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ABSTRACT

This report focuses on the relationship between State aid to education and incentives for the efficient allocation of resources. Following a description of the historical and current manifestations of State aid, an empirical analysis was conducted to study the impact of State aid on several variables. More State aid was found to be associated with (1) higher per pupil expenditures, (2) lower per pupil local revenues, (3) less likelihood to raise funds through local bond issues, (4) lower nonpublic enrollments, and (5) larger average school size. In another phase of the study, incentive features were developed that could be incorporated into State aid schemes. These incentive features were divided into (1) Scale Incentives -- designed to highlight the potential for cost savings through scale adjustment; and (2) Output Incentives which considered two possible goals: maximum output regardless of cost and maximum output per dollar of cost. Penalty factors and incentive payments, singly and combined, were presented as alternative methods to increase efficiency in terms of both scale incentive and output incentives. (Author)

FINAL REPORT

Project No. R020628

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PREFACE

While working on a survey of the economics of education, I noticed the absence of incentive features in the current state aid formulas and in discussions of state aid in the literature. My study of Iowa high schools, however, and a survey of other input-output studies in public education clearly indicated that a considerable waste of resources occurs in public education, perhaps because educational administrators do not have the necessary incentives to induce them to operate efficiently. Another possibility is that they are not aware of the possibilities for cost savings through reorganization or other types of reallocation of resources. Given that state aid is becoming an indispensable source of revenue for all but very few school districts, it is surprising that it has not yet been employed to achieve greater efficiency in school operations--in addition to effecting some degree of equalization among districts. This report is, therefore, addressed to the efficiency aspects of state aid to education; proposals for incentive features in the state aid formulas are discussed herein.

In developing the background material for the report--describing the history of and current practices in educational financing--I was fortunate to have the services of Stephen D. Millman, who had major responsibility for Chapters 2, 3, and 4. Robert W. Clyde gathered most of the data for Chapter 5 and assisted in the writing of Chapter 2. Computer assistance was provided by Maureen Gallagher. I am also grateful to Alice Beamesderfer for editorial assistance and for preparing the Glossary and Table of Contents.

Elchanan Cohn
Project Director

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CHAPTER 1

INTRODUCTION

Education is the largest single industry in the United States. Total educational expenditures in the public elementary and secondary schools have increased rapidly over past years and are estimated to be $44.4 billion for the 1971-72 school year. Current expenditures per pupil have risen from $375 in 1959-60 to $870 in 1971-72.[1] Since nearly 50 percent of these expenditures are financed by local revenue, and since institutional-legal constraints restrict the taxing powers of local governments, the potential for increased local revenues for the support of public schools is extremely limited. Moreover, the majority of revenues collected by local governments are obtained through property taxation. Because of adverse allocative and distributive aspects of the property tax,[2] the principal tax base for the collection of local educational revenues has come under severe attack. Although alternative proposals for alleviating the fiscal problems of local governments have been suggested in recent years,[3] it appears that state aid will assume an increasingly important role in the financing of public education.

Recent court decisions in Texas, California, Minnesota, New Jersey, and other states reflect a deep and widespread dissatisfaction with the present systems of providing state aid to local districts.

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[1] See Simon and Fullam (1969) and Foster and Barr (1972).

[2] For excellent summaries of the economic aspects of the property tax consult Due and Friedlaender (1973), Chapter 18, and Netzer (1966, 1970).

[3] For a discussion of some recent suggestions see Riew (1971). Another proposal, concerning a differential tax on land, has recently been advanced by Riew (1973).

The very recent decision by the U.S. Supreme Court has, for the time being, reduced, if not eliminated, the importance of the courts in determining legally acceptable state aid systems. Nevertheless, dissatisfaction with the current systems remains, and it is likely that the battlefield will move from the courts to the state legislatures or the U.S. Congress rather than fade away.[4]

The current state of affairs in educational financing is extremely complicated. Not only is the field in flux, but there is much variation among existing state aid schemes and many of the schemes are very intricate. An attempt will be made in this report to compare and contrast the various plans and to suggest the general principles under which state aid is given to local districts.

By far, most of the attention in educational finance literature has been concentrated on the issue of equity, that is, whether existing or proposed state aid schemes should strive to equalize resources, "needs," outputs, etc. The main focus has been directed at the concept of "equalization." What has been left out of the analysis is the impact of various aid schemes on the incentives districts have to operate efficiently.

The main purpose of this report is, therefore, to focus attention on the relationship between state aid and incentives for the efficient allocation of resources. The study approaches this objective from two angles. First, an empirical analysis is conducted to study the discernible impact of state aid on average school size, per pupil expenditures, rates of enrollment in nonpublic schools, per pupil bond issues, and per pupil local revenues. State-by-state data have been gathered for this purpose.

The second phase of the study consists of the development of incentive features that could be incorporated into state aid schemes. The incentive features are divided into two groups: incentives for scale effects and output incentives. The scale incentives are designed to highlight the potential for considerable cost savings through scale

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[4]For a similar view see Shannon (1973).

adjustment. The incentive features are designed to provide a stimulus for districts to reorganize schools in such a manner that they will be able to make maximum use of scale effects.

The analysis of output incentives considers two possible goals: the attainment of maximum output, regardless of cost, and the attainment of maximum output per dollar of cost (maximum efficiency). Incentive features are developed for each of these goals. It is also pointed out that incentive features may be used to attain a combination of these two goals.

It was believed that a discussion of the economic effects of state aid to education and an analysis of incentive features should be preceded by a thorough analysis of the historical and current manifestations of state aid. Consequently, the origins and development of the state aid formulas are discussed in Chapter 2, followed by a discussion of the theory and practice of equalization in Chapter 3 and a brief description of current state aid formulas in Chapter 4.

The economic effects of state aid are analyzed in Chapter 5, followed by a discussion of scale effect incentives in Chapter 6 and output incentives in Chapter 7. A brief summary and some conclusions are presented in Chapter 8.

CHAPTER 2

ORIGINS AND DEVELOPMENT OF AMERICAN EDUCATIONAL FINANCE

Introduction

It is the intent of this chapter to direct the reader's attention to the origins, development, and general patterns of current programs of school finance. Detailed information in regard to many of the topics introduced in this chapter is contained in later sections of this report; however, the purpose here is to provide a general framework and to sketch gross contours for what is to follow.

The study of educational finance has profited from the input of professionals representing many disciplines. While this state of affairs may be expected to result in a more comprehensive view, the impact of scholars operating from different perspectives and using different analytical tools can appear to represent a veritable Tower of Babel. For this reason, if no other, it is essential to provide a common background upon which to foster comprehension of the present study.

Persons familiar with the historical development of educational finance and related issues may wish to proceed directly to other sections of the analysis. However, this chapter provides capsule information for those individuals more interested in a total view.

The Present: A Perspective

> When the history of our times is written, it may designate the two decades following World War II as the golden age of American education. Never before was education more highly valued. Never before was so much of it so readily available to so many. Never before had it been supported so generously. Never before was so much expected of it.

> But in this eighth decade of the twentieth century, public education in this country appears to be in trouble. Taxpayers are revolting against skyrocketing costs of education. Schools are being denied the funds they need for quality of education (Ebel [1972], p. 3).

As stated above by the president of the American Educational Research Association, it is increasingly evident that public education, which has recently enjoyed so much favor, may now be facing difficult days. Also clearly apparent is the fact--alluded to above--that much of the malaise, directly or indirectly, has to do with issues of educational finance. As a report of the Rockefeller Brothers Fund (1958) pointed out, "All the problems of the schools lead us back sooner or later to one basic problem--financing" (p. 38).

Current disenchantment notwithstanding, education in America is a formidable enterprise, the dimensions of which are often not fully appreciated. It might therefore be worthwhile to briefly note the size of the terrain being explored. In its most recent survey of the schools, the National Education Association (1972) reports:

> In Fall 1971, 60.5 million pupils were enrolled in the regular schools, public and private, at all grade levels. All full- and part-time workers in the schools were estimated at 6.4 million, 4.0 million of which were teachers, administrators, or other professional staff. The total expenditures of the regular schools are $83.1 billion for the school year 1971-72 (p. 5).

Available data indicate that although funds for the schools are still increasing, the increase is at a decreasing rate. Educators and others are concerned, therefore, that allocation of resources is not keeping pace with increasing demands or increasing costs of existing demands. Conditions would thus suggest the need for more systematic analysis of public support for education.

Taking a Longer View

Even within the context of current debate regarding the level of support for education, there is basic agreement on the perspective

of education as a public responsibility. While such a view seems so natural as to be taken for granted, it is worth noting that such a belief has not always existed in this country. Less than a century and a half ago, debate raged in this nation--as in many others--about whether education was a private or public concern. As Meyer (1967) indicates:

> The idea that education was a function of the state obtained in only one western nation--the kingdom of Prussia...In America, meanwhile, education [in the 18th century] continued to be regarded as a private or semi-private enterprise, a responsibility left by government to the church and the parents (p. 121).

The Prussian approach to education was generally adopted by the remainder of the Germanic states and by France. However, the British--from whom most of our educational traditions were adopted--held resolutely, during this period, to the view of education as a private matter.

Walsh and Walsh (1930) note that when the matter was seriously taken up in the state of Pennsylvania, the two opposing views were clearly evident:

> On the one hand was the state-supported and state-controlled systems of Germany and France, and on the other, the privately controlled, individualistic, decentralized plan of England. The former was best known and best advertised in America, and it was the one adopted, with modifications, by Massachusetts and other states, but the English plan was most attractive to the decentralized, homogeneous individualistic people of Pennsylvania. This was the most German of the states, but it was also the most decentralized, and even the German settlers had no desire to go back to the Prussian centralization from which many of them had escaped (p. 321).

Public cognizance and support for the needs of "the common schools" began to coalesce firmly during the 1820s and 1830s. Under the leadership of such educational visionaries as Horace Mann,

Gordon Carter, Henry Barnard, and others, the public was aroused by what has been called "the free school movement." The issues were not solved instantly, but great forward movement was initiated. In Meyer's words,

> The same issues and the same contestants sprang up everywhere. Now the controversy ignited over the educational powers of the state authority; now over the government's right to lay school taxes; now over its right to conscript children to learn their ABCs. Some apostles cried out for better teachers, better methods, better books; others bawled for more and better buildings (Meyer [1967], p. 185).

At first, schools had been funded exclusively from receipts of tuition for students enrolled, so-called "fees and rate bills." As the free school movement gained momentum, various approaches were attempted to finance the schools. Two quite popular and relatively effective means in the short run were (1) issuing of scrip as proceeds from past or future land sales and (2) instituting state lotteries for education.

As the number of schools and number of students grew, however, the need for increased funds also became evident. Since a personal income tax was not a practicable proposition during this period, most localities turned to what seemed to be the most feasible and equitable source of revenue--a tax on real property.

Subsidiarity and Federalism

Coons, Clune, and Sugarman (1970) state their belief that an understanding of the historical application of the concept of "subsidiarity" is essential to an understanding of the funding and control of American education. Specifically, subsidiarity refers to the philosophical position that decisions should be made at the level closest to the decision situation. This is to say that decisions which can reasonably and expeditiously be made by the family should not be made by government. And situations which can be handled sufficiently by local government should not be taken up by state or federal government.

All other things being equal, there is much intuitive merit to this principle. Coons, Clune, and Sugarman posit that it was this concept, the pervasive embodiment of which is called "federalism," that . . . inspired the framers of American government. Coons, Clune, and Sugarman describe this distincly American state of affairs as

> ...that slightly eccentric emphasis upon local government which is the scandal of foreign visitors and the pride of the pioneer. There is no adequate name for it. 'Federalism' is a label for what is merely one domestic example of the principle; the terms 'provincialism' and 'localism' both overemphasize the whimsical aspects...There is nothing simpleminded or bizarre about the principle that government should ordinarily leave decision-making and administration to the smallest unit of society competent to handle them (p. 14).

By whatever name, the principle of local initiative has been particularly evident in American education. An understanding of current issues of control and finance can not proceed without consideration of the historical role of the three levels of government in the operation of public education. In general, matters have been left with the lowest level of government unless a determination is made that considerations of equity or quality demand action by a higher authority. In this way, states and the federal government have been successively brought into the operation of public education.

The history thus far reviewed has dealt primarily with the practical consequences of American educational traditions. What follows is intended to be an analysis of the input made by theorists of educational finance. The form of presentation is to discuss the successive development of various approaches through the ideas of the major scholars in this area. Emphasis is placed on the impact of these theories on the development and adoption of the particular plans by the states.[1]

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[1]Additional information on the history of the development of educational finance can be found in Benson (1968), Johns and Morphet (1969), and Johns (1971).

The Philosophy and Practice of State Aid in Retrospect

Elwood P. Cubberley: Formulating Basic Concepts of State School Financing

Elwood P. Cubberley was a student at Teachers College, Columbia University, at the beginning of the twentieth century. His doctoral dissertation, "School Funds and Their Apportionment" (Cubberley [1905]), set down basic values and goals for the distribution of school funds by the states. Of particular concern to Cubberley was the fact that considerable disparities existed in fiscal capacity and tax effort among local school districts within the same state. Cubberley saw that expenditures per pupil in neighboring school districts were often very different. This observation stimulated the simple but far-reaching conceptualization of what he believed to be the state's responsibility in apportioning state school funds:

> Theoretically, all the children of the State are equally important and are entitled to have the same advantages; practically this can never be quite true. The duty of the State is to secure for all as high a minimum of good instruction as is possible, but not to reduce all to this minimum; to place a premium on those local efforts which will enable local communities to rise above the legal minimum as far as possible; and to encourage communities to extend their educational energies to new and desirable undertakings (Cubberley [1905], p. 17).

In the early 1900s much emphasis was being placed on what were known as "stimulation grants," the purpose of which was to encourage the adoption and development of particular innovations in the school curriculum, such as industrial education, trade schools, evening and vocational schools, physical training, and farm schools. Cubberley was in favor of extending the range of educational programs and was interested in seeing the day come when secondary education was the rule rather than the exception. He favored the use of state aid as a reward for those districts which took the initiative to pioneer in providing such special services. Cubberley's idea was to stimulate the adoption of

such programs so as to get the diffusion process to the point where the programs could be made a part of the state's mandated minimum requirement (Benson [1968]). The rewards would go to those districts which, through innovation, played a part in upgrading the standards of education.

Cubberley's research enabled him to become aware of the inequities existing in the quality of education among school districts within individual states. The obvious reason for this differential was the fact that local financial capability to support schools varied greatly from one district to another. Therefore, educational expenditures and financial capability to support education were positively correlated, and Cubberley noted that the method of distributing state funds, at that time, merely aggravated this situation.

Cubberley's work was successful in exposing what the American public had long preferred not to think about. Satisfied that he had presented a strong case for state aid in general, he directed his attention to the form that this state aid should take. The following is a list of what Cubberley saw as the alternative criteria for the apportionment of state funds for public education:

(1) the amount of taxes levied by the district
(2) the total population of the district
(3) the school census of the district
(4) the average membership (enrollment) of the district
(5) the average or aggregate daily attendance of the district
(6) the number of teachers employed by the district

Cubberley believed that criteria (1) and (2) were both relatively inferior. Criterion (1), which may be described as a shared tax, was inadequate because it had no equalizing effects and would tend to favor city districts over rural districts (the cities in the early twentieth century generally had more wealth than did the rural areas). Criterion (2) would also be biased in favor of those districts whose age distributions were such that the percentage of population of school age was relatively less than that of other districts. Cubberley saw alternatives (3) and (4) to be slightly more desirable but still not adequate to reflect differing local needs. Alternative (5) was considered

even more favorable but not without its inequities in that it favored city over rural schools (the former were able to stay open for a greater number of days in a year). Cubberley concluded that the best of the alternatives was (6), the criterion of number of teachers employed, in combination with the criterion of average daily attendance (ADA). The distribution of funds based on these criteria would not discriminate against rural districts, which tended to have a relatively lower teacher-pupil ratio, and could therefore stimulate the adoption of special training programs in that aid would be distributed according to the number of teachers employed regardless of the program in which they were involved. By including the ADA criterion, there would be no reason for the school districts to reduce the number of days in the school year. Cubberley believed that if these criteria were used, then his principal objective--that aid be apportioned on the bases of effort and need--would be achieved.

Cubberley also added a "safety valve" to his plan. He advocated the distribution of equalizing grants, in addition to general aid, to those school districts which were unable to meet the minimum standards of quality education (set by the state) when it had already taxed itself at the maximum rate permitted by law.

A benchmark from which future plans would evolve, Cubberley's approach was based on concepts and principles which are highly relevant to the discussions and debates on educational finance even today. Cubberley was thus the early proponent of the Flat Grant Plan. Several researchers who succeeded Cubberley in this field argued that Cubberley's plan, although based on commendable objectives, might fail to realize his objectives. It was, in fact, questioned whether Cubberley's plan might not have a disequalizing effect.

Consider two districts of equal size but of unequal wealth. The wealthy district, in an effort to improve the quality of its school, hires more teachers and consequently gets some part of this added cost paid for by the state according to the "teachers-employed" criterion. The poorer district probably would not be able to do the same because that portion of the added cost, not covered by the state, of hiring more teachers would be more burdensome to the poorer district. Hence,

the wealthier district gets subsidized out of state tax monies which come from not only the wealthy districts but from the poorer districts as well. The result is a greater degree of inequality, a result, no doubt, that Cubberley either did not consider or believed was too insignificant.[2]

Strayer and Haig: Emphasizing the Equalization of Educational Opportunity

George D. Strayer and Robert M. Haig, two educational finance theorists who followed Cubberley, believed that the two main objectives held by Cubberley, e.g., equalization of educational opportunity and the reward for local effort, were mutually inconsistent. As James S. Coleman (1970) points out:

> The history of education since the industrial revolution shows a continual struggle between two forces: the desire by members of society to have educational opportunity for all children, and the desire of each family to provide the best education it can afford for its own children. Neither of these desires is to be despised; they both lead to investment by the older generation in the younger. But they can lead to quite different concrete actions (p. vii).

New York State was using Cubberley's Flat Grant approach at a time when Strayer and Haig were noting the plan's inequities. Giving primary emphasis to equalization of educational opportunity as the objective of state aid, Strayer and Haig had this to say about New York's Flat Grant Plan (one which followed Cubberley's teachers-employed criterion):

> ...Approximately one-half of the state aid is entirely unaffected by the richness of the local economic resources back of the teacher, and the portion which is so affected

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[2]Additional insight into Cubberley's views can be found in Cubberley (1919).

> is allocated in a manner which favors both the very rich and the very poor localities at the expense of those which are moderately well off (Strayer and Haig [1923], p. 162).

Strayer and Haig were thus emphasizing financial considerations as opposed to the "human needs" considerations emphasized by Cubberley (in terms of the number of teachers employed by a school district).

Strayer and Haig then formulated their own plan for a state's distribution of school funds which embodied their main objective of equal opportunity (based on fiscal considerations). This approach, which has come to be known as the Strayer-Haig Minimum Foundation Plan, can be operationalized as follows:

(1) The state determines the cost per pupil of a satisfactory minimum educational program.

(2) The property tax rate which the wealthiest district in the state would have to levy in order to finance this satisfactory minimum is computed.

(3) Each district in the state is required to tax at the rate needed in the wealthiest district to finance this minimum offering.

(4) The state grants to each local district a sum equal to the difference between the amount raised locally at the mandatory tax rate and the amount required to finance the satisfactory minimum offering (Jones [1971], p. 9).

The Strayer-Haig formula considers not only the number of pupils in the district but also the local tax base. (Note that the Minimum Foundation Plan would still allow local school districts to raise their tax rate above the required minimum if they so desired.) It is obvious that wealthy districts would be able to raise additional funds by taxing themselves a few mills above the minimum, while a poorer district would realize less additional money by raising their tax rate the same number of mills. The question to be asked is, What, exactly, did Strayer and Haig mean by "equalization of educational opportunity"? Thomas Jones suggests that it is not <u>equal</u> educational opportunity at all, but rather <u>minimum</u> educational opportunity. "The Strayer-Haig Foundation Plan equalizes local taxes and expenditures only up to a minimum level" (Jones [1971], pp. 9-10).

The Foundation Plan will be discussed in more detail in a subsequent chapter.

Paul R. Mort: Developing the Minimum Foundation Program Plan

Paul R. Mort conducted many studies which enabled a large number of states to implement variants of the Strayer-Haig Minimum Foundation Plan. His major ideas can be found in Mort (1933) and Mort, Reusser, and Polley (1960).

> The "Mort studies" were made by Paul R. Mort of Teachers College, Columbia University, who proposed more refined measures to determine the financial needs of the school districts, defined and outlined a minimum program of state support, and developed his weighted pupil technique (Cowle [1968], p. 15).

As Johns (1971) puts it, Mort was a disseminator rather than a theorist, and it was his efforts which are primarily responsible for the widespread use of the Minimum Foundation Program Plan.

Like Cubberley, Mort thought that it was extremely important that innovation in education rank high on our list of priorities. Mort considered "adaptability," or the propensity to change with the times--new courses of study, expanded extracurricular activities, etc.--to be crucial. "Unless local districts are allowed substantial tax leeway, innovations are less likely to occur" (Jones [1971], p. 18).

Jones has narrowed Mort's main ideas down to the following six phases:

> Phase 1. A given level of educational service and a given level of state school support are in existence.
>
> Phase 2. One or more local school districts perceive a need to provide some new educational service beyond the state minimum. If necessary, they tax themselves above the amount required by the state to provide this educational service.

Phase 3. The adaptation developed in the lighthouse districts is disseminated to other localities. They too raise their local tax rates to institute the adaptation.

Phase 4. The adaptation gradually becomes accepted practice throughout the state. Eventually, the state provides for the adaptation in all local districts, possibly through the institution of a categorical state grant for the purpose.

Phase 5. The adaptation is required by state law, and state financial support for the adaptation is incorporated into the Strayer-Haig Minimum Foundation Program.

Phase 6. The extra state support allows the original lighthouse districts to reduce their tax burdens; hence, they become more receptive to the possibility of still newer adaptations (Jones [1971], pp. 19-20).

Harlan Updegraff: Justifying the Rewards for Local Effort on the Basis of Efficiency

During the years of 1921 and 1922, Harlan Updegraff surveyed the fiscal policies of the states of New York and Pennsylvania in terms of their support of public schools. Updegraff accepted, for the most part, the values and goals set down by Cubberley but placed relatively greater emphasis on the concept of local effort. To Updegraff, efficiency was of primary concern and was his justification for the rewarding of local effort by state governments. R. L. Johns (1971) summarizes Updegraff's views on efficiency as follows:

> The efficient participation of citizens in the responsibility of citizenship should be promoted by making the extent of the state's contribution dependent upon local action....Efficiency in the conduct of schools should be promoted by increasing the state grant whenever the true tax rate is increased and by lowering it whenever the local tax is decreased (pp. 6-7).

Today, several states follow Updegraff's basic principle in what is called the "percentage equalizing grant" (sometimes referred to as the variable level foundation program). This is a plan in which the state government shares the burden of supplying funds for local school

district expenditures. These present-day plans, however, justify the rewarding of local effort not so much for the sake of efficiency as for the sake of reducing variation in per pupil expenditures among school districts.

Updegraff had one main complaint about the Strayer-Haig Minimum Foundation Program Plan. He believed that the minimum was often too low and that the wealthier districts were sometimes able to spend two and three times as much as the poorer districts. He suggested that even the raising of the minimum would not achieve an equal level of education for children in the poorer districts. Thus, Updegraff wanted local government to control the educational enterprise and thought that the state's primary role was to help local school districts provide the educational service desired by the localities. The desired level of educational service would then be reflected by the effort which the localities made themselves (effort in terms of a higher tax rate). So, Updegraff, unlike Strayer and Haig, did not see the state and local governments as "equal partners" in the educational scene but rather gave the dominant position to the local districts.

Updegraff introduced two ideas to help implement his basic plan. First, he introduced the idea of the "teacher unit" as a basis for the state's distribution of funds as opposed to Cubberley's teachers-employed criterion. A "teacher unit" would be a standard number of pupils per teacher which could vary for different types of classes. Second, he proposed a "sliding scale" that would allocate increasing amounts of aid (per teacher unit) for each increase of one-half mill of school taxes which the local school district levied, ranging from three and one-half to nine mills (districts with a lower property value per teacher unit would receive proportionately more aid). Updegraff wanted to help the schools in the poorer communities but maintained the "help those who help themselves" type of attitude:

> General aid seeks to give aid to local districts in accordance with a combination of two factors, one of which is the ability of the district to support schools as measured by its equalized value per

> teacher...and the other, the effort which the district makes to support a school as measured by its tax rate....The sound policy would be to grant aid only to those local districts that had made a reasonable effort to support schools (Cowle [1968], p. 13).

Henry C. Morrison: Advocating That the State Become the Sole Unit of Taxation and Administrator of Public Schools

In 1930, a time when great emphasis was being placed on local initiative and "home rule" in the educational enterprise, Henry C. Morrison, a professor at the University of Chicago, advocated a unified state-wide system of education and full state funding of education. Morrison believed that the purpose of publicly-supported education was to train the young people of the state to be good citizens and not to pursue local interests. Benson sums up Morrison's views on the purpose of public education as follows:

> It is thus necessary to place limits on the expenditures of rich districts in order that public funds shall not be diverted into "private schools," as distinct from citizenship education. Taxes for schools are to be collected where taxable income can be found in the state, and school resources are to be distributed in accordance with local requirements to provide a uniform standard of citizenship training (Benson [1968], p. 165).

Morrison's primary objective was the equalization of educational opportunity. He saw that great inequities in wealth had caused great inequities in the quality of education and that previous attempts to achieve equality in this area through equalization funds and other means had failed. Morrison had this to say about these past plans:

> We have a childish faith in "plans." When the inevitable disillusionment comes, we conclude that the plan "did not work," and look for another. In the case of equalization schemes, the disillusionment is prone to come at a time when the original plan has been forgotten and inequality is discovered all over again (Morrison [1930], p. 194).

There is much dissatisfaction today with the local property taxes as a means of funding education on the local level. Morrison was aware of this disenchantment when he was doing his research, and, therefore, along with his proposal of full state funding, he advocated the use of a state income tax for the purpose of state school support.

Today, Hawaii is the only state which has established a complete state-wide system of education with no local school districts, and a few other states have maintained high percentages of state support.

More Recent Additions: Power Equalizing and Educational Vouchers

Although a number of theorists discussed thus far are relatively contemporary, and some have continued to write up to the present, two relatively major departures from the historical mainstream have aroused much current attention. The new approaches are generally referred to as power equalizing plans and the establishment of educational vouchers. Very often, these approaches are considered in tandem since they draw upon the same philosophical base. Here, for the sake of clarity, they will be considered separately. When added to the concept of full state funding, which is actually an old idea originated by Morrison, these three possibilities must be considered to currently occupy center stage in regard to alternative programs of educational finance.

The concept of power equalizing, developed by Professor Coons and associates (Coons, Clune, and Sugarman [1970]), proposes that the amount of state assistance to particular school districts be a function solely of the rate at which citizens of that district are willing to tax themselves for education. That is to say, programs of financial subvention would not be a function of wealth of the community but rather of the tax effort the community makes. Regardless of the different tax bases in different communities, those willing to tax at a specified rate would be guaranteed a fixed total amount available for the schooling of each child.

Because Coons and associates have also written extensively on the concept of educational voucher programs, such an approach is sometimes associated with the program just described. Both place an emphasis on a determination by parents of how much education should be provided and at what price.

The voucher plan, as originally proposed by Milton Friedman, provides that each family would be given a chit for each school age child, to be used by the family at an educational institution of its choice. All subsidies to education would thus be funneled through the family rather than directly to the school. The aim is to apply the mechanics of supply and demand in a free marketplace to the issues of educational finance. Early thoughts on educational vouchers are contained in Friedman (1955); later modifications are included in Friedman (1962).

Erickson describes the Friedman plan as follows:

> Each voucher would represent a child's share of the state's investment in general education and would be redeemable by any approved school that the parents might decide to patronize. Among the advantages that Friedman saw in the approach, two seem particularly pertinent to the present discussion: (1) programs would be more precisely matched to parental wishes, and (2) individual families would have more power to determine how much money was spent on the schooling of their young (Erickson [1970], p. 109).

Because of the distinct advantages (as well as disadvantages) that such a plan would entail, the topic has become highly controversial. The ability of the public sector to do any long-range planning in such a fluid situation has been of particular concern. Issues of educational hucksterism, social policy, social integration, and aid to sectarian institutions are also involved and show no simple resolution.

Under the sponsorship of the Office of Economic Opportunity, a rather large scale trial of the voucher plan is currently under way in the Alum Rock Union School District of California. Located in a racially-mixed suburb of San Jose, the experiment provides each parent with a voucher for $680 (elementary) or $970 (secondary) which can be

redeemed in any public school in the district. Private schools are not included becasue California law precludes financial assistance to such institutions. Approximately half of the students have also been issued "compensatory vouchers" for additional funds due to educational deficiency. This was done both to encourage innovative programs for these students and to transform the least desirable pupils into the most desirable because they bring more money to the schools.

Although the study is still in an early stage and findings must be considered tentative, evidence would seem to debunk some of the most serious objections to such a plan. The racial composition of the individual schools is roughly the same as it was prior to the inception of the experiment. As a matter of fact, only a small number of students are attending schools other than the ones they would have attended otherwise. In regard to innovative curricular developments, it is difficult to determine whether the limited number of programs would have been initiated in any case.[3]

As indicated, the full state assumption of educational costs is derived from Morrison and has received the recent backing of many prestigious groups.[4] Hawaii is the only state operating such a system, and no other states currently show movement in that direction.

Concluding Remarks

This chapter has described the evolution of strategies for school finance up to the present. The various plans, as well as the context in which they emerged, have been discussed.

Relatively early, most states implemented programs whose ostensible purpose was to provide a minimum educational experience for all members of the school-age population. A partnership has been

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[3]For additional discussion, both pro and con, of the voucher issue, see, for example, Friedman (1955, 1962); Jencks (1971); Carr and Hayward (1970); Glennan (1971); Special issue of Phi Delta Kappan, (1970).

[4]See, for example, Thomas (1970).

created--on paper at the very least--between the states and their constituent school districts whereby the state variously supplements the resources of the community in providing adequate schooling.

As will be indicated in Chapter 3, however, the actual impact of state programs of educational finance is less clear than their stated purposes would suggest. The structure, funding, or encumbering provisions of the various legislative acts in the states often serve to dilute or distort effectiveness of the programs as originally conceived. The present chapter, however, serves as a base upon which to evaluate reality as described in the next chapter.

CHAPTER 3

THEORY AND PRACTICE OF EQUALIZATION

While the previous chapter presented an overview of the entire area of educational finance as it has developed in America, the present chapter concentrates on the concept and practice of equalization in education. Concern for the quality and quantity of education in this country remains an important issue, but the educational community has increasingly focused its attention on matters of equity. This chapter first defines equalization, then discusses theoretical and practical difficulties in conceptualization, and concludes with an examination of the impact of various equalization programs in the various states.

Equality in education, although conceptually related to the general call for social equality in other sectors of society, has a special significance and urgency of its own. There are two reasons for the distinction: (1) equality of education can serve as a base upon which equality in other areas can be accomplished more easily, and (2) the financial support for education is under the control of the state and not a de facto condition occurring in its own right. This latter point, which may warrant some additional explanation, is discussed by Coons, Clune, and Sugarman (1970):

> There is, however, an important difference between discrimination in public education and most of the other social ills we tend to associate with poverty. Crime, slum housing, illness, and bad nutrition are not the anticipated consequence of government planning. Discrimination in education, on the other hand, is precisely the anticipated consequence of the legislated structure of public education....Such a system bears the appearance of calculated unfairness (p. 7).

Equalization: Its Meaning

When individuals speak of equity considerations in education, attention most commonly turns to the process through which funds are directed from federal and/or state sources to the school districts and thus to the schools. What, then, constitutes an equalization plan? Roe L. Johns and Richard G. Salmon (1971) framed the following goals of equalization for the National Educational Finance Project:

> Financial equalization is most nearly accomplished when the following two factors are met: (1) the varying educational needs of the student population are taken into consideration before the allocations are made, and (2) the variation of the ability of the local school districts to support education is reduced or eliminated through the utilization of state resources (p. 120).

An equalizing approach to educational finance, thus, must be concerned with two conditions: the educational achievement (or deficiency) of the students and the financial capacity of the school district to provide necessary services. Most states have programs of financial assistance to school districts which are labelled "equalizing," but the extent to which these programs are actually equalizing varies greatly, depending, in part, on the following factors: (1) consideration of "educational needs"; (2) absolute number of dollars devoted to equalization; (3) the existence of flat grants, general grants, and categorical grants; (4) encumbering ceiling, minimum, and save-harmless provisions. These will be discussed in a later section of this report.

In line with the above distinctions, Alexander, Hamilton, and Forth (1971) identify five basic patterns which characterize state programs of finance to public education. The first they label circumscribed; this includes categorical and discretionary funds not administered uniformly. The second type is called uniform, wherein each district receives a flat amount per classroom or student unit. In the third type, fiscal-modified, the financial capability of the community is considered, but not the educational needs. In type four, the client-modified pattern,

the varying educational needs of localities are accounted for, but not financial capacity. In the final form, both fiscal and client needs are taken into account in the formulas.

Neither financial capability nor "educational need" can be determined in particular cases without difficulties of definition and measurement. Figure 3-1 splits the determinants of equalization from the grossest level to the most minute. Starting at the left side of the page, one can take any path to the right side, and this is what most analyses have done. It is increasingly important, however, to evaluate movement along all paths simultaneously.

Various specific plans to accomplish the goal of educational equalization have wide currency and are presently in use in the various states. Before these can be discussed, however, two very fundamental questions must be asked. The first is: what is to be equalized? The second is: among which units is equalization to occur?[1]

The answers to these questions are not subject to wide agreement, either in academic or judicial discourse. In regard to the first matter (equalization of what?), a wide number of possibilities present themselves. Some of the alternatives concern inputs, others outputs. They are arrayed in these two categories below:

INPUTS

Equalization of resources
Equalization of "educational opportunity"
Equalization of tax effort per educational expenditure
Equalization of program options

OUTPUTS

Equalization of student achievement
Equalization of student economic/noneconomic benefits
Equalization of societal economic/noneconomic benefits

Parallel to, but distinct from, the problem of what to equalize is the quandary about the units among which equalization is to occur. Possible alternative answers include the following:

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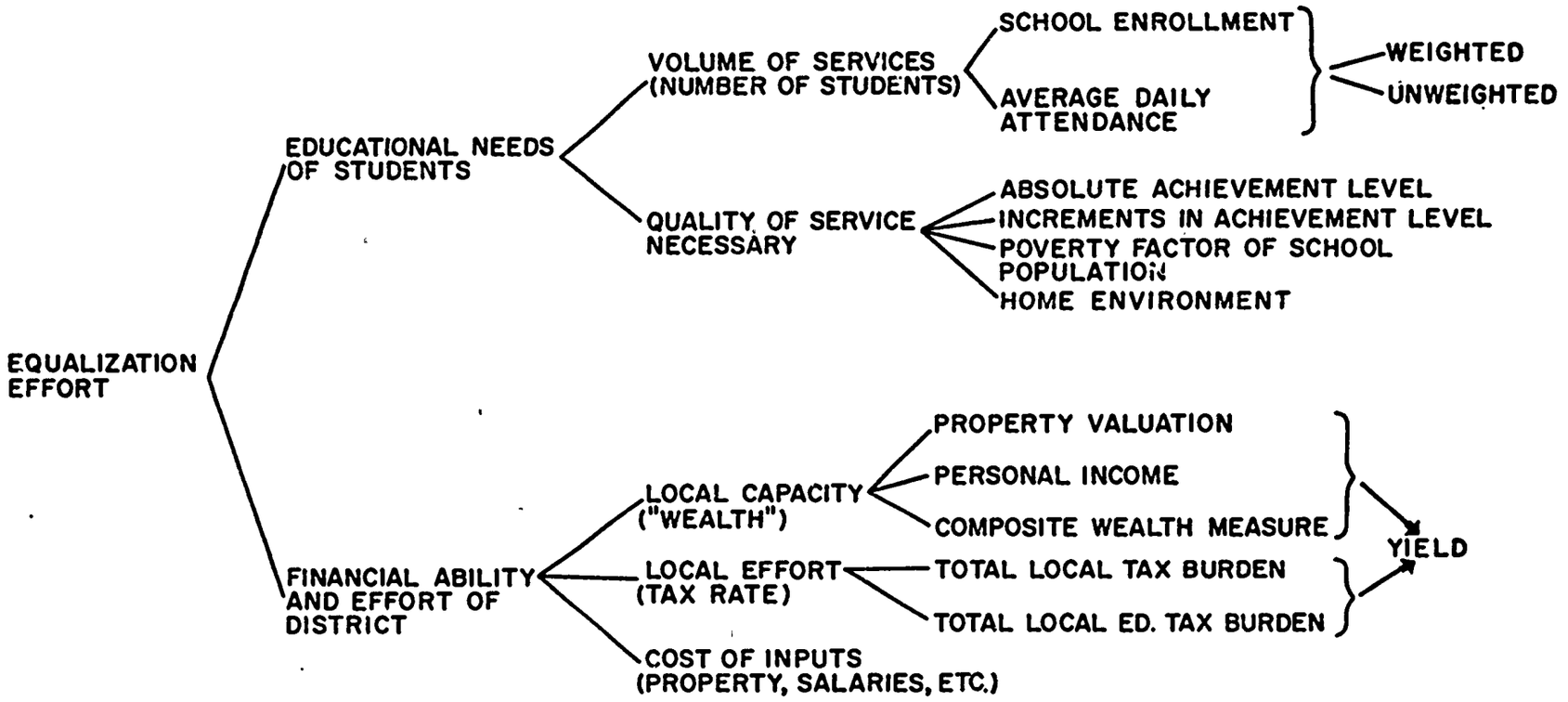
[1]This section draws heavily from Hickrod (1972).

FIGURE 3-1



CRITICAL ISSUES IN EVALUATION OF EQUALIZATION EFFORT

Equalization among states
Equalization among districts within each state
Equalization among schools within each district
Equalization among families (in regard to educational expense)

Figures 3-2 and 3-3 indicate graphically the relationships in the questions of (1) equalization of what? and (2) equalization among which units? At any level of the second question, we may be concerned with equity of inputs, outputs, or outputs as a function of inputs.

Once attention has been drawn to the matter of what is to be equalized, we may begin to ask whether we are concerned successively with equity among families, among schools, among school districts within a state, or among states. Whereas the Serrano action concerned equity among school districts, the Hobson vs. Hansen judgment dealt with schools within a given school district. Because of the lack of clear constitutional issue, the extremes listed above--equalization among families and equalization among states--have not been considered in major judicial action to date.

A final point should be made about Figure 3-2. From this diagram, one might assume that there is some substantive agreement on exactly what constitutes the inputs, transformation process, and outputs of education. Such an assumption would appear to be unwarranted at present, and this serves to add additional ambiguity to an already unclear situation.

Recent court actions have dealt with many of these issues with less than unanimity and with a degree of befuddlement in regard to the complexity of the factors involved. The opinion of Judge Skelly Wright in the case of Hobson vs. Hansen (cited in Clune [1972]) serves as a commentary on the situation.

> Plaintiff's motion for an amended decree and for further enforcement has now been argued and reargued...for one full year. During this time the unfortunate if inevitable tendency has been to lose sight of the disadvantaged young students, on whose behalf this suit was first brought, in an overgrown garden of numbers and charts and jargon like "standard deviation of the variable," "statistical significance," and "Pearson product moment correlations." The reports by the experts...are less helpful than they might have been for the simple reason that they do not begin from a common data base, disagree over crucial

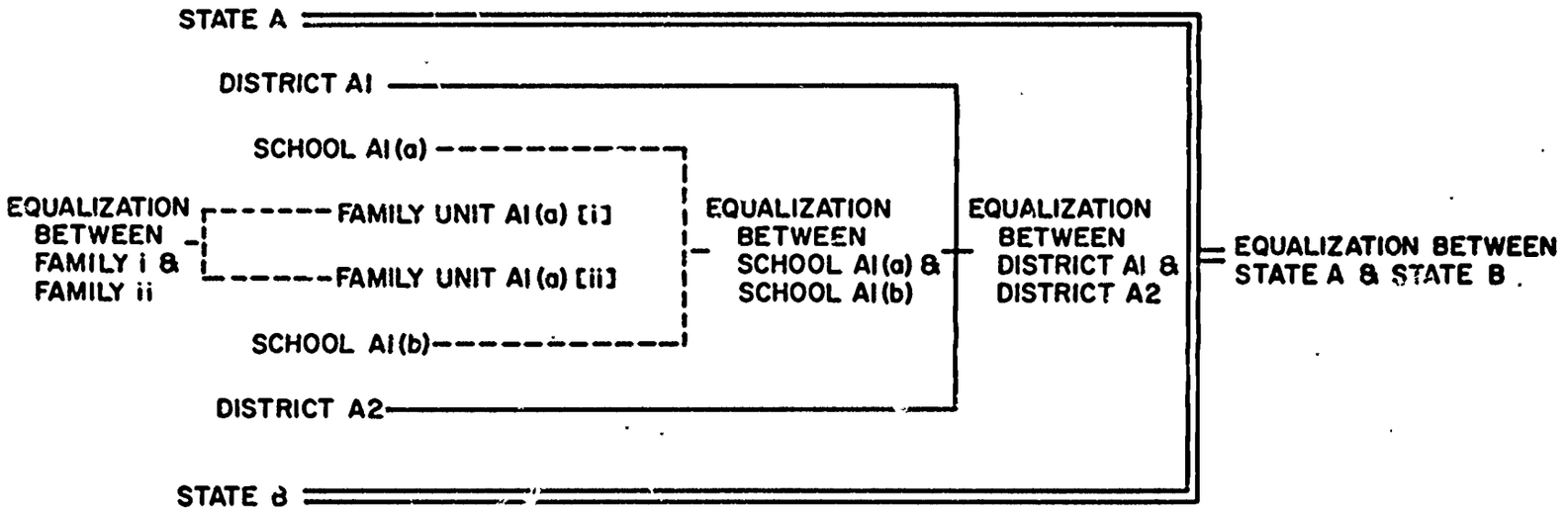
FIGURE 3-2

Equalization of What?

INPUTS	TRANSFORMATION	OUTPUTS
Dollars	Program Options	Amount of Knowledge
Staff	Techniques	Type of Job Held
Facilities		Income Difference
		Societal Benefits (Externalities)

In attempting to "equalize" educational opportunity, one must first decide whether to attempt to equalize inputs, transformation (throughout), or outputs. It then becomes necessary to decide which dimensions within these elements are to be equalized. Representative dimensions are given as examples above.

FIGURE 3-3



EQUALIZATION AMONG WHOM?

> statistical assumptions, and reach different conclusions... This court has been forced back to its own common sense approach to a problem, which, though admittedly complex, has certainly been made more obscure than was necessary.

As indicated by Hickrod (1972), judicially acceptable standards of equalization efforts have differed markedly. The differences are of degree as well as of kind. Hickrod suggests that the following possibilities have variously received favorable judicial reaction: (1) "permissible variance," (2) "inverse allocation," (3) "fiscal neutrality," and (4) "fiscal intervention." These are explained below.

The principle of permissible variance is that there may be allowed to exist only a specified variation in the funds allocated per student to individual schools. Exactly how much variation is permissible has not been determined, although suggestions have included a percentage variation of as much as 50 percent and as little as 5 percent. The principle seeks equalization of expenditure irrespective of need.

Through inverse allocation, one attempts to supply additional resources in inverse relation to the wealth of the local community. In theory, most present state aid formulas are of this type, while in practice, they do not seem to meet this standard in a very satisfactory fashion. Many believe that through procedural modifications, however, such an approach can be made workable and is the most viable solution.

The concept of "fiscal neutrality," as explained by Hickrod, would seem to suggest very large flat grants from the state with little or no local contribution.[2] In point of fact, full state funding of educational

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[2]This is inconsistent with an interpretation of the term in its economic jargon--which would imply that the relative financial position of all districts would remain unchanged after aid is given. Using the economic jargon, fiscal neutrality would imply such plans as a collection-based revenue sharing (what some prefer to term "shared taxes"), where each district receives state aid in proportion to revenues that the state collects fr[illegible]he district. Full state funding or flat grants would certainly not be [illegible]scally neutral.

costs has received increasing attention, and support for such an approach has been voiced by such prestigious groups as the Advisory Commission on Intergovernmental Relations (1969), the New York State Fleischmann Commission (1973), and the President's Commission on School Finance (1972).

There is some dispute as to whether the fiscal neutrality model applies to level of expenditure, level of tax effort, or one as a function of the other. That is to say, it is unclear whether adherence to this model would allow for the possibility of adopting power equalizing plans as suggested by Coons, Clune, and Sugarman (1970). Hickrod (1972) suggests that one interpretation of the principle would lead to the view that the "tax rate may not be a function of wealth, but it may be a function of the expenditure level" (p. 18). Except for Utah, no states currently operate within the parameters of such a plan, and its legal justification has not been tested. The Fleischmann Commission states the case against power equalizing in noting, "The quality of a child's education should, in our view, be no more a function of how highly his neighbors value education than how wealthy they are" (p. 89).

The fourth model, that of fiscal intervention, is based on the socio-political supposition that those with the greatest need should receive the greatest allocation of resources. Such an approach, Hickrod notes, would, in effect, rule "that the level of educational achievement may not be a function of wealth other than the wealth of the state" (p. 20). This is the only model which is stated in terms of output rather than input. It is a marked departure from current thought and even farther from current practice.

The ambiguity over whether our focus should be fixed on inputs or outputs has been noted by many writers. Berke, Campbell, and Goettel (1972) state:

> There are, for example, those whose concern with equity focuses on the fairness of how we raise revenues for education. Others concentrate on the way we distribute resources for learning. To still others the touchstone of equity is the output of the educational system, measured either by achievement levels or ideally by some longitudinal evaluation of career patterns and personal development (p. 2).

Implementation of the Equalization Concept

This section will review existing research which has been undertaken to study the effects of financial inputs in the form of various state equalization plans. It is first necessary to describe the types of plans which are currently in use.

Johns and Salmon (1971) describe state plans for educational finance in terms of the categories developed for the National Educational Finance Project as follows:

1. Flat grants
   a. uniform flat grants
   b. variable flat grants

2. Equalization grants
   a. Strayer-Haig-Mort [foundation] programs
   b. percentage equalization or state aid ratio program
   c. guaranteed valuation program

3. Nonequalizing matching grants

Flat grants are funds which are channelled to school districts on a per student or classroom basis. In the case of uniform flat grants, account is taken of neither variation in educational needs nor community financial capacity. Variable flat grants similarly take no account of financial capacity; however, they do attempt to compensate for differing classroom u . 's. Most commonly, instructional units are thus weighted for secondary versus elementary instruction. Weights for other factors are found occasionally. Flat grants are often used in conjunction with other plans discussed below.

A majority of the states use equalizing plans to distribute the major portion of general (noncategorical, special purpose) funds, and of these, the foundation program or a variation of it is most popular.

The basic foundation approach is to set a level for a minimum educational package and within that level, set limits for the state to provide whatever funds are required to bring local revenue at a mandated tax rate up to the foundation level per student. Foundation programs may be either weighted or unweighted with regard to educational level or other factors.

A second type of equalizing plan is the percentage equalizing program. State aid increases with per pupil expenditures on education and is an inverse function of the relative wealth of the district. In a third equalizing approach, guaranteed valuation, the state guarantees a fixed yield from a mandated tax rate. The state pays the difference between what the tax produces and the guaranteed amount. The guaranteed valuation approach is, in effect, equivalent to the basic foundation approach.

In addition to flat grants and the various equalization grants, certain additional state (and federal) monies are available on a matching basis, wherein the district must match dollar for dollar, or in some other proportion, all funds supplied by the subventor. Such grants are not equalizing with regard to financial capacity. However, since many of these grants are for special educational purposes, to that extent they could be described as differentially supplying funds for special educational needs.

Although it will be shown in Chapter 4 that the aid formulas within each type of plan vary among the states, it might be useful to provide fairly rigorous definitions of the plans in terms of their general characteristics.

The Foundation Plan

Equalization aid is typically computed according to the formula

$$(3\text{-}1) \quad EA_i = WADA_i(F - rV_i)$$

where

EA_i = equalization aid to the ith district

$WADA_i$ = weighted average daily attendance

F = foundation level

r = mandated tax rate

V_i = assessed valuation per pupil in the ith district

If EA_i in Equation (3-1) is negative, equalization aid is zero.

The mandated tax rate, r, may be calculated on the basis of the tax levy that would yield the foundation level of support (F) in the wealthiest district. Then,

$$(3\text{-}2) \quad r = F/V_h$$

where V_h is the per pupil valuation in the wealthiest district. Then Equation (3-1) becomes

$$(3\text{-}3) \quad EA_i = WADA_i \cdot F(1 - V_i/V_h)$$

One could also compute r on the basis of the necessary tax levy to yield F when average per pupil valuation in the state (V_s) is substituted for V_h. Then Equation (3-3) becomes

$$(3\text{-}4) \quad EA_i = WADA_i \cdot F(1 - V_i/V_s)$$

When Equation (3-3) is used, all but the wealthiest districts would receive some equalization aid. When Equation (3-4) is used, only districts with per pupil valuations under the state average would receive equalization aid. In both cases, aid is given in inverse relation to the relative wealth of the districts.

The Guaranteed Valuation Plan

As noted previously, this plan is algebraically equivalent to the foundation plan. The guaranteed valuation plan specifies a given level of valuation, V_g, which all districts may use to compute the level of property tax revenues per pupil that the state will guarantee. Thus, rV_g--where r is the mandatory tax rate--defines the guaranteed yield, which in the foundation plan has been called the minimum foundation

support level, F. The guaranteed valuation plan provides for equalization aid on the basis of the following formula:

$$(3\text{-}5) \quad EA_i = WADA_i(RV_g - rV_i)$$

Since rV_g, in effect, is equal to F, Equation (3-5) reduces to Equation (3-1), proving that the two plans are algebraically equivalent.

It should be noted, however, that the practical application of the two formulas could result in some differences in equalization aid. For example, V_g in Wisconsin varies according to school organization and school classification (see Riew [1970] and Cohn [1972], pp. 329-331). If such a variation is justifiable--and it may not be--it might be politically easier to effect such a variation in the guaranteed valuation plan than in the foundation plan--in which case one would have to vary the value of F among school organizations and classifications.

The Percentage Equalizing Plan

Equalization aid is distributed according to the following formula:

$$(3\text{-}6) \quad EA_i = WADA_i(1 - xV_i/V_s)EXP_i$$

where EXP_i is local per pupil expenditures in the ith district, and x is a scalar between 0 and 1 indicating the extent to which the state is willing to share in educational expenditures. (A higher value of x indicates a smaller state share.)

For example, if $V_i/V_s = 1/2$ for district i, and if $x = 0.25$, the state will then pay a proportion $1 - 1/2(0.25) = 0.875$ (87.5 percent) of local expenditures. If, however, $x = 0.5$, the state will pay only \$0.75 per dollar of expenditures.

It can also be shown that as the ratio V_i/V_s increases, state aid per dollar of expenditures decreases. For example, if $x = 0.25$ and $V_i/V_s = 2$, the state will pay \$0.50 per dollar of local expenditures. If $x = 0.50$, the state will pay no equalization aid to that district.

As noted earlier, many states have combined such equalization plans with flat grants and other types of categorical grants. Also, states using the percentage equalization plan have stipulated maximum levels of EXP_i for the purpose of equalization aid, thus limiting the extent to which equalization could be achieved.

The Power Equalizing Plan

In both the foundation and the percentage equalizing plans, per pupil expenditures in the individual districts remain a function of the district's wealth, measured by assessed valuation of property. Even if some wealthy districts receive no state aid whatever, they may still be able to raise more educational revenues for a given tax effort than other districts receiving state aid. It follows that the quality of the schools in a district (measured by per pupil expenditures) remains a function of wealth.

The power equalizing scheme, proposed by Coons and his colleagues (1970), calls for equal state aid to districts based on equal tax effort. That is, school districts that impose a given tax rate should be entitled to spend a given sum on education (per pupil) and no more. Any discrepancy between the amount the district can raise and that to which it is entitled will be filled by the state. Moreover, if a district can raise educational funds, for a given tax effort, in excess of the stipulated amount set by the state, the excess must be transferred to the state. In sum, any two school districts that impose the same property tax rate will have identical educational funds per pupil at their disposal, no matter how wealthy or poor the community is.

One method by which the concept may be implemented is to define state aid--both positive and negative--on the basis of the following formula:

$$(3\text{-}7) \quad EA_i = WADA_i[r_i V_s - r_i V_i] = WADA_i[r_i (V_s - V_i)]$$

where r_i is the tax rate that residents of district i are willing to impose on themselves.

For example, if V_s = \$5,000, and V_i = \$3,000, aid will be given to the districts on the basis of the formula $EA_i = r(\$2,000)WADA_i$. If the district chooses a low tax rate, say 10 mills (r = 0.01), then per pupil aid is \$20. If it chooses a very high rate, say 100 mills (r = 0.1), per pupil aid would be \$200. For each additional mill, the district will get additional aid of \$2.00 per pupil in WADA.

On the other hand, if a district has a per pupil valuation (V_i) of \$6,000, it will pay the state negative aid based on the formula $EA_i = r_i(-\$1,000)$. For each mill levied (yielding \$6.00 per pupil), the district will pay the state \$1.00. Hence if the district chose to levy a tax of 10 mills, it will raise \$60 per pupil, pay the state \$10 per pupil, and retain \$50 per pupil. For the district in the preceding paragraph, local revenue for the 10-mill levy would be \$30 per pupil. Add to that the \$20 per pupil in state aid, and it is clear that both districts are left with \$50 per pupil despite the wide disparity in wealth between the two.

Instead of Equation (3-7), it is possible to formulate a specific schedule indicating the amount of educational revenues to which a district is entitled within a given range of tax levies. If revenue entitlement is denoted by RE, then state aid, positive or negative, is given by

$$(3\text{-}8) \quad EA_i = [RE - r_i V_i]WADA_i$$

Note that RE in Equation (3-7) is simply $r_i V_s$, representing tax yield when the average property value in the state is taxed at the rate r_i.

The power equalizing plan has been implemented to date only in Utah--and there only partially. Variations of the plan could incorporate a different measure of wealth in Equations (3-7) or (3-8) and perhaps permit a certain amount of variation among districts in per pupil expenditures not based entirely on tax effort. Examples of this would be categorical grants for special purposes or separate transportation and capital aid distribution formulas.[3]

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[3]The (hypothetical) effect of a variant of the power equalizing plan on total educational revenues for a sample of Pennsylvania districts is illustrated in Summers (1973).

A General Description of Current Aid Programs

States vary not only in the means by which they provide financial assistance to local school districts but also in regard to the percent of total funds provided by the state and the actual equalizing effect derived from the particular subvention programs. On the other side of the ledger, states also vary considerably in their source of revenues for the schools--whether by legislative appropriation or special taxes earmarked for education. The authority and extent to which localities can levy nonproperty taxes is similarly variable in the different states, as is statewide participation in capital costs, transportation, and the purchase of textbooks, to mention only a few special areas.

The general types of subvention programs currently in use in the states are shown in Table 3-1. It can be seen that a majority of the states currently operate with some variation of the Strayer-Haig-Mort "foundation plan." If there is indeed a change from past years, it would appear to be away from flat grants (and in some cases, away from foundation plans) toward increased use of percentage equalizing or guaranteed valuation programs. Although, as indicated in the previous chapter, considerable interest and support has been given to a full state funding approach to education, Hawaii is still the only state with such a plan in operation.

More specifically, thirty-three of the contiguous states operate on a Strayer-Haig-Mort foundation plan, including most of the Southern, Border, Midwestern, and Western states. A widely dispersed group of ten states at least partially relies on flat grants to school districts. The two more recent types of programs--percentage equalizing and guaranteed valuation--seem to have gained a rather substantial foothold in New England and the Middle Atlantic region.

This regionality in funding plans is shown in Figure 3-4. The fact that basically similar programs have become clustered in readily identifiable regions of the country would appear to indicate that some particular mix of practical politics and educational philosophy that is distinct in each region leads to specific approaches to educational

TABLE 3-1

Classification of the States' Basic Multi-Program
by Type of Plan Used for Its Calculation, 1970-1971

Flat Grants					
Uniform	Variable	Strayer-Haig-Mort	Percentage Equalizing	Guaranteed Valuation or Tax Yield Plan	Complete State and Federal Support
Arizona[a]	Arkansas[b]	Alabama	Iowa[c]	New Jersey[d,e]	Hawaii
California[f,g]	Delaware	California[f,g]	Massachusetts	Utah[h]	
Connecticut	Nebraska[i]	Colorado	New York[d]	Wisconsin	
Oregon[i]	New Mexico	Florida	Pennsylvania		
	North Carolina	Georgia	Rhode Island		
	South Carolina	Idaho	Vermont		
		Illinois			
		Indiana			
		Kansas			
		Kentucky			
		Louisiana			
		Maine			
		Maryland			
		Michigan			
		Minnesota[d]			
		Mississippi			
		Missouri			
		Montana[i]			
		Nebraska[i]			
		Nevada			
		New Hampshire			
		New Jersey[d, e]			
		North Dakota			
		Ohio[d]			
		Oregon[j]			
		South Dakota[f]			
		Tennessee			
		Texas			
		Washington			
		West Virginia			
		Wyoming[f]			
		Oklahoma			
		Virginia[d]			
		Alaska[k]			

Source: Reproduced from Johns (1972), Table 3.

[a]Arizona distributes $15,069,000 in equalization aid; however, the state's primary school funds are distributed on a flat-grant basis.

[b]While local wealth is not taken directly into account in the major portion of the primary school fund, the distribution does equalize to some degree.

[c]Iowa will operate under a Strayer-Haig-Mort Program in 1972-73.

[d]1972-73 school year reported.

[e]While New Jersey operates under a guaranteed valuation program, the law guarantees the levels of funding under the previous Strayer-Haig-Mort type program, and so both classifications apply.

[f]1970-71 school year reported.

[g]California operates under a combination flat-grant and Strayer-Haig-Mort Program

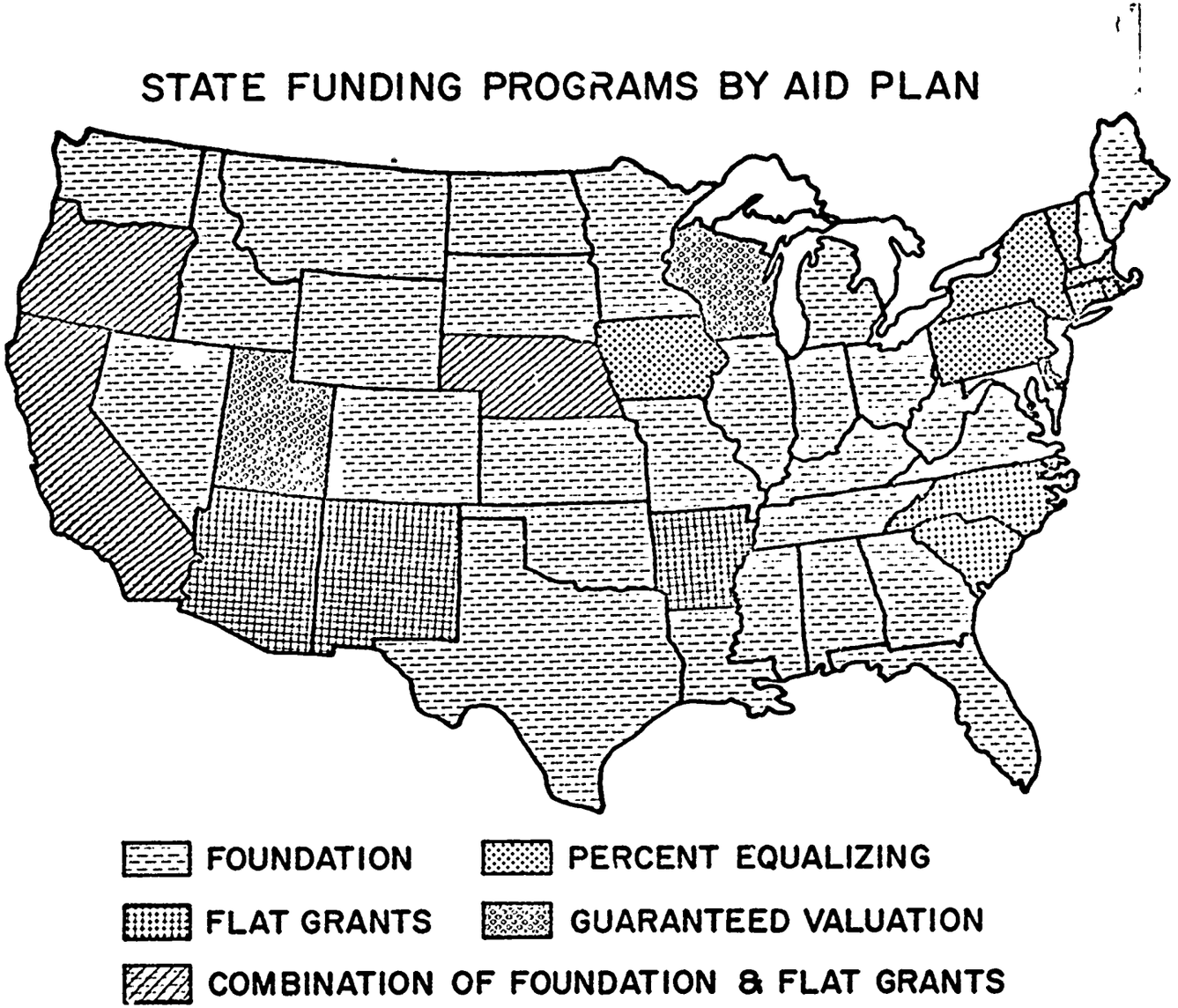
[h]The Utah program could also be classified as a variation of the Strayer-Haig-Mort Program.

[i]Nebraska operates under a combination flat-grant and Strayer-Haig-Mort Program

[j]Oregon operates under a combination flat-grant and Strayer-Haig-Mort Program.

[k]The Alaska plan combines the Strayer-Haig-Mort foundation approach with the percentage equalizing method of determining the local share of the calculation.

FIGURE 3-4


STATE FUNDING PROGRAMS BY AID PLAN
FOUNDATION
PERCENT EQUALIZING
FLAT GRANTS
GUARANTEED VALUATION
COMBINATION OF FOUNDATION & FLAT GRANTS

finance. This view is intensified by the regional variation in state funding of transportation, textbook purchase, and other special services to be discussed shortly.

The variation in percentage of educational costs underwritten by the state as a whole provides perhaps the greatest range of difference of any of the potent factors. It should be recalled that irrespective of the particular formula used for state disbursement of funds, all other things being equal, the larger the state contribution, the more equalizing the system is. This is true even if flat grants are used extensively. The reason for this is simply that most state revenues are collected on some statewide "per wealth" basis but are returned on some "per student" or "per capita" basis.

Table 3-2 presents data for the percent of total nonfederal educational funds provided for the schools by the states. The figures shown in this table range from approximately 6 percent in New Hampshire to 83 percent in New Mexico. Some regional patterns regarding this variable may be observed in Figure 3-5. The Southern states appear to have the highest percentage of funds provided by the states, while the Plains states have the lowest percentage.

The type of financial plan used and the percentage of state funds relative to total educational costs are the two most important variables in determining the equalizing effect of the state program. This is not to say, however, that all other things are equal. The remainder of this section will be devoted to a discussion of these other factors.

State participation in school district capital costs provides an interesting case in point. While the modal state pattern is to provide loans or, alternatively, to guarantee loans undertaken within certain limits by the individual school districts, some states are more directly involved in capital construction. In at least two states, a state authority absorbs full cost of construction, builds the facilities, and holds title to them until the buildings are fully amortized.

Most states impose statutory or executive limits in regard to type, use, and functionality of specific school buildings. In the Commonwealth of Pennsylvania, for example, the governor's 1973-74

TABLE 3-2

Percent of Total Nonfederal Funds Provided by Individual States[a]

Less than .29	.30 to .39	.40 to .49	.50 to .59	.60 to .69	Over .70
New Hampshire .06	Kansas .30	Massachusetts .40	New Jersey .50	Florida .60[b]	Minnesota .70
Iowa .14	Maine .30	Illinois .41[b]	Oklahoma .50	Louisiana .60	Alabama .73
South Dakota .15	Colorado .31	Michigan .42	New Jersey .51	Kentucky .61	North Carolina .76
Nebraska .18	North Dakota .31	Arizona .44[b]	Washington .54	Georgia .64	Delaware .80
Oregon .21[b]	Wisconsin .31	New York .44	Utah .55	West Virginia .65	New Mexico .83
Montana .25	Connecticut .32	Idaho .47	Tennessee .56	Texas .66	
	Maryland .32	Pennsylvania .49		South Carolina .67[b]	
	Rhode Island .32			Mississippi .69	
	Missouri .34				
	Ohio .36				
	Vermont .36				
	California .38				
	Virginia .38				
	Indiana .39				
	Wyoming .39				

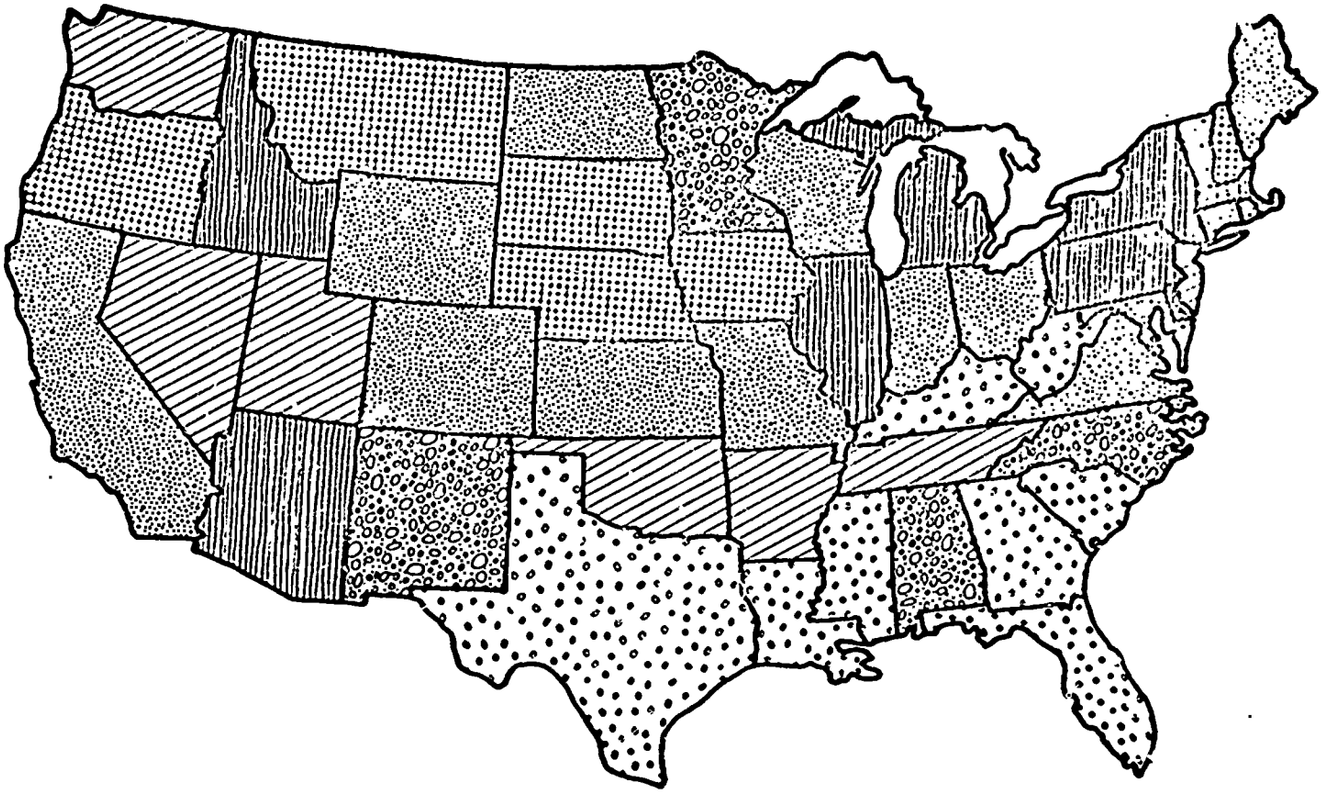
Sources: Adapted from information presented in Johns (1972), except as noted.

[a]States are listed by percentage category. Within categories, they are listed in ascending percent contribution. Within the same percent, they are listed alphabetically.

[b]Percentages for these states were computed from data in National Education Association, Research Division, Estimates of School Statistics, 1972-73. (Washington, D.C.: The Association, 1972).

FIGURE 3-5

PERCENT OF TOTAL NON-FEDERAL FUNDS PROVIDED BY INDIVIDUAL STATES



LESS THAN .29
.30 — .39
.40 — .49
.50 — .59
.60 — .69
OVER .70

budget message (Shapp [1973]) indicates strong support for limitations "to control the construction of 'Taj Majal' schools by local school districts." The governor goes on to indicate his belief that "unnecessarily lavish school construction is a chief factor in the rising cost of education at both local and state levels" (p. 10). Pennsylvania would thus seem ready to join many other states in limiting the options of school districts in terms of school construction.

Many states provide subsidies for the cost of textbook purchases. Most typically, the Southern states pay the full cost of textbooks with the provision that the books be purchased through the state in accordance with an approved textbook list. This practice has come about partly in response to the fact that many of these states previously required students to purchase books on an individual basis. While it provides the potential for some economies of scale, such centralized control of textual school material would appear to be less palatable to the populace in other regions of the country.

Most states also provide a reimbursement for transportation costs necessary to bring children to school. While all have dollar limitations, various states consider factors such as the quality of the roads, steepness of the terrain, number of miles traveled, availability of commercial or municipal common carriers, and sparsity and/or density of population in the district. Some states go even further with regard to transportation. In both of the Carolinas, for example, the state owns and operates the school buses. In Ohio, the state pays the full cost of bus operation but not their purchase.

In regard to all three of these miscellaneous program areas--buildings, textbooks, and transportation--the majority of the states operate on a flat grant basis. Significantly, however, a number of states provide these subsidies on an equalizing basis. That is, these programs are either included within the confines of the total program for "general educational costs" or are funded at the same percentage level at which the individual districts receive reimbursement for general educational programs.

In addition to these programs, every state has some program for vocational education, either within the confines of the same school

buildings or in separate facilities. These special purpose educational programs go by various names and are occasionally linked with the junior or community college network. Programs of vocational-technical education appear to be most highly developed in the Southern states, although other states have shown much recent interest. In New York State, vocational education is only one component of regional "boards of cooperative education" through which neighboring districts provide services which would not be financially feasible to enter into as single units. These services include vocational and distributional education as well as certain compensatory and remedial services. In Pennsylvania, intermediate units operate to provide some of these same support services. In other states, school districts are organized on a county basis (Maryland and Illinois, for example) and are able to provide services on a wider scale with less unnecessary duplication.

Evaluation of Equalization Efforts in the States

A complete analysis of the degree of equalization achieved in each of the fifty states is beyond the scope of this report. Such an analysis is indeed difficult and requires information not only about the provisions of the specific enabling legislation in each state, but also knowledge of actual appropriations as well as local costs and local options. A program which appears very equalizing on paper may have no such effect because of inadequate funding, extent of participation, encumbering provisions, or other extrinsic factors.

Instead of attempting a new analysis with a limited data base, it seems most appropriate here to report a recent study of equalization impact undertaken by Johns and Salmon (1971). These investigators studied school funding plans in the fifty states, making use of a typology developed for the National Educational Finance Project. The NEFP evaluation typology is presented in abstracted form below. Equalization levels are arranged from 0 to 5 as follows.

> LEVEL 0: State funds are allocated in such a manner as to leave districts with the same or greater differences in financial capacity to support education as they were before receiving state allocations....

LEVEL 1: State funds are allocated on the basis of a flat amount per unweighted pupil or unadjusted classroom unit basis, or some other method which ignores unit cost variations..., and a required local share in proportion to the taxpaying ability of the local districts is not deducted before the apportionment is made....

LEVEL 2: State funds are allocated on a weighted unit basis..., and a required local share in proportion to the taxpaying ability of the local district is not deducted before the apportionment is made....

LEVEL 3: State funds...are allocated on the basis of unweighted [units]..., but a required local share in proportion to the taxpaying ability of the local districts is deducted before the apportionment is made....

LEVEL 4: State funds are allocated on a weighted [unit] basis..., and a required local share in proportion to the taxpaying ability of the local districts is deducted before the apportionment is made....[4]

Using the above typology, the levels are scored from 0 (for Level 1) to 8.40 (for Level 4). Local funds are considered in a fashion similar to the method used for rating state finance programs. Dollars which are considered in the state equalization program to be deducted from the basic program are considered Level 3 or 4, depending on whether unit costs are taken into account. Additional local funds are categorized Level 0.

Using this scheme to evaluate school finance programs during the academic year 1968-69, Johns and Salmon found the impact of these programs to vary greatly in the several states. In order of descending equalization effect, in terms of their definitions above, ranking of the states is shown in Table 3-3.

As can be seen, Hawaii (because of its unitary school system) is the only state to manifest a "perfect" equalization score. Of the contiguous states, Utah--the only state with a variation of the power equalizing approach--ranks highest. Connecticut, with a straight flat grant program of limited proportions, comes out last. In contrast to other states,

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[4] Abridged from Johns and Salmon (1971), pp. 125-127; emphasis as indicated above has been added.

TABLE 3-3

Ranking and Equalization Scores of the States
Based on the NEFP Typology for the School Year, 1968-69

Rank	State	Score	Rank	State	Score
1	Hawaii	8.400	26	Maryland	5.092
2	Utah	7.143	27	Virginia	5.085
3	Rhode Island	6.862	28	Texas	4.963
4	Alaska	6.628	29	California	4.841
5	Wyoming	6.543	30	Montana	4.810
6	Washington	6.368	31	Maine	4.804
7	Idaho	6.318	32	Nevada	4.779
8	Alabama	6.220	33	Massachusetts	4.536
9	Delaware	6.202	34	Oregon	4.535
10	North Carolina	6.148	35	Tennessee	4.521
11	Georgia	6.103	36	Minnesota	4.433
12	Kentucky	6.042	37	Arizona	4.355
13	Florida	5.995	38	Iowa	4.042
14	New York	5.957	39	North Dakota	3.931
15	Louisiana	5.929	40	Missouri	3.852
16	New Mexico	5.915	41	Michigan	3.844
17	Ohio	5.882	42	Kansas	3.820
18	Pennsylvania	5.870	43	New Jersey	3.754
19	Vermont	5.834	44	Indiana	3.704
20	Wisconsin	5.781	45	Oklahoma	3.691
21	Mississippi	5.744	46	Arkansas	3.647
22	West Virginia	5.578	47	Colorado	3.571
23	Illinois	5.398	48	South Dakota	3.420
24	Nebraska	5.378	49	New Hampshire	3.091
25	South Carolina	5.235	50	Connecticut	2.295

Source: Reproduced from Johns and Salmon (1971), p. 137.

however, Connecticut puts 34.3 percent of its state education funds into district capital costs. If this were considered, Connecticut's rating would undoubtedly improve considerably.

As in previous sections of this chapter, it is interesting to ask whether any regional pattern emerges from this information. The Johns and Salmon data are divided into the eight geographical regions used by the National Education Association. Information on the matter of regionality is shown in Figure 3-6.

It should be made clear that in this pictorial representation, the unit of analysis is the regional mean. Therefore, each of the states in each region may not be higher or lower in itself than states in other regions, but the means for the regions are in order of magnitude of equalization scores.

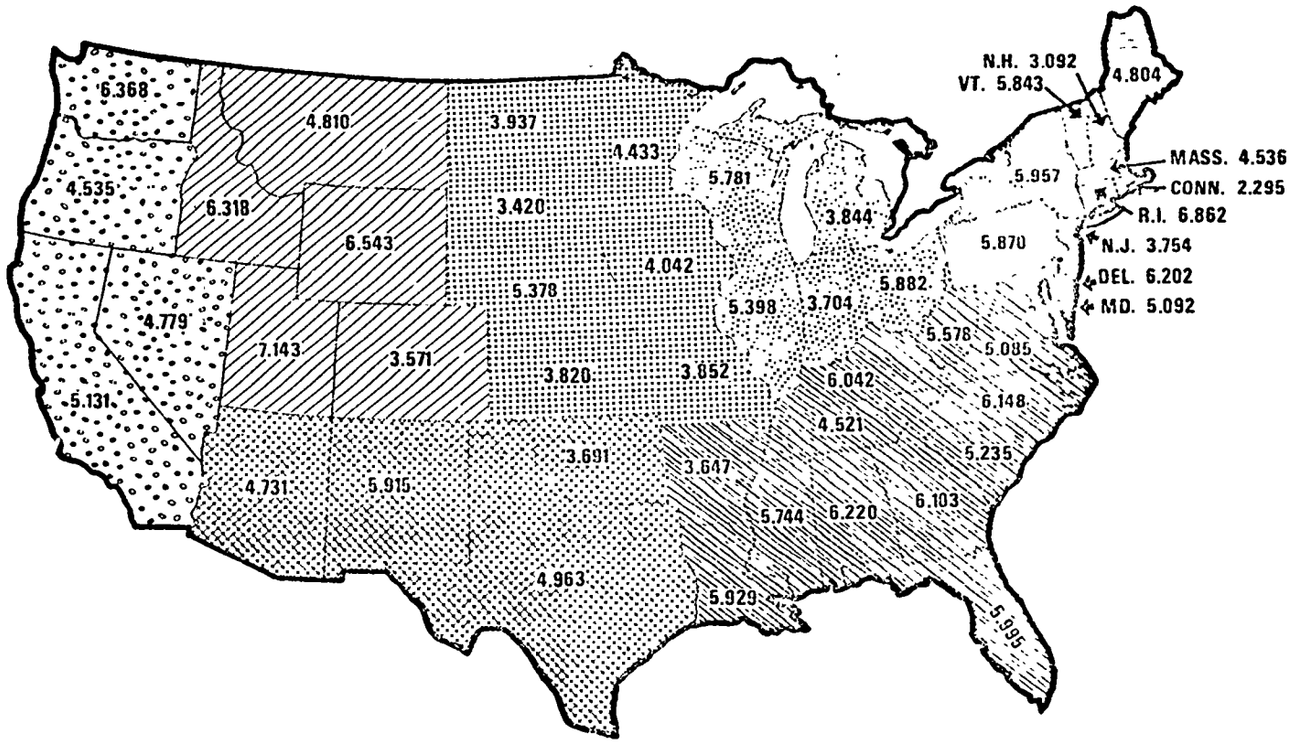
Generally, the Rocky Mountain states most nearly equalize the cost of education within their individual borders, followed closely by the Southeastern states. The Plains states have the least equalization by a sizeable margin. While the Far Western states sit squarely on the national norm (5.131), the Great Lakes, Southwest, New England, and Plains states are all below the national mean. States above the mean are in the Rocky Mountain, Southeast, and Mideast areas. This information is summarized in Table 3-4.

The fact that the type of plan used is not necessarily indicative of the equalization score would tend to give credence to the hypothesis expressed by many educational finance spokesmen that, short of full state funding such as in Hawaii, no particular type of plan can be said, in and of itself, to be a better equalizing agent than others. Johns and Salmon point out that the equalization score has a significantly positive simple correlation with percentage of funds supplied by the state and a significantly negative correlation with number of separate state education program funds.

All other things being equal, it appears, then, that the larger the relative amount of state funds and the fewer the number of categorical programs, the more equalizing the total finance program will be. This can be confirmed by reviewing the data presented in Figures 3-4 and 3-6. It can be seen that the regions having above average equalizing

FIGURE 3-6

MEAN NATIONAL EDUCATION FINANCE PROJECT EQUALIZATION SCORES BY GEOGRAPHICAL REGIONS



ROCKY MT. – 5.677
SOUTHEAST – 5.521
MIDEAST — 5.375
FARWEST — 5.131
GREAT LAKES — 4.922
SOUTHWEST — 4.731
NEW ENGLAND – 4.570
PLAINS ——— 4.125

U.S. MEAN — 5.131

TABLE 3-4

Mean Equalization Scores in Major Geographical Regions
Based on the NEFP Typology for the Academic Year, 1968-69

Region	Mean Score
Rocky Mountains (Col., Idaho, Mont., Utah, and Wyoming)	5.677
Southeast (Ala., Ark., Fla., Ga., Ktky., La., Miss., N. C., S. C., Tenn., Va., and W. Va)	5.521
Mideast (Del., Md., N. J., N. Y., and Pa.)	5.375
Far West (Cal., Nev., Ore., and Wash.)	5.131
Great Lakes (Ill., Ind., Mich., Ohio, and Wis.)	4.922
Southwest (Ariz., N. M., Okla., and Texas)	4.731
New England (Conn., Me., Mass., N. H., R. I., and Vt.)	4.570
Plains (Iowa, Kans., Minn., Mo., Neb., N. D., and S. D.)	4.125
All States	5.131

Source: Adapted from Johns and Salmon (1971), p. 139.

impact come from the ranks of those with all of the various funding plans. However, it can be seen from Figures 3-5 and 3-6 that there is some relationship between percent of state funds involved and degree of equalization.

Studying the effect of equalization efforts under widely different statutory conditions is a very difficult task. Nevertheless, in terms of the current research, it would appear that the Johns and Salmon method leaves something to be desired. Surely, there are other more important keystones of "student need" than the simon-pur weightings most states attach to disbursements for elementary and secondary education.

If the two-pronged NEFP definition, stressing taxpaying ability and student "educational needs," is to be meaningful, we must speak in terms of individual student abilities, needs, required compensatory programs, and requisite additional costs involved. In point of fact, there is some fragmentary evidence (see, for example, Fleischmann Commission [1973]; and Berke, Campbell, and Goettel [1972]) that elementary/secondary funding differentials work to the detriment of the poorest schools because of the extremely large number of dropouts and the earliness with which individuals do drop out in blighted areas. Therefore, the Johns and Salmon schema is not dealing well with the "need" component of equalization and may in fact be imposing an inverse measure.

Concluding Comments

In addition to defining and discussing the concept of equalization, this chapter has provided basic information about various state plans for educacional finance. The following chápter carries this discussion further by presenting more detailed information about current programs for educational finance in the states.

CHAPTER 4

CURRENT STATUS OF EDUCATIONAL FINANCE PROGRAMS

This chapter provides additional information about school finance programs which currently operate in the different states. Salient aspects of these programs, along with schemata for categorizations, have been presented in previous parts of this report. The task here is to fill in more of the detail in terms of operating procedures and formulas, as well as amounts, sources, and uses of funds involved.

The order of presentation in this chapter is as follows. The first five sections will successively describe the operation of (1) flat grant programs, (2) foundation programs, (3) percentage equalizing programs, (4) guaranteed valuation programs, and (5) a modified power equalizing plan. In each case, a group of states using the respective approaches will provide illustration. The chapter concludes with an examination of the various encumbering provisions of state plans and a discussion of sources and specific uses of school revenues.

Flat Grant Programs

Ten states at least partially disburse general (basic) funds for the schools by use of a flat grant procedure. These states are Arizona, California, Connecticut, Oregon, Arkansas, Delaware, Nebraska, New Mexico, North Carolina, and South Carolina. The first four base assistance on a uniform flat grant, the latter six upon variable flat grants. The uniform flat grants take no account of cost variations; variable grants are weighted in accordance with program level or other factor(s). Of these ten states, five (Connecticut, Delaware, New Mexico, North and South Carolina) rely exclusively on flat grant disbursements; the remaining five states use a flat grant in combination with some other equalizing program. Of the states that rely exclusively on flat grants, the level of grant per student is shown in Table 4-1.

TABLE 4-1

Levels of Per Pupil Flat Grants in Five States, 1971-72

State	Flat Grant Per Pupil in ADA
Connecticut	$205.00
Delaware	(274.00 to 481.00, approximately)[a]
New Mexico	346.95[b]
North Carolina	(243.00 to 542.00, approximately)[a]
South Carolina	(202.00 to 344.00, approximately)[c]

Source: Adapted from Johns (1972).

[a]based on education and experience of teachers

[b]per Average Daily Membership (ADM) rather than ADA

[c]based on teacher education, experience, and score on National Teachers Examination

States using a combination flat and equalizing grant approach, as might be expected, have flat grant levels considerably below those which can be observed above. Arizona has a flat grant of $182.50, California $125.00, and Nebraska $35.00 to $49.00 (depending on the qualifications of teachers).

While flat grants are not, by definition, equalization plans in intent, they do, as indicated in Chapter 3, equalize to the extent that they are underwritten by taxes collected in accordance with wealth and are distributed on the basis of attendance units. This degree of equalization occurs if the plans are adequately funded. As can be seen by the figures cited above, none of the flat grant programs in operation provides anything near the cost of what is considered to be an adequate educational program.

Foundation Plans

Variations of the Strayer-Haig-Mort foundation approach are still the most popular form of state assistance to the schools. Thirty-three of the contiguous states (plus Alaska) use a foundation program. As with the flat grants, there are two types of units upon which to base the foundation level--student or classroom (teacher) units.

The foundation programs based upon students in attendance will be discussed first. There is a great deal of variation in foundation levels among the states. New Hampshire sets its foundation level at $200 (elementary education foundation), while Oregon funds its elementary program at the foundation level of $593.58. Ohio, the only state with a higher figure, pegs its foundation level at $600. The foundation level in the majority of states using student units ranges from $300 to $500 per pupil.

Wyoming has established a foundation level of $11,800 per classroom unit. All other states using a classroom foundation unit allot funds in accordance with the education and experience of the particular classroom teachers. Again, there is a great deal of variation among states, as shown in Table 4-2.

The greatest amount of variation can be seen in the extremes of the degree structure. For beginning teachers with less than a bachelor's degree, the range is from $1,800 in Mississippi to $4,160 in Tennessee. At the doctoral level, the range is from $7,000 in Tennessee to $8,645 in Georgia. At the bachelor's degree level, the variation is only from $5,300 in Florida to $6,000 in Texas and Louisiana. Allotments for master's degree starting salaries are $300 to $600 higher than the respective baccalaureate salaries.

While foundation plans based on classroom units may at first appear to be closer to actual incurred costs than those based on student units, it must be remembered that the classroom allotments must go toward paying more than just the teachers' salaries. Other direct and indirect instructional costs must also be borne.

TABLE 4-2

Minimum and Maximum Stipulated Teachers' Salary Levels, by Educational Attainment, to Determine State Aid in Nine States, 1971-72[a]

State	Less than Baccalaureate	Baccalaureate	Master's	Master's plus[b]	Doctorate
Florida	$3,000[c]	$5,300[c]	$6,300[c]	$7,000[c]	$7,700[c]
Georgia	d	$5,600 to 7,560	$6,328 to 8,650	$7,644 to 9,800[e]	$8,645 to 10,920[f]
Kentucky	$2,600 to 2,900	$5,530 to 6,950	$5,980 to 7,400	$6,430 to 7,850	d
Louisiana	$4,000 to 6,600	$6,000 to 8,200	$6,200 to 9,100	$6,200 to 9,800	$6,900 to 10,300
Mississippi	$1,800 to 3,836	$5,400 to 6,000	$5,700 to 6,300	d	d
Tennessee	$4,160 to 5,170	$5,500 to 6,550	$6,000 to 7,125	$6,500 to 7,625	$7,000 to 8,125
Texas	d	$6,000 to 8,050	$6,600 to 9,310	d	d
Virginia	$3,800 to 5,000	$5,900 to 7,700	$6,400 to 8,100	d	d
West Virginia[g]	d	$5,719[h]	$6,257	$6,794[i]	$7,053

Source: data extrapolated from Johns (1972)

[a]Within each degree level, there are generally from six to fifteen steps. Steps most commonly consist of one year's service. Compensation is for a nine-month contract.

[b]Master's plus refers to attainment of the first professional degree and thirty additional advanced graduate semester hours (or forty-five quarter hours), unless noted otherwise.

[c]For all degree levels in Florida, an additional $400 is added to the base for "each instructional unit sustained by a certificated degree teacher"; additional $400 for seven years Florida teaching experience; additional $400 for ten years; additional $600 for fifteen years.

[d]Salaries for these levels are not reported in these states.

[e]Compensation listed is for attainment of "Sixth Year Certificate."

[f]Compensation listed is for attainment of "Seventh Year Certificate."

[g]West Virginia awards $129 for each additional year of teaching service.

[h]Compensation for bachelor's degree plus fifteen hours of graduate work is $5,888.

[i]Compensation for master's degree plus fifteen additional graduate hours is $6,525.

One must conclude that such foundation plans, at best, only equalize that portion of the educational costs within the specified levels. All additional non-reimbursible costs fall on the district alone. Unless realistic foundation levels are established, the equalizing effect of these plans is minimal and, perhaps more importantly, deceptive.

Percentage Equalizing Plans

The percentage equalizing approach is currently in operation in the states of Iowa, Massachusetts, New York, Pennsylvania, Rhode Island, and Vermont. While this plan, at the time of its introduction, was seen in some quarters as a panacea, it operates much like a foundation program. The generalized formula for a percentage equalizing plan has been discussed in Chapter 3 (see Equation 3-6). Unlike the foundation-type plan, state aid is a function of the level of expenditures in the percentage equalizing approach. The state shares a portion of total reimbursible expenditures depending on the ratio of local assessed property valuation to total state valuation.

One positive aspect of many percentage equalizing plans is the addition of measures of wealth other than property valuations. The states of Iowa, Rhode Island, and (apparently) Vermont add various measures of district per capita income to property valuation to determine "district wealth."

The exact constituent elements of the various state percentage equalizing plans differ somewhat from one another. Iowa, for example, in developing a composite wealth measure, weights equalized property valuation at .70 and district gross income at .30. In addition, the pupil counting unit is also a hybrid; it consists of the arithmetic average of ADM and the school census (SC). The formula thus reads:

$$(4\text{-}1)\quad \text{State Aid Per Pupil} = \left[1.00 - \left(.25 \frac{\frac{(V_i)(.7) + (I_i)(.3)}{(ADM_i + SC_i)/2}}{\frac{(V_s)(.7) + (I_s)(.3)}{(ADM_s + SC_s)/2}}\right)\right][EXP_i - BSTR]$$

where V_i and V_s are, respectively, total property valuation in the ith district and the state ($V_s = \sum_{j=1}^{N} V_j$, N being the number of districts in the state); ADM_i and ADM_s are, respectively, average daily membership in the ith district and the state ($ADM_s = \sum_{j=1}^{N} ADM_j$); SC_i and SC_s are, respectively, school census in the ith district and the state ($SC_s = \sum_{j=1}^{N} SC_j$); I_i and I_s are, respectively, personal income in the ith district and the state ($I_s = \sum_{j=1}^{N} I_j$); and where district revenues from state basic school funds (flat grants) (BSTR) are subtracted from reimbursible expense (EXP_i) before computing equalization aid.

To add one more complexity to the Iowa plan, public school and nonpublic school students are included in the computation of student units upon which to fund the public schools. By comparison, the Massachusetts formula is very streamlined. On a per pupil basis, the formula is as follows:

$$(4\text{-}2)\quad \text{State Aid Per Pupil} = [1.00 - .65 \frac{V_i/ADA_i}{V_s/ADA_s}]EXP_i$$

where EXP_i is reimbursible expenditure per pupil in the ith district.

Except for a difference in the actual weights used, the Massachusetts formula is identical to the New York and Pennsylvania formulas. Rhode Island, however, is slightly different, using a standard (mandated) tax rate times the "equalized weighted assessed valuation of real and tangible property modified by the ratio district median family income bears to state median family income [MLWAV]" (Johns [1972], p. 292). The formula looks somewhat less foreboding than the verbage:

$$(4\text{-}3) \quad \text{State Aid Per Pupil} = \left[1.00 - \frac{(\text{Mandated tax rate})\ (\text{MEWAV})}{(\$500)(\text{ADM})}\right]\text{EXP}_i$$

where the mandated tax rate is established by the state, and MEWAV is as defined above.

As indicated, the percentage equalizing plans are the only ones currently in use which attempt to implement measures of wealth based on other than property values. Of course, such measures could be incorporated into the foundation-type plans. To the extent that property wealth is an inadequate measure of a districts' ability to raise educational funds, this must be seen as a step in the right direction.

Many believe that these plans would equalize to a greater degree if there were not minima and maxima for state aid. In New York, for example, no district can receive more than 90 percent of reimbursible costs or less than $274 or $310 (depending on local options). While Berke et al. (1972) indicate that the maximum aid is not a problem at present (since all districts can afford to expend 10 percent of costs), the minimum provisions provide a disequalizing influence.

Since the entire impetus for percentage equalizing is that equalizable expenditures are not limited to a predetermined level (as in the foundation-type plan), it appears self-defeating to place unrealistic minima and maxima on the program. What is needed is the imposition of rather minimal structural safeguards against unnecessary extravagance and/or fiscal mismanagement.

Guaranteed Valuation Programs

Another recent variant of the foundation plan is the guaranteed valuation program. Currently operating in the states of New Jersey and Wisconsin, the intent is to guarantee to each district, irrespective of wealth, an identical yield from a comparable tax. In New Jersey, for example, valuation in each district is guaranteed at the level of $30,000 per pupil. Those districts above this figure receive

the minimum (flat) grant of $110. Those below the $30,000 valuation level receive from the state the difference between what they can actually raise at a mandated tax rate and what they would have received from a levy on the guaranteed level of property valuation. However, in New Jersey, as in other places where marked departures from past programs have been attempted, an encumbering provision provides that no school district will receive less than it did before implementation of the new plan. Therefore, the effectiveness of the guaranteed valuation plan in that state can not be truly measured.

Wisconsin was the first state to implement a guaranteed valuation plan for educational finance, and it is of some interest to examine its current program. Somewhat more complicated than the New Jersey plan, it contains nuances which deserve separate attention.

While the New Jersey plan, as developed by that state's legislature, contains provisions for differing guaranteed valuation levels for different types of districts, lack of full funding of the act has precluded the use of these distinctions at present. In New Jersey, all districts are--at least for the time being--considered "basic" districts. In Wisconsin, on the other hand, the distinction is made between "integrated" and "basic" districts--with the integrated districts being ones with enriched programs and the basic districts having only a standard program. For the three levels of school districts (elementary only, secondary only, or combined), the guaranteed valuation levels per pupil are indicated in Table 4-3.

Wisconsin places approximately 47 percent of total state education funds in the guaranteed valuation plan described. However, an additional 21 percent of the total goes into flat grants distributed to the districts. The flat grants are also based on level and type of district as shown in Table 4-4.

It should be pointed out as shown in Chapter 3, that the generalized formula for guaranteed valuation plans is algebraically equivalent to the formula for foundation programs. It follows, then, that with the relative weights held constant for the two types of programs, they will alternatively equalize or fail to equalize to the same degree.

TABLE 4-3

Guaranteed Valuation Levels, by Type of District:
Wisconsin, 1971-72

	Basic	Integrated
Elementary Districts	$24,500	$45,900
Union High Districts	55,000	114,600
Twelve-Grade Districts	35,925[a]	47,900

Source: adapted from Johns (1972), p. 366.

[a]Aid for basic twelve-grade districts is computed on the same basis as for integrated districts; however, only 75 percent of the amount is payable. Therefore, although the basic guarantee is officially also $47,900, this amount has been reduced above to 75 percent of guarantee in order to reflect true relationships among types and levels of districts.

TABLE 4-4

Flat Grants Per Pupil, by Type of District:
Wisconsin, 1971-72

	Basic	Integrated
Elementary Districts	$30	$66
Secondary Districts	40	48

Source: adapted from Johns (1972), p. 366.

Note: Also included in the total Wisconsin program are six types of categorical grants (all flat) for specific purposes. None of the categorical grants distinguish between basic and integrated districts.

Power Equalizing Plans

Although Johns (1972) categorizes Utah as a state operating with a guaranteed valuation plan, the Utah program has the rudiments of a power equalizing format. At the least, it is the closest to a power equalizing approach currently in operation. The basic Utah plan guarantees to each district $9,120 per "distribution unit" (which, for practical purposes, is a classroom unit). Districts must levy a sixteen-mill property tax for education. If the district cannot raise the stated amount at this millage, the state contributes the remainder. If the district raises more than $9,120, the district must refund this to the state for redistribution to other districts.

The refund of excess revenues is only one unique aspect of the Utah plan. In addition, districts which voluntarily increment their tax rate by another twelve mills are entitled to receive an additional $21? per distribution unit. Further, any district in which the voters approve a higher millage than the above board leeway increment is entitled to $110 per additional mill. These amounts are guaranteed by the state; however, in contrast to the provisions of the original power equalizing plan, excess revenues do not have to be returned to the state.

The Impact of Encumbering Provisions

This chapter cannot be closed without a few words about the encumbering legislation which accompanies many of the state educational finance programs. Sometimes it is innocuous enough, but all too often the intent is to sap, in the name of practical politics, any strength the program might have.

Most bothersome of these provisions are the minimum, maximum, and save-harmless aspects of the various programs. Many states have maximum amounts or percentages of total funds that districts can receive from the state, and even more have minimums--amounting to a flat grant. A large number of states have provisions in enabling legislation similar to the case of New Jersey cited earlier. Minnesota requires that any district will receive "not less from those same sources [than] for the immediately preceding school year" (Johns [1972], p. 169).

In regard to the New York provisions, Berke et al. (1972) conclude that:

> The 'save-harmless' provision is probably the most limiting factor to equalization. It guarantees that when a change occurs in some component of the formula no district will receive less than it received before the change. Thus aid is not related to fiscal or educational need, as defined in the formula, but rather to the aid previously received. Most important, the save-harmless provision places restraints on making any fundamental changes in the formula because it automatically predetermines where a considerable proportion of the monies will be placed (pp. 23-24).

Sources of School Revenues

Most typically, taxes for the schools are derived at the state level from legislative appropriations of funds collected from broad-based income and other taxes, and at the local level from taxes on real and personal property. However, here as elsewhere, there are variations, some of which deserve special mention.

According to information presented in Johns (1972), approximately 30 percent of the states provide educational funds, at least in part, from special earmarked tax sources in contrast to general revenues. These monies might come from specific state fees, licenses, or profits from auxiliary enterprises such as state alcoholic beverage control. All or some of the revenue from these specific activities or programs may, by statute, be assigned to the schools. Additionally, many states have established various size endowments for the schools.

Many states allow districts the local option of imposing taxes other than property taxes. While these are typically sales and user taxes and/or payroll taxes, other local taxes authorized for school district collection run the gamut from taxes on raw fish or grain handling to taxes on rural electrification or games of golf. A list of the states allowing miscellaneous local taxes is contained in Table 4-5.

These special taxes notwithstanding, the lion's share of local school revenues is derived from property taxes. Moore (1972) estimates

TABLE 4-5

Local Nonproperty School Taxes
Authorized by States

State	Type of Taxes Authorized
Alabama	sales, gasoline, mineral release, amusement, tobacco and alcohol, business licenses, raw fish
Arizona	auto lien, aircraft lien, educational excise, cigarette
Delaware	per capita
Kentucky	poll, whiskey, corporation franchise, utilities, occupation, excise
Louisiana	sales
Maryland	income
Minnesota	grain handling, mortgage registry
Mississippi	severance
Nebraska	license, retail power sales
Nevada	sales, motor vehicle licenses
New Mexico	motor vehicle, business licenses, occupation
New York	sales, income
North Carolina	poll, dog, beer, wine
Oklahoma	rural electrification, severance, auto license, intangibles
Pennsylvania	per capita, income, amusement, sales, occupational, real estate transfer, general business, mechanical devices (vending), golf, parimutuel
South Carolina	poll, dog
Tennessee	motor vehicle, sales, tobacco, beer, business privilege
Vermont	poll
Virginia	sales
Wyoming	poll, motor vehicle

Source: adapted from Moore, (1972), pp. 210-211.

97 to 98 percent of local school revenues are property-based. Furthermore, for independent districts (that is, those districts which are fiscally autonomous from their municipalities), the percentage reliance on property tax rises to 99 percent.

Uses of State School Funds

Revenues from the state available for the schools are funneled to the districts within the context of a number of different programs. Funds may be disbursed for general (basic) educational programs as well as other specialized (categorical) activities. These include transportation, textbooks (and other library and instructional media), vocational education, and capital expenditures (construction). In addition, there are various other activities, at least partially supported by states, which are not discussed here because they are generally funded out of specially-generated federal and state accounts. Included in this ~ategory are funds for special and compensatory education, school lunches (and breakfasts), driver education, adult community or continuing education, and/or health services. To illustrate, in many states, funds for driver education are provided from a certain percentage of driver's license and vehicle registration fees. Similarly, school meals are, in part, financed through U. S. Department of Agriculture subsidy programs and/or Title I funds.

In terms of the special programs which will be discussed, great variation is noted among states. Not all programs are directly comparable; for example, vocational education programs in some states are aligned with the community/junior college structure, and in other states the entire two-year college program (including other than occupational programs) is attached to the elementary and secondary school systems. Some states fund special purpose programs through the general program, while others separate the monies.

Typically, states place the greatest share of total funds into the general fund for instructional programs and support. There remains a great deal of variation, however, between the states in this regard. Information on the amount of state funds for specific purposes is given in Table 4-6. Some readers may find the absolute number of dollars

TABLE 4-6

Amount of State Funds by Specific Purpose, 1971-72
(in millions of dollars)

	Total	Basic	Transportation	Texts	Vocational Education	Capital	Other
Alabama	258.6	228.7	*	2.0	12.7	*	15.2
Alaska	112.5	67.1	5.2		#0.7	8.6	30.9
Arizona	182.9	75.9			2.1		104.9
Arkansas	116.0	100.5	9.6	1.9	1.0		3.0
California	1,418.7	1,092.3	26.1	19.3	0.6	40.9	239.5
Colorado	159.6	137.1	5.5		7.0		10.0
Connecticut	273.9	131.6	7.4	0.2	12.4	93.9	28.4
Delaware	104.3	77.5	5.8		1.3	15.8	3.9
Florida	712.7	601.0	*	9.0	#3.2	31.4	68.1
Georgia	425.7	340.3	*	*	14.9	27.2	43.3
Hawaii	222.9	113.6	3.2	7.4		47.2	51.5
Idaho	48.3	47.9	*		0.4		0.4
Illinois	969.7	766.9	32.9		16.0	70.9	83.0
Indiana	333.1	256.7	18.1		2.1	19.0	37.2
Iowa	211.4	115.0			19.6		76.8
Kansas	126.3	109.6	*		0.4	*	16.3
Kentucky	243.6	240.7	*	2.9	*		
Louisiana	417.7	360.6	*	7.8	#3.0		46.3
Maine	65.6	50.3	*		2.3	7.5	5.5
Maryland	467.7	176.7	32.4			217.9	40.7
Massachusetts	312.1	225.0	17.5			43.0	26.6
Michigan	847.4	722.6	32.6			18.6	73.6
Minnesota	644.1	529.3	33.3		34.9		46.6
Mississippi	179.7	142.1	*	3.7	#9.8	7.2	16.9
Missouri	325.1	264.8	25.2		6.9	12.4	15.8
Montana	38.4	29.3	1.3		0.5		7.3
Nebraska	43.6	35.0			0.1		8.5
Nevada	50.0	50.0	*				0.0
New Hampshire	9.2	2.6			0.2	2.0	4.4
New Jersey	551.1	278.5	35.5		#4.7	36.6	195.8
New Mexico	145.2	96.1	8.8	2.7	0.8		36.8
New York	2,582.3	2,345.0	*	17.0		*	220.3
North Carolina	497.7	450.6	#4.8	7.7	#25.5		9.1
North Dakota	32.0	27.1	*		0.9	0.0	4.0
Ohio	786.9	642.0	49.8		#19.3		75.8
Oklahoma	147.6	73.9	*	4.2	#2.1		67.4
Oregon	107.1	97.8	*				9.3
Pennsylvania	1,241.1	953.0	46.0		32.7	95.4	114.0
Rhode Island	65.9	55.3				6.1	4.5
South Carolina	216.6	149.2	14.3	3.1	7.1	19.7	23.2
South Dakota	18.9	14.8	*		0.5		3.6
Tennessee	246.1	224.5	*	4.7	3.2	10.5	3.2
Texas	979.5	642.1	*	24.0	*		313.4
Utah	128.8	105.4	*	0.5	#0.3	3.4	19.2
Vermont	39.1	28.2			1.4	6.8	2.7
Virginia	410.0	267.8	12.5	2.2	12.2		115.3
Washington	356.6	230.1	21.7		#5.7	21.0	78.1
West Virginia	153.7	145.2	*		2.8		5.7
Wisconsin	327.1	153.0	13.4	1.3	*		159.4
Wyoming	20.6	19.9	*			0.0	0.7

Source: adapted from Johns (1972), p. 4.

*indicates that this function is served by general (basic) fund disbursement; no dollar breakdown is available.

#indicates that the amount shown is from categorical grants but is supplemented by disbursements from general (basic) fund.

expended to be of interest and value, but since states vary so greatly in size, composition, wealth, and population, a better means of comparison becomes necessary.

Table 4-7 presents expenditures for particular functions as a percentage of total state education expenditures. This table also indicates total state expenditures per pupil as an additional means of comparison between states.

The absolute number of total dollars expended by states for education ranges from $2.58 billion in New York to $9.2 million in Vermont. When standardized by number of pupils served, however, the gap narrows. With the exception of the two noncontiguous states, the remaining states fall within a surprisingly narrow range of one another.

In terms of specific use of funds, the states vary from 100 percent expenditure on the general fund in Nevada to just over 28 percent for this purpose in New Hampshire. Sixteen states place over 85 percent of their educational funds in the general program. Only four states place less than half of their money in the general fund.

Attention should also be drawn to the asterisks (*) and number signs (#) appearing in Table 4-6. These symbols indicate, respectively, that all or some of the state funds for this purpose are furnished to districts within the confines of the general program. Additionally, certain other states, such as Pennsylvania, distribute categorical funds separately, but in the same proportion to the programs' reimbursible costs as the district's subsidy for general purposes bears to general fund reimbursible costs. The importance of this fact is that, to the extent that these funds are distributed in this fashion, they are also equalizing in impact. While funds listed as categorical in the table may or may not be equalizing (depending on legislative mandate), funds emanating from the general fund (in all but flat grant states) are equalizing--and to the same extent in these special purpose areas as in the primary instructional area.

It should be pointed out that an attempt by a state to place funds in separate categories of school operations may not achieve the implicit purpose of encouraging districts to spend funds in one manner

TABLE 4-7

State Expenditure per Student and Percent of State Funds for Specific Purposes, 1971-72

	State Expenditures per Pupil	Basic	Transportation[b]	Texts[b]	Vocational Education[b]	Capital[b]	Other[b]
Alabama	321	88.4	--	0.8	4.9	--	5.9
Alaska	1,333	59.6	4.6	--	0.6	7.6	27.5
Arizona	a	41.5	--	--	1.1	--	57.4
Arkansas	251	86.6	8.3	1.6	0.9	--	2.6
California	a	77.0	1.8	1.4	--	2.9	16.9
Colorado	283	85.9	3.4	--	4.4	--	6.2
Connecticut	411	48.0	2.7	0.1	4.5	34.2	10.3
Delaware	773	74.3	5.5	--	1.2	15.1	3.7
Florida	482	84.3	--	1.2	0.4	4.4	9.5
Georgia	389	79.9	--	--	3.5	6.3	10.1
Hawaii	1,214	50.9	1.4	3.3	--	21.1	23.1
Idaho	a	99.1	--	--	0.8	--	0.8
Illinois	a	79.0	3.3	--	1.6	7.3	8.6
Indiana	271	77.0	5.4	--	0.6	5.7	11.2
Iowa	324	54.3	--	--	9.3	--	36.3
Kansas	251	86.7	--	--	0.3	--	12.9
Kentucky	338	98.8	--	1.2	--	--	--
Louisiana	491	86.3	--	1.9	0.7	--	11.1
Maine	a	76.6	--	--	3.5	11.4	8.4
Maryland	a	37.7	6.9	--	--	46.6	8.7
Massachusetts	262	72.0	5.6	--	--	13.8	8.5
Michigan	383	85.2	3.8	--	--	2.2	8.7
Minnesota	a	82.1	5.2	--	5.4	--	7.2
Mississippi	339	79.0	--	2.1	5.5	4.0	9.4
Missouri	318	81.5	7.8	--	2.1	3.8	4.9
Montana	a	76.3	3.4	--	1.3	--	19.0
Nebraska	132	80.3	--	--	0.2	--	19.5
Nevada	384	100.0	--	--	--	--	--
New Hampshire	56	28.2	--	--	2.2	21.7	47.8
New Jersey	a	50.5	6.4	--	0.9	6.6	35.5
New Mexico	510	66.1	6.1	1.9	0.6	--	25.3
New York	a	90.8	--	0.7	--	--	8.5
North Carolina	423	90.5	1.0	1.5	5.1	--	1.8
North Dakota	222	84.7	--	--	2.8	--	12.5
Ohio	323	81.5	6.3	--	2.5	--	9.6
Oklahoma	a	50.0	--	2.8	1.4	--	45.7
Oregon	224	91.3	--	--	--	--	8.7
Pennsylvania	524	76.6	3.7	--	2.6	7.7	9.2
Rhode Island	346	83.9	--	--	--	9.3	6.8
South Carolina	334	68.8	6.6	1.4	3.3	9.1	10.7
South Dakota	114	78.3	--	--	2.6	--	19.0
Tennessee	274	91.2	--	1.9	1.3	4.3	1.3
Texas	348	65.5	--	2.5	--	--	32.0
Utah	421	81.8	--	0.4	0.2	2.6	14.9
Vermont	371	72.1	--	--	3.6	17.4	6.9
Virginia	382	65.3	3.0	0.5	13.0	--	28.1
Washington	443	64.5	6.1	--	1.6	5.9	21.9
West Virginia	381	94.5	--	--	1.8	--	3.7
Wisconsin	327	46.7	4.1	0.4	--	--	48.7
Wyoming	238	96.6	--	--	--	--	3.4

Source: Columns 2 thru 5 taken from data in Table 4-6. Column 1 is derived from column 1 in Table 4-6 divided by number of students in membership in that state as reported by Foster and Barr (1972), p. 4.

[a]Enrollment data not reported.

[b]Dashes indicate no dollar amount reported for this category in Table 4-6.

or another because of the fact that "money mixes."[1] For example, state categorical grants for transportation services may supplant local or state general aid funds which otherwise would have been used to pay for such services. Categorical grants only insure that a district spends at least the amount of the categorical grant on the particular service for which a grant is provided. There is no assurance--indeed, it is unlikely--that districts would spend an extra dollar for a specific purpose when an extra dollar of categorical grant for that purpose is provided.

Concluding Comments

This chapter has provided more detailed information about the various state programs of educational finance. Combined with the information presented in the preceding chapter about the mechanics and scope of existing programs, a comprehensive picture of the current situation emerges.

This background information provides the framework within which state aid is provided to districts. The remainder of this report concentrates on manipulations of state aid formulas through which equity and allocative considerations can be examined more expeditiously.

Our study of the current state of affairs in state aid to education revealed the following. The Strayer-Haig-Mort foundation program is clearly the most popular approach to school finance, with thirty-two of the contiguous states currently using variations of this model. Ten states still use flat grants, at least partially, as the core of financial support for the schools. If states which do not officially use flat grants, but which have minimum guarantees in their equalization plans, are added to the flat grant states, most states could also be considered to fall within this group.

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[1] For an excellent exposition of this issue consult Goetz (1972), especially pp. 11-12.

Nine states currently operate within the context of the more recent plans--percentage equalizing, guaranteed valuation, or power equalizing. With few exceptions, these states are clustered in the Northeast.

A variety of local nonproperty sources of revenue in states allowing these special taxes were discussed briefly in this chapter, as were the amounts and percentages of funds being used for various school purposes. The great diversity in allocating funds for specific purposes shows that states still attempt to develop their own individual paths to amelioration of educational problems.

CHAPTER 5

ECONOMIC EFFECTS OF STATE AID

The preceding chapters documented the variation among the states not only in the type of state aid formula but also in the amounts per pupil distributed to local districts. The major purpose of this chapter is to investigate the consequences of such inter-state differences in amount and type of aid. An econometric analysis is presented, employing both single equation estimation (using the familiar Ordinary Least Squares [OLS] estimation technique) and simultaneous-equation estimation (using the Two Stage Least Squares [TSLS] estimation technique).

In recent years, numerous studies have investigated the relationship between state and federal grants-in-aid and school expenditures. Since the studies utilized different methodologies and different data sources, it is not surprising that results differ. Nevertheless, the body of research does point to a general conclusion that state aid is an important determinant of school expenditures.[1]

Two aspects of recent research need to be emphasized here. First, it has been asserted that a positive theory must be developed to explain the supply-demand determinants of school expenditures. Some have attempted to handle this through a simultaneous-equation system employing both demand and supply equations for educational funds (see, e.g., Booms and Hu [1971]). Another method has been employed by McMahon (1970), where demand, production costs, and tax behavior equations are solved to obtain a single, reduced-form equation for analyzing the impact of various variables on per capita educational expenditures. These studies contrast others that employ

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[1] See, for example, Booms and Hu (1971), Hickrod (1972), Hickrod and Sabulao (1969), McMahon (1970), Miner (1963), O'Brien (1971), and Sacks (1972). All of these studies contain references to other works in this area.

a single equation in which both demand and supply variables are entered to explain variations in educational expenditures.

A second aspect of re[illegible]is the neglect of other economic effects of state aid [illegible] We are not aware of any empirical study that has inve[illegible]ed the effect of state aid on such variables as school size, enrollment rates in nonpublic schools, or the results of bond elections. Yet [illegible] appears that such effects occur simultaneously with any expenditure [illegible]s and therefore should be considered along with the expenditu[illegible]tion.

The Model

Several variables are likely to be affected by state aid. For example, since state aid is generally unrelated to school size, it would seem logical to suppose that when other factors are held constant, greater per pupil state aid would reduce the incentive of school administrators to save resources through scale adjustment. As explained in Chapter 6, considerable cost savings are likely to be reaped by choosing the optimal school size.

Of interest, also, is the effect of state aid on expenditures. Since a major purpose of state aid is to achieve greater levels of expenditure, it would be interesting to find out the extent to which increments in state aid lead to increments in educational expenditures.

An often-heard assertion states that greater state aid, leading to greater equalization of resources among districts of a state, would lead to an exodus from the public schools by children of the wealthy, who desire an educational environment which is superior to that of their not-so-wealthy counterparts. This chapter investigates, therefore, the relationship between state aid and enrollment in nonpublic schools when other factors are held constant.

Another important effect of state aid is the result of bond elections. If state aid increases, residents of a school district might consider debt financing unnecessary, especially when it is done for operating costs.

Finally, several studies have investigated the effect of federal aid on state and/or local revenues raised for public education. For example, Booms and Hu (1971) found that federal aid is purely stimulative, increasing the supply of local revenues by $1.68 for each $1.00 of federal aid. Another study (O'Brien [1971]) shows that federal grants to education increase state and local expenditures by $1.64 per $1.00 of federal aid. In this chapter the effect of state aid on local revenues will be investigated.

In addition to the state aid variables, each of the variables to be investigated here is also a function of other factors. First, some of the (endogenous) variables mentioned above might influence one another. For instance, per pupil expenditures in a given state are likely to be a function of school size, as several studies (to be discussed in Chapter 6) have indicated. Or, local revenues may be a function of the percent of enrollment in nonpublic schools. Furthermore, other (exogenous) factors may influence the variables under investigation. For example, the degree of urbanization in the state is likely to affect average school size, local revenues, and per pupil expenditures. Local revenues and expenditures may also be affected by the perceived "quality" of the public schools. Two measures of "quality" are average teachers' salaries and the student/teacher ratio.

Denote the five (endogenous) variables which are to be investigated by $Y_1, Y_2, \ldots, Y_5$, the variable measuring state aid by STAID, and the remaining (exogenous) factors influencing the Y's by $X_1, X_2, \ldots, X_k$. The generalized version of the model is then given in a set of five equations:

$$
\begin{aligned}
Y_1 &= f_1(Y_2, Y_3, \ldots, Y_5;\ \text{STAID};\ X_1, X_2, \ldots, X_k) \\
Y_2 &= f_2(Y_1, Y_3, \ldots, Y_5;\ \text{STAID};\ X_1, X_2, \ldots, X_k) \\
&\vdots \\
Y_5 &= f_5(Y_1, Y_2, \ldots, Y_4;\ \text{STAID};\ X_1, X_2, \ldots, X_k)
\end{aligned}
\tag{5-1}
$$

Since we are interested in the effect of state aid on each of the Y's regression analysis will be employed to compute a coefficient for STAID. But because of the simultaneity in Equation Set (5-1), Ordinary Least Squares analysis is likely to provide biased coefficients. Therefore, an attempt is made to modify the equation system so that the TSLS technique could be utilized.

The variables chosen for the study have been divided into two categories: endogenous variables (those factors which we seek to explain within the confines of the model) and exogenous variables (those factors which are considered as fixed for the purposes of the model). The five endogenous variables are those under investigation. The exogenous variables include, in addition to STAID, such variables as per capita or per pupil personal income, an equalization score, percent of Negro enrollment in public schools, percent of urban population, incidence of poverty, and the two school "quality" variables. Both sets of variables are defined in Table 5-1.

In order that the TSLS technique could be applied, it was necessary to modify Equation Set (5-1) so that the equation set would be identifiable. On the basis of a priori reasoning, the Equation Set (5-1) was modified as shown in Equations (5-2) through (5-6):

$$(5\text{-}2)\quad \overline{\text{RELSIZE}} = a_0 + a_1\overline{\%\text{ENNP}} + a_2\text{BOND} + a_3\text{REV} + a_4\%\text{TPOPENP} + a_5\text{NEGRO} + a_6\text{URBAN} + a_7\text{INCPOV} + a_8\text{STAID} + u_1$$

$$(5\text{-}3)\quad \text{EXP} = b_0 + b_1\text{RELSIZE} + b_2\%\text{ENNP} + b_3\text{BOND} + b_4\text{PPI} + b_5\text{EQUALIZ} + b_6\text{NEGRO} + b_7\text{URBAN} + b_8\text{STAID} + b_9\text{S/T} + u_2$$

$$(5\text{-}4)\quad \%\text{ENNP} = c_0 + c_1\text{RELSIZE} + c_2\text{EXP} + c_3\text{REV} + c_4\text{PCI} + c_5\text{EQUALIZ} + c_6\text{NEGRO} + c_7\text{URBAN} + c_8\text{SALARY} + c_9\text{STAID} + c_{10}\text{S/T} + u_3$$

$$(5\text{-}5)\quad \text{BOND} = d_0 + d_1\text{EXP} + d_2\%\text{ENNP} + d_3\text{REV} + d_4\text{PCI} + d_5\text{EQUALIZ} + d_6\text{NEGRO} + d_7\text{URBAN} + d_8\text{STAID} + d_9\text{S/T} + u_4$$

TABLE 5-1

Means, Standard Deviations, Definitions, and Sources of Variables

Variable Acronym	Mean	Standard Deviation	Definitions of Variables
Endogenous			
RELSIZE	392.59	144.18	Relative size of schools (pupils in ADA per school), 1967-68
EXP	$625.48	125.83	Current expenditures per pupil in ADA (Average Daily Attendance), 1967-68
%ENNP	0.10	0.061	Percent of pupils enrolled in nonpublic schools, 1967-68
BOND	$465.99	364.64	Total approved par value of bond issues, 1962-71, per pupil enrolled in public elementary and secondary schools
REV	$379.60	152.26	Local revenue per pupil, 1967-68
Exogenous			
% TPOPENP	23.09	2.12	Percent of total population enrolled in public schools, 1967-68
PCI	$2,955.10	506.12	Personal income per capita, 1967
PPI	$13,999.59	3,348.94	Personal income per pupil in ADA, 1967
EQUALIZ	5.07	1.12	Equalization score of state, 1968-69
NEGRO	11.74	12.21	Negro enrollment in public schools as a percent of total enrollment, 1968
URBAN	65.42	14.44	Urban population as a percent of total population, 1970
INCPOV	13.36	5.57	Incidence of poverty, 1969 (percentage points)
SALARY	$7,161.59	1,025.38	Average teachers' salary, 1967-68
STAID	$275.41	111.42	State aid per pupil in ADA, 1967-68
S/T	0.023	0.0019	Number of students per 1,000 teachers, 1967-68

Sources:

1. Richard H. Barr and Geraldine J. Scott, Statistics of State School Systems, 1967-68 (Washington, D.C.: U.S. Office of Education, 1970)--for the following variables: RELSIZE, EXP, REV, %TPOPENP, PCI, PPI, SALARY, STAID, and S/T.

2. Roe L. Johns and Richard G. Salmon, "The Financial Equalization of Public Support Programs in the United States for the Year 1968-69," in Status and Impact of Educational Finance Programs, vol. 4, ed. by Roe L. Johns et. al. (Gainesville, Florida: National Educational Finance Project, 1971), p. 137--for EQUALIZ.

3. U. S. Bureau of the Census, Statistical Abstract of the United States: 1969, 1970, and 1971 Editions (Washington, D. C.: Government Printing Office, 1969, 1970, and 1971)--for NEGRO, URBAN, and INCPOV.

4. Irene A. King, Bond Sales for Public School Purposes (Washington, D.C.: U.S. Office of Education, 1972)--for BOND.

$$(5\text{-}6) \quad REV = e_0 + e_1 RELSIZE + e_2 \%ENNP + e_3 BOND + e_4 PPI + e_5 EQUALIZ + e_6 NEGRO + e_7 URBAN + e_8 STAID + e_9 S/T + u_5$$

where the lower-case letters, a, b, c, d, and e, are the coefficients which we seek to estimate, whereas the u's represent stochastic error terms.

It is hypothesized in Equation (5-2) that the larger the percentage of pupils enrolled in nonpublic schools, the smaller would the average school size be, other things equal. It also appears plausible that the variable BOND should be related to school size, but there are two conflicting forces; on the one hand, if proceeds from bond elections are used to build larger schools, the effect on relative size would be positive; on the other hand, if such proceeds are used to reduce crowding by building additional schools (not necessarily of larger average size), then the effect on average school size might be negative. For the same reason, it is not clear a priori how REV and RELSIZE are related.

Among the exogenous variables in the set, five were included in the equation. The variable STAID needs no further comment. The variable %TPOPENP (percent of population enrolled in public schools) indicates the relative demand for public educational facilities in the state. The greater the demand, the greater the average school size is expected to be, other things equal. It is further expected that school size will be directly related to the percentage of Negro enrollment because of the observed overcrowding in areas where large concentrations of Negroes exist. Also, because urban areas are likely to have far greater population densities, greater urbanization should be positively related to school size, other factors remaining the same. Finally, the variable INCPOV has been added to the equation to account for the expected negative relationship between RELSIZE and poverty in states where considerable rural poverty exists.

Concerning Equation (5-3), the determinants of EXP include three endogenous and six exogenous variables. Because scale economies are expected to occur in public school operations, the hypothesized relationship between RELSIZE and EXP is negative. (A parabolic

relationship, indicating a U-shaped relation between the two variables, was found to be nonsignificant; hence, only the linear term has been left in the equation.) It is also hypothesized that the greater the percentage of pupils enrolled in nonpublic schools, the higher would EXP be because local educational revenues collected from all citizens without regard to school enrollment would be distributed over a relatively smaller student population. Furthermore, it is expected that higher values of BOND would be directly correlated with EXP because the variable BOND is indicative of the citizens' attitude toward education. If they are willing to approve bond issues, they would probably also desire higher per pupil expenditures.

The variable PPI is included in the equation to account for differences in wealth per pupil among states. It would also be interesting to compare the results of this study with those of other studies concerning the income elasticity of educational expenditures. It is hypothesized that a higher equalization score would be commensurate with higher per pupil expenditures, that expenditures are lower in states with large Negro enrollments but higher in urban areas, and that greater school quality requires more expenditures, so that S/T and EXP should be negatively correlated.

Three endogenous and seven exogenous variables are included in Equation (5-4). It is hypothesized that as school size increases, especially because of overcrowding, more parents will send their children to private schools. But if per pupil expenditures are greater, fewer parents will seek private education for their children. The effect of REV on %ENNP is not unambiguously clear. On the one hand, more local revenues imply more local expenditures, with the likelihood that greater quality in public schools would encourage parents to send their children to public schools. However, if REV is directly related to community wealth, the relationship between REV and %ENNP might be positive. It is possible, of course, that REV might be greater not because of greater wealth but because of greater tax effort, implying a more favorable attitude toward--and therefore greater rates of attendance in--public education.

Since PCI provides a measure of average wealth, it is expected to be directly related to nonpublic enrollment rates. It is also

hypothesized that greater equalization would lead to greater nonpublic enrollments, as would be the case for greater levels of the variables NEGRO and URBAN. On the other hand, greater school "quality" in the form of higher salaries or lower S/T rates should be negatively related to private enrollment rates.

Three endogenous and six exogenous variables form the specification of Equation (5-5). It is hypothesized that EXP is indicative of a community's attitude toward support of public education; hence a direct relationship between EXP and BOND is anticipated. Conversely, if a greater proportion of pupils attend nonpublic schools, parents would be more reluctant to support the public schools. It also appears that greater local revenues imply less need for bond financing. However, since REV could also be a proxy for local capacity to absorb the financing of the bond as well as community's attitude, it is not clear what sort of relationship one should expect between REV and BOND.

If per capita income (PCI) is indicative of a community's attitudes, a positive correlation between PCI and BOND would be expected. Such a relationship would be strengthened when it is recognized that wealthier communities are likely to be able to absorb the cost of bond financing with relatively greater ease than is the case in poorer districts. On the other hand, it is expected that a higher value of EQUALIZ would result in a lower BOND value since incentives for long-term indebtedness by local governments are reduced. Moreover, because of the general deterioration of the urban areas in the United States, especially in cities where the percentage of nonwhite population is relatively large, it is expected that a negative correlation between NEGRO and BOND, as well as between URBAN and BOND will be found. Finally, since a smaller S/T requires more facilities, a negative relationship between S/T and BOND is expected.

Three endogenous and six exogenous variables have been included in Equation (5-6). The first hypothesis is that because of anticipated scale economies, greater school size would be negatively related to local revenue requirements, other things equal. The effect of %ENNP on REV is not unambiguously clear. On the one hand, higher private

enrollment rates indicate unfavorable attitudes toward the public schools, pointing to a smaller level of REV. On the other hand, states with higher private enrollment rates may also be associated with relatively wealthier districts, in which case REV for an equal tax effort should be greater. A positive sign is expected for the BOND variable for two reasons. First, the variable is indicative of community attitudes. Second, a greater value for BOND is also indicative of greater debt service requirement, which should increase the demand for local revenues.

Per pupil income, as a measure of wealth, should be positively correlated with REV. But EQUALIZ is hypothesized to be negatively correlated with REV because greater equalization is expected to reduce the incentives of many school districts to raise revenues from local sources. It is also hypothesized that local revenues in areas with higher levels of the NEGRO and URBAN variables would be smaller and that greater school "quality," measured by S/T, would require greater local revenues; hence, S/T and REV should be negatively correlated.

A summary of the hypotheses regarding the expected signs of the regression coefficients of Equations (5-2) through (5-6) is provided in Table 5-2.

Data

To implement the model, data have been assembled from various sources, principally publications of the United States Office of Education. The unit of observation is the state, and data are available for forty-nine states. (Hawaii has been excluded because it is essentially one large school district and therefore is not suitable for the present analysis.) The definitions of the variables used in this study--along with some descriptive statistics--are provided in Table 5-1. A complete zero-order correlation matrix is provided in Table 5-3.

Although the data are (with exceptions) for the year 1967-68 and hence do not portray the current state of affairs in public education, the relationships which we seek to derive are probably as relevant today as

TABLE 5-2

Expected Signs of Coefficients of Equations (5-2) through (5-6)

Equation	Dependent Variable	Independent Variables														
		RELSIZE	EXP	%ENNP	BOND	REV	%TPOPENP	PCI	PPI	EQUALIZ	NEGRO	URBAN	INCPOV	SALARY	STAID	S/T
(5-2)	RELSIZE			-	?	?					+	+	-		-	
(5-3)	EXP	-		+	+				+	+	-	+			+	-
(5-4)	%ENNP	+	-			?		+		+	+	+		-	?	+
(5-5)	BOND		+	-		?		+		-	-	-			-	-
(5-6)	REV	-		?	+				+	-	-	-			?	-

Note: For definition of acronyms see Table 5-1. The symbol "?" indicates that an expected sign is not unambiguously clear, a priori. A blank space indicates that the independent variable was not included in the equation.

TABLE 5-3

Zero-Order Correlation Matrix for Endogenous and Exogenous Variables

	Endogenous Variables					Exogenous Variables									
	RELSIZE	EXP	%ENNP	BOND	REV	%TPOPENP	PCI	PPI	EQUALIZ	NEGRO	URBAN	INCPOV	SALARY	STAID	S/T
Endogenous															
RELSIZE	1.000														
EXP	0.210	1.000													
%ENNP	0.086	0.550	1.000												
BOND	-0.170	0.516	0.041	1.000											
REV	-0.087	0.646	0.662	0.255	1.000										
Exogenous															
%TPOPENP	-0.259	-0.364	-0.729	0.142	-0.408	1.000									
PCI	0.301	0.857	0.567	0.499	0.700	-0.412	1.000								
PPI	0.354	0.800	0.765	0.267	0.698	-0.745	0.896	1.000							
EQUALIZ	0.174	-0.022	-0.154	0.076	-0.425	0.154	-0.141	-0.138	1.000						
NEGRO	0.489	-0.377	-0.261	-0.360	-0.561	-0.097	-0.358	-0.209	0.177	1.000					
URBAN	0.645	0.479	0.368	0.146	0.400	-0.257	0.650	0.624	-0.039	-0.072	1.000				
INCPOV	-0.010	-0.585	-0.503	-0.292	-0.680	0.240	-0.704	-0.619	0.158	0.666	-0.421	1.000			
SALARY	0.480	0.815	0.369	0.524	0.468	-0.227	0.868	0.714	0.064	-0.259	0.668	-0.581	1.000		
STAID	0.532	0.419	-0.031	0.135	-0.333	0.021	0.252	0.187	0.440	0.238	0.230	0.057	0.475	1.000	
S/T	0.374	-0.594	-0.441	-0.294	-0.578	0.213	-0.435	-0.420	0.218	0.452	-0.041	0.417	-0.209	0.090	1.000

they were during the 1967-68 period--and this despite the tremendous changes that have occurred since that period in educational finance and administration.

Regression Results

The regression results are reported in Table 5-4. For each of the Equations (5-2) through (5-6), the table reports the coefficients obtained when the Ordinary Least Squares (OLS) estimation procedure was employed--that is, considering each equation independent of the others--as well as the coefficients derived when the Two Stage Least Squares (TSLS) estimation procedure was employed--that is, when Equations (5-2) through (5-6) are considered as a system of equations, and the coefficients derived from the TSLS procedure account for the interdependence among the equations.

Average School Size: The interstate data explain almost 80 percent of the variations in average school size. Contrary to hypothesis, state aid appears to contribute positively to that variable. Since our study of the state aid formulas showed little, if any, incentives for attaining optimal school size, it is difficult to conclude that more state aid is the cause of larger school size. A possible explanation of the positive correlation is that states that happen to have larger schools are the ones that also happen to give more aid to local districts. Nevertheless, the negative correlation that we expected was definitely refuted by the data in both the OLS and TSLS versions of the model.

Concerning the other explanatory variables, the data provide different results for the OLS and TSLS versions. When the OLS version is employed, three variables are statistically significant at the 0.01 level: NEGRO, URBAN, and INCPOV. As hypothesized, the sign of the coefficients of both URBAN and NEGRO is positive, and the sign of INCPOV is negative. This is also the case when the TSLS version is used.

When the TSLS technique is employed, two other variables become statistically significant: %ENNP and %TPOPENP. The results suggest

TABLE 5-4

Regression Coefficients and t-Ratios (in parentheses) for Single-Equation (OLS) and Simultaneous-Equation (TSLS) Models

Equation	Dependent Variable	Independent Variables: Endogenous					Exogenous													
		RELSIZE	EAP	%ENNP	BOND	REV	%TPOPENP	PCI	PP1	EQUALIZ	NEGRO	URBAN	INCPOV	SALARY	STAID	S/T	INTERCEPT	$\bar{R}^2$ [d]	SEE[e]	F
2a (OLS)	RELSIZE			-456.47	206.86	0.29[c]	-9.48				5.62[a]	5.75[a]	-5.55[a]		0.41[a]		206.86			
				(1.69)	(1.03)	(1.73)	(1.28)				(4.44)	(7.20)	(2.84)		(4.38)					
2b (TSLS)				-2018.28[b]	-0.018	0.22	-41.91[a]				4.20[c]	6.40	-7.60[b]		0.40[a]		1097.66	0.79	65.86	27.90[a]
				(2.33)	(0.34)	(0.56)	(19.47)				(1.87)	(5.97)	(2.02)		(3.33)					
3a (OLS)	EAP	0.14[c]		-44.51	0.074[c]				0.018[a]	-3.83	-2.38[a]	-0.80			0.34[a]	-2175.12[a]	790.45			
		(1.94)		(0.35)	(1.47)				(4.38)	(0.59)	(3.72)	(1.01)			(4.79)	(4.75)				
3b (TSLS)		0.28		1347.14	0.23[c]				-0.006	-13.38	-1.03	-0.56			0.36[c]	-16420.16	765.15	0.68	42.69	41.99[a]
		(1.24)		(0.90)	(1.87)				(0.24)	(0.92)	(0.40)	(0.21)			(1.70)	(1.26)				
3a (OLS)	%ENNP	0.000093	0.0003[c]			300.38		0.000065		0.0041	-0.00020	0.00033		-0.000039[c]	-0.00015	-0.67	-0.02			
		(0.78)	(1.78)			(1.08)		(1.61)		(0.55)	(0.21)	(0.35)		(1.98)	(1.44)	(0.10)				
3b (TSLS)		0.00089[b]	0.00077[c]			17.86		0.000035		0.0091	-0.0040	-0.0034		-0.000088[b]	-0.00048[b]	-2.95	0.22	0.35	0.04	3.90[a]
		(2.38)	(1.95)			(0.01)		(0.55)		(0.85)	(1.71)	(1.49)		(2.66)	(2.57)	(0.21)				
4a (OLS)	BOND		0.96	-228.18[b]		0.028		0.24		56.84	-2.78	-7.09			-0.87	-485.46	-1012.44			
			(0.92)	(2.48)		(0.85)		(1.00)		(1.30)	(0.65)	(1.67)			(1.46)	(0.13)				
4b (TSLS)			2.70	-4791.11[b]		0.10		0.32		66.31	-1.60	-4.62			-1.43[c]	1983.68	-1780.68	0.38	286.74	4.29[a]
			(1.24)	(2.95)		(0.84)		(1.23)		(1.54)	(0.37)	(1.02)			(1.80)	(0.38)				
5a (OLS)	REV	0.29[c]		300.38	0.028				0.018[a]	-16.31	-4.23[a]	-0.27			-0.54[a]	-17599.77[b]	690.49			
		(1.73)		(1.08)	(0.85)				(2.80)	(1.63)	(3.69)	(0.22)			(4.41)	(2.48)				
5b (TSLS)		0.22		17.86	0.10				0.022	-18.46	-3.25	-0.067			-0.58[a]	-15034.51	593.44	0.81	66.18	23.90[a]
		(0.56)		(0.01)	(0.84)				(0.92)	(1.19)	(1.31)	(0.028)			(2.79)	(1.20)				

[a] Statistically significant at the .01 level, two-tailed test.

[b] Statistically significant at the .05 level, two-tailed test.

[c] Statistically significant at the .10 level, two-tailed test.

[d] $\bar{R}^2$ = coefficient of determination adjusted for degrees of freedom. $\bar{R}^2$ is taken from the OLS runs; its meaning for the TSLS runs is not theoretically clear.

[e] SEE = standard error of estimate; also taken only from the OLS runs

that, as expected, when enrollments in nonpublic schools are greater, average school size is likely to be smaller. On the other hand, contrary to expectations, the data indicate that a greater relative demand for education, measured by the percentage of total population enrolled in public schools, is associated with smaller school size.

Expenditures Per Pupil: The data confirm the expected relationship between state aid and EXP. For each $1.00 of state aid, expenditures per pupil are likely to increase between $0.34 (OLS) and $0.36 (TSLS). The coefficients are statistically significant at the 0.01 and 0.10 levels for the OLS and TSLS versions, respectively. These results suggest that state aid is likely to be both stimulative and substitutive: on the one hand, more state aid implies higher expenditures (stimulative); on the other, the results suggest that local expenditures are reduced by $0.66 (OLS) or $0.64 (TSLS) for each $1.00 of state aid.[2]

The coefficients of the other explanatory variables differ in size and significance depending on whether the OLS or TSLS methods are used. Beginning with the OLS estimates, five other variables are found to be statistically significant: RELSIZE, BOND, PPI, NEGRO, and S/T. Except for RELSIZE, the signs of the coefficients confirm the expectations depicted in Table 5-2. The positive sign for RELSIZE is surprising; it indicates that, other things the same, larger school size is associated with higher per pupil expenditures. This result is in sharp contrast to numerous studies indicating just the opposite. It is possible, however, that the measure of school size used here is inadequate and that the unit of observation--the state--may not be the appropriate one for discerning scale effects.

The coefficient for per pupil income (0.018) suggests that for a $1.00 increment in PPI, expenditures would rise by only $0.018. At the mean levels of EXP and PPI, this would imply an income elasticity

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[2]Other studies dealing with the issue of stimulative and substitutive effects of grants-in-aid to education include Bishop (1964); Booms and Hu (1971); Freeman (1953); Renshaw (1960); and Sacks (1972), Chapter VII.

of 0.399.[3] This is higher than Miner's estimate of 0.23 (Miner [1963], Table 5, p. 107) but lower than either the supply or demand elasticities found by Booms and Hu (1971) (between 0.7 and 0.8) and much lower than the unit elasticity found by Sacks ([1972], p. 165).

The results also confirm the hypotheses that lower levels of expenditures are associated with higher levels of the NEGRO variable and that higher educational "quality" (in terms of the variable S/T) requires higher per pupil expenditures, other things being the same. It should also be pointed out that the sign of the coefficient of EQUALIZ was negative, contrary to expectations--as is the case for URBAN--but neither coefficient is statistically significant.

When the TSLS estimates are considered, none of the explanatory variables is significant at the 0.05 level. The only variables that have relatively large t-ratios (significant at the 0.10 level) are BOND and STAID.

Nonpublic Enrollment Rates: A single-equation model to predict nonpublic enrollment rates (%ENNP) does not appear to perform well when the interstate data are applied to it. The overall predictive power, measured by $\bar{R}^2$, is relatively weak (only 0.35), and in addition, none of the coefficients is significant at the 0.05 level. The two variables with highest t-ratios (significant at the 0.10 level) are EXP and SALARY. The positive sign for the coefficient of EXP is contrary to expectation, but the negative sign for SALARY confirms our hypothesis. Concerning the STAID variable, it is found that state aid is negatively related to nonpublic enrollment rates; however, the coefficient is not statistically significant.

When the TSLS estimates are reviewed, the results appear to be more encouraging. Three variables are significant at the 0.05 level: RELSIZE, SALARY, and STAID. The coefficient of EXP is significant at the 0.10 level. The coefficient of STAID is, again, negative, and the

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[3]The income elasticity of educational expenditures is defined by $(\partial EXP/\partial PPI)\cdot(PPI/EXP)$. Since $\partial EXP/\partial PPI$ is given by the coefficient of PPI in Equation (5-3), the income elasticity at the mean of EXP and PPI is given by 0.018(14,000/625) = 0.3996.

signs of the coefficients of RELSIZE and SALARY are consistent with a priori expectations.

Approved Value of Bond Issues: The results for this equation are also less than satisfactory. Only 0.38 percent of the variation in BOND is explained by the equation, and only one variable, %ENNP, has a statistically significant coefficient. The results suggest that the only significant determinant of bond sales is the percentage of the population enrolled in nonpublic schools. This is consistent with recent reports of school bond election results in Detroit and other areas with large nonpublic enrollments. The small value of $\bar{R}^2$ is probably due to the fact that the equation does not include legal-institutional factors which influence the process by which bond sales are determined.

When the TSLS estimates are used, the coefficient of STAID is significantly negative at the 0.10 level, indicating lower bond sales in states where higher state aid is given. This is consistent with our a priori expectations.

Local Revenue: The OLS estimates produce three significant estimators of REV: NEGRO, STAID, and S/T. As expected, states with greater Negro enrollments are likely to produce less local revenues. Also, the more state aid, the less local revenues will be raised, confirming our earlier results indicating that some substitution of state for local funds takes place. Finally, the data confirm that greater school "quality" (measured by S/T) requires more local revenues.

Although the signs of the coefficients remain the same, their statistical significance is altered when the TSLS estimates are used. The only variable to retain statistical significance is STAID; all of the other variables have nonsignificant coefficients.

Conclusions

The model provides several insights into the economic effects of state aid. With the exception of average school size, our a priori expectations of such effects were confirmed by the analysis. The results indicate that a greater level of state aid is associated with greater per pupil expenditures, lower local revenues for education,

lower rates of nonpublic enrollments, and lower bond sales. A surprising result is that school size is positively associated with the amount of state aid.

An interesting aspect of the results presented in Table 5-4 is the difference between the OLS and TSLS estimates. One cannot say which of the methods provides more satisfactory results. What can be said is that the TSLS estimates clearly differ from the OLS estimates--and sometimes the differences are quite large--indicating that the OLS method is likely to produce biased estimates.[4]

The only adverse effect of state aid that the data reveal is its impact on local incentives to raise revenue on a short- or long-term basis (REV and BOND, respectively). It appears to have a favorable effect on school size, expenditures, and public enrollments. Nevertheless, the state aid distribution formulas do not explicitly provide for incentives for scale and quality effects. Possible courses of action to provide for such incentives are discussed in Chapters 6 and 7.

[4] It is beyond the scope of this report to discuss the advantages and disadvantages of each method. For an excellent summary, see Johnston (1972), pp. 408-420.

CHAPTER 6

INCENTIVE FEATURES--SCALE EFFECTS

Considerable evidence demonstrating the existence of substantial scale economies in public (especially secondary) schools has been presented in recent years. Although there are differences in methodology and ultimate results, most of the studies indicate a U-shaped relationship between per pupil costs and school size, measured by enrollment. It follows that most schools are either too large or too all, resulting in considerable waste of resources to society. Yet the state aid formulas provide virtually no incentive to schools to reorganize along lines that will increase efficiency. Certainly, organizational improvement would bolster a school's financial position, but educators are frequently unaware of such possibilities or do not have strong incentives to precipitate change. An explicit incentive structure in the state aid process would not only provide a certain degree of stimulus to change school organization but would also serve to focus attention on the scale issue.

Economies of Scale

The typical approach to determine the extent of scale economies has been to regress school cost data on a quadratic function of school size (enrollment) and a number of other variables which are included in the regression equation in order that inter-district cost differences due to variations in input or output quality could be taken into account. Let C and S represent current operating costs per pupil and school size, respectively, and let the vector of other school and nonschool factors be denoted by $X_1, X_2, \ldots, X_n$. Then Equation (6-1) is estimated using cross-

sectional data for schools in a given state (or other sampling base), employing the familiar technique of Ordinary Least Squares estimation.

$$(6\text{-}1) \qquad C = b_o + b_1 S + b_2 S^2 + \sum_{j=1}^{n} b_{j+2} X_j$$

where b_o is the intercept, and $b_1, b_2, \ldots, b_{n+2}$ are the n+2 (slope) coefficients that we wish to estimate.

To obtain an estimate of the effect of scale on per pupil costs, it is necessary to compute the joint effect of S and S^2 on C. Mathematically, this is achieved by computing the partial derivative of C with respect to S. This is defined in Equation (6-2):

$$(6\text{-}2) \qquad \partial C/\partial S = b_1 + 2b_2 S$$

For example, in a study of Iowa high schools for the year 1961-62, the estimated coefficients of b_1 and b_2 were -0.1775 and 0.0000537, respectively (see Cohn [1968], Table 4, Equation IV). Thus, $\partial C/\partial S = -0.1775 + 2(0.0000537)S = -0.1775 + 0.0001074S$. If S = 100, $\partial C/\partial S = -0.16686$. On the other hand, if S = 2,000, $\partial C/\partial S = +0.0373$. This implies that an increase in enrollment of one pupil would <u>reduce</u> per pupil costs by approximately $0.17 when enrollment is 100, but that per pupil costs would <u>increase</u> by nearly $0.04 when another pupil is added to a school in which 2,000 students are already enrolled. Intuitively, it is obvious that the optimal school size is somewhere between 100 and 2,000. To find the optimal school size, we must determine the school enrollment where per pupil costs are at a minimum. That point is found by computing the ratio $-b_1/2b_2$. In the Iowa case, optimal school size is found to be 1,653 (pupils in ADA).[1]

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[1] The derivation of optimal school size is explained in Cohn (1968), p. 432, and Cohn (1972), pp. 267-269.

There are a number of problems with this approach. First, it is assumed that the relationship between per pupil costs and school size is U-shaped, so that a parabolic functional form is appropriate. But an investigation of Iowa and Michigan data lends some support to an alternative hypothesis, namely, that a rectangular hyperbola describes the cost-size relationship more accurately. This implies that costs might decrease indefinitely as school size increases, reaching no discernible optimum point.

A second difficulty concerns the use of the school as the unit for which scale effects are measured. On the one hand, it may be argued that certain types of scale economies are more likely to be realized on a district-wide basis--such as the use of specialized personnel (experts in reading difficulty, psychologists, school health officials, district-wide administrative personnel, etc.) and the large-scale purchasing associated with large-size districts. On the other hand, it is possible--and some data are available to confirm this--that economies of scale are likely to accrue in some programs within a school but not in others. Hence, a mere change in enrollments may not achieve the desired reduction in per pupil costs. It follows that a careful analysis of scale economies must be undertaken at several hierarchical levels to ascertain the potential for cost savings through administrative reorganization.

Last, but certainly not least, is the distinction one should make between expenditure and cost functions. Although the relationship between C and S in Equation (6-1) accounts for other factors, providing a "net" scale effect in Equation (6-2), Equation (6-1) is still far from being a true cost function in the economic sense of the term. To obtain a true cost function it is necessary to find the least-cost combination of inputs associated with each prespecified level of educational output. (The derivation of the cost function is described in Appendix 6-1.)

The cost function which is based on least-cost input combinations is quite difficult to construct for two primary reasons. First, it is necessary to provide a comprehensive index of school output.

Although some progress in the direction of providing such a measure is reported in Chapter 7, there is still a need to observe the output index over time and space so that a test of its reliability and consistency can be made. Second, the prices of inputs must be specified. This is relatively simple in the case of some inputs but extremely difficult in other instances. For example, what is the unit price of such inputs as the teacher's verbal ability, number of different subject matter assignments per teacher, teaching load, or curriculum breadth and/or depth? In addition, the derivation of the economic cost function requires the utilization of an educational production function, the shape of which has not been yet determined with any degree of certainty.

So, despite the conceptual difficulties associated with the cost function embodied in Equation (6-1), it appears to be the most promising approach at this time. Further developments along the lines discussed in the preceding paragraphs would be highly desirable.[2]

Proposals for Scale Incentives

A legislature may adopt a number of possible courses of action to encourage districts operating excessively large or small schools to take administrative action to remedy the situation. Three possibilities are discussed here: (1) a penalty factor, (2) incentive payment for schools which take actions to improve their cost posture, and (3) a combination of (1) and (2).

Penalty Factor

Consider a state where aid to education is distributed on the basis of any of the schemes discussed earlier. If each school district is denoted by the subscript i, then the penalty factor for each district

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[2]Other studies on scale economies in public schools include Cohn, Hu, and Kaufman (1972), Hettich (1968), Katzman (1971), Osborn (1970), Riew (1966), and Sabulao and Hickrod (1971).

would be determined by computing

(6-3) $(C_i^* - C_m^*)p^2 =$ penalty factor

where C_m^* is the minimum cost per pupil in the state associated with the optimal school size, p is a scalar between 0 and 1 determined by the legislature, and C_i^* is adjusted cost per pupil. C_m^* and C_i^* are derived from Equation (6-4):

$$(6\text{-}4) \quad C_i^* = [b_o + \sum_{j=1}^{n} b_{j+2} \bar{X}_j] + b_1 S_i + b_2 S_i^2$$

where $\bar{X}_j$ is the mean of the jth factor included in the equation; C_m^* is the cost associated with the optimal scale level, $S^* = -b_1/b_2$; and C_i^* is the adjusted cost level associated with the scale S_i of the ith school.

For example, the study of Iowa high schools (Cohn [1968]) included an equation consistent with Equation (6-1), as may be seen in Equation (6-5):

$$(6\text{-}5) \quad C = 263.456 + 1.422X_1 + 20.2010X_2 + 0.004X_3 + 1.3573X_4 + 0.00534X_5 - 0.0610X_6 - 0.6398X_7 - 0.1775S + 0.0000537S^2$$

where X_1 = average number of college semester hours per teaching assignment,

X_2 = average number of different subject matter assignments per high school teacher,

X_3 = median high school teachers' salaries,

X_4 = number of credit-units offered (a unit is one course offered for a full school year),

X_5 = building value per pupil in ADA,

X_6 = bonded indebtedness per pupil in ADA,

X_7 = number of pupils in ADA/number of teachers = class size.

When the means of X_1 through X_7 are utilized, as in Equation (6-4), Equation (6-5) reduces to

$$(6\text{-}6) \quad C_i^* = 390.05 - 0.1775S_i + 0.0000537S_i^2 .$$

Since S* (optimal school size) is equal to $0.1775/[2(0.0000537)] = 1,653$, the minimum unit cost, C_m^* (computed from Equation [6-6]), is approximately $238.

In Table 6-1 adjusted unit costs, based on Equation (6-6), are given for a number of scale levels, ranging from 100 to 3,000 pupils in ADA. The table shows that adjusted unit costs in schools with enrollments of 100 are about $135 higher than in schools with optimal enrollments. Similarly, schools with enrollments of 3,000 have adjusted unit costs about $100 in excess of schools with optimal enrollments. The extent of cost savings that could have been achieved by capitalizing on scale economies is considerable.

The penalty factor, based on Equation (6-3), is given in Table 6-1 for eight schools with enrollments varying from 100 to 3,000, based upon the Iowa data. The penalties are given for p = 0.10 and p = 0.5. In the former case (p = 0.10), the penalty factor would be as low as $0.58 per pupil for schools with enrollments of 1,750 and as high as $13.47 per pupil in schools with enrollments of 100. If p = 0.5, the penalties vary from $2.89 to $67.37 per pupil for schools with respective enrollments of 1,750 and 100. Of course, other values of p may be chosen.

If total state aid for district i is given by A_i, then adjusted aid, A_i^*, would be the difference between A_i and the penalty factors. In symbols, adjusted aid is given in Equation (6-7):

$$(6\text{-}7) \quad A_i^* = A_i - p(C_i^* - C_m^*)S_i$$

where S_i is school size in district i.

TABLE 6-1

Adjusted Costs and Penalty Factors
for Selected School Sizes

School Size (S_i)	Adjusted Unit Costs (C^*_i)	$C^*_i - C^*_m$	Penalty Factors	
			$.10(C^*_i - C^*_m)$	$.5(C^*_i - C^*_m)$
100	$372.84	$134.75	$13.47	$67.37
500	314.73	76.64	7.66	38.32
1,000	266.25	28.15	2.81	19.07
1,500	244.63	6.54	0.65	3.27
1,653	238.09	0.00	0.00	0.00
1,750	242.88	5.79	0.58	2.89
2,000	249.90	11.81	1.18	5.90
3,000	340.90	102.81	10.28	51.40

Source: Adjusted costs have been calculated from Equation (6-6), which is based on data for 378 Iowa secondary schools, 1961-62. See Cohn (1968).

The analysis could become slightly more complicated when scale economies are computed on a school-by-school basis (where districts operate more than one school). On the one hand, it is probably necessary to distinguish between elementary and secondary schools. On the other hand, a district might operate some schools that are more nearly optimal with regard to size than others. What should be done is twofold. First, cost functions, and hence optimal school sizes, should be estimated for each type of school that ought to be distinguished from any other. Second, the calculation of the penalty factor should be computed for each school, so that the penalty factor for the district would be the sum of the penalty factors for all of its schools.

Incentive Payments

An alternative measure for achieving greater efficiency through scale effects would be to reward schools with additional aid payments for past cost reductions that are related to scale effects. The legislature could set aside a fixed sum for such incentive payments, let us say an amount equal to $IF (IF = Incentive Fund). The share of a school in the incentive fund would depend on the success had in reducing adjusted costs relative to the reduction in adjusted costs that was achieved by all districts.

Let $(C_i^*)_t$ and $(C_i^*)_{t-1}$ denote adjusted costs of district i during the periods t and t-1 (for example, if t is school year 1972-73, t-1 is the school year 1971-72). Let $(C_m^*)_t$, $(C_m^*)_{t-1}$, and S_{it} be defined in a similar manner. Then we compute ΔC_i^*, as defined in Equation (6-8), for each school:

$$(6\text{-}8) \quad \Delta C_i^* = S_{it}[(C_i^* - C_m^*)_{t-1} - (C_i^* - C_m^*)_t]$$

If there are N districts in the state, then we calculate the sum of the cost savings between period t and period t-1 due to changes in school size, given by $\sum_{i=1}^{N} \Delta C_i^*$. Then the relative savings by district i, denoted by g_i, is given by

$$(6\text{-}9) \quad g_i = \Delta C_i^* / \sum_{i=1}^{N} \Delta C_i^*$$

Incentive aid to district i would then be $g_i IF$, and hence total aid to the district would be given by

$$(6\text{-}10) \quad A_i^* = A_i + g_i IF$$

An illustration of the incentive-payments plan is described in Table 6-2. Consider a state with three school districts, I, II, and III. Adjusted costs, C_i^*, are given in the table for each school for the periods t and t-1. Also, the adjusted costs associated with the optimal school size in each of the periods under study are given (C_m^*). In this example, it is assumed that C_m^* is higher in period t than in t-1, perhaps because of mandatory increases in teachers' salaries and other cost increases due to price inflation. It is also possible that technological conditions change from year to year, resulting in changes in the level of minimum adjusted unit costs.

When the allocation of incentive payments is based on Equations (6-8), (6-9), and (6-10), the two factors that determine the share of each school in the incentive fund are (1) scale level (enrollment) at year t and (2) cost savings per pupil due to scale effects during the period t-1 to t. Of course, only districts with positive cost savings per pupil (row 7 in Table 6-2) are eligible to receive such payments. Whereas the illustration in Table 6-2 is concerned only with payment from the state to a district, one could also use it to reduce aid to districts showing a negative amount in row 7, indicating a unit cost increase during the time period.

It is seen in Table 6-2 that District III receives about 57 percent of the incentive aid, whereas the district accounts for almost 63 percent of total enrollment in the hypothetical state. The same proportion (percent of payment to percent of total enrollment) is also observed for District I--the two districts having the same per pupil reduction in adjusted unit costs. District II, with the highest cost reduction, gets a relatively larger proportion of the incentive fund.

TABLE 6-2

Incentive Payment for Cost Saving through Scale Adjustment: An Illustration

		Districts			
		I	II	III	Total
(1)	$C^*_{i\ (t-1)}$	475	450	375	1,300
(2)	$C^*_{m\ (t-1)}$	250	250	250	750
(3)	(1)-(2)	225	200	125	550
(4)	C^*_{it}	450	400	350	1,200
(5)	C^*_{mt}	300	300	300	900
(6)	(4)-(5)	150	100	50	300
(7)	(3)-(6)	75	100	75	250
(8)	S_{it}	100	500	1,000	1,600
(9)	(8)x(7)	7,500	50,000	75,000	132,500
(10)	$g_i = \frac{(9)}{132,500}$	0.0566	0.3774	0.5660	1.0000
(11)	$S_{it}/1,600$	0.0625	0.3125	0.6250	1.0000

Note: The symbols used in the left-hand column are defined in the text and the Glossary.

If the state set aside $10,000 for the incentive fund, District I would receive $566 ($5.66 per pupil), District II would receive $3,774 ($7.55 per pupil), and District III would receive $5,660 ($5.66 per pupil).

As discussed in the previous section, further complications may enter the incentive payment mechanism. For example, it would be desirable to consider adjusted costs by school or programs, so that the calculation of row 7 in Table 6-2 would have to be carried out several times for each district. Row 9 would then be calculated for each school and summed for all schools in the district to obtain g_i. But what if some schools had cost reductions while others had cost increases? Should we sum only the positive amounts (row 9) or also the negative ones? If administrative control rests entirely with the district and not with the schools of which it is composed, why should districts be rewarded for cost savings in some schools which are offset to a greater or lesser extent by cost increases in other schools? On the other hand, if financial reward could be given to schools, and if the schools have some control over budgetary matters, then it seems appropriate to apply the formula to schools and not districts.

Penalty Factor and Incentive Payment Combined

A legislature may wish to penalize districts with excessive current adjusted unit costs and, at the same time, reward those districts (some of which are subject to the penalty factor) which have taken action to reduce adjusted unit cost between the preceding and current periods. If A_i denotes total state aid in the absence of any scale incentive features, then the combination of the two plans would determine adjusted aid according to Equation (6-11):

$$(6\text{-}11) \quad A_i^* = A_i - p(C_i^* - C_m^*)S_i + g_i IF$$

Table 6-3 provides an illustration of how Equation (6-11) might work for the school systems described in Table 6-2. If $p = 0.10$, and if the incentive fund (IF) is $10,000, only District III

TABLE 6-3

Penalty Factors and Incentive Payments Combined: An Illustration

		Districts			
		I	II	III	Total
(1)	S_{it}	100	500	1,000	1,600
(2)	$(C_i^* - C_m^*)_t$	$ 150	$ 100	$ 50	$ 300
(3)	(1) x (2)	$15,000	$50,000	$50,000	$115,000
(4)	.05(3)	$750	$2,500	$2,500	$ 5,750
(5)	.10(3)	$1,500	$5,000	$5,000	$ 11,500
(6)	g_i	0.0566	0.3774	0.5660	1.0000
(7)	g_i($10,000)	$ 566	$3,774	$5,660	$ 10,000
(8)	(7)-(4)	-$184	$1,274	$3,160	$ 4,250
(9)	(7)-(5)	-$934	-$1,226	$ 660	-$ 1,500
(10)	g_i($11,500)	$ 650.90	$4,340.10	$6,509.00	$ 11,500
(11)	(10)-(4)	-$ 99.10	$1,840.10	$4,009	$ 5,750
(12)	(10)-(5)	-$849.10	-$ 659.90	$1,509.00	$ 0.00

Note: For definition of symbols see text or Glossary.

receives a net incentive payment from the state. The penalties levied on the other districts exceed the incentive payments so A_i^* is lower than A_i. If p = 0.05, both Districts II and III receive net incentive payments, whereas District I has a net penalty of $184. When p = 0.10, total penalties amount to $11,500. If the incentive fund is set equal to the total penalties levied, then, again, only District III receives a net incentive payment. If all districts are to receive a non-negative net incentive payment (i.e., the incentive payment is at least as large as the penalty factor), the total incentive fund would have to be at least $13,251 when p = 0.05 and $26,502 when p = 0.10.

Equity Considerations of Scale Incentive Features

In the discussion of the penalty factor and incentive payments, the fiscal capacity of districts has been disregarded. It is, however, plausible to argue that the penalty factor is inequitable. If there are two districts with identical adjusted costs and enrollments but with different fiscal capacities--abstracting, for the moment, from the problem of defining fiscal capacity--then the penalty would be more burdensome to the poorer district. Of course, if the power equalizing or full state funding schemes are in operation so that educational revenues are entirely unrelated to community wealth, then the equity problem does not exist. However, so long as states use the foundation or percentage equalizing schemes, the penalty factor would seem to result in a greater burden to poorer districts.

The incentive payment, on the other hand, does not appear to have adverse equity problems. If two districts have the same per pupil cost saving, but one is wealthier than the other. the wealthier district would, in fact, receive incentive payment which is a smaller proportion of per pupil wealth than is the case in the poorer school. Just as flat grants are equalizing to some extent, so are the incentive payments.

One method that could be used to correct the apparent inequity of the penalty factor would be to multiply the penalty factor by the ratio W_i/W_h, where W_i is per pupil wealth in the ith district, and

W_h is per pupil wealth in the wealthiest district in the state. The meaning of "wealth" could vary from one jurisdiction to another, but a combination of personal income and net worth appears to provide an attractive solution to the problem.

When equity considerations are taken into account, the penalty factor would be given by

$$(6\text{-}12) \quad \text{penalty factor} = p(W_i/W_h)\ (C_i^* - C_m^*)S_i$$

An illustration of the manner by which the penalty factor might be computed is given in Table 6-4 for a hypothetical state composed of only three school districts. The data are consistent with the illustration given in Table 6-3.

The penalty factor of the wealthiest district (III) remains unchanged. In the other two districts, the penalty is reduced in proportion to relative wealth. The major beneficiary is District II which is forgiven half of its penalty factor. In light of the reduction in total penalties, the state may wish to increase the proportion p if it desires to maintain total penalties at a pre-specified level.

One could also vary the incentive payment by a factor related to community wealth in order to increase its equalizing impact. One possibility would be to redefine g_i as follows:

$$(6\text{-}13) \quad g_i^* = [\Delta C_i^* (1 - W_i/W_h)] \ / \ [\sum_{i=i}^{N} \Delta C_i^* (1 - W_i/W_h)]$$

An illustration of how such a scheme could operate is described in Table 6-4 (rows 8-10). Since District III is considered to be the wealthiest district in the state, it will receive no incentive payments. If \$10,000 are earmarked for IF, then District I shall receive \$1,667 and District II, \$8,333.

In summary, there are at least two possible modifications of the scale incentive effects. The first would define total aid as follows:

TABLE 6-4

Equity Considerations Applied to Penalty Factor and/or Incentive Payment: An Illustration

	Districts			
	I	II	III	Total
(1) S_{it}	100	500	1,000	1,600
(2) $(C_i^* - C_m^*)t$	$150	$100	$50	$300
(3) (1) x (2)	15,000	50,000	50,000	115,000
(4) W_i	20,000	15,000	30,000	65,000
(5) W_i/W_h	0.67	0.5	1.0	—
(6) .05 x (5) x (3)	502.50	1,250	2.500	4,252.50
(7) .10 x (5) x (3)	1,005.00	2,500	5,000	8,505
(8) ΔC_i^*	7,500	50,000	75,000	132,500
(9) $\Delta C_i^*(1 - W_i/W_h)$	5,000	25,000	0	30,000
(10) $g_i^* = \frac{(9)}{30,000}$	0.167	0.833	0	1.000

Note: For definition of symbols, see text or Glossary.

$$(6\text{-}14)\quad A_i^* = A_i - p(W_i/W_h)\,(C_i^* - C_m^*)S_i + g_i IF$$

In Equation (6-14) the second modification would substitute g_i^*, as defined in Equation (6-13), for g_i.

Summary and Conclusions

The principal objective of this chapter has been to demonstrate the possibility of introducing incentive features into state aid formulas to encourage schools to organize along lines that would minimize adjusted unit costs. Three plans were developed: a penalty factor for excessively high adjusted unit costs in a given period; incentive payment for cost savings between the preceding and current time periods; and a combination of the two plans. The chapter also examined the possibility of introducing equity considerations into the analysis, and possible modifications of the incentive features have been presented.

It would be presumptuous to claim that these plans constitute the only course of action regarding incentive effects of scale economies. Rather, the proposed schemes provide a point of departure for legislative enaction and scholarly analysis. Whatever the merits of the specific formulas, it appears that the magnitude of cost savings from proper scale adjustments are so vast that at least an experimental program of scale incentive features should be inaugurated.

APPENDIX 6-1

DERIVATION OF AN ECONOMIC COST FUNCTION TO DETERMINE SCALE EFFECTS*

Suppose that enrollment in a given school is denoted by S, a composite index of per pupil school quality by Q, and the vectors of relevant school and nonschooling inputs by $X_1,\ldots, X_k$ and $Z_1,\ldots, Z_n$, respectively. The production function of educational services can, therefore, be specified (implicitly) as

$$(6A\text{-}1) \quad Q = f(S, X_1,\ldots, X_k/Z_1,\ldots, Z_n)$$

Function (6A-1) assumes that nonschooling factors cannot be directly manipulated by the school administrators.

Let $p_1,\ldots, p_k$ denote the prices of inputs $X_1,\ldots, X_k$. Then if we wish to minimize accounting costs, given by $C = \sum_{i=1}^{k} p_i X_i$, subject to the attainment of a given quality per pupil, Q_o, then we can write the constrained minimum as a Lagrangian expression:

$$(6A\text{-}2) \quad L = \sum_{i=1}^{k} p_i X_i - \lambda[f(S, X_1,\ldots, X_k/Z_1,\ldots, Z_n) - Q_o]$$

Next, we compute the k partial derivatives, $\partial L/\partial X_i$, and set them equal to 0. We then obtain the following k equations:

$$(6A\text{-}3) \quad \begin{aligned} p_1 - \lambda \partial f/\partial X_1 &= 0 \\ &\vdots \\ p_k - \lambda \partial f/\partial X_k &= 0 \end{aligned}$$

From the set of Equations (6A-3), we can derive a set of k-1 independent equations in the form of

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*This appendix is based on Cohn and Riew (in press).

(6A-4) $p_i/p_j = (\partial f/\partial X_i)/(\partial f/\partial X_j),\ i \neq j$

The k-1 equations in (6A-4) define X_1 through X_k on the basis of the input prices and their marginal productivities (the partial derivatives) which are functions of school size (S), the X-vector, and the Z-vector (known magnitudes). Thus, we obtain a set of k-1 equations in k unknowns (the X's). It is possible to solve for the X's when one additional (independent) equation is added to the system. The equation we add is the production function (6A-1) which expresses the X's in terms of Q, S, and the Z vector. When the system of k equations is solved for the k X's we should get

$$\begin{aligned} X_1^* &= g_1(S, Q; Z_1, \ldots, Z_n; p_1, \ldots, p_k) \\ &\vdots \\ X_k^* &= g_k(S, Q; Z_1, \ldots, Z_n; p_1, \ldots, p_k) \end{aligned} \qquad \text{(6A-5)}$$

The X^*'s are the input levels that reflect minimum cost for quality Q_o. The economic cost function therefore becomes:

(6A-6) $C^* = \sum_{i=1}^{k} p_i X_i^*$

Since the p_i's are presumed to be known and constant, and the Z-vector is regarded as exogenous, economic costs (C*) are seen to be a function of quality and school size, i.e.,

(6A-7) $C^* = h(S, Q, \text{and other constant or exogenous quantities})$

Equation (6A-7) may be used to determine the effect of size on economic costs.

The derivation of economic cost functions becomes more complicated when we add other constraints to the model (factor availability, legal factors, etc.), when it is recognized that a composite index of school quality may be extremely difficult to construct, and when the oligopsonistic nature of the factor market for teachers is considered.

CHAPTER 7

INCENTIVE EFFECTS--OUTPUTS

The incentive effects considered in Chapter 6 concern inputs only. They are designed to encourage school districts to operate at optimal enrollment levels, but they do not provide incentives for districts to obtain the maximum output from available inputs. Several suggestions are provided in this chapter for incorporating incentive features into state aid plans to encourage schools to increase educational output or output per dollar of costs.

Production in Secondary Schools

An operational scheme designed to induce schools to produce more--or to produce at a greater level of efficiency--cannot be formulated unless one is able to specify what is meant by "output" in secondary schools, measure that output, and specify a production function describing the process by which educational inputs are transformed into educational outputs.

The task is clearly formidable; some, if not many, would argue that it is totally impossible. Yet, so much progress has been made in this area in recent years that there is much reason to be optimistic. Although the state of the art is far from satisfactory, there is already mounting evidence which provides a starting point for input-output analysis in secondary education.[1]

The output receiving the most attention in recent studies has been achievement in verbal and/or mathematical skills. Other outputs mentioned include holding power (the inverse of the dropout rate), and,

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[1] Examples of such studies include Bowles (1970); Burkhead, Fox, and Holland (1967); Cohn (1968); Fox (1971); Hanushek (1972); Katzman (1971); Kiesling (1967); Levin (1970); and Raymond (1968). A summary of some of these studies appears in Cohn (1972), Chapter 8.

for secondary schools, enrollment in post-secondary educational institutions.

A comprehensive list of educational outputs has been developed by the Bureau of Educational Quality Assessment (BEQA) of the Pennsylvania Department of Education as part of its Pennsylvania Plan. The plan spells out ten educational goals, and twelve measures (outputs) have been developed to implement them[2] (see Table 7-1).

On the basis of its experience with the Pennsylvania Plan, the BEQA has been able to test the reliability and content validity of the output measures. The reliability coefficients for the ten goals are reproduced in Table 7-2, which indicates that the output measures representing the ten goals are, in general, highly reliable. Studies by the BEQA have also demonstrated a highly statistically significant content validity for the output measures.

The Educational Production Function

Suppose there are n educational objectives (outputs Q_1, Q_2,..., Q_n)--such as verbal and mathematical skills, vocational development, creative output, and others--k school-related inputs (X_1, X_2,..., X_k), and m nonschooling factors (Z_1, Z_2,..., Z_m). A generalized educational production function may be described as in Equation (7-1):

$$(7\text{-}1) \quad F(Q_1, Q_2, \ldots, Q_n; X_1, X_2, \ldots, X_k/Z_1, Z_2, \ldots, Z_m) = 0.$$

The function states that educational production is determined by the interaction of the school inputs and outputs, given the level of nonschooling factors.

If each of the n outputs were independent of the other outputs, it would be possible to estimate a production function for each output separately. For the ith output, Q_i, the function would be

$$(7\text{-}2) \quad Q_i = F_i(X_1, X_2, \ldots, X_k/Z_1, Z_2, \ldots, Z_m)$$

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[2] See Campbell and Beers (1970), and Kuhns (1972).

TABLE 7-1

Goals and Outputs of the Pennsylvania Plan

Goal	Variable number	Description Quality education should help every child:	Dimensions
I Self-concept	(1)	acquire the greatest possible understanding of himself and an appreciation of his worthiness as a member of society	Control of environment Personal attributes Achieving in school Relating to others
II Understanding others	(2)	acquire understanding and appreciation of persons belonging to social, cultural, and ethnic groups different from his own	Appreciating others who differ
III Basic skills		acquire to the fullest extent possible for him the mastery of the basic skills in the	
	(3)	use of words	Words
	(4)	use of numbers	Numbers
IV Learning attitude	(5)	acquire a positive attitude toward school and the learning process	Attitude toward school assignments Perception of the learning process Perception of the school climate
V Citizenship	(6)	acquire the habits and attitudes associated with responsible citizenship	Personal responsibility attitudes Initiative in advocating change Personal responsibility applications Concern for democratic principles
VI Health habits	(7)	acquire good health habits and an understanding of the conditions necessary for maintenance of physical and emotional well-being	Health knowledge
VII Creativity		by giving opportunity and encouragement to be creative in one or more fields of endeavor	Self-ratings of creative tendencies Tolerance of ambiguity Inner directedness
	(8)	(i) potential	
	(9)	(ii) output	Creative output
VII Vocational development	(10)	to understand the opportunities open to him for preparing himself for a productive life and should enable him to take full advantage of these opportunities	Perception of work and choice process Involvement in the choice process Judgment and independence in decision making Preference for particular vocational aspects
IX Knowledge of human achievement	(11)	to understand and appreciate as much as he can human achievement in the natural sciences, the humanities, and the arts	Theater and arts Sports, politics, and science Music
X Readiness for change	(12)	to prepare for a world of rapid change and unforseeable demands in which continuing education throughout life should be a normal expectation	Importance of education Change in regulations Change in school climate Change in educational processes

Source: Kuhns (1972), pp. 50-51, taken from Beers (1970).

TABLE 7-2

Reliability Coefficients of Educational Goals in Pennsylvania

	Goal	Reliability	
		Grade 5	Grade 11
I	Self-understanding	.87	.90
II	Understanding others	.77	.88
III	Basic skills	.90+[a]	.90+[b]
IV	Interest in school	.75	.85
V	Citizenship	.90	.91
VI	Health habits	.82	.91
VII	Creative potential	.82	.78
VII	Creative output	___[c]	.93
VIII	Vocational development	.77	.89
IX	Appreciation of human accomplishments	.79	.92
X	Preparation for change	.79	.81

Source: Toole; Campbell, and Beers (1970), p.2.

[a] Measured by the Stanford Achievement Battery or the Iowa Test of Basic Skills.

[b] Measured by the Stanford Achievement Battery or the Iowa Tests of Educational Development.

[c] Not measured

where F_i is the functional form expressing the manner by which the input sets combine to produce the output.

If, on the other hand, the outputs are not independent, so that the production of one output is a function of not only the inputs but also some of the remaining n-1 outputs, then it would be desirable to utilize a simultaneous-equation technique to avoid the possibility of a simultaneous-equation bias when equations of type (7-2) are estimated independently for the n outputs. A general system of equations, given the above input and output sets, is given in Equation Set (7-3):

$$
\begin{aligned}
Q_1 &= F_1(Q_2, Q_3, \ldots, Q_n; X_1, X_2, \ldots, X_k/Z_1, Z_2, \ldots, Z_m) \\
Q_2 &= F_2(Q_1, Q_3, \ldots, Q_n; X_1, X_2, \ldots, X_k/Z_1, Z_2, \ldots, Z_m) \\
&\cdot \\
&\cdot \\
&\cdot \\
Q_n &= F_n(Q_1, Q_2, \ldots, Q_{n-1}; X_1, X_2, \ldots, X_k/Z_1, Z_2, \ldots, Z_m)
\end{aligned}
\tag{7-3}
$$

There exist several statistical methods, such as the widely used Two Stage Least Squares technique, to estimate the parameters of Equation Set (7-3), provided a linear functional form is specified.[3]

Of particular interest is the shape of the production functions. The most convenient specification for Equation (7-2) would be a linear function given by

$$Q_i = a + \sum_{j=1}^{k} b_j X_j + \sum_{h=1}^{m} c_h Z_h + e_i \tag{7-4}$$

where a, b_j, and c_h are the coefficients (constants) which we seek to estimate, whereas e_i is a stochastic error term.

Equation (7-4) conflicts, however, with accepted economic theory which asserts that each factor of production is subject to diminishing marginal returns (that is, $\partial Q_i/\partial X_j < 0$, at least for some region in the production surface), and the marginal rate of technical

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[3] See, for example, Johnston (1972), Chapters 12-13, for a thorough discussion of identification and estimation of simultaneous-equation systems.

substitution between any two inputs should be diminishing--where the marginal rate of technical substitutions between, say, inputs 1 and 2 is given by the ratio $(\partial Q_i/\partial X_1) / (\partial Q_i/\partial X_2)$.

Diminishing marginal returns implies that total output increases at a decreasing rate beyond a given point as each of the inputs is increased, other inputs and technological conditions remaining constant. This is consistent with a total product curve as depicted in Figure 7-1. Note that the curve is nonlinear throughout, indicating a specification different from that in Equation (7-4). If, however, the range of observations regarding inputs and outputs encompasses a relatively short segment of the total product curve, then the linear approximation (7-4) could provide a very good statistical fit to the data. This is shown in Figure 7-1 for the arcs AB or BC, where a straight line provides an excellent approximation to the true curve. On the other hand, it is possible that the range of observation is greater, such as the arc AC in Figure 7-1, indicating the desirability of choosing a nonlinear specification for Equation (7-2). It should also be emphasized that when linear approximations are used, there exists a considerable danger in extrapolating the statistical functions beyond the range of the data.

Diminishing marginal rate of technical substitution explains the substitutability of any two inputs in production. If the linear form (7-4) is used, the marginal rate of substitution is constant (b_1/b_2 is the marginal rate of substituting input 2 for input 1). This implies that the marginal rate of substitution does not depend on the magnitude of the inputs used. Also, the linear function implies that output could be obtained by using any one of the inputs alone.

But once again, when we have data that encompass only a relatively small portion of the input substitution range, a linear function may be satisfactory. In Figure 7-2 an equal product curve is presented. That curve satisfies the requirement of diminishing marginal rate of technical substitution; yet, if we are only interested in a short segment of the curve, say the arc segments AB or BC, then a linear approximation would provide an excellent fit to the data. Again,

FIGURE 7-1

Total Product Curve and Linear Approximations

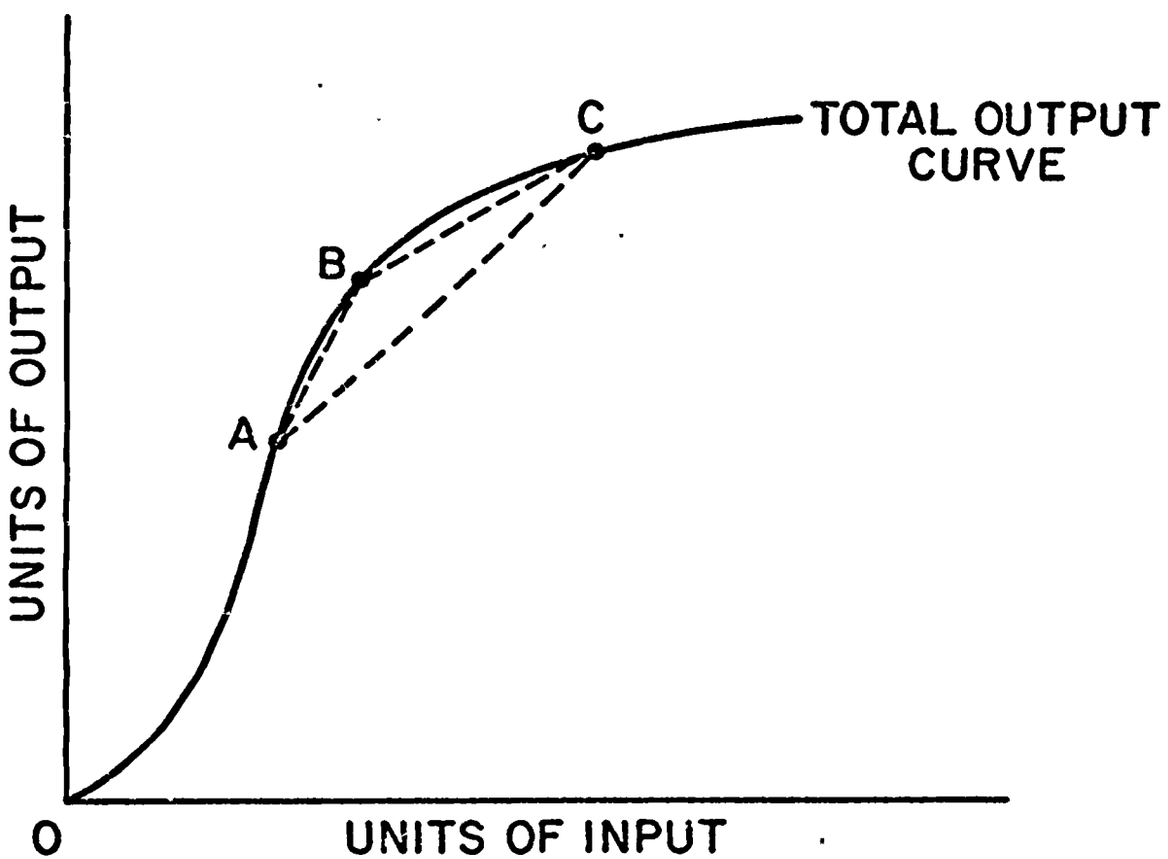
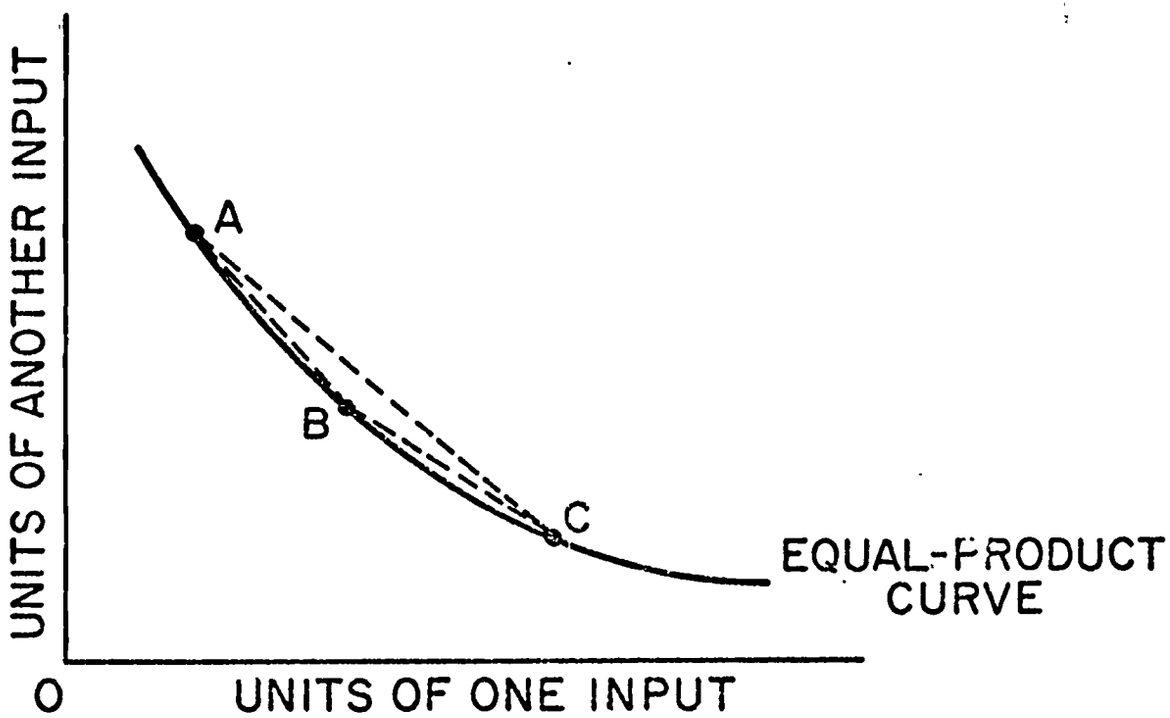


FIGURE 7-2

Equal Product Curve and Linear Approximations



one must be careful not t .se the estimated coefficients to render recommendations concerning areas of production outside the range of the data. Also, one should test for nonlinearity to avoid misspecification, such as when the segment AC in Figure 7-2 is exhibited by the data.[4]

Composite Output Index

In the absence of a price system that could be used to combine the various outputs into a single total educational product, some composite index of the n outputs must be developed in order that the application of the tool for state aid incentives may become operational. Such a composite index would also be of great value to school administrators who seek to evaluate their total performance rather than approach decision making on an output-by-output basis.

It would be possible to obtain a subjective index of the outputs by resorting to panels of experts or questionnaires which would provide weights to be applied to each of the outputs. An alternative method, used here, is to find the weights, $w_1, w_2, \ldots, w_n$, which would maximize the correlation between the output index, $Q = \sum_{i=1}^{n} w_i Q_i$, and a composite input index, $Y = \sum_{j=1}^{k} v_i X_i + \sum_{h=1}^{m} u_i Z_i$, where v_i and u_i are the corresponding input weights.

The technique used to obtain the output and input weights is known as canonical correlations.[5] Given the input and output sets, the technique would assign weights to the inputs and outputs and compute the correlation between Q and Y. In each successive step, the

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[4] For an excellent treatment of production and input substitution consult Ferguson (1972), Chapters 5-6.

[5] A description of the canonical correlation technique is given in Johnston (1972), pp. 331-334. Other studies involving canonical correlations include Chow (1964), Hooper (1959), Hu (1972), Tintner (1946), and Waugh (1942).

technique would recompute the correlation as changes in the weights are effected. The procedure would terminate when it is no longer feasible to achieve a significant increase in the correlation between Q and Y through changes in the weights.

The manner by which the technique may be used is illustrated here using Kuhns' data (1972) for fifty-three Pennsylvania secondary schools (for the academic year 1970-71). Table 7-3 provides the definitions of the input set (of thirteen variables) used in this exercise. (The Pennsylvania data include many more school and nonschool input factors, but canonical correlations could be computed only on the basis of the thirteen variables in Table 7-3 because we were unable to get permission to use the original data and had to make use of information made public in Kuhns' dissertation [1972].) The outputs for the analysis have already been described in Table 7-1.

The normalized weights for the highest canonical correlation between the weighted input and output sets are given in Table 7-4. On the input side, these weights provide a measure of the importance of each of the inputs in explaining the correlation between the inputs and outputs. Similarly, for the outputs, the weights indicate the relative contribution of each output to the canonical correlation.

The canonical correlation technique, then, provides output weights which indicate the extent to which each of the outputs contributes to the correlation between the output and input sets. The weights, therefore, could be construed to describe the relative "importance" of each output as exhibited by the data for the schools chosen for the particular study. They are likely, therefore, to be inconsistent with one's a priori judgment about the various outputs. Also, it should be pointed out that the weights vary a great deal between iterations of the canonical correlation estimation procedure. Nevertheless, whatever the limitations of the approach, it offers one method to estimate a single output index.

TABLE 7-3

Input Variables for Fifty-three Pennsylvania Secondary Schools, 1970-71

Symbol	Definition of Variable[a]
FAMASES	Family socioeconomic status: composite of mother's and father's occupational levels
TSALARY	Mean faculty salary in the school
PROC	Number of different subject matter preparations per week per academic teacher
TLOD	Average academic teacher instructional hours per week
CSIZ	Average class size
AEE	Total amount (in dollars) spent in the school district for extracurricular activities per secondary student
BRAT	Ratio of building enrollment to actual state-rated capacity
AMAN	Total number of secondary school personnel with administrative responsibilities (e.g., principals, assistant principals, department heads, etc.) per student
AXMAN	Total number of counselors, librarians, and audio-visual personnel per student
FSRAT	Student/academic faculty ratio
PSUP	Sum of the hours worked per week by all nonprofessional teacher aides, including secretaries whose primary function is to aid classroom teachers
ENROL	Enrollment
CUG	Total number of different subject matters available for student registration per secondary grade.

Source: Kuhns (1972), pp. 55-57.

[a]All variables are for the secondary school except as noted.

TABLE 7-4

Normalized Weights for Canonical Correlation--
Fifty-three Pennsylvania Secondary Schools, 1970-71

Inputs		Outputs		
Symbol	Normalized weight	Goal	Variable number	Normalized weight
FAMASES	0.512656	I	1	0.011236
TSALARY	0.077284	II	2	0.170569
PROC	0.070756	III	3	0.150544
TLOD	0.005625	III	4	0.023409
CSIZ	0.077841	IV	5	0.071289
AEE	0.002500	V	6	0.323761
BRAT	0.000081	VI	7	0.020449
AMAN	0.000144	VII	8	0.011664
AXMAN	0.025281	VII	9	0.021025
FSRAT	0.192721	VIII	10	0.133225
PSUP	0.124649	IX	11	0.002601
ENROL	0.100000	X	12	0.060516
CUG	0.000784			

Source: Data for computing the weights were taken from Kuhns (1972)

Notes: Canonical Correlation Coefficient = 0.866
Number of Observations = 53
Chi-Square = 233, with 156 degrees of freedom

Proposals for Output Incentives

Once it is agreed that a meaningful set of educational outcomes could be measured, that an output index could be formulated, and that a production function of the type (7-2) could be specified to study the relationship between the composite output index and the input factors, the door would then be open for an analysis in which schools could be encouraged to increase output, or output per unit of cost, through incentive provisions in the state aid formula.

The state may wish to consider one of two goals: (1) to achieve greater total output, no matter how efficient (or inefficient) schools are;(2) to achieve greater efficiency in school operations--that is, increase the ratio of output to cost. An alternative goal might be to achieve greater output subject to the constraint that the output/cost ratio remains within acceptable limits. In this section, only the first two alternatives will be discussed.

In what follows, the term "cost" would be interpreted as costs adjusted for scale effects. Since scale effects were already discussed in the preceding chapter, the measurement of efficiency here will be based on a cost per pupil basis from which the scale effect has been netted out. The method for obtaining such a net cost figure may be explained on the basis of the material introduced in Chapter 6.

Consider, for example, Equation (6-1) describing a cost function with a parabolic relation between costs and size. If one wishes to obtain per pupil cost for a district which is net of scale effects, the procedure would be to calculate net costs, NC_i, for the ith district, by

$$(7\text{-}5) \quad NC_i = C_i - (C_i^* - C_m^*)$$

where C_i^* and C_m^* are per pupil costs associated with enrollment in the ith district and in a district with an optimal enrollment level, respectively. An illustration of the manner by which NC_i might be

computed in reference to Iowa high school data (Cohn [1968]) is provided in Table 7-5.

As in the preceding chapter, the incentive features will include a penalty factor, an incentive payment, a combination of the penalty factor and the incentive payment, and adjustments in the incentive systems to account for equity considerations.

Penalty Factor

Suppose there are N districts in a state. Consider a set of n educational outputs, $Q_1, Q_2, \ldots, Q_n$, which may be consolidated into a single output index, $Q = \sum_{i=i}^{n} w_i Q_i$, where the weights ($w_i$) are obtained by the canonical correlation or any other acceptable method. The state could then set up an output norm, Q^n, which could be based on the highest current output level in the state, the average state level, or any other level which the state wishes to consider.

If it is desired to achieve increments in output without regard to cost of inputs, then each district will pay a penalty equal to some proportion of the difference between the output norm and its output level. Districts achieving or exceeding the norm would pay no penalty.

It should be recognized, however, that many of the outputs depend quite critically on factors that are not directly under the control of the school district. For example, socioeconomic conditions have been shown to influence student achievement in basic skills. It follows that the output measure that should be used to calculate the penalty factor must be adjusted to take into account such nonschooling factors.

The adjusted output measure, Q*, would depend on the underlying production function. If the production function is of type (7-4), then adjusted output for each district is given by

$$(7\text{-}6) \qquad Q_i^* = Q_i - \sum_{h=1}^{m} c_h Z_{hi}$$

where Z_{hi} is the level of the hth nonschooling factor in district i.

TABLE 7-5

Calculation of Per Pupil School Costs in Which Scale Effects are Netted Out

School	School Size (S_i)	Scale Effect ($C_i^* - C_m^*$)	Per Pupil Costs (C_i)	$NC_i = C_i - (C_i^* - C_m^*)$
(1)	(2)	(3)	(4)	(5)=(4)-(3)
A	100	$134.75	$500	$365.25
B	500	76.64	500	423.36
C	1,000	28.15	750	721.85
D	1,500	6.54	350	343.46
E	1,653	0.00	400	400.00
F	1,750	5.79	1,000	994.21
G	2,000	11.81	600	588.19
H	3,000	102.81	700	579.19

Source: Column (3) is taken from Table 6-1, which is based on Cohn (1968), Table 4.

Note: For definition of symbols see text or Glossary.

If the state chooses a sum of $\$q_1$ for the penalty factor, total penalties for district i would amount to

(7-7) penalty for district i = $q_1(Q^n - Q_i^*)S_i$

where S_i is enrollment in district i. Therefore, adjusted state aid--ignoring any scale effects--would be

(7-8) $A_i^* = A_i - q_1(Q^n - Q_i^*)S_i$

For example, if maximum Q is 100, and the norm is set at 70, the penalty factor would be $q_1(70 - Q_i^*)S_i$. A district achieving an adjusted Q-level of 40 would pay a penalty of $30q_1$ per pupil. If q_1 is set at \$1, the district would pay a penalty of \$30 per pupil.

The formula could be used for both a penalty and payment (negative penalty) for schools where Q_i^* exceeds Q^n. The problem with such a program would be that as a school approaches the maximum output level, it becomes much more difficult to attain higher output levels. Also, given scarce funds, most states would probably wish to encourage increased production at districts with low output levels.

Suppose that the state wishes to increase efficiency, measured by output per unit of costs, rather than output. Since scale effects have already been discussed earlier, the concept of "costs" should be net of scale effects, as explained previously. For each district, the output/cost ratio is thus given by Q_i^*/NC_i. Again, the state sets a norm for the output/cost ratio, denoted by $(Q/NC)^n$, based on best practice, the state average, or any other method which the state finds acceptable. If q_2 is the penalty amount set by the state, then the penalty for each district for which $Q_i^*/NC_i < (Q/NC)^n$ is given by

(7-9) penalty for district i = $q_2[(Q/NC)^n - (Q_i^*/NC_i)]S_i$

For example, if the output/cost norm is 1/5 (representing, for example, an output norm of 70 and (net) per pupil cost of \$350)--indicating

that it takes \$5 to produce a unit of output--then the per pupil penalty for district i would be $q_2(1/5 - Q_i^*/NC_i)$. If district i could manage only an output/cost ratio of 1/10, its penalty would be $q_2(1/10)$ per pupil. If q_2 is set equal to \$50, then the district would pay a penalty of \$5 per pupil.

Adjusted state aid would, in this case, be

$$(7\text{-}10) \quad A_i^* = A_i - Q_2[(Q/NC)^n - (Q_i^*/NC_i)]S_i$$

Incentive Payments

Instead of a penalty levy associated with unsatisfactory output or output/cost levels, a state may wish to allocate a certain sum, say \$IF, for incentive payments to districts showing improvement in their output or output/cost posture over a prespecified time period (from t-1 to t).

Let $(Q_i^* - Q^n)_t$ denote the absolute value of the difference between a district's adjusted output and the state's output norm at time period t. Then the improvement in a district's output level during the period from t-1 to t is given by

$$(7\text{-}11) \quad \Delta Q_i^* = [(Q_i^* - Q^n)_t - (Q_i^* - Q^n)_{t-1}]S_{it}$$

If the output norm does not change between the two time periods, i.e., $Q_t^n = Q_{t-1}^n$, then Equation (7-11) reduces to

$$(7\text{-}12) \quad Q_i^* = [Q_{it}^* - Q_{i(t-1)}^*]S_{it}$$

If there are N districts in the state, we calculate the sum of the output improvements for all districts, given by $\sum_{i=1}^{N} \Delta Q_i^*$. The improvement by the ith district relative to total improvement by all districts, denoted by h_{1i}, is given by

$$(7\text{-}13)\quad h_{1i} = \Delta Q_i^* \Big/ \sum_{i=1}^{N} \Delta Q_i^*$$

Incentive aid to district i would then be $h_{1i}IF$, and adjusted state aid would be computed by the formula

$$(7\text{-}14)\quad A_i^* = A_i + h_{1i}IF$$

If the state wishes to encourage greater efficiency rather than output per se, we would substitute the following for Equation (7-11):

$$(7\text{-}15)\quad \Delta(Q_i^*/NC_i) = \left\{\left[(Q_i^*/NC_i)_t - (Q/NC)_t^n\right] - \left[(Q_i^*/NC_i)_{t-1} - (Q/NC)_{t-1}^n\right]\right\} S_{it}$$

If the output/cost norm does not change between the two periods, Equation (7-15) simplifies to

$$(7\text{-}16)\quad \Delta(Q_i^*/NC_i) = \left[(Q_i^*/NC_i)_t - (Q_i^*/NC_i)_{t-1}\right] S_{it}$$

The relative improvement in the output/cost ratio, h_{2i}, is defined by

$$(7\text{-}17)\quad h_{2i} = \Delta(Q_i^*/NC_i) \Big/ \sum_{i=1}^{N} \Delta(Q_i^*/NC_i)$$

and the share of the ith district in the incentive fund is given by $h_{2i}IF$. Adjusted state aid for district i is therefore given by

$$(7\text{-}18)\quad A_i^* = A_i + h_{2i}IF$$

Combination of the Penalty Factor and Incentive Payment Programs

A state may wish to penalize districts with substandard output or output/cost levels yet also seek to encourage greater output or productivity by rewarding districts showing improvement over a pre-specified time period.

If increased output is the state's goal, the adjusted aid formula would be given by

$$(7\text{-}19)\quad A_i^* = A_i - q_1(Q^n - Q_i^*)S_i + h_{1i}IF$$

On the other hand, if the state wishes to encourage greater productivity, adjusted state aid would be given by

$$(7\text{-}20) \quad A_i^* = A_i - q_2[(Q/NC)^n - Q_i^*/NC_i]S_i + h_{2i}IF$$

It is, of course, possible to combine the two programs in such a way that one part of the scheme (say the penalty factor) would be related to total output while the other part (the incentive payment) would be related to the improvement in productivity or vice versa.

Equity Aspects of Incentive Formulas

As noted in Chapter 6, it is evident that a dollar of penalty would be more burdensome to poor than to rich districts. One could, therefore, modify Equations (7-8) and (7-10) to take account of a community's fiscal capacity.

If a district's wealth is denoted by W_i and the wealth of the richest district is W_h, then one method which would incorporate equity considerations into the incentive formulas would be to multiply the penalty factor by the ratio W_i/W_h. The penalty factor would remain unchanged for the wealthiest district and would be nill for a very poor district. The modified aid formulas are given in Equations (7-21) and (7-22):

$$(7\text{-}21) \quad A_i^* = A_i - q_1(W_i/W_h)\ (Q^n - Q_i^*)S_i$$

and

$$(7\text{-}22) \quad A_i^* = A_i - q_2(W_i/W_h)\ [(Q/NC)^n - Q_i^*/NC_i]S_i$$

One could also modify the incentive payment formulas to provide greater equalization of community wealth. The procedure would be identical to the one described in Equation (6-13) for the scale incentive scheme.

Summary

It has been argued that at least some educational outputs can be measured. Given data on educational inputs and outputs in a given state for certain time periods, it would be possible to develop the output index and calculate an adjusted output for each district. Using such data, it would also be possible to devise incentive features in the state aid formulas to provide for a penalty factor, incentive payments, or both. Such schemes could be applied to encourage greater output levels, greater efficiency (in terms of the output/cost ratio), or both. Modification of the formulas to take account of equity factors has also been described.

It is recognized that the enactment of such incentive features is subject to both practical and theoretical limitations. The nature of the educational outputs and the form and shape of the educational production function need a great deal more study. In addition, it would be desirable to study the proposed formulas in relation to actual information for individual states. (Attempts to get Pennsylvania data have so far been frustrated.) Nevertheless, the analysis opens the door to further study in this area, may provide stimulus to researchers to improve the state of the art concerning educational production, and ultimately may result in such schemes being incorporated into state aid formulas.

CHAPTER 8

SUMMARY AND CONCLUSIONS

Two principal goals were set for the present study: (1) an empirical analysis of the economic effects of state aid and (2) the development of incentive features that could be incorporated into state aid formulas in order that school districts will attempt to seek a school size which reflects lower unit costs and/or strive to reach higher levels of output or output per dollar of costs.

The first phase of the study, reported in Chapter 5, provides several interesting insights about the effects of state aid. It was found that higher levels of state aid are associated with higher levels of per pupil expenditures, but it was also found that school districts are likely to substitute some of the state aid monies for resources that would have otherwise come from local sources. It is not clear whether state aid to education results in a shifting of local revenues from education to other municipal services or whether state aid is used to effect some local tax relief.

The empirical analysis also revealed that states giving more aid are likely to discourage local districts from raising funds through bond issues. On the other hand, more state aid was found to be associated with lower nonpublic enrollments and larger average school size.

In the second phase of the study, several options were presented for states to provide incentives for scale effects. One method would be to levy a penalty on schools which have enrollments below or above optimum scale. The penalty would be in proportion to the cost savings that would be realized had the district operated schools with optimal enrollment levels. Another method would be to calculate past improvements in a district's enrollment relative to optimal scale levels and to provide districts with incentive payment which would be in proportion

to a district's improvement in school size relative to the improvement experienced by all districts in a state. A further possibility that may be considered is a combination of the penalty factor and the incentive payment. Together, the two methods would penalize schools that have inoptimal enrollment levels yet reward districts that have shown an improvement over past periods. As a final suggestion, the analysis considered the employment of a relative wealth factor in the incentive formulas to increase their equalizing impact.

A number of options concerning the use of incentive features to increase output and/or output per dollar of cost have been discussed. In each instance, penalty factors and incentive payments, along the lines suggested for the scale effects, have been proposed. Combinations of the penalty factor and the incentive payment and/or the output and output-per-dollar-of-cost plans have also been discussed, as have equity considerations.

One could, of course, include the scale effect in the incentive feature for the output-per-dollar-of-cost plan. In that case, variations in costs per unit of output would reflect inefficient management as well as inefficient school size. In order that the school size effect will receive explicit attention, however, the two effects have been separated. Thus, the discussion in Chapter 7 (of output per dollar of cost) employed a cost concept from which the scale effect has been netted out.

Although we believe that the information provided in this report should be valuable to both researchers and governments, it is recognized that both the empirical and theoretical components of the study are subject to various limitations. For example, the empirical study could have benefited from additional analysis of less aggregative data, more recent data, and additional variables that were not included in the present study. The development of the incentive features is limited by the nature of the knowledge we possess about scale effects and the educational production process. Moreover, a simulation of the incentive formulas--using actual data . a number of states--would have been highly desirable.

Further development of the empirical model, along the lines suggested above, would appear to be highly advantageous, and a test of the impact of the incentive features on a district's behavior would form a most interesting scholarly investigation. It is hoped that the present study will stimulate further research in this area and generate the enactment of incentive features in state aid formulas so that schools will be provided the incentive to produce more per dollar of cost.

GLOSSARY

A_i	Total state aid to district i
A_i^*	Adjusted state aid to district i
ADA	Average daily attendance
ADM	Average daily membership
BOND	Total approved par value of bond issues (1962-71), per pupil enrolled in public elementary and secondary schools
BSTR	Basic school funds
C_i	Cost per pupil in district i
C_i^*	Adjusted cost per pupil in district i
C_m^*	The minimum cost per pupil in the state, associated with the optimal school size
Δ	A change in the variable following this symbol
EA_i	Equalization aid to the ith district
EQUALIZ	Equalization score of state
EXP_i	Per pupil expenditures in the ith district
F	Foundation level of support
g_i	Relative savings due to improvement in scale by district i
g_i^*	Adjusted relative savings due to improvement in scale by district i
h_{1i}	Relative improvement in output by the ith district
h_{2i}	Relative improvement in output/cost ratio in the ith district
I_i	Personal income in the ith district
I_s	Personal income in the state
IF	Incentive fund
INCPOV	Incidence of poverty

MEWAV	The equalized weighted assessed valuation of real and tangible property, modified by the ratio of district median family income to state median family income
N	Number of districts in the state
NC_i	Costs net of scale effects for the ith district
NEGRO	Negro enrollment in public schools as a percent of total enrollment
p	A scalar between 0 and 1
PCI	Personal income per capita
PPI	Personal income per pupil in ADA
%ENNP	Percent of pupils enrolled in nonpublic schools
%TPOPENP	Percent of total population enrolled in public schools
q_1	A sum chosen for the output penalty
q_2	A sum chosen for the output/cost penalty
Q	A composite index of per pupil output
Q^n	An output norm (based on the highest current output level, the average level, or some other level the state wishes to consider)
r	Mandated tax rate
RE	Revenue entitlement, i.e., the amount of educational revenues to which a district is entitled within a given range of tax levies
RELSIZE	Relative size of schools
REV	Local revenue per pupil
S	School size, measured by enrollment
S*	Optimal school size
SALARY	Average teachers' salary
SC	School census
S/T	Student/teacher ratio

STAID	State aid
t	A time period (if t = school year 1972-73, then t-1 is the school year 1971-72)
URBAN	Urban population as a percent of total population
V_g	A given level of property valuation which all districts may use to compute the level of property tax revenues per pupil that the state will guarantee
V_h	Assessed valuation per pupil in the wealthiest district
V_i	Assessed valuation per pupil in the ith district
V_s	Average per pupil valuation in the state
W_h	Per pupil wealth in the wealthiest district
W_i	Per pupil wealth in the ith district
WADA	Weighted average daily attendance
x	A scalar between 0 and 1

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