
**The Preparation and Selection of
Public School Administrators in Pennsylvania:
Supply and Demand and the Effects on Student Achievement**

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School Principals:
Their Role in Improving Outcomes
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ABSTRACT

In Pennsylvania, there was evidence over the period 1975-1999 of aggregate excess supply in the number of newly certified administrators (principals and superintendents) compared to the number of vacancies. The number of provisional administrative certificates was 40% higher in the mid 1990's than to the prior peak in 1975. However, increasingly districts have sought principals and superintendents from outside their districts or region to meet their administrative needs. This suggests that there may be coordination problems in the market. The turnover of school and especially district administrators was much higher than that of teachers.

Over 1984-99, teacher salaries generally rose faster than inflation, and the range of lowest to highest teacher compensation was maintained, presumably through the collective bargaining process and the right to strike, of about 2:1. On the other hand, administrative salaries over 1984-99 displayed declining premiums compared to teaching. This decline in the premium for becoming a school manager was most pronounced in the case of elementary principals. While premiums for administration declined, the likely range of responsibility increased over the 1984-99 period, since school employment has generally increased but the number of administrators has remained constant. While there was evidence that higher administrative pay premiums were associated with higher student achievement, the effect was not very large in terms of student test scores.

School administration has become increasingly a female occupation as public education has always been. The very pronounced changes in the demographics of school managers may have significant implications for the sociology and nature of student disciplinary interactions in the schools themselves.

In general, the characteristics of school administrators did not directly or substantially impact building level student achievement scores. On the other hand, whether or not a building had employed teachers who were disciplined by the state did make a difference. Thus, indirectly through the teacher hiring process, the nature of administrative choice can make a difference in student achievement. Whether paper and pencil knowledge of Pennsylvania's administrative school procedures, now required of newly certified administrators, is related to student achievement remains an untested hypothesis and worthy of further investigation.

1.0 Introduction

1.1 Administrators as a Component of School Reform

There is a growing consensus that reform of America's public school system must not only entail higher academic standards for students, stronger content and pedagogical knowledge and performance of classroom teachers, but also greater autonomy of individual schools and their administrative staff. A corollary to this last observation is that administrators at the school level must not only have greater autonomy in both leading and enabling classroom teachers to set higher learning standards for their students, but also must have authority over resource and staffing decisions to accomplish the objective of improving student performance. Aligning authority with what many argue should be greater responsibility with educational outcomes at the school level only makes common sense, and comports with modern management techniques in the for profit sector.

While there is a significant body of research on school administrators², rather less is known systematically about: (i) the decision of classroom teachers to prepare themselves for school administration, (ii) the paths by which they actually move into educational administration, and (iii) whether or not one can discern, using appropriate statistical techniques how the nature of administrative staff at the school level is related to educational outcomes across the schools *of an entire state*. The issue of the nature of current school administrators is of increasing importance as retirements of both teachers and administrators loom large in many states.

Much of what we know in the U.S. about school administrators derives either from case studies of several schools, or the sample survey results of the National Center for Educational Statistics periodic *Schools and Staffing Surveys*³. The April, 1997 NCES analysis of public and private school principals,⁴ as have its earlier analyses, focused primarily on the gender and ethnicity of public and private school principals, their compensation over time, origins of newly appointed principals, and perceptions of serious problems. At the national level in the mid 1990's, school principals were about 48 years of age, 65% male, and 10% Black, and earned about \$55,000/year. By 1994/4, 57% of newly appointed principals were female, although the bulk of women principals were at the elementary level; the majority of secondary school principals appointed continued to be men.⁵

1.2 Goals of Paper

The purpose of this paper is to examine longitudinally (1984-99) Pennsylvania's records on its school teachers and administrators, and to relate these characteristics to

² See Hallinger and Heck(1996) for a review of the 1980-95 research literature, and Bridges(1982), and Bossert, Dwyer, Rowan and Lee(1982) for reviews of the earlier research literature on the relationship between school administrators (primarily school principals) and student outcomes.

³ See NCES(1997) for the most recent statistical description of characteristics and perceptions of public and private school principals in the United. States.

⁴ See NCES(1997).

⁵ NCES1997), Table 2., p. 7, and Figure 2, p. 9.

student outcomes in 1998. Unlike NCES studies of school administrators, this report is based on the administrative records of individuals over time, and not their responses to sample survey questionnaires. Also, this report is based on the *universe* of school administrators in Pennsylvania. The data analyzed and reported on below were collected under a series of signed confidentiality agreements by the author with the Pennsylvania Department of Education in conjunction with a recent monograph⁶ for the Pennsylvania State Board of Education. Another unique aspect of this study is that it utilizes the universe of administrative records of employed school administrators to investigate relations between administrator characteristics and student outcomes.

1.3 The Nature and Sources of Data in Study

This paper exploits individual level data on teachers and administrators in Pennsylvania, and also exploits school⁷ and school district level data in relation to summarized individual level data.

The Pennsylvania Department of Education (PDE) routinely collects detailed information about its prospective, certified, and employed professional personnel. These administrative records track the application of those being trained by institutions of higher education to obtain a certificate from PDE. The certificate enables them to be legally employed as a teacher, school administrator, and/or school supervisor. PDE's Professional Personnel Certification File is the universe of any person who applied to be certified by PDE, and reflects PDE's effort in the mid 1960's to computerize its administrative records. The Certification File also contains any person who earned professional certification in other states⁷ and whose certificates are recognized by Pennsylvania through signed inter-state reciprocity agreements. The Certification File thus reflects what is known about the supply of teachers and administrators in Pennsylvania, and contains demographic information and educational information as well as information on up to 15 professional certificates issued by the PDE. As of June, 1997, there were 526,913 persons in the Certification File.⁸

The second source of data analyzed in this study relates to those actually employed by local education agencies (LEA's) which themselves are composed of 29 intermediate units, 501 public school districts, and 70 area vocational technical schools. Each fall PDE requires the chief administrator of a LEA, typically a school superintendent in a public school district, to inventory its professional personnel and report full and part time employees. The resultant demographic and employment information is returned to PDE which constructs an annual Professional Personnel File. Information on age, gender, ethnicity, educational attainment, detailed major and minor assignments, school of employment within the LEA, and reasons for withdrawal from the

⁶ See Strauss(1998), and also Strauss, Bowes, Marks and Plesko(2000).

⁷ A school should be thought of as group of students, teachers, administrators and supervisors, across various grade levels, who are under the administrative control of a principal. A school need not be a building, *per se*, since one building may house both a middle school and a high school etc.. Given vast changes in student demography over time, school districts routinely utilize a building for different student age and grade groupings.

⁸ This count reflects the number about whom PDE received any information (instate or out of state).

LEA are annually maintained by SSN. Annual Professional Personnel Files from school years 1984/5 through 1999/2000 were concatenated and merged to the Professional Certification file by SSN to examine the supply and demand for school administrators in Pennsylvania.

Information on enrollment, average daily membership, and the number of students obtaining free or reduced price lunches, at the building level and district level, are available from PDE's world wide web site maintained at Penn State University. Also available there, are the mean reading and math achievement scores for grades 5, 8, and 11 from the 1998 Pennsylvania System of Student Assessment (PSSA)⁹.

Socioeconomic information by school district reflect tabulations by school district and maintained by the Pennsylvania State Data Center in Harrisburg. Information from the 1990 Census of Population on the percentage of district adults holding a bachelors degree or higher will be utilized below when examining determinants of student achievement.

The paper is organized as follows: Section 2 briefly describes the institutional framework under which administrators are licensed in Pennsylvania, Section 3 discusses the market for school administrators, Section 4 discusses how administrator characteristics, as contrasted with other explanatory factors, affect student achievement at the building level, and Section 5 discusses the policy implications of these empirical findings.

2.0 Licensure Requirements to become a Pennsylvania School Administrator

Pennsylvania's teacher and administrator licensure statutes, like those in other states, presumes that by stipulating minimum standards of education and experience of candidate administrators, it fulfills the state's licensure responsibilities in the area of local educational administration. This is accomplished by creating a pool of competent professionals from which school districts may hire.

Pennsylvania has a highly structured, two-stage process of certification that leads to credentials required to be a school administrator (elementary, middle or secondary school principal) or school supervisor (curriculum, special education etc.). The process enables a permanently certified teacher to become a provisionally certified and then permanently certified administrator, i.e. career paths that lead to becoming a principal.¹⁰

After at least three and no more than six years of teaching with a provisional teaching certificate (Level I)¹¹, the candidate may convert the provisional teaching

⁹ See generally: <http://www.pde.psu.edu/> and <http://paprofiles.org> for the various school and district data files.

¹⁰ Pennsylvania creates a second administrative channel described as "supervision"; however, earning supervisory certificates does not enable one to become a principal or superintendent.

¹¹ Provisional certification is earned by: (1) graduating from an approved teacher preparation program, (2) passing ETS Praxis Examinations at state defined passing scores that were dramatically raised in 2000, and

certificate to a Level II certificate, which is a permanent teaching certificate. During the probationary period, the teacher must have completed 24 credits from an approved program at an institute of higher education in order to be eligible for this conversion.

To obtain certification as a school administrator, primary or secondary school principal, a candidate must have completed an approved program of graduate level study preparing him/her to "... direct, operate, supervise, and administer the organizational and general educational activities of a school." Up until 1999, which is the period under study, there was a two-step procedure to become permanently certified as an administrator; this has been simplified into one procedure.

To obtain an Administrator I (provisional) certificate, the candidate must be recommended for certification as a primary or secondary school principal by the authorized certification officer of the higher education institution where the degree was obtained. The candidate must also provide a chief school administrator's verification of the completion of five years of satisfactory professional school experience.

Satisfactory completion of three years of administrative experience, as attested to by the chief school administrator of the LEA where the candidate works, entitles the candidate to convert the Administrator I certificate into an Administrator II or permanent certificate.

Thus, as a practical matter, to become certified as an administrator, one must first become permanently certified as a classroom teacher, obtain administrative course work typically on a part-time basis from a nearby college or university approved by the state department of education to offer such a degree program, and then function for three years to the satisfaction of one's school employer in some sort of administrative position. These part-time graduate administrative programs are typically staffed by a mixture of career academics and former school administrators who have been hired as adjunct or fulltime faculty.¹²

Pennsylvania's procedure to become certified as a district superintendent is less structured than to become a school principal. The superintendent candidate must first obtain a letter of eligibility from the Pennsylvania Department of Education. Additionally, the candidate must have completed a Pennsylvania approved, two-year (at least) graduate-level program of educational administration for the preparation of chief school administrators. If the candidate completed his/her training out of state, the program must be demonstrated to be equivalent to those approved in Pennsylvania. A recommendation from the preparing institution for certification as a chief school (district level) administrator must be obtained. Finally, to receive the Assistant Superintendent's Letter of Eligibility, evidence of six years of teaching or other professionally certificated service in the basic schools must be provided. For the Superintendent's Letter of

(3) obtaining a letter from the preparation program to the Pennsylvania Department of Education endorsing the request for provisional certification.

¹² Independent evaluation of candidates' knowledge of basic school laws and approaches to educational administration is now being implemented by the state which is utilizing ETS written examinations.

Eligibility, three of those six years must have been in a supervisory or administrative capacity.

There exist statutory emergency provisions that permit a local district to request temporary administrative certificates from the Department of Education for certain individuals. Additionally, alternate mechanisms also exist from the above-described superintendent credentialing process that have enabled, for example, university faculty to become superintendent of the Philadelphia public schools.

3.0 The Market for School Administrators in Pennsylvania: 1984-99

3.1 Supply of New Administrative Licenses and Employment of School Administrators

The annual supply of newly credentialed teaching and administrative personnel has varied over the years as individuals consider teaching compared to other jobs, and consider administration vs. teaching once permanently employed in the public schools. In 1975, in the midst of a student demographic boom, about 12,000 Instructional I certificates were issued in Pennsylvania, 7,100 Instructional II certificates were issued, 408 Administrative 1 certificates were issued and 383 Administrative II certificates were issued. During the period 1975-1996, the number of employed classroom teachers grew slowly from about 98,000 to 110,000, while the number of employed administrators remained constant at about 6,300.

As Figure 1 shows, the supply of new teaching certificates¹³ returned by the mid 1990's to its 1975 peak, while the recent supply of provisional administrative certificates was about 40% *higher* than its 1975 peak production. This suggests that, at least in Pennsylvania, there is an *aggregate* cadre of initially credentialed administrators ready to take on principalships upon the creation of vacancies through retirement.

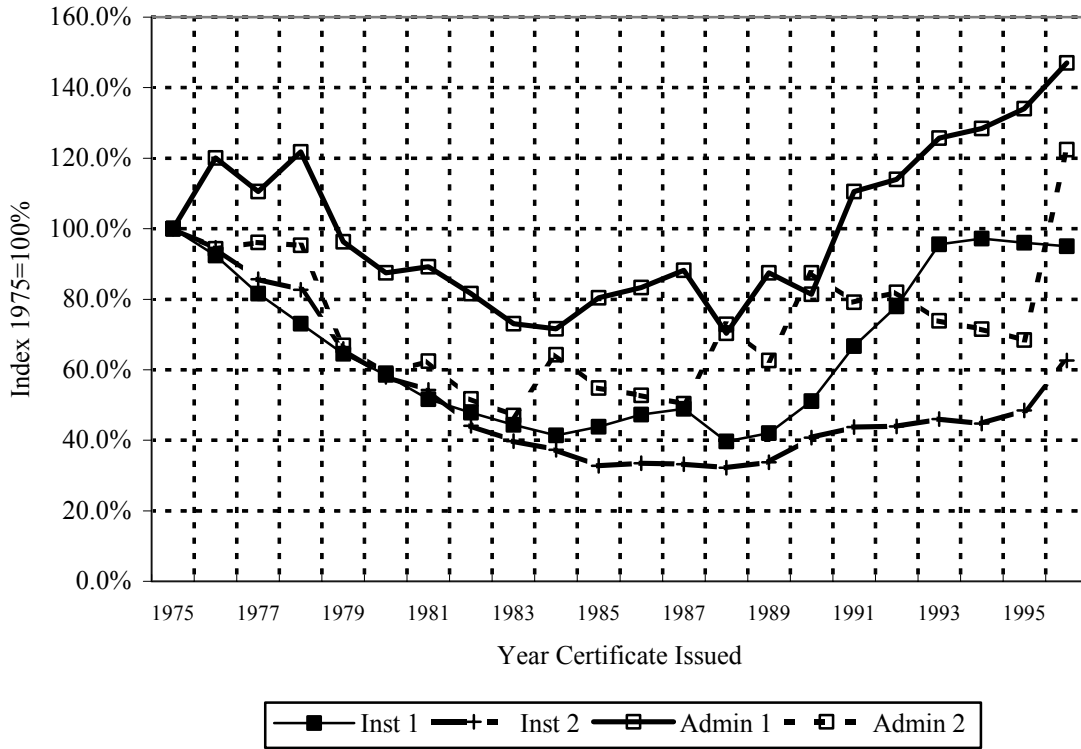
Note also in Figure 1 that in 1996, the number of newly issued permanent administrative certificates jumped dramatically (from 262 in 1995 to 469 in 1996). This reflects the delayed reaction by the credentialing system to the early retirement incentives provided by the Pennsylvania General Assembly in 1991 and 1992, and the replacement of retiring administrators in the early 1990's with provisionally certified administrators who by 1996 had earned their permanent administrative certificate as a consequence of performing 3 years of satisfactory service in their local district.

Provisionally certificated teachers have always been predominantly female---70% in 1975 vs 75% in 1996. The pattern for newly permanently certified (employed) teachers is quite similar---71% female in 1975 and 78% in 1996. On the other hand, only 17% of provisionally certified administrators were women in 1975 while fully 57% were women

¹³ Strauss(1993), Chapter 7, reports real, relative salary supply elasticities of +1.8 for primary teachers, and +.33 for secondary teachers. The "optimistic" long-run projections (see Figure 7.3 of Strauss(1993)) are consistent with actual data shown in Figure 1 here, and reflect the ability of the collective bargaining process to materially raise real teacher salaries.

in 1996. The women's share of newly permanently certified (employed) administrators has grown from 8% in 1975 to 42% in 1996.

**Figure 1: Pennsylvania: 1975-1996
Supply of Instructional and Administrative Certificates**



3.2 Total Employment of School Professional Personnel

Total professional employment in Pennsylvania's public schools displays long-term secular growth. In 1984 there were 116,950 professional employees, while in 1999 there were 135,399. This 16% overall growth¹⁴ in personnel is two times larger than the growth in student enrollment during the same period: compare 1,664,636 students in 1984 to 1,777,470 students in 1999 or a 6.8% growth. Over this same period, while the number of teachers and coordinators grew significantly, the number of administrators employed throughout Pennsylvania remained relatively stable at around 6,300 personnel.

Since the number of teachers, administrators, and supervisors has risen by 16% but the number of administrators has remained constant, it follows that the task of administration has risen by at least 16%.¹ One can make the argument that the task of administration has grown much more than 16%, since the number of possible personal interactions grows geometrically with the number of people in an organization: $n(n-1)/2$

¹⁴ This amounts to .9%/year annual growth rate.

where n is the number of people in the organization. Consider a district with an initial 20:1 ratio of professional to administrative staff¹⁵, and increase the ratio by 16% to 23.2. The number of interactions, defined as $n(n-1)/2$, grows from 190 to 255 or a 34% increase.

3.3 Demographics of Newly Hired School Administrators

The median age at the time of a first administrative appointment has risen by about 8 years from a median age of 38 in 1985 to 46 in 1999. Newly appointed primary and secondary principals have a similar range of median age from 41 in 1985 to 47 in 1999. Middle school principals and principals of combined K-12 are somewhat older at first appointment ranging from a median age of 45 in 1985 to 49 in 1999. Similarly, the median age of first appointment as a superintendent ranges from 46 in 1984 to 51 in 1999.

Overall, there has been about a 4-year increase in the median number of years of professional experience that a person brings to his/her first administrative position. The median number of years of professional experience of a person accepting a first appointment as superintendent has risen from 20 years in 1985 to 29 years in 1999.

District level experience at time of first appointment as school administrators is much shorter, and has actually been *falling*. Median years of district experience fell from 12 years in 1985 to 10 years in 1999. This decline in district experience prior to becoming a principal was most pronounced for secondary principals, with the median years of district experience being 15 in 1985 compared to only 5 in 1999. This suggests that those who seek to be principals, especially high school principals, have become more willing to relocate to another district.

3.4 Turnover Rates of Professional Personnel

Each year school administrators and school boards must deal with the reality that teachers and administrators retire, leave the profession, take a leave of absence, or move to another district. Overall, administrators are more likely to withdraw from their professional position than their classroom counterpart. In 1984, 4.8% of classroom teachers withdrew from classroom teaching in Pennsylvania, while 5.8% of administrators withdrew. In 1998 14.3% of all administrators withdrew compared to 8.4% of all classroom teachers.

Superintendents were most likely to withdraw with 9.8% leaving in 1984, and 16.6% leaving in 1998. (In 1992, due to early retirement incentives, one out of every five superintendents left his district, compared to one out of every 14 teachers.) Secondary school principals are far more likely to withdraw than elementary school or middle school principals. In 1998 17.3% of secondary principals withdrew, compared to 12.5%

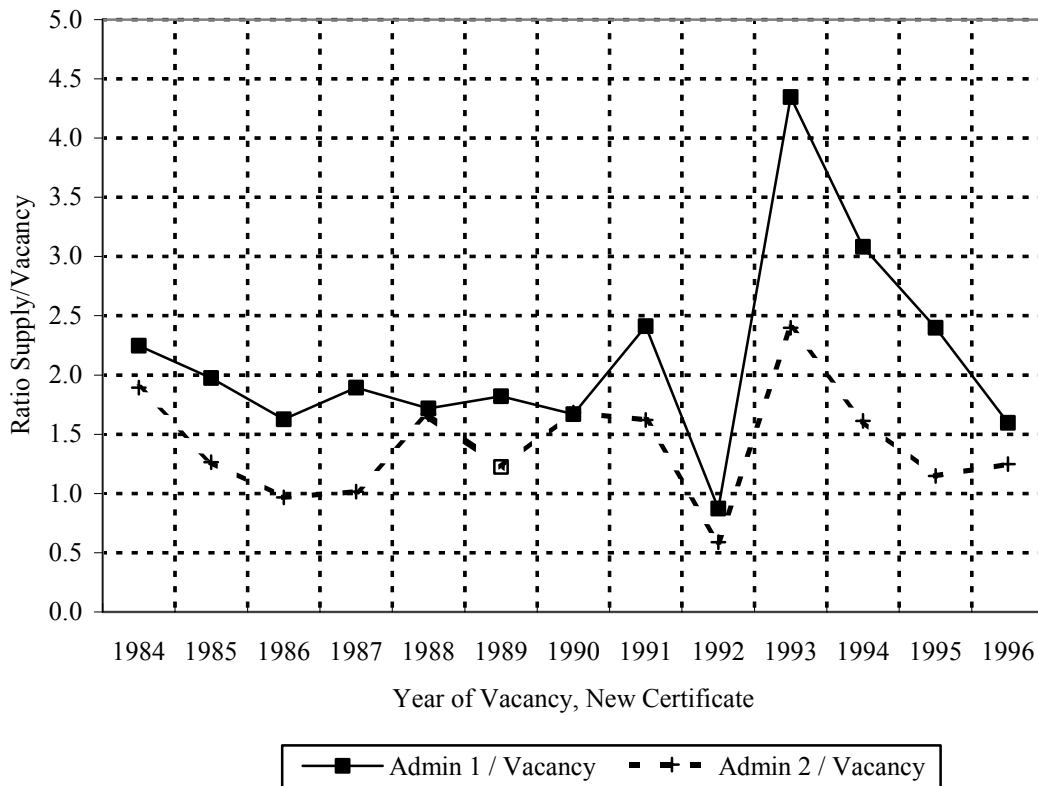
¹⁵ Given 116,950 *total* professional personnel in 1984 and 6,230 administrators, the ratio of personnel to administrators in 1984 was 18.5. In 1999, the respective employment figures were 135,399 professional personnel and 6,383 administrators, implying a ratio of 21.2 or a 15% overall increase.

of elementary school principals. These rather high rates of turnover must mean that school boards and superintendents are increasingly spending their time seeking building level managers.

3.5 The Market for Pennsylvania’s School Administrators: Excess Demand or Excess Supply?

While much national attention has been focused on alleged “shortages” of school principals in the last several years, a comparison of the state-wide numbers of provisional Administrative I certificates to school level vacancies shows a substantial excess of supply to demand. Figure 2 plots the statewide annual ratios of new Administrative I and Administrative II certificates to school level withdrawals by school principals. Since Administrative I certificate holders typically do not yet enjoy a principalship, the ratio reasonably reflects aggregate market balances. As is evident for all years but 1992 when the early retirement incentives led to significant retirements, the ratio of new supply to vacancies was typically in excess of 1.5:1.

**Figure 2: Pennsylvania School Principals:
New Certificates / New Vacancies: 1984-1996**



3.6 Salary Patterns of Professional Personnel: 1984 and 1999

Encouraging teachers to move from the classroom to administration no doubt depends on the presence of financial incentives. Administrators, unlike classroom teachers, generally work much longer hours and more months in the academic year. While all Pennsylvania school districts are under collective bargaining agreements with either the Pennsylvania State Education Association or the Pennsylvania Federation of Teachers, school administrators, however, are not covered by collective bargaining agreements (with the exception of Philadelphia whose principals became organized in the mid 1990's), and practices vary among districts in terms of the manner in which administrative salaries are determined during collective bargaining and budgetary cycles.

When comparing the salary patterns of professional personnel for year 1984 to year 1999, it is necessary to adjust for inflation. For example, the median teacher salary in Philadelphia was \$30,555 in 1984, and \$53,148 or a 73% increase in 1999. During the same period, the Consumer Price Index Rose 60%, so that median inflation adjusted professional personnel salary rose 13% in Philadelphia. In Pittsburgh, the median salary rose from \$30,560 to \$65,200 or a 113% increase, which reflects a 53% increase in inflation adjusted median salary between 1984 and 1999. The median salary of 4th class (typically rural) school districts was quite low in 1984, only \$19,225, but rose to \$43,210 in 1999. 3rd and 4th class school district median salaries have been about \$10,000/year lower than in Pittsburgh and Philadelphia.

Salaries of principals vary by geographic region. Taking the non-metropolitan area salary as a benchmark because it is typically the lowest, it is possible to compare salaries between MSAs. In 1999, the median elementary school principal in a non-metropolitan area earned \$64,200. The median counterpart in the Allentown MSA earned 1.129 or 12.9% higher. Representative elementary school principals in Johnstown, Sharon and State College earned a bit less than the non-metro principal. Principals in the Philadelphia metropolitan area earned 26.2% more than their non-metro counterpart. The results for secondary school salaries are broadly the same. Having a higher educational degree generally brings an increased salary. Having a PhD as a secondary principal was more rewarding than as an elementary school principal, even though both the levels are higher than the MA counterpart. The relative gain of the MA compared to the BA counterpart is generally higher as well.

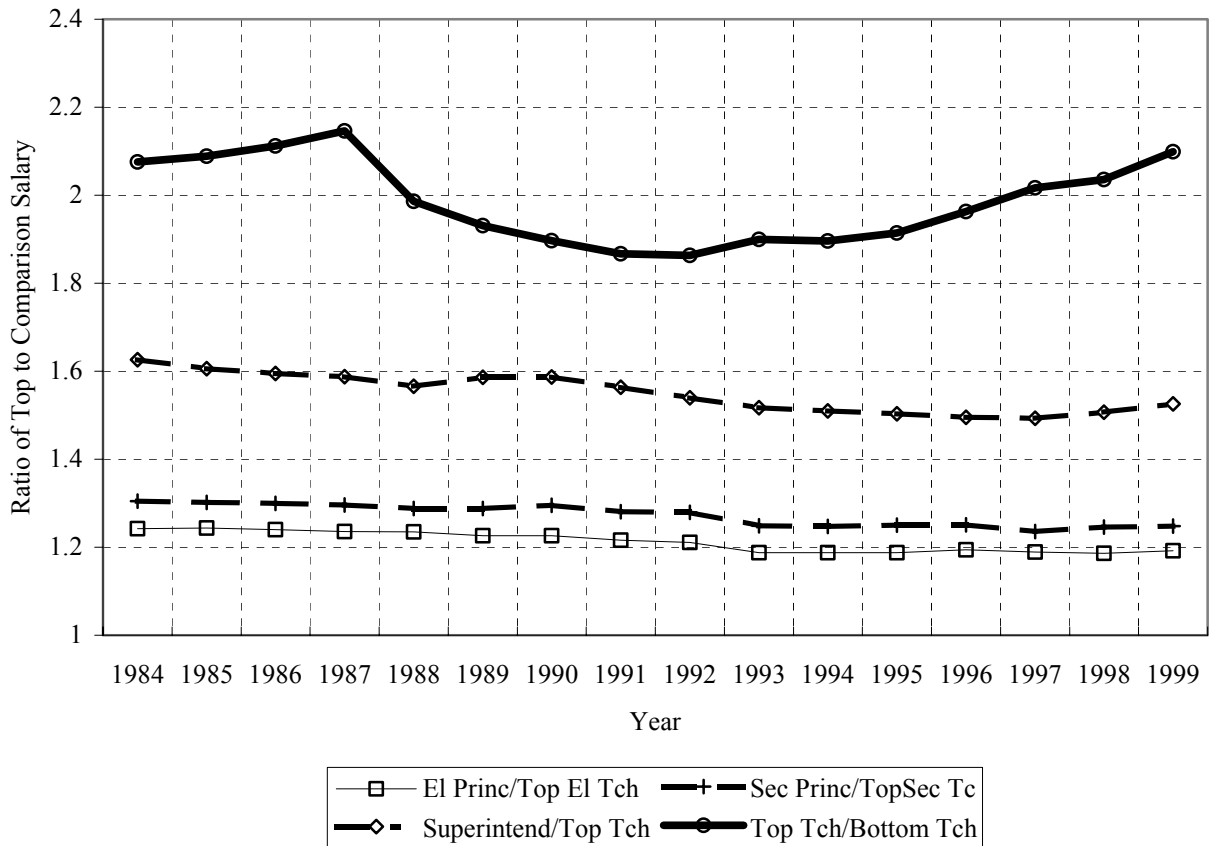
3.7 Salary Compression Among School Professionals: Median Ratio of Top School Principal to Top School Teacher Salary

There is substantial evidence in Pennsylvania that elementary school principals have experienced significant salary compression --- across all districts in Pennsylvania from 1984 to 1999. In 1984, the median ratio of top elementary principal salary to top teacher salary was 24%; by 1999 this premium dropped to 19%. Given that principals typically work 2 to 3 months longer than their classroom counterparts, viewed on a monthly basis it would appear there is no premium to be a building level manager. (See Figure 3)

Secondary principals evidenced a similar pattern of compression; superintendents in the 1980's generally earned about 60+% more than the top teacher in their district. However, it is evident that this premium declined in the 1990's.

Remarkably, teachers through the collective bargaining process were able to maintain greater salary differentiation over the same time period; the ratio of top to bottom teacher salary never fell below 1.8 and has grown in the 1990's to 2.1 by 1999.

Figure 3: Salary Compression in Administrative Salaries Pennsylvania: 1984-1999
Median of Top Administrator to Top Teacher Salary and Top to Bottom Teacher Salary



3.8 Career and Salary Patterns upon Ascending to the School Principalship

There are substantial differences in where school principals come from both in terms of previous position and geographic location. In the case of elementary school principals, from about one-third to one-half are drawn immediately from the classroom without primary administrative experience. In the case of secondary school principals, anywhere from one third to two thirds have come from the ranks of assistant secondary principals.

Until 1995 districts recruited about 75% of their principals from within the same district, although around one half each year were drawn from a *different* building to a principal appointment.¹⁶ Beginning in 1995, districts increasingly began recruiting their secondary principals from outside their district. In 1999, 74% of elementary school principals were drawn from within the district, while only 58% of secondary school principals were drawn from within the district. As districts have gone outside their district for new secondary school principals, increasingly they have gone outside their MSA to find them. By 1999, 43.7% of those secondary principals drawn from outside their school district were also from outside the MSA. The origin of new superintendents was the most geographically diverse with anywhere from one-third to one-half being drawn from a different district over the study period.

Those who become elementary or middle school principals have experienced the smallest increase in compensation, and the percentage gain has fallen over time. For example, in 1996, the median gain in compensation was only 1.7% for elementary school principals and 5.7% for middle school principals.

The largest salary increases upon becoming an administrator resulted from changing school districts. A teacher who moved to another district to become a first time elementary school principal experienced a 17.9% salary gain, while his/her secondary teacher counterpart who moved to become a secondary school principal experienced a 25.8% gain. Interestingly, superintendents who moved to another district, compared to those who did not, experienced rather modest gains in compensation, and well less on a relative basis than their secondary teacher/principal counterpart. Superintendents typically experience single digit percentage gains in compensation for beginning their first superintendency in another district, while their principal counterparts often gained in double-digit percentage terms.

Those administrators who moved to a new MSA typically raised their salaries, regardless of whether they were seeking a primary, middle school or secondary principal position. Superintendents are the exception to the rule. For example, in 1984, an administrator accepting his first post as a superintendent who remained in his own MSA experienced a median salary gain of 12.8%, where the same administrator who accepted a new assignment outside of his MSA experienced a median salary gain of only 7.2%. Similarly, in 1999, the administrator who accepted his first assignment as a Superintendent within his own MSA experienced a median salary gain of 12.5%, while the administrator who accepted the first superintendent assignment outside of his MSA experienced a median salary gain of only 10.6%.

4.0 Effects of Administrator Characteristics on Student Achievement

Having reviewed the market for school administrators in Pennsylvania for the period 1985-1999, we turn to examine student achievement in the late 1990's in relation to demographic and professional characteristics of school administrators. Studies of

¹⁶ This suggests that districts attempt to reassign administrators to buildings other than where they did their teaching.

school administrators have been a prominent component of educational research.¹⁷ Historically, such studies have primarily focused on the antecedents of administrative behavior rather than the results of school administrator activities. Much of the post-WWII research has been based on questionnaires administered in one or several districts, and used, by today's standards of social science statistical analysis, rather simple inference techniques to ascertain whether or not administrators demonstrate "leadership", and whether or not teachers share the same views as their administrators on curricula and other matters.¹⁸ Where researchers have gone beyond trying to measure "leadership," they have found that principals are centrally involved in teacher selection, but by virtue of being middle or lower middle "management," are subject to central administration rules, regulations, and oversight.

There are two educational production function studies whose perspectives motivate below our analysis of Pennsylvania student achievement and administrator data. Eberts and Stone(1988) examined the mathematics scores of a national sample of 15,000 4th grade students in 300 schools in relation to: 1) perceptions by teachers of their elementary principals' leadership skills, 2) highest degree of the principal, 3) various characteristics of the students taking the mathematics test including their prior math test score, 4) teacher characteristics, and 5) school and district variables. While various measures of leadership skills were statistically significant, the *size* of these effects on the *gain* in math score was quite small, despite the fact that about 55% of the variation in test scores was explained by the regression model.¹⁹

More recently, Brewer(1993) examined high school principals with High School and Beyond data, and examined directly whether or not principals characteristics, including how the principal viewed academic excellence, affected the *gain* between 1980 and 1982 in 2,070 sophomore and subsequent senior test scores while holding constant community and student socio-economic characteristics. In addition to including family characteristics such as parental educational achievement and family income, Brewer examined the size of the building the principal supervises, the achievement effects of: the percentage of faculty appointed by the principal, administrative experience, the role of principal vs. teacher salaries may play, and various measures of perceived influence or leadership in the school. Brewer found schools in which principals emphasized academic excellence were schools in which student performance was higher, and conversely. Moreover, the effects were quite large, and amplified by the percentage of faculty appointed. Brewer also found that the higher the relative salary of secondary principals viz. a viz. mean teacher salaries, the greater was the gain in test scores, and this relative effect is quite large: increasing relative salary by 5% raises the mean gain score by 20%.

¹⁷ See Bridges(1982) for a review of the 1967-1980 literature, and Hallinger and Heck(1996) for a review of the 1980-1995 literature. Also, see Hart(1993).

¹⁸ See Hunter(1995) for a relatively recent example of this sort of methodology. That research sought to ascertain if middle school principals at high achieving schools in the Los Angeles Unified School District perceived that they demonstrate greater instructional leadership than their counterparts at low achieving buildings.

¹⁹ If one calculates elasticities of the leadership effects from Table 1 in Eberts and Stone (1988), they are never greater in absolute value than .00001. The largest elasticity implied by their regression results is the effect of the prior math test score on the new math score.

Pennsylvania school building level mean reading and math achievement test scores in 1998 were analyzed in conjunction with socioeconomic characteristics of the students and the community, and various characteristics of the school principal. The percentage of students in the school receiving free and subsidized lunches is used to measure the basic poverty rate of students. The socioeconomic status of families was measured by the percentage of adults in the district with a bachelor degree or more and is from the 1990 Census.

Administrator characteristics included in this analysis are gender, ethnicity, years of professional experience as a principal, school district, total professional experience, prior administrative experience that each principal acquired immediately prior to appointment as a principal, level of educational degree, and administrative certificates held.

4.1 Characteristics of the Data Used in Regression Analysis

In our examination below of Pennsylvania data, we examine test scores at the building level and associate them with administrator characteristics, educational characteristics of the community, and socioeconomic characteristics of students at the building level. Because we are dealing with the universe of school administrators in the state we can examine elementary schools, secondary schools, and the small number of middle schools or combined schools of grades K-12.²⁰ Student achievement is measured in this study by mean reading and math achievement tests that were administered at the school level through the Pennsylvania System of Scholastic Achievement (PSSA) test program. Mean math and reading scores for 1998 were obtained at the school level for primary, secondary and middle schools. The tests were administered to 5th, 8th, and 11th grade students in the Spring of 1998, and subsequently posted to the Pennsylvania Department of Education web site. The PSSA tests were designed to have means of 1300 for each test, with minimums of 1000 and maximums of 1600, and standard deviations of about 100. (See Table 1 for means and standard deviations of variables used in the econometric modeling below).

District measures of the socioeconomic status of students were recorded as part of the testing process. The percentage of students in the school receiving free and subsidized lunches is used to measure the basic poverty rate of students. The socioeconomic status

²⁰ Since we are analyzing the universe of public schools in Pennsylvania and using mean test scores per building, there is some question about whether or not we need to examine the standard errors of the estimated regression coefficients (which are supplied below). Several considerations argue for viewing the statistical results as *samples* drawn from the population of principals and students, and thus limiting our conclusions to those statistical findings which are statistically different from zero at, say, the 95% level. First, the test results are for selected grades, and participation in test-taking, while high, was not 100%. Second, the results are at a point in time so that they can be viewed as drawn from a continuum of effects which occur through time. Third, due to limitations in the availability of data, some explanatory information is at the school level while other explanatory information is at the district level, and the time periods reflected in the measurement of some explanatory variables are not coterminous with the time at which the student tests were administered.

of families was measured by the percentage of adults in the district with a bachelor degree or more and is from the 1990 Census.²¹

In addition to examining the socioeconomic status of students and the community, we measure the size of the school by 1998 average daily membership (ADM), and fraction of the 1990 population in the district classified as rural.

To ascertain if particular characteristics of administrators are associated with more successful student performance at the school level, we examine typical demographic and educational characteristics such as gender and ethnicity, and years of professional experience in the principalship, district, and total professional experience, and the presence or absence of masters and PhD degrees in comparison to the omitted category of just a bachelors degree. Additionally, we examine which administrative certificates the school level principal has obtained, and through a series of dummy variables, the type of prior administrative experience that each principal brought immediately prior to his principalship.

It is important to remember that as building level managers, principals typically play a central role in the first steps of the teacher hiring process. In 1998, 91% of Pennsylvania's districts reported that school principals determined which applicants for teaching positions moved from the paper application stage to the interview stage; school principals were more than twice as likely to make such initial screening determinations than assistant superintendents or superintendents.²² Similarly, school principals participated in better than 94% of first interviews, and 88% of school principals were responsible for making either a recommendation for an offer or for a second interview.

To account *ex post* for the type of decision principals make in the hiring decision, we examine the number of teachers in the school who had been formally disciplined by the Pennsylvania Department of Education, or who had their certificate revoked. Also, we include, when possible, analogous measures for the principals themselves to determine if such sanctions are associated with differential student achievement.

Finally, categorical variables are included for the two largest urban school districts, Philadelphia and Pittsburgh, to ascertain if student achievement varies systematically after having accounted for socioeconomic and administrative factors, as well as the various metropolitan statistical areas of the state.

From 1/5 to 1/3 of Pennsylvania's elementary school students received free or subsidized lunches in 1998. On average, between 15% and 18% of the adults in Pennsylvania school districts had a bachelors degree or higher in 1990. Average daily membership in a Pennsylvania elementary school was about 517 students in 1998, while ADM in an average secondary school was about 900.

²¹ It should be noted that this measure is both dated (1990), and district-wide rather than at the school level. Unlike many other states, Pennsylvania's demographics and educational attainment statistics have not changed much between 1990 and 2000.

²² Strauss(1998), Chapter 10, p. 188.

The typical elementary school principal in our regression analysis below had been an elementary school principal for 7 years and served in the district for 18 years; respective figures for secondary principals were 5.6 years as a principal, and 17 years of service in the district. School principals in 1998 were overwhelming white (89% elementary, 90% secondary, and most were men (53% in elementary schools, 73% in secondary schools). Better than 80% of both groups had a masters degree. As noted above, elementary school principal salaries are much closer to top teacher salaries (the average margin was only 118% for elementary school principals) than secondary principal salaries (the average margin was 133% for secondary school principals).

From one-fifth to one-third of Pennsylvania's elementary school students received free or subsidized lunches in 1998. On average, between 15% and 18% of the adults in Pennsylvania school districts had a bachelors degree or higher in 1990. Average daily membership in a Pennsylvania elementary school was about 517 students in 1998, while ADM in an average secondary school was about 900.

**Table 1: Means and Standard Deviations of Data Used for Econometric Modeling:
1333 Elementary School Building Principals (689,161 students)**

Row	Outcome Measures	Mean	Standard Deviation
		1998/9 PSSA Math Score	1309.0300
	1998/9 PSSA Reading Score	1310.2300	100.2965
Row	Explanatory Measures	Mean	Standard Deviation
2	% Students with Free Lunch	36.3896	27.7827
3	% of District Pop with BA+ Education	17.0280	9.2151
4	% Population Rural	32.3268	36.3625
5	1998 Average Daily Membership	517.4173	266.0589
6	1998 ADM Squared	338463.8900	409982.1300
7	# Teach Past 8 years Disc Action	0.0903	0.3596
8	# Teach Past 8 years Cert Revoked	0.0514	0.3364
9	Princ Pending Prof Discipline	0.0012	0.0352
10	Years Since Ever El Principal	6.9851	4.7575
11	Years Since Ever El Principal Years Squared	71.4121	72.9578
12	Number years served in SD	18.2296	11.3434
13	Total years of experience	25.8855	7.2158
14	WHITE (White=1, Non-White=0)	0.8948	0.3069
15	MALE (Male=1, Female=0)	0.5402	0.4985
16	MA (MA=1)	0.8348	0.3715
17	PHD (PHD=1)	0.1219	0.3273
18	Supervisory Certificate 1	0.1603	0.3670
19	Supervisory Certificate 2	0.0681	0.2519
20	Administrative Certificate 1	0.3682	0.4825
21	Administrative Certificate 2	0.7178	0.4502
22	Educational Specialist 1	0.0037	0.0608
23	Educational Specialist 2	0.0012	0.0352
24	Letter of Endorsement	0.1974	0.3982
25	Salary of Top Elem Princ/Top Elem Tch	1.1766	0.1386
26	# 25 Squared	1.4035	0.3479
27	Elem Prior Adm:Dist Superin	0.0050	0.0702
28	Elem Prior Adm:Assist Superin	0.0006	0.0249
29	Elem Prior Adm:Admin Assist	0.0037	0.0608
30	Elem Prior Adm:Assist Elem Princ	0.0916	0.2885
31	Elem Prior Adm:Secon Princ	0.0260	0.1592
32	Elem Prior Adm:Asst Secon Princ	0.0507	0.2195
33	Elem Prior Adm:Princ K- 12 or Mid Sch	0.0229	0.1496
34	Elem Prior Adm:Assist Prin/K-12/Mid Sch	0.0476	0.2131
35	Elem Prior Adm:Coordinator	0.0012	0.0352
36	Elem Prior Adm:Supervisor	0.0563	0.2306
37	Elem Prior Tch:Kindergarten	0.0031	0.0556
38	Elem Prior Tch:Secon	0.0260	0.1592

Row	Outcome Measures	Mean	Standard Deviation
		1998/9 PSSA Math Score	1309.0300
	1998/9 PSSA Reading Score	1310.2300	100.2965
Row	Explanatory Measures	Mean	Standard Deviation
39	Elem Prior Tch:Special Ed, K-12	0.0093	0.0959
40	Elem Prior Tch:Special Ed	0.0408	0.1980
41	Elem Prior Tch:Dept Head	0.0019	0.0431
42	Elem Prior Coord/Adm:Asst Superin for I	0.0012	0.0352
43	Elem Prior Coord/Adm:Curric Cood	0.0025	0.0497
44	Elem Prior Coord/Adm:Dir of Data Proces	0.0006	0.0249
45	Elem Prior Coord/Adm:Dir of Personnel	0.0012	0.0352
46	Elem Prior Coord/Adm:Cood Fed Pgms	0.0031	0.0556
47	Elem Prior Coord/Adm:Guid Elem	0.0210	0.1436
48	Elem Prior Coord/Adm:Guid Second	0.0056	0.0744
49	Elem Prior Coord/Adm:Guid K-12	0.0031	0.0556
50	Elem Prior Coord/Adm:Lib Elem	0.0025	0.0497
51	Elem Prior Coord/Adm:Lib Secon	0.0006	0.0249
52	Elem Prior Coord/Adm:Lib K-12	0.0006	0.0249
53	Elem Prior Coord/Adm:Psych	0.0056	0.0744
54	Elem Prior Coord/Adm:Specialist	0.0328	0.1782
55	Elem Prior Coord/Adm:NEC	0.0223	0.1476
56	PHILLY	0.1262	0.3322
57	PITTS	0.0353	0.1845
58	Allentown-Bethlehem MSA (1)	0.0452	0.2079
59	Altoona MSA (2)	0.0112	0.1050
60	Erie MSA (3)	0.0266	0.1611
61	Harrisburg-Lebanon MSA (4)	0.0638	0.2445
62	Johnstown MSA (5)	0.0149	0.1211
63	Lancaster MSA (6)	0.0428	0.2024
64	Scranton-Wilkes-Barre MSA (7)	0.0514	0.2209
65	Philadelphia MSA (8)	0.3086	0.4620
66	Pittsburgh MSA (9)	0.1803	0.3846
67	Reading MSA (10)	0.0297	0.1699
68	Sharon MSA (11)	0.0112	0.1050
69	State College MSA (12)	0.0087	0.0928
70	Williamsport MSA (13)	0.0130	0.1134
71	York MSA (14)	0.0452	0.2079
72	Beaver MSA (15)	0.0124	0.1107

**Table 2: Means and Standard Deviations of Data Used for Econometric Modeling:
839 Secondary School Building Principals (752,583 students)**

Row	Outcome Measures	Mean	Standard Deviation
		1998/9 PSSA Math Score	1287.0500
	1998/9 PSSA Reading Score	1287.6100	101.3850
Row	Explanatory Measures	Mean	Standard Deviation
2	% Students with Free Lunch	28.3566	24.5656
3	% of District Pop with BA+ Education	15.8448	9.3095
4	% Population Rural	39.2489	39.3361
5	1998 Average Daily Membership	897.3447	546.2938
6	1998 ADM Squared	1103323.8300	1492058.5900
7	# Teachers Past 8 years Disc Action	0.1977	0.6114
8	# Teachers Past 8 years Cert Revoked	0.1073	0.4694
9	Principal Pending Prof Discipline	0.0045	0.0671
10	Principal Revoked in Other State	0.0023	0.0475
11	Principal Criminal Charges in Other State	0.0011	0.0336
12	Years Since Ever Sec Principal	5.6407	4.4981
13	Years Since Ever Sec Principal Squared	52.0271	65.2048
14	Number years served in SD	16.7311	11.7489
15	Total years of experience	25.6927	7.4978
16	WHITE (White=1, Non-White=0)	0.8972	0.3039
17	MALE (Male=1, Female=0)	0.8339	0.3724
18	MA (MA=1)	0.8023	0.3985
19	PHD (PHD=1)	0.1435	0.3508
20	Supervisory Certificate 1	0.1164	0.3209
21	Supervisory Certificate 2	0.0294	0.1690
22	WHITE (White=1, Non-White=0)	0.3774	0.4850
23	MALE (Male=1, Female=0)	0.7379	0.4401
24	Educational Specialist 1	0.0045	0.0671
25	Educational Specialist 2	0.0011	0.0336
26	Letter of Endorsement	0.2520	0.4344
27	Salary of Top Secondary Principal/Salary of Top Secondary Teacher	1.3291	0.1941
28	# 27 Squared	1.8041	0.5904
29	Se Prior Adm:Dist Superin	0.0079	0.0886
30	Se Prior Adm:Assist Superin	0.0056	0.0750
31	Se Prior Adm:Admin Assist	0.0045	0.0671
32	Se Prior Adm:Elem Princ	0.0362	0.1868
33	Se Prior Adm:Assist Elem Princ	0.0023	0.0475
34	Se Prior Adm:Secon Princ	0.1209	0.3262
35	Se Prior Adm:Asst Secon Princ	0.4576	0.4985
36	Se Prior Adm:Princ K- 12 or Mid Sch	0.0497	0.2175
37	Se Prior Adm:Assist Prin/K-12/Mid Sch	0.0339	0.1811
38	Se Prior Adm:Dir of Voc Ed	0.0023	0.0475

39	Se Prior Adm:Assist Dir of Voc Ed	0.0023	0.0475
40	Se Prior Adm:Coordinator	0.0011	0.0336
41	Se Prior Adm:Supervisor	0.0294	0.1690
42	Se Prior Tch:Elementary	0.0136	0.1157
43	Se Prior Tch:Special Ed K-12	0.0147	0.1204
44	Se Prior Tch:Special Ed	0.0158	0.1248
45	Se Prior Tch:Dept Head	0.0034	0.0582
46	Se Prior Coord/Adm:Asst Superin for Inst	0.0011	0.0336
47	Se Prior Coord/Adm:Asst to Superin Bus A	0.0011	0.0336
48	Se Prior Coord/Adm:Guid Elem	0.0023	0.0475
49	Se Prior Coord/Adm:Guid Secon	0.0102	0.1004
50	Se Prior Coord/Adm:Guid K-12	0.0011	0.0336
51	Se Prior Coord/Adm:Psych	0.0023	0.0475
52	Se Prior Coord/Adm:Sch Nurse	0.0011	0.0336
53	Se Prior Coord/Adm:Specialist	0.0068	0.0821
54	Se Prior Coord/Adm:NEC	0.0169	0.1292
55	PHILLY	0.1390	0.3461
56	PITTS	0.0124	0.1109
57	Allentown-Bethlehem MSA (1)	0.0420	0.2006
58	Altoona MSA (2)	0.0113	0.1059
59	Erie MSA (3)	0.0295	0.1692
60	Harrisburg-Lebanon MSA (4)	0.0522	0.2225
61	Johnstown MSA (5)	0.0238	0.1525
62	Lancaster MSA (6)	0.0249	0.1560
63	Scranton-Wilkes-Barre MSA (7)	0.0556	0.2292
64	Philadelphia MSA (8)	0.2744	0.4465
65	Pittsburgh MSA (9)	0.1553	0.3624
66	Reading MSA (10)	0.0295	0.1692
67	Sharon MSA (11)	0.0159	0.1251
68	State College MSA (12)	0.0079	0.0888
69	Williamsport MSA (13)	0.0113	0.1059
70	York MSA (14)	0.0306	0.1724
71	Beaver MSA (15)	0.0204	0.1415

Table 3: Means and Standard Deviations of 242 Middle School and K-12 Building School Principals (164,318 students)

Row	Outcome Measures	Mean	Standard Deviation
		1998/9 PSSA Math Score	PSSA Math Score
	1998/9 PSSA Reading Score	PSSA Reading Score	1318.0400
	Explanatory Measures	Mean	Standard Deviation
2	% Students with Free Lunch	29.0822	22.1196
3	% of District Pop with BA+ Education	16.2549	8.8860
4	% Population Rural	38.3145	36.5254
5	1998 Average Daily Membership	679.8897	334.1669
6	1998 ADM Squared	573520.0700	595860.5200
7	# Teachers Past 8 years Disciplinary Action	0.0353	0.1850
8	# Teachers Past 8 years Certificate Revoked	0.0177	0.1320
9	Years Since Ever Secondary Principal	3.8672	3.3551
10	# 9 Squared	26.1697	36.7452
11	Number Years in District	16.9541	11.0746
12	Total Number Years of Professional Experience	25.5442	7.0011
13	WHITE (White=1, Non-White=0)	0.9152	0.2791
14	MALE (Male=1, Female=0)	0.7279	0.4458
15	MA (MA=1)	0.8127	0.3908
16	PHD (PHD=1)	0.1449	0.3526
17	Supervisory Certificate 1	0.1131	0.3172
18	Supervisory Certificate 2	0.0495	0.2172
19	WHITE (White=1, Non-White=0)	0.3074	0.4622
20	MALE (Male=1, Female=0)	0.7845	0.4119
21	Educational Specialist 1	0.0106	0.1026
22	Letter of Endorsement	0.2438	0.4301
23	Person s Salary/Top Teacher Sal in Bldg	1.2108	0.1249
24	Rel Sal Sq	1.4815	0.3019
25	MS Prior Adm:Assist Superin	0.0035	0.0594
26	MS Prior Adm:Elem Princ	0.1343	0.3416
27	MS Prior Adm:Assist Elem Princ	0.0141	0.1183
28	MS Prior Adm:Secon Princ	0.2191	0.4144
29	MS Prior Adm:Asst Secon Princ	0.2085	0.4069
30	MS Prior Adm:Assist Prin/K-12/Mid Sch	0.2120	0.4095
31	MS Prior Adm:Supervisor	0.0247	0.1556
32	MS Prior Tch:Elementary	0.0389	0.1936
33	MS Prior Tch:Special Ed MS/K-12	0.0071	0.0839
34	MS Prior Tch:Special Ed	0.0071	0.0839
35	MS Prior Coord/Adm:Asst Superin for Inst	0.0035	0.0594
36	MS Prior Coord/Adm:Guid Elem	0.0035	0.0594
37	MS Prior Coord/Adm:Guid Secon	0.0071	0.0839
38	MS Prior Coord/Adm:Specialist	0.0035	0.0594
39	MS Prior Coord/Adm:NEC	0.0177	0.1320

Row	Outcome Measures	Mean	Standard Deviation
	1998/9 PSSA Math Score	PSSA Math Score	1317.4100
	1998/9 PSSA Reading Score	PSSA Reading Score	1318.0400
	Explanatory Measures	Mean	Standard Deviation
40	PITTS	0.0742	0.2626
41	Allentown-Bethlehem MSA (1)	0.0671	0.2507
42	Altoona MSA (2)	0.0106	0.1026
43	Erie MSA (3)	0.0353	0.1850
44	Harrisburg-Lebanon MSA (4)	0.0848	0.2791
45	Johnstown MSA (5)	0.0353	0.1850
46	Lancaster MSA (6)	0.0671	0.2507
47	Scranton-Wilkes-Barre MSA (7)	0.0353	0.1850
48	Philadelphia MSA (8)	0.1661	0.3728
49	Pittsburgh MSA (9)	0.2191	0.4144
50	Reading MSA (10)	0.0318	0.1758
51	York MSA (14)	0.0530	0.2244
52	Beaver MSA (15)	0.0353	0.1850

4.2 Effects of Principals' Characteristics on Student Achievement Compared to Socioeconomic factors

In all of the six regression models, better than 70% of the gross variation in mean achievement scores was explained, and in four of the six models, the adjusted variation in mean achievement scores was better than 80%.

With few exceptions, the background preparation, credentials, and experience of the school administrators had very little effect on student performance as long as the certification standards established by the Pennsylvania Department of Education were adhered to. One exception was that the more years of experience an administrator held as principal of a middle school, the better the middle school math scores. Another exception was that holding an Ed Specialist II certificate vastly improved secondary math scores. Having previous experience as an assistant superintendent for instruction raised student reading scores for elementary principals and having previous experience as guidance directors in K-12 was correlated with increased math and reading scores. White principals were generally more successful than non-white principals, and that effect grew from elementary school to secondary for both math (from a 14 point to 18 point math test gain), and reading (a 18 point to 23 point score gain). Further consideration of the total impact of these considerations could have some implication for future certification criteria.

There is some evidence in the literature to suggest that financial compensation of administrators is correlated to student achievement, and the findings of this study show that moving out of one's own school district brings greater compensation. While most administrators in Pennsylvania schools have higher degrees, and therefore there is no demonstrable effect of possession of a higher degree having an effect on student achievement, possessing a higher degree does bring greater monetary gain, so it would be interesting to study this relationship further.

Schools with a history of troubled teachers, e.g. those whose certificates were removed or those subjected to formal disciplinary procedures, were also schools with lower math and reading students test scores. For example, there are buildings in Pennsylvania that contained as many as 8 teachers whose certificates were revoked in the past eight years. In such secondary buildings the regression model predicted that in such buildings mean reading test scores would be 120 points lower holding everything else constant.

The size of building enrollment, measured by average daily attendance, did not affect student achievement at any level, nor did "ruralness" with the exception of elementary reading.

Regional differences in student achievement were very pronounced. At the elementary building level, Philadelphia buildings scored below the rest of the state by about one-third to one-half a standard deviation in test score (44 to 50 points). Elementary school buildings in the Altoona, Erie, Johnstown and Scranton MSAs were

above the non-metro elementary buildings. These spatial effects were often quite large, on the order of 25 to 50 (in the case of Altoona) test score points, and much larger than other gender or ethnic effects. Elementary buildings in the MSAs of Harrisburg, Lancaster, and York (-21, -24, and -25 respectively) displayed systematically lower math and/or reading test scores, again large in absolute levels. The spatial differentials in test score results varied between reading and math. MSAs that experienced lower math scores in the two years generally did worse among secondary schools than primary schools. This effect could be on the order of 1/2 standard deviation in test score. This result was more frequent and larger for reading scores than in math scores.

Socioeconomic factors had significant impacts on student achievement. Higher poverty levels in a building were associated with lower achievement scores. Also, the higher levels of education in the community were associated with higher levels of student achievement. A one percent increase in poverty at the elementary level, holding all else constant, was associated with a 2.2 point decline in reading scores at the elementary school level, a 2.24 point decline at the middle school level, and a 2.8 point decline at the high school level. This effect is also evident in math scores. A one percentage point increase in student poverty at the elementary school level is associated with a 2.44 point decline in math score, and a 2.6 point decline in math score at the secondary level.

The impact of the community education level also *grows* in impact on reading and math scores across grade levels. At the elementary school level, a one percentage point increase in the fraction of the community with a BA degree level or better is associated with a 2.33 point increase in mean elementary math test score, but a 3.31 point increase in mean secondary math test score. The effect on reading scores was comparable, but at a somewhat lower level: elementary school reading scores rose 1.55 points for every 1 percent point in the fraction of the community with a BA or better, and this effect rose to 2.03 reading score points at the high school level.

Table 4: 1998 Elementary Math and Reading Achievement Model

		Math Score $\mu=1310.9$ $N=1290$		Reading Score $\mu=1311.8$ $N=1290$	
		$R^2 = .7196$	$\bar{R}^2 = .7035$	$R^2 = .7939$	$\bar{R}^2 = .7821$
Row	Elementary School Explanatory Variable	Parameter	Student t	Parameter	Student t
1	Intercept	1324.1218	16.04	1365.3954	19.30
2	% Students with Free Lunch	-2.0956	-20.12	-2.3291	-26.08
3	% of District Pop with BA+ Education	2.3944	9.10	1.6523	7.33
4	% Population Rural	0.1208	1.91	0.1074	1.98
5	1998 Average Daily Membership	-0.0483	-2.03	-0.0207	-1.02
6	1998 ADM Squared	1.8460E-05	1.09	2.2100E-06	0.15
7	# Teachers in Past 8 years Disciplinary Action	-16.1130	-3.25	-13.2492	-3.11
8	# Teachers in Past 8 years Certificate Revoked	-2.4061	-0.52	-8.0518	-2.03
9	Years since 1st Elementary Principal Position	-1.1590	-0.75	0.4018	0.30
10	Years Squared	0.0607	0.65	-0.0159	-0.20
11	Number years in District	0.0652	0.32	0.0377	0.22
12	Total number years of Professional Experience	0.0601	0.19	0.2272	0.85
13	White=1, Non-White=0	12.4734	2.13	14.8629	2.96
14	Male=1, Female=0	-3.3799	-0.97	-0.8538	-0.28
15	MA Degree=1	-4.3455	-0.53	4.1626	0.59
16	PhD Degree=1	1.6599	0.17	3.5491	0.43
17	Supervisory I Certificate	0.4198	0.09	6.7978	1.78
18	Supervisory II Certificate	-1.0141	-0.13	-2.2327	-0.34
19	Administrative I Certificate	0.7811	0.20	0.9033	0.26
20	Administrative II Certificate	2.3312	0.45	-3.5360	-0.79
21	Ed Specialist I Certificate	5.0266	0.19	13.9776	0.63
22	Ed Specialist II Certificate	-11.8989	-0.21	-16.3949	-0.34
23	Endorsement Letter	5.4010	1.20	4.0214	1.04
24	Salary of Top Elem Princ/Top Elem Tch	34.5249	0.24	-6.4596	-0.05
25	Relative Salary Squared	-2.7060	-0.04	5.9294	0.11
26	Principal's Prior Position: District Superintendent	6.4007	0.30	20.8691	1.15
27	Principal's Prior Position: Assist Superintendent	9.7417	0.18	18.3112	0.39
28	Principal's Prior Position: Admin Assist	2.4673	0.11	-17.0817	-0.86
29	Principal's Prior Position: Assist Elementary Princip	-6.4076	-1.07	4.1644	0.81
30	Principal's Prior Position: Secondary Principal	-12.7713	-1.28	1.6165	0.19
31	Principal's Prior Position: Assistant Secondary Princ	-8.5867	-1.14	1.4948	0.23
32	Principal's Prior Position: Principal K- 12 or MS	-5.3767	-0.52	10.7949	1.23
33	Principal's Prior Position :Assist Principal/K-12/MS	3.2794	0.41	4.5713	0.67
34	Principal's Prior Position: Coordinator	-53.0970	-1.38	-27.9421	-0.84
35	Principal's Prior Position: Supervisor	1.8757	0.23	0.5828	0.08
36	Principal's Prior Position: Kindergarten Teacher	24.7722	0.88	9.8632	0.41
37	Principal's Prior Position: Secondary Teacher	-0.0324	0.00	-2.0640	-0.25
38	Principal's Prior Position: Specialist	6.4769	0.42	9.1437	0.69
39	Principal's Prior Position: Special Education Teach.	-10.4049	-1.22	-10.6902	-1.46

		Math Score $\mu=1310.9$ N=1290		Reading Score $\mu=1311.8$ N=1290	
		$R^2 = .7196$	$\bar{R}^2 = .7035$	$R^2 = .7939$	$\bar{R}^2 = .7821$
Row	Elementary School Explanatory Variable	Parameter	Student t	Parameter	Student t
40	Principal's Prior Position: Department Head	-27.0990	-0.85	10.1997	0.37
41	Principal's Prior Position : Assistant Superintendent for Instruction	113.9018	2.09	27.4667	0.59
42	Principal's Prior Position: Curriculum Coordinator	-8.3566	-0.26	-17.0775	-0.62
43	Principal's Prior Position: Director of Data Process.	0.9309	0.02	-16.0765	-0.34
44	Principal's Prior Position: Director of Personnel	-46.3567	-0.85	-30.6026	-0.65
45	Principal's Prior Position: Coordinator Fed Programs	40.5230	1.63	24.8594	1.16
46	Principal's Prior Position : Guidance Elementary	-29.0563	-2.67	-12.7987	-1.37
47	Principal's Prior Position : Guidance Secondary	-27.7198	-1.33	1.6251	0.09
48	Principal's Prior Position: Guidance K-12	53.1290	2.15	48.0738	2.27
49	Principal's Prior Position: Librarian Elementary	-0.3486	-0.01	5.9472	0.22
50	Principal's Prior Position: Librarian Secondary	-110.2023	-2.00	-80.5772	-1.71
51	Principal's Prior Position: Librarian K-12/MS	-35.5974	-0.65	-26.0368	-0.56
52	Principal's Prior Position: Psychologist	15.6247	0.68	-3.3911	-0.17
53	Principal's Prior Position: Specialist	5.8989	0.63	5.5153	0.69
54	Principal's Prior Position: NEC	-6.7561	-0.63	-0.7224	-0.08
55	School in Philadelphia	-50.5475	-6.07	-44.3862	-6.22
56	School in Pittsburgh	16.2699	1.64	-8.5805	-1.01
57	Allentown-Bethlehem MSA (1)	-10.5180	-1.19	-27.4813	-3.63
58	Altoona MSA (2)	51.4414	3.43	40.1466	3.13
59	Erie MSA (3)	31.7097	3.05	26.4336	2.97
60	Harrisburg-Lebanon MSA (4)	-18.3593	-2.29	-21.2403	-3.10
61	Johnstown MSA (5)	31.7033	2.47	38.8233	3.52
62	Lancaster MSA (6)	-24.1183	-2.80	-33.4707	-4.53
63	Scranton-Wilkes-Barre MSA (7)	24.8514	2.92	13.6611	1.88
64	Philadelphia MSA (8)	6.4445	0.94	-18.0249	-3.06
65	Pittsburgh MSA (9)	4.7285	0.69	3.6019	0.61
66	Reading MSA (10)	-1.8787	-0.19	-16.1614	-1.95
67	Sharon MSA (11)	32.2683	1.96	-6.2399	-0.44
68	State College MSA (12)	3.4215	0.20	-14.7831	-1.02
69	Williamsport MSA (13)	-3.4046	-0.24	-6.4986	-0.54
70	York MSA (14)	-16.6930	-1.79	-25.3936	-3.17
71	Beaver MSA (15)	0.2077	0.01	9.6226	0.62

Notes: Elementary Teacher is omitted category for prior position analysis; Non-Metro Area is omitted category for MSA dummies.

Table 5: Secondary Math and Reading Achievement Model

Row	Secondary School Explanatory Variable	Math Score $\mu=1287.6$ N=821		Reading Score $\mu=1287.7$ N=821	
		$R^2 = .7659$	$\bar{R}^2 = .7451$	$R^2 = .7009$	$\bar{R}^2 = .6743$
		Parameter	Student t	Parameter	Student t
1	Intercept	1250.6836	16.33	1246.9496	14.48
2	% Students with Free Lunch	-2.8121	-16.67	-2.6114	-13.77
3	% of District Pop with BA+ Education	3.2988	10.99	2.0436	6.06
4	% Population Rural	0.0556	0.76	0.0506	0.61
5	1998 Average Daily Membership	-0.0074	-0.59	-0.0050	-0.35
6	1998 ADM Squared	-2.7400E-06	-0.64	-5.1300E-06	-1.07
7	# Teach Past 8 years Disciplinary Action	-9.6971	-2.56	-11.7985	-2.77
8	# Teach Past 8 years Certificate Revoked	-12.8453	-2.85	-15.5471	-3.07
9	Years Since Ever Sec Principal	-0.3054	-0.16	-2.0038	-0.91
10	Years Since Ever Sec Principal 2	0.0316	0.20	0.1821	1.01
11	Number Years in School District	0.0882	0.39	0.2878	1.13
12	Total Number of Years Professional Experience	0.6008	1.68	0.3223	0.80
13	White=1, Non-White=0	15.7484	2.06	21.3189	2.48
14	Male=1, Female=0	2.5843	0.47	6.7880	1.10
15	MA Degree=1	-2.5101	-0.28	-5.2924	-0.53
16	PhD Degree=1	3.5520	0.34	-1.9242	-0.16
17	Supervisory I Certificate	-7.1976	-1.20	-7.0926	-1.05
18	Supervisory II Certificate	-1.3624	-0.11	7.5878	0.53
19	Administrative I Certificate	3.4963	0.75	2.2226	0.42
20	Administrative II Certificate	-1.5310	-0.24	-4.2711	-0.60
21	Ed Specialist I Certificate	-5.5487	-0.18	-0.0792	0.00
22	Ed Specialist II Certificate	150.6892	2.01	112.3030	1.33
23	Endorsement Letter	-4.6674	-0.93	-3.0138	-0.53
24	Salary of Top Sec Principal/Top Secondary Teacher	67.3304	0.53	109.8941	0.76
25	Relative Salary Squared	-18.4874	-0.35	-38.7819	-0.64
26	Principal's Prior Position: District Superintendent	-23.5853	-1.14	-23.2911	-1.00
27	Principal's Prior Position: Assistant Superintendent	7.4327	0.31	0.6063	0.02
28	Principal's Prior Position: Administrative Assistant	5.2809	0.20	37.8370	1.25
29	Principal's Prior Position: Elementary Principal	-5.5639	-0.50	-0.8218	-0.07
30	Principal's Prior Position: Assistant Elementary Princ	-7.7883	-0.21	-55.2335	-1.31
31	Principal's Prior Position: Secondary Principal	4.2105	0.32	-0.7559	-0.05
32	Principal's Prior Position: Assistant Secondary Principal	3.6428	0.62	5.7776	0.88
33	Principal's Prior Position: Principal K- 12 or MS	-2.7120	-0.27	-2.2283	-0.20
34	Principal's Prior Position: :Assistant Principal /K-12/MS	3.6097	0.30	-3.0005	-0.22
35	Principal's Prior Position: Director of Voc Ed	6.3273	0.17	-14.0019	-0.33
36	Principal's Prior Position: Assistant Director of Voc Ed	-15.6508	-0.39	13.8359	0.31
37	Principal's Prior Position: Coordinator	-49.0858	-0.92	-71.0973	-1.19
38	Principal's Prior Position: Supervisor	-7.2447	-0.56	-10.2086	-0.70
39	Principal's Prior Position: :Elementary Teacher	-14.5937	-0.84	-11.4603	-0.59

Row	Secondary School Explanatory Variable	Math Score $\mu=1287.6$ N=821		Reading Score $\mu=1287.7$ N=821	
		$R^2 = .7659$	$\bar{R}^2 = .7451$	$R^2 = .7009$	$\bar{R}^2 = .6743$
		Parameter	Student t	Parameter	Student t
40	Principal's Prior Position: Specialized, K-12 Tch	11.1560	0.73	14.6297	0.85
41	Principal's Prior Position: Special Education	32.4332	2.03	34.9822	1.95
42	Principal's Prior Position: Department Head	-38.6050	-1.25	-3.4499	-0.10
43	Principal's Prior Position: Assistant to Superintendent for Instruction	4.1615	0.08	15.6101	0.26
44	Principal's Prior Position: Assistant to Superintendent for Bus Affairs	-42.5855	-0.81	-25.7876	-0.44
45	Principal's Prior Position: Guidance Elementary	-95.9498	-1.77	-30.8923	-0.51
46	Principal's Prior Position: Guidance Secondary	12.5107	0.64	24.3532	1.11
47	Principal's Prior Position: Guidance K-12 or MS	-11.3055	-0.21	-27.2194	-0.46
48	Principal's Prior Position: Psychologist	-41.0849	-1.09	-169.0656	-3.98
49	Principal's Prior Position: School Nurse	-8.4552	-0.16	-24.0519	-0.41
50	Principal's Prior Position: Specialist	93.0335	3.99	102.5690	3.92
51	Principal's Prior Position: NEC	-9.5146	-0.60	5.7775	0.32
52	School in Philadelphia	13.9601	1.13	-4.7352	-0.34
53	School in Pittsburgh	-23.9812	-1.35	-10.6978	-0.54
54	Allentown-Bethlehem MSA (1)	-20.5206	-1.97	-18.4473	-1.58
55	Altoona MSA (2)	34.4897	2.00	43.8662	2.27
56	Erie MSA (3)	4.7857	0.38	3.1231	0.22
57	Harrisburg-Lebanon MSA (4)	-33.9978	-3.43	-41.6848	-3.74
58	Johnstown MSA (5)	27.8587	2.23	23.5938	1.68
59	Lancaster MSA (6)	-17.3222	-1.33	-44.5511	-3.05
60	Scranton-Wilkes-Barre MSA (7)	-14.3450	-1.54	-4.9464	-0.47
61	Philadelphia MSA (8)	-21.8844	-2.60	-12.6457	-1.34
62	Pittsburgh MSA (9)	-22.6510	-2.94	-19.4075	-2.24
63	Reading MSA (10)	-47.8747	-4.14	-50.1941	-3.86
64	Sharon MSA (11)	14.5396	0.98	24.9586	1.50
65	State College MSA (12)	-12.3585	-0.57	-34.8401	-1.42
66	Williamsport MSA (13)	-5.8145	-0.34	-17.9759	-0.94
67	York MSA (14)	-23.8567	-2.11	-34.2659	-2.69
68	Beaver MSA (15)	-3.0650	-0.22	-1.4671	-0.09

Table 6: K-12/Middle School Math and Reading Achievement Model

Row	Middle School Explanatory Variable	Math Score $\mu=1318.8$ N=236		Reading Score $\mu=1318.9$ N=236	
		$R^2 = .7713$	$\bar{R}^2 = .7098$	$R^2 = .7573$	$\bar{R}^2 = .6920$
		Parameter	Student t	Parameter	Student t y
1	Intercept	1496.8710	8.35	1503.2095	8.51
2	% Students with Free Lunch	-2.2739	-11.59	-2.3737	-12.27
3	% of District Pop with BA+ Education	2.6090	5.69	1.5483	3.43
4	% Population Rural	0.0496	0.48	0.0863	0.84
5	1998 Average Daily Membership	-0.0153	-0.50	-0.0007	-0.02
6	1998 ADM Squared	-2.4200E-06	-0.16	-2.0800E-06	-0.14
7	# Teachers in School Past 8 years Discip Action	-22.0263	-1.53	-19.3011	-1.36
8	# Teachers in School Past 8 years Certif Revoked	20.4426	1.10	6.4076	0.35
9	Years Since Ever MS/K-12 Principal	5.8258	2.31	3.0752	1.23
10	Years Squared	-0.4362	-2.01	-0.1643	-0.77
11	Number Years in School District	-0.5480	-1.62	-0.4145	-1.24
12	Total Number of Years Professional Experience	-0.3338	-0.57	-0.2383	-0.41
13	White=1, Non-White=0	6.2748	0.53	-12.8526	-1.11
14	Male=1, Female=0	-0.3915	-0.06	3.7110	0.56
15	MA Degree=1	11.4917	0.79	11.1594	0.78
16	PhD Degree=1	1.6938	0.10	-1.1861	-0.07
17	Supervisory I Certificate	-10.2585	-1.17	-6.7096	-0.78
18	Supervisory II Certificate	-17.6264	-1.15	-24.4577	-1.62
19	Administrative I Certificate	-4.7346	-0.69	-3.7097	-0.54
20	Administrative II Certificate	12.8438	1.47	3.1269	0.36
21	Ed Specialist I Certificate	-11.6603	-0.29	-4.0635	-0.10
22	Endorsement Letter	-11.0424	-1.48	-6.4277	-0.87
23	Salary of Principal/Top MS or K-12 Teacher	-276.5860	-0.92	-265.1023	-0.90
24	Relative Salary Squared	134.8154	1.08	133.0317	1.08
25	Principal's Prior Position: Assist Superintendent	-9.3066	-0.21	30.3821	0.68
26	Principal's Prior Position: Elementary Principal	-29.3773	-1.99	-4.0493	-0.28
27	Principal's Prior Position: Assist Elementary Principal	0.2667	0.01	41.9480	1.59
28	Principal's Prior Position: Secondary Principal	-19.1603	-1.38	2.7599	0.20
29	Principal's Prior Position: Assistant Secondary Principal	-21.7754	-1.65	-6.2131	-0.48
30	Principal's Prior Position: Assist Principal/K-12/Mid School	-29.6972	-2.27	-3.7381	-0.29
31	Principal's Prior Position: Supervisor	-16.0785	-0.73	16.2740	0.74
32	Principal's Prior Position: Elementary Teacher	-9.2254	-0.45	16.4972	0.82
33	Principal's Prior Position: Specialized, K-12/MS	-47.1750	-1.54	-57.1490	-1.90
34	Principal's Prior Position: Assistant to Superintendent for Instruction	-2.1612	-0.05	-16.3875	-0.36
35	Principal's Prior Position: Guidance Elementary	25.8380	0.60	-2.2705	-0.05
36	Principal's Prior Position: Guidance Secondary	-71.5025	-2.36	-49.4614	-1.65
37	Principal's Prior Position: Specialist	15.9783	0.33	25.8778	0.55
38	Principal's Prior Position: NEC	-9.9039	-0.47	-8.7761	-0.42
39	School in Pittsburgh	-7.0108	-0.40	-18.9487	-1.11
40	Allentown-Bethlehem MSA (1)	-2.7056	-0.20	-24.8173	-1.88
41	Altoona MSA (2)	13.2712	0.52	20.5436	0.81

Row	Middle School Explanatory Variable	Math Score $\mu=1318.8$ N=236		Reading Score $\mu=1318.9$ N=236	
		$R^2 = .7713$	$\bar{R}^2 = .7098$	$R^2 = .7573$	$\bar{R}^2 = .6920$
		Parameter	Student t	Parameter	Student t y
42	Erie MSA (3)	30.3120	1.82	22.0782	1.35
43	Harrisburg-Lebanon MSA (4)	-26.8873	-2.23	-28.0167	-2.36
44	Johnstown MSA (5)	46.1567	2.92	40.8555	2.62
45	Lancaster MSA (6)	-15.6935	-1.27	-36.0191	-2.96
46	Scranton-Wilkes-Barre MSA (7)	-25.5892	-1.59	-13.7315	-0.86
47	Philadelphia MSA (8)	-6.1552	-0.56	-19.2362	-1.76
48	Pittsburgh MSA (9)	14.4604	1.31	8.8948	0.81
49	Reading MSA (10)	-34.6863	-2.19	-24.1771	-1.55
50	York MSA (14)	-17.8045	-1.32	-39.3283	-2.95
51	Beaver MSA (15)	19.0539	1.17	-5.5586	-0.35

4.3 Comparison of Explanatory Effects Across Types of Principals and Schools

We now turn to comparing the effects of various explanatory variables on student achievement by building level, and enquire, for example, whether or not student poverty and educational background of the population affect in the same manner math and reading achievement at different levels of education. Table 7 compares the effects of various explanatory factors on math achievement, and Table 8 compares the effects of various explanatory factors on reading achievement.

There are a number of interesting and important results from comparing the statistical analysis in this way. First, the effect of student poverty on achievement increases with grade level. A one percent increase in poverty at the elementary school level, holding all else constant, is associated with a 2.2 point decline in reading scores at the elementary school level, a 2.24 point decline at the middle school level, and a 2.8 point decline at the high school level. This effect is also evident in math scores, though the growth in effect is smaller for higher grade levels. A one percentage point increase in student poverty at the elementary school level is associated with a 2.44 point decline in math score, and a 2.6 point decline in math score at the secondary level.

The impact of the community education level also grows in impact on reading and math scores across grade levels. At the elementary school level, a one percentage point increase in the fraction of the community with a BA degree level or better is associated with a 2.33 point increase in elementary math test score, but a 3.31 point increase in secondary math test score. The effect on reading scores is comparable, but at a somewhat lower level: elementary school reading scores rise 1.55 points for every 1 percent point in the fraction of the community with a BA or better, and this effect rises to 2.03 reading score points at the high school level.

The effect on student achievement of having teachers who were subjected to disciplinary hearing or whose certificates were pulled declined in impact from elementary school to secondary school; compare a 16 point reduction in elementary math test score

to a 10 point reduction in high school math score for each building teacher who had had been subjected to disciplinary action. For reading, the impact was a reduction of 13 reading score points at the elementary school level to a reduction of 11 high school reading score points for each teacher subjected to a disciplinary hearing.

As noted above, there were very few credential measures that had any discernible impact on student achievement across types of principals or in terms of math or reading achievement scores. White principals were generally more successful than non-white principals, and that effect grew from elementary school to secondary for both math (from a 14 point to 18 point math test gain), and reading (a 18 point to 23 point score gain).

The spatial differentials in test score results varied between reading and math. MSA's that experienced lower math scores in the two years generally did worse among secondary schools than primary schools, and this effect could be on the order of 1/2 standard deviation in test score. This effect was more frequent and larger for reading scores than in math scores, and is, frankly, surprising.

Table 7: Comparison of OLS Effects of Principals' Characteristics on PSSA Math Scores

Explanatory Variable	Elementary Principals		Secondary Principals		Middle School Principals	
	R ² = .7035	N=1290	R ² = .7451	N=821	R ² = .7098	N=236
	μ=1310.9	σ=99.84	μ=1287.6	σ=101.98	μ=1318.8	σ=70.27
	Parameter	t-statistic	Parameter	t-statistic	Parameter	t-statistic
Intercept	1132.7536	16.16	1325.4649	19.48	1505.6081	8.42
% Students with Free Lunch	-2.2037	-22.39	-2.8245	-17.01	-2.2410	-11.67
% District with BA+ Education	2.3277	8.97	3.3125	11.05	2.6311	5.75
% Rural Pop.	0.1053	1.72	0.0996	1.38	0.0526	0.51
Average Daily Membership	-0.0023	-0.12	-0.0023	-0.20	0.0210	0.83
ADM ²	0.0000	-0.83	0.0000	-1.17	0.0000	-1.39
# Teachers Disciplined	-16.1694	-3.24	-9.5519	-2.52	-23.4797	-1.71
# Teachers Certificates Revoked	-2.2825	-0.49	-12.3287	-2.72	19.8009	1.07
Principal Pending Discipline	-53.8429	-1.38	28.0390	1.05		
Principal's Certificate Revoked in other State			-54.1176	-1.44		
Principal Accused of Criminal Charges in other State			-10.5401	-0.20		
Years since Principal	-1.1212	-0.73	0.0052	0.00	5.7286	2.28
Years since Principal ²	0.0538	0.58	0.0262	0.16	-0.4230	-1.95
Years of Service in SD	0.0356	0.18	0.1588	0.71	-0.5405	-1.63
Total Years of Service in Pa	-0.0316	-0.10	0.7100	2.00	-0.3387	-0.58
White=1	14.6170	2.54	18.3079	2.40	4.1690	0.36
Male=1	-3.5060	-1.01	2.2908	0.42	0.1052	0.02
MA	-3.5325	-0.45	-1.3583	-0.16	9.4294	0.68

Explanatory Variable	Elementary Principals		Secondary Principals		Middle School Principals	
	R ² = .7035	N=1290	R ² = .7451	N=821	R ² = .7098	N=236
	μ=1310.9 Parameter	σ=99.84 t-statistic	μ=1287.6 Parameter	σ=101.98 t-statistic	μ=1318.8 Parameter	σ=70.27 t-statistic
Phd	1.6461	0.18	2.8334	0.28	0.2921	0.02
Supervisory Certificate I	0.7806	0.18	-6.2895	-1.04	-9.3161	-1.06
Supervisory Certificate II	-2.1897	-0.30	-0.7399	-0.06	-18.4046	-1.20
Administrative Certificate 1	0.3967	0.10	4.2220	0.91	-4.1116	-0.59
Administrative Certificate II	2.1677	0.42	-0.2450	-0.04	11.9111	1.36
Educational Specialist I	0.7320	0.03	-3.5427	-0.11	-3.2059	-0.08
Educational Specialist II	-17.2179	-0.31	154.7509	2.04		
Endorsement Letter	5.5337	1.24	-3.7288	-0.75	-9.8101	-1.32
Top Principal Salary to Top Teacher Salary	332.9873	2.83	-52.8360	-0.55	-302.8295	-1.01
Top Relative Salary ²	-124.2304	-2.53	18.6954	0.56	141.9308	1.14
Philadelphia SD=1	-45.1754	-5.54	15.5028	1.27		
Pittsburgh SD=1	19.7957	2.07	-25.4183	-1.44	-1.9872	-0.12
Allentown-Bethlehem MSA (1)	-11.2883	-1.28	-19.6593	-1.87	-4.3201	-0.32
Altoona MSA (2)	51.8592	3.57	37.7034	2.19	14.7915	0.58
Erie MSA (3)	29.7387	2.89	9.1074	0.74	26.6739	1.61
Harrisburg-Lebanon MSA (4)	-26.5362	-3.44	-36.3548	-3.68	-24.1698	-2.02
Johnstown MSA (5)	31.8661	2.47	27.1481	2.17	47.0680	3.00
Lancaster MSA (6)	-24.5079	-2.84	-19.7604	-1.53	-17.5971	-1.42
Scranton-Wilkes-Barre MSA (7)	21.3459	2.58	-15.4525	-1.69	-32.7424	-2.16
Philadelphia MSA (8)	5.8380	0.86	-19.9270	-2.37	-9.3943	-0.85
Pittsburgh MSA (9)	8.8679	1.33	-20.1191	-2.69	9.0834	0.85
Reading MSA (10)	-2.7244	-0.28	-47.0211	-4.02	-36.6913	-2.31
Sharon MSA (11)	31.7719	1.93	13.9447	0.93		
State College MSA (12)	7.8558	0.47	-10.1638	-0.46		
Williamspport MSA (13)	-4.3038	-0.31	-5.4198	-0.32		
York MSA (14)	-16.1611	-1.74	-20.7982	-1.83	-20.1997	-1.49
Beaver MSA (15)	-1.0069	-0.06	-0.3458	-0.03	18.2583	1.11

Table 8: Comparison of OLS Effects of Principals' Characteristics on PSSA Reading Scores

Explanatory Variable	Elementary Principals		Secondary Principals		Middle School Principals	
	R ² = .7821	N=1290	R ² = .6743	N=821	R ² = .6920	N=236
	μ=1311.8 Parameter	σ=100.29 t-statistic	μ=1287.7 Parameter	σ=101.38 t-statistic	μ=1318.9 Parameter	σ=67.11 t-statistic
Intercept	1133.5594	18.76	1371.5302	18.02	1510.9362	8.61
% Students with Free Lunch	-2.4415	-28.76	-2.6048	-14.03	-2.3466	-12.45
% District with BA Education	1.5541	6.95	2.0280	6.05	1.5736	3.51
% Rural Pop.	0.1173	2.23	0.0966	1.19	0.0952	0.95
Average Daily Membership	0.0087	0.53	-0.0055	-0.44	0.0324	1.31
ADM ²	0.0000	-1.46	0.0000	-1.23	0.0000	
# Teachers Disciplined by State in Last 8 Years	-13.1342	-3.05	-11.3905	-2.69	-19.9581	-1.48
# Teachers Certificates Revoked by State in Last 8 Years	-7.6458	-1.92	-15.3659	-3.03	6.7902	0.37
Principal Pending State Discipline	-46.8568	-1.40	19.6821	0.66		
Principal Certificate Revoked in other State			-61.8308	-1.47		
Principal Accused of Criminal Charges in other State			-36.9725	-0.63		
Years since Principal	0.4818	0.37	-1.3225	-0.61	2.7801	1.13
Years since Principal ²	-0.0253	-0.32	0.1501	0.84	-0.1404	-0.66
Years of Service in SD	-0.0179	-0.11	0.3256	1.30	-0.4098	-1.26
Total Years of Service in Pa	0.1178	0.44	0.4634	1.17	-0.1779	-0.31
White=1	18.5906	3.74	23.3089	2.73	-14.8255	-1.29
Male=1	-0.7447	-0.25	6.8755	1.13	5.4081	0.82
MA	3.5895	0.53	-3.8969	-0.40	10.4060	0.77
Phd	2.3326	0.29	-2.3610	-0.21	-1.5534	-0.10
Supervisory Certificate I	7.6448	2.02	-5.4396	-0.80	-6.0155	-0.70
Supervisory Certificate II	-3.3366	-0.52	9.1633	0.64	-25.1752	-1.67
Administrative Certificate I	-0.0641	-0.02	3.3685	0.65	-2.6849	-0.40
Administrative Certificate II	-4.7079	-1.05	-2.7554	-0.40	2.7524	0.32
Educational Specialist I	9.0904	0.40	0.9560	0.03	4.4402	0.11
Educational Specialist II	-23.0052	-0.48	110.7758	1.31		
Endorsement Letter	3.6770	0.96	-2.7441	-0.49	-5.0091	-0.69
Top Principal Salary to Top Teacher Salary	369.1443	3.63	-77.5251	-0.72	-294.3529	-1.00
Top Relative Salary ²	-146.6997	-3.47	22.2964	0.59	141.6225	1.16
Philadelphia SD=1	-38.2879	-5.44	-4.7300	-0.35		
Pittsburgh SD=1	-5.9304	-0.72	-12.7517	-0.64	-12.9155	-0.78
Allentown-Bethlehem MSA (1)	-27.6817	-3.65	-17.7417	-1.51	-25.6684	-1.95
Altoona MSA (2)	39.8367	3.18	47.3240	2.45	21.8729	0.87
Erie MSA (3)	26.1990	2.95	9.4892	0.69	19.9714	1.22
Harrisburg-Lebanon MSA (4)	-32.2283	-4.84	-41.5808	-3.76	-25.3199	-2.15

Explanatory Variable	Elementary Principals		Secondary Principals		Middle School Principals	
	$R^2 = .7821$	N=1290	$R^2 = .6743$	N=821	$R^2 = .6920$	N=236
	$\mu=1311.8$	$\sigma=100.29$	$\mu=1287.7$	$\sigma=101.38$	$\mu=1318.9$	$\sigma=67.11$
	Parameter	t-statistic	Parameter	t-statistic	Parameter	t-statistic
Johnstown MSA (5)	38.9803	3.50	22.6048	1.61	41.8229	2.72
Lancaster MSA (6)	-33.6133	-4.51	-48.7559	-3.37	-37.1414	-3.06
Scranton-Wilkes-Barre MSA (7)	13.5775	1.90	-4.6401	-0.45	-16.7119	-1.12
Philadelphia MSA (8)	-17.8360	-3.04	-10.8631	-1.15	-21.8977	-2.02
Pittsburgh MSA (9)	9.3460	1.63	-17.4219	-2.09	3.0615	0.29
Reading MSA (10)	-15.9362	-1.91	-50.5642	-3.87	-25.5627	-1.64
Sharon MSA (11)	-6.3989	-0.45	24.0236	1.43		
State College MSA (12)	-11.4818	-0.79	-33.0384	-1.35		
Williamsport MSA (13)	-7.3711	-0.61	-19.0513	-0.99		
York MSA (14)	-24.0022	-3.00	-31.4851	-2.48	-41.4535	-3.12
Beaver MSA (15)	8.9952	0.57	1.0173	0.07	-5.8826	-0.37

5.0 Implications for Public Policy

In Pennsylvania, there was evidence over the period 1984-1999 of aggregate excess supply in the number of newly certified administrators compared to the number of vacancies. Increasingly districts have sought principals and superintendents from outside their districts or region to meet their administrative needs. The turnover of school and especially district managers is much higher than that of teachers, and appears to be higher than in the private sector.

Over 1984-99, teacher salaries generally rose faster than inflation, and the range of lowest to highest teacher compensation was maintained, presumably through the collective bargaining process and the right to strike, of about 2:1. On the other hand, administrative salaries over 1984-99 displayed declining premiums compared to teaching. This decline in the premium for becoming a school manager was most pronounced in the case of elementary principals. While premiums for administration declined, the likely range of responsibility increased over the 1984-99 period, since school employment has generally increased but the number of administrators has remained constant. While there was evidence that higher administrative pay premiums were associated with higher student achievement, the effect was not very large in terms of student test scores.

School administration has become increasingly a female occupation as public education has always been. It is beyond the scope of this study to delve into the implications of work situations in which women are supervising women, and women being responsible for disciplining student populations that are 50% male. However, the very pronounced changes in the demographics of school managers may have significant implications for the sociology and nature of student disciplinary interactions in the schools themselves.

In general, the characteristics of school administrators did not directly or substantially impact building level student achievement scores. On the other hand, whether or not a building had employed teachers who were disciplined by the state did make a difference. Thus, indirectly through the teacher hiring process²³, the nature of administrative choice can make a difference in student achievement. Whether paper and pencil knowledge of Pennsylvania's administrative school procedures is related to student achievement remains an untested hypothesis and worthy of further investigation.

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²³ For evidence on the effects of teacher content knowledge on student achievement, see Strauss and Sawyer(1986), and Strauss and Vogt (2003). For evidence on the issues of salaries and the selectivity of teacher hiring practices, see Ballou and Podgursky(1997), and Kain, Hanushek, and Rivkin(2002).

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