variables at one point in time; if voting results from a later time are used in ordinary least squares with the same demographics, the model will have failed to capture possible changes in community characteristics during this time lapse.

Although the voter behavior studies may serve as a measure of explanation for the quantity and type of public choice demand, they do not measure the quality of the resultant collective goods provided.

In an attempt to assess this quality, researchers have focused on the transformation process through which voter-chosen levels of expenditures are translated into identifiable public goods. Such input-output studies have, in terms of the public good of education, concerned themselves most with determining what specific educational resources would produce the greatest gain in students' scholastic achievement.

The Industrial Approach

An input-output relationship between educational expenditures and educational quality may be expressed as an educational production function. Such a function quantifies the maximum amount of educational output (measured in terms of increased learning, for example) that can be produced by dollar inputs of specific educational resources.

In educational research, outputs resulting from differing levels of educational investment tend to be expressed in terms of pupil performance on standardized achievement tests. The assumption which is implicit in analyzing this relationship between expenditure and achievement is that pupil performance on standardized achievement tests provides an index of educational output, or quality.

One of the earliest attempts at assessing educational effectiveness was conducted by the New York State Department of Education from 1957-60. Data from this study were subsequently analyzed by Kiesling (1) in 1967.

Pupils participating in the New York program were first stratified by grade, socioeconomic class (as determined by their father's job) and size of school district, then given an achievement test designed for their grade level (1, p. 251).

For each grade level and socioeconomic group, the average school district achievement was regressed on average pupil intelligence, school district size and annual per pupil expenditure. The expenditure-performance relationship was strongest, Kiesling (1) found, for students in the lower grades, middle socioeconomic groups and large school districts.

In a 1963 study, Benson (1) analyzed the results of a reading comprehension test which had been administered to fifth-graders in 249 California school districts.

In addition to test results, Benson (1) collected data from published sources on school inputs and socioeconomic characteristics of district residents. These explanatory variables were then used by Benson (1) in a series of stepwise regressions on the median test score for various groupings of school districts.

Benson (1, p. 251) found that one or more of the school input variables were significant in explaining test scores in each regression; however, since he did not report regression coefficients, it is not possible to compute the percentage improvement in pupil achievement associated with an increased supply of a school variable.

Possibly the most extensive input-output study on education was that conducted by Coleman (1) under the direction of the U.S. Office of Education in 1966. The Equality of Educational Opportunity Study (which has come to be known as the Coleman Report) was based on a stratified national sample survey of over 600,000 students and their schools and homes.

Like previous input-output studies, the Coleman Report regressed a series of explanatory variables upon student achievement test scores (in this case, a verbal achievement test administered by the Educational Testing Service was used). The independent variables were grouped into categories of student attitudes, student background, school characteristics, student body characteristics and teacher traits (1, p. 253).

Because the independent variable groups were highly correlated with one another, only a portion of the variance in reading achievement scores could be assigned uniquely to a specific group of characteristics.

Using the Coleman Report's method of multiple step-wise regressions, the portion of the variance in test scores explained by an independent variables depended on the order in which that variable was entered into the regression equation. Because Coleman (1) uniformly entered student background variables into the regression equation first, he minimized the amount of test score variance attributable to the many school variables. Thus, the conclusion of the Report was that, although schools do make a difference in terms of student achievement, the primary factor in student success was that of the student's personal background.

The use of achievement test scores as a surrogate for educational effectiveness has drawn a great deal of criticism. The most serious concern with the tests is that they may not measure precisely what they purport to measure. A reading test, for example, may actually assess skills other than reading, such as reasoning or general intellectual ability. Test questions that measure reasoning may be heavily influenced by non-school factors such as home background and innate ability (29, p. 425). Such questions should not be included in a reading test which purports to measure the quality of reading instruction of a school system.

Most standardized achievement tests were not designed for the purpose of evaluating a school program's effectiveness; rather, they were geared towards measuring a student's general intellectual ability so that the school could make counseling and classification decisions.

Since standardized tests are not very sensitive to instruction and were designed to measure general intellectual ability (which is affected by non-school factors such as family background), it is not surprising, as McDermott and Klein (29, p. 426) point out, that family background (as in the Coleman Report) should correlate higher with achievescores than school expenditures.

The expenditure indices used by researchers may also be inadequate, in that they fail to adequately match specific inputs with the specific outputs being measured. A reading test, for example, can at best only measure the results obtained from a very small portion of the resources devoted to a school district's educational program. To correlate performance on reading tests with expenditures that comprise all school inputs is to use the tests for purposes for which they were never designed (29, p. 427).

In addition, any association, or correlation, between educational expenditures and achievement scores established through regression analysis represents a statistical relationship between the two variables and not necessarily a causal relationship. Thus, a statement that higher educational expenditures cause higher achievement scores is not implied and does not necessarily follow from a positive correlation between the two items.

Another defect in input-output studies is the cross-sectional nature of the research, whereby the relationship between inputs and outputs is examined at a single point in time. Such research assumes that any differences in inputs received in prior years did not have any impact on the output assessed in the study year (29, p. 430). To say that a child's reading comprehension in fifth grade is a function of educational expenditures of that year alone is to negate the influence of that student's preceding four years of eduation upon that student's reading ability.

While input-output analysis has attempted to define a cost-quality, or cost-effectiveness structure for the public good of education, it has done little in the way of assessing the efficiency aspect of educational expenditures.

The Economic Approach

Much of the work on educational efficiency has been done by economists under the structure of the traditional dollar benefit-cost approach. The commitment of funds to education is taken as a given, with the efficiency question being asked in terms of the return to the individual or society as a whole that can be expected as a result of this funding. In other words, efficiency research does not concern itself with finding alternative sources for the funds presently devoted to education.

In the benefit-cost approach to public education, the educational benefits are measured by the additional lifetime income, properly discounted to present value, that is attributable to the cost of the educational investment.

The majority of studies on the relationship between education and income use as their principal source of data the U.S. Census of Population, which classifies income of persons according to age and educational attainment. The Census provides the researcher with the chance to estimate the contribution of education to income by correlating the cross-sectional data.

As Cohn (10, p. 136) points out: "The possibility of a purely spurious correlation between education and income cannot be summarily dismissed." But Cohn (10, p. 232) is quick to note that "we have by now many studies, using different data bases, that show very similar net education to income relationships."

Weisbrod (52, p. 45) echoes Cohn (10): "There is scarcely any doubt that education does make a person more productive and does thereby increase his earning power."

The question then becomes what percentage of the differences in incomes associated with education is actually caused by education? Denison (15) uses a figure of 60%; Hines (23) cites studies indicating a range from 60 to 88%. Garms (20, p. 213), in his benefit-cost analysis of the Upward Bound program, adopted the position that a high proportion of the income differentials correlating with education levels could be caused by education, and used a figure of 75%.

In contrast, Lassiter (26, p. 19), using 1960 Census data, found regression coefficients for education that were significant but low, explaining between 39 and 52% of the variance in income in middle-age groups. Schweitzer (39, p. 325) reiterates that "it is possible to conclude that there is a small but significant component of earnings which is explainable in terms of educational attainment."

Thus, while the researchers differ on the percentage of income differentials that may be attributable to education, they all define increased future income streams of individuals as the primary benefit of educational expenditures.

This assumption that public education expenditures are made, at least implicity, with an eye to anticipated benefits, is nothing more than the rationality assumption of consumer behavior applied to public services.

The use of a rationalistic welfare-maximization model for public goods, however, does not imply that voters actually and carefully weigh costs and benefits explicitly in the process of reaching a decision on expenditure levels. Rather, the interpretation is that they behave collectively as if they were maximizing.

The economic approach to public choice does not assume that citizens are always conscious of the benefits they receive from the education of others; rather, it recognizes that citizens may not calculate the benefits of education any more carefully or correctly than consumers calculate the benefits received from a purchase of an automobile or a pair of shoes (52, p. 123).

Acting on the basis of the preceding economic assumptions and accepting the implied causality between education and future income, empirical research in the field has concentrated on quantifying the benefit-cost aspects of education.

Hanoch's 1967 study (22) on earnings and schooling correlated expected earnings of males in the U.S. with age and education, then derived internal rates of return for schooling in the U.S.

Hanoch (22) held constant a number of factors in his calculations, chiefly those of geographical region, urban or rural residence, mobility, marital status and size of family. His estimate of the total education-earnings function gives, according to Schultz (38, p. 298), "the best estimate of returns from schooling in the U.S."

Hanoch's (22) method of analysis parallels that of Hirsch and Segelhorst (24) who used multivariate analysis to study the effect of education on income, while holding the effects of other variables, such as race, sex and father's occupation constant. Hirsch and Segelhorst (24) found a significant (at the .05 level) relationship between education and income.

Wolfe and Smith (54) also found differentials between the earnings of highly educated individuals (college graduates) and those of less educated persons (non-graduates), even though both groups were similar in terms of I.Q., grades achieved and family background.

In terms of actual results, Hanoch (22) found average internal rates of return for white male high school graduates in 1960 to range from 16% (Northern region) to 19% (Southern region) with nonwhites having rates from 22% (North) to 12% (South). Hanoch (22, p. 324) notes that such rates, although "lower than is usually claimed" are still "considerably higher than rates of interest in the market and somewhat higher than average rates of return generally estimated for nonhuman capital."

Becker (5, p. 128) estimated internal rates of return for white males completing high school in the U.S. of 16%, 20%, 25%, 28% and 28% for the years 1939, 1949, 1956, 1958 and 1959, respectively.

Garms (20) found white and nonwhite males to have lifetime incomes associated with four years of high school of $478,280 and $309,765, respectively, When discounted to present value using a 5% rate, these figures became $147,951 and $99,817; with a rate of 10%, they were $66,940 and $46,323.

Criticism of the benefit-cost studies in education has been directed at their use of ex-post information to test ex-ante hypotheses. Reliance on past censuses to give data for future benefit calculations rests on the assumption that the existing pattern of economic life will continue far into the future.

Or, as Schultz (38) notes:

> Our estimates of the profiles of lifetime earnings from education are pictures of the past. They reveal ex-post supply and demand intercepts of the capabilities acquired from education. But when it comes to projecting these estimates into the future, reason, economic logic and theory and appeals to probabilities are quite imperfect in making projections that will prove to be right (p. 305).

In other words, traditional benefit-cost analysis of education suffers in that it relies on a dollar estimate of lifetime income attributable to education. Construction of such an estimate requires the researcher to anticipate all possible events which may affect an individual's earnings capacity over that person's lifetime.

The researcher must not only forecast changes in earnings which may occur from the action of inflation, but must (if a realistic figure is to be obtained) also anticipate the effect of events such as merit raises, promotions and possible job changes on lifetime earnings.

The lifetime earnings calculation also forces the researcher to stipulate personal factors for the worker: mobility factors (which might result in a different wage or pay structure), supplemental earnings possibilities from overtime or moonlighting, probability of work lapses due to strikes, lay-offs or firings, as well as the anticipated mortality date.

The resultant dollar figure for lifetime earnings which is attributable to education, although impressive in amount, may bear so little relationship to the real world that the figure's value for comparative purposes may be rather limited.

The Research Approach of This Study

This study attempts to determine the efficiency of providing the specific public good of elementary and secondary education through differently constructed political voting systems. To minimize some of the weaknesses heretofore inherent in benefit-cost models, the study will construct an efficiency criterion independent of ex-ante calculations of lifetime earnings.

Public elementary and secondary education represents an area of social goods provision where it is relatively easy to trace tax dollars to their objects of expenditure. This is because the property tax on real property, for many localities in the U.S. today, serves as an earmarked revenue source for elementary and secondary education.

Unlike income and excise taxes, then, the linkage between the imposition and expenditure side of the property tax structure is fairly easy to establish and an efficiency study of the voting structure surrounding such a tax becomes that much more feasible.

In terms of being able to isolate two different political structures under which this earmarked tax for education is imposed, the problem becomes more complicated. The tendency is for most localities to fund elementary and secondary education through voter approval of property tax rates (a referendum process where school district administrators typically structure the ballot tax issue). It cannot be overlooked, however, that localities do exist that fund such educational expenditures without submitting the tax rates to voter approval (a legislative process). Among the former groups (referendum-set tax rates), the state of Ohio is one of the most prolific in the nation in terms of submitting education tax levies to the voters for approval, having held 114 school bond elections and 600 tax levy elections in the space of three years (1970-72) (21, p. 4).

However, the state of Indiana, during the same period, held no such elections, either for school bonds or for school operating tax levies, simply because its state constitution does not require voter approval of funding processes of elementary and secondary education (49, pp. 129, 130).

This study will calculate the effective property tax rate applicable to education in each county of the two aforementioned states during four time periods. Effective tax rates for education of the counties of the two states will be compared, using a one-way analysis of variance design, to determine whether significant differences exist between each polity's setting of tax rates for the financing of education.

In addition, retention rates for elementary and secondary school systems will be determined on a county-wide basis for each of the intervals of the study; then compared using ANOVA for significant differences.

Finally, benefit-cost ratios will be constructed for each county, using the tax rates and retention rates as surrogates for costs and benefits of education, respectively. The ratios will be aggregated into state-wide benefit-cost ratios for each state for each period within the study to obtain a measure of efficiency.

The following chapter introduces the research hypotheses of this study and details the specific methodology used to test the statistical equivalents of these hypotheses.

CHAPTER III

HYPOTHESES AND METHODOLOGY

Introduction

This research effort focuses on determining whether there exist efficiency differences in the provision of public goods between differently-constructed political voting systems. As noted in Chapter I, this study of the efficiency, or costs and benefits of public goods, prompts the following research questions:

1. Will the level of taxation selected for the funding of public goods by the populace under a direct voting system differ from that level which would be set by legislators under an indirect voting system?
2. Will the level of benefits received from tax-funded public goods provided through a direct voting system differ from that level provided through an indirect system?

As the preceding chapters point out, the study of efficiency in public goods provision is simplified by focusing on those goods funded through earmarked taxes. Such is the case with public elementary and secondary education; where, at the local level, the property tax serves as the primary source of funding (43, p. 2).

The selection of the two states of Indiana and Ohio as focal areas for this study of the provision of public elementary and secondary education proceeds directly from the study's focus on differently-constructed voting systems. Under state law, Ohio school districts must submit tax levies to voter approval; in contrast, Indiana districts may levy taxes and issue bonds without voter approval (49, p. 130 and 280). Thus, in the provision of public elementary and secondary education, Ohio serves as an example of a direct voting system; Indiana, as an example of an indirect voting system.

In order for this research to focus solely on the differences in voting systems between the states of Indiana and Ohio, it was necessary to determine whether there were other demographic differences between the polities that might possibly be the cause of different levels of efficiency in the provision of education. Appendix B of this paper details the statistical steps undertaken to demonstrate that Indiana and Ohio possess the same financial ability to purchase public education in addition to evidencing the same need for purchasing such a good.

With the states of Indiana and Ohio serving respectively to illustrate the indirect and direct voting systems mentioned in the research questions, the identification of specific real-world surrogates for the costs and benefits of the public good under consideration (elementary and secondary education) became the next step in translating the research questions' implied hypotheses into statistically testable equivalents.

The Hypotheses

In specific form, the research questions of this study will be tested in the form of the following two null hypotheses:

1. The effective local property tax rate for public elementary and secondary education does not differ between the differently-constructed polities of Indiana and Ohio; that is, between a state where tax rates for education are legislatively-determined (Indiana) and one where they are voter-determined through referenda (Ohio).

   Or, H_o: No difference in effective tax rates for public elementary and secondary education between Indiana and Ohio.

2. The retention rate of public elementary and secondary education does not differ between the differently-constructed polities of Indiana and Ohio.

   Or, H_o: No difference in retention rates for public elementary and secondary education between Indiana and Ohio.

In the above hypotheses, the effective local property tax rate serves as the surrogate for the cost of public elementary and secondary education; the retention rate of public elementary and secondary schools is the surrogate for the benefits received from education. Discussion of the construction of such rates is deferred momentarily in order to focus on the time period and data elements encompassed by the study.

Time Period Encompassed by the Study

This study concerns itself with the costs and benefits (as defined in succeeding sections of this chapter) of public elementary and secondary education in the states of Indiana and Ohio during each of the four following years: 1964, 1967, 1971 and 1976. The restriction of the study to these four years arose because assessment-sales price ratios for Indiana (required in calculating the effective tax rate for education) were not available for any other years.

For 1964 and 1967, the assessment-sales price ratios for Indiana used in this study are those compiled by the Indiana State Board of Tax Commissioners. State-wide ratio studies in Indiana were discontinued, however, in 1967 (48, p. 6). The assessment-sales price ratios for 1971 and 1976 for Indiana were obtained from the 1972 and 1977 Census of Governments (44).

In order to align the data collection process in the state of Ohio with that in Indiana, state-produced assessment-sales price ratios were used in Ohio, as in Indiana, for 1964 and 1967, with Census of Governments (44) ratios being employed for 1971 and 1976. Even though the state of Ohio did generate assessment-sales price ratios on its own for 1971 and 1976, it was felt that a more controlled approach to the empirical testing would result if both states under study had assessment-sales price ratios generated from similar cources (either both state-generated or both federally-generated ratios).

The Data Collection Process

Data for the study were collected on a county-wide basis in both states for each of the four years in the study. In 1964 and 1967, data were collected for every county in each of the two states (Indiana had 92 counties; Ohio has 88). In 1971 and 1976, when it was necessary to rely on federally-collected assessment-sales price ratios for Indiana, it was also necessary to reduce the number of counties studied. This reduction occurred simply because the federally-produced data derived from a sample of all counties in Indiana and Ohio; thus, county selection in this study is pegged to the federal sample of counties in the 1972 and 1977 Census of Governments, Volume 2: Taxable Property Values and Assessment-Sales Price Ratios, "Statistics on Real Property Assessments and Measurable Sales Occurring During a Six Month Period for Selected Local Areas" (44, Tables 11 and 19 in 1972 and 1977, respectively) for which the necessary assessment-sales price ratios were furnished. The number of counties studied in 1971 totaled 33 for Indiana and 48 for Ohio; in 1976, the total was 36 in Indiana and 42 in Ohio. It should be emphasized, however, that reliance on a random sample of counties (as in the 1972 and 1976 Census of Governments selection) in order to provide a portrayal of the states is very much within the boundaries of acceptable empirical research.

The Focus of This Study

This study equates benefits received from public elementary and secondary education with the retention ability of the school system; costs are equated with the real property taxes levied for such education.

Thus, in terms of this study, the benefit-cost ratio for public elementary and secondary education is expressed as follows:

$$\frac{B}{C} = \frac{\# \cdot R_b \cdot I}{R_c \cdot T}$$

where B = benefits of public elementary and secondary education

C = costs of public elementary and secondary education

$\# \cdot R_b \cdot I$ = pupils (#) retained in school (R_b) and the earnings (I) attributable to their education

$R_c \cdot T$ = effective tax rate (R_c) levied on real property (T) for school operations

If one were interested in determining a dollar benefit-cost ratio, it would be necessary both to determine a retention rate for each grade level and to assign a future incremental income stream to those students completing each grade level. As Chapter II pointed out, the calculation of a worker's lifetime earnings involves a foray into the future , armed only with data from the past: one posits a relationship between education and earnings based on current data; then extends it forward, attempting to adjust for inflation, mortality and, possibly, productivity (merit raises) along the way. The resulting dollar total is then discounted back to the present, utilizing an interest rate preselected by the researcher. The end result, while generally impressive in magnitude, as most large-dollar amounts are, remains somewhat divorced from reality. It is, after all, a valid estimate of the future only if the future continues to behave as did the past.

One can bypass the imputing of hypothetical dollar amounts and yet still derive an indication as to whether benefits will exceed costs, by focusing on the other components of the benefit-cost equation. By transposing the benefit-cost equation, we may view it, not as a ratio of total dollar benefits to total dollar costs, but as a ratio of the benefit rate to the cost rate, as the following equations demonstrate.

Original Equation: $$\frac{B}{C} = \frac{\# \cdot R_b \cdot I}{R_c \cdot T}$$

Transposed Equation: $$\frac{R_b}{R_c} = \frac{B}{C} \cdot \frac{T}{\# \cdot I}$$

If the retention rate exceeds that of the cost rate, the construction of the transposed equation is such that dollar benefits will also exceed dollar costs. A benefit-cost ratio based on rates may then be used as a gauge of the direction the dollar benefit-cost ratio will take (i.e., greater or lesser than unity).

It must be emphasized again that the dollar benefit-cost ratio relies on a forecast of future dollar earnings. Calculation of a retention rate-effective tax ratio requires no such forecasting: both rates can be determined with certainty as they are derived from present data.

This study calculates, on a county-wide basis, for each of the four years previously mentioned, the following rates:

1. The effective tax rate for public elementary and secondary education;
2. The retention rate for public elementary and secconday education.

After calculation of the preceding county-wide rates in Ohio and in Indiana, the tax rate per county in Ohio was compared with that of Indiana, using a one-way analysis of variance (with the political systems serving as treatments) to determine whether statistically significant differences existed between the states' tax rates for education.

A one-way analysis of variance was also employed to determine whether significant differences existed between retention rates for education between Indiana and Ohio.

Finally, benefit-cost ratios were constructed on a state-wide basis for each year within the study by aggregating the county ratios. The state-wide ratios were then compared to determine the efficiency of providing the public good of education between the two differently-constructed political voting systems of Indiana and Ohio.

Details of the analysis of variance procedure employed are presented in a subsequent section of this chapter; explanations of the empirical test results are given in Chapter IV of this study.

The two sections of this chapter which immediately follow provide a discussion of the assumptions behind as well as an illustration of the calculations for the cost and benefit surrogates of public elementary and secondary education used in this study.

The Tax Costs of Public Elementary And Secondary Education

The costs of financing elementary and secondary education as determined at the county-wide level, are met by revenues generated through property taxation in Indiana and Ohio. Property subject to taxation is classified by both states as being real, personal and public utility.

Appendix A, Table XVIII, shows the extent to which school districts in Indiana and Ohio are locally financed. Table XIX of the same appendix, which presents school financing in terms of local revenues only, illustrates the great extent to which such revenues are derived from a single source of taxation: the property tax.

In terms of taxing property, most taxing localities levy a tax rate based upon assessed value of the property in question. This assessed value, in turn, is only a fraction of the property's true market value. Thus, the tax equation for property may be expressed as follows:

$$\text{Property Tax Revenue} = \text{Tax Rate} \times \text{Assessment Ratio} \times \text{Fair Market Value of Property}$$

Because assessment ratios (assessed value as a percentage of market value) may differ from locality to locality, no valid comparison of tax rates can be made using the above equation's nominal tax rate.

However, one can standardize the comparison of property tax policies by looking, not at nominal tax rates applied to assessed values of property, but at the effective property tax rates as follows:

$$\text{Effective Tax Rate} = \frac{\text{Property Tax Revenues}}{\text{Fair Market Value of Property}}$$

An effective tax rate gives a more realistic portrayal of the economic impact of a tax upon the taxpayer.

The equation for property tax revenues may be restated as follows:

$$\text{Property Tax Revenue} = \text{Effective Tax Rate} \times \text{Fair Market Value of Property}$$

As detailed in Appendix A, only a portion (albeit, a substantial portion in Indiana and Ohio) of such property tax revenue goes toward financing education; the rest being diverted towards the funding of other public expenditures such as police and fire protection or road maintenance.

For both states in this study, taxes on real property (land and land-based structures), as distinct from those on personal or public utility property, represent the largest source of local funding for public elementary and secondary education.

Table I and II compare the assessed values for the three components of taxable property in Indiana and Ohio for the four years of this study. It should be noted that local taxes for education in both states are applied at the same rate to each category of property: real, personal and utility. Thus, the category of property with the greatest assessed value (real property) will also be the category which generates the largest amount of tax revenues for education.

In addition to serving as the largest contributor of local tax revenues for public elementary and secondary education, real property is readily adaptable to calculations for effective tax rates, for which a fair market value of property must be employed. Both Indiana and Ohio have conducted assessment-sales price ratio studies throughout the years on real property. The outcome of such studies, as detailed in the following section, will be used in this paper to generate fair market values for real property in the calculation of effective tax rates.

TABLE I

GROSS ASSESSED PROPERTY VALUES IN INDIANA
FOR 1964, 1967, 1971 AND 1976

(millions of dollars)	Total, All Types of Property	Real Property	Personal Property	Public Utility Property
1964				
Dollars	$ 9,812.7	$ 6,179.8	$2,573.6	$1,059.3
Percentages	100%	62.9%	26.2%	10.8%
1967				
Dollars	$11,043.3	$ 7,022.8	$2,947.1	$1,073.4
Percentages	100%	63.6%	26.7%	9.7%
1971				
Dollars	$13,114.7	$ 9,286.5	$2,626.5	$1,201.7
Percentages	100%	70.8%	20.0%	9.2%
1976				
Dollars	$16,400.4	$10,984.0	$3,935.5	$1,490.9
Percentages	100%	66.9%	23.9%	9.1%

Source: The State of Indiana, Annual Report of The Auditor of the State of Indiana (Indianapolis, 1964, 1967, 1971 and 1976).

TABLE II

GROSS ASSESSED PROPERTY VALUES IN OHIO
FOR 1964, 1967, 1971 AND 1976

(millions of dollars)	Total, All Types of Property	Real Property	Personal Property	Public Utility Property
1964				
Dollars	$31,835.8	$20,375.1	$ 7,236.6	$4,224.1
Percentages	100%	64.0%	22.7%	13.3%
1967				
Dollars	$35,663.2	$22,134.9	$ 9,010.5	$4,517.8
Percentages	100%	62.1%	25.3%	12.6%
1971				
Dollars	$41,785.8	$25,543.2	$10,827.1	$5,415.5
Percentages	100%	61.1%	25.9%	12.9%
1976				
Dollars	$60,247.8	$39,544.9	$13,578.7	$7,124.2
Percentages	100%	65.6%	22.5%	11.8%

Source: Ohio Department of Tax Equalization, Form V-1, (Columbus, 1978).

Since there exists no equivalent assessment-sales price ratio studies for either personal or public utility properties, these two sources of local tax revenues for education were not adaptable to this study on effective tax rates and hence were not used in this study.

For purposes of this study, then, the effective tax rate of interest is illustrated below. This is the rate at which individuals are taxed, or tax themselves on real property, in order to supply the public good of elementary and secondary education.

$$\text{Effective Local Real Property Tax Rate for Education} = \frac{\text{School Operating Revenues From Local Real Property Taxes}}{\text{Fair Market Value of Locally Taxable Real Property}}$$

The taxpaying public will tend to view the real property tax revenues diverted to education as being synonymous with the costs of education; hence, the effective tax rate for education may also be expressed as a cost of education equation:

$$\text{Local Costs of Education} = \text{Effective Local Real Property Tax Rate for Education} \times \text{Fair Market Value of Taxable Real Property}$$

Or, in a simpler form:

$$C = R_c \cdot x \cdot T$$

where: C = costs of education

R_c = effective tax rate for education (or tax rate associated with costs)

T = tax base

The following section details the precise procedures employed in this study to calculate the costs of public elementary and secondary education in Indiana.

Calculation of the Costs in Indiana

Local Costs of Education: Real Property Taxes. For both states in this study, the local costs were defined as operating costs for the public school systems; hence, taxes levied for building funds (which would occur on an irregular schedule) are not included in the cost calculations.

In Indiana, the following values were obtained from the annual reports of the Auditor of the State for 1964, 1967, 1971 and 1976 (41):

Assessed value of all property (real, personal and utility) in Indiana, per county

Assessed value of real property in Indiana, per county

School operating taxes levied on all sources of property, per county

The assessed values of real property utilized in this study are gross values, i.e., before deduction for exemptions from taxation for such reasons as age, low income levels or religion. Since such deductions vary from state to state, a standardized picture of a state's ability to provide education through property taxation could only be achieved through use of gross values.

School operating taxes generated from real property taxes in Indiana were derived by establishing the following equation:

$$\text{Real Property as a Percentage of All Property} \times \text{School Operating Taxes Levied on All Property} = \text{School Operating Taxes Levied on Real Property}$$

In application, the above equation is restructured as follows:

$$\text{School Operating Taxes Levied on Real Property} = \text{School Operating Taxes Levied on All Property} \times \frac{\text{Assessed Value, Real Property}}{\text{Assessed Value, All Property}}$$

Local Tax Base for Education: Fair Market Value. In order to compute Indiana's effective tax rate on real property for education, the school operating taxes on real property calculation presented above had to be coupled with the fair market value of real property, as follows:

$$\text{Effective Tax Rate for Education on Real Property} = \frac{\text{School Operating Taxes Levied on Real Property}}{\text{Fair Market Value of Real Property}}$$

The following procedures were employed to calculate the fair market value of real property component of the above equation: assessed values for real property, on a county-wide basis within Indiana, were divided by a county-wide assessment-sales price ratio. The equation that describes this computation is as follows:

$$\text{Fair Market Value of Real Property} = \frac{\text{Assessed Value, Real Property}}{\text{Assessment-Sales Price Ratio}}$$

The assessment-sales price ratio is structured as follows:

$$\text{Assessment-Sales Price Ratio} = \frac{\text{Assessed Value, Real Property}}{\text{Sales Price, Real Property}}$$

Thus, the equation presented on the bottom of page 47 may be also written:

$$\text{Fair Market Value of Real Property} = \frac{\text{Assessed Value, Real Property}}{\dfrac{\text{Assessed Value, Real Property}}{\text{Sales Price, Real Property}}}$$

Rearranging the preceding equation results in the following:

$$\text{Fair Market Value of Real Property} = \frac{\text{Assessed Value, Real Property}}{1} \times \frac{\text{Sales Price, Real Property}}{\text{Assessed Value Real Property}}$$

Thus, fair market value of real property in this study is synonymous with sales price of real property.

Assessment-Sales Price Ratios

Assessment-sales price ratios in Indiana, as in any other state that assembles such data, are derived by comparing selling prices of real property with the respective assessed values of such properties. During any one year, only a portion of a state's total assessed real property will be involved in a sale; thus, the assessment-sales price ratio which is generated for that year is a reflection of only that portion of the state involved in the sale. In other words, the sales universe constitutes only a small percentage of all realty in the state.

Use of an assessment-sales price ratio, derived as it is from a subset of all possible sales, to compute the fair market value of all real property calls for a degree of caution in viewing this outputted value. The resultant fair market value is an estimate, though one that must be characterized as the best possible estimate of such a value that is obtainable under real-world conditions.

In this study, the 1971 and 1976 assessment-sales price ratios for Indiana and Ohio counties were taken from the Census of Governments (44) because the state of Indiana, as has been previously mentioned, discontinued its own program of generating such ratios in 1967. The 1967 ratios for Indiana were taken directly from state documents; however, the 1964 Indiana county ratios are the result of an averaging process.

Because county-wide data necessary to compute the benefits for education were obtainable in Indiana only for the years 1964 onward, cost calculations had to be restructured to fit this time period as well. Actual county-wide assessment-sales price ratios in Indiana were available for 1963 and 1967 only. The 1964 assessment-sales price ratios for each of Indiana's ninety-two counties which were employed in this paper were derived by subtracting from the 1963 assessment-sales price ratio the average percentage decrease in the county's assessment-sales price ratio from 1963 to 1967. The preceding procedure is illustrated on the next page.

1964 County Assessment-Sales Price Ratio	=	1963 County Assessment-Sales Price Ratio	less	1/4 the Gross Difference Between 1963 and 1967 Ratios

Such a calculation makes the assumption that there was a proportionate yearly decrease in county assessment-sales price ratios in Indiana over the time period 1963 to 1967.

This assumption may be better illustrated by looking at actual data for the state as a whole. In 1963, the assessment-sales price ratio for the state of Indiana was .264 (or, the assessed value of real property was 26.4% of sales price); in 1967, the ratio was .237. Thus, from 1963 to 1967, the assessment-sales price ratio declined, in aggregate, .027. Assuming a proportionate and cumulative decline throughout each of the four years in this period, assessment-sales ratios for the entire state would be calculated for 1964 to 1966 as follows:

1964 ratio	=	1963 ratio less ¼(change in ratio: 63-67)
	=	.26400 - ¼(.027)
	=	.25725
1965 ratio	=	1964 ratio less ¼(change in ratio: 63-67)
	=	.25725 - ¼(.027)
	=	.25050
1966 ratio	=	1965 ratio less ¼(change in ratio: 63-67)
	=	.25050 - ¼(.027)
	=	.24375

Thus, the following assessment-sales price ratios would result for the state as a whole:

1963	1964	1965	1966	1967
.264	.25725	.25050	.24375	.237

The assumption of a proportionately decreasing assessment-sales price ratio in this research results in a fixed expectation as to the behavior of market prices for real property over the same time period. Because one of the components of the assessment-sales price ratio, the assessed value of real property, is known with certainty, the behavior of market prices (the other component of the ratio) can be deduced, given the proportionately declining ratio assumption.

In other words, the change in the assessment-sales price ratio is composed of the changes in the individual components of the ratio: the assessed value of real property and the sales price of real property. If one knows the direction of change (increase or decrease) in the assessed value and stipulates the direction of change in the ratio as a whole, one has also fixed the direction and amount of change in the sales price.

Table III, which is presented on the next page, serves to illustrate the behavior of the ratio components. In equation form, the preceding discussion may be stated as:

$$\text{Assessment-Sales Price Ratio} = \frac{\Delta \text{ Assessed Value}}{\Delta \text{ Sales Price}}$$

where Δ = percentage change

TABLE III

ASSESSMENT-SALES PRICE RATIO COMPONENTS IN INDIANA, 1964 AND 1967

	1964	1967	Percentage Change, 1964-1967
Gross Assessed Value, Real Property	$ 6,179,751,444	$ 7,022,833,060	13.64265% (increase)
Assessment-Sales Price Ratio (from page 53)	.25725	.237	7.8717 % (decrease)
Sales Price of Real Property (Assessed Value Assessment-Sales Price Ratio)	$24,022,357,410	$29,632,207,000	23.3526 % (increase)

Source: Gross assessed values are from The State of Indiana, *Annual Report of the Auditor of the State of Indiana*, (Indianapolis, 1964 and 1967), pp. 181 and 86, respectively.

Rearranging the preceding equation to solve for sales price:

$$\text{Sales Price} = \frac{(1 + \Delta \text{ Assessed Value}) - (1 + \Delta \text{ Ratio})}{(1 + \Delta \text{ Ratio})}$$

Using the data from page 52 in the above equation gives the following results:

$$\text{Sales Price} = \frac{(1 + .1364265) - 1 + (-.078717)}{1 + (-.078717)}$$

$$= \frac{1.1364265 - .921283}{.921283}$$

$$= .233526 \quad \text{(rounded)}$$

If the research is to be founded on the assumption that Indiana's total fair market value of real property increased 23.35% over the period 1964-67 (and did so proportionately), it would be reassuring to be able to cite comparable increases in real property in other areas which occurred during this time period. There exists, however, no source for determining fair market value for all real property; the closest equivalents are federal government studies on the median sales prices of new homes (46, p. 92). While new homes comprise only a portion of the real property area, one might use both the direction and magnitude of change in new homes' selling prices as an indication of market change for all real property.

From 1964-1967, median sales prices of new one-family houses in the U.S. increased 20.11%. Median sales prices of such homes in the north central region (which includes Indiana and Ohio) increased 29.38% (46, p. 92). The 23.35% increase calculated for all real property in Indiana on page 52 of this study is certainly in the same direction of change as the federal government figures; again, comparison of magnitude of change is hampered because the federal figures deal with only new houses, which comprise only a portion of all real property available for sale.

As more research is conducted in this area, there will doubtlessly be less of a need to rely on assumptions such as proportionately declining assessment-sales price ratios; for the present time, however, progress in this field would be nonexistent without utilization of these assumptions.

Cost Calculation Data in Indiana. The actual data inputs for the cost computations in Indiana are presented in Table XLIV of Appendix C. Details on assessment-sales price ratio computations for 1964, on a county-wide basis, are given in Table XLV of Appendix C.

The following section enumerates the procedures followed for cost calculations in the state of Ohio for the four years encompassed by this study.

Calculation of the Costs in Ohio

In Ohio, the following values were obtained from the Department of Tax Equalization for the years between 1964 and 1976, except where noted:

Assessed value of real property in Ohio, per county

Assessment-sales price ratios in Ohio, per county
(years 1964, 1966 and 1967 were not available)

In addition, annual millage rates for school operating tax levies were obtained from the following sources:

Ohio Education Association, for the years 1964-1972

Ohio State Department of Education, Division of School Finance, for the years 1972-76

School operating taxes generated from real property taxes in Ohio were derived for each county through the following equation:

$$\text{School Operating Taxes Levied on Real Property} = \text{Average Operating Millage Rates} \times \text{Gross Assessed Value of Real Property}$$

The operating millage rate employed in the above equation is a simple average of all operating millage rates in the school districts comprising each county; this is the procedure followed by the Division of School Finance in Ohio to generate county-wide millage rates.

Local Tax Base for Education: Fair Market Value. Fair market value of real property in Ohio, on a county-wide basis was calculated as has been previously detailed for counties in Indiana, or, as follows:

$$\text{Fair Market Value of Real Property} = \frac{\text{Assessed Value, Real Property}}{\text{Assessment-Sales Price Ratio}}$$

Thus, the effective local tax rate for education in Ohio is constructed as is that of Indiana's. The equation for this effective local tax rate for education in Ohio is presented on the following page.

$$\text{Effective Tax Rate for Education on Real Property} = \frac{\text{School Operating Taxes Levied on Real Property}}{\text{Fair Market Value of Real Property}}$$

The above equation, again, is computed on a county-wide basis for both states.

Assessment-Sales Price Ratios in Ohio. In Ohio, as in the state of Indiana, the nonavailability of assessment-sales price ratios for certain years necessitated employing certain assumptions in order to proceed with the study. In Ohio's case, assessment-sales price ratios were not available from the Department of Tax Equalization for the years 1964, 1966 and 1967, although the department did have such ratios for all other years in the period 1964 through 1976.

Accordingly, the assumption of proportionately declining assessment-sales price ratios detailed earlier for the state of Indiana was also adopted for the state of Ohio. Ohio's state-wide average assessment-sales price ratio had declined, much like Indiana's had, during the middle 1960's (from .3878 in 1963 to .3393 in 1968, or a decline of 12.5%).

The 1964 assessment-sales price ratios for Ohio employed in this study were established as the mid-points between 1964 and 1965 county assessment-sales price ratios; the 1967 assessment-sales price ratios for counties were calculated in much the same manner as was done for counties in Indiana in 1964. The procedure for calculating Ohio's

1967 assessment-sales price ratios is illustrated as follows:

1967 Assessment-Sales Price Ratio, Per County	=	1968 Assessment-Sales Price Ratio, Per County	Less	1/3 Change in the Ratio, 1965 to 1968

The data used to generate 1964 and 1967 assessment-sales price ratios for the Ohio counties is detailed in Tables XLVIII and XLIX of Appendix D, which also furnish numerical examples of the calculations employed.

The Benefits of Public Elementary and Secondary Education

It is impossible to isolate benefits of education as they are perceived by individual taxpayers. Taxpayers might accede to being taxed for education because they have children in the schools, because they possess a feeling of "public regardiness" or altruism, because of peer pressure, because "experts" tout the benefits of education to them or because they themselves are employed by school systems.

Instead of trying to define the individual's assessment of educational benefits, one can look at the aggregate costs of education as born by the taxpayers (the school district revenues supplied by property taxes) and adjudge the aggregate benefits of education to be the promulgation of future taxpayers, by assuming that the educational process will produce future workers who will in turn shoulder a share of the tax burdens.

Following this line of reasoning, the expenditures of educating, say, first grade students in any one year may be thought of as buying the following amount of benefits:

Total Benefit of Education = \$A plus \$B

Where	\$A	=	Number of Students Dropping Out of First Grade	X	Discounted Future Incremental Earnings of Persons With <u>Less</u> Than a First Grade Education
and	\$B	=	Number of Students Completing First Grade	X	Discounted Future Incremental Earnings of Persons With a First Grade Education

However, the suppliers of educational financing (the taxpayers) are "buying" the future benefits that accrue to studnets who <u>remain</u> in school, not the benefits that might accrue to those students who drop out.

Although one might argue that there might be some benefits accruing to drop-outs because educational funds have been expended on them prior to their dropping-out, determining the extent of such benefits would require knowledge of the exact date of a student's withdrawal from school in order to calculate the monies expended on that student.

This study assumes that the costs of educating students who remain in the schools for the majority of the school year only to drop out prior to completion of the year are balanced by the savings that result from not having to spend funds on students who drop out early in the year. The school system which has budgeted funds to educate such early drop-outs is thus free to allocate the savings among the remaining students.

Past research on the benefits of education has established that a correlation exists between the number of years of schooling completed by a person and the wage levels earned by that person. The amount of money expended for public education, following such reasoning, may be expected to produce a greater amount of benefits if the school system receiving such funding has a correspondingly high rate of retention for its enrollees. The retention rate of the school system, then, becomes one key to the amount of future benefits that will accrue to a polity as a result of educational spending: the higher the retention rate, the greater the amount of benefits (future incomes of enrollees)

The preceding definition of benefits, of course, rests on the assumption that education levels and earning capacities of individuals are positively associated. The U.S. Census data points to a strong positive correlation between levels of education achieved and levels of income earned; however, as in all correlation studies, no causal relationship can be presumed to underlie this relationship. The greater earning capability of the highly-educated may just as easily be attributed to other socioeconomic factors in their backgrounds which were independent of the educational process.

However, as previous educational efficiency studies have pointed out: "the effect of education remains by far the most important factor in determining earnings differentials" (10, p. 151).

Utilization of retention rates as a measure of educational benefits with the implicit linkage of such rates to future income levels of students does not appear to be a gross misstatement of the benefits side of the educational process.

Procedurally, this study will show that if retention rates for education are in excess of the tax rates used to generate funds for education, a positive (i.e., greater than unity) benefit-cost ratio will result, which, as in all benefit-cost studies, can be used as a comparative measure in studying alternative means of providing education.

One advantage of using retention rates as benefit measures lies in their ready availability. More importantly, however, use of retention rates in a benefit-cost study does not result in total reliance on projections of future income streams, the dollar value of which may differ from researcher to researcher, depending upon the assumptions made by each as to inflation rates, wage raises, mortality factors and discount rates.

Thus, use of retention rates may eliminate the possibility of making decisions based upon dollar "guess-timates" as to the future benefits of education. While use of rates, it is true, will generate no picture of the magnitude of dollar benefits which may accrue to educated workers, the benefit-cost ratio constructed with rates (retention rate and tax rate) will provide the user with an indication as to whether benefits from education are likely to exceed the costs of such education--as to whether the benefit-cost ratio is positive, or greater than one. The benefit-cost ratio based on rates, in other words, is indicative as to whether output of the educational process will exceed the input, but the ratio takes the conservative step of stopping far short of attaching a dollar amount to this excess. The reader, if so inclined, is free to attach a real dollar measure of benefits to the ratio, hopefully with the realization that justification for such a measure rests solely with her or him.

Furthermore, calculation of the retention rate may be done with data that is, by definition, "hard" data: by viewing educational costs in a historical context, retention rates associated with expenditures may be calculated by referring to the enrollment figures of the years both encompassing and succeeding the expenditure year.

The measure of benefits which accrues to the funding of one year's worth of education is stated as follows:

Dollar Benefits of Education	=	Number of Pupils Enrolled	X	Retention Rate Applicable to Enrolled Pupils	X	Discounted Future Incremental Dollar Earnings Applicable to Students After an Additional Year of School

When the above equation is restructured in a simpler format, the equation presented on page 62 is then produced.

$$B = \# \cdot R_b \cdot I$$

Where: B = dollar benefits of education

$\#$ = number of pupils

R_b = retention rate (or, rate associated with benefits)

I = discounted future earnings associated with education

The yearly local expenditure for education buys the total benefits inherent in retaining students in grades one through twelve for an entire year (or: buys the possibility that first graders of this year will stay in school to become second graders next year, and so forth). In other words, a county expends monies for education in the hopes of obtaining the benefits of moving all students presently enrolled up by one grade level (first to second, second to third and so on).

In this study, a one-year lag is assumed to occur between the passage of school operating tax levies and the application of the tax funds to the educational system. Tax levies assessed against real property in 1964, for example, would not be collected and available in cash form for the use of schools until 1965. Thus, the relevent benefit rate is that derived from total enrollments in the two years following the tax levy year, or:

$$\text{Total Retention Rate} = \frac{\text{Number of Students in Grades 2-12, Time 2}}{\text{Number of Students in Grades 1-11, Time 1}}$$

$$= \frac{\sum_{i=2}^{12} X_{i,2}}{\sum_{i=1}^{11} X_{i,1}}$$

Where: X = number of students enrolled

i = grade level

1,2 = time periods (Time 0 would be tax levy year)

Calculation of the Benefits in Indiana

The following information was obtained from the Department of Public Instruction, Division of Educational Information and Research in Indiana:

Public school enrollments, by grade level, per county for the years 1964 through 1978

The enrollment figures used to generate county-wide retention rates were fall semester gross enrollment figures. For purposes of this study, only students in graded classes were included in retention rate computations; students enrolled in nursery or kindergarden section, in special education classes, in ungraded sections or in post-high school graduate classes were not included.

Actual calculation of retention rates proceeded as follows for both Indiana and Ohio (again, assuming a one year lage between the levying of real property taxes and the inclusion of such tax funds in school budgets):

$$\text{1964 Retention Rate} = \frac{\text{Enrollment, Grades 2-12 in 1966}}{\text{Enrollment, Grades 1-11 in 1965}}$$

$$\text{1967 Retention Rate} = \frac{\text{Enrollment, Grades 2-12 in 1969}}{\text{Enrollment, Grades 1-11 in 1968}}$$

$$\text{1971 Retention Rate} = \frac{\text{Enrollment, Grades 2-12 in 1973}}{\text{Enrollment, Grades 1-11 in 1972}}$$

$$\text{1976 Retention Rate} = \frac{\text{Enrollment, Grades 2-12 in 1978}}{\text{Enrollment, Grades 1-11 in 1977}}$$

Calculation of the Benefits in Ohio

Inputs for retention rates in Ohio were taken from the fall enrollment figures supplied by the Department of Education, Division of Computer Services and Statistical Reports, in Ohio. As in Indiana, the following were obtained:

Public school enrollments, by grade level, per county for the years 1964 through 1978

Actual calculation of retention rates for 1964, 1967, 1971 and 1976 for Ohio counties followed the same procedure detailed previously for counties in Indiana.

The actual county enrollment figures used to generate the retention rates for Ohio and Indiana in this study are contained in the tables found in Appendixes C and D.

The following section of this chapter details the statistical methods employed in this study to test the research hypotheses stated at the onset of this chapter.

Statistical Procedures Employed in the Analysis of the Data

Each of the years studied in this research paper comprised a separate testing ground for the two research hypotheses detailed on page 34 of this chapter. The structuring of the research design along cross-sectional lines was done in order to eliminate problems inherent in time series analysis of successive years (see Appendix B).

Within each of the four years (1964, 1967, 1971 and 1976) covered by this study, a one-way analysis of variance was conducted, using as the treatment effect (or independent variables) the two different political structures--the states of Indiana and Ohio

The two dependent variables regressed on the Ohio and Indiana independent variables were those of R_c (the effective tax rate) and R_b (the retention rate).

Because the number of counties per treatment (state) differed within each year, the one-way ANOVA (analysis of variance) became an analysis for two groups having unequal replication (40, p. 112).

As Steel and Torrie (40, p. 252) point out, where data in a one-way ANOVA is structured such that there are unequal numbers of observations per treatment, the treatment sum of squares is defined as $\sum_i n_i(\overline{x}_{i.}-\overline{x}_{..})^2$ and is computed as $\sum_i (x_{i.}^2/n_i) - x_{..}^2/n$.

Treatment sum of squares in this situation is a weighted sum of squares of the deviations from the overall mean $\overline{x}$, which by itself is a weighted average of treatment means (the weights are reciprocals of σ^2/n_i, the variance). Error sum of squares for this single factor experiment (considered on a per year basis) is the sum of the within-treatment sum of squares.

Or, in equation form, total sum of squares can be expressed as follows:

$$\sum_{1}^{k} \sum_{1}^{n} (X_{ij} - \bar{X}_{..})^2$$

Where: k = number of treatments

n = number of observations per treatment

i = number assigned to a particular observation

j = number assigned to a particular treatment

Total sum of squares, as previously noted, may be partitioned into two different sums of squares:

$$\sum_{1}^{k} \sum_{1}^{n} (X_{ij} - \bar{X}_{..})^2 = \sum_{1}^{k} \sum_{1}^{n} (X_{ij} - \bar{X}_{.j})^2 + n \sum_{1}^{k} (\bar{X}_{.j} - \bar{X}_{..})^2$$

The first term on the right of the equals sign, in a one-way ANOVA, is the error sum of squares; the second term is the between groups sum of squares (25, pp. 46, 47).

In graphic form, the one-way analysis of variance for each year in the study would take the form illustrated in Figure 1 on page 67. Figure 1 shows the procedure undertaken to test the null hypothesis that there is no difference between effective tax rates for education between differently-constructed polities.

Figure 2, also shown on the following page, illustrates the procedure undertaken to test the null hypothesis that there is no difference between retention rates for education

	Treatments (different political voting systems)	
	Indiana	Ohio
Dependent Variables	R_c's for counties	R_c's for counties

Figure 1. ANOVA on effective tax rates

	Treatments (different political voting systems	
	Indiana	Ohio
Dependent Variables	R_b's for counties	R_b's for counties

Figure 2. ANOVA on retention rates

between differently-constructed polities.

Within each year of the study, two single-factor ANOVAs were performed, one using the dependent variable R_c and another using the dependent variable R_b, resulting in a total of eight ANOVAs.

To process the ANOVA calculations, the ANOVA procedure of SAS (Statistical Analysis System) was employed. While SAS's procedure for ANOVA is set up for analysis of balanced designs (4, p. 57), it may be used to analyze certain designs whose cell frequencies are proportional to each other and, in addition, are proportional to the background population. The present research design, structured as it is along one-way ANOVA lines, fits within these proportional qualifications.

State-Wide Measures of Efficiency

After ANOVA had been performed on the two dependent variables R_c and R_b within each state for each year of the study, benefit-cost ratios were constructed on a state-wide basis for each year by comparing the aggregate county ratios for R_c and R_b.

In comparing the efficiency levels of the two states, it was initially expected that one of five situations could result yearly:

1. R_b Indiana $\neq$ R_b Ohio

and

R_c Indiana $=$ R_c Ohio

so that

$$\frac{R_b}{R_c} \text{ Indiana} \neq \frac{R_b}{R_c} \text{ Ohio}$$

If tax rates for education for a given year were not significantly different between Ohio and Indiana as determined from the ANOVA on R_c, but significant differences existed between the states' retention rates (as determined from the

R_b ANOVA), the resulting benefit-cost ratio difference could not be attributed to the educational financing policies. Rather, the difference could have been attributable only to the operational efficiencies between the two education systems.

2. $$R_b \text{ Indiana} = R_b \text{ Ohio}$$

and

$$R_c \text{ Indiana} \neq R_c \text{ Ohio}$$

so that

$$\frac{R_b}{R_c} \text{ Indiana} \neq \frac{R_b}{R_c} \text{ Ohio}$$

If the tax rates of the two states were significantly different, but the retention rates were not, the system with the higher tax rate was inefficient in using its educational funds.

3. $$R_b \text{ Indiana} = R_b \text{ Ohio}$$

and

$$R_c \text{ Indiana} = R_c \text{ Ohio}$$

so that

$$\frac{R_b}{R_c} \text{ Indiana} = \frac{R_b}{R_c} \text{ Ohio}$$

If neither the tax rates nor the retention rates of the two states were significantly different, both states had efficient systems of financing education and of operating their public elementary and secondary schools.

4. R_b Indiana $\neq$ R_b Ohio

and

R_c Indiana $\neq$ R_c Ohio

so that

$$\frac{R_b}{R_c} \text{ Indiana} \neq \frac{R_b}{R_c} \text{ Ohio}$$

If both the tax rates and the retention rates were different and the resulting benefit-cost ratio was also different, the efficiency difference was due to a combination of both school financing and operational factors and identification of the specific cause would not be possible.

5. R_b Indiana $\neq$ R_b Ohio

and

R_c Indiana $\neq$ R_c Ohio

so that

$$\frac{R_b}{R_c} \text{ Indiana} = \frac{R_b}{R_c} \text{ Ohio}$$

If both the tax rates and the retention rates differed between the states but the benefit-cost ratio did not, the conclusion reached on page 69 in example three must hold; however, neither the method of financing schools nor that of operating them can be isolated as the specific determinant of efficiency.

The following chapter presents the empirical results obtained by applying the methodology detailed in this chapter to the data and analyzes the implications of such results within the confines of this study.

CHAPTER IV

ANALYSIS AND INTERPRETATION OF THE DATA

Introduction

For each of the four years (1964, 1967, 1971 and 1976) encompassed by this study, two separate analyses of variance were performed: one testing for significant differences between Indiana's and Ohio's county-wide retention rates for public elementary and secondary education (R_b) and a second testing for significant differences between the two states' county-wide effective tax rates (R_c) for school operations which are derived from real property.

After this separate analysis of the two components of the benefit-cost ratio, the county-wide R_bs and R_cs were each summed and a state-wide benefit-cost ratio produced, using the average retention rate and tax rate for each state.

This chapter details the results of the eight ANOVA performed in addition to presented the four state-wide benefit cost ratios.

The 1964 Test Results

In 1964, information on school enrollment was obtained from all 92 counties in Indiana and all 88 counties in Ohio. The actual data inputs are listed in the data tables of Appendixes C and D.

ANOVA on R_b (Retention Rate)

The results of the one-way analysis of variance for 1964, as generated by the ANOVA procedure of SAS (4), are presented in Table IV.

TABLE IV

ANALYSIS OF VARIANCE ON Rb (RETENTION RATE) FOR 1964

Source of Variance	Degrees of Freedom	Sum of Squares	Mean Square
Treatment (States)	1	0.00134385	0.00134385
Error	178	0.15897390	0.00089311
Corrected Total	179	0.16031775	

The calculated F statistic is 1.50 (mean square treatment divided by mean square error); the probability of obtaining an F value greater than this is .2216, or, the observed significance level in this case is .7754. The conclusion reached is that there is no significant difference (at α.05 or less) in retention ability of Indiana's and Ohio's public elementary and secondary education institutions for 1964, on the basis of this study's methodology.

ANOVA on R_c (Effective Tax Rate)

The results of the one-way analysis of variance on R_c for 1964 are detailed in the following table.

TABLE V

ANALYSIS OF VARIANCE ON Rc (EFFECTIVE TAX RATE) FOR 1964

Source of Variance	Degrees of Freedom	Sum of Squares	Mean Square
Treatment (States)	1	0.00001404	0.00001404
Error	178	0.00025508	0.00000143
Corrected Total	179	0.00026911	

The F value calculated from the above data was 9.80, with the probability of obtaining an F value greater than this being .002. The observed significance level in this instance is .998, leading to the conclusion that there is a significant difference (α.01) between the level of taxation in Indiana and Ohio.

Further examination of state-wide means generated by the ANOVA procedure on R_c reveals the following:

1964 mean of R_c in Indiana = .00638376

1964 mean of R_c in Ohio = .00694242

In 1964, the direct voting state, Ohio, had a significantly higher effective tax rate for education than did the indirect voting polity of Indiana.

The State-Wide Benefit-Cost Ratio

Constructing a state-wide benefit-cost ratio for 1964 from the mean R_b and R_c of each state (obtained by taking an average of the aggregated county values for R_b and R_c, respectively) leads to the following results:

$$\frac{R_b \text{ Indiana}}{R_c \text{ Indiana}} = \frac{.98013178}{.00638376}$$

$$= 153.5351862$$

$$\frac{R_b \text{ Ohio}}{R_c \text{ Ohio}} = \frac{.97466569}{.00694242}$$

$$= 140.3927867$$

Thus, in reference to Chapter III's discussion of possible outcomes for this study (pp. 68-70), the above situation may be written as follows:

$$R_b \text{ Indiana} = R_b \text{ Ohio}$$

and

$$R_c \text{ Indiana} \neq R_c \text{ Ohio}$$

so that

$$\frac{R_b}{R_c} \text{ Indiana} \neq \frac{R_b}{R_c} \text{ Ohio}$$

In 1964, the state of Indiana was more efficient in utilizing tax funds from real property to fund public elementary and secondary education.

Further details on the state-wide mean R_b and R_c for Indiana and Ohio, including the standard deviation from such means, are available in Table L of Appendix E.

The 1967 Test Results

1967 test results on R_b and R_c were, like those of 1964's obtained from all 92 counties in Indiana and all 88 counties in Ohio. Actual data inputs are listed in the data tables of Appendixes C and D.

ANOVA on R_b (Retention Rate)

Table VI, which is presented on the following page, presents the 1967 results for the R_b analysis of variance. The F value calculated from the data in Table VI was 2.69. The observed significance level in this instance was .8971 (or, the probability of obtaining a greater F value was .1029); there is no significant difference (at α.05 or less) in retention ability between the two different political voting systems of Indiana and Ohio in 1967.

ANOVA on R_c (Effective Tax Rate)

Table VII, which is presented on the following page, shows the results of the one-way analysis of variance on R_c.

TABLE VI

ANALYSIS OF VARIANCE ON Rb (RETENTION RATE) FOR 1967

Source of Variance	Degrees of Freedom	Sum of Squares	Mean Square
Treatment (States)	1	0.00107257	0.00107257
Error	178	0.07102315	0.00039901
Corrected Total	179	0.07209573	

TABLE VII

ANALYSIS OF VARIANCE ON Rc (EFFECTIVE TAX RATE) FOR 1967

Source of Variance	Degrees of Freedom	Sum of Squares	Mean Square
Treatment (States)	1	0.00005058	0.00005058
Error	178	0.00029937	0.00000168
Corrected Total	179	0.00034995	

The F value for Table VII was 30.07, with the probability of obtaining a value greater than this by chance being .0001. The observed significance level is thus .9999, which is indicative of a very significant difference (α .01) between the effective tax rates in Indiana and Ohio for 1967.

Examination of the state-wide means for R_c in 1967 shows the following:

1967 mean of R_c in Indiana = .00821054

1967 mean of R_c in Ohio = .00715011

Thus, in 1967, the indirect voting state of Indiana had a significantly higher effective tax rate for education than did the direct voting state of Ohio.

<u>The State-Wide Benefit-Cost Ratio</u>

Using state-wide averages of R_b and R_c, the 1967 benefit-cost ratio for each state appears below:

$$\frac{R_b \text{ Indiana}}{R_c \text{ Indiana}} = \frac{.98613684}{.00821054}$$

$$= 120.1062098$$

$$\frac{R_b \text{ Ohio}}{R_c \text{ Ohio}} = \frac{.98125352}{.00715011}$$

$$= 137.2361432$$

Thus, the following situation exists in 1967:

$$R_b \text{ Indiana} = R_b \text{ Ohio}$$

and

$$R_c \text{ Indiana} \neq R_c \text{ Ohio}$$

so that

$$\frac{R_b}{R_c} \text{ Indiana} \neq R_b \text{ Ohio}$$

In 1967, the state of Ohio was more efficient in funding public elementary and secondary education from taxes levied on real property than was the state of Indiana.

The 1971 Test Results

For 1971, the number of counties from which information was obtained totaled 33 in Indiana and 48 in Ohio. Actual data are shown in the data tables of Appendixes C and D.

ANOVA on R_b (Retention Rate)

Table VIII presents the ANOVA on R_b results for 1971.

TABLE VIII

ANALYSIS OF VARIANCE ON Rb (RETENTION RATE) FOR 1971

Source of Variance	Degrees of Freedom	Sum of Squares	Mean Square
Treatment (States)	1	0.00000084	0.00000084
Error	79	0.04664957	0.00059050
Corrected Total	80	0.04665041	

For the data presented in Table VIII, the computed F statistic was 0.00, with an observed significance level of .03. The conclusion reached was that there was no significant difference (at α.05 or less) between retention rates of Indiana and Ohio in 1971.

ANOVA on R_c (Effective Tax Rate)

Table IX presents the results of the ANOVA on R_c for the year of 1971.

TABLE IX

ANALYSIS OF VARIANCE ON Rc
(EFFECTIVE TAX RATE) FOR 1971

Source of Variance	Degrees of Freedom	Sum of Squares	Mean Square
Treatment (States)	1	0.00000843	0.00000843
Error	79	0.00015556	0.00000197
Corrected Total	80	0.00016399	

Calculated F in the above case was 4.28 and the observed significance level was .9583. At an alpha level of .05, the conclusion could be reached that significant differences existed between the two states' effective tax rates.

For the year of 1971, the state-wide means for R_c

for Indiana and Ohio are as follows:

1971 mean of R_c in Indiana = .00914092

1971 mean of R_c in Ohio = .00848416

Thus, in 1971, the state of Indiana had a significantly higher (at α.05) effective tax rate for education than did the state of Ohio.

The State-Wide Benefit-Cost Ratio

The results of the state-wide comparisons of R_b and R_c in Indiana and Ohio are as follows:

$$\frac{R_b \text{ Indiana}}{R_c \text{ Indiana}} = \frac{.98378793}{.00914092}$$

$$= 107.6246078$$

$$\frac{R_b \text{ Ohio}}{R_c \text{ Ohio}} = \frac{.98358050}{.00848416}$$

$$= 115.9313945$$

The following situation exists for the year of 1971:

$$R_b \text{ Indiana} = R_b \text{ Ohio}$$

and

$$R_c \text{ Indiana} \neq R_c \text{ Ohio}$$

so that

$$\frac{R_b}{R_c} \text{ Indiana} \neq \frac{R_b}{R_c} \text{ Ohio}$$

In 1971, the state of Ohio was more efficient in funding public elementary and secondary education with real property taxes than was the state of Indiana.

The 1976 Test Results

The 1976 test results were derived from information obtained in 36 Indiana counties and 42 Ohio counties. Actual data employed are contained in Appendixes C and D of this study.

ANOVA on R_b (Retention Rate)

Table X presents the results of the ANOVA on R_b for the year of 1976.

TABLE X

ANALYSIS OF VARIANCE ON Rb (RETENTION RATE) FOR 1976

Source of Variance	Degrees of Freedom	Sum of Squares	Mean Square
Treatment (States)	1	0.00043959	0.00043959
Error	76	0.05502081	0.00074396
Corrected Total	77	0.05546040	

The F value calculated from the above table was .61 and the observed significance level was .5617. No significant difference (at α .05 or less) was found between retention rates of the two states.

ANOVA on R_c (Effective Tax Rate)

The results of the one-way analysis of variance on the effective tax rates in 1976 are presented in Table XI. The F value for the data in Table XI was 45.81, with the probability of obtaining an F value greater than this being .0001. The observed significance level was .9999; a significant difference (α.01) exists in 1976 between the effective tax rates of Indiana and Ohio.

TABLE XI

ANALYSIS OF VARIANCE ON Rc (EFFECTIVE TAX RATE) FOR 1976

Source of Variance	Degrees of Freedom	Sum of Squares	Mean Square
Treatment (States)	1	0.00014343	0.00014343
Error	76	0.00023795	0.00000313
Corrected Total	77	0.00038138	

State-wide means for R_c in 1976 were as follows:

1976 mean of R_c in Indiana = .00481038

1976 mean of R_c in Ohio = .00753055

The state of Ohio, in 1976, had a significantly higher effective tax rate for education on real property than did that of Indiana.

The State-Wide Benefit-Cost Ratio

The 1976 benefit-cost ratios for each state were generated as follows, using mean R_bs and R_cs for each state in the study:

$$\frac{R_b \text{ Indiana}}{R_c \text{ Indiana}} = \frac{.98193662}{.00481038}$$

$$= 204.1287009$$

$$\frac{R_b \text{ Ohio}}{R_c \text{ Ohio}} = \frac{.98669869}{.00753055}$$

$$= 131.0261123$$

Thus, the following situation exists for 1976:

$$R_b \text{ Indiana} = R_b \text{ Ohio}$$

and

$$R_c \text{ Indiana} \neq R_c \text{ Ohio}$$

so that

$$\frac{R_b}{R_c} \text{ Indiana} \neq \frac{R_b}{R_c} \text{ Ohio}$$

In 1976, the indirect voting state of Indiana was more efficient in funding public elementary and secondary education with taxes on real property.

Interpretation of the Results

Table XII presents the results of the statistical tests for the four years of this study in summary fashion.

TABLE XII

SUMMARY OF TEST RESULTS

Year	Dependent Variable Tested	Significant Difference	No Significant Difference	Alpha Level	More Efficient State
1964	R_b		X	.01	Indiana
	R_c	X		.01	
1967	R_b		X	.01	Ohio
	R_c	X		.01	
1971	R_b		X	.01	Ohio
	R_c	X		.05	
1976	R_b		X	.01	Indiana
	R_c	X		.01	

As Table XII reveals, differences between the two differently-constructed voting systems do exist in terms of their effective tax rates for public elementary and secondary education, but no significant differences (at α .05 or less) were observed in the two systems' retention rates for such educational systems.

In an attempt to gain a better understanding of the differences in effective tax rates, this research examined the changes in the components of the school operating taxes in Indiana and Ohio from 1960-1976.

School Operating Taxes

As Chapter III of this research noted, the levying of a nominal tax rate upon the assessed value of real property determines the gross amount of tax dollars raised from that particular source, or:

Nominal Tax Rate for School Operations	X	Assessed Value of Real Property	=	Total School Operating Taxes From Real Property

The gross amount of tax dollars, when divided by fair market value of real property, yields the effective tax rate which was the subject of this chapter's statistical testing.

Because Indiana and Ohio are adjacent to one another geographically and because they were tested for demographic differences (other than those of political voting structure, as detailed in Appendix B), it does not appear likely that differences between the states in their effective tax rates for public elementary and secondary education would arise from differences in the fair market value of real property within each state.

Rather, the difference in effective tax rates appears to have arisen from differences between the gross amount of taxes levied within the states. These differences, in turn, may be attributed to changes, over time, in the components of the gross taxes, which are shown in the equation on page 86.

In order to isolate changes in gross tax components over time, the equation on page 86 was re-written in the following manner:

$$\%\Delta\,\text{Taxes} = \%\Delta\,\text{Rate} + \%\Delta\,\text{Assessed Value} + \left(\%\Delta\,\text{Rate} \times \%\Delta\,\text{Assessed Value}\right)$$

Where $\%\Delta$ = percentage change over time

Taxes = school operating taxes levied on real property

Rate = nominal tax rate on real property for school operation

Assessed Value = assessed value of real property

The following sections detail the observed changes in the total school operating tax components.

1964 Differences in School Operating Taxes

Results of the statistical tests presented earlier in this chapter indicated that Ohio had a higher effective tax rate (and hence, was less efficient) in 1964 for public elementary and secondary education than did Indiana.

Viewing both states from the period 1960-1964, the changes noted in Table XIII on the following page were observed. As Table XIII details, the largest component of Ohio's 35.283% increase in total school operating taxes from

TABLE XIII

CHANGES IN TOTAL SCHOOL TAX COMPONENTS, 1960-1964

	Ohio	Indiana
Percentage Change in Total Assessed Value, Real Property	13.539% increase [1]	32.020% increase [2]
Percentage Change in Nominal Tax Rate for School Operations	19.152% increase [3]	8.374% increase [4]
Percentage Change in Total School Operating Taxes Levied on Real Property	35.283% increase [5]	43.070% increase [6]

[1]From $17,945,568,547 in 1960 to $20,375,129,865 in 1964. Source: Ohio Department of Tax Equalization, "Valuation of Real Estate, Public Utilities and Tangible Personal Property for the Tax Years 1931 to 1977", Form V-1 (Columbus, 1977).

[2]From $4,680,975,833 in 1960 to $6,179,751,444 in 1964. Source: Annual Report of the Auditor of the State of Indiana (Indianapolis, 1961; 1965).

[3]From .0165 in 1960 to .01966 in 1964. Source: Ohio Education Association, Research and Development Division, Basic Financial Data of Ohio School Districts, 24, 2 (Columbus, 1970), p. 8.

[4]From .0245558 in 1960 to .0266121 in 1964. Derived by dividing total taxes by assessed values of real property.

[5]From $296,101,881 in 1960 to $400,575,053 in 1964. Calculated by multiplying nominal tax rates against assessed values of real property.

[6]From $114,945,046 in 1960 to $164,455,958 in 1964. Source: Annual Report of the Auditor, (Indiana, 1961;1965).

1960-1964 was the change in nominal tax rates levied on real property.

The selection of nominal tax rates in Ohio is the province of the voters, while the fixing of assessed values for real property is determined by elected county assessors in that state. In 1964, for the state of Ohio, voters' actions apparently accounted for more of the increase in total school operating taxes (and by extension, accounted for more of the state's inefficiency in supplying the public good of elementary and secondary education) than did county assessors' actions in increasing assessed values of real property in the state.

Although the 1964 total taxes in Indiana in Table XIII show a greater percentage increase than those of Ohio, it should be pointed out that the assessed values for real property in Indiana which were obtainable from the state auditor's annual report differ in their composition from 1960 to 1964. The 1960 real property assessed values do not include real property of railroads and utilities; the 1964 total value for real property incorporates railroad and utility real property. Inclusion of railroad and utility real property in 1960's assessed value for real property in Table XIII would reduce the 32.02% increase shown there; however, data were not available with which to compute the exact downward adjustment.

The following page details the results of the 1967 differences in school operating taxes that were observed.

1967 Differences in School Operating Taxes

Statistical tests on 1967 effective tax rates in Indiana and Ohio revealed that Indiana had a significantly higher (at an alpha of .01) rate than did Ohio. Table XIV on the next page presents changes in total operating tax components for 1964-1967.

The largest component underlying Indiana's 53.466% increase in total school operating taxes from 1964-1967 was that of the change in nominal tax rates levied on real property. Determination of nominal tax rates in Indiana is a function of school district officials; imposition of such rates does not require voter approval.

1971 Differences in School Operating Taxes

In 1971, the state of Indiana, according to this chapter's statistical tests, had a higher effective tax rate for public education than did the state of Ohio. Table XV on page 92 presents the 1967-71 changes in total school operating tax components.

During the period 1967-1971, the largest component of Indiana's 47.1% increase in total school operating taxes, as shown with Table XV, was the change in assessed values of real property. It should be noted that the difference between the two states' effective tax rates in 1971 was significant only at an alpha level of .05 (observed significance level was .9583), as compared to 1964, 1967 and 1976 differences in effective tax rates which were significant at

TABLE XIV

CHANGES IN TOTAL SCHOOL TAX COMPONENTS, 1964-1967

	Ohio	Indiana
Percentage Change in Total Assessed Value, Real Property	8.637% increase[1]	13.643% increase[2]
Percentage Change in Nominal Tax Rate for School Operations	13.9369% increase[3]	35.042% increase[4]
Percentage Change in Total School Operating Taxes Levied on Real Property	23.777% increase[5]	53.466% increase[6]

[1]From $20,375,129,865 in 1964 to $22,134,886,588 in 1967. Source: Ohio Department of Tax Equalization, Form V-1.

[2]From $6,179,751,444 in 1964 to $7,022,833,069 in 1967. Source: Annual Report of the Auditor (Indiana, 1965;1968).

[3]From .01966 in 1964 to .0224 in 1967. Source: Ohio Education Association, Basic Financial Data of Ohio School Districts, 24, 2 (Columbus, 1970), p. 8.

[4]From .0266121 in 1964 to .03593761 in 1967. Derived by dividing total taxes by assessed values of real property.

[5]From $400,575,053 in 1964 to $495,821,459 in 1967. Calculated by multiplying nominal tax rates against assessed values.

[6]From $164,455,958 in 1964 to $252,383,812 in 1967. Source: Annual Report of the Auditor (Indiana, 1965; 1968).

TABLE XV

CHANGES IN TOTAL SCHOOL TAX COMPONENTS, 1967-1971

	Ohio	Indiana
Percentage Change in Total Assessed Value, Real Property	15.398% increase[1]	32.23% increase[2]
Percentage Change in Nominal Tax Rate for School Operations	26.830% increase[3]	11.25% increase[4]
Percentage Change in Total School Operating Taxes Levied on Real Property	46.359% increase[5]	47.10% increase[6]

[1]From $22,134,886,588 in 1967 to $25,543,258,521 in 1971. Source: Ohio Department of Tax Equalization, Form V-1.

[2]From $7,022,833,069 in 1967 to $9,286,530,025 in 1971. Source: Annual Report of the Auditor (Indiana, 1968; 1972).

[3]From .0224 in 1967 to .02841 in 1971. Source: Ohio Education Association, Basic Financial Data of Ohio School Districts, 24,2 (Columbus, 1970), p. 8.

[4]From .03593761 in 1967 to .03997897 in 1971. Derived by dividing total taxes by assessed values of real property.

[5]From $495,821,459 in 1967 to $725,683,975 in 1971. Calculated by multiplying nominal tax rates against assessed values of real property.

[6]From $252,383,812 in 1967 to $371,265,879 in 1971. Source: Annual Report of the Auditor (Indiana, 1968; 1972).

the α.01 level. 1971's lower significance level can be visually corroborated by noticing that Ohio's percentage change in total school operating taxes (46.359% increase) for 1967-1971 closely paralleled that of Indiana's.

1976 Differences in School Operating Taxes

In 1976, the state of Ohio had a higher effective tax rate for public elementary and secondary education than did Indiana. The table upon page 94 presents the 1971-1976 changes in school operating tax components.

From 1971-1976, the greatest portion of Ohio's 58.598% increase in total school operating taxes from real property came from the state's increase in assessed values for real property. Changes in assessed values are attributable to actions by county assessors, rather than to any direct action on the part of the citizenry.

Summary

The previous sections' presentations of changes in the components of school operating taxes are summarized in Table XVII on page 95.

The largest contributing factor to the change in total school operating taxes (and, by extension, to the change in effective tax rates) was, in three out of the four time periods listed in Table XVII, that of the change in nominal tax rates for the state of Ohio. In Ohio, changes in nominal tax rates are attributable to voters' actions; much of the

TABLE XVI

CHANGES IN TOTAL SCHOOL TAX COMPONENTS, 1971-1976

	Ohio	Indiana
Percentage Change in Total Assessed Value, Real Property	54.800% increase[1]	18.28% increase[2]
Percentage Change in Nominal Tax Rate for School Operations	2.440% increase[3]	14.29% decrease[4]
Percentage Change in Total School Operating Taxes Levied on Real Property	58.598% increase[5]	1.37% increase[6]

[1]From $25,543,258,521 in 1971 to $39,544,886,946 in 1976. Scource: Ohio Department of Tax Equalization, Form V-1.

[2]From $9,286,530,025 in 1971 to $10,984,026,091 in 1976. Source: Annual Report of the Auditor (Indiana, 1972; 1977).

[3]From .0310994 in 1971 to .0318593 in 1976. Calculated by dividing total school operating taxes by assessed values of real property.

[4]From .03997897 in 1971 to .0342644 in 1976. Derived by dividing total taxes by assessed values of real property.

[5]From $794,380,215 in 1971 to $1,259,874,018 in 1976. Calculated by multiplying average county operating millage rates against assessed values of real property, per county. See data in Appendix D.

[6]From $371,265,879 in 1971 to $376,361,541 in 1976. Source: Annual Report of the Auditor (Indiana, 1972; 1977).

TABLE XVII

MAJOR CONTRIBUTING FACTORS TO CHANGE IN TOTAL SCHOOL OPERATING TAXES

Time Period	Ohio	Indiana
1960 - 1964	%Δ Nominal Rate	%Δ Assessed Value*
1964 - 1967	%Δ Nominal Rate*	%Δ Nominal Rate
1967 - 1971	%Δ Nominal Rate*	%Δ Assessed Value
1971 - 1976	%Δ Assessed Value	%Δ Assessed Value*

Where: * = more efficient state (state with lowest effective tax rate)

%Δ = percentage change over time

Nominal Rate = nominal tax rate for school operations

Assessed Value = assessed value of real property

impetus behind the change in total school operating taxes in Ohio appears to have originated with the populace directly.

In Indiana, by contrast, the largest contributing factor to the change in total school operating taxes was, in three of the four time periods listed in Table XVII, that of the change in assessed values of real property. County assessors in Indiana are responsible for changing assessed values of real property. Thus, in Indiana, change in total school taxes may be largely attributable to alterations made by elected officials, the county assessors.

Efficiency in funding public elementary and secondary education through taxes on real property does not appear to be the sole province of any one political voting system structure. In two out of the four time periods listed in Table XVII, the direct voting state of Ohio was more efficient (i.e., had a lower effective tax rate for education) than was the indirect voting state of Indiana in supplying the public good of elementary and secondary education; the situation reverses in the other two time periods.

To better relate the statistical test results and the interpretation of these results reached in this chapter to the initial research questions posited at the start of this paper, the next chapter offers both a summary of the research effort as well as a statement of the conclusions reached.

CHAPTER V

SUMMARY, CONCLUSIONS AND IMPLICATIONS FOR FUTURE RESEARCH

Summary

Introduction

The impetus for this research originated with the passage of California's Proposition 13 in the spring of 1978. Much of the media coverage on this event dealt with the fact that direct voting on tax issues had resulted in a lowering of the tax burden.

It was very natural to inquire, following such coverage, as to whether different political voting structures (i.e., indirect versus direct) would always produce different election outcomes for taxing measures.

Since taxes in today's society are levied most frequently for the purpose of funding common, or public goods (as opposed to their being levied for strictly punitive purposes), the question raised on whether different voting systems would produce different taxing levels was quickly followed by a second question on the amounts of public goods such tax levels would purchase.

The original intentions of this research, then, were twofold: to determine whether the tax costs of public goods would differ under different political voting systems and secondly, to determine whether the quantity of tax-funded pulic goods would also differ between different voting systems which provided them.

As a prelude to the research effort, this researcher surveyed related works by other authors. The following section briefly summarizes previous research efforts in this field.

Related Research Efforts

Studies by political scientists on voting systems, as Chapter II of this research pointed out, tended to take a behavioristic approach to the analyzing of election outcomes. Results of elections were viewed as the starting point from which one could isolate socioeconomic characteristics of the voters. The implication underlying such studies was that voter behavior could be explained and possibly predicted by reference to cultural traits of the voter.

While the political scientists' mode of analysis proceedéd backwards from election outcomes to the individual voters producing such outcomes, researchers utilizing industrial and economic modes tended to move forward in time, linking election results to the public goods produced as a result of such elections.

Research under the industrial approach into the cost effectiveness of education concentrated on quantifying the educational output produced by predetermined dollar level inputs of educational resources. The outputs were expressed in terms of pupil performance on standardized achievement tests.

In an attempt to analyze the efficiency of providing public education, economists linked dollar measures of educational inputs and outputs under a benefit-cost framework. Educational outputs, or benefits, under this mode, were measured by the additional dollars of lifetime income attributable to an individual's education.

While researchers in political science, education and economics may have made mention of political voting structures, they did so only in passing and, generally, tended to regard the ballot box or the legislature only as starting points from which to begin research efforts.

This research effort, in contrast, has concentrated on the political voting structure itself as being a possible determinant of the level of expenditures for the public good of elementary and secondary education.

The Approach of This Study

This research raised the question as to whether differences in the political voting structure under which decisions on the provision of the public good of elementary and secondary education were made would affect the efficiency of providing such a good.

Public elementary and secondary education was selected for study because of the ease with which educational tax dollars could be traced to the educational systems.

The methodological approach to this study began with the construction of two research questions which are paraphrased below:

1. Will the level of taxation for public goods chosen under a direct voting system differ from that set under an indirect voting system?
2. Will the level of benefits received from tax-funded public goods under a direct voting system differ from that received under an indirect voting system?

With the states of Indiana and Ohio serving respectively as examples of the indirect and direct voting systems, the costs and benefits of public elementary and secondary education were represented by the effective tax rates on real property and the retention rates of school systems.

The use of such real-world surrogates enabled the two research questions to be translated into statistically testable hypotheses, as follows:

1. The effective local real property tax rate for public elementary and secondary education does not differ between Indiana and Ohio.

   Or, H_o: R_c Indiana = R_c Ohio
2. The retention rate of public elementary and secondary education systems does not differ between Indiana and Ohio.

   Or, H_o: R_b Indiana = R_b Ohio

This study focused upon rates of cost and of benefit of education in order to avoid the problems inherent in imputing hypothetical lifetime income streams which were attributable to education. As Chapter III pointed out, one can bypass this imputation and still derive an efficiency measure for education by focusing on the rate components of this study's benefit-cost equation for education. Under this research's methods, if the retention rate for public elementary and secondary education exceeds the cost rate, the dollar benefits will also exceed dollar costs.

Before this study made benefit-cost comparisons, though, it tested the retention rates and the effective tax rates separately for differences between the two political voting systems, using a one-way analysis of variance.

The following section summarizes the results obtained from this testing procedure and details the conclusions reached by this researcher following an interpretation of those testing results.

Conclusions of the Study

The Empirical Test Results

The empirical data for this study's testing were gathered on a county-wide basis from Indiana and Ohio. The tests themselves were conducted separately for each of the four years in the study: 1964, 1967, 1971 and 1976.

A one-way analysis of variance on retention rates for public elementary and secondary education conducted in each of the four study years revealed no significant differences between the different political voting systems represented by Indiana and Ohio. Thus, the null hypothesis of H_o: $R_{b\ Indiana} = R_{b\ Ohio}$ could not be rejected at alpha levels of .05 or less.

Significant differences between the two states' effective real property tax rates for public elementary and secondary education were observed at the α.01 level in 1964, 1967 and 1976 and at the α.05 level in 1971.

However, no discernable link could be observed between the voting system and the level of effective tax rates: the direct voting system of Ohio had significantly lower tax rates in 1967 and in 1971 while the indirect voting state of Indiana had significantly lower tax rates in 1964 and 1976.

Since significant differences were observed only in effective tax rates, the results obtained from construction of state-wide benefit-cost ratios utilizing county averages of the retention and tax rates paralleled those observed in testing the effective tax rates. The state having the lower tax rate in a particular test year would also have the larger benefit-cost ratio; thus, in 1967 and 1971, Ohio was the more efficient in utilizing real property taxes for education; in 1964 and 1976, Indiana was more efficient.

In an attempt to determine whether the differences in effective tax rates within the years of the study could be traced to differences in the political voting system structures, this research examined the changes which took place in the components of the school operating tax structure from 1960-1976.

The Changes in Total School Taxes

In Chapter IV, it was noted that the difference which existed between the two states' effective tax rates were most likely attributable to differences between the gross amount of school operating taxes levied within the states. These differences, in turn, could be traced to the changes which took place over time in the components of the gross taxes; the nominal tax rate and the assessed value of the real property subject to taxation.

In the state of Ohio, for three of the four years under study, it was observed that the largest contributing factor to the change in total school operating taxes was the change in nominal tax rates. Since changes in nominal tax rates are the province of the voters in Ohio, it appears that much of the change in total taxes in Ohio could be attributed to voter action.

For Indiana, the largest contributing factor to the change in total school operating taxes was, in three of the four years of the study, that of the change in assessed values of real property. Since changes in assessed values are the function of elected county assessors in Indiana, one may attribute the change in total school operating taxes in the indirect voting state of Indiana to action on the part of such elected officials.

Conclusions

As Chapter IV points out, efficiency in the provision of the public good of elementary and secondary education does not appear, under this study's methodology, to be attributable to any one particular voting structure. Of the four years encompassed by this study, the indirect voting state of Indiana was more efficient (i.e., had a greater benefit to cost ratio) than was the direct voting state of Ohio in two of those years; the state of Ohio was more efficient in the other two years.

The surrogate of retention rates, employed in this study to represent benefits of public elementary and secondary education, appeared to operate independently of political voting system structure and of the total amounts of taxes levied for such education, although such a conclusion is reached only by observance of the analysis of variance results of Chapter IV and does not represent the result of statistical testing.

While this study does point to significant differences in the effective tax rates of different political voting systems, no conclusion can be reached as to the direction of the difference. The indirect and the direct voting systems each had two years in which they levied lower effective tax rates; conversely, each also had two years of higher effective tax rates than the other system.

If one may glean any information from observing the changes in the components of total school operating taxes, however, it may be the following: within the direct voting system of Ohio, total school operating taxes were altered to a greater extent by voter selection of higher nominal tax rates than by county assessor changes in assessed valuation of taxable real property. Conversely, within the indirect voting system of Indiana, total school operating taxes were altered to a greater extent by county assessor changes in assessed valuation of taxable real property than by elected official selection of higher nominal tax rates.

Implications for Future Research

While this study attempted to determine the effects, if any, of political voting system structure upon the costs and benefits of a particular public good, it did so on a small scale, confining itself to two states, each of which taxed real property as a means of funding public elementary and secondary education.

A very natural extension of this research would involve conducting it on a national scale. Public elementary and secondary education, as Chapter I points outs, represents an area of ever-increasing costs and personnel commitments. The recent creation of a separate federal Department of Education may indicate that the national government itself does not expect these extensive commitments of money and time to be diminished in the near future.

Extension of such a study to the national level would require the ability to effectively trace different types of tax dollars to their objects of expenditure because many states rely on indirect means of taxation, such as sales or excise taxes, to finance the public good of education.

It may be that the greater need for future research in taxation lies in establishing such a tracing method: in devising a system that can readily link tax dollars to the public goods they buy. This is, after all, no more than the translating of one governmental function into terms readily understandable to even the most novice consumer: one should get what one pays for. At the present time, the linkage between being taxed for public goods and being supplied with such goods is often a very tenuous one.

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APPENDIX A

SCHOOL DISTRICT REVENUES

The following table illustrates the extent to which school districts in Indiana and Ohio are locally financed.

TABLE XVIII

SCHOOL DISTRICT REVENUES BY SOURCE INDIANA AND OHIO IN 1972

	(thousands of dollars) Total Revenues, School Districts, All Sources: Local, State and Federal	School District Revenue: Local Sources Total Local Sources	Property Taxes	Other Taxes	Charges and Other Revenue
Indiana	$1,249,117	$ 839,684	$ 737,943	$1,144	$100,597
Percentages	100%	67%	-	-	-
		100%	59%	.09%	8%
Ohio	$2,125,025	$1,506,885	$1,363,662	$ 522	$142,701
Percentages	100%	71%	-	-	-
		100%	64%	.02%	6.7%

Source: (42).

The reliance of school districts in Ohio and Indiana upon the property tax as a source of funding becomes even more apparent if Table XVIII is presented in terms of local revenues only, as is done in Table XIX.

TABLE XIX

SCHOOL DISTRICT REVENUES FROM LOCAL SOURCES: INDIANA AND OHIO IN 1972

	(thousands of dollars)			
	Total School District Revenues, Local Sources	Revenues From Property Taxes	Revenues From Other Taxes	Revenues From Charges and Other Sources
Indiana	$ 839,684	$ 737,943	$1,144	$100,597
Percentages	100%	88%	.1%	11.9%
Ohio	$1,506,885	$1,363,662	$ 522	$142,702
Percentages	100%	90.5%	.03%	9.5%

Source: (42).

The columns from Tables XVIII and XIX that are titled "Charges and Other Revenues" comprise revenues received by school districts from such activities as school lunch sales, interest earnings and sale of property: from activities that occur only as a result of the school district itself being in operation. The property tax, then, may be viewed as not only the backbone of school district funding for these states, but as the impetus behind the generation of miscellaneous school district income.

Information supplied by the Office of Education of the Department of Health, Education and Welfare on school finance programs further reiterates the dependency of Ohio and Indiana elementary and secondary public school systems upon the property tax (49, pp. 121, 171).

<u>1961-61: Local Support for Public Schools</u>

<u>Indiana</u>

Local and county revenue for public elementary and secondary schools is, for all practical purposes, derived from property taxes.

Approximately 4% of the local and county revenue received for schools is from local poll tax levies.

There is no other nonproperty tax authorized for the schools.

<u>Ohio</u>

Approximately 91% of the locally derived school revenues is from property taxes. The other 9% includes receipts from interest on bank deposits, school lunches and other miscellaneous items.

There are no authorized nonproperty taxes for school support.

<u>1966-67: Local Support for Public Schools</u>

<u>Indiana</u>

Same as 1961-62.

<u>Ohio</u>

Same as 1961-62.

1968-69: Local Support for Public Schools

Indiana

Same as 1961-62

Ohio

Same as 1961-62

1971-72: Local Support for Public Schools

Indiana

Local and county revenues for public elementary and secondary schools are derived primarily from property taxes and an excise tax on motor vehicles.

Ohio

Same as 1961-62.

1975-76: Local Support for Public Schools

Indiana

Local and county revenues for public elementary and secondary schools are derived primarily from an ad valorem property tax, a motor vehicle excise tax and a local option income tax which is available in counties adopting the local option tax.

Ohio

Same as 1961-62.

As noted in the preceding paragraphs, Indiana took steps to shift educational financing away from sole dependency on the property tax, with the funneling of motor vehicle excise taxes to the schools in 1971 and the institution of an optional local income tax in 1974. Indiana counties that do not adopt an income tax are restricted to the tax rates for property that were in effect in 1973. This limits future property tax increases to increases in assessed value only (2, pp. 27-28).

Until the local income tax makes some headway in Indiana, the state, like its neighbor Ohio, will find itself in the position of funding its public elementary and secondary schools through property taxes.

APPENDIX B

STATE DEMOGRAPHIC VARIABLES

This appendix outlines the procedures undertaken to determine whether there were other demographic differences between the states of Indiana and Ohio beyond those of vo-system construction that might possibly have been the cause of different levels of efficiency in the provision of education. In order to focus solely on the voting system differences, it was necessary to determine whether Indiana and Ohio had the same financial ability available for purchasing public goods and whether they had the same need for purchasing such goods.

The following five demographic variables were selected for testing and data obtained on them for Indiana and Ohio for a time period corresponding to the years in the study. (35).

Per capita personal income

School-age population as a percentage of total population

Public school enrollment as a percentage of total school enrollment

Percentage of total public school revenue supplied by local governments

Property tax revenues of state and local governments as a percentage of total tax revenues

It should be noted that because time-series data consist of observations of a variable at different points in time, there is usually a mutual dependence of successive observations.

Thus, an observed value of a variable may be correlated with, and hence, not be independent of the value of the same variable in the previous time period (or, $x_{t+1} = f(x_t)$). This type of correlation is termed autocorrelation and describes the correlation of a time series with itself.

One of the basic stipulations of statistical testing is that the data being tested must represent random samples from the population. The existence of autocorrelation within a time series means that data observations are not random, or independent, of one another; hence, the traditional tests of significance are not acceptable (33, p. 352).

However, it has been found that many economic time series which contain autocorrelation when the raw data are used in tests of significance exhibit no autocorrelation in tests in which first differences of the data are used. (9, p. 125), (33, p. 364), (36, p. 439), (32, pp. 28, 56, 64-67).

Thus, statistical tests of differences may be run on first differences of time series data without violating the assumption of random observations.

Data for the five previously mentioned demographics were obtained for each state (Indiana and Ohio) and tested for the presence of autocorrelation using the coefficient of autocorrelation (17, p. 337), as is shown below:

$$\frac{\sum z_t \, z_{t+1}}{\sum z^2_t}$$

Where: r = coefficient of autocorrelation

z = residual error

t = time period

Tests for autocorrelation on the data for the five demographics revealed autocorrelation significant at the 1% level for school-age population, public school enrollment and public school revenue. Per capita income demographics contained autocorrelation when tested at the 5% level of significance but not at the 1% level. Property tax revenue demographics contained no autocorrelation at either the 5% or 1% level. The results of the testing procedures are presented in the tables following the text of the appendix.

After first differencing, testing for the presence of autocorrelation on the first differences revealed no significant autocorrelation (.01 level) in any of the four demographic series which had been autocorrelated.

A Wilcoxon matched-pairs signed ranks test was then run of the first differences of four demographic series (school-age population, public school enrollment, public school revenue and per capita income) and on the actual data of property tax revenue. The Wilcoxon test is the nonparametric equivalent of the parametric paired t test; its power is approximately 95% relative to the paired t test when both are applied to normally distributed differences (42, p. 87).

A nonparametric test was chosen for testing differences in the states' demographics in this instance because of the small number of observations obtainable for each demographic variable; this researcher did not feel that the parametric test assumptions of normally distributed populations and equal population variances could be satisfactorily met with such a small number of observations. Since nonparametric statistics are distribution-free statistics in that they do not depend upon a prior knowledge of population distribution and parameters, they may be used to test for significance in instances where it is not possible to specify the functional form of the population distribution.

The results of the Wilcoxon signed-ranks test (a two-tailed test where H_o: No difference between distribution of demographic variables between states and where an alpha level of .01 was employed) resulted in an inability to reject H_o for each of the five demographic variables tested.

Additional Information

Both Indiana and Ohio experienced a positive rate of population change from 1950-75 with Indiana's population in0 creasing 3.2% over this period and Ohio's increasing 3.1% (50).

Both states reported equivalent median years of schooling achieved for persons 25 years and older: 9.9 years, 10.0 years and 12.1 years for Ohio in 1950, 1960 and 1970; 9.6 years, 10.8 years and 12.1 years for Indiana in 1950, 1960 and 1970, respectively (45).

Since the voter behavior studies concerned themselves with identifying many socioeconomic characteristics which may have influenced voter behavior, this researcher also examined several such characteristics within Indiana and Ohio, specifically the following: percentage of population that is black, percentage of population aged 65 years or older, percentage of population that is urban, birth rate of population and density of population.

When the preceding characteristics were subjected to the testing procedures previously described, the null hypothesis of no differences could not be rejected at an alpha level of .01. It should be pointed out that the linkage of such characteristics to voter behavior is dependent, in many cases, upon the specific regression model constructed; the significance of the demographic, in other words, may depend upon who is conducting the research. Denzau, for example, found that the variables of race and parent's education were irrelevent in determining a populace's educational spending (16, p. 246).

Results of the Statistical Tests

The tables which begin on the following page detail the results of the statistical tests on the five demographic variables mentioned on page 114 of this appendix.

The reader is referred to the following sources for presentation of the statistical significance tables utilized by this researcher: (17, p. 338; 11, p. 383).

TABLE XX

PER CAPITA PERSONAL INCOME:
ACTUAL DATA

t	(Year)	Ohio	Indiana
1	(1960)	2,339	2,179
2	(1961)	2,330	2,213
3	(1962)	2,392	2,350
4	(1963)	2,474	2,481
5	(1965)	2,829	2,846
6	(1966)	3,056	3,076
7	(1968)	3,509	3,412
8	(1969)	3,738	3,687
9	(1970)	3,972	3,781
10	(1971)	4,175	4,027
11	(1972)	4,534	4,366
12	(1974)	5,518	5,184

Source: (35).

TABLE XXI

TESTS FOR AUTOCORRELATION USING ACTUAL DATA ON PER CAPITA INCOME

	Ohio		Indiana	
t	x_t	x_{t+1}	x_t	x_{t+1}
1	2,339	2,330	2,179	2,213
2	2,330	2,392	2,213	2,350
3	2,392	2,474	2,350	2,481
4	2,474	2,829	2,481	2,846
5	2,829	3,056	2,846	3,076
6	3,056	3,509	3,076	3,412
7	3,509	3,738	3,412	3,687
8	3,738	3,972	3,687	3,781
9	3,972	4,175	3,781	4,027
10	4,175	4,534	4,027	4,366
11	4,534	5,518	4,366	5.184
12	5,518	2,339	5,184	2,179

Ohio	Indiana
Calculated r = .48549994	Calculated r = .47876742
$r_{table}\ \alpha.05$ = .348	$r_{table}\ \alpha.05$ = .348
$r_{table}\ \alpha.01$ = .505	$r_{table}\ \alpha.01$ = .505
Significant autocorrelation exists at α.05 and at α.01 levels.	Significant autocorrelation exists at the α.05 level but not at the α.01 level.

TABLE XXII

COMPUTATION OF FIRST DIFFERENCES: PER CAPITA PERSONAL INCOME

	Ohio			Indiana		
t	x_t	x_{t+1}	D_i First Difference $(x_t - x_{t+1})$	x_t	x_{t+1}	D_i First Difference $(x_t - x_{t+1})$
1	2,339	2,330	9	2,179	2,213	- 34
2	2,330	2,392	- 62	2,213	2,350	-137
3	2,392	2,474	- 82	2,350	2,481	-131
4	2,474	2,829	-355	2,481	2,846	-365
5	2,829	3,056	-227	2,846	3,076	-230
6	3,056	3,509	-453	3,076	3,412	-336
7	3,509	3,738	-229	3,412	3,687	-275
8	3,738	3,972	-234	3,687	3,781	- 94
9	3,972	4,175	-203	3,781	4,027	-246
10	4,175	4,534	-359	4,027	4,366	-339
11	4,534	5,518	-984	4,366	5,184	-818
12	5,518	---	---	5,184	---	---

TABLE XXIII

TESTS FOR AUTOCORRELATION USING FIRST DIFFERENCES OF PER CAPITA INCOME

	Ohio		Indiana	
t	D_t	D_{t+1}	D_t	D_{t+1}
1	9	- 62	- 34	-137
2	- 62	- 82	-137	-131
3	- 82	-355	-131	-365
4	-355	-227	-365	-230
5	-227	-453	-230	-336
6	-453	-229	-336	-275
7	-229	-234	-275	- 94
8	-234	-203	- 94	-246
9	-203	-359	-246	-339
10	-359	-984	-339	-818
11	-984	9	-818	- 34

Ohio	Indiana
Calculated r = -.11048923	Calculated r = -.13367178
r_{table} α.05 = -.539	r_{table} α.05 = -.539
r_{table} α.01 = -.679	r_{table} α.01 = -.679
No significant auto-correlation exists at the α.05 or at the α.01 level.	No significant auto-correlation exists at the α.05 or at the α.01 level.

TABLE XXIV

WILCOXON SIGNED RANKS TEST
USING FIRST DIFFERENCES ON
PER CAPITA INCOME

t	D_t Ohio	D_t Indiana	D_i (Ohio - Indiana)	Ranking of D_i
1	9	- 34	43	4.5
2	- 62	-137	75	8.0
3	- 82	-131	49	7.0
4	-355	-365	10	2.0
5	-227	-230	3	1.0
6	-453	-336	-117	9.0
7	-229	-275	46	6.0
8	-234	- 94	-140	10.0
9	-203	-246	43	4.5
10	-359	-339	- 20	3.0
11	-984	-818	-166	11.0

T (test statistic) = Rankings 9+10+3+11
= 33

<u>at α .05, n = 11</u>

upper quantile = 55
lower quantile = 11

<u>at α .01, n = 11</u>

upper quantile = 60
lower quantile = 6

Since T does not fall outside the upper or lower quantile limits at α.05 or α.01, the null hypothesis H_o: no difference between $x_{t\ Ohio}$ and $x_{t\ Indiana}$ is accepted.

TABLE XXV

SCHOOL-AGE POPULATION AS A PERCENTAGE OF TOTAL POPULATION: ACTUAL DATA

t	(Year)	Ohio	Indiana
1	(1960)	25.2%	26.1%
2	(1962)	25.3%	26.1%
3	(1963)	26.1%	26.3%
4	(1964)	26.4%	26.9%
5	(1966)	26.8%	26.9%
6	(1967)	26.8%	26.9%
7	(1969)	26.8%	26.8%
8	(1970)	27.2%	26.7%
9	(1971)	26.3%	26.5%
10	(1972)	25.8%	25.8%
11	(1973)	25.1%	25.3%
12	(1975)	24.1%	24.3%

Source: (35).

TABLE XXVI

TESTS FOR AUTOCORRELATION USING ACTUAL DATA ON SCHOOL-AGE POPULATION

	Ohio		Indiana	
t	x_t	x_{t+1}	x_t	x_{t+1}
1	25.2	25.3	26.1	26.1
2	25.3	26.1	26.1	26.3
3	26.1	26.4	26.3	26.9
4	26.4	26.8	26.9	26.9
5	26.8	26.8	26.9	26.9
6	26.8	26.8	26.9	26.8
7	26.8	27.2	26.8	26.7
8	27.2	26.3	26.7	26.5
9	26.3	25,8	26.5	25.8
10	25.8	25.1	25.8	25.3
11	25.1	24.1	25.3	24.3
12	24.1	25.2	24.3	26.1

Ohio	Indiana
Calculated r = .7383042	Calculated r = .59862272
$r_{table\ \alpha .05}$ = .348	$r_{table\ \alpha .05}$ = .348
$r_{table\ \alpha .01}$ = .505	$r_{table\ \alpha .01}$ = .505
Significant autocorrelation exists at α .05 and at α.01 levels	Significant autocorrelation exists at α .05 and at α.01 levels.

TABLE XXVII

COMPUTATION OF FIRST DIFFERENCES:
SCHOOL-AGE POPULATION

	Ohio			Indiana		
t	x_t	x_{t+1}	D_i First Difference $(x_t - x_{t+1})$	x_t	x_{t+1}	D_i First Difference $(x_t - x_{t+1})$
1	25.2	25.3	-0.1	26.1	26.1	0.0
2	25.3	26.1	-0.8	26.1	26.3	-0.2
3	26.1	26.4	-0.3	26.3	26.9	-0.6
4	26.4	26.8	-0.4	26.9	26.9	0.0
5	26.8	26.8	0.0	26.9	26.9	0.0
6	26.8	26.8	0.0	26.9	26.8	0.1
7	26.8	27.2	-0.4	26.8	26.7	0.1
8	27.2	26.3	0.9	26.7	26.5	0.2
9	26.3	25.8	0.5	26.5	25.8	0.7
10	25.8	25.1	0.7	25.8	25.3	0.5
11	25.1	24.1	1.0	25.3	24.3	1.0
12	24.1	---	---	24.3	---	---

TABLE XXVIII

TESTS FOR AUTOCORRELATION USING FIRST DIFFERENCES OF SCHOOL-AGE POPULATION

	Ohio		Indiana	
t	D_t	D_{t+1}	D_t	D_{t+1}
1	-0.1	-0.8	0.0	-0.2
2	-0.8	-0.3	-0.2	-0.6
3	-0.3	-0.4	-0.6	0.0
4	-0.4	0.0	0.0	0.0
5	0.0	0.0	0.0	0.1
6	0.0	-0.4	0.1	0.1
7	-0.4	0.9	0.1	0.2
8	0.9	0.5	0.2	0.7
9	0.5	0.7	0.7	0.5
10	0.7	1.0	0.5	1.0
11	1.0	-0.1	1.0	0.0

Ohio	Indiana
Calculated r = .39142857	Calculated r = .44370229
$r_{table\ \alpha .05}$ = .353	$r_{table\ \alpha .05}$ = .353
$r_{table\ \alpha .01}$ = .515	$r_{table\ \alpha .01}$ = .515
Significant autocorrelation exists at the α.05 level but not at the α.01 level.	Significant autocorrelation exists at the α.05 level but not at the α.01 level.

TABLE XXIX

WILCOXON SIGNED RANKS TEST USING FIRST DIFFERENCES ON SCHOOL-AGE POPULATION

t	D_t Ohio	D_t Indiana	D_i (Ohio - Indiana)	Ranking of D_i
1	-0.1	0.0	-0.1	1.5
2	-0.8	-0.2	-0.6	8.0
3	-0.3	-0.6	0.3	5.0
4	-0.4	0.0	-0.4	6.0
5	0.0	0.0	0.0	---
6	0.0	0.1	-0.1	1.5
7	-0.4	0.1	-0.5	7.0
8	0.9	0.2	0.7	9.0
9	0.5	0.7	-0.2	3.5
10	0.7	0.5	0.2	3.5
11	1.0	1.0	0.0	---

T (test statistic) = Rankings 5+9+3.5
= 17.5

<u>at α .05, n = 9</u>
upper quantile = 39
lower quantile = 6

<u>at α .01, n = 9</u>
upper quantile = 43
lower quantile = 2

Since T does not fall outside the upper or lower quantile limits at α.05 or α.01, the null hypothesis H_o: no difference between $x_{t\ Ohio}$ and $x_{t\ Indiana}$ is accepted.

TABLE XXX

PUBLIC SCHOOL ENROLLMENT AS A PERCENTAGE
OF TOTAL SCHOOL ENROLLMENT: ACTUAL DATA

t	(Year)	Ohio	Indiana
1	(1959)	85.2%	88.7%
2	(1962)	83.9%	87.9%
3	(1964)	83.6%	88.1%
4	(1966)	84.2%	88.6%
5	(1968)	86.8%	89.9%
6	(1969)	87.5%	90.6%
7	(1970)	87.0%	90.9%
8	(1971)	87.0%	90.9%
9	(1972)	88.4%	92.0%
10	(1974)	88.9%	92.4%

Source: (35).

TABLE XXXI

TESTS FOR AUTOCORRELATION USING ACTUAL DATA ON PUBLIC SCHOOL ENROLLMENT

	Ohio		Indiana	
t	x_t	x_{t+1}	x_t	x_{t+1}
1	85.2	83.9	88.7	87.9
2	83.9	83.6	87.9	88.1
3	83.6	84.2	88.1	88.6
4	84.2	86.8	88.6	89.9
5	86.8	87.5	89.9	90.6
6	87.5	87.0	90.6	90.9
7	87.0	87.0	90.9	90.9
8	87.0	88.4	90.9	92.0
9	88.4	88.9	92.0	92.4
10	88.9	85.2	92.4	88.7

Ohio	Indiana
Calculated r = .60689549	Calculated r = .61016225
r_{table} α.05 = .360	r_{table} α.05 = .360
r_{table} α.01 = .525	r_{table} α.01 = .525
Significant autocorrelation exists at α.05 and at α.01 levels.	Significant autocorrelation exists at α.05 and at α.01 levels.

TABLE XXXII

COMPUTATION OF FIRST DIFFERENCES:
PUBLIC SCHOOL ENROLLMENT

	Ohio			Indiana		
t	x_t	x_{t+1}	D_i First Difference $(x_t - x_{t+1})$	x_t	x_{t+1}	D_i First Difference $(x_t - x_{t+1})$
1	85.2	83.9	1.3	88.7	87.9	0.8
2	83.9	83.6	0.3	87.9	88.1	-0.2
3	83.6	84.2	-0.6	88.1	88.6	-0.5
4	84.2	86.8	-2.6	88.6	89.9	-1.3
5	86.8	87.5	-0.7	89.9	90.6	-0.7
6	87.5	87.0	0.5	90.6	90.9	-0.3
7	87.0	87.0	0.0	90.9	90.9	0.0
8	87.0	88.4	-1.4	90.9	92.0	-1.1
9	88.4	88.9	-0.5	92.0	92.4	-0.4
10	88.9	---	---	92.4	---	---

TABLE XXXIII

TESTS FOR AUTOCORRELATION USING FIRST DIFFERENCES OF PUBLIC SCHOOL ENROLLMENT

	Ohio		Indiana	
t	D_t	D_{t+1}	D_t	D_{t+1}
1	1.3	0.3	0.8	-0.2
2	0.3	-0.6	-0.2	-0.5
3	-0.6	-2.6	-0.5	-1.3
4	-2.6	-0.7	-1.3	-0.7
5	-0.7	0.5	-0.7	-0.3
6	0.5	0.0	-0.3	0.0
7	0.0	-1.4	0.0	-1.1
8	-1.4	-0.5	-1.1	-0.4
9	-0.5	1.3	-0.4	0.8

Ohio	Indiana
Calculated r = .17125645	Calculated r = .10131195
$r_{table\ \alpha.05}$ = .366	$r_{table\ \alpha.05}$ = .366
$r_{table\ \alpha.01}$ = .533	$r_{table\ \alpha.01}$ = .533
No significant auto-correlation exists at the α.05 or at the α.01 level.	No significant auto-correlation exists at the α.05 or at the α.01 level.

TABLE XXXIV

WILCOXON SIGNED RANKS TEST
USING FIRST DIFFERENCES ON
PUBLIC SCHOOL ENROLLMENT

t	D_t Ohio	D_t Indiana	D_i (Ohio - Indiana)	Ranking of D_i
1	1.3	0.8	0.5	4.5
2	0.3	-0.2	0.5	4.5
3	-0.6	-0.5	-0.1	1.5
4	-2.6	-1.3	-1.3	7.0
5	-0.7	-0.7	0.0	---
6	0.5	-0.3	0.8	6.0
7	0.0	0.0	0.0	---
8	-1.4	-1.1	-0.3	3.0
9	-0.5	-0.4	-0.1	1.5

T (test statistic) = Rankings 4.5+4.5+6
= 15

at α .05, n = 7

upper quantile = 25
lower quantile = 3

at α.01, n = 7

upper quantile = 28
lower quantile = 0

Since T does not fall outside the upper or lower quantile limits at α.05 or α.01, the null hypothesis H_o: no difference between $x_{t\ Ohio}$ and $x_{t\ Indiana}$ is accepted.

TABLE XXXV

PERCENTAGE OF TOTAL PUBLIC SCHOOL REVENUE
SUPPLIED BY LOCAL GOVERNMENTS:
ACTUAL DATA

t	(Year)	Ohio	Indiana
1	(1960)	68.1%	65.3%
2	(1961)	68.5%	65.7%
3	(1962)	74.9%	65.7%
4	(1963)	73.9%	63.3%
5	(1964)	70.9%	62.6%
6	(1966)	67.6%	55.3%
7	(1967)	63.3%	52.5%
8	(1969)	63.7%	61.0%
9	(1970)	66.5%	63.6%
10	(1971)	63.3%	63.1%
11	(1972)	60.9%	63.5%
12	(1973)	58.5%	62.2%
13	(1974)	56.5%	59.6%
14	(1975)	57.5%	58.5%

Source: (35).

TABLE XXXVI

TESTS FOR AUTOCORRELATION USING ACTUAL DATA ON PUBLIC SCHOOL REVENUE

	Ohio		Indiana	
t	x_t	x_{t+1}	x_t	x_{t+1}
1	68.1	68.5	65.3	65.7
2	68.5	74.9	65.7	65.7
3	74.9	73.9	65.7	63.3
4	73.9	70.9	63.3	62.6
5	70.9	67.6	62.6	55.3
6	67.6	63.3	55.3	52.5
7	63.3	63.7	52.5	61.0
8	63.7	66.5	61.0	63.6
9	66.5	63.3	63.6	63.1
10	63.3	60.9	63.1	63.5
11	60.9	58.5	63.5	62.2
12	58.5	56.5	62.2	59.6
13	56.5	57.5	59.6	58.8
14	57.5	68.1	58.8	65.3

Ohio	Indiana
Calculated r = .73940378	Calculated r = .49443481
$r_{table\ \alpha .05}$ = .335	$r_{table\ \alpha .05}$ = .335
$r_{table\ \alpha .01}$ = .485	$r_{table\ \alpha .01}$ = .485
Significant autocorrelation exists at α.05 and at α.01 levels.	Significant autocorrelation exists at α.05 and at α.01 levels.

TABLE XXXVII

COMPUTATION OF FIRST DIFFERENCES:
PUBLIC SCHOOL REVENUE

	Ohio			Indiana		
t	x_t	x_{t+1}	D_i First Difference $(x_t - x_{t+1})$	x_t	x_{t+1}	D_i First Difference $(x_t - x_{t+1})$
1	68.1	68.5	-0.4	65.3	65.7	-0.4
2	65.5	74.9	-6.4	65.7	65.7	0.0
3	74.9	73.9	1.0	65.7	63.3	2.4
4	73.9	70.9	3.0	63.3	62.6	0.7
5	70.9	67.6	3.3	62.6	55.3	7.3
6	67.6	63.3	4.3	55.3	52.5	2.8
7	63.3	63.7	-0.4	52.5	61.0	-8.5
8	63.7	66.5	-2.8	61.0	63.5	-2.6
9	66.5	63.3	3.2	63.6	63.1	0.5
10	63.3	60.9	2.4	63.1	63.5	-0.4
11	60.9	58.5	2.4	63.5	62.2	1.3
12	58.5	56.5	2.0	62.2	59.6	2.6
13	56.5	57.5	-1.0	59.6	58.8	0.8
14	57.5	---	---	58.8	---	---

TABLE XXXVIII

TESTS FOR AUTOCORRELATION USING FIRST DIFFERENCES OF PUBLIC SCHOOL REVENUE

	Ohio		Indiana	
t	D_t	D_{t+1}	D_t	D_{t+1}
1	-0.4	-6.4	-0.4	0.0
2	-6.4	1.0	0.0	2.4
3	1.0	3.0	2.4	0.7
4	3.0	3.3	0.7	7.3
5	3.3	4.3	7.3	2.8
6	4.3	-0.4	2.8	-8.5
7	-0.4	-2.8	-8.5	-2.6
8	-2.8	3.2	-2.6	0.5
9	3.2	2.4	0.5	-0.4
10	2.4	2.4	-0.4	1.3
11	2.4	2.0	1.3	2.6
12	2.0	-1.0	2.6	0.8
13	-1.0	-0.4	0.8	-0.4

Ohio	Indiana
Calculated r = .20340976	Calculated r = .16623036
r_{table} α.05 = .341	r_{table} α.05 = .341
r_{table} α.01 = .495	r_{table} α.01 = .495
No significant autocorrelation exists at the α.05 or at the α.01 level.	No significant autocorrelation exists at the α.05 or at the α.01 level.

TABLE XXXIX

WILCOXON SIGNED RANKS TEST
USING FIRST DIFFERENCES ON
PUBLIC SCHOOL REVENUE

t	D_t Ohio	D_t Indiana	D_i (Ohio - Indiana	Ranking of D_i
1	-0.4	-0.4	0.0	--
2	-6.4	0.0	-6.4	11
3	1.0	2.4	-1.4	4
4	3.0	0.7	2.3	7
5	3.3	7.3	-4.0	10
6	4.3	2.8	1.5	5
7	-0.4	-8.5	8.1	12
8	-2.8	-2.6	-0.2	1
9	3.2	0.5	2.7	8
10	2.4	-0.4	2.8	9
11	2.4	1.3	1.1	3
12	2.0	2.6	-0.6	2
13	-1.0	0.8	-1.8	6

T (test statistic) = Rankings 11+4+10+1+2+6
= 34

at α.05, n = 12

upper quantile = 64
lower quantile = 14

at α.01, n = 12

upper quantile = 70
lower quantile = 8

Since T does not fall outside the upper or lower quantile limits at α.05 or α.01, the null hypothesis H_o: no difference between $x_{t\ Ohio}$ and $x_{t\ Indiana}$ is accepted.

TABLE XL

PROPERTY TAX REVENUE OF STATE AND LOCAL GOVERNMENTS AS A PERCENTAGE OF TOTAL TAX REVENUES: ACTUAL DATA

t	(Year)	Ohio	Indiana
1	(1962)	52.1%	56.1%
2	(1963)	51.9%	56.6%
3	(1964)	51.8%	49.1%
4	(1965)	51.8%	49.0%
5	(1967)	49.1%	47.9%
6	(1968)	47.9%	49.4%
7	(1969)	47.2%	47.0%
8	(1970)	47.2%	50.8%
9	(1971)	43.0%	59.5%
10	(1973)	38.6%	43.1%

Source: (35).

TABLE XLI

TESTS FOR AUTOCORRELATION USING ACTUAL DATA ON PROPERTY TAX REVENUES

	Ohio		Indiana	
t	x_t	x_{t+1}	x_t	x_{t+1}
1	52.1	51.9	56.1	56.6
2	51.9	51.8	56.6	49.1
3	51.8	51.8	49.1	49.0
4	51.8	49.1	49.0	47.9
5	49.1	47.9	47.9	49.4
6	47.9	47.2	49.4	47.0
7	47.2	47.2	47.0	50.8
8	47.2	43.0	50.8	49.5
9	43.0	38.6	49.5	43.1
10	38.6	52.1	43.1	56.1

Ohio	Indiana
Calculated r = .35345510	Calculated r = -.00888504
$r_{table\ \alpha .05}$ = .360	$r_{table\ \alpha .05}$ = -.565
$r_{table\ \alpha .01}$ = .525	$r_{table\ \alpha .01}$ = -.705
No significant autocorrelation exists at the α.05 or at the α.01 level.	No significant autocorrelation exists at the α.05 or at the α.01 level.

TABLE XLII

WILCOXON SIGNED RANKS TEST
USING ACTUAL DATA ON
PROPERTY TAX REVENUES

t	D_t Ohio	D_t Indiana	D_i (Ohio - Indiana)	Ranking of D_i
1	52.1	56.1	-4.0	7
2	51.9	56.6	-4.7	9
3	51.8	49.1	2.7	4
4	51.8	49.0	2.8	5
5	49.1	47.9	1.2	2
6	47.9	49.4	-1.5	3
7	47.2	47.0	0.2	1
8	47.2	50.8	-3.6	6
9	43.0	49.5	-6.5	10
10	38.6	43.1	-4.5	8

T (test statistic) = Rankings 4+5+2+1
= 12

at α.05, n = 10

upper quantile = 46
lower quantile = 9

at α.01, n = 10

upper quantile = 51
lower quantile = 4

Since T does not fall outside the upper or lower quantile limits at α.05 or α.01, the null hypothesis H_o: no difference between $x_{t\ Ohio}$ and $x_{t\ Indiana}$ is accepted.

APPENDIX C

DATA FOR INDIANA

TABLE XLIII

DATA FOR RETENTION RATE CALCULATIONS IN INDIANA

FOR YEAR 1964

Counties	Enrollment Grades 1-11 Fall 1965	Enrollment Grades 2-12 Fall 1966
Adams	4,809	4,865
Allen	41,835	41,709
Bartholomew	11,498	11,420
Benton	2,753	2,741
Blackford	3,215	3,124
Boone	6,204	5,999
Brown	1,967	1,887
Carroll	3,222	3,204
Cass	7,601	7,440
Clark	14,112	13,849
Clay	4,366	4,295
Clinton	6,716	6,519
Crawford	1,779	1,686
Daviess	4,816	4,589
Dearborn	5,722	5,492
Decatur	4,168	4,203
Dekalb	6,287	6,253
Delaware	24,557	23,977
Dubois	5,718	5,792
Elkhart	24,809	24,280
Fayette	5,283	5,138
Floyd	10,159	10,035
Fountain	4,032	3,875
Franklin	2,861	2,779
Fulton	3,129	3,117

TABLE XLIII (Continued)

Counties	Enrollment Grades 1-11 Fall 1965	Enrollment Grades 2-12 Fall 1966
Gibson	5,570	5,467
Grant	16,596	16,055
Greene	5,377	5,221
Hamilton	10,774	10,829
Hancock	6,816	6,778
Harrison	4,223	4,183
Hendricks	10,676	10,649
Henry	10,567	10,315
Howard	17,358	17,260
Huntington	6,730	6,581
Jackson	6,390	6,379
Jasper	3,646	3,600
Jay	4,881	4,786
Jefferson	4,923	4,845
Jennings	3,721	3,621
Johnson	12,518	12,423
Knox	6,967	6,830
Kosciusko	10,523	10,514
Lafrange	4,851	4,647
Lake	109,304	108,328
Laporte	20,671	20,544
Lawrence	7,717	7,591
Madison	27,091	26,798
Marion	141,989	137,869
Marshall	7,755	7,774
Martin	2,419	2,176
Miami	9,971	9,753
Monroe	12,097	12,066
Montgomery	7,003	6,848
Morgan	9,551	9,440
Newton	2,617	2,518
Noble	6,141	5,989
Ohio	859	824
Orange	3,485	3,402
Owen	2,200	2,164
Parke	2,912	2,836
Perry	4,422	4,304
Pike	2,390	2,344
Porter	16,138	16,310
Posey	3,796	3,871
Pulaski	2,459	2,455
Putnam	5,293	5,257
Randolph	6,497	6,322
Ripley	4,864	4,685
Rush	4,189	4,053

TABLE XLIII (Continued)

Counties	Enrollment Grades 1-11 Fall 1965	Enrollment Grades 2-12 Fall 1966
St. Joseph	42,887	42,381
Scott	3,796	3,617
Shelby	7,642	7,519
Spencer	3,609	3,513
Starke	4,014	3,988
Steuben	3,118	3,041
Sullivan	4,000	3.823
Switzerland	1,344	1,300
Tippecanoe	16,234	15,939
Tipton	3,601	3,599
Union	1,673	1,471
Vanderburgh	27,229	26,989
Vermillion	3,107	3,051
Vigo	18,893	17,853
Wabash	7,164	7,127
Warren	1,704	1,635
Warrick	5,253	5,244
Washington	4,142	4,030
Wayne	15,314	15,180
Wells	5,258	5,205
White	5,574	5,507
Whitley	4,551	4,549

TABLE XLIII (Continued)

FOR YEAR 1967

Counties	Enrollment Grades 1-11 Fall 1968	Enrollment Grades 2-12 Fall 1969
Adams	5,074	5,123
Allen	47,448	47,207
Bartholomew	12,330	12,216
Benton	2,838	2,802
Blackford	3,374	3,284
Boone	6,472	6,441
Brown	2,181	2,071
Carroll	3,313	3,292
Cass	7,705	7,634
Clark	15,260	15,114
Clay	4,471	4,418
Clinton	6,833	6,752
Crawford	1,702	1,715
Daviess	4,826	4,866
Dearborn	6,451	6,356
Decatur	4,571	4,544
Dekalb	6,557	6,553
Delaware	25,542	24,978
Dubois	6,562	6,572
Elkhart	26,081	25,687
Fayette	5,377	5,316
Floyd	10,939	10,952
Fountain	4,059	3,918
Franklin	2,950	2,789
Fulton	3,193	3,095
Gibson	5,681	5,691
Grant	17,799	17,253
Greene	5,485	5,485
Hamilton	12,212	12,387
Hancock	7,544	7,576
Harrison	4,379	4,422
Hendricks	11,944	12,017
Henry	10,891	10,648
Howard	18,777	18,152
Huntington	6,894	6,865
Jackson	6,728	6,660
Jasper	3,647	3,678
Jay	5,201	4,931
Jefferson	5,259	5,133
Jennings	3,975	3,815
Johnson	13,899	13,732
Knox	7,010	7,069
Kosciusko	11,107	11,025

TABLE XLIII (Continued)

Counties	Enrollment Grades 1-11 Fall 1968	Enrollment Grades 2-12 Fall 1969
Lagrange	4,889	4,756
Lake	116,204	113,753
Laporte	21,585	21,348
Lawrence	7,895	7,688
Madison	28,323	27,496
Marion	153,203	147,757
Marshall	7,032	7,109
Martin	2,508	2,549
Miami	10,651	10,131
Monroe	12,979	12,646
Montgomery	7,307	7,193
Morgan	10,418	10,226
Newton	2,658	2,598
Noble	6,484	6,280
Ohio	913	890
Orange	3,514	3,472
Owen	2,281	2,249
Parke	3,000	2,999
Perry	4,461	4,481
Pike	2,515	2,419
Porter	18,474	18,540
Posey	4,198	4,248
Pulaski	2,562	2,548
Putnam	5,586	5,494
Randolph	6,713	6,422
Ripley	4,551	4,479
Rush	4,188	4,071
St. Joseph	44,808	43,918
Scott	4,058	3,993
Shelby	8,271	8,092
Spencer	3,800	3,720
Starke	4,242	4,169
Steuben	3,241	3,225
Sullivan	3,932	3,862
Switzerland	1,344	1,312
Tippecanoe	17,508	17,082
Tipton	3,601	3,642
Union	1,610	1,556
Vanderburgh	28,553	28,154
Vermillion	3,151	3,053
Vigo	19,455	19,001
Wabash	7,476	7,344
Warren	1,715	1,748
Warrick	5,692	5,887
Washington	4,317	4,214

TABLE XLIII (Continued)

Counties	Enrollment Grades 1-11 Fall 1968	Enrollment Grades 2-12 Fall 1969
Wayne	16,154	15,721
Wells	5,449	5,337
White	5,677	5,554
Whitley	4,759	4,784

TABLE XLIII (Continued)

FOR YEAR 1971

Counties	Enrollment Grades 1-11 Fall 1972	Enrollment Grades 2-12 Fall 1973
Allen	50,917	49,121
Bartholomew	12,786	12,757
Boone	6,237	6,668
Clark	15,618	15,608
Clay	4,576	4,489
Dearborn	6,781	6,695
Delaware	25,160	23,860
Elkhart	25,941	24,959
Floyd	11,084	10,975
Grant	16,820	16,387
Hamilton	14,197	14,617
Hancock	8,626	8,394
Hendricks	13,213	13,256
Henry	11,315	11,077
Howard	18,379	17,679
Johnson	15,059	14,917
Lake	111,626	109,400
Laporte	22,124	21,331
Madison	28,349	27,618
Marion	147,578	140,518
Marshall	7,235	7,207
Monroe	13,084	12,827
Morgan	10,881	10,640
Porter	19,717	20,061
St. Joseph	40,882	40,593
Shelby	8,566	8,396
Sullivan	3,753	3,614
Tippecanoe	17,420	16,746
Vanderburgh	27,044	26,408
Vermillion	3,241	3,130
Vigo	18,948	18,420
Warrick	6,945	7,056
Wayne	15,000	14,751

TABLE XLIII (Continued)

FOR YEAR 1976

Counties	Enrollment Grades 1-11 Fall 1977	Enrollment Grades 2-12 Fall 1978
Adams	4,646	4,665
Allen	46,712	44,872
Bartholomew	12,020	11,529
Boone	6,552	6,578
Clark	15,408	15,303
Clay	4,232	4,081
Dearborn	6,877	6,817
Dekalb	6,282	6,044
Delaware	22,074	21,899
Elkhart	24,884	23,915
Floyd	10,606	10,503
Gibson	5,272	5,240
Grant	15,326	14,595
Hamilton	16,204	16,400
Hancock	8,969	8,903
Hendricks	13,196	13,137
Henry	10,611	10,212
Howard	15,904	17,037
Johnson	15,472	15,285
Lake	93,966	90,556
Laporte	19,788	19,205
Madison	25,628	24,925
Marion	122,874	116,723
Marshall	6,782	6,566
Morgan	10,564	10,253
Porter	20,841	20,952
Posey	4,410	4,502
St. Joseph	36,210	35,606
Shelby	7,786	7,588
Sullivan	3,606	3,539
Tippecanoe	15,793	15,300
Vanderburgh	22,670	22,509
Vermillion	3,149	2,991
Vigo	17,692	17,038
Warrick	7,817	7,816
Wells	4,938	4,761

Data in Table XLIII was compiled from information furnished by the Indiana Department of Public Instruction, Division of Research and Data Processing in their _Report A: Number of Pupils Enrolled in Indiana Public School Corporation_, (Indianapolis, annually).

TABLE XLIV

DATA FOR EFFECTIVE TAX RATE CALCULATIONS IN INDIANA

FOR YEAR 1964

Counties	Assessed Value, Real Property	Assessed Value, All Property	School Taxes Levied on All Property	Assessment Sales Price Ratios
Adams	$ 36,024,510	$ 54,594,540	$ 1,205,606.06	.228775
Allen	359,439,340	549,400,050	13,623,871.40	.277000
Bartholomew	67,644,150	114,343,910	2,872,771.10	.278275
Benton	30,283,100	42,817,260	1,039,341.82	.258675
Blackford	18,754,860	29,853,185	748,016.76	.293575
Boone	44,329,320	64,830,490	1,980,619.73	.263250
Brown	6,968,400	10,165,320	325,593.53	.181950
Carroll	31,707,910	45,512,900	1,125,862.35	.260675
Cass	54,143,840	89,078,960	2,178,783.05	.263400
Clark	72,102,835	110,781,740	2,320,497.22	.273500
Clay	22,322,685	36,281,640	928,545.64	.249425
Clinton	49,897,555	70,414,025	1,822,165.85	.266600
Crawford	6,152,710	10,129,080	152,467.67	.288275
Daviess	24,305,500	37,268,010	990,048.76	.215400
Dearborn	38,826,465	92,128,875	1,416,581.24	.248875
Decatur	25,000,605	38,490,075	1,038,587.23	.237750
Dekalb	30,364,720	53,283,910	1,372,818.90	.256400
Delaware	129,638,740	207,972,120	5,586,486.59	.264700
Dubois	35,029,370	51,478,230	911,440.65	.254800
Elkhart	174,916,700	261,424,890	6,833,515.46	.277650
Fayette	30,211,370	45,718,890	1,172,819.39	.288550
Floyd	59,784,090	96,461,175	1,957,322.22	.274050
Fountain	24,328,030	37,371,760	793,228.84	.237700
Franklin	18,241,800	26,846,820	587,706.94	.284025
Fulton	25,888,960	40,731,000	997,306.92	.256400
Gibson	37,094,575	55,934,645	1,255,367.06	.265450
Grant	99,512,780	156,306,110	4,042,819.98	.264125
Greene	21,882,220	37,681,785	918,419.59	.227250
Hamilton	66,871,690	96,552,010	2,546,838.66	.265375
Hancock	47,039,004	65,318,884	1,608,875.20	.268850
Harrison	16,268,370	24,703,760	505,521.33	.212975
Hendricks	54,567,890	80,987,980	2,029,745.50	.234775
Henry	64,501,770	94,291,290	2,466,376.76	.308575
Howard	97,616,550	158,723,570	4,735,663.69	.245125
Huntington	41,943,550	66,436,160	1,897,605.24	.287825
Jackson	36,007,690	56,618,110	1,286,731.17	.244525
Jasper	32,360,780	46,916,800	1,040,740.81	.226575

TABLE XLIV (Continued)

Counties	Assessed Value, Real Property	Assessed Value, All Property	School Taxes Levied on All Property	Assessment Sales Price Ratios
Jay	$ 27,192,965	$ 44,184,135	$ 1,004,276.82	.264100
Jefferson	36,801,870	82,880,880	1,321,623.19	.282000
Jennings	13,881,095	22,444,775	479,211.75	.295725
Johnson	56,891,370	83,288,260	2,160,759.84	.246900
Knox	43,278,430	70,295,730	1,218,150.57	.254425
Kosciusko	70,874,460	112,170,300	2,480,211.15	.238325
Lagrange	27,495,700	40,940,160	1,201,284.26	.267250
Lake	568,405,360	1,111,597,225	35,963,086.21	.194000
Laporte	131,781,910	219,125,260	6,164,272.74	.252500
Lawrence	31,489,185	55,630,190	1,252,236.05	.250525
Madison	149,056,195	224,869,040	6,119,176.12	.255675
Marion	1,087,909,000	1,599,895,260	44,603,007.65	.308200
Marshall	52,295,460	81,078,920	2,107,128.18	.257200
Martin	6,467,820	12,848,000	235,179.37	.222800
Miami	39,752,725	54,044,520	1,571,350.50	.268025
Monroe	64,404,925	94,575,550	2,789,999.22	.254100
Montgomery	55,903,140	79,283,550	1,828,249.85	.291100
Morgan	39,638,610	66,339,910	1,605,168.66	.235625
Newton	25,905,080	37,268,350	950,647.25	.227075
Noble	35,850,950	59,415,890	1,758,820.67	.261500
Ohio	4,002,410	5,711,090	145,041.85	.283100
Orange	16,590,420	26,281,170	493,102.84	.293100
Owen	8,724,260	15,115,130	345,914.52	.215975
Parke	17,768,300	29,172,140	845,739.25	.255125
Perry	16,480,440	24,676,810	361,131.47	.290425
Pike	12,254,920	21,709,440	368,902.51	.258025
Porter	79,811,790	140,874,840	4,618,713.71	.209525
Posey	27,793,600	41,736,120	1,054,556.65	.266675
Pulaski	24,472,330	39,084,970	921,562.67	.265450
Putnam	28,702,390	49,166,380	1,183,005.37	.250900
Randolph	44,689,600	65,669,405	1,426,465.67	.311025
Ripley	20,002,710	34,507,020	1,052,845.80	.231600
Rush	36,165,315	50,822,735	1,323,838.05	.287375
St. Joseph	291,816,450	447,056,180	13,085,349.83	.257000
Scott	15,065,280	22,891,910	464,034.58	.268025
Shelby	47,250,930	69,255,475	1,680,394.42	.262225
Spencer	17,140,550	26,868,100	523,468.94	.279075
Starke	23,828,910	37,435,305	891,793.09	.271400
Steuben	27,487,880	42,945,730	1,209,442.45	.244850
Sullivan	23,171,490	50,698,920	1,188,507.84	.220200
Switzerland	6,872,450	9,884,420	284,260.83	.287125
Tippecanoe	130,672,625	196,268,645	4,732,990.77	.261300
Tipton	26,145,670	37,940,190	1,100,898.98	.245250

TABLE XLIV (Continued)

Counties	Assessed Value, Real Property	Assessed Value, All Property	School Taxes Levied on All Property	Assessment Sales Price Ratios
Union	$ 9,927,290	$ 15,080,980	$ 435,893.72	.284950
Vanderburgh	192,817,290	289,573,200	6,916,015.11	.277550
Vermillion	15,021,865	24,936,035	671,662.14	.254625
Vigo	106,845,910	205,287,410	6,474,074.22	.261450
Wabash	39,893,400	62,158,950	2,214,391.55	.254750
Warren	19,664,455	27,993,615	723,705.89	.255725
Warrick	28,778,360	49,703,855	1,048,211.84	.251475
Washington	19,633,680	29,176,640	547,995.02	.291450
Wayne	100,009,720	151,085,880	3,632,177.03	.288750
Wells	32,778,150	49,738,560	1,258,420.41	.258825
White	43,269,930	62,221,730	1,618,973.73	.256725
Whitley	26,949,990	43,323,740	1,162,411.25	.245100

TABLE XLIV (Continued)

FOR YEAR 1967

Counties	Assessed Value, Real Property	Assessed Value, All Property	School Taxes Levied on All Property	Assessment Sales Price Ratios
Adams	$ 40,792,930	$ 61,578,430	$ 2,205,182.12	.210400
Allen	446,547,540	665,767,310	22,953,213,20	.278200
Bartholomew	84,493,360	140,423,730	5,447,853,75	.263800
Benton	31,669,075	44,733,465	1,322,474.53	.268200
Blackford	20,002,195	30,497,040	872,362.75	.269500
Boone	48,137,230	68,490,190	2,803,652.92	.238500
Brown	7,895,700	11,755,130	644,189.62	.148500
Carroll	35,029,780	49,884,380	1,779,503.63	.233000
Cass	57,383,810	91,569,955	3,112,231.35	.244200
Clark	75,551,485	118,348,780	3,685,397.85	.234200
Clay	24,302,400	40,221,155	1,407,999.30	.239300
Clinton	53,515,220	76,316,455	2,826,923.46	.248000
Crawford	6,542,370	10,883,300	396,712.33	.244400
Daviess	28,054,200	41,921,835	1,792,212.94	.191700
Dearborn	41,439,985	96,196,860	1,658,563.54	.244300
Decatur	29,550,755	45,321,055	1,287,226.58	.234300
Dekalb	35,926,590	58,626,900	2,508,024.04	.234500
Delaware	145,631,460	229,624,056	8,739,063.52	.232300
Dubois	43,678,230	64,360,095	1,617,858.23	.249700
Elkhart	184,866,410	290,182,530	11,592,793.65	.247500
Fayette	38,877,030	60,473,500	1,861,829.82	.248200
Floyd	65,505,285	101,850,150	3,056,605.01	.267300
Fountain	25,695,350	53,598,405	1,379,739.45	.211300
Franklin	20,240,335	38,987,770	955,546.49	.229800
Fulton	28,246,070	43,984,780	1,506,266.12	.244700
Gibson	38,108,430	57,646,030	2,024,590.29	.256000
Grant	114,559,190	179,336,440	7,207,556.94	.249800
Greene	24,540,025	43,103,870	1,566,366.31	.225000
Hamilton	77,255,370	108,264,040	4,412,734.14	.232600
Hancock	52,069,032	71,174,012	2,357,888.15	.248000
Harrison	18,493,715	27,681,175	939,091.88	.211400
Hendricks	62,422,630	89,030,830	3,188,992.37	.217900
Henry	72,492,380	106,146,930	3,728,839.36	.270700
Howard	117,123,900	197,099,720	7,335,892.69	.226300
Huntington	49,051,150	74,449,590	2,672,248.31	.240200
Jackson	41,482,160	64,384,800	2,118,847.68	.207400
Jasper	34,251,490	50,036,640	1,633,366.06	.235800
Jay	31,180,185	49,760,345	1,259,610.14	.236200
Jefferson	41,715,460	79,977,500	2,117,695,53	.265200

TABLE XLIV (Continued)

Counties	Assessed Value, Real Property	Assessed Value, All Property	School Taxes Levied on All Property	Assessment Sales Price Ratios
Jennings	$ 15,930,740	$ 24,763,300	$ 992,946.06	.224700
Johnson	68,335,750	97,262,000	3,856,596.30	.245400
Knox	50,734,280	79,951,450	2,384,314.68	.229300
Kosciusko	81,662,770	126,788,180	4,560,823.97	.245300
Lagrange	30,709,680	46,108,350	1,968,283.51	.256900
Lake	615,982,725	1,160,514,665	51,290,046.70	.200600
Laporte	147,483,660	243,833,080	8,803,848.02	.232400
Lawrence	36,083,920	63,638,685	2,065,921.93	.244600
Madison	173,671,405	257,580,640	9,287,474.42	.212400
Marion	1,211,073,750	1,785,553,640	59,898,504.42	.308800
Marshall	62,565,390	92,382,040	2,969,727.26	.258100
Martin	7,722,930	13,889,210	355,869.37	.230000
Miami	47,862,135	69,433,705	2,120,975.15	.232400
Monroe	82,997,580	121,230,110	4,739,241.17	.226800
Montgomery	61,161,420	88,257,420	3,042,084.20	.263500
Morgan	43,419,370	70,815,280	2,814,556.25	.203600
Newton	27,041,220	38,735,290	1,585,446.18	.218300
Noble	38,916,260	62,322,310	2,292,541.62	.236000
Ohio	4,210,605	5,835,355	210,005.96	.261800
Orange	18,587,860	29,240,725	1,035,155.89	.260400
Owen	9,308,070	16,058,140	544,475.08	.171200
Parke	18,379,780	29,280,910	1,155,258.30	.201800
Perry	18,558,650	26,272.420	880,576.60	.251200
Pike	14,569,215	26,786,050	706,626.89	.232000
Porter	110,743,380	222,638,160	8,258,801.77	.205100
Posey	31,464,030	49,129,930	1,769,002.75	.220400
Pulaski	25,832,170	40,860,100	1,403,605.74	.231700
Putnam	34,080,060	55,871,970	2,257,832.86	.222100
Randolph	47,467,540	68,223,060	1,913,760.10	.297900
Ripley	21,147,265	36,295,140	1,558,451.81	.213900
Rush	38,564,150	53,770,585	1,942,341.98	.245300
St. Joseph	337,242,510	500,566,550	19,330,350.46	.209000
Scott	14,522,060	22,222,945	676,626.11	.269600
Shelby	51,442,510	77,121,220	3,282,730.54	.223000
Spencer	19,545,240	30,443,850	820,904.56	.211200
Starke	28,069,970	42,301,070	1,304,745.64	.235700
Steuben	29,444,350	46,861,290	1,803,345.68	.247400
Sullivan	24,742,535	53,722,780	1,758,886.00	.231300
Switzerland	10,094,380	15,738,000	465,373.99	.257500
Tippecanoe	145,857,385	216,376,255	7,543,076.25	.214500
Tipton	28,051,475	41,540,365	1,646,206.23	.219900
Union	10,304,380	15,378,770	547,357.10	.256300

TABLE XLIV (Continued)

Counties	Assessed Value, Real Property	Assessed Value, All Property	School Taxes Levied on All Property	Assessment Sales Price Ratios
Vanderburgh	$229,069,467	$333,605,867	$10,656,918.42	.257300
Vermillion	16,312,400	26,647,580	1,123,751.68	.213900
Vigo	125,339,200	231,615,350	8,477,954.74	.270600
Wabash	45,650,970	71,520,855	2,959,440.26	.248600
Warren	20,855,170	28,982,675	1,029,777.16	.250700
Warrick	40,627,275	90,183,055	2,142,570.09	.212100
Washington	21,425,370	32,668,410	1,189,310.12	.233100
Wayne	119,343,660	178,711,330	5,110,223.84	.282900
Wells	36,963,920	58,878,210	2,144,289.76	.246600
White	47,778,830	68,583,920	2,164,577.97	.204000
Whitley	29,562,340	47,371,275	2,052,547.31	.217800

TABLE XLIV (Continued)

FOR YEAR 1971

Counties	Assessed Value, Real Property	Assessed Value, All Property	School Taxes Levied on All Property	Assess-ment Sales Price Ratios
Allen	$620,494,250	$824,053,520	$31,099,502.01	.267000
Bartholo-mew	123,984,230	173,809,190	7,223,862.09	.241000
Boone	58,528,020	74,488,390	3,220,333.68	.187000
Clark	114,041,350	153,560,110	6,215,565.51	.231000
Clay	30,578,010	42,197,530	1,679,680.95	.188000
Dearborn	47,819,280	91,988,160	2,989,011.50	.195000
Delaware	171,206,275	249,243,980	10,716,394.70	.243000
Elkhart	244,206,780	346,141,550	15,247,337.48	.221000
Floyd	81,567,340	110,021,780	4,502,708.80	.237000
Grant	144,088,770	202,339,620	8,363,439.35	.265000
Hamilton	122,025,150	148,889,460	6,450,372.64	.226000
Hancock	64,082,850	80,318,900	3,408,454.97	.211000
Hendricks	94,784,310	116,306,785	4,486,106.28	.235000
Henry	83,661,160	112,078,930	4,560,359.62	.232000
Howard	183,118,990	256,077,900	9,846,280.01	.247000
Johnson	94,244,980	120,966,640	4,996,637.44	.203000
Lake	731,749,265	1,321,001,800	55,989,704.23	.166000
Laporte	202,839,260	291,411,930	12,207,194.51	.228000
Madison	224,627,530	304,781,180	11,568,422.98	.280000
Marion	1,499,260,570	2,020,634,150	85,635,171.10	.269000
Marshall	76,348,260	103,979,680	4,144,133,54	.253000
Monroe	133,580,885	170,593,610	6,971,466.89	.241000
Morgan	59,977,500	81,872,310	3,673,067.33	.209000
Porter	205,655,520	370,739,250	12,794,884.02	.210000
St. Joseph	479,268,570	615,203,950	22,146,323.13	.247000
Shelby	65,822,925	89,318,400	4,092,150.44	.251000
Sullivan	31,069,565	58,266,975	2,493,648.35	.229000
Tippecanoe	198,987,030	268,787,995	11,785,660.51	.250000
Vander-burgh	292,775,640	396,796,305	16,376,919.98	.235000
Vermillion	29,850,995	53,938,450	1,794,884.07	.172000
Vigo	174,500,270	276,162,630	10,308,902.82	.187000
Warrick	65,508,645	125,261,495	3,890,931.24	.207000
Wayne	149,500,110	202,385,620	6,983,394.75	.266000

TABLE XLIV (Continued)

FOR YEAR 1976				
Counties	Assessed Value, Real Property	Assessed Value, All Property	School Taxes Levied on All Property	Assess-ment Sales Price Ratios
Adams	$ 62,770,300	$ 92,451,300	$ 3,376,014.32	.142000
Allen	740,857,200	1,031,396,280	32,893,321.65	.185000
Bartholo-mew	150,567,330	235,571,900	7,448,722.75	.182000
Boone	72,245,470	95,514,320	3,504,285.67	.126000
Clark	144,065,790	202,341,160	6,854,533.75	.166000
Clay	34,545,994	52,421,129	1,822,368.28	.111000
Dearborn	55,117,565	104,760,370	3,351,864.57	.086000
Dekalb	58,376,130	89,111,480	2,805,010.50	.155000
Delaware	200,407,235	300,112,080	11,329,633.42	.183000
Elkhart	315,937,060	469,402,150	15,936,180.65	.174000
Floyd	100,205,770	132,861,730	4,386,140.24	.167000
Gibson	55,486,780	96,585,070	2,612,457.75	.103000
Grant	158,311,740	230,829,890	8,628,800.72	.085000
Hamilton	187,450,180	231,230,980	7,935,736.05	.176000
Hancock	82,736,080	106,717,850	4,273,218.41	.113000
Hendricks	125,866,820	158,662,780	4,995,502.82	.158000
Henry	96,158,430	135,473,960	5,070,695.79	.123000
Howard	212,696,670	316,783,780	10,158,757.40	.169000
Johnson	127,258,680	170,899,070	5,341,496.68	.158000
Lake	848,025,795	1,596,242,605	65,504,138.07	.119000
Laporte	235,886,440	367,567,990	12,572,794.24	.158000
Madison	256,160,034	360,136,309	12,442,723.07	.170000
Marion	1,777,920,440	2,554,335,160	92,878,875.71	.188000
Marshall	90,714,200	131,568,605	4,267,036.26	.138000
Morgan	74,569,740	100,802,750	3,594,668.80	.138000
Porter	254,368,300	472,300,320	15,344,470.22	.130000
Posey	59,622,210	105,461,640	2,933,957.04	.138000
St. Joseph	558,697,290	747,010,300	23,385,292.19	.176000
Shelby	77,393,340	111,773,580	4,278,984.87	.137000
Sullivan	33,234,740	61,642,370	2,547,197.14	.074000
Tippecanoe	254,012,540	361,330,305	12,796,740.23	.179000
Vander-burgh	324,508,690	467,510,800	16,705,616.25	.134000
Vermillion	34,515,775	81,556,685	1,902,399.76	.062000
Vigo	196,912,410	317,083,810	10,547,414.98	.129000
Warrick	86,877,990	195,831,075	4,685,014.57	.130000
Wells	60,457,940	85,598,870	2,867,166.47	.166000

Sources: (41) for assessed values and taxes; (44) for ratios.

TABLE XLV

ASSESSMENT-SALES PRICE RATIO CALCULATIONS FOR INDIANA, 1964

Counties	A 1963 Assess-ment Sales Price Ratios	B 1967 Assess-ment Sales Price Ratios	C Total Change in Ratios 1963-67 (B-A)	D Average Yearly Change in Ratios 1963-67 (C ÷ 4)	E 1964 Assessment Sales Price Ratios (estimated) (A + D)
Adams	.2349	.2104	-.0245	-.006125	.228775
Allen	.2766	.2782	+.0016	+.000400	.277000
Bartholo-mew	.2831	.2638	-.0193	-.004825	.278275
Benton	.2555	.2682	+.0127	+.003175	.258675
Blackford	.3016	.2695	-.0321	-.008025	.293575
Boone	.2715	.2385	-.0330	-.008250	.263250
Brown	.1931	.1485	-.0446	-.011150	.181950
Carroll	.2699	.2330	-.0369	-.009225	.260675
Cass	.2698	.2442	-.0256	-.006400	.263400
Clark	.2866	.2342	-.0524	-.013100	.273500
Clay	.2528	.2393	-.0135	-.003375	.249425
Clinton	.2728	.2480	-.0248	-.006200	.266600
Crawford	.3029	.2444	-.0585	-.014625	.288275
Daviess	.2233	.1917	-.0316	-.007900	.215400
Dearborn	.2504	.2443	-.0061	-.001525	.248875
Decatur	.2389	.2343	-.0046	-.001150	.237750
Dekalb	.2637	.2345	-.0292	-.007300	.256400
Delaware	.2755	.2323	-.0432	-.010800	.264700
Dubois	.2565	.2497	-.0068	-.001700	.254800
Elkhart	.2877	.2475	-.0402	-.010050	.277650
Fayette	.3020	.2482	-.0538	-.013450	.288550
Floyd	.2763	.2673	-.0090	-.002250	.274050
Fountain	.2465	.2113	-.0352	-.008800	.237700
Franklin	.3021	.2298	-.0723	-.018075	.284025
Fulton	.2603	.2447	-.0156	-.003900	.256400
Gibson	.2686	.2560	-.0125	-.003150	.265450
Grant	.2689	.2498	-.0191	-.004775	.264125
Greene	.2280	.2250	-.0030	-.000750	.227250
Hamilton	.2763	.2326	-.0437	-.010925	.265375
Hancock	.2758	.2480	-.0278	-.006950	.268850
Harrison	.2135	.2114	-.0021	-.000525	.212975
Hendricks	.2404	.2179	-.0225	-.005625	.234775
Henry	.3212	.2707	-.0505	-.012625	.308575
Howard	.2514	.2263	-.0251	-.006275	.245125
Huntington	.3037	.2402	-.0635	-.015875	.287825
Jackson	.2569	.2074	-.0495	-.012375	.244525
Jasper	.2235	.2358	+.0123	+.003075	.226575

TABLE XLV (Continued)

Counties	A 1963 Assessment Sales Price Ratios	B 1967 Assessment Sales Price Ratios	C Total Change in Ratios 1963-67 (B-A)	D Average Yearly Change in Ratios 1963-67 (C ÷ 4)	E 1964 Assessment Sales Price Ratios (estimated) (A + D)
Jay	.2734	.2362	-.0372	-.009300	.264100
Jefferson	.2876	.2652	-.0224	-.005600	.282000
Jennings	.3194	.2247	-.0947	-.023675	.295725
Johnson	.2474	.2454	-.0020	-.000500	.246900
Knox	.2628	.2293	-.0335	-.008375	.254425
Kosciusko	.2360	.2453	+.0093	+.002325	.238325
Lagrange	.2707	.2569	-.0138	-.003450	.267250
Lake	.1918	.2006	+.0088	+.002200	.194000
Laporte	.2592	.2324	-.0268	-.006700	.252500
Lawrence	.2525	.2446	-.0079	-.001975	.250525
Madison	.2701	.2124	-.0577	-.014425	.255675
Marion	.3080	.3088	+.0008	+.000200	.308200
Marshall	.2569	.2581	+.0012	+.000300	.257200
Martin	.2204	.2300	+.0096	+.002400	.222800
Miami	.2799	.2324	-.0047	-.011875	.268025
Monroe	.2632	.2268	-.0364	-.009100	.254100
Montgomery	.3003	.2635	-.0368	-.009200	.291100
Morgan	.2463	.2036	-.0427	-.010675	.235625
Newton	.2300	.2183	-.0117	-.002925	.227075
Noble	.2700	.2360	-.0340	-.008500	.261500
Ohio	.2902	.2618	-.0284	-.007100	.283100
Orange	.3040	.2604	-.0436	-.010900	.293100
Owen	.2309	.1712	-.0597	-.014925	.215975
Parke	.2729	.2018	-.0711	-.017775	.255125
Perry	.3035	.2512	-.0523	-.013075	.290425
Pike	.2667	.2320	-.0347	-.008675	.258025
Porter	.2110	.2051	-.0059	-.001475	.209525
Posey	.2821	.2204	-.0617	-.015425	.266675
Pulaski	.2767	.2317	-.0450	-.011250	.265450
Putnam	.2605	.2221	-.0384	-.009600	.250900
Randolph	.3154	.2979	-.0179	-.004375	.311025
Ripley	.2375	.2139	-.0236	-.005900	.231600
Rush	.3014	.2453	-.0561	-.014025	.287375
St. Joseph	.2730	.2090	-.0640	-.016000	.257000
Scott	.2675	.2696	+.0021	+.000525	.268025
Shelby	.2753	.2230	-.0523	-.013075	.262225
Spencer	.3017	.2112	-.0905	-.022625	.279075
Starke	.2833	.2357	-.0476	-.011900	.271400
Steuben	.2440	.2474	+.0034	+.000850	.244850
Sullivan	.2165	.2313	+.0148	+.003700	.220200

TABLE XLV (Continued)

Counties	A 1963 Assessment Sales Price Ratios	B 1967 Assessment Sales Price Ratios	C Total Change in Ratios 1963-67 (B-A)	D Average Yearly Change in Ratios 1963-67 (C ÷ 4)	E 1964 Assessment Sales Price Ratios (estimated) (A + D)
Switzerland	.2970	.2575	-.0395	-.009875	.287125
Tippecanoe	.2769	.2145	-.0624	-.015600	.261300
Tipton	.2537	.2199	-.0338	-.008450	.245250
Union	.2945	.2563	-.0382	-.009550	.284950
Vanderburgh	.2843	.2573	-.0270	-.006750	.277550
Vermillion	.2682	.2139	-.0543	-.013575	.254625
Vigo	.2584	.2706	+.0122	+.003050	.261450
Wabash	.2568	.2486	-.0082	-.002050	.254750
Warren	.2574	.2507	-.0067	-.001675	.255725
Warrick	.2646	.2121	-.0525	-.013125	.251475
Washington	.3109	.2331	-.0778	-.019450	.291450
Wayne	.2907	.2829	-.0078	-.001950	.288750
Wells	.2629	.2466	-.0163	-.004075	.258825
White	.2743	.2040	-.0703	-.017575	.256725
Whitley	.2542	.2178	-.0364	-.009100	.245100

1963 and 1967 ratios are from unpublished information furnished by the Indiana State Board of Tax Commissioners, Indianapolis, Indiana.

APPENDIX D

DATA FOR OHIO

TABLE XLVI

DATA FOR RETENTION RATE CALCULATIONS IN OHIO

FOR YEAR 1964

Counties	Enrollment Grades 1-11 Fall 1965	Enrollment Grades 2-12 Fall 1966
Adams	4,585	4,396
Allen	21,663	21,168
Ashland	8,278	8,086
Ashtabula	19,500	19,299
Athens	8,411	8,265
Auglaize	8,084	7,930
Belmont	14,061	13,730
Brown	5,319	5,078
Butler	42,322	40,802
Carroll	3,448	3,270
Champaign	7,347	7,097
Clark	31,055	30,106
Clermont	21,132	14,549
Clinton	7,719	7,531
Columbiana	21,537	21,100
Coshocton	6,774	6,608
Crawford	10,326	10,269
Cuyahoga	263,816	258,358
Darke	9,549	9,405
Defiance	7,281	7,229
Delaware	7,683	7,597
Erie	14,856	14,757
Fairfield	13,789	13,493
Fayette	5,784	5,502
Franklin	145,322	141,866

TABLE XLVI (Continued)

Counties	Enrollment Grades 1-11 Fall 1965	Enrollment Grades 2-12 Fall 1966
Fulton	7,823	7,937
Gallia	5,378	5,206
Geauga	11,827	11,771
Greene	26,987	26,466
Guernsey	6,226	6,132
Hamilton	141,452	132,148
Hancock	11,312	11,120
Hardin	6,946	6,883
Harrison	4,159	3,999
Henry	5,542	5,653
Highland	6,755	6,408
Hocking	4,069	3,946
Holmes	4,223	3,882
Huron	10,572	10,471
Jackson	6,620	6,468
Jefferson	18,562	18,302
Knox	7,620	7,518
Lake	36,544	36,697
Lawrence	12,845	12,378
Licking	21,717	21,391
Logan	7,134	7,001
Lorain	47,855	47,465
Lucas	78,100	77,393
Madison	6,401	6,179
Mahoning	52,055	52,333
Marion	13,388	12,733
Medina	17,662	17,547
Meigs	4,706	4,491
Mercer	8,945	8,771
Miami	17,043	16,715
Monroe	3,362	3,278
Montgomery	110,464	106,550
Morgan	2,594	2,500
Morrow	4,674	4,498
Muskingum	16,968	16,152
Noble	2,576	2,572
Ottawa	8,306	7,905
Paulding	4,329	4,308
Perry	5,456	5,486
Pickaway	7,456	7,186
Pike	5,276	5,049
Portage	22,611	22,325
Preble	8,479	8,680
Putnam	6,514	6,832
Richland	26,469	25,994

TABLE XLVI (Continued)

Counties	Enrollment Grades 1-11 Fall 1965	Enrollment Grades 2-12 Fall 1966
Ross	12,602	11,901
Sandusky	11,871	11,891
Scioto	17,176	16,415
Seneca	10,938	10,758
Shelby	8,028	7,831
Stark	69,943	68,754
Summit	104,687	102,184
Trumbull	44,638	44,299
Tuscarawas	15,890	15,520
Union	4,445	4,359
Van Wert	4,828	4,772
Vinton	2,316	2,114
Warren	19,445	18,642
Washington	11,510	11,366
Wayne	17,347	17,061
Williams	6,813	6,759
Wood	14,806	14,560
Wyandot	4,469	4,472

TABLE XLVI (Continued)

FOR YEAR 1967

Counties	Enrollment Grades 1-11 Fall 1968	Enrollment Grades 2-12 Fall 1969
Adams	4,417	4,504
Allen	22,436	22,034
Ashland	8,370	8,258
Ashtabula	20,413	20,278
Athens	8,777	8,493
Auglaize	8,289	8,189
Belmont	13,559	13,310
Brown	5,519	5,156
Butler	44,192	42,903
Carroll	3,531	3,438
Champaign	7,401	7,236
Clark	30,495	28,740
Clermont	22,495	21,645
Clinton	7,950	7,860
Columbiana	21,036	20,659
Coshocton	7,025	6,881
Crawford	10,878	10,480
Cuyahoga	277,887	271,406
Darke	10,202	9,937
Defiance	7,807	7,914
Delaware	8,325	8,262
Erie	16,753	16,154
Fairfield	14,847	14,643
Fayette	5,868	5,631
Frankline	156,286	152,154
Fulton	8,437	8,741
Gallia	5,378	5,108
Geauga	12,959	12,868
Greene	27,782	27,216
Guernsey	6,435	6,367
Hamilton	149,985	140,347
Hancock	12,073	11,888
Hardin	7,061	7,042
Harrison	3,982	3,926
Henry	5,926	5,775
Highland	6,455	6,411
Hocking	4,240	4,188
Holmes	4,271	3,940
Huron	11,512	11,626
Jackson	6,490	6,278
Jefferson	18,599	17,861
Knox	7,956	7,832
Lake	40,232	40,089

TABLE XLVI (Continued)

Counties	Enrollment Grades 1-11 Fall 1968	Enrollment Grades 2-12 Fall 1969
Lawrence	12,407	12,068
Licking	23,179	22,694
Logan	7,519	7,335
Lorain	52,629	51,977
Lucas	81,137	79,876
Madison	6,476	6,336
Mahoning	53,325	52,644
Marion	13,783	13,296
Medina	19,586	19,445
Meigs	4,461	4,309
Mercer	9,250	9,158
Miami	18,550	18,161
Monroe	4,247	4,217
Montgomery	115,999	110,554
Morgan	2,674	2,616
Morrow	4,898	4,809
Muskingum	17,362	16,875
Noble	2,569	2,536
Ottawa	7,706	7,602
Paulding	4,617	4,580
Perry	5,676	5,681
Pickaway	7,770	7,728
Pike	5,030	4,873
Portage	24,899	24,829
Preble	8,652	8,387
Putnam	6,988	7,124
Richland	25,791	24,468
Ross	12,735	12,290
Sandusky	12,392	12,606
Scioto	16,068	16,155
Seneca	10,889	10,693
Shelby	8,398	8,123
Stark	66,219	67,147
Summit	107,347	104,357
Trumbull	46,818	46,528
Tuscarawas	15,734	15,843
Union	4,784	4,732
Van Wert	4,761	4,663
Vinton	2,149	2,072
Warren	20,619	18,375
Washington	11,119	11,634
Wayne	18,098	17,903
Williams	7,161	7,048
Wood	15,434	15,441
Wyandot	4,564	4,564

TABLE XLVI (Continued)

FOR YEAR 1971

Counties	Enrollment Grades 1-11 Fall 1972	Enrollment Grades 2-12 Fall 1973
Allen	21,658	21,155
Ashtabula	20,627	20,161
Athens	8,736	8,523
Belmont	12,553	12,418
Butler	41,695	43,064
Clark	29,403	29,086
Clermont	21,279	20,965
Columbiana	21,580	20,973
Crawford	10,870	10,313
Cuyahoga	271,803	264,742
Delaware	9,006	8,973
Erie	17,165	16,084
Fairfield	15,120	15,199
Franklin	157,447	151,418
Geauga	13,022	12,848
Greene	27,513	26,931
Hamilton	142,061	136,644
Hancock	11,984	11,975
Jefferson	17,516	16,892
Lake	39,045	38,045
Lawrence	12,121	11,625
Licking	23,281	23,098
Lorain	53,108	51,979
Lucas	81,076	79,006
Mahoning	51,198	51,104
Marion	13,844	13,331
Medina	21,448	21,783
Miami	19,289	18,566
Montgomery	107,989	103,027
Muskingum	17,283	16,733
Pickaway	9,055	8,884
Portage	25,742	25,466
Preble	7,662	7,582
Putnam	7,552	7,535
Richland	24,137	24,056
Ross	12,029	11,715
Sandusky	12,699	12,589
Scioto	14,280	15,196
Seneca	11,402	10,689
Stark	73,013	71,006
Summit	103,808	101,471
Trumbull	46,701	47,061
Tuscarawas	14,331	14,390

TABLE XLVI (Continued)

Counties	Enrollment Grades 1-11 Fall 1972	Enrollment Grades 2-12 Fall 1973
Van Wert	4,502	4,357
Warren	17,556	17,369
Washington	11,250	11,128
Wayne	17,890	17,475
Wood	14,776	15,562

TABLE XLVI (Continued)

FOR YEAR 1976

Counties	Enrollment Grades 1-11 Fall 1977	Enrollment Grades 2-12 Fall 1978
Allen	19,528	19,076
Ashtabula	19,335	18,843
Belmont	11,999	11,843
Butler	42,562	41,550
Carroll	3,716	3,615
Champaign	6,876	6,668
Clark	26,578	26,197
Clermont	21,174	21,355
Columbiana	19,507	18,922
Cuyahoga	220,277	213,201
Delaware	8,656	8,677
Erie	15,270	14,817
Fairfield	16,185	16,606
Franklin	139,408	131,073
Fulton	8,390	8,198
Geauga	12,278	12,160
Greene	20,910	22,925
Hamilton	122,225	115,729
Lake	34,195	35,251
Lawrence	10,956	11,349
Licking	22,335	21,945
Lorain	48,658	48,155
Lucas	69,578	66,614
Madison	5,995	5,911
Mahoning	43,524	42,759
Marion	12,749	12,170
Medina	23,269	23,074
Miami	17,688	17,094
Montgomery	95,296	90,948
Ottawa	7,074	6,995
Pickaway	9,061	9,005
Portage	23,591	23,206
Preble	7,181	6,828
Richland	20,831	20,501
Sandusky	11,819	11,412
Scioto	13,732	14,347
Stark	62,517	62,697
Summit	90,295	87,382
Trumbull	42,881	41,886
Warren	17,239	17,402
Wayne	16,577	16,480
Wood	14,474	14,588

From data furnished by the Ohio Department of Education.

TABLE XLVII

DATA FOR EFFECTIVE TAX RATE CALCULATIONS IN OHIO

FOR YEAR 1964

Counties	Average School Operating Millage Rate	Assessed Value, Real Property	Assessment-Sales Price Ratios
Adams	.01342857	$ 19,859,850	.31930
Allen	.01734583	196,385,340	.37525
Ashland	.02209250	71,453,180	.37375
Ashtabula	.01924429	177,820,010	.36890
Athens	.01608750	43,458,030	.35730
Auglaize	.01995556	72,027,680	.34990
Belmont	.01648800	113,522,550	.40425
Brown	.01754286	32,557,810	.29635
Butler	.02136820	407,830,480	.38315
Carroll	.01654000	26,086,100	.36210
Champaign	.01792000	57,951,130	.37655
Clark	.01912143	255,719,470	.41295
Clermont	.02165556	131,850,930	.38310
Clinton	.02040000	59,939,010	.35400
Columbiana	.01929091	145,928,240	.36845
Coshocton	.01523333	55,330,030	.37085
Crawford	.01876667	91,834,750	.34905
Cuyahoga	.02404156	4,071,564,070	.37475
Darke	.01983000	96,104,110	.35915
Defiance	.01894000	64,648,625	.35800
Delaware	.01787500	74,186,840	.34210
Erie	.01913250	145,303,870	.34470
Fairfield	.01848750	122,475,410	.37060
Fayette	.01900000	56,407,040	.36330
Franklin	.01981824	1,518,521,220	.38295
Fulton	.02130000	64,372,920	.36185
Gallia	.01410000	25,931,020	.34370
Geauga	.02862500	116,864,150	.34750
Greene	.02176429	197,093,140	.40885
Guernsey	.01792000	49,311,310	.34355
Hamilton	.01901708	2,252,872,100	.43575
Hancock	.01945000	129,225,230	.34590
Hardin	.01695000	54,723,120	.34630
Harrison	.01677273	28,527,510	.46150
Henry	.01767000	65,863,590	.32670
Highland	.01960000	46,928,990	.33525
Hocking	.01538750	23,791,440	.33080
Holmes	.01460000	32,810,630	.37920

TABLE XLVII (Continued)

Counties	Average School Operating Millage Rate	Assessed Value, Real Property	Assessment-Sales Price Ratios
Huron	.02080125	$ 80,216,000	.33000
Jackson	.01712000	26,712,220	.36380
Jefferson	.01705769	168,235,340	.38655
Knox	.02030000	68,612,490	.37380
Lake	.02610000	360,928,090	.35555
Lawrence	.01445000	61,148,190	.33020
Licking	.01763500	161,024,760	.34505
Logan	.01778333	70,979,060	.37380
Lorain	.02372600	431,829,340	.34810
Lucas	.02181000	922,298,430	.39130
Madison	.01932000	55,348,860	.34715
Mahoning	.02277933	611,171,760	.38950
Marion	.02460000	115,295,760	.37050
Medina	.02368571	136,929,940	.35190
Meigs	.01510000	17,750,910	.36440
Mercer	.01913750	68,400,280	.33550
Miami	.01964545	145,885,490	.35940
Monroe	.01435000	35,891,660	.40400
Montgomery	.02251412	1,137,533,620	.41290
Morgan	.02830000	14,574,550	.37635
Morrow	.01807500	32,712,580	.33475
Muskingum	.01632500	106,021,600	.36060
Noble	.01820000	12,367,830	.33315
Ottawa	.01677000	78,147,570	.32750
Paulding	.01970000	36,196,600	.31495
Perry	.01695000	25,571,800	.33500
Pickaway	.01630000	65,752,200	.30045
Pike	.01640000	17,405,290	.34660
Portage	.02437500	164,433,690	.33335
Preble	.02266000	58,806,410	.33490
Putnam	.01828333	61,144,950	.33910
Richland	.02206667	242,621,600	.36420
Roxx	.01627000	91,940,240	.37855
Sandusky	.02060500	109,897,590	.36295
Scioto	.01557273	107,598,520	.39070
Seneca	.01822727	107,432,190	.34035
Shelby	.01931250	68,260,600	.34965
Stark	.02050000	698,092,100	.41965
Summit	.02527000	1,131,284,980	.37505
Trumbull	.02270000	434,103,440	.37850
Tuscarawas	.02020000	112,600,340	.35265
Union	.01856667	41,279,650	.33140
Van Wert	.02025000	64,150,130	.33590

TABLE XLVII (Continued)

Counties	Average School Operating Millage Rate	Assessed Value, Real Property	Assessment-Sales Price Ratios
Vinton	.01608333	$ 7,927,920	.30190
Warren	.02001000	116,340,640	.34765
Washington	.01643750	93,302,490	.36090
Wayne	.02225000	140,888,080	.35805
Williams	.01861667	60,651,680	.35775
Wood	.02313333	154,242,980	.32480
Wayndot	.01882500	46,106,490	.35225

TABLE XLVII (Continued)

FOR YEAR 1967

Counties	Average School Operating Millage Rate	Assessed Value, Real Property	Assessment-Sales Price Ratios
Adams	.01446000	$ 20,885,760	.2623333
Allen	.01929091	226,446,360	.3582666
Ashland	.02430000	80,881,670	.3339666
Ashtabula	.02217143	184,760,890	.3514666
Athens	.01942000	54,731,660	.3198333
Auglaize	.02255000	75,634,980	.3190333
Belmont	.01875300	118,382,830	.3698000
Brown	.01855000	34,237,310	.2685666
Butler	.02356000	442,995,880	.3494666
Carroll	.02275000	31,937,830	.3421666
Champaign	.02262000	62,416,960	.3371000
Clark	.02407000	264,912,400	.3550666
Clermont	.02375556	146,441,720	.3534333
Clinton	.02105000	62,806,240	.3351333
Columbiana	.02335455	153,284,390	.3450000
Coshocton	.01850000	64,807,810	.3507000
Crawford	.02146667	99,567,650	.3196666
Cuyahoga	.02787313	4,312,375,680	.3483333
Darke	.02278000	101,627,660	.3225666
Defiance	.02104000	71,907,125	.3128333
Delaware	.02087500	80,837,840	.3029333
Erie	.02498571	159,975,250	.3083000
Fairfield	.02111250	136,840,070	.3351000
Fayette	.01900000	59,480,910	.3176000
Franklin	.02339471	1,723,816,800	.3542333
Fulton	.02338750	76,878,750	.3332666
Gallia	.01558333	27,534,050	.3187666
Geauga	.03300000	127,392,490	.3135333
Greene	.02507857	218,335,010	.3484333
Guernsey	.01980000	52,748,712	.3460333
Hamilton	.02276875	2,374,805,640	.4138666
Hancock	.02106250	138,431,080	.3119666
Hardin	.02063333	56,814,900	.3252666
Harrison	.01966667	29,382,160	.4262000
Henry	.02250000	69,214,870	.2877666
Highland	.02104000	48,987,360	.3070666
Hocking	.02083750	26,865,980	.2989666
Holmes	.01692500	35,344,520	.3247000
Huron	.02424500	86,636,020	.2939333
Jackson	.01798000	27,793,760	.3034333
Jefferson	.01856000	184,431,030	.3714666

TABLE XLVII (Continued)

Counties	Average School Operating Millage Rate	Assessed Value, Real Property	Assessment-Sales Price Ratios
Knox	.02382000	$ 77,972,390	.3406333
Lake	.03087111	397,752,140	.3113333
Lawrence	.01592857	63,890,710	.3093333
Licking	.01969000	179,224,410	.3218333
Logan	.02080000	74,155,350	.3483333
Lorain	.02778400	469,664,890	.3238333
Lucas	.02512500	996,056,630	.3475000
Madison	.01964000	65,788,650	.3237666
Mahoning	.02616400	639,748,480	.3829000
Marion	.02186000	127,648,300	.3526000
Medina	.02678571	150,180,350	.3064000
Meigs	.01610000	18,108,600	.3074333
Mercer	.02052857	72,641,490	.2893000
Miami	.02258182	156,944,550	.3186000
Monroe	.01847500	36,041,180	.3609333
Montgomery	.02495750	1,282,766,840	.3687666
Morgan	.01830000	15,102,710	.3174333
Morrow	.02237500	37,052,291	.2915000
Muskingum	.01915556	111,638,630	.3370333
Noble	.01786667	13,935,240	.3441333
Ottawa	.01920625	81,933,660	.2949000
Paulding	.02037143	38,352,950	.3048334
Perry	.01787000	26,790,390	.3067000
Pickaway	.01907500	70,932,850	.3252333
Pike	.01840000	18,277,909	.2993333
Portage	.02690455	182,413,320	.3065000
Preble	.02396000	62,285,080	.2999333
Putnam	.02095000	65,456,800	.2965000
Richland	.02677778	262,283,510	.3448000
Ross	.01948571	101,316,990	.3456333
Sandusky	.02321250	120,890,040	.3284666
Scioto	.01745091	112,351,060	.3708000
Seneca	.02238182	113,533,810	.3156000
Shelby	.02208750	72,955,860	.3217000
Stark	.02313529	751,948,820	.3856000
Summit	.02596235	1,303,730,560	.3621000
Trumbull	.02475435	476,337,950	.3495333
Tuscarawas	.02285000	121,732,470	.3195666
Union	.02053333	47,578,430	.2963000
Van Wert	.02257500	67,133,040	.3193000
Vinton	.01540000	10,004,920	.3249000
Warren	.02239250	128,683,960	.3230000

TABLE XLVII (Continued)

Counties	Average School Operating Millage Rate	Assessed Value, Real Property	Assessment-Sales Price Ratios
Washington	.01785000	$100,045,930	.3328666
Wayne	.02464000	166,083,270	.3511333
Williams	.02353571	66,027,230	.3075000
Wood	.02487500	174,812,820	.2809666
Wyandot	.01962500	51,089,940	.3327000

TABLE XLVII (Continued)

FOR YEAR 1971

Counties	Average School Operating Millage Rate	Assessed Value, Real Property	Assessment-Sales Price Ratios
Allen	.024100000	$242,899,620	.3010
Ashtabula	.030685714	201,860,640	.2910
Athens	.025400000	63,094,940	.2810
Belmont	.024064285	138,018,260	.2760
Butler	.028276666	509,352,350	.2780
Clark	.028731428	318,579,040	.3170
Clermont	.029688888	158,140,310	.2540
Columbiana	.025672727	190,124,930	.2900
Crawford	.028133333	119,744,020	.2900
Cuyahoga	.034965625	4,768,796,730	.3130
Delaware	.027050000	108,437,640	.2420
Erie	.031307142	194,493,620	.2820
Fairfield	.027750000	173,553,040	.3000
Franklin	.030703750	2,032,289,460	.3000
Geauga	.039857142	170,976,750	.2570
Greene	.031435714	253,663,740	.2840
Hamilton	.032286363	2,560,227,840	.3530
Hancock	.026725000	175,533,510	.3040
Jefferson	.022150000	201,867,920	.3980
Lake	.037006666	534,835,480	.2980
Lawrence	.021142857	75,140,310	.2770
Licking	.032400000	220,800,860	.2960
Lorain	.033192000	589,470,743	.3028
Lucas	.031425000	1,139,953,670	.2870
Mahoning	.031740714	666,992,758	.3260
Marion	.026800000	153,446,110	.3260
Medina	.035742857	215,227,700	.2600
Miami	.028822222	215,790,900	.3140
Montgomery	.032990000	1,483,766,860	.3080
Muskingum	.025525000	131,081,590	.3070
Pickaway	.021950000	93,727,280	.3090
Portage	.034977272	252,950,970	.2780
Preble	.028520000	79,543,650	.2630
Putnam	.024722222	81,553,920	.2820
Richland	.033277777	304,657,800	.3220
Ross	.023100000	115,355,270	.3350
Sandusky	.029360000	130,961,910	.2460
Scioto	.020550000	119,207,090	.3240
Seneca	.027471428	141,643,320	.3100
Stark	.029335294	832,882,010	.2900
Summit	.034321764	1,444,246,040	.2790

TABLE XLVII (Continued)

Counties	Average School Operating Millage Rate	Assessed Value, Real Property	Assessment-Sales Price Ratios
Trumbull	.028923809	$575,304,480	.2970
Tuscarawas	.028525000	148,247,650	.2570
Van Wert	.026312500	82,016,220	.3060
Warren	.027656250	158,217,690	.2730
Washington	.021458333	122,144,670	.2940
Wayne	.031300000	184,252,080	.2970
Wood	.029272222	227,749,230	.2600

TABLE XLVII (Continued)

FOR YEAR 1976			
Counties	Average School Operating Millage Rate	Assessed Value, Real Property	Assessment-Sales Price Ratios
Allen	.02390	$365,151,080	.2700
Ashtabula	.02609	324,200,910	.2010
Belmont	.02592	247,224,440	.1750
Butler	.02600	872,651,070	.3220
Carroll	.02605	50,881,130	.1680
Champaign	.02862	86,806,930	.1950
Clark	.02880	363,449,260	.2160
Clermont	.02692	303,683,240	.2350
Columbiana	.02434	277,482,180	.2470
Cuyahoga	.03812	6,486,854,880	.2870
Delaware	.02101	242,986,927	.3300
Erie	.03306	330,949,580	.2500
Fiarfield	.02805	220,753,710	.1680
Franklin	.02446	3,644,472,160	.2990
Fulton	.03031	154,774,010	.1570
Geauga	.03136	312,898,670	.2390
Greene	.03096	427,218,000	.2720
Hamilton	.03073	3,309,219,277	.2810
Lake	.04022	938,293,920	.3040
Lawrence	.02172	129,293,910	.1870
Licking	.02554	374,876,040	.2570
Lorain	.03551	967,117,460	.2640
Lucas	.03371	2,027,434,940	.3570
Madison	.02536	125,094,000	.2340
Mahoning	.02893	942,867,880	.2730
Marion	.03130	172,477,700	.2160
Medina	.03559	297,393,030	.2010
Miami	.03024	254,687,300	.4250
Montgomery	.03069	2,000,091,370	.2720
Ottawa	.02616	194,816,190	.2470
Pickaway	.02216	163,475,090	.2950
Portage	.03706	476,621,330	.2670
Preble	.02326	164,729,540	.3040
Richland	.02881	445,465,760	.3270
Sandusky	.02606	241,282,010	.2960
Scioto	.02447	174,524,520	.2140
Stark	.03017	1,439,089,710	.3390
Summit	.03153	2,140,311,410	.2890
Trumbull	.02647	847,392,881	.2600
Warren	.03253	355,693,470	.2820

TABLE XLVII (Continued)

Counties	Average School Operating Millage Rate	Assessed Value, Real Property	Assessment-Sales Price Ratios
Wayne	.02743	$343,440,720	.2750
Wood	.02508	434,486,150	.2960

Sources: (35) for millage rates; assessed values and ratios are compiled from data furnished by the Ohio Department of Tax Equalization, Columbus, Ohio.

TABLE XLVIII

ASSESSMENT-SALES PRICE RATIO CALCULATIONS FOR OHIO, 1964

Counties	A 1963 Assessment Sales Price Ratios	B 1965 Assessment Sales Price Ratios	C 1964 Assessment Sales Price Ratios (estimated) (A+B ÷ 2
Adams	.3322	.3064	.31930
Allen	.3763	.3742	.37525
Ashland	.3724	.3751	.37375
Ashtabula	.3714	.3664	.36890
Athens	.3479	.3667	.35730
Auglaize	.3569	.3429	.34990
Belmont	.4159	.3926	.40425
Brown	.2906	.3021	.29635
Butler	.3925	.3738	.38315
Carroll	.3597	.3645	.36210
Champaign	.3892	.3639	.37655
Clark	.4349	.3910	.41295
Clermont	.3817	.3845	.38310
Clinton	.3622	.3458	.35400
Columbiana	.3723	.3646	.36845
Coshocton	.3856	.3561	.37085
Crawford	.3515	.3466	.34905
Cuyahoga	.3811	.3684	.37475
Darke	.3752	.3431	.35915
Defiance	.3755	.3405	.35800
Delaware	.3436	.3406	.34210
Erie	.3557	.3337	.34470
Fairfield	.3725	.3687	.37060
Fayette	.3692	.3574	.36330
Franklin	.3854	.3805	.38295
Fulton	.3537	.3700	.36185
Gallia	.3503	.3371	.34370
Geauga	.3472	.3478	.34750
Greene	.4242	.3935	.40885
Guernsey	.3408	.3463	.34355
Hamilton	.4327	.4388	.43575
Hancock	.3459	.3459	.34590
Hardin	.3582	.3344	.34630
Harrison	.4814	.4416	.46150
Henry	.3367	.3167	.32670
Highland	.3365	.3340	.33525
Hocking	.3295	.3321	.33080

TABLE XLVIII (Continued)

Counties	A 1963 Assessment Sales Price Ratios	B 1965 Assessment Sales Price Ratios	C 1964 Assessment Sales Price Ratios (estimated) (A+B ÷ 2
Holmes	.3879	.3705	.37920
Huron	.3392	.3208	.33000
Jackson	.3669	.3607	.36380
Jefferson	.3911	.3820	.38655
Knox	.3697	.3779	.37380
Lake	.3599	.3512	.35555
Lawrence	.3396	.3208	.33020
Licking	.3522	.3379	.34505
Logan	.3824	.3652	.37380
Lorain	.3551	.3411	.34810
Lucas	.4079	.3747	.31930
Madison	.3418	.3525	.34715
Mahoning	.3867	.3923	.38950
Marion	.3786	.3624	.37050
Medina	.3600	.3438	.35190
Meigs	.3777	.3511	.36440
Mercer	.3538	.3133	.33355
Miami	.3684	.3504	.35940
Monroe	.4244	.3836	.40400
Montgomery	.4219	.4039	.41290
Morgan	.3948	.3579	.37635
Morrow	.3444	.3251	.33475
Muskingum	.3639	.3573	.36060
Noble	.3159	.3504	.33315
Ottawa	.3255	.3295	.32750
Paulding	.3340	.2959	.31495
Perry	.3371	.3329	.33500
Pickaway	.3674	.3535	.30045
Pike	.3582	.3350	.34660
Portage	.3350	.3317	.33335
Preble	.3468	.3230	.33490
Putnam	.3559	.3223	.33910
Richland	.3600	.3684	.36420
Ross	.3810	.3761	.37855
Sandusky	.3661	.3598	.36295
Scioto	.4008	.3806	.39070
Seneca	.3571	.3236	.36035
Shelby	.3632	.3361	.34965
Stark	.4285	.4108	.41965
Summit	.3658	.3843	.37505
Trumbull	.3854	.3716	.37850

TABLE XLVIII (Continued)

Counties	A 1963 Assess-ment Sales Price Ratios	B 1965 Assess-ment Sales Price Ratios	C 1964 Assessment Sales Price Ratios (estimated) (A+B ÷ 2
Tuscarawas	.3614	.3439	.35265
Union	.3369	.3259	.33140
Van Wert	.3567	.3151	.33590
Vinton	.3029	.3009	.30190
Warren	.3509	.3444	.34765
Washington	.3658	.3560	.36090
Wayne	.3385	.3776	.35805
Williams	.3868	.3287	.35775
Wood	.3395	.3101	.32480
Wyandot	.3498	.3547	.35225

1963 and 1967 ratios are from information furnished by the Ohio Department of Tax Equalization, Columbus, Ohio.

TABLE XLIX

ASSESSMENT-SALES PRICE RATIO
CALCULATIONS FOR OHIO
1967

Counties	A 1965 Assess- ment Sales Price Ratios	B 1968 Assess- ment Sales Price Ratios	C Total Change in Ratios 1965-68 (B-A)	D Average Yearly Change in Ratios 1965-68 (C ÷ 3)	E 1967 Assessment Sales Price Ratios (estimated) (B-D)
Adams	.3064	.2403	-.0661	-.0220333	.2623333
Allen	.3742	.3503	-.0239	-.0079666	.3582666
Ashland	.3751	.3134	-.0617	-.0205666	.3339666
Ashtabula	.3664	.3440	-.0224	-.0074666	.3514666
Athens	.3667	.2964	-.0703	-.0234333	.3198333
Auglaize	.3429	.3071	-.0358	-.0119333	.3190333
Belmont	.3926	.3584	-.0342	-.0114000	.3698000
Brown	.3021	.2518	-.0503	-.0167666	.2685666
Butler	.3738	.3373	-.0365	-.0121666	.3494666
Carroll	.3645	.3310	-.0335	-.0111666	.3421666
Champaign	.3639	.3237	-.0402	-.0134000	.3371000
Clark	.3910	.3371	-.0539	-.0179666	.3550666
Clermont	.3845	.3379	-.0466	-.0155333	.3534333
Clinton	.3458	.3298	-.0160	-.0053333	.3351333
Columbiana	.3646	.3352	-.0294	-.0098000	.3450000
Coshocton	.3561	.3480	-.0081	-.0027000	.3507000
Crawford	.3466	.3062	-.0404	-.0134666	.3196666
Cuyahoga	.3684	.3383	-.0301	-.0100333	.3483333
Darke	.3431	.3123	-.0308	-.0102666	.3225666
Defiance	.3405	.2990	-.0415	-.0138333	.3128333
Delaware	.3406	.2841	-.0565	-.0188333	.3029333
Erie	.3337	.2956	-.0381	-.0127000	.3083000
Fairfield	.3687	.3183	-.0504	-.0168000	.3351000
Fayette	.3574	.2977	-.0597	-.0199000	.3176000
Franklin	.3805	.3411	-.0394	-.0131333	.3542333
Fulton	.3700	.3149	-.0551	-.0183666	.3332666
Gallia	.3371	.3096	-.0275	-.0091666	.3187666
Geauga	.3478	.2964	-.0514	-.0171333	.3135333
Greene	.3935	.3259	-.0676	-.0225333	.3484333
Guernsey	.3463	.3459	-.0004	-.0001333	.3460333
Hamilton	.4388	.4014	-.0374	-.0124666	.4138666
Hancock	.3459	.2950	-.0509	-.0169666	.3119666
Hardin	.3344	.3207	-.0137	-.0045666	.3252666
Harrison	.4416	.4185	-.0231	-.0077000	.4262000
Henry	.3167	.2733	-.0434	-.0144666	.2877666
Highland	.3340	.2936	-.0404	-.0134666	.3070666
Hocking	.3321	.2824	-.0497	-.0165666	.2989666

TABLE XLIX (Continued)

Counties	A 1965 Assess- ment Sales Price Ratios	B 1968 Assess- ment Sales Price Ratios	C Total Change in Ratios 1965-68 (B-A)	D Average Yearly Change in Ratios 1965-68 (C ÷ 3)	E 1967 Assessment Sales Price Ratios (estimated) (B-D)
Holmes	.3705	.3018	-.0687	-.0229000	.3247000
Huron	.3208	.2805	-.0403	-.0134333	.2939333
Jackson	.3607	.2748	-.0859	-.0286333	.3034333
Jefferson	.3820	.3662	-.0158	-.0052666	.3714666
Knox	.3779	.3220	-.0559	-.0186333	.3406333
Lake	.3512	.2914	-.0598	-.0199333	.3113333
Lawrence	.3208	.3036	-.0172	-.0057333	.3093333
Licking	.3379	.3138	-.0241	-.0080333	.3218333
Logan	.3652	.3399	-.0253	-.0084333	.3483333
Lorain	.3411	.3152	-.0259	-.0086333	.3238333
Lucas	.3747	.3339	-.0408	-.0136000	.3475000
Madison	.3525	.3094	-.0431	-.0143666	.3237666
Mahoning	.3923	.3782	-.0141	-.0047000	.3829000
Marion	.3624	.3477	-.0147	-.0049000	.3526000
Medina	.3438	.2877	-.0561	-.0187000	.3064000
Meigs	.3511	.2856	-.0655	-.0218333	.3074333
Mercer	.3133	.2773	-.0360	-.0120000	.2893000
Miami	.3504	.3027	-.0477	-.0159000	.3186000
Monroe	.3826	.3496	-.0340	-.0113333	.3609333
Montgomery	.4039	.3512	-.0527	-.0175666	.3687666
Morgan	.3579	.2972	-.0607	-.0202333	.3174333
Morrow	.3251	.2747	-.0504	-.0168000	.2915000
Muskingum	.3573	.3269	-.0304	-.0101333	.3370333
Noble	.3504	.3410	-.0094	-.0031333	.3441333
Ottawa	.3295	.2776	-.0519	-.0173000	.2949000
Paulding	.2959	.3093	+.0134	+.0044666	.3048334
Perry	.3329	.2936	-.0393	-.0131000	.3067000
Pickaway	.3535	.3111	-.0424	-.0141333	.3252333
Pike	.3350	.2815	-.0535	-.0178333	.2993333
Portage	.3317	.2939	-.0378	-.0126000	.3065000
Preble	.3230	.2884	-.0346	-.0115333	.2999333
Putnam	.3223	.2836	-.0387	-.0129000	.2965000
Richland	.3684	.3330	-.0354	-.0118000	.3448000
Ross	.3761	.3304	-.0457	-.0152333	.3456333
Sandusky	.3598	.3128	-.0470	-.0156666	.3284666
Scioto	.3806	.3659	-.0147	-.0049000	.3708000
Seneca	.3236	.3116	-.0120	-.0040000	.3156000
Shelby	.3361	.3145	-.0216	-.0072000	.3217000
Stark	.4108	.3730	-.0378	-.0126000	.3856000
Summit	.3843	.3510	-.0333	-.0111000	.3621000
Trumbull	.3716	.3385	-.0331	-.0110333	.3495333

TABLE XLIX (Continued)

Counties	A 1965 Assess- ment Sales Price Ratios	B 1968 Assess- ment Sales Price Ratios	C Total Change in Ratios 1965-68 (B-A)	D Average Yearly Change in Ratios 1965-68 (C ÷ 3)	E 1967 Assessment Sales Price Ratios (estimated) (B-D)
Tuscarawas	.3439	.3074	-.0365	-.0121666	.3195666
Union	.3259	.2815	-.0444	-.0148000	.2963000
Van Wert	.3151	.3214	+.0063	+.0021000	.3193000
Vinton	.3009	.3369	+.0360	+.0120000	.3249000
Warren	.3444	.3123	-.0321	-.0107000	.3230000
Washington	.3560	.3213	-.0347	-.0115666	.3328666
Wayne	.3776	.3379	-.0397	-.0132333	.3511333
Williams	.3287	.2969	-.0318	-.0106000	.3075000
Wood	.3101	.2664	-.0437	-.0145666	.2809666
Wyandot	.3547	.3217	-.0330	-.0110000	.3327000

1965 and 1968 ratios are from information furnished by the Ohio Department of Tax Equalization, Columbus, Ohio.

APPENDIX E

DETAILS OF STATE-WIDE BENEFIT-COST RATIOS

TABLE L

STATE-WIDE MEAN R_b AND R_c FOR INDIANA AND OHIO

VARIABLE	N	MEAN	STANDARD DEVIATION	MINIMUM VALUE	MAXIMUM VALUE	STD ERROR OF MEAN	SUM	VARIANCE	C.V.
YEAR=64 STATE=I									
RB	92	0.98013178	0.02053209	0.87925882	1.01975764	0.00214062	90.17212341	0.00042157	2.095
RC	92	0.00638376	0.00110967	0.00382672	0.00907538	0.00011569	0.58730551	0.00000123	17.383
YEAR=64 STATE=O									
RB	88	0.97466559	0.03723355	0.68848192	1.04881793	0.00396911	85.77058049	0.00138634	3.820
RC	88	0.00694242	0.00128216	0.00428774	0.01065071	0.00013668	0.61093300	0.00000164	18.468
YEAR=67 STATE=I									
RB	92	0.98613684	0.01719129	0.94542373	1.03425861	0.00179232	90.72458899	0.00029554	1.743
RC	92	0.00821054	0.00128790	0.00421206	0.01096660	0.00013427	0.75536990	0.00000166	15.686
YEAR=67 STATE=O									
RB	88	0.98125352	0.02252176	0.89116834	1.04631711	0.00240083	86.35030994	0.00050723	2.295
RC	88	0.00715011	0.00130619	0.00379334	0.01034660	0.00013924	0.62920962	0.00000171	18.268
YEAR=71 STATE=I									
RB	33	0.98378793	0.02404748	0.94833068	1.06910374	0.00418613	32.46500177	0.00057828	2.444
RC	33	0.00914092	0.00148592	0.00572356	0.01149964	0.00025866	0.30165027	0.00000221	16.256
YEAR=71 STATE=O									
RB	48	0.98358050	0.02447081	0.93702301	1.06414566	0.00353206	47.21186399	0.00059882	2.488
RC	48	0.00848416	0.00134404	0.00585657	0.01139709	0.00019400	0.40723968	0.00000181	15.842
YEAR=76 STATE=I									
RB	36	0.98193662	0.02416032	0.94982534	1.07123994	0.00402672	35.34971822	0.00058372	2.460
RC	36	0.00481038	0.00120844	0.00144622	0.00690850	0.00020141	0.17317367	0.00000146	25.121
YEAR=76 STATE=O									
RB	42	0.98669869	0.02904604	0.94021147	1.09636538	0.00448190	41.44134508	0.00084367	2.944
RC	42	0.00753055	0.00213471	0.00406164	0.01285200	0.00032939	0.31628330	0.00000456	28.347

VITA

Debra Margaret White

Candidate for the Degree of

Doctor of Philosophy

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