Pergamon

Economics of Education Review, Vol. 15, No. 2, pp. 111–124, 1996

0272-7757/96 $15.00+0.00

0272-7757(95)00032-1

Does More School District Administration Lower Educational Productivity? Some Evidence on the "Administrative Blob" in New York Public Schools

DOMINIC J. BREWER

RAND Corporation, P.O. Box 2138, 1700 Main Street, Santa Monica, CA 90407-2138, U.S.A.

Abstract—U.S. public schools are often criticized as overly bureaucratic: administration is said to consume too great a share of educational resources, to the detriment of educational productivity. Despite this common assertion, remarkably little is known about the resource allocation patterns of school districts, how these vary across districts, and how they have changed over time. This paper presents some evidence on resource allocation in New York state, using a panel of school districts, 1978–87. The paper then attempts to determine if there is any evidence at the district level of a systematic relationship between administrative inputs and educational output in the form of standardized test scores. A variety of statistical models is shown to yield inconsistent results, providing weak support for the contention that administrative resources are necessarily detrimental to educational productivity. [*JEL* I21] Copyright © 1996 Elsevier Science Ltd

1. INTRODUCTION

WILLIAM BENNETT, former Secretary of Education, has claimed that U.S. schools suffer from an "administrative blob": a suboptimal allocation of resources, with administration consuming too great a share of educational expenditures. This sentiment has been echoed by President Clinton's Secretary of Education Richard Riley who has called for "shifting resources going to school administration into the classroom".[1] The assertion that there is "too much" administration has been accompanied by a somewhat more refined argument, namely that public schools are too centralized and rule bound. This bureaucratic structure has led, it is claimed, to decision making unresponsive to the demands of parents and needs of students (Chubb and Moe, 1990). However, despite these common criticisms, remarkably little is known about school districts' use of different input mixes. While there is some evidence that U.S. schools as a whole utilize noninstructional resources more than schools in other industrialized countries, there have been few attempts to map out resource allocation patterns outside of large urban districts. Even less is known about how–if at all–a school district's internal distribution of inputs between administration, instruction, and other uses, is linked to the performance of its students.

The major purpose of this research is to examine the extent to which school districts allocate personnel (and expenditures) to instructional and noninstructional uses, and to determine if this allocation affects a district's educational productivity. The paper uses panel data on 700 New York school districts (1978–87) to examine differential resource patterns across districts and over time. Part of this sample is then used to estimate district level educational production functions (with output proxied by standardized test scores) that include measures of administrative and other resources as predictors. A variety of specifi-

[Manuscript received 1 September 1994; revision accepted for publication 5 September 1995.]

cations and variable constructions are estimated in order to demonstrate the sensitivity of estimated resource effects. For example, since both the quantity and structure of school administration may be endogenous, i.e. partially determined by student attributes including academic performance, inclusion of administrative variables in the production functions may lead to inconsistent estimates of the effect of these variables on student achievement. Hence, models with instruments for each staffing input are estimated, and the appropriateness of this specification tested. The data also permit estimation of models with district specific (fixed) effects. It is found that the estimated coefficients of various inputs differ somewhat according to the statistical model used. The results provide some support, albeit weak, to the view that districts with larger central office staffs have lower educational output, but that building administration can have positive effects on performance. Overall, the results suggest that administration's impact on educational productivity is far more subtle and complex than is often assumed.

The paper is set out as follows. In Section 2, the prevailing negative views about the role of school administration are discussed, and an outline of the empirical framework employed is given. Section 3 describes the data, and provides evidence on the resource allocation patterns of school districts in New York. In Section 4, the educational production function estimates are presented. This permits a determination of administration's effect on school district output. Section 5 discusses the implications of the findings.

2. ADMINISTRATION AND SCHOOL DISTRICT BEHAVIOR

In most states local districts control the flow of resources, and coordinate the activities of public schools. These tasks are managed by superintendents and their assistants at the district level. Principals, assistant principals, and departmental heads oversee the day-to-day administration of schools, assisted by professional/"paraprofessional" support staff (psychologists, teaching aides, etc.) and "nonprofessional" staff (secretarial, transportation, and building maintenance workers). While the purpose of this administrative hierarchy is ostensibly to ensure smooth operation of the school system, it is widely regarded as a source of inefficiency in the sense that district output is adversely affected. While this view is often imprecisely characterized, it appears to have at least two distinct dimensions.

First, it is asserted that there are too many administrators, or at least too many noninstructional inputs.[2] Dollars and personnel are misallocated such that instructional (classroom) activities receive too few resources, to the detriment of school output. While there is some evidence that schools in the United States devote fewer resources to teaching than other countries (Organization for Economic Cooperation and Development, 1993), statistical evidence of the supposed negative effects of administrative resources on school productivity is scant. The "administrative blob" view hinges on some notion of an *optimal* level of administration appropriate for a school district that is not currently being achieved, and that resources reallocated to teaching (via smaller class sizes, or more experienced teachers, for example) would increase output. This latter proposition has received only weak support indirectly in the educational productivity literature (Hanushek, 1986).[3] While some studies have included measures of aggregate district spending per pupil in statistical achievement models, administrative and teaching resources have generally not been separately identified.

The second common criticism of public school administration is that, independent of its size, it is too centralized, hierarchical, and formalistic (rule bound). Central (district level) administration is often viewed as a hinderance to building level administrators and teachers. For example, teachers are said to have too little freedom over what to teach and how to teach it, and principals are not given sufficient authority over personnel decisions. The "effective schools" literature (Rosenholtz, 1985; Purkey and Smith, 1983) provides some evidence for this, but much of the research is methodologically weak and generalizing from it is problematic. Attempts to analyze nationally representative data such as *High School and Beyond* (Chubb and Moe, 1990; Bryk and Driscoll, 1988) have provided additional insights, but administrative inputs are typically combined into amorphous "indexes" or composite variables which are extremely difficult to interpret. Evidence that school-level administrators (principals) positively affect student achievement (Brewer, 1993; Eberts and Stone, 1988) is not necessarily inconsistent with the assertion that central administration has an adverse effect.

In this paper the hypothesis that school districts which devote more resources to administration have lower productivity is tested, *ceteris paribus*. There are several parts to this assertion. First, an extreme version of this hypothesis maintains that more administration *per se* actually lowers output, i.e. administrative resources have a negative marginal product at current usage levels. This might be due to the increased burden central offices and building administrators place upon teachers in terms of paperwork, compliance with regulations, and harmful interference in classroom activities, which causes districts as a whole to be less productive than otherwise.[4] Second, a weaker view is that while administration does not directly lower educational output, it indirectly affects productivity by displacing more productive instructional inputs in the context of a fixed budget. Hence district output could be raised were resources to be reallocated away from administration. (This does not require negative marginal products associated with administration, merely that administration is less productive than teaching resources.) Third, a more refined view of administrative inputs maintains that it is *central (district level) administration* which lowers district output. Greater central office staffs tend to be an indicator of more hierarchy and formalism which interferes with the ability of both building administrators and teachers to effectively serve students.

In order to test these hypotheses, the concept of educational productivity is used (Hanushek, 1986; Monk, 1992). Each school district is assumed to have an educational production function, f, which relates school output (Y) to a set of inputs consisting of student and community characteristics (X) and schooling characteristics (Z). Empirically Y is expressed as linear function of X and Z, and a random error term (η), as given by (1), and the model is estimated by ordinary least squares:

$$Y = f(X, Z) = X\beta + Z\delta + \eta. \quad (1)$$

Y is typically proxied by standardized test scores. The vector X consists of variables such as parental and community education and income levels, the racial and ethnic composition of the community, the urbanicity of the district, etc.[5] Z includes schooling characteristics such as district enrollment, books per pupil, aggregate expenditures per pupil, teacher experience and qualifications.

Controlling for district size (enrollment) and total available resources (i.e. a budget constraint), and including measures of instructional and noninstructional input usage in Z, the estimated vector δ can provide a test of the hypotheses regarding administration's productivity. First, if administrative resources do indeed have a negative effect on student achievement then we would expect to find $\delta_{DA} < 0$ (district administration) and $\delta_{BA} < 0$ (building administration). Second, the weaker contention that administrative resources are less productive than instructional resources, and the assertion that central administration is more detrimental than building administration, can be tested by comparing the signs and magnitudes of these δ coefficients. Applying the production function concept to the district level (this point is discussed further in Section 4) and using aggregate input measures is admittedly crude and will not adequately capture more complex relationships among schooling inputs. However, the purpose here is simply to assess whether differences in resource utilization between school districts can explain variation in district performance as is widely asserted.

One problem with this analysis is that utilization of schooling inputs is likely related to student and community characteristics, including (possibly) student achievement, i.e.

$$Z = g(X, Y). \quad (2)$$

For example, more nonprofessional staff may be required for maintenance work in districts with old, deteriorating buildings, or more rural districts may need more expenditures on transportation. Likewise, more paraprofessional support (teacher's aides and guidance counselors) may be essential in a district with an academically below average student population. Similarly, more building administrators will be required if a district opts for smaller schools, or greater departmentalization, and more central administrators might be required to coordinate activities in larger and more diverse districts.

If these assertions are correct then (1) combined with (2), clearly implies that δ is not identified. Although other authors have recognized this problem (for example, Chubb and Moe, 1990, pp. 157–8), it is ignored in statistical modelling (i.e. administrative inputs are simply assumed exogenous). In order to ensure consistent estimates of the effects of administrative and other inputs on district achievement, a suitable set of instruments for Z may be required. The set of instruments used in this paper is discussed in Section 4. (Note that there may also be other reasons to expect $E(Z, \eta) \neq 0$, and hence the need to instrument for Z, as discussed in Ehrenberg and Brewer, 1994, Ehrenberg and Brewer, 1995.[6])

3. EVIDENCE ON SCHOOL DISTRICT RESOURCE ALLOCATION FROM NEW YORK

Before proceeding to the statistical analyses, this section presents some background on the resource allocation patterns of school districts. Surprisingly little is known about how districts use their resources, although increasingly researchers are turning their attention to the issue; see Picus (1995) for an overview of this work. Some evidence exists in regard to big city school "bureaucracies" (in particular, Chicago and New York City). Hess (1992), for example, found real administrative costs amounted to 14% of the total (in 1990), and traced some growth in administrative expenditure in Chicago 1981–88. Cooper and Sarrel (1991/2), in a widely publicized finding, computed that only 32% of expenditures were devoted to instruction in New York City. Such figures are misleading because of different classifications of expenditures (for example debt service or teacher pension benefits are counted as overhead by Cooper and Sarrel). While this limited research provides some corroboration for ample anecdotal evidence about the bureaucratic nature of these vast school systems, it is misleading to draw broader inferences from it. This is because these city districts are quite unlike the "typical" school district in the United States. New York City, for example, has almost one million students, compared to a nationwide district average of a few thousand; it is far more ethnically and racially mixed than most other districts; and it is beset by social problems such as drug use and violence on a much larger scale than in rural and suburban settings.

Other descriptive studies at national level (Picus, 1993; Chambers *et al.*, 1993), of specific states (State of New York, 1993; Nakib, 1995; Krop *et al.*, 1994), and cross-country studies (Organization for Economic Cooperation and Development, 1993), have provided some indication of the extent to which school districts use administrative resources. For a sample of over 4000 districts nationwide, Picus (1993) found an average of about 60% of school district spending went to instruction, with relatively little variation across districts. Using Florida data for 1991/2, Nakib (1995) found that out of an average of 113 professional staff per 1000 students in districts across the state, five were "district officials" and about three were school-level administrators. A recent New York study (State of New York, 1993), classified around 7% of expenditures as "administration" in 1990, and found some evidence for an increase in administrative staff per pupil over the previous 5 years (though not necessarily of an increased administrative share). Krop *et al.* (1994) report similar findings for expenditure patterns in California school districts.

This paper provides an analysis of data based on a sample of more than 700 New York state public school districts, *excluding* New York City, over the 1978–1987 period. New York City is excluded from all analyses because of its different organizational structure, and its vast size. Employment shares and payroll cost shares in each district are divided into five categories: district-level administrators, building-level administrators, teachers, professional/paraprofessional support, and nonprofessionals. Full details of the data, and the definitions used in the paper, are given in the appendix. Unlike previous evidence, the New York data used here has the advantage of permitting a detailed breakdown of employment patterns by district type and across time.[7]

Table 1 shows mean and median employment, mean employment per pupil, and employment shares, for five types of staff (DA: District level administrators, BA: Building level administrators, T: Teachers, PP: Paraprofessionals, NP: Nonprofessionals), for 1978, 1981, 1984, and 1987. All figures are based on a sample of 702 New York state school districts, excluding New York City, and are for full-time equivalents (FTE). Several features are striking. First, the overall share of total employment made up of noninstructional staff is around 45%, and this figure has barely changed over time. Second, while district enrollment has fallen throughout the period, district employment has failed to fall proportionately. Hence in terms of personnel per pupil, *all* inputs have increased. The largest proportionate increases have been in the number of building administrators per pupil and in paraprofessional staff per pupil, not in central administrators per pupil as is often claimed. In fact, the mean share of school employment devoted to administration, both at district and building level, was 11% in each year. The most marked increase has been in the use of paraprofessional support staff, from a median of 8 per district in 1978 to 14 per district by 1987; this represents a mean of 9% of total district employment.[8] The shares of total payroll expenditure associated with each input, are similar to the reported employment shares. In 1987, for example, administration constitutes about 12% of payroll, teachers 62%, paraprofessionals 15%, and nonprofessionals about 12%.

Table 1. School district employment distribution by function, New York, 1978–87

		1978	1981	1984	1987
District administration	Mean number	13.9	12.5	13.0	13.8
	Median number	5	4.5	5	5
	Mean number per pupil	0.005	0.006	0.007	0.007
	Mean share	0.04	0.04	0.04	0.04
Building administration	Mean number	23.0	22.1	22.4	24.4
	Median number	11.5	11	11	13
	Mean number per pupil	0.008	0.009	0.010	0.011
	Mean share	0.07	0.07	0.07	0.07
Teachers	Mean number	163.3	157.2	155.1	161.8
	Median number	99	93	94	98.5
	Mean number per pupil	0.062	0.067	0.072	0.078
	Mean share	0.55	0.55	0.54	0.54
Paraprofessional support	Mean number	16.1	20.5	23.9	28.9
	Median number	8	10	12	14
	Mean number per pupil	0.007	0.009	0.011	0.014
	Mean share	0.06	0.07	0.08	0.09
Nonprofessionals	Mean number	82.6	80.5	79.1	80.3
	Median number	52	49.5	48.5	50
	Mean number per pupil	0.031	0.033	0.036	0.037
	Mean share	0.28	0.28	0.27	0.26
District enrollment	Mean	2910	2579	2376	2287
	Median	1726	1520	1429	1432

Notes: For definitions see Appendix.

Table 2 shows cross-sectional variation in employment shares by district size, district wealth (median household income), urbanicity, and percent of a district's population that is white.[9] While there are some differences across types of district, these tend to be small. In addition, the shares exhibit remarkable stability. There is some evidence that urban and poorer districts have more administrators at both district and building level. In terms of building administrators, this may simply be due to the tendency of such districts to have larger, more decentralized schools, that require more administrators. The big growth in paraprofessional staff has come primarily in smaller, wealthier districts, and where the population consists of more white people. This may be due to the fact that these additional support staff represent service growth in districts where resources are available to finance such expansion. The largest reduction in the share of employment devoted to teaching has been in urban and poorer districts.

4. DOES ADMINISTRATION AFFECT SCHOOL DISTRICT PRODUCTIVITY?

In this section the results of the estimation of standard district level educational production functions like (1) are presented, using a subset of the New York data used in the previous section. All students in New York take a variety of standardized tests each year (see Ehrenberg *et al.*, 1991). Here the results used are of third and sixth grade reading and math tests, and a fifth grade writing test (PEP), eighth and ninth grade tests in reading and writing (PCT), and high school students Regents competency tests in reading, writing, and math (RCT). These measures thus cover elementary, middle, and secondary school levels respectively.[10] The variables used for PEP and PCT tests are the percentage of the district's students above the state reference point or SRP on each test, and for RCT the percentage of the district's students who took the test who passed.[11] While not ideal, these are the best proxies for educational output available for New York state as a whole. Test score data covering 4 years are available, 1984–87. The outcome measures are regressed on variables capturing the schooling personnel inputs of the district, and (in most cases) a set of district level controls such as enrollment, median household income, the percentage of students on welfare, urban/rural dummies, and the racial composition of the student population.

One difficulty with estimating production functions of this form is the level of aggregation, i.e. the district

Table 2. School district employment shares by function and district type, New York

	District size				District wealth			
	Largest		Smallest		Richest		Poorest	
	1978	1987	1978	1987	1978	1987	1978	1987
District administration	0.05	0.05	0.04	0.04	0.05	0.04	0.05	0.05
Building administration	0.06	0.07	0.08	0.08	0.07	0.07	0.08	0.09
Teachers	0.55	0.54	0.56	0.52	0.53	0.53	0.56	0.53
Paraprofessional support	0.07	0.09	0.04	0.09	0.07	0.10	0.05	0.08
Nonprofessional	0.27	0.24	0.28	0.24	0.29	0.26	0.26	0.26
	Urbanicity				Percent district white			
	Urban		Rural		Highest		Lowest	
	1978	1987	1978	1987	1978	1987	1978	1987
District administration	0.05	0.05	0.04	0.04	0.04	0.05	0.04	0.04
Building administration	0.08	0.09	0.06	0.06	0.08	0.08	0.06	0.07
Teaching	0.57	0.53	0.54	0.54	0.56	0.53	0.54	0.54
Paraprofessional support	0.05	0.09	0.06	0.08	0.06	0.11	0.06	0.08
Nonprofessionals	0.25	0.24	0.30	0.28	0.24	0.23	0.30	0.28

Notes: For definitions see Appendix and note 9.

level. Previous literature has applied the education production function concept to district, school, classroom, and individual student levels. Increasingly the availability of large nationally representative samples of individual students surveyed and tested at several points in time has allowed for more refined research in which it is possible to better control for prior achievement and individual and family characteristics than is possible in more aggregate analyses (Hedges *et al.*, 1994, p. 12).[12] Given the importance of adequately controlling for these traits, this more recent micro level work is generally regarded as most reliable (Monk, 1992; Hanushek, 1979). (Typically a large portion of the variation in individual standardized test scores is attributable to differences between individuals within a school or district. Estimating district level production functions means that we are attempting to explain only the variation in test scores between districts.) However, while these longitudinal datasets usually contain information on school and teacher characteristics they typically do not contain breakdowns of the resource mix which differentiate between district and building level administration, or paraprofessional support staff. [Some examples of studies which use other (older) individual student level data are cited in Hanushek (1986) and Eberts and Stone (1984).] Further, schooling information is typically confined to a single point in time; the New York panel used here has the advantage of time series as well as cross-sectional variation in district level resource measures. One final point is that it is extremely difficult to pinpoint the ways in which *district* level administrators affect individual students. Since the public policy debate over administration is typically concerned with the "gross" effect on educational output, and given data availability, district level production functions are estimated here.

Table 3 shows selected coefficients from models estimated by ordinary least squares for each of these three test score measures. Column (1) shows an educational production function in which district personnel divided into the same five categories described in Section 3 (i.e. district administrators, building administrators, teachers, paraprofessional support staff, and nonprofessionals) are included as measures of resource utilization.[13] The models include district enrollment and median household income along with a set of other district characteristics (the percentage of students on welfare, percentage of the district's residents with a high school education or less, urban/rural dummies, and the percentage of students white, black and Hispanic). Column (2) of Table 3 adds proxies for the quality of professional staff employed by each district: the mean experience levels

Table 3. School district educational production functions: selected coefficients from OLS models (absolute value *t*-statistics)

	PEP			PCT			RCT		
	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)
District administration	−0.046(1.0)	−0.051(0.8)	−17.71(0.8)	0.025(0.4)	0.036(0.6)	21.26(0.7)	−0.025(0.3)	−0.030(0.4)	−53.79(1.2)
Building administration	−0.053(1.0)	−0.047(0.9)	−42.27(1.8)	0.155(2.2)	0.163(2.3)	53.97(1.8)	0.121(1.2)	0.127(1.3)	−1.93(0.0)
Teachers	0.108(2.6)	0.106(2.5)	82.40(5.8)	0.040(0.7)	0.047(0.9)	27.54(1.5)	−0.183(2.4)	−0.131(1.7)	85.80(3.3)
Paraprofessional support	0.016(0.4)	0.022(1.3)	−21.70(1.3)	−0.055(1.2)	−0.057(1.2)	−61.67(2.8)	0.261(4.0)	0.240(3.7)	−21.43 (0.7)
Nonprofessionals	0.036(1.5)	0.031(1.3)	19.76(2.0)	−0.002(0.5)	−0.002(0.7)	−12.01(1.0)	−0.043(1.0)	−0.044(1.0)	−18.82(1.1)
Observations	2008	1886	1886	2008	1886	1886	2008	1886	1886
Adj. R^2	0.32	0.34	0.35	0.27	0.30	0.30	0.35	0.35	0.34

Notes: For models (1) and (2) each input category variable is a personnel count. Reported coefficients are multiplied by 10. For model (3) each input category variable is personnel per pupil. Full model estimates are available from the author. For variable definitions see Appendix. Models (1) and (3) also include district enrollment, median household income, urban/rural dummies, percent school population on welfare, percent school enrollment white, black, or Hispanic, and percent of district's residents with a high school education or less. Model (2) also includes the percentage of teachers, percentage of building administrators, and percentage of district administrators, with more than a masters degree, and mean experience levels for these three groups.

for district administrators, building administrators, and teachers, and the percentage of district administrators, building administrators, and teachers who have more than a masters degree, for each district.[14] Column (3) reports an alternative specification based on *per pupil* input figures rather than simple counts of personnel in each input category. This formulation may be a better indicator of resource intensity and allows for nonlinear scale effects to operate.[15]

In general the results on the three alternative model specifications yield consistent results for each input for each test but inconsistent results across tests. Comparing columns (1) and (2) of Table 3 reveals that coefficient estimates are relatively insensitive to the addition of personnel quality proxies. F-tests of the hypothesis that the coefficients of the added quality variables in (2) are jointly equal to zero cannot be rejected for PEP or RCT tests. In the remainder of the paper this issue is ignored. Likewise use of per pupil personnel variables [column (3)] yields similar results to those that include numbers of personnel. The one exception is for the high school (RCT) tests. While the greater the number of teachers a district employs, holding the number of students and all else constant, the higher is student achievement on all PEP and PCT tests, the effect is statistically significant and negative for the RCT tests. Here there is evidence of nonlinear scale effects not adequately captured by models (1) and (2). Teachers per pupil is in fact positive in model (3). The estimated coefficient of paraprofessional staff also flips sign when per pupil figures are used.

Table 3 provides little evidence of systematic negative effects of noninstructional resources on test scores. For example, both district and building administrators rarely have a statistically significant effect on achievement, though in most cases the effect of building administrators is less negative (or more positive) than that of district administrators.[16] This inconsistent pattern of estimates may be due in part to the inappropriateness of an OLS specification. For example, it is possible that the estimated coefficients of the inputs are biased due to omitted district characteristics. If there is some attribute of each district that systematically affects its educational output but is excluded, the results may be misleading. If we are prepared to assume that this district effect is fixed over time, the panel data available here permit the estimation of educational production functions with a separate intercept for each district. The result of this exercise is reported in Table 4. (Note that since district enrollment does vary over time this is included as an explanatory variable in these fixed effects models.) Column (1) uses personnel counts, column (2) per pupil figures, for each input category. As in Table 3, the larger the number of teachers a district employs, the better the performance of its students, all else constant. However, this is the only result consistent with Table 3 to emerge from these models. For example, across tests, the effect of increasing the number of building administrators, or building administrators per pupil, is now to raise district test score performance. Other inputs including district administration are rarely statistically significant.

As discussed in Section 2, a school district's utilization of personnel inputs is likely determined in part

Table 4. School district educational production functions: selected coefficients from fixed (district specific) effects models (absolute value *t*-statistics)

	PEP		PCT		RCT	
	(1)	(2)	(1)	(2)	(1)	(2)
District administration	−0.058(1.3)	19.03(1.2)	−0.041(0.6)	−35.51(1.1)	−0.047(0.6)	−3.60(0.0)
Building administration	0.119(2.0)	67.91(3.7)	0.248(3.0)	113.47(4.1)	0.141(1.2)	147.88(3.4)
Teachers	0.541(7.7)	26.21(3.5)	0.350(3.5)	20.96(2.0)	0.502(3.4)	286.13(6.1)
Paraprofessional support	0.020(0.3)	95.66(4.4)	−0.027(0.3)	29.64(1.0)	−0.059(0.5)	10.61(0.2)
Nonprofessionals	−0.014(0.3)	12.85(1.2)	−0.046(0.7)	−16.25(1.0)	0.058(0.6)	20.68(0.6)
Observations	2940	2940	2728	2728	2143	2143
R_2	0.73	0.72	0.67	0.67	0.70	0.71

Notes: For model (1) each personnel variable is a count, for model (2) each personnel variable is a per pupil figure. Reported coefficients in model (1) are multiplied by 10. Full model estimates are available from the author. For variable definitions see Appendix. Models (1) and (2) include district specific fixed effects and district enrollment only.

by the characteristics of the students it serves (including academic performance) and of the district's residents as a whole. To allow for the endogeneity of resource mix, three-stage least squares is used to estimate the district production function, with a set of characteristics of a district's students and its broader population used as instruments for each input (or inputs per pupil). These variables include district enrollment, median household income, urban/rural dummies, percent school population on welfare, percent residents with high school education or lower and percent with 5 or more years of college, percent residents white, black, or Hispanic, percent school enrollment white, black, or Hispanic, percent residents under 18 and percent over 60, and percent owner occupiers. Table 5 shows the results of this procedure. Column (1) shows the estimated coefficients on each input expressed in terms of numbers of personnel, and column (2) uses per pupil inputs. Each model allows the same set of district characteristics (district enrollment, median household income, urban/rural dummies, percent school population on welfare, percent school enrollment white, black, or Hispanic) to directly influence test scores–as well as in this case the utilization of each input–as used in Table 3. As in previous models, the positive effect of teacher employment on each test outcome remains, district administration has insignificant negative effects on district performance across tests, and other inputs vary in sign. It should be stressed that these estimates are sensitive to changes in model specification. If fewer control variables are included in the models (for example, if it assumed that only enrollment, income, and urbanicity affect test scores directly) the estimated coefficients on building administration become large and negative, and estimated teacher effects are much larger and positive. This instability arises because of collinearity among the five instrumented inputs.

Table 6 summarizes the direction of the estimated coefficients for each input measure by model type and test score, derived from Tables 3–5. In terms of statistically significant coefficient estimates, the table suggests that districts employing more teachers have higher test scores, *ceteris paribus*. The results for administrative inputs are less consistent. In terms of classical statistical tests, the effects of district administration are indistinguishable from zero (i.e. in no case are the estimated coefficients significant). On the other hand, 15 of the 18 estimates shown are negative, clearly more than would be expected if the true relationship were zero.[17] Similarly, 14 of the coefficient estimates for building administration are positive, although the instability of the three-stage least squares estimates suggest more caution is warranted. Hence there is some weak evidence in support of the assertion that districts which devote more resources to central administration have lower productivity, while those employing more teaching and administrative inputs at the building level tend to have higher test scores.

Table 5. School district educational production functions: selected coefficients from three-stage least squares models (absolute value t-statistics)

	PEP		PCT		RCT	
	(1)	(2)	(1)	(2)	(1)	(2)
District administration	−0.038(0.5)	−861.75(0.5)	−0.142(0.9)	−1878.90(1.1)	−0.491(1.5)	−2744.59(1.5)
Building administration	−0.068(0.8)	−87.96(0.1)	0.142(1.0)	734.07(1.2)	0.485(1.6)	1134.04(1.3)
Teachers	0.011(0.3)	227.72(0.9)	0.089(1.0)	275.63(1.2)	−0.211(1.2)	238.73(1.0)
Paraprofessional support	−0.032(0.5)	−477.44(1.1)	−0.175(1.1)	−313.47(0.9)	0.430(1.4)	466.46(1.1)
Nonprofessionals	0.008(0.2)	−13.52(0.0)	−0.136(1.3)	−337.01(0.9)	0.170(0.8)	234.96(0.6)
Observations	2901	2901	2685	2685	2109	2109

Notes: For model (1) each personnel variable is a count, for model (2) each personnel variable is in per pupil form. In each model the five inputs are assumed endogenous and identified by the following set of instruments: percent school population on welfare, percent residents less than high school education, or five or more years of college; percent residents white, black, or Hispanic, district enrollment, median household income, urban/rural dummies, percent school enrollment white, black, or Hispanic, percent residents under 18, or over 60; percent residents owner occupiers.

Table 6. School district educational production functions: summary of coefficient signs from Tables 3–5

		PEP			PCT			RCT		
		OLS Table 3	FE Table 4	IV Table 5	OLS Table 3	FE Table 4	IV Table 5	OLS Table 3	FE Table 4	IV Table 5
District administration	Number	−	−	−	+	−	−	−	−	−
	Per pupil	−	+	−	+	−	−	−	−	−
Building administration	Number	−	+*	−	+*	+*	+	+	+	+*
	Per pupil	−*	+*	−	−*	+*	+	−	+*	+
Teachers	Number	+*	+*	+	+*	+*	+	−*	+*	−
	Per pupil	+*	+*	+	+	+*	+	+*	+*	+
Para-professional support	Number	+	+	−	−	−	−	+*	−	+
	Per pupil	−	+*	−	−*	+	−	−	+	+
Non-professionals	Number	+	−	+	−	−	−	−	+	+
	Per pupil	+*	+	−	−	−	−	−	+	+

Notes: *Statistically significant at the 10% level or better.

5. CONCLUSIONS

The evidence presented in this paper provides mixed support for the widespread contention that administrative resources are consuming a large share of educational resources, to the detriment of educational productivity. While there appears to have been some growth in school districts' use of noninstructional inputs over the last decade or so, this has largely been in the form of paraprofessional support staff rather than administration, at least in New York. Estimates of the effects of the different inputs on educational output are hard to gauge given a lack of consistency across models. Increasing the employment of teachers, all else constant, seems to have a significant positive impact on output across OLS, fixed effects, and three-stage least squares specifications of educational production functions estimated using three standardized test score measures as outcomes. The effect of administrative resources is inconsistent across models; however there is certainly little evidence of any *systematic* statistically significant negative effects of school administration on educational productivity. In most models central administration has a negative impact on output; building level administration tends to have positive effects.

It is worth reiterating that the analysis in this paper is crude in the sense that schooling inputs are confined to measures of resource mix for five broad employment categories. In addition, the estimated models explain variation in district level performance, not individual test scores. Thus the analysis cannot capture the more complex and subtle ways in which school administration impacts students, and how administrators interact with other resources. However, given the often simplistic assertions about public school "bureaucracies", and the fact that many educational policy proposals are based on the (unsubstantiated) view that administration has large negative effects on how well schools perform, it is important to try to provide some firmer evidence as to the links between district resource allocation and school performance.

Acknowledgements—I thank Ronald G. Ehrenberg, David H. Monk, seminar participants at the American Education Finance Association Conference in Nashville (March 1994), and two anonymous referees for helpful comments on an earlier version. Financial support for this paper was provided by RAND's Institute on Education and Training with funding provided by a grant from the Lilly Endowment, and by the Finance Center of the Consortium for Policy Research in Education (CPRE). CPRE is a consortium of the University of Southern California, Rutgers University, Cornell University, Harvard University, Michigan State University, Stanford University, and the University of Wisconsin-Madison, supported by grant #R1178G10039 from the U.S. Department of Education, Office of Educational Research and Improvement. I am also indebted to the New York State Department of Education for permission to use some of the data analyzed in this paper. The views expressed are those of the author and are not necessarily shared by RAND, CPRE or the U.S. Department of Education.

NOTES

1. *The Ithaca Journal*, 12/8/93.
2. This is a commonly held view that has received much popular press: see for example, *U.S. News and World Report* (January 11, 1993) ("Public schooling's vast infrastructure–from those who change the light bulbs to the bureaucrats who push the paper–has grown so unwieldy and idiosyncratic that it is more often a hinderance than a support to education," p. 50).
3. Hanushek (1986) in reviewing these production function studies finds little evidence of systematic positive effects of schooling inputs on student performance. For more optimistic reviews of the literature see Monk (1992) and Hedges *et al.* (1994). See, however, the response by Hanushek (1994) in *Educational Researcher*, **23**(5): 5–10.
4. Of course, administration might have some positive effect on output–for example, relieving teachers of much parental and school board time–but on the margin given existing input utilization, these benefits are outweighed by detrimental activities.
5. Since learning is cumulative, X should also contain a measure of previous achievement (i.e. lagged Y) at least when the educational production function is estimated using individual level data. At the district level with considerable shifts in student population and no "true" longitudinal data, no prior achievement measure is included.
6. Since both teacher and parental locational choices are not random it is likely that schooling inputs, Z, and the error term, η, in (1) will be correlated, such that an instrument for Z is required to obtain consistent estimates of δ.
7. See Brewer (1996) for a brief description of the characteristics of administrators in New York.
8. A detailed breakdown of professional/paraprofessional support staff shows that teaching aides and teaching assistants have constituted around 70% of the total throughout the period. Teaching assistants make up the bulk of this group (at least half of all paraprofessionals) although there has been faster growth in aides. In the latter part of the period occupational, recreational, and physical therapists were added to the district level data, whereas prior to 1987 they had not been separately identified. This makes inferences about the source of professional/paraprofessional support staff growth problematic.
9. In Table 2, the top and bottom quartiles are used to define district categories: "largest" refers to the largest 25% of districts, "smallest" to the bottom 25%. The wealth measure used is median household income in the district and the racial composition is the percentage of the district's population that is white, both obtained from the *Census*.
10. It could be argued that use of these output measures requires the separation of elementary and secondary inputs. However, this is complicated by the fact that district level administrators, nonprofessionals (and many professional/paraprofessional support staff), are generally not assigned to a specific school.
11. Given the form of these measures it is strictly incorrect to use simple linear models with PEP, PCT, or RCT as the dependent variable varying between 0 and 100. In principle $\{\log [P/(100 - P)]\}$ (where P represents each test score measure)–or some variant of this form–is a more appropriate form of the dependent variable. However, when the models shown in Tables 2–4 are repeated using this form of the test score variable, the results are similar to those shown (the signs of the reported coefficients are identical in each case). Given that the linear models are much simpler to interpret they are included here.
12. For example, High School and Beyond (HSB), the National Education Longitudinal Study of 1988 (NELS88), and the Longitudinal Survey of American Youth (LSAY).
13. Each input's share of a school district's budget could be used as an alternative measure of resource allocation (although conceptually only input quantities enter as arguments of production functions). Since administrators are generally paid more than teachers (for a discussion of this point see Brewer, 1996), use of personnel counts may actually *understate* the extent to which administration consumes district resources. When the models reported below were reestimated using payroll shares for district administration, building administration, teachers, and paraprofessionals, a similarly inconsistent pattern of coefficient estimates was found, and no systematic evidence of a negative relationship between administrative inputs and district test scores. One problem with using budget shares is that given salary schedule arrangements they reflect the experience and credentials profiles of a districts staff as well as price variation across districts within New York, which makes interpretation of budget share coefficients in production functions somewhat problematic.
14. To this point in the paper, an implicit assumption of the analysis has been that inputs are homogenous. Clearly this may not be true. Previous evidence suggests, however, that traditional "quality" measures, such as mean teacher experience levels, are rarely statistically significant in models of student achievement (Hanushek, 1986), most likely because they are in fact poor proxies for "quality". Personnel based data are used to construct similar measures here. No quality proxies can be obtained for paraprofessional or nonprofessional staff, though for the latter the assumption of homogeneous inputs may be more reasonable.

15. This possibility was investigated in other ways. For example, using log input measures, and log enrollment. The pattern of results is consistent with those reported in the paper.
16. Additional evidence of nonlinearities was explored via inclusion of interaction effects in the estimated models. It is possible for example that administrators can help teachers in ways which boost output (for example, by reducing teacher time spent on paperwork or in dealing with parents). See Eberts and Stone (1984) for discussion of these points. Although it is difficult to capture such effects directly in aggregate district level production functions, it is possible to enter administrative variables interacted with teacher variables. When this was done in models otherwise similar to those reported in the paper, there was in fact only mixed support for such effects. (Results available from the author on request.) There was some indication of a complementarity between building administrators and teachers (i.e. the coefficient of this interaction term was positive) but the effect was small and not consistent across tests.
17. For example, if the number of negative coefficients is a random variable with a binomial distribution, the probability of finding 15 of these outcomes in 18 models would be less than 1%, given by (18! /[15!3!]) multiplied by $(0.5^{15} \times 0.5^{3}) = 0.003$. (See Hedges *et al.*, 1994, and Ehrenberg *et al.*, 1995, for a more formal discussion of this approach.)

REFERENCES

Brewer, D.J. (1993) Principals and student outcomes: evidence from U.S. high schools. *Econ. Educ. Rev.* **12,** 281–292.

Brewer, D.J. (1996) Career paths and quit decisions: evidence from teaching. *J. Lab. Econ.* **14**(2), 313–339.

Bryk, A.S. and Driscoll, M.E. (1988) *The School as Community: Contextual Influences, and Consequences for Students and Teachers.* Madison, WI: National Center on Effective Secondary Schools, November.

Chambers, J.G., Parrish, T., Goertz, M., Marder, C. and Padilla, C. (1993) *Resources in the Context of State and Local Resources for Education,* Chapter 1, Translating dollars into services. Palo Alto, CA: American Institutes for Research.

Chubb, J.E. and Moe, T. (1990) *Politics, Markets, and America's Schools.* Washington, DC: The Brookings Institution.

Cooper, B.S. and Sarrel, R. (1991/2) Managing for school efficiency and effectiveness: it can be done even in New York City. *National Forum of Educational Administration and Supervision Journal* **8**(3), 4–17.

Eberts, R.W. and Stone, J.A. (1984) *Unions and Public Schools: The Effect of Collective Bargaining on American Education.* Lexington, MA: D.C. Heath.

Eberts, R.W. and Stone, J.A. (1988) Student achievement in public schools: do principals make a difference? *Econ. Educ. Rev* **7,** 291–299.

Ehrenberg, R.G., Ehrenberg, R.A., Rees, D.I. and Ehrenberg, E.L. (1991) School district leave policies, teacher absenteeism, and student achievement. *J. Human Resources* **26,** 72–105.

Ehrenberg, R.G. and Brewer, D.J. (1994) Do school and teacher characteristics matter? Evidence from high school and beyond. *Econ. Educ. Rev* **13,** 1–17.

Ehrenberg, R.G. and Brewer, D.J. (1995) Did teacher verbal ability and race matter in the 1960s? *Coleman* revisited. *Econ. Educ. Rev.* **14,** 1–21.

Ehrenberg, R.G., Goldhaber, D.D. and Brewer, D.J. (1995) Do teachers' race, gender and ethnicity matter? Evidence from *NELS88. Industrial and Labor Relations Review* **48,** 547–561.

Hanushek E.A. (1979) Conceptual and empirical issues in the estimation of education production functions. *J. Human Resources* **14,** 351–388.

Hanushek, E.A. (1986) The economics of schooling: production function and efficiency in the public schools? *J. Econ. Literature* **XXIV,** 1141–78.

Hedges, L.V., Laine, R. and Greenwald, R. (1994) Does money matter? A meta-analysis of the effects of differential school inputs on student outcomes. *Educ. Researcher* **23**(3), 5–14.

Hess, A. (1992), Reorienting a school district's funding priorities by state mandate. *News and Views* May, 70–80. (Available from the author.)

Krop, C., Carroll, S. and Ross, R. (1994) *Tracking K-12 Education Spending in California: Who, Where and How Much?* Santa Monica, CA: RAND.

Monk, D.H. (1992) Educational productivity research: an update and assessment of its role in education finance reform. *Educ. Eval. Policy Analysis* **14,** 307–332.

Nakib, Y.A. (1995) Beyond district level expenditures: schooling resource allocation and use. In *Where Does the Money Go? Resource Allocation in Elementary and Secondary Schools* (Edited by Picus, L.O.), pp. 85–105. Sherman Oaks, CA: Corwin Press.

Organization for Economic Cooperation and Development (OECD) (1993) Report cited in *Education in States and Nations.* Washington, DC: U.S. Department of Education, October.

Picus, L.O. (1993) The allocation and use of educational resources: district level evidence from the schools and staffing survey. Working paper No. 34, January. Los Angeles, CA: The Finance Center of CPRE.

Picus, L.O. (1995) *Where Does the Money Go? Resource Allocation in Elementary and Secondary Schools*. Sherman Oaks, CA: Corwin Press.

Purkey, S.C. and Smith, M.S. (1983) Effective schools: a review. *Elementary School J.* **83,** 427–452.

Rosenholtz, S.J. (1985) Effective schools: interpreting the evidence. *Am. J. Educ.* **93,** 357–88.

State of New York (1993) *State Education Department Staff Study: Some School Districts' Administrative Costs Appear To Be Excessive.* Albany, NY: Office of the State Comptroller, Division of Management Audit, Report 93-D-19.

APPENDIX: NEW YORK DATA

1. DATA SOURCES

Personnel Master File, New York State Department of Education, annually, 1978/9–1989/90 (PMF). These are **restricted**: permission of the New York State Department of Education is required before it may be used. Contains personal characteristics for each assignment for classroom and nonclassroom staff, identified by (scrambled) social security number that remains constant across years, and a school and district identification number.

Institutional Master File, New York State Department of Education, annually, 1978/9–1989/90 (IMF). This file contains data on enrollments, resources (both physical and human) for each school and district in the state).

School Financial Files, New York State Department of Education, annually, 1978/9–1989/90 (FIN). These files contain the detailed financial accounts of each school district.

Comprehensive Assessment Report, New York State Department of Education 1986/7, and 1989/90 (CAR). This report contains standardized test score measures for each district for a variety of tests administered by the state.

Census of Population, School District Files, New York State, U.S. Bureau of the Census 1980 (CEN). These files contain data on the characteristics of each school district's population in 1979.

2. VARIABLE DEFINITIONS

Variable source indicated in parentheses. All variables are yearly, except those taken from the *Census* (CEN) which are time invariant (based on 1979 data). Detailed descriptions for the construction of each variable.

Note that all employment figures are expressed in full-time equivalents. **PP: DA: District Administrators**. Professional staff assigned to more than one school (IMF). **BA: Building Administrators**. Professional staff at school level (IMF). **T: Teachers**. Professional staff designated as classroom staff (IMF). **PP: Professional/paraprofessional support staff**. Teaching assistants, teaching aides, athletic trainers, pupil personnel service aides, occupational therapists, physical therapists, recreation therapists, audiologists, library aides, health aides, and "other para- professional" staff (IMF). **NP: Nonprofessionals**. Secretaries, maintenance workers, bus drivers, school lunch workers, and "other nonprofessional" staff (IMF). **DAPS: District administrators share of district payroll**. Noninstructional salaries for Board of Education, district clerk, district meeting, chief school administrator, business administration, auditing, treasurer, tax collector, legal, personnel, purchasing, public information, dataprocessing, research, and inservice training (FIN). **BAPS: Building administrators share of district payroll**. Supervision instructional and noninstructional salaries at regular and special schools, and curriculum development (FIN). **TPS: Teachers share of district payroll**. Teacher salaries at regular and special schools (FIN). **PPPS: Professional/paraprofessional support staff share of district payroll**. Instructional and noninstructional salaries for handicap program, special needs, employment protection, library/audiovisual, educational television, computing, personal services (attendance, guidance, health diagnostic services, psychological services), social work, curriculum, and athletics (FIN). **NPPS: Nonprofessionals share of district payroll**. Noninstructional salaries of transport, garage, plant operations, plant maintenance, storeroom, and printing (FIN).

PEP: Mean percentage of students scoring above the state reference point on PEP tests administered in 3rd grade math, 3rd grade reading, 6th grade math, 6th grade reading, and 5th grade writing (CAR). **PCT**: Mean percentage of students above the state reference point on 8th and 9th grade PCT reading and writing tests (CAR). **RCT**: Mean percentage of those who took the high school Regents competency tests, RCT, who passed, for math (January and June), reading (January and June), and writing (June) (CAR).

Additional variables used in statistical models: District enrollment (IMF); percent school district population on welfare (weighted school average) (IMF); percent school district enrollment white, black, or Hispanic (weighted school average) (IMF); percent district's residents less than high school education, or five or more years of college (CEN); percent district's residents white, black, or Hispanic (CEN); percent district's residents under 18, or over 60 (CEN); percent district's residents owner occupiers (CEN); district median household income (CEN); district mean percentage of teachers, building administrators, and district administrators, with more than a masters degree, and district mean years of experience (PMF).