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ABSTRACT

The demand for educational professionals is considered in this study by attempting to determine what school district expenditures would be for educational personnel should school district budgets be increased. Three alternative methods of school district expenditure behavior are developed, and all three models are analyzed to determine the demand for teachers and other inputs. The study used data taken from the U. S. Office of Education's Elementary and Secondary General Information Survey on the expenditure and staffing patterns of large districts during the 1969-70 school year. In general, the results of the study suggest that: (a) 15-20 percent of a budget increment would be allocated to secondary teachers, (b) 15-20 percent would be allocated to elementary teachers, (c) 20-25 percent would be allocated to other educational professionals, (d) 5 percent would be allocated to administrative expenditures, (e) 10-15 percent would be spent for plant operation and maintenance, (f) 1 or 2 percent would be allocated to health and attendance services, (g) 10 percent would be allocated to nonpersonnel instructional inputs, and (h) the rest would go for pupil transportation. (HMD)

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ANALYSIS OF THE EDUCATIONAL PERSONNEL SYSTEM: III. THE DEMAND FOR EDUCATIONAL PROFESSIONALS

PREPARED FOR THE DEPARTMENT OF HEALTH, EDUCATION AND WELFARE

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PREFACE

Under Contract OEC-0-71-2533(099) with the U.S. Office of Education, The Rand Corporation has been conducting an analysis of the educational personnel system in the United States. This is the third in a series of reports presenting the results of Rand's research. This report focuses on school district expenditure behavior and the demands of those districts for elementary and secondary teachers, other professionals serving instruction, nonprofessional staff, and various nonpersonnel school inputs.

The other reports in this series are:

David Greenberg and John McCall, *Analysis of the Educational Personnel System: I. Teacher Mobility in San Diego*, R-1071-HEW.

David Greenberg and John McCall, *Analysis of the Educational Personnel System: II. A Theory of Labor Mobility with Application to the Teacher Market*, R-1270-HEW.

Emmett Keeler, *Analysis of the Educational Personnel System: IV. Teacher Turnover*, R-1325-HEW.

Stephen J. Carroll and Kenneth F. Ryder, Jr., *Analysis of the Educational Personnel System: V. The Supply of Elementary and Secondary Teachers*, R-1341-HEW.

Kenneth F. Ryder, Jr., and Bruce M. Juba, *Analysis of the Educational Personnel System: VI. Staffing Patterns in U.S. Local Public Schools*, R-1342-HEW.

David Greenberg and John McCall, *Analysis of the Educational Personnel System: VII. Teacher Mobility in Michigan*, R-1343-HEW.

Stephen J. Carroll, et al., *Analysis of the Educational Personnel System: VIII. Overview and Summary*, R-1344-HEW.

SUMMARY

This study considers two major questions: How do local public school districts allocate funds among school inputs, and what are their resulting demands for elementary and secondary teachers, other educational professionals, and nonprofessional staff? The analysis of these issues is based on the economic theory of constrained maximizing behavior. The school district is viewed as a decisionmaking unit that attempts to obtain an "optimal" set of school inputs within the constraint of a fixed budget. The investigation is conducted at the micro-level with the individual school district as the unit of analysis. The focus is on how a school district with a given budget facing given factor market conditions allocates its available funds. A large part of the effort is devoted to modeling district expenditure behavior with respect to teachers and other educational professionals since these categories of personnel account for large portions of school district budgets and since the demand for teachers is of particular interest.

We explore three alternative formulations of the theory of school district expenditure behavior that differ in terms of the assumed objective of the district. The first begins with the assumption that the school district seeks to maximize a value function whose arguments are various educational outcomes and the community's priorities among them. The district's objective is to choose, from among those combinations of inputs it can afford, one that yields a set of educational outcomes that maximizes the value function. The second formulation begins with the assumption that the district has preferences among alternative combinations of inputs, regardless of how those inputs are related to educational outcomes. In this case, the district's goal is to obtain the most preferred set of inputs from among the sets it can afford. Finally, we explore a formulation that combines elements of both approaches. The district is assumed to have preferences for both educational outcomes and school inputs. Its objective is to choose, from among those combinations of inputs it can afford, the most preferred set of inputs,

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taking account of the educational outcomes obtained through the use of those inputs.

In all three formulations we assume that the district acts as if it has consistent preferences that can be described by utility functions with properties analogous to those usually assumed in consumer demand theory. We allow for the possibility that preferences may vary systematically with district characteristics such as urban vs. rural location or composition of the pupil population.

We derive the district's demands for teachers and other school inputs in all three versions of the model. This analysis demonstrates that, with appropriate assumptions, a number of empirically testable propositions about the relationships between a district's expenditure patterns and its budget level and the set of input prices it faces are implied by all three formulations. This, in turn, implies that in certain important respects the district's demands for inputs can be empirically examined irrespective of the assumed objectives of the district. This result also implies that empirical analysis of district demands for inputs cannot discriminate among the alternative formulations.

To empirically test these propositions it is necessary to assume an explicit functional form for the district's preference function. We employ a modified form of the additive-logarithmic function used to derive the linear expenditure system of consumer economics. This function is empirically convenient in that it yields demand equations (one for each type of input) that are linear in the parameters.

The demand equations are estimated using data from the U.S. Office of Education's Elementary and Secondary General Information Survey (ELSEGIS) on the expenditure and staffing patterns of large (enrollments in excess of 10,000) school districts in the 1969-1970 school year. To control for differences among the communities served by different districts, the districts are stratified by region (four categories) and metropolitan status (three categories). The model is estimated for each of the resulting 12 subsets of districts.

The empirical work focuses on district expenditures for elementary and secondary teachers, other educational professionals, and nonprofessional staff. Expenditures for five categories of "nonprofessional" school inputs -- administration, nonhuman instructional inputs, attendance and health services, pupil transportation, and plant operation and maintenance -- are also considered. Accordingly, the empirical analysis consists of the estimation of a system of 9 expenditure equations, one for each school input, for each of the 12 samples of districts. Detailed results of the 108 regressions are provided in the Appendix.

The model explains expenditures for elementary and secondary teachers and nonprofessionals quite well. Its performance with respect to expenditures for other professionals, a heterogeneous category including all educational professionals serving instruction in any capacity other than elementary and secondary teachers, and expenditures for plant operation and maintenance is also quite good. The model does reasonably well in explaining expenditures for inputs in each of the remaining categories, except for pupil transportation where the results are relatively poor. This comes as no surprise since variables such as population density and terrain, which clearly affect the costs of pupil transportation, are not considered in the analysis. The model appears to explain the data for each of the 12 types of districts equally well.

In general, our results suggest that roughly 15 to 20 percent of a budget increment would be allocated to elementary teachers and roughly the same amount would be allocated to secondary teachers. Other professionals would be allocated approximately 20 to 25 percent of the change in the budget. Approximately 5 percent would be allocated to expenditures for administration and about 10 percent to expenditures for nonpersonnel instructional inputs. Health and attendance services would receive 1 or 2 percent of the change in the budget, while 10 to 15 percent would go to plant operation and maintenance. The remainder would be allocated to pupil transportation. It must be emphasized, however, that there are substantial differences in the expenditure behavior of different district types, and that the above statements are rough generalizations.

This analysis is restricted in many respects by the limitations of the currently available ELSEGIS data. The ELSEGIS sampling design does not provide a satisfactory data base for longitudinal analysis. Other important problems are the lack of data on personnel flows (new hires and terminations), on the distributions of professionals by degree level and experience, and on the expenditures for fringe benefits, particularly the district's contribution to employees' pension plans.

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The author is particularly grateful to Kenneth F. Ryder, Jr., who provided much of the theoretical analysis discussed in Sec. II.

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I. INTRODUCTION

OBJECTIVES OF T STUDY

The purpos f this study is to investigate how local school districts behave in allocating their budgets among the main categories of school inputs: teachers, other professional educators, nonprofessional (support) personnel, and nonpersonnel resources. This question is currently of great interest because of its relationship to the ongoing policy debate over the reform of school finance. It is also closely related to the educational policy issues that stem from the growing teacher surplus.

As a result of legal and political developments during the past two years, major reforms in school finance may soon be undertaken in many of the fifty states. Several states, notably California, Minnesota, and Florida, have recently modified their systems substantially. The consequences in those states, and in others that are likely to follow suit, will probably include major reallocations of funds among school districts and may also result in substantial increases in aggregate, or average, support. Indeed, some of the momentum for reform has been lost as a result of the recent Supreme Court decision that existing patterns of inequality in school finance are *not* unconstitutional.* Nevertheless, it appears that pressures for reform will continue to be exerted through state courts (as was recently shown in New Jersey) and through state political processes. The outlook, then, is that school districts in many states will be experiencing substantial changes in their budget levels during the next few years. The question of how such districts will respond to change is, therefore, of far more than academic interest. At present, however, very little information bearing on that question is available. This study represents an initial attempt to fill that information gap.

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* *San Antonio Independent School District, et al. v. Rodriguez et al.*, Supreme Court of the United States, No. 71-1332, March 21, 1973.

The results of the study also bear on the numerous educational policy issues related to the large and growing teacher surplus. The educational personnel preparation system -- approximately 1,200 institutions of higher education that prepare students to teach -- has been significantly affected by the lack of opportunities for graduates prepared to teach. A number of institutions have recently cut teacher education programs.* Given the lags in the system (e.g., the time required to build up or reduce faculties in schools or departments of education), decisions being made now will largely determine the characteristics and size of the stock of educational professionals into the 1980s. Thus, decisionmakers concerned with the preparation of educational personnel must be able to anticipate the demands for teachers over the forthcoming decade. At present, however, the only available estimates of the demand for teachers are based on linear extrapolations that assume continuation of current trends in pupil/teacher ratios. These estimates neglect the relationships among the competing demands on limited school district budgets on the one hand, and the derived demand for teachers on the other. In view of the growing militancy of teachers' unions, the financial problems that currently face many districts, and the unsettled future of school finance reform proposals, it seems clear that educational decisionmakers need to be able to examine the kinds of demands that might be placed upon the educational personnel preparation system in a variety of alternative circumstances.

PREVIOUS RESEARCH ON THE DEMAND FOR TEACHERS

Despite the increasing proportion of the labor force employed in state and local governments, there has been remarkably little analysis of the determinants of employment in those sectors. In the case of education, the available analyses of the demand for teachers are implicit in projections of imbalances (surpluses or shortages) in the educational manpower labor market. The model of the demand for teachers that underlies these projections implicitly assumes that the number of teachers demanded

*See, for example, Maeroff (1972), Miller (1972), or Van Dine (1972).

is a function of exogenous teacher/pupil ratios and enrollments.* In particular, teachers' salaries and prices of other school inputs, both human and nonhuman, are entirely omitted from previous analyses.

Carlsson and Robinson (1969) go beyond the trend projection approach and suggest a theoretical model of the demand for employees in the public sector analogous to the traditional consumer demand model. They also propose a variant of the model in which the agency is required to employ a fixed number of persons. In both models, input prices (salaries) and budgets are fixed. In the latter model, the level of employment is also exogenous.

Brown (1972) examines the demand for teachers in the context of a traditional economic model of the derived demand for inputs. He concentrates, however, on the estimation of an educational production function. The derived demand component of the model thus receives little attention and the empirical results are disappointing.

THE CONTENTS OF THIS REPORT

In Sec. II we develop a general theory of school district expenditure behavior. An explicit interpretation of the theoretical model, designed to take advantage of the available data, is presented in Sec. III. Some of the limitations of the analysis are outlined in Sec. IV. Our empirical results are discussed in Sec. V and presented in tabular form in the Appendix. Section VI presents our conclusions.

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*See, for example, The National Educational Association (1972); Folger, Astin, and Bayer (1970); U.S. Department of Labor (1970); The National Center for Educational Statistics (1972); Dean, Reisman, and Rattner (1971); and Froomkin, Endriss, and Stump (1971).

II. THEORETICAL ANALYSIS

The development of a theoretical model of school district behavior in allocating its budget among school inputs could be approached from a number of different perspectives. The analyses reported in this study are based upon concepts developed in the economic theories of consumer and producer behavior. We explore three alternative formulations of the theoretical model that differ in the assumed objectives of the district.* However, if the appropriate assumptions are made in each case, each yields essentially the same set of empirically testable propositions regarding the district's demands for teachers and other school inputs. This result is important because it permits the empirical analysis of district expenditure behavior to be separated from the debate over the objectives of districts. It also demonstrates that we cannot infer the district's objectives from observations of its expenditure behavior.

We begin with a discussion of assumptions common to all three formulations of the model. Each of the three approaches to the development of the model is then described in turn. Finally, we discuss the empirical implications of the theoretical analysis.

COMMON ASSUMPTIONS

The model represents the behavior of a school district that seeks to obtain the "best" combination of resources or inputs subject to an exogenously determined budget and exogenously determined salary levels and other input prices. This does not imply that the district is assumed to have no impact on its budget or the set of input prices it faces. Rather, we assume that the district's decisions with respect to the school inputs it will use depend upon only the magnitudes of its budget and the set of input prices it faces -- both of which are determined

*The first and third alternative formulations were developed by Kenneth F. Ryder, Jr., of The Rand Corporation. The second alternative is a generalization of the Carlsson and Robinson (1969) model.

outside the model. There is a large and growing literature on the determination of school district budget levels* and a much smaller, but also growing, literature on the determinants of teacher salary.** In neither area does there appear to be evidence contrary to this assumption.

Assuming that no borrowing is allowed (to support current operations) and that the district does not accumulate cash balances, its budget constraint can be written

$$p_1x_1 + p_2x_2 + \dots + p_kx_k = b \ , \qquad (1)$$

where b is the district's budget for current operations, $x_i (i = 1, \dots, k)$ is the amount of the ith input employed or purchased by the district, and $p_i (i = 1, \dots, k)$ is the unit "price" of the ith input. If, for example, x_1 is the number of inexperienced teachers with bachelor's degrees employed by the district, then p_1 is the scheduled salary for teachers of that type plus whatever additional costs are associated with the employment of those teachers -- payroll taxes, the district's contribution to a pension plan, and so on.

We assume that the district is completely free to allocate its budget among inputs. This assumption implies that all factors are variable and can be obtained from the market at any desired level. Unfortunately, this is an unrealistic assumption. Some school factors are fixed, at least in the short run (e.g., capital items such as buildings). Others are "quasi-fixed" in the sense that they cannot be freely reduced, although they can be readily increased. An obvious example is the district's commitment to the support of existing staff (many of whom may be tenured) according to a salary schedule that provides built-in longevity increases.

We avoid the problems associated with fixed inputs by devoting our attention to the district's behavior in allocating its budget for current operations. Capital outlays and capital constraints are neglected throughout the analysis. The problems associated with quasi-fixed

*See, for example, Barro (1972) or McMahon (1970).

**See, for example, Thornton (1971) or Schmenner (1973).

inputs can be addressed in the theoretical analysis, but the available data are not sufficient to support the associated empirical work. Accordingly, we must neglect consideration of such constraints on the district's budgetary discretion.

We also treat all funds as equivalent regardless of source and make no attempt to reflect linkages between funding sources and specific resource allocation decisions.

For convenience in the subsequent analysis, we define b and the x_i in per pupil terms.

THREE ALTERNATIVE FORMULATIONS OF THE MODEL

Alternative 1

The first formulation of the model begins with the assumption that the district seeks to maximize a linear combination of potential educational outcomes, each weighted by a community priority. The priorities can be interpreted as shadow prices, reflecting the marginal value of each type of educational outcome to the community's preference set. The district thus seeks to maximize

$$V = \sum_{i=1}^{n} \alpha_i Q_i \, , \qquad (2)$$

where Q_i is the amount of the ith educational outcome (in per pupil terms) produced by the district, and α_i is a measure reflecting the priority that the community affords the ith outcome.

We assume that the amount of the ith outcome produced by the district depends upon the amounts of each of the inputs used by the district given the characteristics of the district's students. Specifically, we assume that there exists a set of educational production functions of the general form

$$Q_i = f_i(x_1, \ldots, x_k, s_1, \ldots, s_m) \quad i = 1, \ldots, n \, , \qquad (3)$$

where s_i is the ith measure of the characteristics of the district's students. Thus, the district seeks to maximize its value function

(Eq. 2) subject to the budget constraint (Eq. 1) and the production functions (Eq. 3).

We form the Lagrangian expression*

$$L = \sum_{i}^{n}[\alpha_i Q_i + \lambda_i(f_i - Q_i)] + \lambda_{n+1}[\sum_{j=1}^{k} p_j x_j - b] .$$

Differentiating with respect to the unknowns yields the following 2n + k + 1 equations:

$$\partial L/\partial Q_i = \alpha_i - \lambda_i \qquad i = 1, \ldots, n$$

$$\partial L/\partial x_j = \sum_{i=1}^{n} \lambda_i \partial f_i/\partial x_j + \lambda_{n+1} p_j \qquad j = 1, \ldots, k$$

$$\partial L/\partial \lambda_i = f_i - Q_i \qquad i = 1, \ldots, n$$

$$\partial L/\partial \lambda_{n+1} = \sum_{j=1}^{k} p_j x_j - b .$$

Setting each equation equal to zero (a necessary condition for the maximum of the Lagrangian expression), yields the conditions for a maximum of Eq. 3 subject to the constraints

$$\lambda_i = \alpha_i \qquad i = 1, \ldots, n$$

$$-\lambda_{n+1} = \frac{\sum_{i=1}^{n} \lambda_i \partial f_i/\partial x_j}{p_j} \qquad j = 1, \ldots, k ,$$

in addition to the constraints of Eqs. 1 and 2.

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*For notational convenience we write f_i for the function $f_i(x_1, \ldots, x_k, s_1, \ldots, s_m)$. We should also note that a variety of assumptions regarding the mathematical properties of the system are implicit in the analysis. These are familiar to consumer demand theory and are not discussed here.

Substituting for λ_i and dividing one of the k equations by another yields the conditions

$$p_j/p_\ell = \frac{\sum_{i=1}^{n} \alpha_i \partial f_i/\partial x_j}{\sum_{i=1}^{n} \alpha_i \partial f_i/\partial x_\ell} \qquad j, \ell = 1, \ldots, k . \qquad (4)$$

Since the partial derivatives, $\partial f_i/\partial x_j$ and $\partial f_i/\partial x_\ell$, in (Eq. 4) represent marginal physical productivities for each factor and the α_i are the values for each output, the term on the right-hand side of the equation represents the ratio of the value of the marginal product in all i production functions for any two inputs. The condition in Eq. 4 thus indicates that at the optimum the price ratio of any two purchased inputs will be equal to the ratio of the sum of the value of their respective marginal products for each output. Let $VMP_{i,j}$ be the value of the marginal product of input j in the production of outcome i; that is, $VMP_{ij} = \alpha_i \partial f_i/\partial x_j$. We can then rewrite Eq. 4 as follows:

$$\frac{\sum_{i=1}^{n} VMP_{i,j}}{p_j} = \frac{\sum_{i=1}^{n} VMP_{i,\ell}}{p_\ell} \qquad j, \ell = 1, \ldots, k .$$

This is the familar condition of economic production theory -- each input will be used until the value of its marginal products relative to its factor price equals that ratio for every other factor.

Since the p_j and α_i are fixed for each district, we can solve the k equations in Eq. 4 for the unknown quantities x_j. This yields a system of k factor-demand equations of the form

$$x_j = h(p_1, \ldots, p_k, \alpha_1, \ldots, \alpha_n, s_1, \ldots, s_m, b) . \qquad (5)$$

Thus, the demand for the jth factor will depend upon its own factor price, the prices of all other factors, the district's shadow prices for all potential outputs, the set of student characteristics, and the size of the district's budget. In our case, demand for teachers (type j) will thus depend upon the teacher wage rate (i.e., its factor price), the factor prices of all other inputs, the priorities assigned to each educational output for that district, the set of student characteristics, and the total budget level.

While this result holds for our initial set of assumptions, one could easily question these assumptions. The most tenuous assumption concerns the district's value function. In its current form, the assumption implies that communities recognize each potential type of output from the educational process and are able to assign priorities to each. However, little is known about the outputs from the educational process; not only are the outputs poorly defined, but the few that are defined are also difficult to quantify or measure very precisely. Consequently, communities may not be able to assign priorities to these ill-defined outputs.*

Alternative 2

A second approach to the development of a model of school district expenditure behavior begins with the basic premise that school districts behave as if they had consistent preferences among alternative combinations of school inputs, and that these preferences can be described by utility functions of the form

$$U = U(x_1, \ldots, x_k, s_1, \ldots, s_m) . \qquad (6)$$

The use of input quantities as arguments in the preference function is not in accordance with the usual procedure in factor-demand studies, which is to derive factor demands from demands for final outputs and technological relationships in production (production functions). But dealing directly with trade-offs among input categories in the case of schooling is justified by two considerations: (a) there is no reason to

*Note that our approach does not require that this potential output set be defined. The Q_i do not appear in the factor-demand equations (Eq. 5). What are required, however, are the priorities that each local community would assign to these outputs.

assume the same kind of output maximizing behavior for school districts as underlies the derived demand notion applied to business firms (Levin, 1970); and (b) as a practical matter, there is insufficient knowledge of production functions in education (and even insufficient evidence of their existence) to support empirical work based on an output-oriented specification of the model.*

We leave open the question of whether hypothesized preferences among input categories derive from subjective perceptions of production functions by district decisionmakers, from traditional notions of what sets of inputs make up a "good" education, or from bureaucratic motives, such as staff enlargement or prestige. None of these is inconsistent with the basic formulation in terms of trade-offs among different input categories, the starting point for our theoretical model.

In view of these considerations, the district may seek to obtain the most preferred set of inputs (i.e., maximize Eq. 6) subject to the budget constraints (Eq. 1). We form the Lagrangian expression

$$L = U(x_1, \ldots, x_k, s_1, \ldots, s_m) + \lambda\left(\sum_{j=1}^{k} p_j x_j - b\right) .$$

Differentiating with respect to the unknowns, setting the resulting k + 1 equations equal to zero, and solving the system yields a set of necessary conditions for a maximum

$$\frac{p_j}{p_\ell} = \frac{\frac{\partial U}{\partial x_j}}{\frac{\partial U}{\partial x_\ell}} \qquad j, \ell = 1, \ldots, k . \tag{7}$$

*The lack of adequate measures of educational outcomes may affect educational decisionmakers as well as economists. Thus, district officials may use inputs as proxies for educational outcomes or quality even though they would not dispute the existence of an educational production function.

The interpretation of this set of conditions is straightforward. Since the function U is a measure of the district's satisfaction with a combination of inputs, given the characteristics of the district's students, the partial derivative of U for any input is the input's marginal contribution to the district's satisfaction. The system of equations in Eq. 7 thus indicates that each input will be used until the value of its marginal contribution to satisfaction relative to its factor price equals that ratio for every other factor.

Since the p_j and b are fixed for the district, the k - 1 independent equations in Eq. 7 plus the budget constraint, Eq. 1, can be solved for the x_j. This yields a system of k factor-demand equations of the form

$$x_j = h(p_1, \ldots, p_k, s_1, \ldots, s_m, b) . \qquad (8)$$

Thus, the demand for the jth factor will depend on its own factor price, the prices of all other factors, the set of student characteristics, and the size of the district's budget.

Comparing Eq. 8 with the factor-demand equations yielded by Alternative 1, Eq. 5, we see that the two systems are the same except for the inclusion of district preferences among outcomes in the latter.

<u>Alternative 3</u>

Rather than try to maximize a value function containing unmeasurable elements of the potential educational output set, a district might seek to maximize a very different type of value function containing only measurable arguments, such as pupil achievement and the amount of input per student utilized by the district. We can demonstrate, however, that this interpretation of the behavioral model will produce essentially the same set of marginal conditions for constrained maximization as Alternatives 1 and 2.

Assume that the district seeks to maximize the objective function

$$V = \beta A + U(x_1, \ldots, x_k, s_1, \ldots, s_m) , \qquad (9)$$

where A is a measure of average student achievement, and β is the priority of shadow price the community assigns to student achievement. The utility function, U, reflects the district's preferences for inputs, independent of the relationships between inputs and achievement. Our production function can be expressed in terms of the output proxy, student achievement, as follows:

$$A = g(x_i, \ldots, x_k, s_1, \ldots, s_m) .$$

The district faces the budget constraint given in Eq. 1.

We now form the Lagrangian expression

$$\begin{aligned} L = {} & \beta A + U(x_1, \ldots, x_k, s_1, \ldots, s_k) \\ & + \lambda_o[g(x_1, \ldots, x_k, s_1, \ldots, s_k) - A] \\ & + \lambda_1\left(\sum_{i=1}^{k} p_j x_j - b\right) . \end{aligned}$$

Maximizing the function yields the k + 3 necessary conditions for a maximum of Eq. 9 subject to the production function and the budget constraint (Eq. 1). Setting these conditions equal to zero and solving yields the following:

$$\frac{p_j}{p_\ell} = \frac{\dfrac{\partial U}{\partial x_j} + \beta \dfrac{\partial g}{\partial x_j}}{\dfrac{\partial U}{\partial x_\ell} + \beta \dfrac{\partial g}{\partial x_\ell}} \qquad j, \ell = 1, \ldots, k . \tag{10}$$

The similarity between this result and that obtained in the previous models (Eqs. 4 and 7) is striking. An interpretation of the expressions on the right-hand side of Eq. 10 will reinforce this basic similarity. The partial derivatives, $\partial g/\partial x_j$ and $\partial g/\partial x_\ell$, reflect the marginal productivity of a purchased factor in the production of achievement. The β is the shadow price assigned to achievement, and thus the term $\beta\partial g/\partial x_j$ represents the VMP of factor x_j in the production of achievement.* In this

*Note the similarity to the previously defined $VMP_{i,j} = \alpha_i \partial f_i/\partial x_j$.

case, there is an additional term, $\frac{\partial U}{\partial x_j}$, which reflects the amount that an increment in factor x_j contributes directly to the district's satisfaction. Hence, the total marginal value product of a factor x_j in this model consists of the direct marginal-value product and the indirect product obtained through the value of the marginal productivity of the factor in the production of achievement. Defining the total marginal value product as

$$VMP_j = \frac{\partial U}{\partial x_j} + \beta \frac{\partial g}{\partial x_j} ,$$

we can rewrite the marginal conditions in the more familiar form,

$$\frac{VMP_j}{p_j} = \frac{VMP_\ell}{p_\ell} \qquad j, \ell = 1, \ldots, k.$$

Each factor will be used until the ratio of its marginal value product relative to its price is equal to that same ratio for all other factors.

Our factor-demand equations can be derived from the conditions in Eq. 10, since the factor prices and the community's priority, the p_j and β, are predetermined for each district. The elements in the factor-demand equation are the same as those in the previous factor-demand equations (Eqs. 5 and 8), except that β enters as a measure of community priority. Thus,

$$x_\ell = h(p_1, \ldots, p_k, \beta, s_1, \ldots, s_m, b) . \qquad (11)$$

IMPLICATIONS

We have examined three alternative approaches to the development of a theoretical model of a district's demand for school inputs. All three alternatives are special cases of a general model in which the district seeks to maximize a value function whose arguments include both educational outcomes and school inputs, subject to a fixed budget and, perhaps, a system of educational production functions.

The three systems of demand equations (Eqs. 5, 8, and 11) derived have much in common. Regardless of what was assumed to be the district's objective, its demand for each input depends upon the price of that input, the prices of all other inputs, the district's budget, and the characteristics of its students. The only difference among the three demand systems is the inclusion of the community's priorities for various educational outcomes in the Alternative 1 and the inclusion of the community's priority for student achievement in the Alternative 3.

Now, the community's priorities for educational outcomes (the α_1 in Eq. 5) or for student achievement (β in Eq. 11) are assumed to vary with its economic and sociological characteristics. Similarly, the characteristics of a district's students are assumed to vary with the economic and sociological characteristics of the community in which the district is located. Thus, if y_i $(i = 1, \ldots, \ell)$ is the ith community characteristic, Eq. 5 or 8 or 11 can be written

$$x_i = h(p_1, \ldots, p_k, y_1, \ldots, y, b) \quad . \qquad i = 1, \ldots, k \ . \qquad (12)$$

Thus, Eq. 12 is a general specification of the district's demands for school inputs.

It should be emphasized that we are *not* arguing that a district's demands for inputs are the same regardless of its objectives. We would expect that the number of teachers required by a district seeking to maximize some combination of educational outcomes would differ from the number needed if it sought to maximize some set of preferences for inputs. The important point for our purposes is that the set of variables that must be included in an empirical analysis of a school district's demands are the same regardless of its objectives.

A second, closely related point is that empirical analysis of Eq. 12 cannot resolve the issue of which of the three formulations of the model more closely approximates reality. To accomplish that task, we would have to obtain direct measures of community priorities and student characteristics, estimate Eqs. 5, 8, and 11 directly, and compare those results. Such an effort is, however, beyond the scope of this study.

Our concern is with the district's demands for inputs and not with the process whereby those demands arise. In fact, the primary purpose of the theoretical analysis is to demonstrate that by making the appropriate assumptions, we can examine the demands for inputs without regard to the district's objectives.

Finally, we note that the community characteristic variables in Eq. 12, the y_i, cannot be interpreted without reference to one of the three alternative formulations of the model. These are proxy variables and, depending upon the underlying model, can be interpreted as indirect measures of student characteristics, community priorities among educational outcomes, or community priority for student achievement.

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III. EMPIRICAL ANALYSIS

In this section we develop an explicit interpretation of the theoretical model and derive the appropriate estimating equations. Since the model is designed to take advantage of the existing data, we begin with a discussion of the ELSEGIS files and then turn to the model.

DATA

The ELSEGIS files contain data collected in annual, two-part surveys of random samples of public school districts. Part A of each survey obtains information on the district's schools, pupils, and staff for the current school year. Part B of each survey obtains information on the district's revenues and expenditures during the previous school year. In order to develop a consistent data base on staff and expenditures, we merged the expenditures data from the 1970 ELSEGIS file, the most recent available, and the pupils and staffing data from the 1969 ELSEGIS file.

The ELSEGIS sample is drawn from six enrollment strata with 100 percent coverage of districts serving more than 10,000 pupils.* There were relatively few cases in the lower enrollment strata in which the same district was sampled in two consecutive years. Accordingly, we limit the analysis to the large districts.

We were able to match the staffing and expenditure data, in the manner described above, for 671 districts. We eliminated the New York City school district on the grounds that its size and budget were so different from the norm, even for large districts, as to make it a special case. We also eliminated 53 districts that served only elementary or secondary students on the grounds that the expenditure behavior of such districts was apt to be quite different from the behavior of a district that served pupils at all levels. Finally, as a matter of convenience

*Prior to 1969, only districts in which enrollments exceeded 25,000 were automatically included in the sample.

in processing the data, we eliminated five districts that had no nonprofessional staff. The analysis is thus based on observations of 612 school districts having enrollments in excess of 10,000 in the 1969-1970 school year.

The ELSEGIS files do not contain data on the characteristics of the community in which a district is located. They do, however, identify the region (North Atlantic, Great Lakes and Plains, Southeast, West and Southwest) and metropolitan status of the district. The latter variable indicates whether the district is located in the central city of a county in a Standard Metropolitan Statistical Area (SMSA), elsewhere in a SMSA, or outside a SMSA.* On the assumption that the districts in a region having the same metropolitan status serve relatively homogeneous communities, we divide the large districts into 12 groups by metropolitan status and region and separately estimate the model for the districts in each group.

For each district we define the following:

T_E = number of elementary teachers,

T_S = number of secondary teachers,

T_O = number of all other professional staff serving instruction (principals; assistant principals; supervisors of instruction; "other" teachers; librarians; and guidance staff; psychological staff; and audiovisual staff),

N = number of nonprofessional staff serving instruction (teacher aides, library aides, and secretarial and clerical staff),

E = number of elementary pupils,

S = number of secondary pupils,

A = E + S,

P_T = average salary of professional staff,

*The "metropolitan, other" districts tend to be suburban, although a few are rural. The non-SMSA districts include rural areas, small towns, and cities that lie outside SMSAs. In systems that include both the central city and surrounding areas, a 50-percent rule is applied. Dade County, Florida, for example, is a single district classified as "metropolitan, other" because less than 50 percent of its pupils are in the central city (Miami).

P_N = average salary of nonprofessional staff,
X_5 = expenditures per pupil for administration,
X_6 = nonpersonnel instructional expenditures per pupil,
X_7 = expenditures per pupil for attendance and health services,
X_8 = expenditures per pupil for pupil transportation,
X_9 = expenditures per pupil for plant operation and maintenance, and
b = budget for current operations per pupil (expenditures allocable to pupil costs minus fixed charges divided by A).

Except for the two price variables, P_T and P_N, all variables are directly derived from the ELSEGIS files. The average salary of professional (nonprofessional) staff, P_T (P_N), was calculated by dividing the number of professional (nonprofessional) staff serving instruction into instructional expenditures for professional (nonprofessional) staff.

THE EMPIRICAL MODEL

The explicit preference function we use is a modified version of the additive-logarithmic utility function used to derive the linear expenditure system of consumer economics.* We choose this particular function because of its empirical convenience. As will be shown below, the estimating equations derived from the function are linear. The form of the function is:

$$U = \left(\frac{T_E}{E} - C_1\right)^{\alpha_1}\left(\frac{T_S}{S} - C_2\right)^{\alpha_2}\left(\frac{T_O}{A} - C_3\right)^{\alpha_3}\left(\frac{N}{A} - C_4\right)^{\alpha_4} \prod_{i=5}^{9} (X_i - C_i)^{\alpha_1} , \quad (13)$$

where the α and the C are parameters. Thus, we are assuming that the district concerns itself with nine inputs -- the teacher/pupil ratios in its elementary and secondary schools, the ratios of all other professionals and of nonprofessionals to total pupils, and the levels of expenditures per pupil in each of five categories.

*See Pollak and Wales (1969) or Brown and Deaton (1972) for detailed discussions of the linear expenditure system.

The parameter C_i can be interpreted as a "minimum required" level of the ith input per pupil. For example, the parameter C_1 is interpreted as the minimum acceptable teacher/student ratio at the elementary level. Similarly, C_2 is the minimum acceptable level of the teacher/pupil ratio at the secondary level. C_3 and C_4 represent minimum requirements for other professional staff/pupil and for nonprofessional staff/pupil, respectively.* The C_i for i = 5, ..., 9 represent minimum expenditures per pupil in the respective input categories.

These minimum requirements reflect precommitments on the part of the district (e.g., tenured teachers must be employed) as well as preconditions that must be satisfied if the district is to operate. Health and safety considerations, for example, may require that the district provide a minimum level of building maintenance. Bureaucratic motives or concepts of prestige (e.g., the district's teacher/pupil ratio will be no smaller than the teacher/pupil ratios of "comparable" districts) or notions as to which inputs are required to provide a "quality" education (e.g., the National Educational Association's specification of the minimum acceptable teacher/pupil ratio) may also be reflected in the minimum requirements.

The α can be interpreted as measures of the relative values the district places on the various inputs. Since the district is required to obtain at least C_i units of the ith input, a portion of its budget is precommitted. It is free to utilize the remainder of its budget to obtain amounts of the various inputs in excess of the minimum requirements. The parameter α_i indicates the share of the district's discretionary budget -- that portion of its budget not committed to meeting the minimum requirements -- that will be allocated to the acquisition of units of the ith input beyond the minimum required level.

The district seeks to maximize Eq. 13 subject to the budget constraint

$$b = P_T\left(\frac{T_E + T_S + T_O}{A}\right) + \frac{P_N N}{A} + \sum_{i=5}^{9} X_i \; . \qquad (14)$$

*The data on other professionals and nonprofessionals are not disaggregated by level. Hence, we can only examine the overall staff/pupil ratios for personnel in these categories.

For notational convenience, we can rewrite Eq. 14 in the form

$$b = \sum_{i=1}^{9} p_i x_i ,$$

where $p_i = 1$ for $i = 5, \ldots, 9$ and

$$X_1 = T_E/E, \qquad p_1 = P_T E/A,$$

$$X_2 = T_S/S, \qquad p_2 = P_T S/A,$$

$$X_3 = T_O/A, \qquad p_3 = P_T,$$

$$X_4 = N/A, \qquad p_4 = P_N.$$

The X_i for $i = 5, \ldots, 9$ remain unchanged.

Maximization of Eq. 13 subject to Eq. 14 is equivalent to maximization of the Lagrangian expression,

$$L = \prod_{i=1}^{9} (X_i - C_i)^{\alpha_i} + \lambda\left(\sum_{i=1}^{9} p_i X_i - b\right) .$$

The first-order conditions for a maximum are

$$\frac{\partial L}{\partial x_i} = \frac{\alpha_i \prod_{j=1}^{9} (X_j - C_j)^{\alpha_j}}{X_i - C_i} + \lambda p_i = 0 \qquad i = 1, \ldots, 9$$

$$\frac{\partial L}{\partial \lambda} = \sum_{i=1}^{9} p_i X_i - b = 0 .$$

Solving the ith equation for λ and substituting into the jth equation we obtain

$$\frac{p_i(X_i - C_i)}{p_j(X_j - C_j)} = \frac{\alpha_i}{\alpha_j} , \qquad i, j = 1, \ldots, 9 . \qquad (15)$$

Note that if the district is required to obtain C_i units of the ith input, then $X_i - C_i$ is the number of units beyond the minimum requirement purchased by the district. The cost of the additional units is $p_i(X_i - C_i)$. Thus, the ratio of the district's discretionary expenditures on the ith input to its descretionary expenditures on the jth input equals the ratio of α_i to α_j.

Finally, if we sum Eq. 15 over i = 1, ..., 9, for fixed j and assume that $\sum_{i=1}^{9} \alpha_i = 1$, we obtain

$$\alpha_j = \frac{p_j(X_j - C_j)}{\sum_{i=1}^{9} p_i(X_i - C_i)} \qquad j = 1, \ldots, 9 ,$$

which shows that α_j is the share of the district's discretionary budget expended on the jth input.

Solving the system of equations (Eq. 15) and using the budget constraint (Eq. 14), we obtain the system of expenditure equations:

$$p_i X_i = \alpha_i b - \sum_{j=1}^{9} \alpha_i C_j p_j + C_i p_i \qquad i = 1, \ldots, 9 .$$

Rewriting these equations in terms of the exogenous variables, we obtain the system used for empirical estimation.* Thus,

$$p_i X_i = \beta_{i0} + \beta_{i1} b + \beta_{i2} \frac{P_T E}{A} + \beta_{i3} P_T + \beta_{i4} P_N \qquad i = 1, 3, \ldots, 9$$

$$p_2 X_2 = \beta_{20} + \beta_{21} b + \beta_{22} \frac{P_T S}{A} + \beta_{23} P_T + \beta_{24} P_N , \qquad (16)$$

*Recall that $p_1 + p_2 = p_3$.

where

$$\beta_{i0} = \begin{cases} -\alpha_i \sum_{j=5}^{9} C_j & i = 1, \ldots, 4 \\ C_i - \alpha_i \sum_{j=5}^{9} C_j & i = 5, \ldots, 9 \end{cases}$$

$$\beta_{i1} = \alpha_i \qquad i = 1, \ldots, 9$$

$$\beta_{12} = C_1 - \alpha_1(C_1 - C_2)$$

$$\beta_{22} = C_2 + \alpha_2(C_1 - C_2)$$

$$\beta_{i2} = -\alpha_i(C_1 - C_2) \qquad i = 3, \ldots, 9$$

$$\beta_{i3} = -\alpha_i(C_2 + C_3) \qquad i = 1, 4, \ldots, 9$$

$$\beta_{23} = -\alpha_2(C_1 + C_3)$$

$$\beta_{33} = C_3 - \alpha_3(C_2 + C_3)$$

$$\beta_{i4} = -\alpha_i C_4 \qquad i = 1, 2, 3, 5, \ldots, 9$$

$$\beta_{44} = C_4 - \alpha_4 C_4 .$$

Equation 16 is a system of nine expenditure equations, each of which models school district behavior with respect to expenditures for a school input. We estimated each expenditure equation for the district in each of the 12 status samples. The results of these 108 regressions are presented in the Appendix tables.

IV. LIMITATIONS OF THE ANALYSIS

Time and resource constraints have forced us to restrict the scope of the empirical analysis in two important respects. We treat the districts' budgets and the teachers' and nonprofessionals' salary levels as exogenous variables. This approach clearly limits the set of issues that can be addressed by the model. We have also been forced to disregard certain econometric considerations implicit in the model.

The limitations of the currently available ELSEGIS data restrict this analysis in a variety of ways. One obvious problem is the restriction of the empirical work to a cross-sectional analysis of district expenditure behavior in the 1969-1970 school year. Another important problem is the lack of data on personnel flows (e.g., terminations and new hires), which forces us to formulate the analysis in terms of desired stocks of elementary and secondary teachers and other professionals. We are also concerned about the extremely crude definitions of district type and the price of a teacher we have had to use. Finally, we lack the data needed to assess the influence of teacher degree level and experience in district decisionmaking. Each of these problems is discussed below.

EXOGENOUS VARIABLES

We have treated the districts' budgets and the salary levels of both teachers and nonprofessionals as exogenous variables (i.e., determined outside the model). This approach has serious implications for the use of the model in policy analyses. We cannot address the issue of how an increase in a school district's budget will be divided between increased teacher and/or nonprofessional salaries on the one hand, and the acquisition of additional personnel and nonpersonnel school inputs on the other hand. Moreover, we cannot address the issue of how changes in a community's willingness and/or ability to pay will affect a district's budget. Nor can we relate federal or state aid policies to district budgetary behavior. In essence, the model presented above represents an investigation of school district expenditure policies in the short run. We have examined how a school district with a given budget, facing given factor market conditions, allocates its budget among inputs.

An important consequence of this limitation of the model concerns its use in projection. The model cannot be used to project the demand for teachers or for any other school input. Rather, school district budgets and teacher and nonprofessional salary levels must first be independently projected. Only then can the model be used to examine the implications of those projections for the allocation of expenditures among school inputs.

The implication of this observation for future research in this area is clear. Research efforts should be directed toward the development of simultaneous models of teachers' price determination and expenditure behavior.* These models would consist of (1) a specification of school district objectives, e.g., a preference function such as the one used in this analysis, (2) a specification of the objectives of teachers or teachers' unions expressing, for example, their willingness to trade off pay increases for reductions in class size or for the provision of specialists or aides who could reduce the teachers' work load. Following that, more general models incorporating the budget determination process should be developed.

ESTIMATION PROCEDURE

The second important limitation of this analysis concerns the procedures used to estimate the school district expenditure equations

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*In view of the small proportion of districts' expenditures allocated to nonprofessionals and the consequent negligible impact of changes in the salary level of nonprofessionals, detailed analysis of the determination of P_N does not seem warranted.

(Eq. 16). The nine expenditure equations in the system contain a total of 45 parameters (β_{ij}, for i = 1, ..., 9 and j = 0, ..., 4) to be estimated. However, each of the 45 parameters is a function of the 18 structural parameters of the assumed district preference function (Eq. 13). That is, each of β_{ij} is a function of the α_i and C_i (i = 1, ..., 9). Clearly the β_{ij} are not independent.

Park (1969) outlines a statistical procedure for the estimation of expenditure systems, such as the one examined here, that yield consistent, maximum likelihood estimators for β_{ij}. Unfortunately, that procedure requires more time and resources than were available for this analysis. Moreover, we wished to test the model with the data to discover whether or not an unconstrained estimation of the expenditure system would yield parameter estimates that approximately satisfied the implicit relationships among β_{ij}. Accordingly, we estimated each of the nine expenditure equations of the system (Eq. 16) independently.

The implication of this limitation of the analysis is that the estimates presented in the Appendix tables, and the elasticities of demand calculated from those estimates (discussed in Sec. V) cannot be accepted uncritically. When time and resources permit, the system should be reestimated using an approach that preserves the implicit relationships among the β_{ij}.

LONGITUDINAL DATA

The policy issues addressed in this study hinge on district responses, in terms of their expenditures for various school inputs, to changes in their budgets or in the salaries paid to teachers and nonprofessionals. An appropriate approach would clearly include a longitudinal analysis in which changes in district budgets or in their teacher and nonprofessional salary levels were related to changes in their expenditure patterns. Unfortunately, the only national data base on school district expenditures and staffing patterns, the ELSEGIS files, does not lend itself to this approach. The two-part ELSEGIS instrument obtains data on current district staffing; but the financial data obtained each year refers to the previous year. Thus, changes in a district's staff could be related to changes in its budget only if the district were included in the sample for three consecutive years. The ELSEGIS design, a random sample of districts stratified by enrollment size, yields relatively few cases in which a district is included three continuous years except for the large districts that are automatically covered each year. Moreover, the results of this analysis show that different types of districts have quite different expenditure patterns. Thus, longitudinal analysis would require that a reasonable sample of districts of each type be included in the survey for three consecutive years.

In this study we merged staffing data from ELSEGIS II (1969) with finance data from ELSEGIS III (1970) for the 671 large districts included in both.* When ELSEGIS IV becomes available it may be possible to link its financial data to the ELSEGIS III staffing data for most if not all of these districts. If so, differences in district budgets or salary levels between the 1969-1970 and the 1970-1971 school years can be directly related to differences in their staffing patterns between those two years. If, however, for some reason the ELSEGIS IV data cannot be merged with the data from the earlier surveys, we can see no immediate solution to the problem.

Longitudinal staffing and finance data are available on the district level in some states. Such studies could thus be conducted for the districts in a state. But the substantial differences in expenditure patterns we have found among districts in different regions, even though they have the same metropolitan status, raise questions as to the generality of results thereby obtained. (It is possible that "region" is not an appropriate basis for defining district types. If so, there is a possibility that statewide studies would yield generalizable results.)

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*As a matter of analytic convenience we used the data for 612 districts. See Sec. II.

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It is clear that the ELSEGIS design does not provide a very satisfactory basis for longitudinal analyses.* As long as the large districts are automatically included each year, this problem is somewhat alleviated. As demonstrated in this analysis, the number of such districts is sufficient to support fairly detailed empirical studies. The large districts include approximately one-half of the elementary and secondary public school pupils and educational professionals in the nation, and therefore understanding their behavior is important. However, the large districts may not be representative of school districts in general. It would be desirable to develop an understanding of the behavior of smaller districts, which account for more than 95 percent (in 1970) of all local educational agencies.

In summary, the lack of longitudinal data on district expenditures and staffing patterns significantly limits empirical work, and the ELSEGIS design is not conducive to the development of a longitudinal data base for smaller districts. Accordingly, the automatic inclusion of large districts in the sample, which results in the generation of longitudinal data for those districts, should be retained, and consideration should be given to adapting the design to obtain longitudinal data for smaller districts.

STOCK AND FLOW

The ELSEGIS files do not contain data on either new hires or terminations. Only the numbers of educational professionals employed by each district are available. This data limitation is reflected in our empirical work, which focuses on the "stock" of elementary and secondary teachers and other professionals demanded by a district given its budget and the factor market conditions it faces. The lack

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*We must note that a variety of factors other than those addressed here impinge on the design of a large annual survey such as the ELSEGIS. Our purpose is not to suggest that the ELSEGIS design be changed in the light of this analysis but, rather, to bring these points to the attention of those concerned.

of data on new hires and terminations is unfortunate since it precludes the translation of our estimates of the demands for educational professionals, which pertain to the numbers of professionals a district will seek to have on its staff, into statements about the numbers of persons the district will newly employ. This problem is important in addressing issues related to the teacher surplus since the relevant concern is generally the number of trained personnel who cannot find a position.

We should note that the stock of professionals in a district in any given year equals the previous year's stock less terminations plus new hires. Thus, if staffing data are available for a district in two consecutive years, we can compute terminations from data on new hires and vice versa.

In sum, issues related to the teacher surplus are contingent on the number of trained professionals seeking a position in relation to the number of positions available. The number of available positions, in turn, depends upon the termination rate. Consideration should be given to the acquisition of data on either new hires or terminations to supplement ELSEGIS.

DISTRICT TYPE

The definition of district type used in this analysis leaves much to be desired. We use region and metropolitan status to distinguish among districts because these are the only variables in the ELSEGIS files related to the community each district serves. As will be shown in Sec. V, the results of the empirical work demonstrate that different types of districts exhibit markedly different expenditure behavior at the margin despite the similarity in overall expenditure patterns. We presume that more meaningful (that is, more directly related to a community's educational needs and priorities) descriptors of district type would enhance the quality of the estimates considerably.

It may be possible for ELSEGIS to collect some data on district pupil characteristics (e.g., percentage minority, percentage of pupils

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on welfare, rate of growth in enrollment, absenteeism, and so on), which would permit district type to be defined in terms of the kinds of pupils a district serves. More elaborate measures of the characteristics of the community served by a district (e.g., average income or educational level) are potentially available from other sources such as the Census. What is needed, however, is the development of techniques for mapping such data into districts.

TEACHER SALARY

We have used the average salary of educational professionals as a measure of the price of a teacher. Since teachers are an overwhelming majority of these professionals, this is probably a reasonably accurate estimate of the average teachers' salary. Unfortunately, average teachers' salary may not be a particularly accurate estimate of the price of a teacher to the district.

When a district employs a teacher it incurs costs equal to the salary it pays that teacher plus the expenditures it makes on his or her behalf. The ELSEGIS accounting system reports recurrent expenditures not readily allocable to other accounts in the fixed charges category. These include employer contributions to employee retirement as well as insurance, judgments, rental of land and buildings, and so on. To the extent that a district's "fixed charges" include expenditures that vary with the employment of teachers and other professionals, our measure understates the average price of a teacher. Consideration should be given to possible changes in the ELSEGIS accounting system that would separately report what are, in essence, expenditures for professionals' fringe benefits.

We should also note that the costs of providing fringe benefits, most notably contributions to retirement, are likely to become an increasingly important aspect of school district budgeting. During the 1950s and 1960s there was rapid growth in the number of professionals engaged in education. Barring major continuing increases in school district per pupil budgets, the leveling off of enrollments that began in the late 1960s and is projected to continue into the

1980s implies a similar leveling off in professional staff. We can thus expect relatively rapid "ageing" to occur. To the extent that employer contributions to employee retirement are related to experience or to salary, which in the vast majority of districts is a function of experience (and degree level), we can expect district expenditure for employee retirement to grow, even if staff sizes, salary schedules, and retirement benefits remain unchanged. If retirement benefits grow, the problem is exacerbated, even in "fully funded" plans. Districts participating in retirement plans funded on a revolving basis may encounter extreme problems if retirement "bulges" materialize in the early 1980s.

These observations are speculative. The lack of data precludes analysis of these issues. However, the change in the ELSEGIS accounting system suggested above would provide the kinds of data needed to begin to assess the potential extent to which such problems may emerge in the future. Of course, detailed analysis would require additional data on the types of retirement plans in which districts participate, coverage, benefits, and so on. These data would probably have to be obtained in a special survey, perhaps supplemental to the ELSEGIS.

Returning to the problem of measuring the price of a teacher, even if we had the average cost, to the district, of employing a professional, we would still lack a good measure of what the district perceives as the price of a teacher. A teacher's salary depends upon his or her degree level and experience. The price of an inexperienced teacher with a Bachelor's degree can be one-half to two-thirds the price of a teacher who has had years of experience and possesses a Master's degree. How much it costs a district to hire a teacher depends upon the kind of teacher it hires. We lack the data needed to assess the districts' priorities in this regard (see below) and hence do not know what the district uses as a measure of the price of a teacher when it makes staffing decisions.

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TEACHER CHARACTERISTICS

The ELSEGIS files provide no data on the characteristics of teachers or other professionals other than assignment, e.g., elementary teacher, secondary teacher, principal, and so on. The conventional wisdom holds that a teachers' degree level and experience matter. It seems reasonable to believe that districts have preferences for one type of teacher as compared to another. And, as noted above, the cost of employing a teacher certainly varies with these characteristics. Districts are thus confronted with choices among inputs which may, from the district's point of view, differ in quality* and which certainly differ in price. The lack of data on teacher characteristics precludes analysis of this aspect of district expenditure behavior. Consideration should be given to amending the ELSEGIS staffing instrument to obtain data on the distributions of teachers by degree level and experience.

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*Whether a teacher's experience or degree level actually affect the "quality" of education is not at issue here.

V. EMPIRICAL RESULTS

This section is divided into four parts. We begin by defining some basic concepts that will be used later in the section. In the second part we examine the demand for educational professionals, elementary and secondary teachers, and "other" professionals. We then examine the demand for nonprofessionals and, in addition, demands for nonpersonnel school inputs. Since the primary focus of this analysis is the school districts' demands for educational professionals, we devote relatively little attention to the other input categories.

PRELIMINARY REMARKS

The expenditure model (Eq. 16) contains nine expenditure equations, each of which "explains" school district expenditures for one of the nine school inputs included in the analyses. The coefficient of b in each equation, β_{i1} in the equation for the ith input, is particularly interesting because it is an estimate of the parameter α_i. Recall that this parameter indicates the share of a district's discretionary budget that it will spend on the ith input. We can thus interpret the coefficient as the rate of increase (decrease) in a district's expenditures for elementary teachers that would accompany an increase (decrease) in its budget.* For example, β_{11} for North Atlantic Central City districts is .223. This implies that, other things being equal, if such a district's budget were increased by, say, $10 per pupil, its expenditures for elementary teachers would increase by $2.23 per pupil. We would expect the estimate of α_i to be positive.

The partial elasticity of expenditures on the ith input with respect to the budget is defined as the percentage change in expenditures

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*Since we assume that the district's budget is sufficient to meet the minimum requirements, any marginal increase (decrease) in its budget is an increase (decrease) in its discretionary funds.

for the ith input divided by the percentage change in the budget and denoted $\varepsilon(P_iX_i{:}b)$.* The partial elasticity of expenditures on the ith input for the teachers' salary level, P_T, is defined as the percentage change in the expenditures for the ith input divided by the percentage change in the "price" of teachers and denoted $\varepsilon(P_iX_i{:}P_T)$. The important property of the elasticity of a function is that it is a number that is independent of the units in which the variables are measured. (An elasticity is defined in terms of proportional changes that are necessarily independent of units.)

For example, $\varepsilon(P_iX_i{:}b) = \beta_{11}b/P_iX_i$. Thus, the partial elasticity of expenditures per pupil for elementary teachers with regard to the budget equals β_{11} multiplied by the budget divided by expenditures per pupil for elementary teachers. Multiplying both sides of the first equation of Eq. 16 by A, taking the partial derivative with respect to b, and then multiplying that partial derivative by b/P_TT_E, we obtain the following set of relationships:**

$$\left(\frac{b}{P_TT_E}\right)\left(\frac{\partial(p_1X_1A)}{\partial b}\right)=\left(\frac{b}{P_TT_E}\right)\left(\frac{\partial(P_TT_E)}{\partial b}\right)=\frac{\beta_{11}bA}{P_TT_E}=\frac{\beta_{11}b}{p_1X_1},$$

which shows that the partial elasticity of expenditures for elementary teachers with respect to the budget is independent of the units in which expenditures are measured.

The elasticities cited below are, in all cases, calculated at the mean. In North Atlantic central city districts, β_{11} is estimated to be .223; the average budget in such districts is $765.36 per pupil; and

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*In general, if $X = f(y_1, y_2, \ldots, y_n)$, the partial elasticity of X regarding y_i is $\frac{X}{y_i}\frac{\partial f(y_1y_2, \ldots, y_n)}{\partial X}$ and will be denoted $\varepsilon(X{:}y_i)$.

**Recall that $p_1X_1 = \left(\frac{P_TE}{A}\right)\left(\frac{T_E}{E}\right)$.

the average expenditure per pupil for elementary teachers is \$247.68. Hence, for North Atlantic central city districts, $\varepsilon(p_1X_1:b) = .689$. In other words, a 1-percent increase (decrease) in a North Atlantic central city district budget will be translated into a .69-percent increase (decrease) in its expenditures for elementary teachers.

One final comment on the concept of a partial elasticity is in order. In all cases, we explicitly assume that the exogenous variables are independent. Thus, the partial elasticity of expenditures for the ith input in terms of b (or P_T) is the percentage change in p_iX_i that would result from a 1-percent change in $b(P_T)$, assuming that $(b)P_T$ and P_N are not affected by the change in $b(P_T)$.

DEMAND FOR EDUCATIONAL PROFESSIONALS

The first three equations of the system in Eq. 16 describe school district behavior regarding expenditures per pupil for elementary teachers, secondary teachers, and other professionals, respectively. Thus,

$$\frac{P_T T_E}{A} = \beta_{10} + \beta_{11} b + \beta_{12} \frac{P_T E}{A} + \beta_{13} P_T + \beta_{14} P_N \qquad (16.1)$$

$$\frac{P_T T_S}{A} = \beta_{20} + \beta_{21} b + \beta_{22} \frac{P_T S}{A} + \beta_{23} P_T + \beta_{24} P_N \qquad (16.2)$$

$$\frac{P_T T_O}{A} = \beta_{30} + \beta_{31} b + \beta_{32} \frac{P_T E}{A} + \beta_{33} P_T + \beta_{34} P_N \ , \qquad (16.3)$$

where the β represents functions of the parameters α_i and $C_i (i = 1, \ldots, 9)$. Multiplying each equation through by A/P_T, we obtain the derived demand equations for the three categories of educational professionals:

$$T_E = \left(\beta_{10} + \beta_{11} b + \beta_{14} P_N\right) \frac{A}{P_T} + \beta_{12} E + \beta_{13} A \ ,$$

and similarly for Eqs. 16.2 and 16.3. Tables A1 through A3 in the Appendix provide the results of the estimation of Eqs. 16.1 through 16.3 for each of the 12 regions defined by metropolitan status.*

Overall, the model performs extremely well. The model explains about 90 percent of the variance in district behavior regarding per pupil expenditures for elementary teachers in 10 of the 12 samples. The results for central city school districts and for suburban districts in the Great Lakes and Plains region -- regressions numbered 1.21 and 1.22 -- are somewhat less satisfactory though even in these two cases roughly 65 percent of the variance in expenditures for elementary teachers is explained by the model. The model performs even better with respect to expenditures per pupil for secondary teachers, explaining at least 80 percent of the variance in every case and better than 90 percent in 7 of the 12 cases.

The residual category of professionals ("other professionals") contains a heterogeneous group of personnel including teachers not assigned to an elementary or secondary school, various specialists, and supervisory personnel employed in the school building. It is no surprise that the model does less well in explaining expenditures for other professionals. Roughly 70 percent of the variance in expenditures for personnel in this category is captured.

The F statistics for the regressions are very high in every case.

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*We also estimated the normalized derived demand equations corresponding to Eqs. 16.1 through 16.3. For example,

$$\frac{T_E}{E} = \beta_{12} + \beta_{10}\frac{A}{P_T E} + \beta_{11}\frac{bA}{P_T E} + \beta_{13}\frac{A}{\beta} + \beta_{14}\frac{P_N A}{P_T E} .$$

The value of R^2 obtained for each estimation was, of course, lower than that obtained from the estimation of the corresponding expenditure equation. However, the parameter estimates were not greatly affected. In particular, the estimates of β_{i1}, β_{i3}, and β_{i4} were virtually identical in the two sets of estimates for $i = 1, 2, 3$, for all 12 regional samples. The estimates of β_{i0} and β_{i2} were somewhat less stable across the two approaches, but the differences were never large.

Demand for Elementary Teachers

Table 1 summarizes the demand for elementary teachers in terms of three characteristics of the demand function: α_1, the rate at which a marginal change in a district's budget is translated into expenditures for elementary teachers; $\varepsilon(T_E:b)$, the partial elasticity of the demand for elementary teachers in regard to the budget; and $\varepsilon(T_E:P_T)$, the partial elasticity of the demand for elementary teachers in regard to the price of teachers. These are calculated using the parameter estimates of Appendix Table A1.

The estimated values of $\alpha_1(\beta_{11})$ are positive, as expected, in every case and significant at the 1-percent level in 9 of the 12 cases. The coefficient is not significant for the North Atlantic nonmetropolitan districts, the Great Lakes and Plains central city districts, and the nonmetropolitan districts in the West and Southwest. Among those cases where the coefficient is significant, it ranges in value from about .15 in the Southeast and West and Southwest central city districts, to .28 in North Atlantic suburban districts. In general, then, there are major differences among district types in terms of their demands for elementary teachers. North Atlantic suburban districts would devote nearly 30 percent of a budget increment to increased expenditures for elementary teachers, whereas other types of districts would allocate a share of a budget increment insignificantly different from zero to that expenditure category.

The third column of Table 1 provides estimates of $\varepsilon(T_E:b)$. Note that, with respect to the budget, the partial elasticity of expenditures for elementary teachers, the partial elasticity of the demand for elementary teachers, and the partial elasticity of the teacher/pupil ratio at the elementary level are identical.* Thus, a 1-percent increase in a North Atlantic central city district's budget would yield a .69-percent increase in its expenditures for elementary teachers, a .69-percent increase in the number of elementary teachers it would seek to employ, and a .69-percent increase in its teacher/pupil ratio at the elementary level.

*That is, $\varepsilon(P_T T_E:b) = \varepsilon(T_E:b) = \varepsilon(T_E/E:b)$.

Table 1

SUMMARY OF DEMAND FOR ELEMENTARY TEACHERS

District Type	α_1	$\varepsilon(T_E{:}b)$	$\varepsilon(T_E{:}P_T)$
North Atlantic			
Central City	.223	.689	-.760
Metropolitan, Other	.286	.928	-1.078
Nonmetropolitan	.029	.090	-.235
Great Lakes and Plains			
Central City	.053	.166	-.378
Metropolitan, Other	.170	.527	-.848
Nonmetropolitan	.193	.572	-.876
Southeast			
Central City	.156	.424	-.246
Metropolitan, Other	.235	.645	-.532
Nonmetropolitan	.201	.556	-.308
West and Southwest			
Central City	.155	.466	-.409
Metropolitan, Other	.170	.503	-.369
Nonmetropolitan	.097	.300	-.316

The budget elasticities of demand for elementary teachers range from .09 in North Atlantic nonmetropolitan districts to .93 in North Atlantic suburban districts. In general, it appears that a 1-percent increase in a school district's budget will induce an increase of approximately .5 percent in its demand for elementary teachers, expenditures for elementary teachers, and teacher/pupil ratio at the elementary level.

There are, however, substantial differences among the 12 samples. Even neglecting the upper extreme and the three cases in which the elasticity is based on an estimate of α_1 not significantly different from zero, there are major differences among districts having differing metropolitan status within a region and among districts having the same metropolitan status in different regions. Within the North Atlantic and Southeast regions, for example, the budget elasticities in suburban districts are about 50 percent greater than the respective budget elasticities in central city districts. Similarly, North Atlantic central city districts have an elasticity about 50 percent greater than the elasticities of central city districts in either the Southeast or the West and Southwest regions.

The relationship between the "price" of an elementary teacher -- the teachers' salary level, P_T -- and a district's expenditures per pupil for elementary teachers is relatively straightforward. An increase in the teachers' salary level increases the cost of meeting the minimum requirements for educational professionals* and thus reduces the district's discretionary budget. Since a constant proportion, α_1, of the discretionary budget will be allocated to the employment of elementary teachers, the number of discretionary dollars allocated to elementary teachers will be reduced. Each additional elementary teacher costs more, and there are fewer dollars available for discretionary purchases of elementary teachers. The number of elementary teachers demanded at the increased salary level thus will be reduced.

The above argument does not, however, imply that the district's total expenditures on elementary teachers will necessarily be reduced as a result of an increase in the price of teachers, despite the fact that discretionary expenditures on elementary teachers will be reduced. Expenditures on the minimum required number of elementary teachers at the new higher price will be increased. Hence, what happens to expenditures on elementary teachers when P_T is increased depends upon whether the increase in required expenditures for elementary teachers is greater or less than the decrease in discretionary expenditures for elementary teachers.

Partially differentiating Eq. 16.1 with respect to P_T and substituting for β_{12} and β_{13} yields

$$\frac{\partial\left(\frac{P_T T_E}{A}\right)}{\partial P_T} = \beta_{12}\frac{E}{A} + \beta_{13} = (C_1 - \alpha_1(C_1 - C_2))\frac{E}{A} - \alpha_1(C_1 + C_3).$$

*An increase in P_T makes secondary teachers and other professionals more expensive as well as increasing the cost of elementary teachers.

Recall that C_1 is the minimum required teacher/student ratio at the elementary level. We define T_E' to be the minimum required number of elementary teachers; i.e., $C_1 = T_E'/E$. Similarly, $C_2 = T_S'/S$ and $C_3 = T_O'/A$, where T_S' and T_O' are the minimum required numbers of secondary teachers and other professionals. Then,

$$\frac{\partial\left(\frac{P_T T_E}{A}\right)}{\partial P_T} = \frac{T_E'}{A} - \frac{\alpha_1\left(T_E' + T_S' + T_O'\right)}{A} .$$

The first term on the right-hand side of the equation, T_E'/A, is the rate of change in expenditures per pupil for the minimum required number of elementary teachers. The second term, $\alpha_1(T_E' + T_S' + T_O')/A$, is the rate of change in expenditures per pupil for the minimum required number of professionals, $(T_E' + T_S' + T_O')A$, which equals the change in the district's discretionary budget multiplied by the share of the discretionary budget, α_1, allocated to expenditures for elementary teachers.

The estimates of β_{12} and β_{13} for each of the 12 samples are given in the Appendix (Table A1). The β_{12} is positive as expected and significantly different from zero at the 1-percent level in every case. The estimates range from .03 to .06. The estimates of β_{13} are uniformly negative as expected and significantly differ from zero at the 5-percent level in 11 of the 12 cases. In West and Southwest nonmetropolitan districts, β_{13} is insignificant at the 5-percent level.

The fourth column of Table 1 indicates the partial elasticities of the demand for elementary teachers with regard to teacher salary for each of the 12 samples. The $\varepsilon(T_E:P_T)$ are all, of course, negative and range in value from -.23 to -1.08. The interpretation of these estimates follows directly from the definition of the partial elasticity of the demand for elementary teachers. In North Atlantic central city districts, for example, $\varepsilon(T_E:P_T)$ equals -.76, which implies that a 1-percent increase in teachers' salaries would lead to a .76 percent reduction in the number of elementary teachers demanded.

The partial elasticity of expenditures for salaries of elementary teachers is equal to one plus the partial elasticity of demand for elementary teachers with respect to salary.* Thus, except for one case -- North Atlantic suburban districts -- an increase in the price of teachers would lead to an increase in expenditures for elementary teachers despite the fact that fewer elementary teachers will be employed as their price rises. In North Atlantic central city districts, for example, expenditures for elementary teachers would rise by .24 percent for each percent increase in teacher salary.

The remaining variable in Eq. 16.1 is the salary level of nonprofessional staff, P_N. Its effect upon expenditures per pupil for elementary teachers is similar to the effect of P_T. That is, an increase in P_N increases the district's cost of meeting the minimum requirement for nonprofessionals which, in turn, reduces the district's discretionary budget. Finally, the reduction in the district's discretionary budget is reflected in reduced discretionary expenditures for elementary teachers.**

The coefficient of P_N, β_{14}, is negative as expected in 11 of the 12 samples. However, β_{14} is significantly different from zero at the 5-percent level in only two cases. Elasticities of the demand for elementary teachers in terms of P_N are quite small in all cases (approximately -.02).

Demand for Secondary Teachers

Table 2 summarizes the demand for secondary teachers in terms of α_2 -- the rate at which marginal changes in a district's budget are

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*That is, $\varepsilon(P_T T_E : P_T) = \varepsilon(T_E : P_T) + 1$.

**Taking the partial derivative of Eq. 16.1 with respect to P_N and substituting for β_{14},

$$\frac{\partial\left(\frac{P_T T_E}{A}\right)}{\partial P_N} = -\alpha_1 C_4 = \frac{-\alpha_1 N'}{A} ,$$

where N' is the minimum required number of nonprofessional staff.

translated into expenditures for secondary teachers -- and the partial elasticities of the demand for secondary teachers with respect to the budget and the teachers' salary level. The parameter estimates appear in Appendix Table A2.

The coefficient of b in each regression, β_{21}, is an estimate of the parameter α_2 for the districts in the sample. It is interpreted as the rate of increase in a district's expenditures for secondary teachers that would result from an increase in its budget. The second column of Table 2 displays the estimates of α_2 for the districts in each of the 12 samples.

The estimated values of α_2 are positive, as expected, in every case, and statistically significant at the 1-percent level in 10 of the 12 cases. In the case of the nonmetropolitan North Atlantic districts, the coefficient fails to be significant at the 5-percent level. The estimates range from .07 in North Atlantic nonmetropolitan districts to about .25 in Great Lakes and Plains and Southeast suburban districts. As was the case for elementary teachers, there are major differences among district types in terms of the share of a marginal change in their respective budgets that would be allocated to secondary teachers.

The partial elasticities of demand for secondary teachers with respect to the budget are displayed in the third column of Table 2. They are, of course, positive in every case. The elasticities range between .27 and .89. In general, it appears that a 1-percent increase in a school district budget will yield an increase in its expenditures for secondary teachers of approximately .6 percent.* There are, again, major differences among district types. Hence, the impact of a budget increase upon the demand for secondary teachers varies considerably from one type of district to another. Among North Atlantic districts, for example, the elasticity of demand for secondary teachers in metropolitan areas (both central city and suburban districts) is more than twice that of nonmetropolitan areas.

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*Note that $\varepsilon(P_T T_S:b) = \varepsilon(T_S/S:b) = \varepsilon(T_S:b)$.

Table 2

SUMMARY OF DEMAND FOR SECONDARY TEACHERS

District Type	α_2	$\varepsilon(T_S:b)$	$\varepsilon(T_S:P_T)$
North Atlantic			
Central City	.152	.573	-.843
Metropolitan, Other	.180	.630	-1.031
Nonmetropolitan	.071	.270	-.298
Great Lakes and Plains			
Central City	.118	.453	-.499
Metropolitan, Other	.259	.849	-.766
Nonmetropolitan	.127	.420	-.171
Southeast			
Central City	.195	.687	-.465
Metropolitan, Other	.252	.888	-.858
Nonmetropolitan	.155	.582	-.451
West and Southwest			
Central City	.177	.611	-.579
Metropolitan, Other	.153	.541	-.519
Nonmetropolitan	.162	.579	-.568

The relationship between the teacher salary level, P_T, and expenditures for secondary teachers can be viewed in the same terms as the earlier discussed relationship between P_T and expenditures for elementary teachers. A change in P_T affects the district's discretionary budget which, in turn, affects its discretionary expenditures for secondary teachers. Partially differentiating Eq. 16.2 in terms of P_T and substituting for β_{22} and β_{23} and then for C_1, C_2, and C_3 yields

$$\frac{\partial\left(\frac{P_T T_S}{A}\right)}{\partial P_T} = \beta_{22}\frac{S}{A} + \beta_{23} = (C_2 + \alpha_2(C_1 - C_2))\frac{S}{A} - \alpha_2(C_1 + C_3)$$

$$= \frac{T_S'}{A} - \alpha_1 \frac{\left(T_E' + T_S' + T_O'\right)}{A} .$$

The first term on the right-hand side of the equation, T_S'/A, is the rate of increase, with respect to P_T, in per pupil required expenditures for secondary teachers. The second term on the right side is the rate of increase, with respect to P_T, in required per pupil expenditures for professionals, which equals the rate of decrease in the discretionary budget (note the minus sign) times the share of the discretionary budget allocated to secondary teachers.

Estimates of β_{22} and β_{23} for each of the 12 samples are presented in Appendix Table A2. The β_{12} has the expected positive sign and is significant at the 1-percent level in 9 of the 12 cases. The estimates of β_{12} fall between .035 and .049, while the estimated values of β_{13} range from -.021 to -.001.

The partial elasticities of the demand for secondary teachers with respect to P_T are displayed in the fourth column of Table 2. All are negative and, except North Atlantic suburban districts, all are greater than -.85. The $\varepsilon(T_S:P_T)$ for North Atlantic suburban districts is -1.03. The partial elasticity of expenditures for secondary teachers with respect to the teachers' salary level equals one plus the partial elasticity of demand for secondary teachers with respect to P_T. Hence, with the exception of North Atlantic suburban districts, $\varepsilon(P_T T_S:P_T)$ is positive and less than one.

In sum, these results imply that a 1-percent increase in teacher salary level would lead to a reduction in the number of secondary teachers demanded. The magnitude of the reduction would be between .17 and 1.03 percent, depending upon district type. Expenditures for secondary teachers would rise by .16 to .83 percent, again depending upon district type, except for North Atlantic suburban districts where expenditures on secondary teachers would fall slightly.

The coefficient of the price of nonprofessionals, P_N, has the expected negative sign in 10 of the 12 cases, but is significantly different from zero at the 5-percent level in only three cases. Moreover, one of the significant coefficients (regression 2.13) has the wrong sign. The magnitudes of the coefficients tend to be so small that the $\varepsilon(T_S:P_N)$ are negligible.

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Demand for "Other" Professionals

We now turn to the results for educational professionals other than elementary and secondary teachers. Table A3 in the Appendix displays the results of the estimation of Eq. 16.3 for the 12 samples. Table 3 provides the estimates of α_3 -- the rate at which marginal budget changes are transformed into expenditures for other professionals -- and the partial elasticities of demand for other professionals with regard to budget, $\varepsilon(T_O:P_T)$, and with regard to the teacher salary level, $\varepsilon(T_O:P_T)$.

The values of β_{31}, the coefficients of b, are estimates of the parameter α_3. They are positive, as expected, and statistically significant at the 1-percent level in every case. The estimated values range from .09 in Southeast suburban districts to .32 in Great Lakes and Plains central city districts. These results imply that, in general, about one-fifth of a marginal change in a district's budget would be allocated to expenditures for the professionals.

It is interesting to note that school district expenditures for elementary teachers tend to be three to four times as large as their expenditures for other professionals. Expenditures for secondary teachers tend to be smaller than expenditures for elementary teachers, but are still roughly three times the size of expenditures for other professionals.* However, among the 12 samples, α_3 -- the share of the discretionary budget allocated to other professionals -- is generally as large or larger than α_1 or α_2 -- the respective shares of the discretionary budget allocated to elementary and secondary teachers. This implies that the relatively large proportions of districts' budgets allocated to expenditures for elementary and secondary teachers is not indicative of their spending behaviors at the margin. Districts spend large shares of their budgets on elementary and secondary teachers to meet the minimum requirements for those two inputs. A much smaller share of the discretionary budget is devoted to expansion of the teaching staff beyond the minimum required levels.

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*See Appendix Tables A1, A2, and A3. The entries in the first row of each table give mean expenditures per pupil for the 12 samples for the school input to which the table applies.

Table 3

SUMMARY OF DEMAND FOR OTHER PROFESSIONALS

District Type	α_3	$\varepsilon(T_0:b)$	$\varepsilon(T_0:P_T)$
North Atlantic			
Central City	.216	2.031	-1.688
Metropolitan, Other	.202	2.087	-1.299
Nonmetropolitan	.306	3.194	-2.937
Great Lakes and Plains			
Central City	.319	2.622	-2.222
Metropolitan, Other	.128	1.347	-1.142
Nonmetropolitan	.197	2.095	-2.135
Southeast			
Central City	.238	2.505	-2.812
Metropolitan, Other	.091	.959	-.789
Nonmetropolitan	.272	2.504	-2.996
West and Southwest			
Central City	.246	2.225	-2.413
Metropolitan, Other	.238	2.354	-2.579
Nonmetropolitan	.187	1.673	-1.932

This result is reflected by the partial elasticities of the demand for other professionals with respect to the budget, reported in the third column of Table 3. The $\varepsilon(T_0:b)$ ranges from .96 in Southeast suburban districts to 3.19 in North Atlantic nonmetropolitan districts. Thus, a 1-percent increase in a district's budget would result in an increase of about 2 percent in the number of other professionals it employs. Since both the partial elasticity of expenditures for other professionals and the partial elasticity of the ratio of other professionals to pupils equal the partial elasticity of demand for other professionals, with respect to the budget, a 1-percent increase in a district's budget would increase both its expenditures for other professionals and its ratio of other professionals to students by about 2 percent.

The partial elasticities of demand for elementary and secondary teachers regarding the budget were found to be less than 1 in every case and most fell in the range of .4 to .7. Thus, a 1-percent increase in a district's budget would result in a percentage increase in demand for other professionals about four times as large as the resulting percentage increases in the demands for elementary and secondary teachers.

Again, we remind the reader that there appear to be substantial differences among district types. Hence, these general statements should not be taken literally. For example, a 1-percent budget increase would result in an increase in expenditures for other professionals of slightly less than 1 percent in Southeast "metropolitan, other" districts and of more than 3 percent in North Atlantic nonmetropolitan districts.

The relationship between the teachers' salary level and the demand for other professionals is essentially the same as the above described relationships between P_T and the demands for elementary and secondary teachers. That is, an increase in P_T reduces the district's discretionary budget and thus its discretionary expenditures for other professionals. This can be formally demonstrated by partially differentiating Eq. 16.3 in terms of P_T and substituting for β_{32} and β_{33}.

$$\frac{\partial\left(\frac{P_T T_O}{A}\right)}{\partial P_T} = \beta_{32}\frac{E}{A} + \beta_{33} = \frac{T_O'}{A} - \frac{\alpha_3\left(T_E' + T_S' + T_O'\right)}{A}$$

The partial elasticity of demand for other professionals with respect to P_T is reported, for each of the 12 samples, in the fourth column of Table 3. Southeast nonmetropolitan districts are the most responsive to changes in P_T. The elasticity of -2.99 indicates that a 1-percent change in the teachers' salary level would result in a change of approximately 3 percent in the demand for other professionals in those districts. At the other extreme is the elasticity of .79 for Southeast suburban districts. It should be noted, however, that these elasticities are calculated from the estimated values of β_{32} and β_{33}, few of which are significant. At the 5-percent level, 3 of the 12 estimates of β_{32} and 5 of the 12 estimates of β_{33} are significantly different from zero.

In absolute values, the partial elasticities of demand for other professionals with regard to P_T tend to be much larger than the partial elasticities of demand for either elementary or secondary teachers with regard to the price of teachers. This relationship is consistent with the above noted relationships between the respective α_i and between the respective elasticities with regard to b.

As was the case for both elementary and secondary teachers, the coefficients of P_N tend to be insignificant and, in any event, so small as to yield negligible elasticities of demand for other professionals connected with the price of nonprofessionals.

Aggregate Demand for Educational Professionals

District behavior with respect to total expenditures for educational professionals can be obtained by summing the expenditure equations for each of the three categories:

$$\frac{P_T\left(T_E + T_S + T_O\right)}{A} = \sum_{i=1}^{3}\left(\beta_{i0} + \beta_{i1}b + \beta_{i2}\frac{P_TE}{A} + \beta_{i3}P_T + \beta_{i4}P_N\right) .$$

We can then calculate the share of a district's discretionary budget that will be allocated to educational professionals, and the partial elasticities of demand for educational professionals with respect to the budget and to the teachers' salary level. Table 4 provides these data using the parameter estimates of $\beta_{ij}(i, j = 1, 2, 3)$ obtained from estimation of the three disaggregated models. For example, the share of a district's discretionary budget that it allocates to educational professionals equals the partial derivative of total expenditures for educational professionals in terms of b which, in turn, equals

$$\beta_{11} + \beta_{21} + \beta_{31} .$$

The estimates provided in the second column of Table 4 imply that depending upon district type, a district will allocate between 40 and 66 percent of a marginal increase in its budget to expanding its professional staff. Or, in terms of the elasticity estimates in the third column of

Table 4

SUMMARY OF DEMAND FOR PROFESSIONAL STAFF

District Type	$\alpha_1+\alpha_2+\alpha_3$	$\varepsilon(T_E+T_S+T_O:b)$	$\varepsilon(T_E+T_S+T_O:P_T)$
North Atlantic			
Central City	.591	.550	-.936
Metropolitan, Other	.668	.967	-1.090
Nonmetropolitan	.406	.596	-.648
Great Lakes and Plains			
Central City	.490	.699	-.743
Metropolitan, Other	.557	.771	-.853
Nonmetropolitan	.517	.704	-.751
Southeast			
Central City	.589	.788	-.661
Metropolitan, Other	.506	.681	-.687
Nonmetropolitan	.628	.852	-.767
West and Southwest			
Central City	.578	.788	-.782
Metropolitan, Other	.561	.777	-.738
Nonmetropolitan	.446	.624	-.675

Table 4, a 1-percent increase in a district's budget would result in an increase in expenditures for professional staff of between .60 and .96 percent, depending upon the type of district. A 1-percent increase in teachers' salary, P_T, would result in a decline in the district's demand for professionals of about .75 percent and an increase in expenditures for professional staff of about .25 percent.* The ranges of the latter two estimates are .65 to 1.09 and .35 to -.09.

DEMAND FOR NONPROFESSIONALS

The fourth equation of the system Eq. 16 describes school district behavior associated with expenditures per pupil for nonprofessional staff as

$$\frac{P_N N}{A} = \beta_{40} + \beta_{41} b + \beta_{42} \frac{P_T E}{A} + \beta_{43} P_T + \beta_{44} P_N \quad . \qquad (16.4)$$

*Note that $\varepsilon(P_T(T_E + T_S + T_O):P_T) = \varepsilon(T_E + T_S + T_O:P_T) + 1$.

The derived demand equation for nonprofessionals is obtained by multiplying Eq. 16.4 through by A/P_N. Appendix Table A4 provides the results of the estimation of Eq. 16.4 for each of the 12 samples.

Overall, the model fits the data quite well. In only one case -- regression 4.23 -- is less than 50 percent of the variance in districts' expenditures per pupil for nonprofessional staff explained by the model, and R^2 is better than .7 in 9 of the 12 cases. The F statistics for the regressions are large in every case except regression 4.23.

Table 5 summarizes the demand for nonprofessionals in terms of four characteristics of the demand function: α_4, the rate at which a marginal change in a district's budget is translated into expenditures for nonprofessional staff; $\varepsilon(N:b)$, the partial elasticity of the demand for nonprofessionals with respect to the budget; and $\varepsilon(N:P_T)$ and $\varepsilon(N:P_N)$, the partial elasticities of demand for nonprofessionals with respect to the teachers' salary level and the salary level for nonprofessionals.

The estimated values of $\alpha_5(\beta_{41})$ are positive, as expected, and significantly different from zero at the 5-percent level in every case. The estimates vary from one type of district to another, ranging in value from about .025 in the North Atlantic suburban and Southeast and West and Southwest nonmetropolitan districts to .142 in the Great Lakes and Plains central city districts. Only two of the estimates, however, are greater than .083. Thus, in general, it appears that roughly 5 percent of a marginal change in a school district's budget will be allocated to nonprofessional staff.

The third column of Table 5 provides the estimates of $\varepsilon(N:b)$. In terms of the budget, the partial elasticity of expenditures for nonprofessionals, the partial elasticity of the demand for nonprofessionals, and the partial elasticity of the ratio of nonprofessionals to pupils are identically equal. Thus, a 1-percent increase in a North Atlantic central city district's budget will result in an approximately 1.5-percent increase in its expenditures for nonprofessionals, its demand for nonprofessionals, and its ratio of nonprofessionals to students.

The budget elasticities of demand for nonprofessionals are positive in all 12 cases and range between .68 in West and Southwest nonmetropolitan

Table 5

SUMMARY OF DEMAND FOR NONPROFESSIONALS

District Type	α_5	$\varepsilon(N:b)$	$\varepsilon(N:P_T)$	$\varepsilon(N:P_N)$
North Atlantic				
Central City	.057	1.529	-.624	-.366
Metropolitan, Other	.025	.733	.336	-.314
Nonmetropolitan	.078	1.814	-.615	.420
Great Lakes and Plains				
Central City	.142	2.351	-.858	-.343
Metropolitan, Other	.039	1.228	.475	-.847
Nonmetropolitan	.083	2.888	-1.135	-1.000
Southeast				
Central City	.061	1.992	-.625	-.472
Metropolitan, Other	.048	1.733	-.581	-.107
Nonmetropolitan	.026	.859	.000	-.363
West and Southwest				
Central City	.112	2.327	-1.269	-.836
Metropolitan, Other	.073	1.523	-.476	-.662
Nonmetropolitan	.028	.677	.000	-1.727

districts to 2.89 in Great Lakes and Plains nonmetropolitan districts. These elasticities are greater than 1.5 in 8 of the 12 cases and greater than 2.0 in three of those instances. There are clearly substantial differences among districts in terms of their responsiveness, with respect to expenditures for nonprofessionals, to an incremental change in their budgets.

There does not appear to be a consistent relationship between the teachers' salary level and expenditures per pupil for nonprofessional staff. The estimate of β_{42} is significant at the 5-percent level in only 3 of the 12 samples, and the estimates of β_{43} are insignificantly different from zero in 10 of the 12 samples. The partial elasticity of demand for nonprofessionals in terms of P_T is given for each of the 12 samples in the fourth column of Table 5. With two exceptions, one of which happens to be the single instance in which both β_{42} and β_{43} are significant, the elasticities are negative.

The last column of Table 5 displays the partial elasticities of demand for nonprofessionals associated with the price of nonprofessionals. These are based upon the estimated values of β_{44} (which are positive, as

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expected, in every case) and are significantly different from zero at the 5-percent level in 11 of the 12 samples. The elasticities range from -1.73 in West and Southwest nonmetropolitan districts to .42 in North Atlantic nonmetropolitan districts. A 1-percent increase in P_N will, accordingly, yield a decrease in the number of nonprofessionals demanded, except in North Atlantic nonmetropolitan districts. The magnitude of the decrease will range from .11 to 1.73-percent.

The partial elasticity of expenditures for nonprofessional staff with respect to P_N equals one plus the partial elasticity of demand for nonprofessionals with respect to the budget. Thus, in only one case, West and Southwest nonmetropolitan districts, will an increase in the salary level of nonprofessional staff result in reduced expenditures for nonprofessionals. In the remaining 11 cases, a 1-percent increase in P_N will yield an increase in expenditures for nonprofessionals of between zero percent in Great Lakes and Plains nonmetropolitan districts to 1.42 percent in North Atlantic nonmetropolitan districts.

In the exceptional case, West and Southwest nonmetropolitan districts, a 1-percent increase in P_N will result in a .73-percent decrease in expenditures for nonprofessional staff.

DEMANDS FOR NONPERSONNEL INPUTS

The last five equations of Eq. 16 describe school district behavior associated with expenditures per pupil for the nonpersonnel school inputs: administration (X_5), nonpersonnel instructional inputs (X_6), attendance and health services (X_7), pupil transportation (X_8), and plant operation and maintenance (X_9). Thus,

$$x_i = \beta_{io} + \beta_{i1} b + \beta_{i2} \frac{P_T E}{A} + \beta_{i3} P_T + \beta_{i4} P_N \qquad i = 5, \ldots, 9. \quad (16.5)$$

We use the term "nonpersonnel" to describe these inputs because the data do not identify the various physical units involved in each case. Thus, the input category "administration" includes personnel inputs; lacking data on those inputs, however, we must deal with aggregate expenditures for administration as the input measure.

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In view of the ad hoc treatment of these input categories, it is no surprise that the model does not perform as well in explaining expenditures for these inputs as it did for the personnel input categories. Nonetheless, the model does reasonably well in three categories -- administration, attendance and health services, and other instructional inputs -- and surprisingly well in one -- plant operation and maintenance. It performs poorly in terms of pupil transportation. Since factors such as population density and terrain obviously affect the costs of pupil transportation, yet are not reflected in the model, we did not expect to do very well in this regard.

Demand for Administration

Appendix Table A5 presents the results of the empirical analysis of district expenditure for administration. In 9 of the 12 samples the model, Eq. 16.5 explains a significant proportion of the variance in expenditures for administration among the districts included. The F statistic is insignificant in the regressions for the North Atlantic and the Great Lakes and Plains nonmetropolitan districts and the Southeast central city districts. In those cases where the regression is significant, we can account for 40 to 75 percent of the variance in the dependent variable.

The coefficients of b (see Table A5) are positive, as expected, in every case and significant at the 5-percent level in 10 of the 12 samples. These coefficients are estimates of α_5, the rate at which marginal changes in a district's budget are translated into expenditures for administration. They range in value from .04 (considering only significant estimates) to about .07.

The second and third column of Table 6 provide our estimates of the partial elasticities of expenditures for administration with respect to the budget, $\varepsilon(X_5:b)$, and with respect to the teacher salary level, $\varepsilon(X_5:P_T)$. It should be noted that the estimates β_{52} and β_{53} enter the latter. Both coefficients are significantly different from zero at the 5-percent level for the Great Lakes and Plains central city and suburban district samples. Both coefficients are insignificant at the 5-percent level in the remaining 10 samples.

The coefficient of P_N, β_{54}, is significant, with the expected negative sign, in 3 cases and insignificant in the other 9.

Demand for Other Instructional Inputs

The results of the empirical analysis of district expenditures for other instructional inputs are presented in Appendix Table A6. The model (Eq. 16.6) fails to explain a significant (at the 5-percent level) portion of the variance in expenditures for this input in Southeast central city and nonmetropolitan districts. The F for the regression is significant at the 5-percent level in the remaining 10 cases. R^2, for the significant regressions, ranges from .29 to about .7.

The coefficients of b are estimates of the parameter α_6. They are positive, as expected, and significantly different from zero at the 5-percent level in every case. The lowest value of β_{61} is .06 for the Southeast nonmetropolitan districts. The highest estimate is .21, obtained in the regression for North Atlantic nonmetropolitan districts. This implies that 6- to 21-percent of a marginal change in a district's budget would be allocated to other instructional inputs, depending upon district type.

The estimates of β_{62} range in value from -.008 to .007. The coefficient is significant in 5 of the 12 cases, including both extremes. The coefficients of P_T, the β_{63}, are significant in 9 of the 12 samples and range in value from -.01 to .004. Again, both extreme estimates are significant. The estimated values of P_N are negative in every case. Seven of the 12 estimates are significantly different from zero at the 5-percent level.

The fourth column of Table 8 displays estimates of $\varepsilon(X_6:b)$, the partial elasticity of expenditures for nonpersonnel instructional inputs with regard to the budget. Estimates of $\varepsilon(X_6:P_T)$, the partial elasticity of expenditures for other instructional inputs with respect to the teachers' salary level, are given in the fifth column.

Table 6

SUMMARY OF DEMANDS FOR NONPERSONNEL SCHOOL INPUTS

District Type	$\varepsilon(X_5:b)$	$\varepsilon(X_5:P_T)$	$\varepsilon(X_6:b)$	$\varepsilon(X_6:P_T)$	$\varepsilon(X_7:b)$	$\varepsilon(X_7:P_T)$	$\varepsilon(X_8:b)$	$\varepsilon(X_8:P_T)$	$\varepsilon(X_9:b)$	$\varepsilon(X_9:P_T)$
North Atlantic										
Central City	1.371	.074	2.989	-1.087	.890	.129	.670	.429	.717	.121
Metropolitan, Other	1.897	-.699	1.493	.623	1.332	.098	.460	.874	.869	-.079
Nonmetropolitan	.641	.319	3.721	-2.308	2.650	.312	2.424	-1.799	.860	.069
Great Lakes and Plains										
Central City	2.284	-.685	1.977	-2.042	1.093	-.980	.986	-.594	1.431	-.090
Metropolitan, Other	1.105	-1.960	2.258	-2.108	1.139	1.075	2.164	-2.098	1.379	.338
Nonmetropolitan	1.725	.076	1.781	-1.217	2.582	-1.869	3.624	-1.780	1.149	-.228
Southeast										
Central City	1.535	-1.849	1.417	-1.342	2.683	-2.252	1.063	-1.249	1.674	-.468
Metropolitan, Other	1.717	-1.236	1.767	-1.195	4.088	.000	1.276	-2.528	1.536	.000
Nonmetropolitan	1.568	-.041	1.228	-.984	1.285	-2.201	2.616	-2.050	1.040	-.008
West and Southwest										
Central City	1.312	-.626	2.587	-1.315	.324	.000	2.089	-1.162	1.080	.000
Metropolitan, Other	1.618	-.478	2.483	-1.491	.618	.000	2.795	-2.737	1.126	-.132
Nonmetropolitan	1.472	-.274	2.573	-1.184	4.003	-1.624	4.433	-3.113	1.451	-.447

Demand for Attendance and Health Services

Four of the 12 empirical analyses of expenditures for attendance and health services failed to account for a significant proportion of the variance in districts' behaviors with respect to the input category. These were the regressions for the Great Lakes and Plains central city and nonmetropolitan districts, the Southeast nonmetropolitan districts, and the West and Southwest central city districts. Table A7 in the Appendix provides the results of the estimation of Eq. 16.7 for all 12 samples.

The coefficient of b, β_{71}, was not significant at the 5-percent level in each of the above mentioned samples and was significant in each of the remaining eight samples. Among those cases where the coefficient was significant, it ranged in value from .006 for West and Southwest suburban districts to .045 for North Atlantic nonmetropolitan districts.

Partial elasticities of expenditures for attendance and health services with respect to the budget and the teacher salary level are given in columns six and seven of Table 6. However, the estimate of β_{72} is significant at the 5-percent level in only two cases. The estimate of β_{73} is significant in only one case.

Demand for Pupil Transportation

As noted above, the model does not sufficiently explain expenditures for pupil transportation. Five of the 12 regressions are insignificant, and the F statistics for the remaining 6 are unimpressive, though significant. Detailed results may be found in Appendix Table A8.

The estimated values of β_{81} are positive in every case and significant at the 5-percent level in 8 of the 12 cases. In magnitude they range from less than .02 (not significantly different from zero) to .14. The estimates of β_{82}, β_{83}, and β_{84} are seldom significant. The eighth and ninth columns of Table 6 indicate the partial elasticity of expenditures for pupil transportation in terms of the budget and the teacher salary level.

Demand for Plant Operation and Maintenance

The model performed surprisingly well in explaining school district behavior with respect to expenditures for plant operation and maintenance. The regressions account for at least 50 percent of the variance in expenditures for these inputs among districts in each of the 12 samples. R^2 is 69 percent or better in eight of the samples. The F statistics for the regressions are high in every case. Details are provided in Appendix Table A9.

The coefficient of b in each regression, β_{91}, is an estimate of α_9 -- the rate at which marginal changes in a district's budget are translated into expenditures for plant operation and maintenance. The estimated values of α_9 range from .09 in North Atlantic central city districts to .19 in the Great Lakes and Plains and the Southeast central city districts. They are significant at the 5-percent level in every case. The remaining three coefficients in each regression tend to be insignificant. The β_{92}, β_{93}, and β_{94} are each significantly different from zero at the 5-percent level in 2 of the 12 samples.

The partial elasticities of expenditures for plant operation and maintenance with regard to the budget and the teacher salary level are displayed in columns nine and ten of Table 6.

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VI. SUMMARY AND CONCLUSIONS

At the outset of this report we identified the two major issues that motivated the analysis: How would school districts allocate additional funds among school inputs, and in what ways and to what extent would changes in various exogenous factors affect the demand for teachers and other educational professionals? In this section we present our conclusions for each of these issues.

SCHOOL DISTRICT EXPENDITURE BEHAVIOR

Table 7 summarizes our empirical results and displays our principal conclusions regarding school district expenditure behavior. The entries in the table are the estimated values of the parameter α_i for each district type associated with each school input. We demonstrated, in the development of the empirical model (Eq. 16) that this parameter indicates the portion of a district's discretionary budget that would be allocated to the ith school input. Given the assumption that districts' budgets are sufficient to meet the minimum requirements for each input, these parameters are estimates of how school districts would allocate incremental funds among school inputs. If, for example, a North Atlantic central city district were to receive an incremental budget increase, we estimate that 22.3 percent of the increase would be allocated to expenditures for elementary teachers, 15.2 percent to expenditures for secondary teachers, and so on through plant operation and maintenance, which would receive 9.1 percent of the budget increase.

In general, the data in Table 7 imply that about 15 to 20 percent of a budget increment would be allocated to elementary teachers and that 15 to 20 percent would be allocated to secondary teachers. Approximately 20 to 25 percent of the change in the budget would be allocated to "other" professionals; 5 percent to expenditures for administration, and 10 percent to expenditures for nonpersonnel instructional inputs. Health and attendance services would receive

Table 7

ESTIMATED ALLOCATION OF DISCRETIONARY BUDGET AMONG INPUTS
(percent)

District Type	Elementary Teachers	Secondary Teachers	Other Professionals	Non-Professionals	Administration	Other Instructional	Attendance and Health Services	Pupil Transportation	Plant Operation and Maintenance
North Atlantic									
Central City	22.3	15.2	21.6	5.7	4.8	18.0	1.9	1.6[a]	9.1
Metropolitan, Other	28.6	18.0	20.2	2.5	6.8	9.1	2.6	1.8[a]	10.4
Nonmetropolitan	2.9[a]	7.1[a]	30.6	7.8	1.9[a]	20.7	4.5	14.5	10.1
Great Lakes and Plains									
Central City	5.3[a]	11.8	31.9	14.2	6.4	8.4	1.3[a]	1.9[a]	18.9
Metropolitan, Other	17.0	25.9	12.8	3.9	4.9	9.8	0.9[a]	7.2	17.7
Nonmetropolitan	19.3	12.7	19.7	8.3	4.8[a]	6.7	2.1	11.1	15.3
Southeast									
Central City	15.6	19.5	23.8	6.1	4.5	7.4	1.9	1.9[a]	19.4
Metropolitan, Other	23.5	25.2	9.1	4.8	4.7	9.0	2.6[a]	5.2	16.0
Nonmetropolitan	20.1	15.5	27.2	2.6	4.6	6.1	0.9	12.8	10.2
West and Southwest									
Central City	15.5	17.7	24.6	11.2	4.2	10.6	0.4[a]	2.9	12.9
Metropolitan, Other	17.0	15.3	23.8	7.3	5.4	10.7	0.6	6.3	13.7
Nonmetropolitan	9.7[a]	16.2	18.7	2.8	4.7	12.7	3.6	14.0	17.7

[a]Not significantly different from zero at the 5-percent level.

1 or 2 percent of the change, while 10 to 15 percent would go to plant operation and maintenance. The remainder would be allocated to pupil transportation.

We must emphasize that there are substantial differences among district types in terms of their respective expenditure behaviors and that the above statements are no more than rough generalizations. Thus, North Atlantic and West and Southwest nonmetropolitan districts and Great Lakes and Plains central city districts would allocate less than 10 percent of a budget increase to elementary teachers while North Atlantic central city and suburban districts and Southeast suburban districts would allocate more than 20 percent.

It is interesting to compare these estimates of district allocative behavior at the margin with their respective average behaviors. Table 8 displays for each type of district the distribution of total expenditures among the inputs, calculated at the mean. North Atlantic central city districts, for example, spent 32.4 percent of their total budgets (less fixed costs)* for elementary teachers. Their expenditures for secondary teachers equaled 26.5 percent of their total budgets, and so on.

Note that there is far less variability among the different types of districts in terms of the portion of total budgets allocated to each input as compared to the portion of discretionary budgets. The reason for this difference is that the share of a district's total budget allocated to an input reflects both its expenditures to provide the minimum required level of that input and its discretionary expenditures for that input. If the minimum required level of expenditures for an input is large relative to discretionary expenditures for that input, and if the minimum requirements are roughly the same for different types of districts, then the proportion of total expenditures

*In order to facilitate comparisons between Tables 7 and 8, we use the same definition of "budget" in Table 8 as was used in the analyses. That is, expenditures allocable to per pupil costs minus fixed costs.

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Table 8

AVERAGE ALLOCATION OF TOTAL BUDGET AMONG INPUTS
(percent)

District Type	Elementary Teachers	Secondary Teachers	Other Professionals	Non-Professionals	Administration	Other Instructional	Attendance and Health Services	Pupil Transportation	Plant Operation and Maintenance
North Atlantic									
Central City	32.4	26.5	10.6	3.7	3.5	6.0	2.1	2.4	12.7
Metropolitan, Other	30.8	28.6	9.7	3.4	3.6	6.1	2.0	2.9	12.0
Nonmetropolitan	32.1	26.2	9.6	4.3	3.0	5.6	1.7	6.0	11.6
Great Lakes and Plains									
Central City	32.1	26.2	12.3	6.0	2.8	4.2	1.2	1.9	13.2
Metropolitan, Other	31.8	30.1	9.4	3.2	4.3	4.3	0.8	3.3	12.8
Nonmetropolitan	33.8	30.2	9.4	2.9	2.8	3.8	0.8	3.1	13.3
Southeast									
Central City	36.8	28.4	9.5	3.1	2.9	5.2	0.7	1.8	11.6
Metropolitan, Other	36.4	28.4	9.5	2.8	2.7	5.1	0.6	4.1	10.4
Nonmetropolitan	36.2	26.6	10.9	3.0	2.9	5.0	0.7	4.9	9.8
West and Southwest									
Central City	33.3	29.0	11.1	4.8	3.2	4.1	1.2	1.4	11.9
Metropolitan, Other	33.8	28.3	10.1	4.8	3.3	4.3	1.0	4.3	12.2
Nonmetropolitan	32.3	28.0	11.2	4.1	3.2	4.9	0.9	3.2	12.2

allocated to each input would be approximately the same for different types of districts even though the proportions of discretionary expenditures allocated to each input were much different.

Comparing the entries in Table 7 with those in Table 8, we see that although districts tend to spend roughly 33 percent of their total budget for elementary teachers, they would allocate a much smaller share -- roughly 15 to 20 percent -- of a budget increase to elementary teachers. Similarly, the share of an increase in a district's budget that would be allocated to secondary teachers -- again, roughly 15 to 20 percent -- would be much smaller than the share of the total budget -- approximately 28 percent. On the other hand, other professionals account for about 10 percent of districts' total budgets, but something like 20 to 30 percent of an increase in a district's budget would go to increased expenditures for other professionals.

Summing the shares of total budgets allocated to elementary and secondary teachers and other professionals, we see that districts tend to spend 70 to 75 percent of their budgets for educational professionals. If we sum the estimated portions of discretionary budgets allocated to educational professionals as a group, we obtain combined estimates of about 50 to 60 percent.

Of course, since the budget share allocated to educational professionals at the margin is substantially smaller than the average share of the budget allocated to professionals, expenditures for nonprofessionals and nonpersonnel inputs must occur at a marginal rate substantially larger than the average rate of expenditures for inputs in these categories. Comparing Tables 7 and 8, we see that each of the six remaining inputs generally receives a share of the discretionary budget greater than that of the total budget. The difference is smallest for attendance and health services and greatest for other instructional inputs.

DEMAND FOR EDUCATIONAL PROFESSIONALS

As for the demands for elementary and secondary teachers and other professionals, the first point to be made is that the number of professionals of each type demanded by a school district depends upon the district budget and the teacher salary level. This result may appear so obvious that it need not be emphasized. However, as we noted in the Introduction, none of the currently available projections of the demand for teachers and other professionals takes account of these factors.

Table 1 presented estimates of the partial elasticities of demand for elementary teachers with regard to the budget and the teachers' salary level. Tables 2, 3, and 4 provided similar estimates for secondary teachers, other professionals, and educational professionals as a group, respectively. These estimates suggest that, other things being equal, a 1-percent increase in a district's budget will result in an increase of approximately .5 percent in the number of elementary teachers it would seek to employ, a .6-percent increase for secondary teachers, a 2-percent increase for other professionals, and a .7-percent increase for educational professionals. A 1-percent increase in the teachers' salary level would, other things being equal, reduce the numbers of educational professionals demanded by approximately .7 percent. The number of elementary teachers demanded would decline by about .4 percent, while the number of secondary teachers would decline by about .5 percent. Finally, there would be a decline of approximately 2 percent in the number of other professionals.

We hasten to remind the reader that the magnitudes of the relationships between the budget and the teachers' salary level on the one hand, and the number of educational professional demanded on the other hand are substantially different for different types of districts. Hence, the above statements are only general indications of the relationships. The reader is referred to Tables 1 through 4 for the various estimates relevant to each district type.

A second important point about the demand for teachers and other educational professionals follows from the analysis of school district expenditure behavior and the data presented in Tables 7 and 8. We found that the rates at which districts allocate discretionary funds to elementary and secondary teachers are considerably smaller than the shares of the districts' total budgets allocated to each type of teacher. Although the rate of district expenditures for other professionals tends to be greater at the margin than at the mean, the share of a district's discretionary budget allocated to educational professionals as a group is much less than their aggregate share of the total budget. This implies that, other things being equal, increases in school district's budgets will result in disproportionately smaller increases in the numbers of professionals demanded. Or, to put it in other words, a 1-percent increase in the number of educational professionals demanded can be accomplished only through an increase in districts' budgets that is greater than 1 percent.

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Appendix

REGRESSION RESULTS

Each of the nine tables in this Appendix reports the results of the empirical analysis of district expenditures in one of the nine expenditure categories for the 12 sets of districts. The regressions are numbered in the form X.YZ where X denotes the table number, Y denotes the region (1 = North Atlantic, 2 = Great Lakes and Plains, 3 = Southeast, and 4 = West and Southwest), and Z denotes metropolitan status (1 = central city; 2 = metropolitan, other; and 3 = nonmetropolitan). Thus, regression number X.YZ presents the results for district expenditure behavior with respect to expenditure category X for the districts in region Y that have metropolitan status Z. The number of districts in each group is denoted by N. Otherwise, the notation given on pp. 17-18 applies. The numbers in parentheses are t statistics.

Table A1

REGRESSION RESULTS
(Dependent Variable: Expenditures per Pupil for Elementary Teachers)

Item	Regression Number											
	1.11	1.12	1.13	1.21	1.22	1.23	1.31	1.32	1.33	1.41	1.42	1.43
Mean of Dependent Variable	247.68	252.41	237.16	223.73	223.66	223.25	184.53	177.53	175.06	203.62	214.46	196.49
Regression Coefficients												
b	.223	.286	.029	.053	.170	.193	.156	.235	.201	.155	.170	.097
	(6.80)	(10.32)	(.33)	(1.24)	(5.78)	(3.42)	(5.63)	(9.34)	(7.17)	(5.93)	(7.80)	(1.51)
$P_T E/A$	.050	.041	.060	.039	.029	.061	.039	.036	.035	.033	.035	.036
	(12.32)	(12.33)	(8.85)	(7.56)	(5.09)	(11.05)	(13.37)	(12.49)	(13.61)	(8.64)	(13.39)	(8.37)
P_T	-.024	-.025	-.017	-.009	-.013	-.032	-.006	-.011	-.005	-.006	-.007	-.005
	(-5.42)	(-9.09)	(-2.13)	(-1.97)	(-3.47)	(-5.35)	(-1.80)	(-3.14)	(-1.83)	(-1.75)	(-2.66)	(-1.05)
P_N	-.001	-.001	-.009	-.000	.003	-.001	-.002	-.002	-.001	-.000	-.002	-.005
	(-1.05)	(-1.01)	(-2.02)	(-.44)	(.24)	(-1.04)	(-1.10)	(-1.54)	(-1.38)	(-.46)	(-3.07)	(-1.45)
Constant	16.83	43.14	73.25	48.58	68.76	75.10	-24.50	-14.24	-39.37	-11.84	-13.55	19.36
R^2	.88	.87	.91	.69	.63	.91	.92	.95	.87	.92	.91	.92
F	80.26	113.63	42.32	24.04	21.97	45.61	120.45	209.97	114.13	155.58	215.47	36.25
Standard Error	21.03	19.13	21.25	21.91	18.56	11.77	10.06	9.33	10.57	13.56	17.34	16.98
N	49	71	22	48	57	23	46	53	74	57	94	18

Table A2

REGRESSION RESULTS
(Dependent Variable: Average Expenditures per Pupil for Secondary Teachers)

Item	Regression Number											
	2.11	2.12	2.13	2.21	2.22	2.23	2.31	2.32	2.33	2.41	2.42	2.43
Mean of Dependent Variables	203.11	234.28	193.48	182.91	211.54	199.97	142.34	138.27	128.97	177.18	179.27	170.31
Regression Coefficients												
b	.152	.180	.071	.118	.259	.127	.195	.252	.155	.177	.153	.162
	(4.75)	(5.93)	(1.28)	(3.01)	(15.31)	(1.74)	(6.57)	(8.26)	(7.60)	(6.53)	(7.67)	(3.63)
$P_T S/A$	.043	.049	.038	.038	.043	.048	.042	.040	.035	.044	.042	.041
	(11.09)	(13.23)	(8.72)	(8.10)	(13.01)	(6.82)	(13.35)	(11.47)	(18.92)	(11.16)	(17.69)	(13.62)
P_T	-.013	-.021	-.001	-.006	-.014	-.004	-.007	-.013	-.004	-.012	-.009	-.009
	(-3.75)	(-6.02)	(-.23)	(-1.57)	(-7.35)	(-.78)	(-2.34)	(-4.50)	(-2.57)	(-4.94)	(-4.58)	(-3.31)
P_N	-.001	.000	.007	-.000	-.001	-.000	-.003	-.003	-.000	-.000	-.000	-.005
	(-1.50)	(.33)	(2.53)	(-1.46)	(-.79)	(-.28)	(-2.17)	(-1.64)	(-.57)	(-.45)	(-.59)	(-2.45)
Constant	53.00	82.11	-25.33	5.68	-15.65	-45.96	-25.95	3.39	-20.24	-9.16	-13.06	14.28
R^2	.79	.85	.87	.79	.96	.88	.90	.94	.94	.93	.92	.97
F	42.13	91.41	29.73	39.68	333.54	32.73	89.07	187.62	292.61	163.00	261.18	79.94
Standard Error	20.48	20.94	13.78	19.91	10.69	15.22	10.76	11.34	7.66	14.03	15.88	11.81
N	49	71	22	48	57	23	46	53	74	57	94	18

Table A3

REGRESSION RESULTS
(Dependent Variable: Average Expenditures per Pupil for Other Professionals)

Item	Regression Number											
	3.11	3.12	3.13	3.21	3.22	3.23	3.31	3.32	3.33	3.41	3.42	3.43
Mean of Dependent Variable	81.41	79.29	70.51	85.44	65.88	62.20	47.63	46.26	52.59	67.63	64.15	68.00
Regression Coefficients												
b	.216 (6.73)	.202 (8.00)	.306 (4.73)	.319 (5.47)	.128 (6.27)	.197 (3.59)	.238 (7.95)	.091 (3.51)	.272 (7.87)	.246 (8.51)	.238 (12.68)	.187 (3.16)
$P_T E/A$	-.001 (-.18)	-.002 (-.53)	-.012 (-2.30)	-.004 (-.59)	.002 (.48)	.007 (1.28)	-.003 (-.84)	-.003 (-1.07)	-.007 (-.217)	.006 (1.38)	.004 (1.69)	-.004 (-.88)
P_T	-.005 (-1.24)	-.001 (-.42)	-.007 (-1.18)	-.008 (-1.29)	-.002 (-.71)	-.011 (-1.89)	-.009 (-2.44)	.003 (.93)	-.010 (-2.91)	-.013 (-3.44)	-.012 (-5.04)	-.005 (-1.00)
P_N	.000 (.33)	-.003 (-2.18)	-.004 (-2.00)	-.002 (-4.11)	.001 (.76)	.001 (.77)	.004 (2.46)	.005 (3.51)	.000 (.18)	-.000 (-.91)	.000 (.41)	.004 (1.47)
Constant	-28.41	-54.93	.57	-18.89	-16.90	-.13	6.37	-21.42	27.86	13.92	11.32	-1.28
R^2	.62	.75	.65	.46	.61	.53	.71	.81	.71	.69	.80	.67
F	17.98	48.81	7.98	9.31	20.20	5.15	25.51	50.21	42.88	29.56	90.86	6.83
Standard Error	20.65	17.50	16.04	29.78	12.86	11.48	10.87	9.59	13.01	15.01	14.93	15.62
N	49	71	22	48	57	23	46	53	74	57	94	18

Table A4

REGRESSION RESULTS
(Dependent Variable: Average Expenditures per Pupil for Nonprofessional Staff)

Item	Regression Number											
	4.11	4.12	4.13	4.21	4.22	4.23	4.31	4.32	4.33	4.41	4.42	4.43
Mean of Dependent Variables	28.54	27.94	31.74	42.11	22.35	19.01	15.35	13.50	14.65	29.44	30.41	25.14
Regression Coefficients												
b	.057 (3.26)	.025 (1.95)	.078 (2.76)	.142 (4.15)	.039 (3.62)	.083 (2.54)	.061 (5.41)	.048 (7.59)	.026 (2.58)	.112 (7.28)	.073 (6.47)	.028 (1.74)
$P_T E/A$	.002 (1.05)	.005 (3.32)	.005 (2.21)	-.006 (-1.59)	.000 (.15)	-.002 (-.69)	-.002 (-2.05)	.000 (.45)	-.000 (-.34)	.004 (1.70)	.001 (.44)	.000 (.45)
P_T	-.003 (-1.50)	-.002 (-1.82)	-.005 (-1.71)	-.000 (-.14)	.001 (.54)	-.001 (-.24)	-.000 (-.31)	-.001 (-1.47)	-.000 (-.35)	-.006 (-3.22)	-.002 (-1.63)	-.000 (-.32)
P_N	.004 (7.36)	.005 (8.62)	.010 (6.79)	.004 (17.72)	.001 (2.87)	.000 (.72)	.003 (5.29)	.005 (13.45)	.004 (12.74)	.001 (2.75)	.002 (6.19)	.005 (6.24)
Constant	-11.24	-18.02	-53.14	-49.49	-18.70	-16.94	-8.39	-12.35	-4.47	-.68	-8.41	-8.90
R^2	.73	.64	.84	.96	.56	.46	.74	.95	.86	.70	.78	.89
F	29.96	29.99	22.59	250.42	16.57	3.76	29.53	243.54	103.64	30.85	77.09	26.74
Standard Error	11.17	8.73	6.99	17.39	6.78	6.81	4.08	2.35	3.82	7.99	9.03	4.20
N	49	71	22	48	57	23	46	53	74	57	94	18

Table A5

REGRESSION RESULTS
(Dependent Variable: Average Expenditures per Pupil for Administration)

Item	Regression Number											
	5.11	5.12	5.13	5.21	5.22	5.23	5.31	5.32	5.33	5.41	5.42	5.43
Mean of Dependent Variables	26.79	29.38	21.88	19.54	30.55	18.41	14.70	13.34	14.20	19.58	21.17	19.42
Regression Coefficients												
b	.048 (3.57)	.068 (5.15)	.019 (.74)	.064 (7.51)	.048 (6.04)	.048 (1.63)	.045 (2.43)	.047 (3.95)	.046 (3.92)	.042 (3.72)	.054 (8.22)	.047 (4.10)
$P_T E/A \times 10$	.000 (.00)	.002 (-.12)	-.003 (-.13)	.028 (2.78)	.074 (2.37)	-.015 (-.52)	-.000 (-.01)	-.005 (-.40)	.002 (.16)	-.008 (-.48)	.007 (.87)	-.000 (-.07)
$P_T \times 10$	.002 (.13)	-.020 (-1.52)	.009 (.39)	-.030 (-3.34)	-.098 (-4.82)	.010 (.32)	-.034 (-1.41)	-.018 (-1.05)	-.002 (-.17)	-.008 (-.57)	-.014 (-1.65)	-.006 (-.72)
$P_N \times 10$	.003 (.94)	-.009 (-1.44)	-.006 (-.48)	-.004 (-5.51)	-.017 (-2.55)	.003 (.49)	.009 (.87)	.014 (.65)	-.001 (-.33)	.001 (.65)	-.005 (-2.12)	.000 (.01)
Constant	-13.90	.28	3.37	-9.20	28.56	-16.14	17.00	5.82	-6.85	5.59	-.71	-2.75
R^2	.45	.44	.20	.64	.46	.39	.17	.52	.38	.42	.67	.75
F	9.07	12.75	1.09	19.52	10.97	2.83	2.11	12.93	10.68	9.26	44.87	9.96
Standard Error	8.61	9.13	6.29	4.33	10.23	6.16	6.69	4.43	4.38	5.88	5.24	3.00
N	49	71	22	48	57	23	46	53	74	57	94	18

Table A6

REGRESSION RESULTS

(Dependent Variable: Average Expenditures per Pupil for Other Instructional Inputs)

Item	Regression Number											
	6.11	6.12	6.13	6.21	6.22	6.23	6.31	6.32	6.33	6.41	6.42	6.43
Mean of Dependent Variables	46.09	49.93	41.05	29.63	30.55	24.88	26.19	24.83	24.05	25.06	27.34	30.02
Regression Coefficients												
b	.180 (5.62)	.091 (4.34)	.207 (3.97)	.084 (3.97)	.098 (6.04)	.067 (1.75)	.074 (2.68)	.090 (4.08)	.061 (3.09)	.106 (7.23)	.107 (11.23)	.127 (4.76)
$P_T E/A$	-.005 (-1.38)	-.002 (-.93)	-.008 (-1.86)	.000 (.08)	.007 (2.37)	-.007 (-1.98)	.006 (2.09)	.007 (2.60)	.003 (1.78)	.003 (1.32)	.000 (.08)	-.000 (.13)
P_T	-.002 (-.54)	.004 (1.93)	-.005 (-1.10)	-.006 (-2.73)	-.010 (-4.82)	.001 (.33)	-.008 (-2.35)	-.008 (-2.59)	-.005 (-2.53)	-.005 (-2.86)	-.004 (-3.77)	-.004 (-1.94)
P_N	-.003 (-3.38)	-.003 (-3.02)	-.002 (-1.88)	-.001 (-3.50)	-.002 (-2.55)	-.001 (-1.25)	-.001 (-.96)	-.003 (-2.07)	-.000 (-.82)	-.000 (-.90)	-.001 (-2.11)	-.000 (-.13)
Constant	-21.05	-43.40	7.04	35.34	28.56	14.21	31.21	18.90	19.18	-.73	8.82	-7.89
R^2	.48	.65	.59	.29	.46	.46	.22	.36	.14	.64	.71	.72
F	10.01	31.53	6.10	4.49	10.97	3.87	2.85	6.68	2.80	22.58	55.65	8.44
Standard Error	20.53	14.54	12.93	10.78	10.23	8.03	10.08	8.19	7.41	7.58	7.56	7.01
N	49	71	22	48	57	23	46	53	74	57	94	18

Table A7

REGRESSION RESULTS
(Dependent Variable: Average Expenditures per Pupil for Attendance and Health Services

Item	Regression Number											
	7.11	7.12	7.13	7.21	7.22	7.23	7.31	7.32	7.3[illegible]	7.41	7.42	7.43
Mean of Dependent Variables	16.34	16.00	12.53	8.29	5.56	5.38	3.55	3.10	3.39	7.55	6.16	5.47
Regression Coefficients												
b	.019 (2.21)	.026 (3.63)	.045 (2.35)	.013 (1.32)	.009 (1.85)	.021 (1.19)	.019 (2.74)	.026 (4.76)	.009 (1.29)	.004 (.62)	.006 (1.92)	.036 (6.36)
$P_T E/A$	.002 (2.14)	.002 (2.09)	-.001 (-.56)	.002 (1.69)	.001 (.84)	-.000 (-.17)	.000 (.22)	-.000 (-.51)	.000 (.37)	-.000 (-.43)	.000 (.29)	.000 (.95)
P_T	-.001 (-.49)	-.001 (-.85)	.001 (.30)	-.002 (-1.48)	-.000 (-.64)	-.001 (-.36)	-.001 (-.55)	-.000 (-.03)	-.001 (-1.49)	.000 (.15)	.000 (.64)	-.001 (-3.55)
P_N	-.000 (-1.40)	.000 (1.48)	.001 (.64)	-.000 (-1.34)	.001 (3.76)	.000 (.10)	.000 (.48)	-.001 (-3.81)	-.000 (-.37)	.000 (.34)	.000 (.34)	-.001 (-2.94)
Constant	-4.48	-11.53	-23.63	3.54	-4.52	-.02	-3.38	-4.97	6.08	5.73	-1.25	-.66
R^2	.31	.52	.52	.09	.36	.11	.24	.59	.05	.04	.32	.77
F	4.95	17.73	4.61	1.12	7.30	.56	3.28	17.00	.90	.48	10.32	10.60
Standard Error	5.48	4.90	4.75	4.95	3.24	3.66	2.58	1.99	2.62	3.63	2.55	1.49
N	49	71	22	48	57	23	46	53	74	57	94	18

Table A8

REGRESSION RESULTS

(Dependent Variable: Average Expenditures per Pupil for Pupil Transportation)

Item	Regression Number											
	8.11	8.12	8.13	8.21	8.22	8.23	8.31	8.32	8.33	8.41	8.42	8.43
Mean of Dependent Variables	18.29	32.06	44.15	13.43	23.42	20.26	8.96	19.86	23.69	8.49	14.30	19.21
Regression Coefficients												
b	.016 (.98)	.018 (.77)	.145 (2.09)	.019 (1.09)	.072 (3.74)	.111 (2.52)	.019 (.72)	.052 (2.59)	.128 (4.77)	.029 (3.20)	.063 (6.88)	.140 (3.25)
$P_T E/A$	-.002 (-.84)	.001 (.22)	-.002 (-.41)	-.003 (-1.26)	.006 (1.50)	-.008 (-1.84)	.001 (.26)	.001 (.53)	.009 (3.52)	.000 (.05)	.002 (1.66)	.004 (1.31)
P_T	.002 (.78)	.002 (.87)	-.007 (-1.10)	.001 (.59)	-.008 (-3.45)	.001 (.15)	-.002 (-.53)	-.007 (-2.55)	-.012 (-4.35)	-.001 (-.91)	-.005 (-4.43)	-.009 (-2.45)
P_N	.000 (.99)	-.001 (-.85)	.000 (.11)	-.000 (-1.06)	-.000 (-.35)	.001 (1.10)	-.003 (-2.15)	-.001 (1.26)	-.002 (-2.73)	.000 (1.04)	-.000 (-.29)	-.001 (-.53)
Constant	-2.96	-5.52	18.38	6.23	29.42	-19.59	18.68	48.69	17.15	.05	16.35	-4.74
R^2	.14	.17	.26	.09	.27	.50	.13	.25	.27	.33	.42	.46
F	1.77	3.33	1.52	1.02	4.76	4.33	1.54	3.97	6.49	6.39	16.19	2.80
Standard Error	10.54	16.14	17.25	8.65	12.09	9.23	9.44	7.46	10.10	4.70	7.29	11.37
N	49	71	22	48	57	23	46	53	74	57	94	18

Table A9

REGRESSION RESULTS
(Dependent Variable: Average Expenditures per Pupil for Plant Operation and Maintenance)

Item	Regression Number											
	9.11	9.12	9.13	9.21	9.22	9.23	9.31	9.32	9.33	9.41	9.42	9.43
Mean of Dependent Variables	97.10	98.12	85.50	92.11	90.31	88.09	58.09	50.78	47.49	73.08	77.18	74.22
Regression Coefficients												
b	.091	.104	.100	.189	.177	.153	.194	.160	.102	.129	.137	.177
	(3.84)	(5.23)	(3.19)	(8.17)	(8.78)	(2.92)	(9.08)	(6.78)	(4.02)	(7.50)	(11.92)	(3.93)
$P_T E/A$	-.003	.004	-.004	.007	-.002	.000	.001	.000	-.005	-.000	.000	.004
	(-.96)	(1.63)	(-1.53)	(2.57)	(-.58)	(.04)	(.33)	(.03)	(-2.08)	(-.09)	(.16)	(1.28)
P_T	.003	-.003	.003	-.005	.004	-.002	-.004	-.000	.003	-.000	-.001	-.006
	(.88)	(-1.38)	(1.07)	(-2.17)	(1.39)	(-.42)	(-1.58)	(-.12)	(.97)	(-.07)	(-.91)	(-1.75)
P_N	.001	.003	.000	-.001	.000	-.000	.001	-.000	.000	.000	.000	.003
	(1.47)	(2.95)	(.27)	(-5.89)	(.39)	(-.06)	(1.15)	(-.15)	(.43)	(.12)	(1.11)	(1.32)
Constant	12.22	7.88	-.51	-21.80	-57.73	9.47	-11.04	23.83	.67	-2.88	.48	-7.42
R^2	.53	.63	.69	.73	.82	.56	.77	.84	.53	.82	.87	.76
F	12.39	27.67	9.26	29.38	59.17	5.61	35.42	64.10	19.31	62.53	155.23	10.54
Standard Error	15.19	13.78	7.76	11.80	12.75	10.94	7.75	8.75	9.51	8.89	9.12	11.90
N	49	71	22	48	57	23	46	53	74	57	94	18

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