EXECUTIVE SUMMARY

Part 1 – Statewide Efficiency & Staffing Analysis

Analyses

1. Fiscal resource distribution across districts
2. Changes in fiscal resource allocation over time by district group
3. Labor market centered analysis of financial resource allocation from 2003 to 2007
4. Labor market centered analysis of certified staff wages in 2006-07
5. Within district & within labor market equity of staffing resource allocation across schools 2006-07
6. Statewide mapping of school level distribution of certified staff by position code 2006-07
7. School resources and the production of outcomes
8. District resources and the production of outcomes
9. District factors influencing spending variation
10. District factors influencing cost variation

Findings

Financial resource allocation

- On average, urban core and large urban Abbott districts had significantly higher current operating expenditures than other districts in their same labor market – about 20% higher in recent years.
- However, expenditures for classroom instruction tended to be only about 10% higher than labor market averages, and teacher wages controlling for degree level, experience and job code about the same as labor market averages or only slightly higher.
- Estimated step scales for core academic teachers in many urban core districts (Trenton, Camden) were nearly matched with estimated step scales for nearest neighbor districts in the same county, but in Newark, teacher wages were slightly higher than neighbors on the front end of the salary schedule and much higher on the back end (senior teachers).
- From 1998 to 2003, Abbott districts in particular showed dramatic increases in shares of total district expenditures allocated to classroom support.

Human resource allocation

- Districts in wealthier factor groups tended to have higher intensity (staff per pupil) of specialist teachers and lower intensity of core classroom teachers, especially at the middle school level.
- Districts in wealthier factor groups also tended to have higher shares of their staff allocated to special instruction (such as arts, music, etc.)
- Charter schools located in Abbott districts, tended to allocate most of their staff to core academic areas, with few in special areas and few for "extra help." Charter schools not located in Abbott districts allocated more staff to special areas.

- On average, districts in wealthier factor groups had higher shares of teachers with 5 to 10 years experience and masters' degree and smaller shares of teachers with less than 3 years and a bachelors' degree.
- Salaries and experience levels are very low in charter schools.
- Over time, teacher salaries have lagged behind salaries for other professions in which workers have a BA or MA, at comparable age.
- The ratio of teacher to non-teacher wage, or relative competitiveness of existing (2000 to 2005) teacher wages, is lowest in areas nearer New York (Bergen-Passaic, Jersey City, Middlesex & Newark) and highest in Atlantic county.

School outcomes

- Aggregate certified salaries per pupil were positively associated with outcomes at the middle school level.
- Higher competitive wages on local labor markets are associated positively with student outcomes (elementary and middle school, Table 55).
- Student outcomes are negatively associated with higher shares of new teachers with a BA only (all grades)
- Class sizes were not associated with outcomes.

District Outcomes

- Higher spending is associated with higher outcomes in either a production or cost framework. In addition, in models of all grades outcomes, districts experiencing increased current expenditure also experienced increased outcomes (Table 61).
- Districts with fewer than 2,000 students appear to perform less well than larger districts at constant spending and student population characteristics.

District Costs & Efficiency

- On average, districts with fewer than 800 students tended to have higher per pupil costs of constant outcomes. Costs were particularly high for districts with fewer than 300 students.
- Poverty factors alone appear insufficient for identifying the additional costs of constant outcomes in poor urban core districts. As such, a poverty weight alone (based only on subsidized lunch rates) may be insufficient to provide for equity in aid allocations. Models including interactions of racial composition, population density and/or poverty provided better prediction of urban core per pupil costs. More investigation is needed on this point.
- In fully specified instrumental variables cost models, there existed no clear pattern of difference in inefficiency by district factor grouping. In stochastic frontier models, for all grade level outcomes, districts in DFG A and DFG J appeared comparably inefficient, while districts in DFG CD appeared least inefficient.

Part 2 – Higher/Lower Performing Schools Analysis

Analyses

1. School level distribution of certified staff by position code in higher and lower performing schools in 2006-07
2. School level distribution of certified staff by qualifications in higher and lower performing schools in 2006-07

3. School level distribution of certified staff by qualifications in higher and lower performing schools from 90 school subset
4. Differences in key resource variables between extreme high and low performing schools

Findings

- On average, higher performing schools tended to be smaller, especially among high schools. But, these school sizes remained in ranges considered in relevant literature to be optimal (elementary schools of 300 to 500, high schools of 600 to 900).
- There exist no substantive differences in the allocation of staff by position code, in aggregate categories, in higher and lower performing schools.
- On average, higher performing schools tended to have smaller shares of teachers with 3 years of experience or less and only a BA (elementary and middle grades), and greater shares of teachers with a Masters Degree and 5 to 10 years experience (all grades)
- On average, there were no substantive or systematic differences in class sizes across higher and lower performing schools
- On average, higher performing elementary and middle schools were less likely to employ alternative route certified teachers, but higher performing high schools were more likely to employ alternative route teachers.

Policy Implications

LITERATURE & FRAMEWORK

1.0 Fiscal Resource Allocation

Presently, there exists far too little empirical research regarding the optimal mix of school district spending. That is, what is the best possible balance of administrative, instructional and other expenditures to improve educational outcomes? Indeed there is a vast body of *production function* literature that attempts to test whether increases to expenditure on specific resources, like teacher's level of education or experience, lead to increased performance outcomes. Few of these studies however, attempt to address specifically the tradeoffs between spending $1 on teacher salary increases (associated with experience or degree level) and spending that same dollar elsewhere in the school district.

In addition, it is increasingly well understood that the allocation of school district resources is not entirely within the control of school district officials. Rather, there are a variety of factors outside the control of school district officials that appear to exert significant influence over where the education dollar is spent.

This subsection attempts to shed some light on research on the relationship between resource allocation and outcomes, with specific emphasis on bureaucratic spending, and on those factors beyond control of district officials that may constrain the spending practices of school districts.

How does resource allocation affect student outcomes?

On the heels of late 1980s and early 1990s criticism[1] that public school systems were woefully inefficient and simply not using existing resources wisely, interest in the allocation of resources within school districts increased. It makes sense that there would be better and worse ways to allocate schooling resources toward improving educational outcomes. In the 1990s, however, many studies were conducted with the forgone conclusion that central administrative expenses were necessarily bad (read inefficient) and that higher percentages of dollars allocated "to the classroom" were necessarily good (read efficient). Software was developed for school districts to track dollars *to the classroom*[ii] and studies reported instructional expenditures in New York City schools at only 21.9% in an attempt to validate the inefficiency of large urban school districts (Speakman et al., 1996).[iii] However, few methodologically strong studies linked directly to student outcomes, the allocation of resources between administrative and other non-instructional expenses and classroom instructional expenses.[iv]

Despite lack of consistent evidence supporting specific strategies, there exists substantial pressure from political pundits for state legislatures and local district officials to adopt quick fix strategies specifically related to internal allocation of resources. In one case, pundits have argued that state legislatures should simply require that all public school districts allocate 65 cents of each education dollar "in the classroom," and in another, pundits have argued that school districts, especially large urban ones, invariably allocate resources across their schools inequitably, and must be required to decentralize governance and control to building level administrators, and allocate funds to schools on a weighted student basis. In a third, consultants have proposed a single *evidence based* model of public schooling, a largely prescriptive, one-size-fits all model for reorganizing school resources which consultants claim will *double* student performance (Picus and Odden, 2007).[v] Several states and large school districts have jumped hastily onto one bandwagon or the other.

A significant point of confusion in the literature on instructional spending relates to the difference between instructional spending levels and instructional spending as a share of total spending. For example, political proponents of requiring public school funding to be targeted to the classroom frequently point to a policy brief prepared for Texas legislators (Patterson, 2005) citing the research of Wenglinsky (1997) as finding a positive relationship between instructional spending and student outcomes.[vi] Wenglinsky, however, does not evaluate tradeoffs between instructional and other spending an outcomes, but rather finds that either instructional or administrative spending increases, both of which appear related to increased overall staffing and class size reduction, lead to improved educational outcomes.

Like Wenglinsky (1997), Ferguson and Ladd (1996)[vii] find in Alabama that instructional spending has a positive effect on test scores. Using data from Oklahoma school districts, Jacques and Borsen (2002)[viii] evaluate the effects of spending levels on student outcomes across a variety of categories, finding "Test scores were positively related to expenditures on instruction and instructional support, and are negatively related to expenditures on student support, such as counseling and school administration." (p. 997) The authors raise concerns however with deriving causal implications from their findings, noting: "It could be that schools with problems hire more administrators and counselors." (p.997) These findings together suggest that when adding new money to education systems, adding that money to instruction holding other areas constant may improve outcomes. In each case, however, the level but not tradeoffs or potential reallocation of existing levels of resources were evaluated. A core tenet of both the 65 and 100% solutions is that more money should not be added, but rather current funds reallocated.

Bedard and Brown (2000)[ix], in an unpublished working paper, attempt the leap from evaluating levels of spending across categories to relative proportions, and find that reallocation from administration specifically toward classroom instruction might lead to increased outcomes. "Either the reallocation of $100 from administrative to classroom spending, with no change in overall expenditures, or an $100 increase aimed directly at the classroom moves the average California high school approximately 5 percentage points higher in the state test score rankings." (p. 1) But, two other published, peer reviewed studies specifically on the question of administrative expenses and student outcomes yielded partially conflicting findings. In one, Brewer (1996)[x] found little relationship between non-instructional expenses and student outcomes. Somewhat in contrast with Brewer's non-effects of resource allocation, Marlow (2001) found that: "While numbers of teachers do not influence performance measures, numbers of administrators are shown to positively affect performance -- results that suggest that too many teachers, but too few administrators, are employed."[xi]

Finally, Huang and Yu (2002) combine NAEP data with NCES Common Core expenditure data to evaluate whether current expenditures per pupil and/or the difference between an individual district's instructional spending rate and the state average instructional spending rate (called DDR in their study) relate to student outcomes in 1990, 1992 and 1996. The authors found overall positive effects of current spending on outcomes but "Net of relevant district factors, DDR was found unrelated to districts' average 8th grade math performance."[xii]

Whether we assume that education dollars should go to the classroom or to administration, important tradeoffs may be made within either department. The primary trade-off in the allocation of education dollars is the choice to leverage those dollars to increase teacher or administrator quantity or to pay higher wages in an attempt to increase teacher or administrator quality. Existing research provides few insights regarding the teacher quantity versus quality tradeoff.

What factors constrain school district level resource allocation?

A number of studies over the past decade have addressed the factors that influence the allocation of school district resources. In particular, Baker (2003)[xiii] finds that school district size and availability of financial resources are primary drivers of the balance of spending between administration and instruction with larger districts and lower spending districts spending proportionately less on administration. Further, specific student populations were associated with allocation differences. Increased prevalence of students with disabilities was tied to significant increases in district staffing levels, from classroom to central office. Increased limited English proficient and low-income populations led to increased allocations to instruction and instruction-related staff, including librarians and school counselors, but not to increases in classroom teachers.

Monk and Hussain (2000)[xiv] and Brent, Roellke and Monk (1997)[xv] also show how location, school size and district wealth may lead to differences in the allocation of resources across specific educational programs. Among other things, these authors find that greater fiscal capacity provides greater opportunity to allocate resources to advanced curricular opportunities. That is, a variety of school district characteristics beyond district control, including district size and student demographic characteristics, appear to influence significantly internal resource allocation. Some of these influences, like increasing marginal costs of overhead or transportation in small districts, are unavoidable. Others, including the apparent escalation of middle level administrators and teaching support staff in higher poverty, urban districts may be *restructurable* in more productive and efficient ways. These findings make clear the potential problems of issuing one-size-fits all mandates regarding shares of budgets to be allocated to *instruction.*

How much do resource allocation patterns change over time?

Many researchers find that there have been few changes over time in the ways in which school districts allocate financial resources. In general, approaches to resource allocation over time across districts and states have arguably become more similar. Margaret Goertz and Gary Natriello studied resource allocation patterns of school districts in New Jersey, Kentucky and Texas prior to and after school finance reforms in those states. In general, they found that in the wake of school finance reforms, despite differences in school contexts, resource allocation patterns tend to become more similar across districts (Goertz and Natriello, 1999, p. 127).[xvi]

Hannaway, McKay and Nakib (2002) found similar results. First, they found that in general, instructional spending levels and shares changed little across districts from 1992 through 1997. Second, focusing specifically on four states identified as implementing significant reforms in standards and accountability (Kentucky, Maryland, North Carolina and Texas), they found no consistent pattern of changes in resource allocation that could be attributed to the reforms.[xvii]

One area where significant changes in resource allocation have occurred over the long run (20 to 30 years) is in special education finance and the relative balance of special to general education spending. Lankford and Wyckoff studied special and general education expenditure patterns for New York school districts from 1980 to 1992, finding that while most of the overall increases in educational expenditures could be attributed to teaching expenses, special education teaching expenses had far outpaced general education teaching expenses.[xviii] Rothstein and Hawley-Miles similarly note that from 1967 to 1991, in a sample of eight representative districts, special education expenditures grew from 4 to 17% of total expenditures while general education decreased from 80 to 59%.[xix]

What about resource allocation across "different" types of schools?

Very little research thus far has addressed whether different types of schools, such as private schools or charter schools, allocate their resources similarly to or differently from traditional public school districts. One structural difference between private schools, independent charter schools and traditional public school districts is the lack of a single central office overseeing multiple schools of varied grade levels. As such, one might expect significant shares of administrative expenses to exist at the school level. A doctoral dissertation conducted at the University of Kansas in 2004, focusing on Catholic High schools in Kansas City, found that on average per pupil spending levels were similar in the catholic high schools and in public high schools in the area. The share of total expenditures allocated to "instruction" was somewhat lower in the catholic high schools and to "other commitments" significantly higher. The allocation of staff across the Catholic high schools was remarkably similar to the allocation of staff in high schools studied by Brent, Roellke and Monk in New York State several years earlier (1997).

Baker, Green and Richards (2008)[xx] use national data to estimate the number of teachers per 1000 students and administrators per 1000 students in conventional public school districts and in independent charter schools in 2000. Focusing only on conventional public school districts comparable in size to the independent charters, Baker, Green and Richards show that conventional school districts had 78.53 teachers per 1,000 students, while charter schools had only 63.49 teachers per 1,000 student and had many more administrators per student. Again, however, it would be inappropriate to make inferences regarding relative efficiency on this basis given the lack of evidence for making such a claim.

What do we know about inequity in resource allocation within school districts?

Proponents of a reform called *weighted student funding,* implemented under the name *Fair Student Funding* in New York City in 2007 argue that weighted student funding will necessarily resolve rampant inequities in funding that persist across schools within districts (see Carr, Gray and Holley, 2007).[xxi] Studies conducted in the 1990s found significant disparities in resources within districts. Burke (1999)[xxii] used national data on elementary school student-to-teacher ratios, found intra-district disparities that in some states exceeded inter-district disparities (Illinois and New York, p. 452). Steifel, Rubenstein and Berne (1998)[xxiii] analyzed school level data from four large urban districts (Chicago, Fort Worth, New York and Rochester) in an effort to measure within district disparities in resources. Like Burke (1999), the authors found significant variation in resources across schools within districts, but also found that some of that variation was positively associated with poverty rates across schools. This finding, however, was not systematic across settings or school types. For example, Rochester middle schools showed stronger positive relationships between poverty and resources than Rochester elementary or high schools.

In a follow-up of previous research, Rubenstein and colleagues (2007)[xxiv] confirm what we generally know about within district resource inequity, coupled with what we know about the distribution of teachers by their qualifications across schools: "Using detailed data on school resources and student and school characteristics in New York City, Cleveland and Columbus, Ohio, we find that schools with higher percentages of poor pupils often receive more money and have more teachers per pupil, but the teachers tend to be less educated and less well paid, with a particularly consistent pattern in New York City schools."

None of these studies explored in-depth the underlying causes of the disparities or whether weighted student funding in particular would provide a possible solution. But, it has been assumed and frequently implied that seniority preferences in teacher contracts, coupled with personnel based allocation strategies are the primary cause. The one recent study to test empirically this issue found "Contrary to certain previous research and conventional wisdom, this study finds no persuasive evidence that the seniority preference rules independently affect the distribution of teachers among schools or exacerbate the negative relationship between higher minority schools and uncredentialed and low-experience teachers." (Koski and Horng, 2007, p. 262).[xxv]

Supporters of weighted student funding frequently cite the findings of Roza and Hawley-Miles (2004)[xxvi] regarding Houston and Cincinnati – two widely applauded weighted student funding success stories. Roza and Hawley-Miles (2004) used school level budget data on Houston and Cincinnati to evaluate whether resources for the general population of students and for specific populations were evenly distributed across schools. That is, did "regular education" students receive comparable funding in one elementary versus another in Houston, and did children in poverty receive comparable funding in one elementary versus another within the district? In short, the "what should be" benchmark in this analysis is that the child in poverty in one school should receive similar resources to the child in poverty in another school, and the gifted child in one school should receive similar resources to the gifted child in another school.

The major conceptual shortcoming of this method is that it fails entirely to account for whether children in poverty or limited English proficient children receive any sufficient support across schools, or on average, whether schools with much higher poverty concentrations received higher levels of per pupil funding than those with lower poverty concentrations. A district could receive a perfect equity index score under this method by allocating $0 per poverty child across all schools and $1,000 per gifted child across all schools, ultimately driving thousands more per pupil in low poverty schools serving larger gifted populations.[xxvii]

Roza and Hawley-Miles conclude that Cincinnati in particular had adjusted its formula toward "virtually eliminating inequity in its schools budgets, in part by eliminating the higher funding levels for the high cost school designs and other magnet programs." The authors go even further to attribute these changes to a change from staffing based budgets to weighted pupil funding, neglecting the possibility that similar changes if they existed could be possible via other budgeting approaches.

Roza , Guin, Gross and Deburgomaster (2007)[xxviii] apply the same problematic analytical framework in an analysis of Texas school district budgets from 1994 to 2003. They note: "We then calculate a ratio, called a Weighted Student Index (WSI), of the actual funding received by each school to the funding we would expect if schools received the district's average allocation for its particular mix of students." The authors then find significant disparities over time in cross school allocation of resources to general and special populations, again implying an important role for weighted student funding as a remedy: "While we would not feel comfortable claiming, based on the analysis here, that student-based budgeting has been the cause of greater equity in Houston's school funding system, our findings do show that despite an initial increase in the coefficient of variation, Houston schools have over the longer term made modest improvements in equity since the strategy was put into place." (p. 73)

Carr, Gray and Holley (2007), in a policy report for the Buckeye Institute adopt a more convoluted framework for making the claim that high poverty Ohio school districts fail to allocate resources equitably across schools. First, Carr et al. select only 72 high poverty districts as the target of their critique, but fail to limit their sample to districts with sufficient numbers of comparable grade level schools. Then Carr et al. estimate correlations between per pupil budgets and poverty rates across schools, regardless of grade level, and tally the number of correlations that are positive and negative, regardless of district size.[xxix] Concurrently, Carr et al. estimate a "what should be" budget benchmark for each school assuming that districts should allocate resources using weights adopted in the state school finance formula, and tallying the count of correlations that should be positively related to poverty. That is, the state school finance formula is assumed to be a good representation of fairness across students. Baker and Green (2005)[xxx] and Baker and Duncombe (2004)[xxxi] have shown this to be a particularly problematic assumption, where in at least some cases, state legislatures have adopted weighting systems that drive resources disproportionately to lower rather than higher need districts. The Carr et al. approach accepts as rational, any policy adopted by state legislature's for allocating different levels of resources across schools.

Like Roza and Hawley-Miles (2004), Carr et al. (2007) attribute the inequities they find to conventional "staffing based" budget systems, noting "Districts, especially larger ones, tend to use staffing allocations to distribute funding. However, these allocations are often a result of central office decisions and collective bargaining agreements, which do not necessarily reflect student needs (p. 1).Carr and colleagues then conclude: “Employing building-based budgeting is one mechanism to guarantee that wealthy schools within districts are not siphoning off the resources that have been appropriated to help close the achievement gap.” (p. 1)

Unfortunately, much of this recent highly politicized and methodologically problematic “research” seems to have drawn attention away from more rigorous studies of within district resource inequity and potential causes of that inequity. Further, this more recent advocacy research has made the bold leap toward the conclusion that weighted student funding is a logical if not the sole solution. To date, there remains little evidence that districts applying weighted student funding formulas achieve any greater equity across schools and children of varied needs than districts adopting “other” strategies.

Breadth and Distribution of Offerings across Different Settings

Another area of emerging interest is the equity and neutrality of the distribution of specific educational opportunities, as defined by resources, rather than total per pupil revenues or expenditures, across schools and districts. Some recent research has explicitly addressed this question, while other research on broader issues of resource allocation has revealed intriguing patterns of inequity of specific opportunities. For example, Brent, Roellke and Monk, in their human resource allocation studies in New York mentioned previously, found that the “small poor” district in their sample of case studies allocated no resources to advanced programs in any of five content areas and allocated comparable resources per pupil to regular and remedial programming in English, Social Studies, Math and Science. In contrast, their “small wealthy” district allocated substantial resources to advanced programming in four of five content areas and no resources to remedial programming in two of those four (English and Social Studies) program areas (p. 220). This finding raises some concerns regarding horizontal equity and fiscal neutrality of the availability of advanced programming opportunities across New York State high schools.

2.0 Teacher Labor Markets

A growing consensus among both researchers and policymakers holds that the most critical school factor related to student achievement and the closing of the achievement gap is teacher quality. Indeed, few educators, economists, or politicians would argue with the contention that, all other things being equal, well-qualified teachers elicit greater student achievement gains than those who are comparatively less qualified. For example, Ferguson (1991, p. 465)[xxxii] concluded from his research in Texas and elsewhere, "Good teachers have distinguishable impacts on student exam scores." Sanders and Horn (1998)[xxxiii] asserted that the “single largest factor affecting academic growth of populations of students is differences in effectiveness of individual classroom teachers” (p. 27). Sanders and Rivers (1996)[xxxiv] found that the difference between attending classes taught by high-quality teachers (highest quartile grouping) and taught by low-quality teachers (lowest quartile grouping) is substantial, approximately 50 percentile points in the distribution of student achievement (cited in Lankford, Loeb & Wyckoff, 2002).[xxxv]

In an ideal situation, all schools would have a full complement of well-qualified teachers; however, this goal remains unattained and far from reach. There is a growing realization that a substantial number of teachers appear to be underqualified for their current teaching positions (Ingersoll, 1999).[xxxvi] Moreover, the distribution of high quality teachers is far from equitable both across and within school systems. Indeed, students in schools serving large percentages of poor and/or minority students have lower levels of teacher quality—regardless of the measure of quality employed. Specifically, researchers have found large disparities in teacher quality across schools in New York, California, and Texas (Lankford, Loeb and Wyckoff, 2002; Esch et al., 2004; Fuller, 2004).[xxxvii] Lankford, Loeb and Wyckoff raise significant equity concerns regarding teacher quality distribution, revealing primarily the weaker academic backgrounds and professional credentials of teachers concentrated in urban districts, serving higher percentages of poor, minority children. More recently, An Education Trust article (Peske & Haycock, 2006) concluded, "Unfortunately, rather than organizing our educational system to pair [low-income and minority] children with our most expert teachers, who can help 'catch them up' with their more advantaged peers, we actually do just the opposite.[xxxviii] The very children who most need strong teachers are assigned, on average, to teachers with less experience, less education, and less skill than those who teach other children" (see also Prince, 2002).

The primary reason for the inequitable distribution of teachers is not the initial distribution of newly certified teachers, but rather the higher turnover rates in particular schools (Ingersoll, 1999, Hanushek, Rivkin, & Kain, 2004).[xxxix] Existing research strongly suggests that teachers migrate from less desirable schools to more desirable schools, leaving some schools with a chronic shortage of well-qualified teachers (Hanushek, Rivkin, & Kain, 2004). The reasons for this phenomenon that results in an inequitable distribution of teachers vary from working conditions and compensation issues to selection and placement practices. For example, economic research on the determinants of sorting of teachers of differing backgrounds typically identifies work environment factors, such as the make-up of the student population, or the desire to work near home or in familiar surroundings as dominant determinants of teacher job choices, with salary differentials playing a smaller, but still significant, role (Hanushek, Kain and Rivken, 1999; Murnane & Olsen, 1989).[xl]

Economic research also suggests that wages may affect the decisions of individuals to enter the teaching profession, that higher salaries may lead to higher overall teacher quality, and that higher quality candidates are more likely to take positions that are better compensated (Murnane & Olsen, 1989; Figlio, 1997, 2002; Ferguson, 1991; Loeb & Page, 1998, 2000).[xli] However, Imazeki (2001)[xlii] found that while "combat pay"-- or sufficient salary differentials -- may shift high-quality teachers to low-income urban schools, increases between 15 and 30% might be required to recruit a teacher of a given set of qualifications from the "average" school to the high-poverty school.

Studies of teacher labor markets emerging in the late 1990s and early 2000s focused on the ways in which teacher sorting resulted in disadvantages for poor, urban schools. Among the relevant findings were that teachers in poor urban schools were more likely to have failed certification exams and less likely to have attended selective undergraduate colleges, two background attributes that had previously been associated with student outcomes (Lankford, Loeb & Wyckoff, 2002).

Studies of teacher career moves have shown that teachers with higher certification exam scores and those who attended more selective undergraduate institutions were more likely to make upward moves between schools or districts (Lankford, Loeb and Wyckoff, 2002). This move behavior was then assumed to exacerbate the inequitable distribution of teachers across school settings. However, upward and outward moves were only a small piece of an inequitable distribution established through initial job matches of teachers.

Existing studies have not effectively parsed out the extent to which distribution inequity of teaching quality is established on initial match between teachers and schools and the extent to which further inequities emerge over time with career moves. While teacher quality distribution equity has been evaluated at the district and school level, the types of career moves that may exacerbate inequality have been studied at individual teacher level, providing little insight into the rate at which a school or district level teacher workforce changes as a function of individual moves.

More recently, studies of individual teacher moves have shifted emphasis from indirect measures of teacher quality via teacher background attributes to more direct measures of teacher quality such as value added student outcomes. That is, recent papers have argued for measuring teacher quality by the aggregate student level value added achievement of students assigned to specific teachers, a notion introduced by Sanders and colleagues in the 1990s (Sanders, Wright & Horn, 1996). Findings of these recent studies include the seemingly contrary finding that teachers who show positive student value added, even those in higher poverty schools, are actually more likely to stay in those schools than to leave (Goldhaber, Gross and Player, 2007).[xliii] Meanwhile, teachers with higher test scores test scores and those from more selective undergraduate colleges remain more likely to leave.

These more recent findings have led to two potentially misinformed conclusions (Goldhaber et al. & Hanushek et al. *The Market for Teacher Quality*). One is the conclusion that this new finding suggests that previous findings regarding teacher's academic background and student outcomes were wrong. In fact, the more recent finding neither refutes nor supports this earlier finding. Rather, the more recent finding that those teachers who experience success regardless of setting are more likely to stay than leave is concluded independent of teachers' own academic background, using knowingly noisy measures of teachers' success with student outcomes. Further, these new findings come from data in Texas and Washington, where teacher backgrounds may differ quite significantly from teachers in New York State and other sites of previous studies.

Second and perhaps far more importantly, these new studies that find that teachers experiencing success are more likely to stay, even in high poverty schools, fail entirely to address the relative proportions of teachers who experience such success across school settings. Again, the aggregate effect on school or district workforce of individual teacher's career choices is not evaluated. That is, there may be 1 in 10 teachers in the high poverty urban setting who experiences success on student value added outcomes, and that teacher may be more likely to stay. But, he or she is still 1 in 10. By contrast there may be 7 or 8 of 10 teachers in low poverty settings who experience such success, and they too decide to stay. If this is the case, more recent findings do little to relieve previous concerns over teacher sorting and the plight of poor urban schools. In fact, while these more recent findings suggest an increased likelihood that high poverty schools may retain their successful teacher(s), these findings also suggest that successful teachers from low poverty schools aren't going anywhere either, and are unlikely to become available for hire in low poverty schools.

3.0 Productivity and Efficiency

Questions over whether and how money matters in public schooling persist in nearly every discussion over financing of public schooling systems, as well they should. Sadly, however, empirical research on these issues has become so highly politicized that it can be difficult to derive meaningful, impartial conclusions from available analyses. We offer a reframing of the question: Does money matter in education? Most relevant to the analyses provided in this report are three versions of the *Does Money Matter* question:

1. At the school or district level as unit of analysis, are there cross-sectional associations between spending more per pupil and achieving higher average or aggregate outcomes on conventional measures of student achievement?

2. Are there benefits, in terms of commonly measured educational outcomes, of implementing specific education reform strategies or changes in quantities and qualities of schooling inputs which may have fiscal implications?

3. Have school finance reforms which have led to increased funding and redistribution of resources across schools and districts within states led to changes in the level or distribution of educational outcomes?

In short, the first question asks whether at the school district level, empirical research provides us any reason to believe that school districts that spend more than other school districts under the same state policy umbrella display higher levels of student outcomes. Alternatively, the first question may be reframed to ask whether it can be estimated that achieving higher levels of student outcomes results in higher costs at the school district level.

The second question focuses on more specific sets of educational inputs including specific educational reforms including class size reduction or implementation of specific comprehensive school reform models and qualities of inputs to education such as the quality of teachers.

Finally, the third question above asks whether empirical research provides us any reason to believe that increases in funding and redistribution of funding resulting from state school finance reforms lead to changes in either the level or distribution of student outcomes. For example, does improved equity in funding lead to improved equity of outcomes?

Direct estimates of fiscal resources on student outcomes

The debate over whether money matters in education is often characterized by the various tabulations of coefficients between fiscal inputs and schooling outcomes assembled by Eric Hanushek and Larry Hedges and colleagues in the 1990s. Rehashing these studies in detail is a fruitless endeavor. In brief, using meta-analyses or more precisely simple tabulations of regression coefficients in studies of the relationship between spending and outcomes, Hanushek drew the conclusion that there is not systematic relationship between school district spending, other school inputs such as pupil to teacher ratios and teacher education level and student outcomes. Hedges and colleagues re-tabulated the studies to conclude instead that resources are systematically related to student achievement and that those relationships are strong enough to be important.[xliv]

Krueger (2002)[xlv] provides among the most useful summaries of concerns with the meta-analysis introduced by Hanushek:

- Hanushek's latest tabulation of the literature is based on 59 articles on class size and 41 on expenditures per student, 22 of which were included in both. Hanushek extracted information on the sign and significance of 277 estimates of the effect of class size drawn from 59 studies. (Each estimate is called a study in Hanushek, 1997.) The number of estimates extracted from the studies varied widely: as many as 24 estimates were extracted from each of two papers, and only one from 17 studies apiece.
- By using estimates as the unit of observation, Hanushek implicitly weights studies by the number of estimates he extracted from them. It is difficult to argue that the studies that receive the most weight in Hanushek's approach deserve more weight than the average study. For example, Summers and Wolfe's (1977) American Economic Review article received a weight of 1, while Link and Mulligan's (1986) Economics of Education Review article received a weight of 24.
- When all studies are given equal weight, however, the literature exhibits systematic evidence of a relationship between class size and achievement, and between expenditures and achievement. Using Hanushek's coding of the studies the number of studies that find positive effects of expenditures per student outnumber those that find negative effects by almost four to one. The number of studies that find a positive effect of smaller classes exceeds the number that find a negative effect by 57 percent. Differences of these magnitudes are unlikely to have occurred by chance.

Methodological Issues in Production Function Studies

Many empirical tests of whether money matters in education apply a single framework – the education production function. Education production functions assume that student outcomes – lifelong economic returns, educational attainment or short-term academic achievement outcomes – can be estimated as a function of schooling and non-schooling inputs.

Outcomes = *f*(School | Non-School)

Typically, in education production function analysis, a statistical model is estimated using some type of student achievement testing data as the outcome measure, a measure of school financial inputs, or other inputs to schooling having financial implications like class size, pupil to teacher ratios or teacher experience and education levels, and a collection of individual student's attributes and perhaps school contextual and student population attributes.[xlvi] In most recent examples, outcomes are measured at the level of the individual student, resources measured at the level of the district or school and student characteristics measured at some combination of individual, classroom, school and district level aggregation.

The art of the education production function and related methods for measuring the relationship between school inputs and outcomes has evolved substantially over time revealing a multitude of methodological shortcomings to previous attempts to estimate input-outcome relationships. For example:

- Few studies seeking to measure the relationship between financial resources and student outcomes sufficiently correct for the relative value of financial resources in one school location versus another (Taylor, 1997).[xlvii] Among major factors influencing the value of the education dollar from one location to another are the competitive wages of school personnel and economies of scale (Duncombe and Yinger, 2008).[xlviii]
- No studies that seek the link between spending and outcomes using the education production function make any attempt to correct for the efficiency with which the education dollar is used (Duncombe and Yinger, 2007).[xlix]
- Many earlier studies attempting to relate education spending and student outcomes lacked sufficient student level data. Hanushek, Rivken and Taylor (1996) show that when analyses use school average, district average or even state average data, the effects of resources on student achievement may be inflated.[l]
- Many studies insufficiently account for the complex, hierarchical structure of public education systems. In a study in which such accommodations were made, Wenglinsky (1997) shows that instructional expenditures do affect student outcomes while some other expenditures such as spending on capital outlay did not display a link.[li]
- Few authors have attempted address complex non-linear relationships between spending and outcomes. Figlio (1999) finds that a highly non-linear *translog* production function may better characterize relationships between spending and outcomes.[lii]

In short, there remain many technical difficulties in estimating directly the relationship between education spending and student outcomes, using the *Education Production Function* as an empirical framework. Some of these difficulties have been resolved in incremental empirical research, such as evaluation of aggregation bias by Hanushek et al. (1996), the hierarchical structure of schooling, using student level data (Wenglinsky, 1997), variation in teacher wages (Taylor, 1997) and non-linearities (Figlio, 1999).[liii] Others, such as the efficiency question have not, requiring an alternative analytical framework altogether, to be discussed later (Duncombe and Yinger, 2007).[liv]

Our read of the most recent and most refined work in this area, coupled with critiques of prior tabulations suggests to us that financial resources are systematically associated with student outcomes.

Estimates of specific schooling inputs on student outcomes

A sizeable body of recent research finds that specific educational reform strategies result in changes in or differences in student outcomes, and at the same time result in increased costs of education. Most reform strategies for public schooling are either based entirely on are related to changes in the quantity of schooling or public school certified personnel. Other research focuses on teacher quality and the relationship between teacher wages and teacher quality, though few specific policy recommendations have yet been derived from this research. Here, we provide a brief summary of the financial implications of improving educational productivity by changing either quantity of inputs provided, or the quality of inputs provided.

Teacher and schooling quantity policies

The quantity of schooling provided to students may be altered in any number of ways, each having significant cost implications. One can increase the numbers of either core instructional staff by reducing class sizes or supplemental staff by providing additional support services, or one can increase the time period over which staff are in contact with students, by increasing the length of school days lengthening the school year or by adding summer school programs. In addition, one can increase the age range of students served, as occurs with the public provision of pre-school programs.

- Several studies indicate both short term and long term sustained benefits of class size reduction which requires substantial increases in the quantity of classroom teachers (Finn and Achilles, 1999).[lv]
- Several studies also indicate benefits of participation in high quality early childhood programs, which are another form of increased education quantity – increasing the numbers of children served and numbers of qualified professional staff required (Barnett, 1995)[lvi]
- Several studies also indicate outcome benefits of participation in summer, extended learning opportunities (Borman and Dowling, 2006; Alexander, Entwisle and Olsen, 2001).[lvii]

Further, studies on class size reduction have often found differential effects by race and poverty, specifically that poor and minority students often benefit more from reduced class sizes. These finding suggest that class size reduction might not only be applied to improve the overall quality of schooling, but also to improve equity across school settings if targeted to high poverty, high minority concentration schools.[lviii]

Teacher quality policies

Questions regarding financial resources and teacher quality may be separated into two parts: a) whether overall increases in teacher salaries lead to overall increases in the quality of teachers on the labor market; and b) whether higher salaries might be used to recruit and retain high quality teachers in higher poverty, higher minority concentration schools. That is, can teacher salary variation be exploited to improve equity in the distribution of teacher qualifications across school settings?

It is relatively well understood based on numerous recent studies, that all else equal, teachers with specific qualifications are less likely to choose to work in higher poverty, lower performing, high minority concentration (specifically % black) schools. Further, it is increasingly understood that disparities in the distribution of teaching quality influence quite strongly disparities in student outcomes. Hanushek and Rivken (2007) note that "Unequal distributions of inexperienced teachers and of racial concentrations in schools can explain all of the increased achievement gap between grades 3 and 8."[lix]

Regarding overall salary levels, select studies have concluded the following:

- Murnane and Olson (1989) find that salaries affect the decision to enter teaching and the duration of the teaching career.[lx]
- Figlio (1997, 2002) and Ferguson (1991) find that higher salaries are associated with better qualified teachers[lxi]
- Loeb and Page (1998, 2000) find that raising teacher wages by ten percent reduces high school dropout rates by between three and six percent and increases college enrollment rates by two percent.[lxii]

Regarding the role of wage differentials for redistributing teachers across school district settings, select studies have concluded:

- Imazeki (2001) estimates that reducing attrition in urban and rural districts "to the same levels as in an average district would require wage increases from fifteen to thirty percent."[lxiii]
- "a school with 10 percent more black students would require about 10 percent higher salaries in order to neutralize the increased probability of leaving." (Hanushek, Rivken, Kain, 2004)
- "We find that teachers in districts with higher salaries relative to non-teaching salaries are less likely to leave teaching. We also find that a teacher is less likely to transfer to another district if the district in which he or she teaches has high salaries relative to other districts in the same county" (Ondrich, Pas & Yinger, 2007).

Notably, the most recent study by Ondrich, Pas and Yinger (2007) finds both that relative teacher salaries and that relative non-teaching salaries influence teacher retention.

No study has yet been able to measure directly the costs and benefits of the trade-off between investing in increased teacher quantities as required in class size reduction an in most comprehensive school reform models, and improving teacher quality.[lxiv]

Increased funding and school finance reform

In the present New Jersey context a central policy concern is whether increased funding to schools through school finance reforms specifically is associated with changes in the level or distribution of schooling outcomes across districts. A handful of relatively recent studies attempt to discern whether state school finance reforms lead to changes in student outcomes, including overall increases or declines in outcomes, or improvement in the equity of student outcomes (e.g. raising the bottom end, though not necessarily "closing the gap."). These studies attempt to test whether new money introduced into low wealth schools via school finance reform, leads to improved outcome levels and improved outcome equity.[lxv]

Whether "school finance reform" as a general concept, leads to improved student outcomes, depends largely on the type of reform implemented and potentially on the conditions under which the reform was implemented. Certain types of reforms tend to produce more consistently positive or more consistently negative results regarding long-run spending and outcomes. The literature on reforms including tax limits typically finds that tax limits level down spending and tax limits may level down student performance.[lxvi] In general, Downes and Shaw (1995) show that the stringency of constraints on local discretion determines the effects of reforms on the level and growth of spending.[lxvii]

Recent literature on significant state-specific school finance reforms indicates positive results with respect to achievement outcomes. Two recent studies focus on school finance reform in Vermont (Downes, 2004) and in Kentucky (Flanagan and Murray, 2004). In each state, funding to low wealth districts was increased dramatically. In Vermont, Downes (2004) found that Vermont's school finance reform (Act 60), which significantly increased funding in low property wealth districts, has also led to increased performance outcomes for children from low wealth districts and that performance outcomes have improved more rapidly in low wealth districts than in high wealth districts.[lxviii] Murray and Flanagan found similarly positive achievement effects from Kentucky's education reform act.[lxix]

Similarly Guryan (2001) finds:

> Using state aid formulas as instruments, I find that increases in per-pupil spending led to significant increases in math, reading, science, and social studies test scores for 4th- and 8th-grade students. The magnitudes imply a $1,000 increase in per-pupil spending leads to about a third to a half of a standard-deviation increase in average test scores. It is noted that the state aid driving the estimates is targeted to under-funded school districts, which may have atypical returns to additional expenditures. (p.1)[lxx]

Finally, Deke (2003) in a study of the infusion of new revenues into Kansas districts in the early 1990s, found: "Using panel models that, if biased, are likely biased downward, I have a conservative estimate of the impact of a 20% increase in spending on the probability of going on to postsecondary education. The regression results show that such a spending increase raises that probability by approximately 5%."[lxxi]

The relationship between outcomes and costs

While it is indeed policy relevant to ask the question whether current public financing of schools is associated with levels, differences and changes in educational outcomes, it may in fact be more relevant to approach the question from a different perspective: What is the "cost" or what level of spending might be required to achieve desired educational outcomes and how do those spending needs vary by educational settings? Like education production function analysis, estimating the costs of achieving specific educational outcomes requires estimating a statistical model in which one identifies a relationship between existing levels of spending across schools and/or districts and existing levels of outcomes, after controlling to the extent possible for various factors outside the control of local school districts that affect the costs of outcomes. Studies attempting to link education spending and outcomes in this way have used a method called the education cost function, which can be specified as follows:

Spending = *f*(outcomes, input prices, structure, inefficiency)

That is, existing levels of education spending across school districts are a function of desired outcome levels, variations in the prices of key inputs to education including teachers, structural characteristics of school districts beyond control of local school officials such as economies of scale and sparsity, and spending is affected by inefficiency in the use of education dollars.

While the goal of education production function studies is to estimate a relationship between current spending and outcomes, without regard for relative efficiency in the key explanatory variable – spending – the goal of cost function analysis is to estimate the relationship between outcomes and spending while at the very least attempting to account for how inefficiency varies across educational settings, based on factors that may influence the efficiency with which school districts produce outcomes.

Recent education cost studies applying cost function methodologies each provide a far more thorough accounting for factors that influence the relative value of the education dollar across settings than do most education production function studies. Further, nearly all education cost function studies adopt some method to account for variation in efficiency across school districts. Invariably, education cost function studies find that higher levels of education outcomes require higher levels of education spending and that the sensitivity of costs to desired outcome levels is often much stronger and clearer than when estimated via production function analysis.[lxxii] In short, applying the cost function rather than production function framework, money clearly matters.

Understanding Educational Efficiency

Educational *Efficiency* is a phrase typically used to refer to the relationship between spending inputs to schooling – per pupil operating expenditures – and the student outcomes achieved by students attending the schools or districts in which the dollars were spent. It is assumed that the most efficient school or district is the one that spends the least for any given outcome level, all else equal. It is also assumed that schools or school districts have wide latitude to expend any given amount of revenue in a variety of different ways, such that the same amount of money might lead to the production of very different outcomes, or different outcome levels. For example, district officials might choose to pay higher wages for teachers in an effort to improve teaching quality, or might use a comparable sum of money to purchase more teachers in order to reduce class sizes.

It is critically important to understand however, that school or district officials likely have constrained options for reorganizing their resources, where constraints on resource re-allocation may range from physical space constraints, such as insufficient classrooms to provide smaller class sizes, to bureaucratic constraints, which may include constraints on the use of state categorical and/or federal funds, and related compliance documentation burdens. These constraints vary across districts, with some districts facing far greater limitations on their latitude to reallocate resources than others. As such, holding the same efficiency expectations across all districts may be unreasonable.

It is also important to understand that in applied analyses of school or district efficiency one can evaluate only efficiency with respect to measured inputs and measured outcomes. In most cases, those measured educational outcomes are state assessment scores, and more often than not, those scores include proficiency rates for groups of students at specific grade levels on tests of reading and math skills. That is, most applied efficiency analyses, including those we offer herein, speak only to the relationship between dollars and schooling inputs purchased with those dollars, and the production of reading and math test scores. While limited, these outcomes are important.

Further, when measuring the input to outcome relationships of schooling, the precision with which the relationship between any two or more variables can be measured is highly contingent upon the precision of the measures themselves. Statisticians like to talk in terms of *variance explained.* There might be a certain amount of variation in student test scores across schools. We might find that in a statistical model where we use detailed data on student demographics, we can explain or predict about 65% of the variations in student outcomes across schools. In fact, that's about what we found in our elementary school screening models. We might find that if we add measures of resource differences across our schools that we can explain even more of the variance in student test scores.

At this stage, remaining variance in outcomes is that variance not explained by either the students in the schools or the money spent on them. It might be instinctive to jump to the conclusion that this remaining variance must be inefficiency that could be controlled by local school officials through better allocation of resources. However, the remaining variance could, in fact be (a) related to other important factors that we have yet to find, or omitted variables, including inefficiencies that are uncontrollable by local officials such as the constraints addressed above, or (b) variance in the testing outcomes that is random and unexplainable - measurement error or noise.

In our analyses we explore efficiency from both production and cost perspectives. From the production perspective, it is assumed that aggregate financial resources may be expended in a variety of ways toward achieving specific educational outcomes. From a statistical modeling perspective, student outcomes are in the position of the dependent variable. We are predicting variance in the student assessment outcome measures, which may be quite noisy. The production perspective might be useful for exploring which combinations of resources are good predictors of outcomes. For example, are outcomes more strongly associated with class size differences or teacher salary differences?

Alternatively, one can evaluate the input-outcome relationship from the cost function perspective. With aggregate spending per pupil as the dependent variable, on can predict spending differences across schools or districts as a function student population differences, district cost factors and student outcomes. That is, with given students, in specific contexts, at constant outcomes, how much is being spent? A more detailed explanation follows.

Production perspective

The education production function is a frequently used tool in education policy and economics literature for evaluating input-outcome relationships in schooling. As discussed above, the education production function assumes that student outcomes are a function of individual and collective student background characteristics, schooling inputs or resources, and a variety of additional contextual factors that may directly affect student outcomes or may affect the value of financial inputs to schools, where inputs are measured in financial terms.

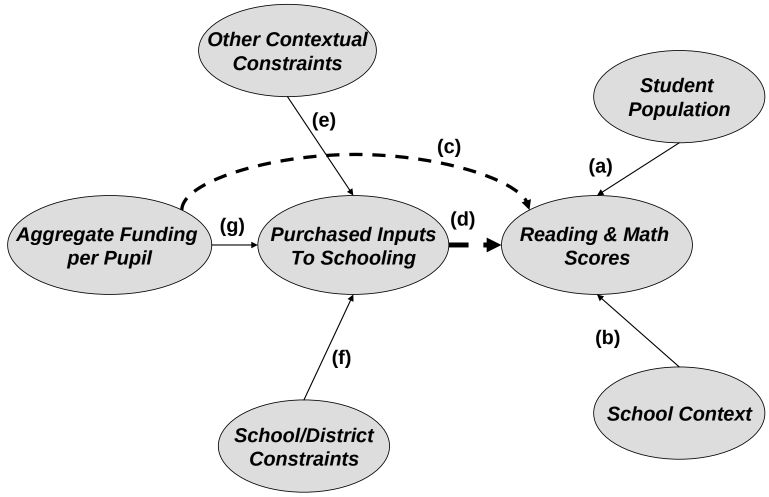
Outcomes = *f*(students, school context, school location, school structure, school resources)

Figure 1 presents a diagram of the production function as relates to our analyses of New Jersey public schools. In our initial selection of 90 schools for further investigation, we evaluated only the relationship between student demographic factors and school level outcomes for elementary, middle and secondary schools (link 'a'). Some models included an urbanicity factor interacted with school poverty rates, to capture other aspects of school context (link 'b'). But, we purposefully did not attempt to address links 'c' or 'd' when selecting schools. This was because one goal of the analysis of 90 schools was to explore on site, in greater depth whether the higher and lower performing schools differ in terms of overall financial resources or resource allocation, in addition to a number of other factors. In the initial screening models, we explained the variance in outcomes that was explainable as a function of student population and limited schooling context factors, leaving behind variance that might be explainable by resource differences and other unmeasured school characteristics (school size), as well as unexplainable noise.

Continuing to focus on school level data, with schools grouped by grade level based on outcome assessments, we now explore links 'c' and 'd' in statewide analysis. That is, to what extent do resource measures in the aggregate or decomposed to specific inputs, relate to student outcomes. State data systems in New Jersey do not provide measures of aggregate financial resources per pupil. Instead, we use statewide staffing data to estimate school level staffing expenditures per pupil. When attempting to measure the relationship between aggregate funding per pupil and outcomes – link 'c' – one must consider as an "other contextual constraint" the value of the education dollar from one location to another toward purchasing educational inputs. In addition, one might consider other school or district constraints such as school size, which may constrain the ability of school officials to reorganize resources (link 'f') or may influence more directly the learning environment of the school (link 'b').

Figure 1

Factors involved in the Input-Outcome Relationship: Production Perspective



At each stage of the analysis – as we include additional variables – it may be useful to evaluate those schools with higher or lower than predicted outcomes. Further, it may be useful to explore factors that predict the remaining variations in outcomes. For example, we may find that aggregate resource levels predict a portion of the differences in outcomes not explained by schooling context or student demographics. From this model, we might find that at certain spending levels, given certain student populations, some schools have higher test performance than others. Using more detailed data on purchased inputs to schooling, we may find that schools using their resources to recruit and retain more experienced and more educated teachers rather than purchasing greater quantities of novice teachers have higher test performance. To a large extent, the resource allocation puzzle of schooling involves price/quality by quantity tradeoffs. But, we must continue to recognize that all such tradeoffs are not fully within the control of local school officials.

For our statewide analyses focused on link ‘d’, we are able to access data on average class sizes from the annual school reports, teacher salaries relative to other teachers of same experience, degree level and primary position code within the same teacher labor market, and percentages of teachers at various degree and experience levels. Our more detailed data collected from the 90 schools provide for much richer contextual analysis.

From the analytical framework presented herein, one might inappropriately conclude that certain schools – at constant personnel expenditures – should simply allocate those expenditures toward purchasing more experienced teachers or reducing class size in order to achieve outcomes more similar to schools having comparable students but more experienced teachers and/or smaller classes. That is, if class size and teacher experience factors prove useful in predicting variations in outcomes not explained by other factors. Again, it is important to recognize that remaining unexplained differences in outcomes may still be a function of important unmeasured differences between schools that may confound apparently simple solutions.

Perhaps more importantly, the distribution of teaching credentials across school settings is highly endogenous to various other conditions. It is increasingly well understood that teachers job location choices are heavily influenced by student population characteristics (Lankford, Loeb & Wyckoff, 2002; Hanushek, Kain and Rivken, 2004), and teacher retention influenced by locally relative salaries (Ondrich, Pas and Yinger, 2007)[lxxiii]. Hanushek and Rivken (2007)[lxxiv] find substantial differences in the shares of novice teachers across schools with varied racial composition. As such, where we find high shares of novice teachers with only bachelors degrees may not be entirely a function of the choices of local district officials. Teacher job choice and district hiring processes are a two-way matching problem only partially influenced by the preferences and actions of district officials.

Goals of Production Modeling in the New Jersey Schools Study

Our production modeling involves all schools by grade level, based on grade levels at which reading and mathematics assessments are taken. This portion of the study is an extension of the screening models which involved predicting school level student outcomes as a function of student demographics. Here, we test whether aggregate financial resources at the school level (school aggregate staffing expenditures per pupil) are positively associated with the residuals of the screening models statewide, and across all schools within major labor markets and across schools within large districts. In addition, we explore whether specific resource factors such as class size, shares of novice teachers, and localized competitiveness of teacher wages are positively associated with the residuals of the screening models.

Secondarily, we include aggregate resources per pupil in the screening models, along with controls for regional cost variation, to estimate a production function model. We then evaluate whether individual resource uses related to experience of the teacher pool, teacher quantity (class size) and relative wages explain residual variation from the production function model. That is, at constant student characteristics and constant aggregate spending, is the way in which the education dollar is spent associated with variations in outcomes?

Cost and expenditure perspective

The alternative perspective for evaluating input-outcome relationships in public schooling is to evaluate those factors associated with differences in spending across educational settings. Because spending data are usually available only at the district and not the school level, such analyses are typically conducted at the district level. A starting point for evaluating district level or school level spending data is to evaluate whether variations in spending across schools or districts may be explained as a function of factors that affect the costs of achieving specific educational outcomes (Duncombe and Yinger, 2008).

Spending = *f*(Student Needs, Input Prices, District Characteristics)

That is, to what extent do student population characteristics, competitive labor markets for school staff and other uncontrollable characteristics of school districts explain differences in spending per pupil across these districts?

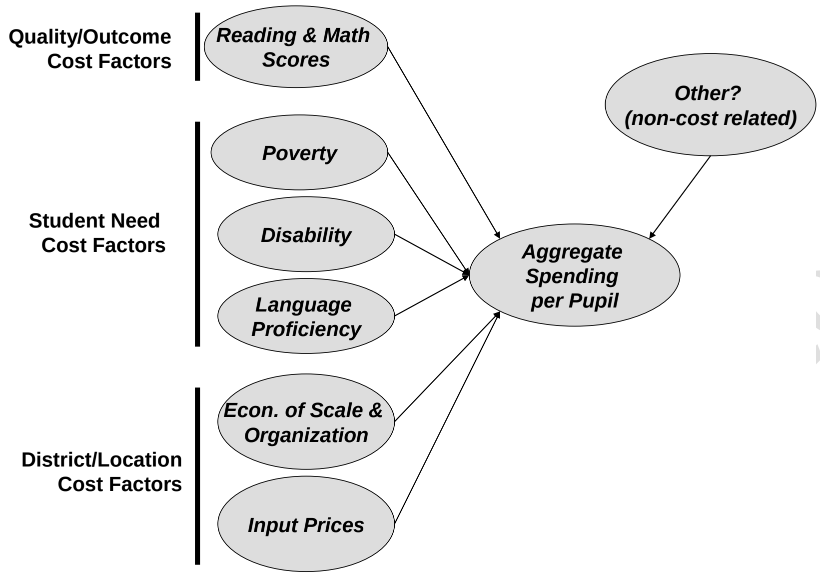
Clearly, the above factors will not be the only factors that explain why some school districts spend more or less than others. One might assume that some districts would spend more in an effort to achieve more on the measured outcomes. That is, if student needs, input prices and district characteristics were the same – held constant – that the desire for higher outcomes or dissatisfaction with current outcomes might warrant higher spending per pupil, perhaps by adoption of a higher local property tax levy. Or, if the state was interested in improving outcomes in some districts, the state might allocate more resources to those districts and thus they would spend more and hopefully achieve more.

If this is the case, then we should include outcomes in our spending model, as an independent variable. That is, we predict differences in spending as a function of uncontrollable cost factors like student needs and input prices, but also at constant outcomes. We ask, how does spending vary across these cost factors (student needs, input prices, district characteristics), toward achieving common outcome goals? The new spending equation is:

Spending = *f*(Outcomes, Student Needs, Input Prices, District Characteristics)

But, we know in this case as well as the previous, that other factors may still be leading to differences in spending across districts. However, in the present specification, those other omitted factors, are leading to differences in spending holding cost factors and outcomes constant. That is, the remaining unexplained differences in spending are not associated with our measured outcomes or costs of outcomes. Figure 2 presents a schematic representation of the spending model, where reading and math scores are a quality outcome measure and it is assumed that achieving higher reading and math scores will require greater spending, all else equal. Student need related cost factors include economic disadvantage, disability concentrations and shares of children with limited English language proficiency, and common district cost factors include location which influences competitive wages, and economies of scale (see Duncombe and Yinger, 2008).

Figure 2
Factors involved in the Input-Outcome Relationship: Spending and Cost Perspective



On the right hand side of Figure 2 are those "other" factors that may lead to spending differences not associated with cost factors or outcomes. But what might these factors be? Among other things, we know that variations in per pupil spending in local control states like New Jersey may be largely a function of differences in local demand across school districts. That is some communities desire higher quality schooling and have the financial capacity to pay for it. However, if these spending differences are a function of demand, but are not related to higher outcomes, then we might label these differences as inefficiency (or these differences in spending might simply be associated with unmeasured outcomes). Note that local voters demand not just to spend more, but to spend more toward some improve outcome.

Duncombe and Yinger (2007) among others apply theories of bureaucratic behavior of local governments to explain why some school districts might actually spend more than would be necessary to achieve any given outcome level. One simple explanation is that fiscal capacity alone, or ability to spend more *frivolously* might be associated with increased inefficiency. A second explanation is that where fiscal capacity is equal, those school districts where either local citizens or state agencies (controllers of the purse-strings) exert less oversight or accountability for spending, current spending may be less efficient. Duncombe and Yinger refer to this effect as *Public Monitoring.* One might conclude, for example, that those school districts with the least local public involvement and/or state accountability oversight, coupled with the greatest ability to spend, would be most likely to spend in ways less associated with measured and publicly reported student outcome measures.

We might consider the possibility that some high fiscal capacity communities hold a great appreciation for the arts or athletics, choosing annually to increase local expenditure to fund these endeavors at very high levels. Such expenditure, if it did not contribute to measured outcomes, might be identified as inefficient. However, there also exists the possibility that lower fiscal capacity communities that may have far greater student need related costs and are under greater state oversight, eliminate their arts and athletic programs to target resources to the narrowly measured outcomes, thus producing the measured outcomes "more efficiently."[lxxv] It would be inequitable to expect that these districts should be required to produce the same outcomes more efficiently by sacrificing the depth and breadth of their educational opportunities. With equity as a concern, efficiency in producing the measured outcomes should be evaluated on an assumption of holding breadth and depth of educational opportunities constant. That is, schools or districts should be able to produce sufficient reading and math scores while still providing equal opportunity to participate in music, art, foreign languages and physical education.

Endogeneity of Outcome Measures

A conceptual and statistical problem arises when we put our spending measure in the position of the dependent variable and our outcome measure as an independent variable. In short, we must assume that spending affects outcomes – the opposite of what our model appears to state. Also, as mentioned above, when setting spending decisions local voters and districts officials are doing so with some ideal as to the outcomes they expect or desire. Spending levels and desired outcomes are simultaneously determined. Addressing this problem requires applying a statistical method known as instrumental variables regression, where we seek to identify exogenous factors that may be used as predictors of the endogenous outcome measure, to correct for the bias in that outcome measure that may exist (see Duncombe and Yinger, 2008, 2007).

Goals of Cost Modeling in the New Jersey Schools Study

Our intent is to apply cost modeling in two ways in the present study. First, using district level data, it is our intent to determine how spending varies across New Jersey school districts in relation to well accepted student need, district and geographic cost factors. As part of this process, we evaluate the error term of our models, identifying those districts which appear to show otherwise unexplainably large differences in spending, relative to predicted spending.

We test the feasibility of extending our district level spending function to a cost model. Note that our goal is not to make predictions regarding the costs of achieving specific outcome levels, but rather to estimate a function which best characterizes the spending differences across New Jersey public school districts as they are associated with current differences in outcomes and cost factors. We use this model in part to seek those "other variables" that may predict spending variations not associated with either cost factors or outcomes. Again, we pay attention to those districts that appear to have significant discrepancies between actual spending at actual outcomes and predicted spending at actual outcomes. Our goal is not to label as being on or off target, but rather to attempt to explain with measurable variables these apparent discrepancies. For example, do certain fiscal capacity or public monitoring factors seem to play a strong role, or does dependence on state categorical funding alter the input-outcome relationship (see Duncombe and Yinger, 2007)?

Second, using school level data we apply a similar approach. For elementary schools across multiple districts within several large labor markets (Newark, Trenton, Camden, etc.), we attempt to estimate models of school level staffing expenditures per pupil. First we evaluate whether those staffing expenditures vary rationally as a function of assumed cost factors, including student outcomes. Second, as with our district analysis, we evaluate those schools for which predicted spending is substantially different from actual spending at current outcomes and seek variables to explain the discrepancies. Among other measures, we look to measures of differences in fiscal capacity and public monitoring across the school districts within the labor markets. In addition, we explore resource use differences at the school level.

Other Technical Issues in Efficiency, Cost and Production Measurement

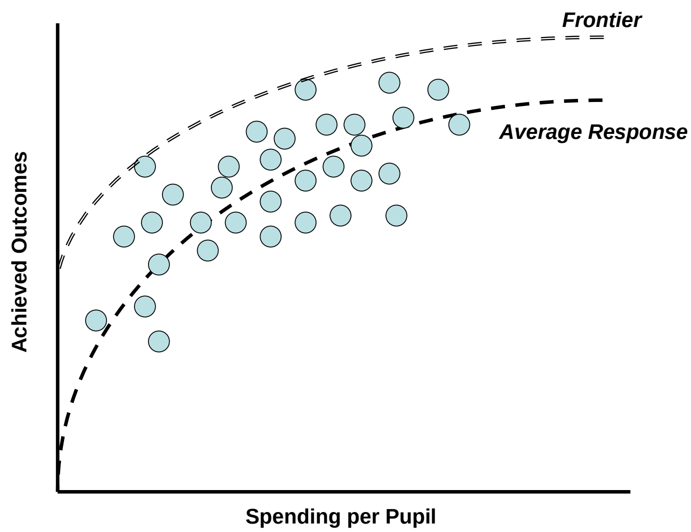
Several authors in recent years have written on the topic of measuring educational efficiency and alternative methods for estimating efficiency from either a cost or production perspective. A handful of technical debates persist over whether and how we might best determine which are the most, and which are the least effective schools or school districts in any given system.

a) whether to evaluate relative efficiency of schools or districts with respect to the *frontier* (frontier cost and production functions) or the *average* (average response function)*;*
b) whether to set a priori assumptions about the nature, or shape (functional form) of the input-outcome relationship, or whether to fit the efficiency model or frontier more flexibly;
c) whether to assume that the entire distance from each school or district's actual position to the frontier or average response is inefficiency, or whether some portion of that distance is random error.

The most common definition of the term "cost" in this context is that the "cost" of producing a given set of outcomes is the "minimum cost" of producing those outcomes in any given context. This might be either a theoretical minimum cost, attained by no school districts in reality, or it might be the actual minimum cost, or expenditure associated with a given level of outcomes in a district with specific characteristics. It is implausible for us, or anyone, to identify the theoretical minimum that might be attainable if resources were organized and practices carried out in their most efficient manner. But in any cost or production function, one can find those school districts that run along the edge of the distribution – either producing the highest outcomes for given conditions and spending (production frontier), or achieving the lowest spending at specific outcomes and conditions (cost frontier). If "cost" the theoretical or measured minimum expenditure associated with a given level of outcomes, then "inefficiency" is any deviation from the expected costs of achieving those outcomes, where that deviation can exist only in one direction (one cannot spend less than cost to achieve a given level of outcomes). One potential concern with models based on these districts or schools along the outer edges of the distribution is that these districts or schools may lie where they do because of substantial unmeasured differences in their characteristics, or even due to measurement error.

Alternatively, one can evaluate "relative efficiency" against the average spending associated with any given level of outcomes under specific conditions. This is the average response function approach, as characterized in Figure 3. That is, one can fit the cost or production model through middle of the field of data points rather than along the edge and evaluate whether districts spend more than average for achieving a given level of outcomes, under current conditions, or less than average. This approach is particularly reasonable if we enter into the analysis with the assumption that on average, New Jersey school districts are producing outcomes at reasonable levels of efficiency.

Figure 3
Average Response versus Frontier Estimation



The second issue raised above may also significantly affect which districts are identified as deviating most, either from the middle or the edges of the pack, in terms of spending or outcomes. One can adopt conventional assumptions of diminishing marginal returns, and apply what is known as a Cobb-Douglas specification, where the natural logarithm of schooling inputs is associated with the natural logarithm of outcomes. Or, one can assumption the relationships to be more complex, with characteristics of schools and students interacting to affect to the costs of achieving outcomes. As noted previously, Figlio (2001) applies a *translog* functional form, which includes numerous non-linearities and interactions to characterize education production. Gronberg, Taylor, Jansen and Booker (2004)[lxxvi] use a *translog* approach to estimate a cost function using Texas data. Alternatively, one can use non-parametric methods such as *Data Envelopment Analysis* to identify the cost or production frontier based on the extreme – most efficient – cases in the distribution.

A secondary advantage of Data Envelopment Analysis is that DEA models can include multiple outcome measures. However, this advantage is somewhat diminished when the various outcomes are highly correlated, in which case the outcomes might best be collapsed into a single measure suitable for use in a stochastic frontier or conventional OLS regression equation. From the outset of the current project we have focused only on state assessment outcomes in math and language arts. Across schools or across districts these measures are highly correlated and, as such, they were collapsed into a single outcome measure.

Critics of educational efficiency analysis point to substantial shortcomings in the precision or accuracy in correctly identifying more and less efficient school districts regardless of method, pointing to significant problems associated with measurement error in student outcomes (Bifulco & Duncombe, 2001; Bifulco, Bretschneider, 2001).[lxxvii] Ruggiero (2007), however, counters that models may be more reliable and less susceptible to such statistical noise when multiple years of data, or panel data, are used. Specifically, Ruggiero compares traditional regression models adjusted to the cost frontier (Corrected Ordinary Least Squares, COLS), *Stochastic Frontier Analysis*, and Data Envelopment Analysis using simulated data. Ruggiero notes that SFA and DEA are perhaps the most common approaches to school district cost-efficiency analysis. The advantage of SFA is that it assumes a portion of the distance from each district to the frontier to be random error. As such SFA might better handle "noisy" data.[lxxviii] That said, Ruggiero (2007)[lxxix] showed that SFA models often produce largely the same results as COLS models. In his comparison across the three approaches, Ruggiero finds that

> These results suggest that the stochastic frontier model holds no real advantage over DEA. In particular, the purported advantage of the stochastic frontier, i.e. the ability to allow measurement error, can be overcome by averaging the data to smooth production. DEA maintains the advantage of being nonparametric and allowing multiple outputs. While this paper shows that **DEA and the stochastic frontier produces similar results,** more work is needed. (p. 266)

For the sake of time, space and reduced complexity herein, we estimate a series of traditional ordinary least squares regression models, fit to the average response function, and evaluate the residuals or distances from that response function for schools and districts, for cost and production functions. Next, we estimate a series of Stochastic Frontier Cost functions, along with average response cost functions to New Jersey school district expenditure data, in an attempt to identify those districts that spend more than expected, given their conditions and current outcome levels. While SFA models hold no real advantage over DEA, it would appear that they hold no real disadvantage either, when applied to the current context which involves panel data and a single collapsed outcome measure. We then evaluate the relationship between our average response function findings and our Stochastic Frontier Findings.

STATEWIDE EFFICIENCY AND STAFFING ANALYSIS

This section includes ten analyses:

1. Fiscal resource distribution across districts
2. Changes in fiscal resource allocation over time by district group
3. Labor market centered analysis of financial resource allocation from 2003 to 2007
4. Labor market centered analysis of certified staff wages in 2006-07
5. Within district & within labor market equity of staffing resource allocation across schools 2006-07
6. Statewide mapping of school level distribution of certified staff by position code 2006-07
7. School resources and the production of outcomes
8. District resources and the production of outcomes
9. District factors influencing spending variation
10. District factors influencing cost variation

The goal of this section is to provide a comprehensive descriptive overview of funding levels and resource allocation patterns across New Jersey school districts and schools. Resources are characterized in terms of financial resources and financial resource categories, as those used by the Department of Education in the Comparative Spending Guide, and resources are characterized in terms of human resources, by salaries, experience and degree levels and position assignments in schools and districts. Analyses 1 through 3 are descriptive analyses of financial resource allocation. Analyses 4 through 6 address human resource issues and to some extent the financial implications of human resources.

In the latter half of this section, we explore specifically what resources are associated with differences in outcomes across schools and we explore factors that influence spending variation across school districts, and factors that create cost pressures on school districts with respect to the production of educational outcomes. Analyses 7 through 10 in this section include a multitude of statistical models of the production of outcomes at the school and district level, and the relative costs – or expenditure associated with – producing specific outcome levels across districts.

Analysis 1
Fiscal resource distribution across DFGs and Type[lxxx]

Analyses in this subsection are primarily descriptive, evaluating allocation of resources by school districts across aggregate areas of expenditures defined by the DOE and used in their Comparative Spending Guide reports. Our intent is to evaluate the distribution of current operating expenditures across a handful of major categories, across district factor groups, spending guide groups and other classifications.

Data

All data for this analysis come from two sources: 1) school district comprehensive annual financial reports; and 2) the New Jersey Department of Education's Comparative Spending Guide, derived from school district annual financial reports. Broad categories of expenditures to be evaluated include, but may not be limited to:

a. Current operating expenditures[lxxxi]
b. Classroom instructional expenditures[lxxxii]
c. Classroom sal/benefits[lxxxiii]
d. Support services[lxxxiv]

Analyses are conducted using data from the most recent available years. Where comparative spending guide data are used, the most recent available year at the time of this study were for 2006-07, and were certified budgeted expenditure data. Raw and compiled (CSG) annual financial report data were available through 2005-06. That said, once aggregated to the level of district factor group or other clustering of school districts, variance between budgeted and actual expenditures appears relatively small. Our primary panel of data for this analysis will include budgeted expenditure data for years 2002-03 through 2006-07 with data on 594 school districts and independent charter schools.

Table 1 displays the distribution of matched observations over the 5 year period by district factor group. 594 districts including 43 charter schools are available for analysis (charters limited to 38 in 2003).

Table 1
Distribution of Observations by District Factor Group

DFG	2003	2004	2005	2006	2007	Total
A	39	39	39	39	39	195
B	68	68	68	68	68	340
CD	67	67	67	67	67	335
DE	83	83	83	83	83	415
FG	89	89	89	89	89	445
GH	77	77	77	77	77	385
I	103	103	103	103	103	515
J	25	25	25	25	25	125
R	43	43	43	43	43	215
Total	594	594	594	594	594	2,970

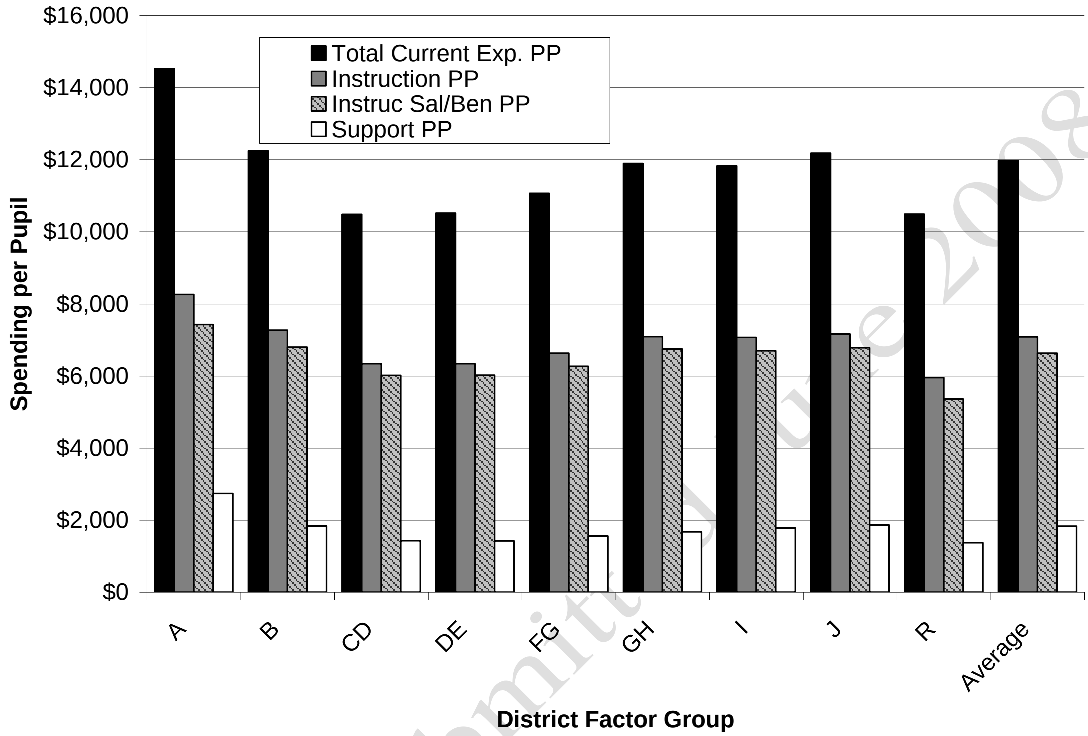
Analysis

As noted above, analyses in this subsection are primarily descriptive. Our goal is to discern broadly *where the money goes*, and how those broad patterns differ – if at all – across school districts by various groupings. We include comparisons of patterns of expenditures:

1. by district factor group
2. in Abbott school districts and poor non-Abbott school districts
3. by school district locale (using NCES 8-level locale code)

Findings

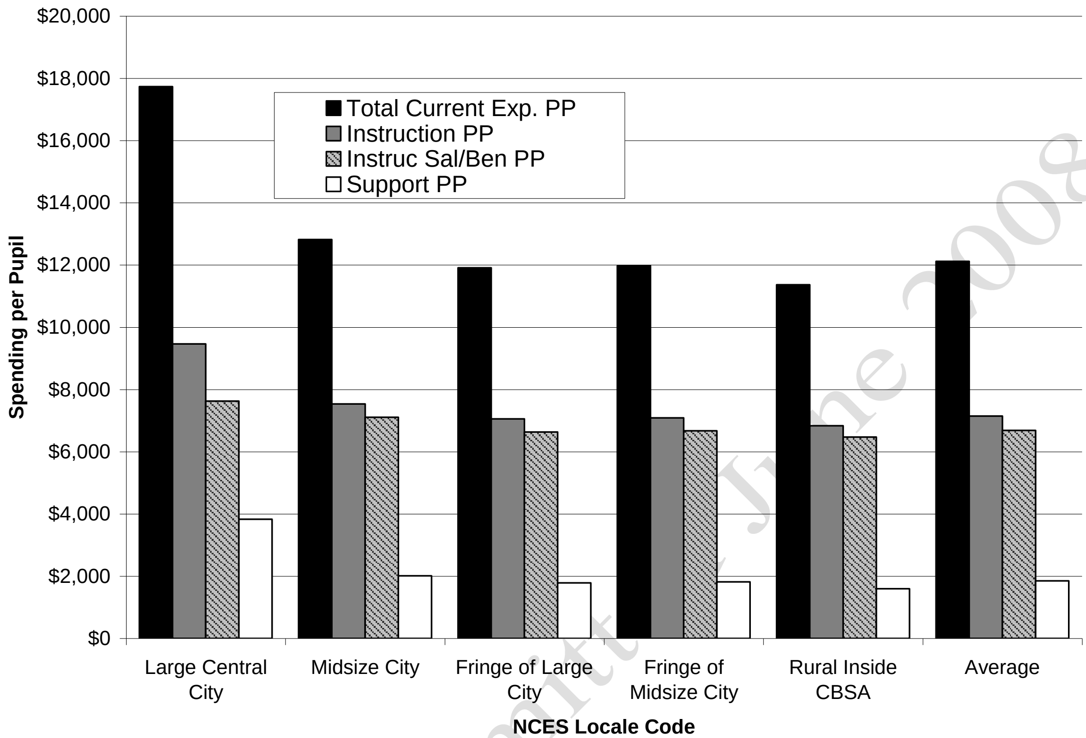
Figure 1
Spending* per pupil 2006-07 by Spending Type and District Factor Group



*Budgeted appropriation
Data Source: NJDOE Comparative Spending Guide 2007

- Districts in Factor Group A had the highest total current operating expenditures per pupil, and the class "U" shape persists.
- Charter schools spend less on average than other schools.
- Differences between total current expenditures per pupil across factor groups are greater than differences in instructional spending or instructional salaries and benefits.

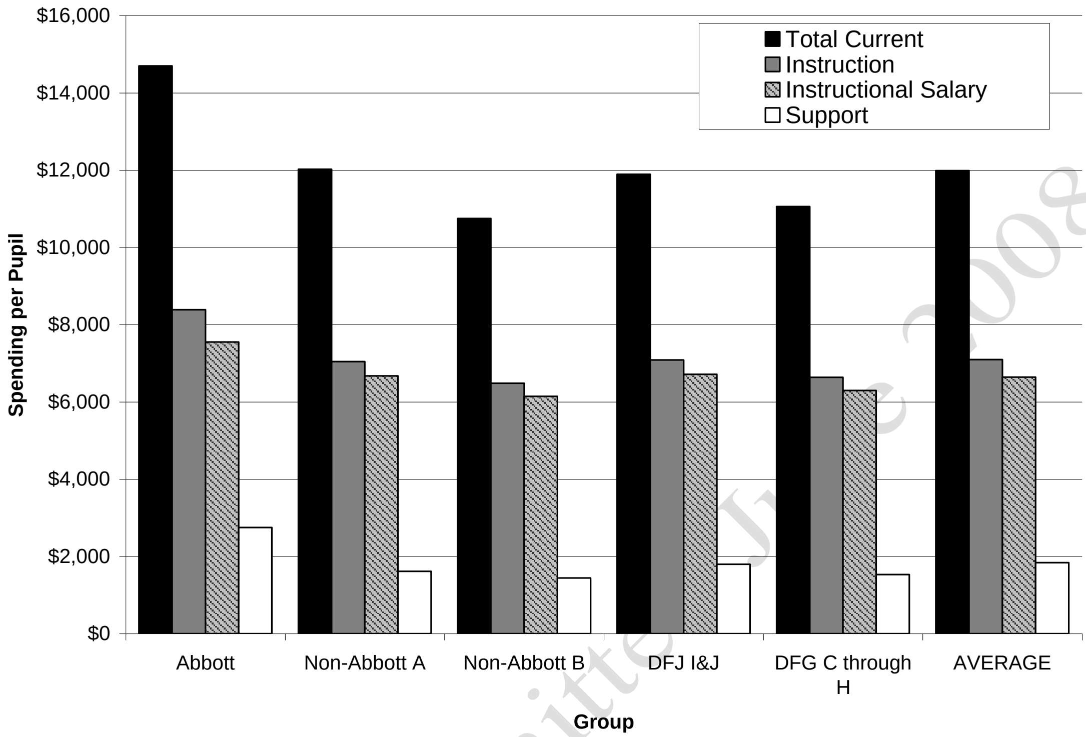
Figure 2
Spending* per pupil 2006-07 by Spending Type and District Locale



*Budgeted appropriation
Data Source: NJDOE Comparative Spending Guide 2007

- Districts in large central cities had the highest total current operating expenditures per pupil and had the highest instructional spending and support spending per pupil.

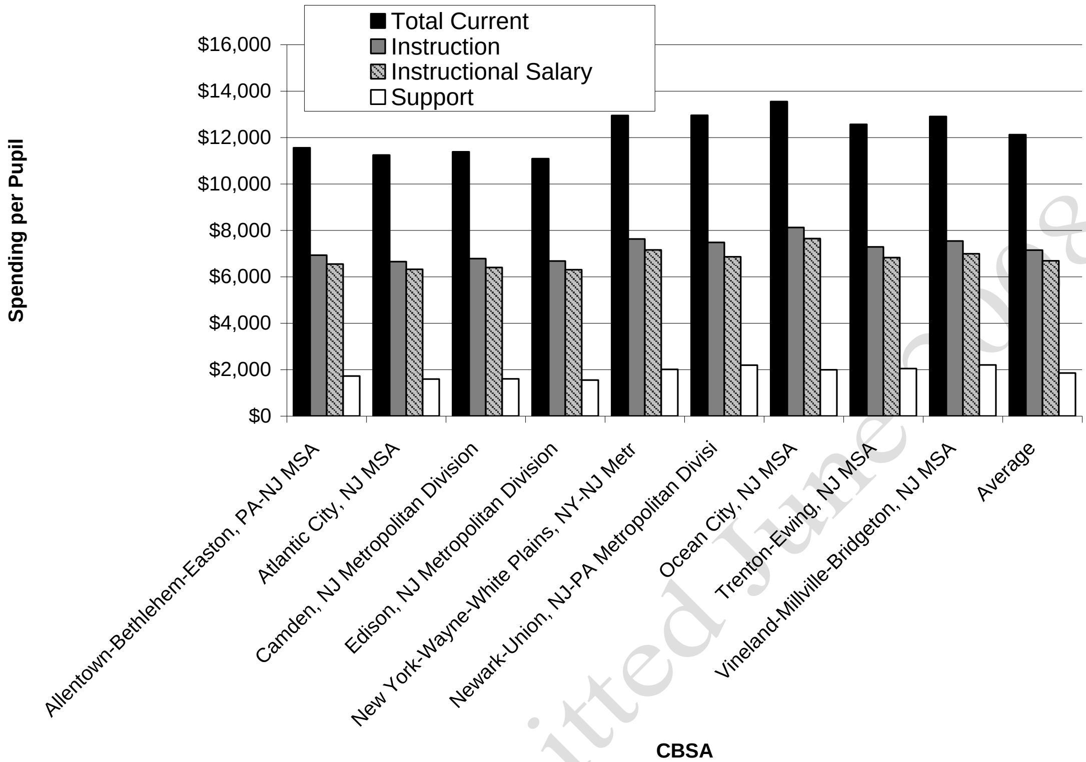
Figure 3
Spending* per pupil 2006-07 by Spending Type and Alternate Grouping



*Budgeted appropriation
Data Source: NJDOE Comparative Spending Guide 2007

- Abbott districts had the highest total current operating spending levels per pupil in 2006-07.
- Differences in total current operating spending were greater than differences in instructional spending.
- Abbott districts also had higher classroom support expenditures.

Figure 4
Spending* per pupil 2006-07 by Spending Type and Core Based Statistical Area



*Budgeted appropriation
Data Source: NJDOE Comparative Spending Guide 2007

- Per pupil spending levels varied somewhat by geographic region within the state, with relatively high levels in the Ocean City area and in the immediate New York Suburbs and Newark area.

Analysis 2
Changes in fiscal resource allocation from 1995 to 2006, by DFG and Type

Analysis 2 will involve longer term trend analysis of major expenditure categories across New Jersey school districts by district factor grouping and other classifications. In addition, we will explore the determinants of internal resource allocation via regression models. As noted in our literature review, various attributes of school districts, many beyond the control of local school boards and district administrators, may influence internal resource allocation. Further, we cannot emphasized enough how little is known about distribution of resources across broad budget categories and the relationship to productive or cost efficiency.

This analysis builds on the previous analysis using the same data sources, but extending our panels of data back to 1997 or 1998. In part, our goal is to capture the influence of the scaling up of funding in Abbott school districts that appears to have occurred primarily between 1997 and 2003.

Data

For this analysis we also use a combination of data from comprehensive annual financial reports and from the NJDOE comparative spending guides, from 1997-98 through 2005-06. A separate panel of data from 1995 through 2006 was compiled using the district financial data component of the School Report Cards databases (http://education.state.nj.us/rc/). This panel includes 549 districts across district factor groups for the year 2000, and 551 across 1990 district factor groupings. Charter schools are excluded from this panel. Again, we focus on the following broad expenditure categories as defined in the Comparative Spending Guide (also available from the CSG in the district finance component of the school report card database):

a. Current operating expenditures
b. Classroom instructional expenditures
c. Classroom sal/benefits
d. Support services

Analysis

As in the previous subsection, analyses in this section are primarily descriptive, evaluating trends in expenditure and allocation across broad categories of expenditure from 1995 through 2006, with specific emphasis on the time frame between 1998 and 2003 as expenditures increased in Abbott school districts. As in the previous analysis, we will explore patterns of expenditure by:

1. district factor group
2. Abbott school districts and poor non-Abbott school districts
3. school district locale (using NCES 8-level locale code)

4. Core Based Statistical Area (labor market)

In addition, in this subsection, we will also explore district characteristics associated with differences in resource allocation. Baker (2003), Brent, Roellke and Monk (1997) and Monk and Hussain (2000) have each shown that many variations in resource allocation across school districts can be explained by factors outside of the control of local school officials. For example, smaller school districts have very different expenditure patterns than larger ones, with proportionately greater shares of spending allocated to administrative costs, among other things. Further, districts receiving greater shares of categorical aid and/or serving higher percentages of special student populations may show greater administrative expenses as a share of their budgets. In this section, we construct a model of factors associated with variations in resource allocation across New Jersey school districts in order to discern the extent to which these variations are associated with factors generally considered beyond the control of local school district officials. That is, to what extent might variation in resource allocation be constrained by uncontrollable factors?

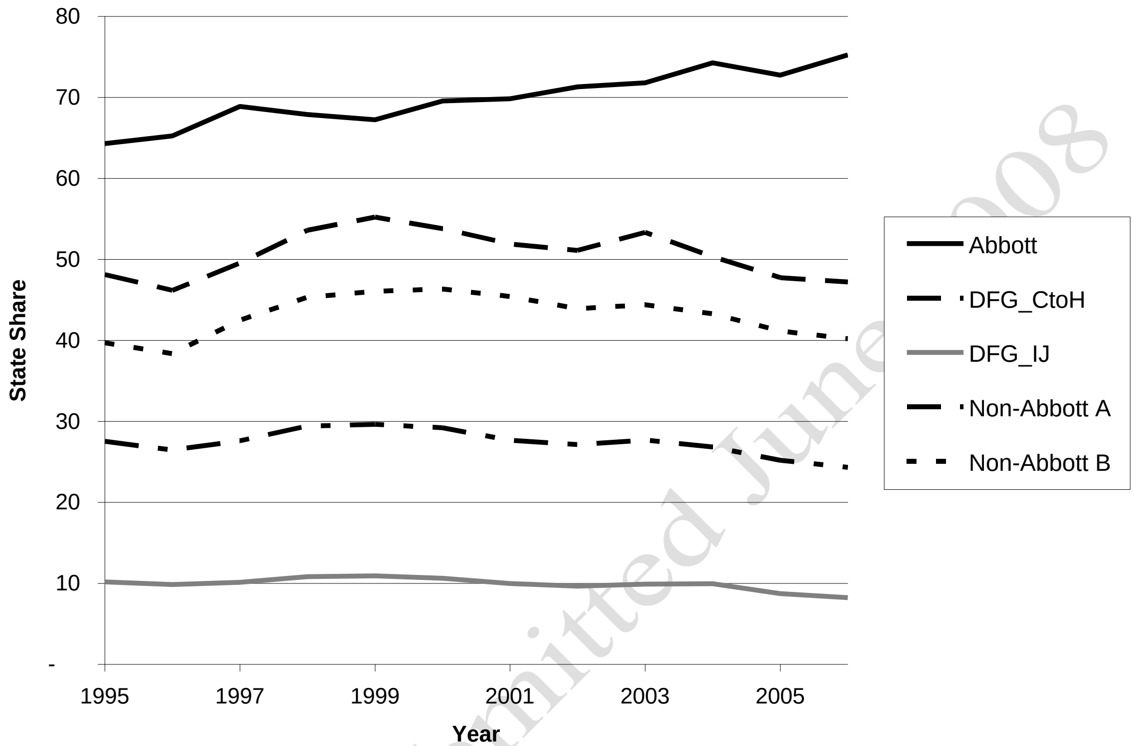
Our models will use as dependent variables, shares of district budgets allocated to the categories outline above, and will include as independent variables: a) school district grade range; b) school district enrollment, or size; c) district factor group; and d) locale.

Allocation = *f*(Grade Range, Size, DFG, Locale, Labor Market)

Preliminary models indicate that these factors alone explain nearly 40% of cross district variation in shares of district budgets allocated to administration.

Findings

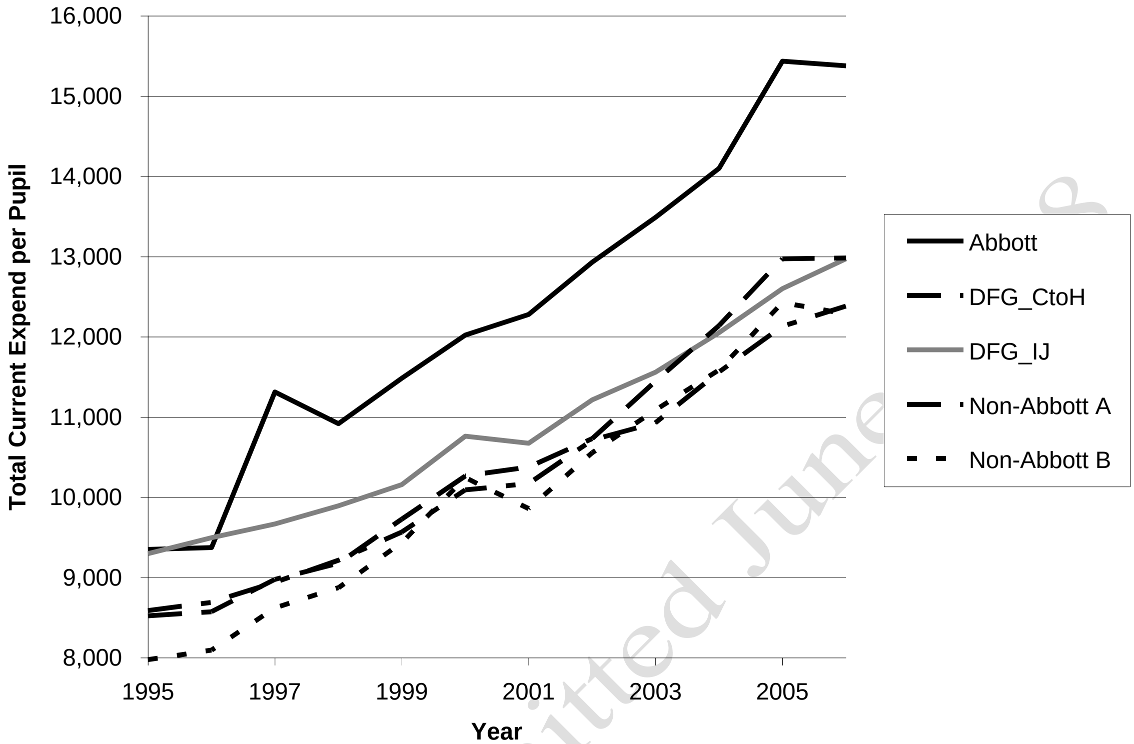
Figure 5
Shares of District Revenue from State Sources 1995 to 2006



Unweighted mean by group
Data Source: District Finance Component of School Reports D-Bases

- Shares of district revenues from state sources crept up over time for Abbott districts and expanded (1997 to 2001) then declined (2003 to 2006) in other districts.

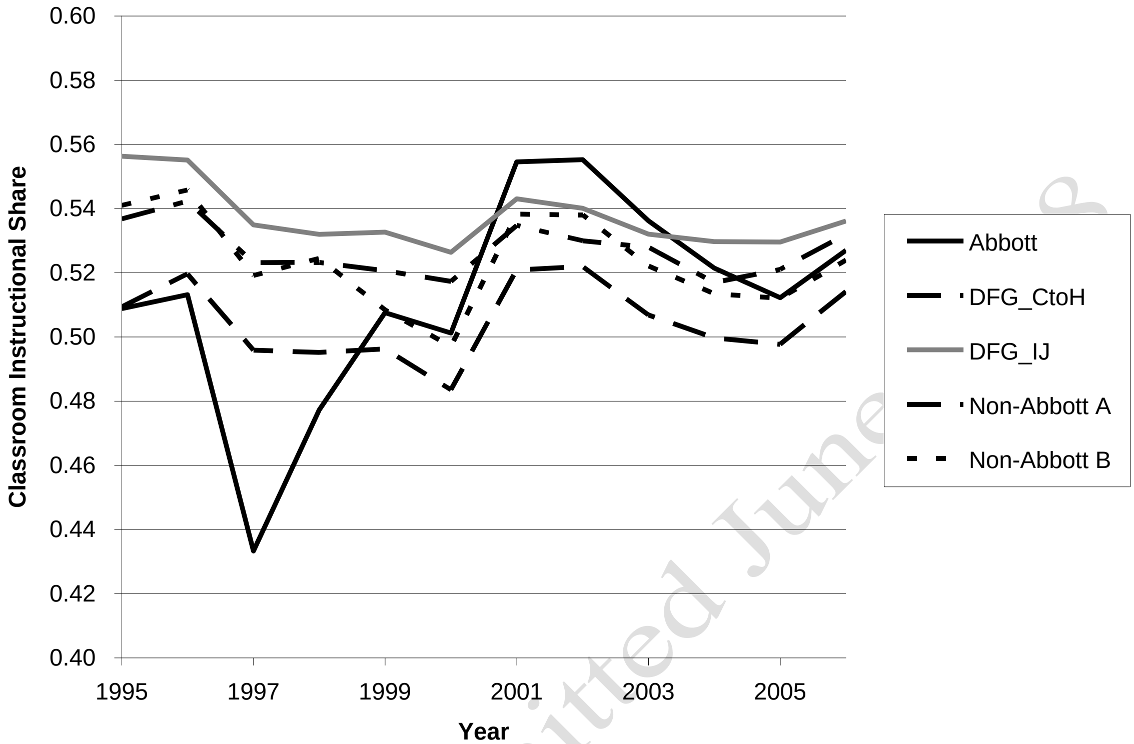
Figure 6
Current Operating Expenditures per Pupil 1995 to 2006



Unweighted mean by group
Data Source: District Finance Component of School Reports D-Bases

- Per pupil current expenditures shifted upward in 1997 for Abbott districts relative to others, and maintained a relatively constant margin since that point in time.
- Districts in DFG C though H, on average improved their relative position from 2001 to 2005, while districts in DFG I&J fell off slightly.

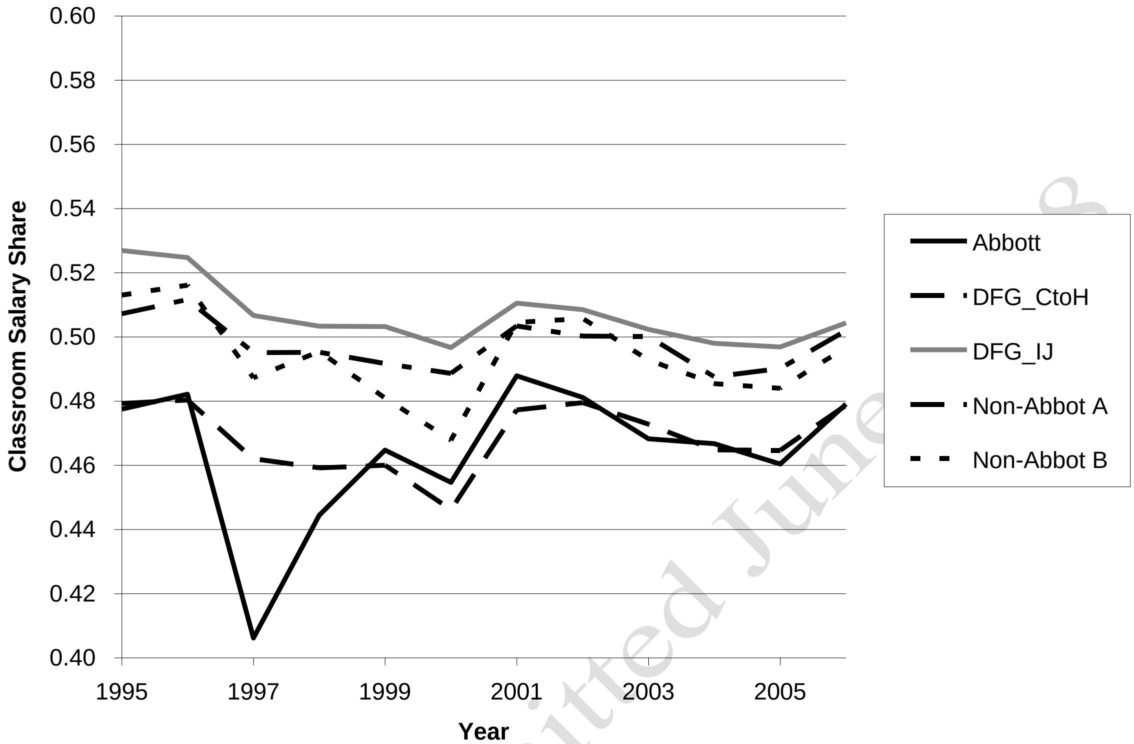
Figure 7
Share of Current Operating Expenditures allocated to Classroom Instruction*



*NJDOE CSG Definition
Unweighted mean by group
Data Source: District Finance Component of School Reports D-Bases

- By 2006, all groups of districts allocated between 50 and 54% of current expenditures to classroom instruction, with Abbott districts falling near the middle of that distribution.

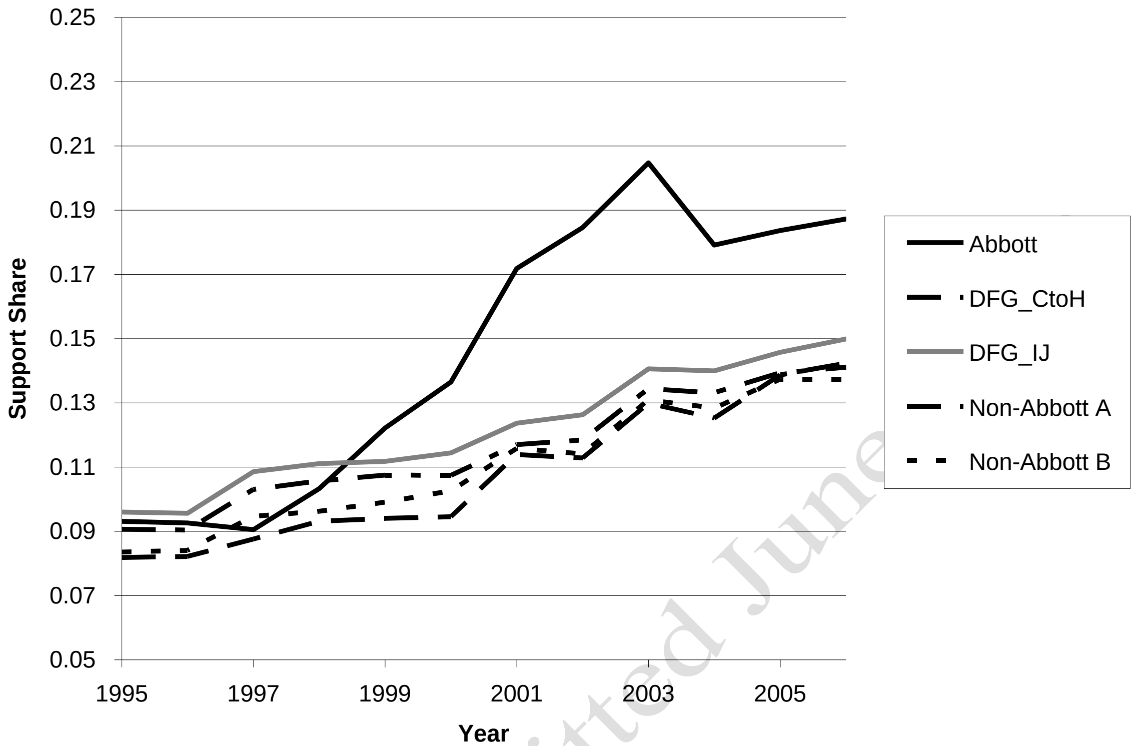
Figure 8
Share of Current Operating Expenditures allocated to Classroom Instructional Salaries*



*NJDOE CSG Definition
Unweighted mean by group
Data Source: District Finance Component of School Reports D-Bases

- By 2006, all groups of districts allocated between 48 and about 50% of current expenditures to instructional salaries. Abbott districts along with those in DFG C to H fell near the lower boundary.

Figure 9
Share of Current Operating Expenditures allocated to Classroom Support*



*NJDOE CSG Definition
Unweighted mean by group
Data Source: District Finance Component of School Reports D-Bases

- Between 1997 and 2003, Abbott districts in particular substantially scaled up the portions of their budgets expended on classroom support.

Table 2
Factors influencing internal allocation of district resources

	% to Instruction			% Instructional Sal/Ben			% Support Services		
	Coef.	*Std. Err.*	*P>t*	*Coef.*	*Std. Err.*	*P>t*	*Coef.*	*Std. Err.*	*P>t*
Group									
Abbott	-0.017	0.003	*	-0.038	0.003	*	0.016	0.002	*
DFG I&J	0.011	0.001	*	0.009	0.001	*	0.007	0.001	*
Non-Abbott A	-0.045	0.003	*	-0.051	0.003	*	-0.006	0.002	*
Non-Abbott B	-0.007	0.002	*	-0.006	0.002	*	-0.005	0.001	*
Grade Range									
Elementary	0.009	0.001	*	0.005	0.001	*	-0.010	0.001	*
Secondary	-0.054	0.002	*	-0.054	0.002	*	0.007	0.001	*
Year									
Year=1996	0.004	0.003		0.003	0.003		0.000	0.001	
Year=1997	-0.020	0.003	*	-0.019	0.003	*	0.011	0.001	*
Year=1998	-0.017	0.003	*	-0.017	0.003	*	0.015	0.001	*
Year=1999	-0.019	0.003	*	-0.020	0.003	*	0.017	0.001	*
Year=2000	-0.024	0.003	*	-0.025	0.003	*	0.019	0.001	*
Year=2001	-0.002	0.003		-0.007	0.003	*	0.031	0.001	*
Year=2002	-0.005	0.003	**	-0.009	0.003	*	0.033	0.001	*
Year=2003	-0.011	0.003	*	-0.013	0.003	*			
Year=2004	-0.020	0.003	*	-0.022	0.003	*			
Year=2005	-0.019	0.003	*	-0.022	0.003	*			
Year=2006	-0.009	0.003	*	-0.011	0.003	*			
Core Based Statistical Area									
Allentown-Bethlehem-Easton, PA-NJ MSA									
Atlantic City, NJ MSA	0.006	0.004		0.008	0.004	*	-0.016	0.002	*
Camden, NJ Metropolitan Division	-0.010	0.003	*	-0.009	0.003	*	-0.011	0.002	*
Edison, NJ Metropolitan Division	-0.014	0.004	*	-0.015	0.003	*	-0.018	0.002	*
New York-Wayne-White Plains, NY-NJ Metro	0.003	0.004		0.004	0.004		-0.015	0.002	*
Newark-Union, NJ-PA Metropolitan Division	-0.006	0.003	**	-0.004	0.003		-0.010	0.002	*
Ocean City, NJ MSA	0.008	0.004	**	0.006	0.004		0.000	0.003	
Trenton-Ewing, NJ MSA	-0.036	0.005	*	-0.036	0.005	*	-0.007	0.003	*
Vineland-Millville-Bridgeton, NJ MSA	0.003	0.004		0.001	0.004		-0.026	0.003	*
Locale									
Large City									
Midsize City	0.043	0.013	*	0.060	0.013	*	0.004	0.008	
Fringe of Large City	0.025	0.013	*	0.039	0.013	*	0.000	0.008	
Fringe of Midsize City	0.038	0.013	*	0.051	0.013	*	0.003	0.008	
Small Town[1]									
Rural in CBSA	0.029	0.013	*	0.042	0.013	*	-	0.008	

									0.001		
Constant	0.518	0.013	*		0.479	0.013	*		0.106	0.008	*
R-Squared	0.223				0.235				0.314		

*p<.05, **p<.10

Unweighted (Unit = District)

Data Source: District Finance Component of School Reports D-Bases

- Abbott districts spent slightly less on instruction and instructional salaries as a share of their budgets than DFG C to H districts and spent a higher share of their budgets on instructional support.
- Elementary only districts spend more on instruction and secondary districts spent less as a share of current expenditures than K-12 unified districts.
- There were some regional and locale differences.
- District characteristics and location alone explain nearly ¼ of variance in instructional spending shares and nearly 1/3 of variance in classroom support shares.

Analysis 3
Labor market centered analysis of fiscal resource allocation 2003-2007

The goal of this set of analyses is to evaluate the relative competitiveness of resource levels available to school districts in their localized competitive context. As discussed in our review of literature, it is becoming increasingly well understood that the value of the education dollar is highly contingent upon localized purchasing power. Specifically, we are most concerned with the ability of school districts in their relatively localized labor markets to compete for sufficient quantities of teachers of comparable quality. In this analysis, we evaluate the relative local competitiveness of current spending, instructional spending and instructional salaries and benefits across various district classification schemes.

Data

For this analysis we return to our panel of the most recent available years of expenditure data, and focus on:

a. Current operating expenditures
b. Classroom instructional expenditures
c. Classroom sal/benefits

Table 3 displays the distribution of New Jersey school districts by Core Based Statistical Area in 2007.

Table 3
Distribution of School Districts (2007) by Core Based Statistical Area

CBSA_NAME	Freq.	Percent	Cum.
Allentown-Bethlehem-Easton, PA-NJ MSA	24	4.25	4.25
Atlantic City, NJ MSA	24	4.25	8.5
Camden, NJ Metropolitan Division	107	18.94	27.43
Edison, NJ Metropolitan Division	122	21.59	49.03
New York-Wayne-White Plains, NY-NJ Metr	108	19.12	68.14
Newark-Union, NJ-PA Metropolitan Divisi	136	24.07	92.21
Ocean City, NJ MSA	17	3.01	95.22
Trenton-Ewing, NJ MSA	11	1.95	97.17
Vineland-Millville-Bridgeton, NJ MSA	16	2.83	100
Total	565	100	

Analysis

For this analysis, we construct labor market centered indices of current expenditures, current instructional expenditures and instructional salaries per pupil for each school district statewide. An underlying assumption of this analysis is that districts with higher current expenditure levels or specifically current instructional expenditure levels should be able to leverage those resources to either hire greater quantities of teachers or pay higher teacher salaries than other districts sharing the same labor market. We are specifically interested in whether higher poverty, higher minority concentration urban school districts are able to significantly outspend lower poverty, lower minority concentration school districts in the same labor market. Further, we are interested in whether differences in current operating expenditures within labor markets translate directly to differences in instructional expenditures and spending on instructional salaries specifically.

For each district statewide, we construct the following indices using budgeted expenditure data from 2003 to 2007. We calculate CBSA mean expenditure levels weighted for student enrollment.

$$\textbf{Current Expend}_{\mathbf{d}} \textbf{ / Current Expend}_{\mathbf{cbsa}}$$

Where Current Expend_d refers to the current operating expenditures per pupil for each district "d," and where Current Expend_{cbsa} refers to the core based statistical area mean current operating expenditures per pupil.

$$\textbf{Current Instruction}_{\mathbf{d}} \textbf{ / Current Instruction}_{\mathbf{cbsa}}$$

Where Current Instruction_d refers to the current instructional expenditures per pupil for each district "d," and where Current $\text{Instruction}_{cbsa}$ refers to the core based statistical area mean current instructional expenditures per pupil.

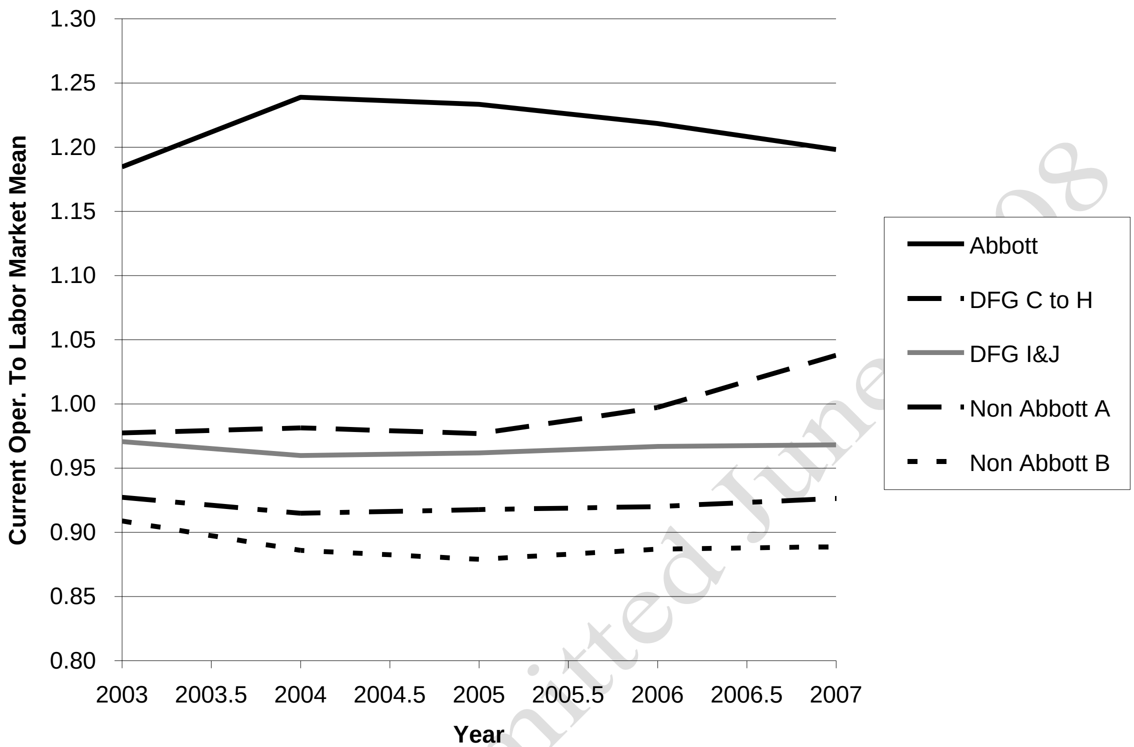
$$\textbf{Instructional Salaries}_{\mathbf{d}} \textbf{ / Instructional Salaries}_{\mathbf{cbsa}}$$

Where Instructional Salaries_d refers to the current instructional expenditures on salaries per pupil for each district "d," and where Instructional Salaries_{cbsa} refers to the core based statistical area mean current instructional expenditures on salaries per pupil.

Using each index above, we evaluate the relative progressiveness of per pupil expenditures for each labor market statewide. To determine progressiveness of expenditures, we estimate the regression trendline (slope and r-squared) between our labor market relative expenditure indices and a variety of measures of school district student population composition, including poverty (relative to labor market), racial composition (relative to labor market) and district factor group. In short, we ask whether school districts serving more disadvantaged student populations have achieved an expenditure advantage over other districts sharing the same labor market. Again, this expenditure advantage might be used either to hire additional teaching staff to meet the needs of disadvantaged students, or pay wage premiums to recruit and retain teachers who typically avoid higher need and lower performing schools.

Findings

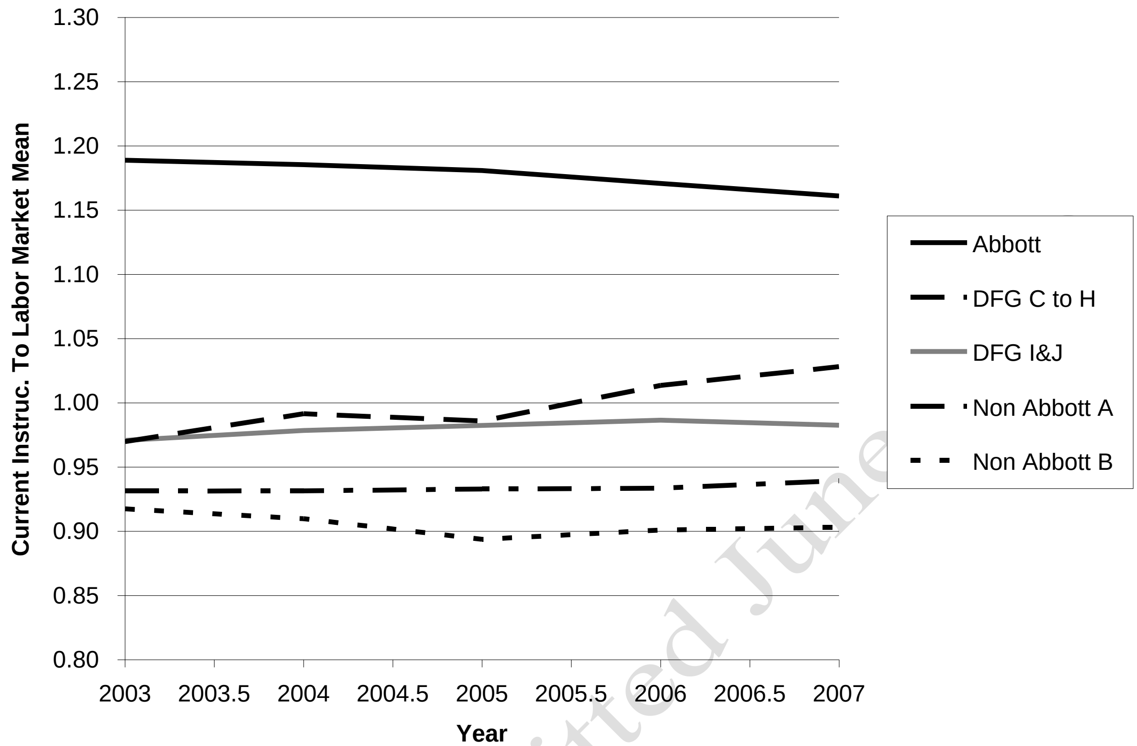
Figure 10
Relative Current Operating Spending per Pupil



Budgeted appropriation for 2006-07
Data Source: NJDOE Comparative Spending Guide 2003-2007

- Between 2003 and 2007, Abbott district spending reached 20% above average spending for other districts sharing a labor market with Abbott districts. This figure grew through 2003 but subsequently declined.
- The relative position of DFG C to H districts has improved since 2005.

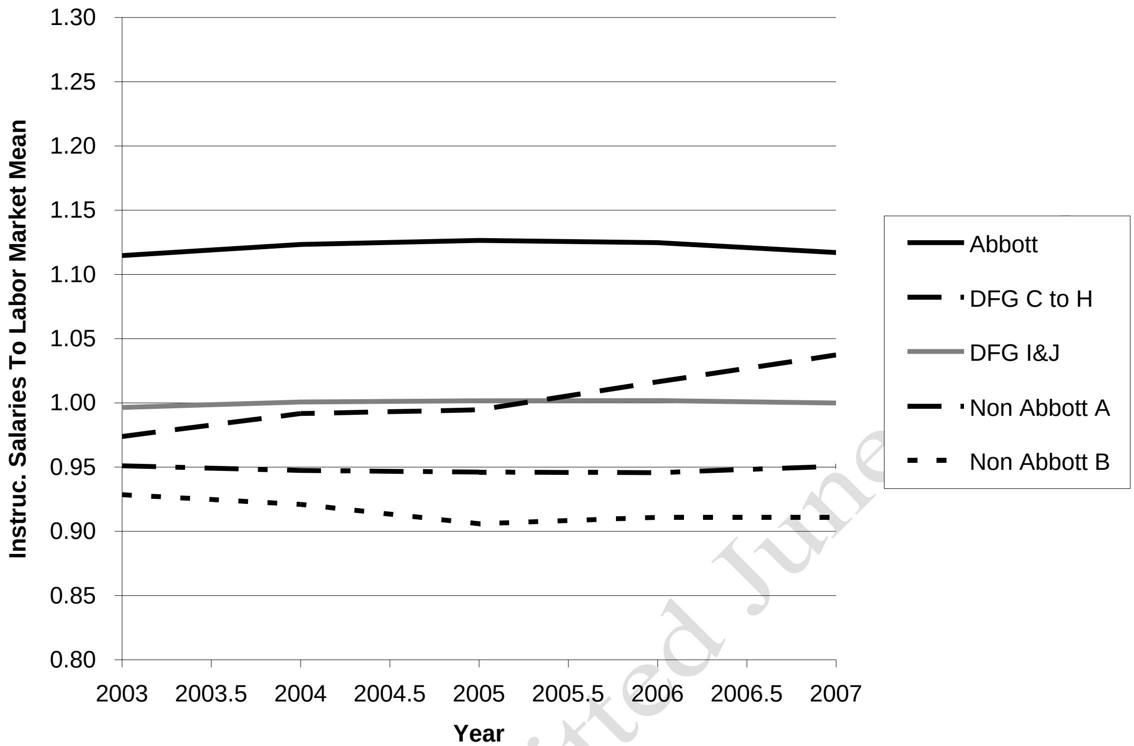
Figure 11
Relative Current Instructional Spending per Pupil



Budgeted appropriation for 2006-07
Data Source: NJDOE Comparative Spending Guide 2003-2007

- While current expenditures per pupil were 20% above labor market averages for Abbott districts, current instructional expenditures per pupil were less than 20% above labor market averages and declined – in relative terms – from 2003 to 2007.
- The relative position of DFG C to H districts improved from 2005 to 2007.

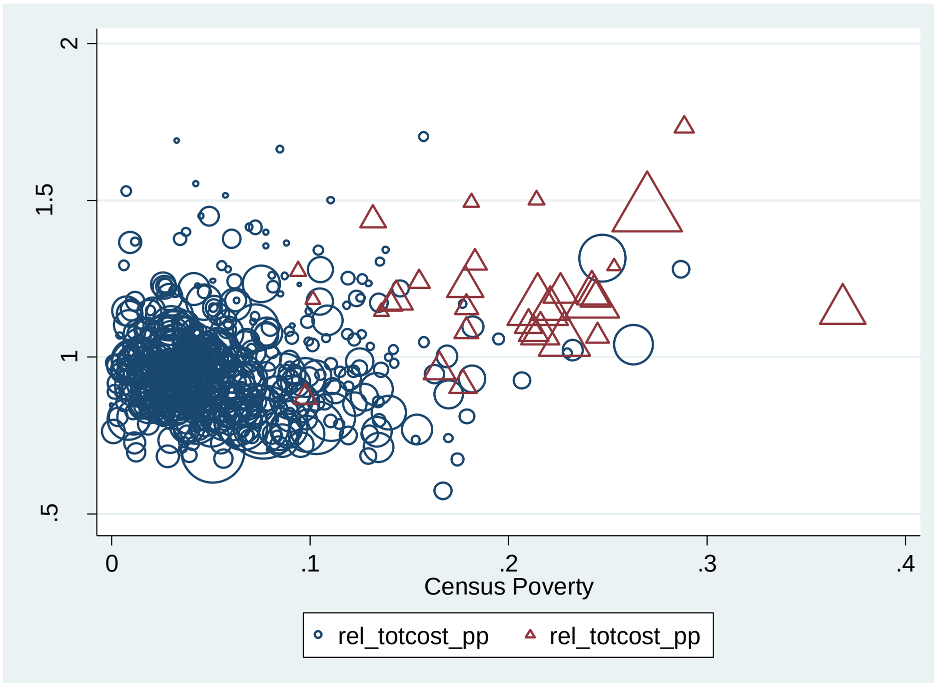
Figure 12
Relative Current Instructional Salaries per Pupil



Budgeted appropriation for 2006-07
Data Source: NJDOE Comparative Spending Guide 2003-2007

- While current expenditures per pupil were 20% above labor market averages for Abbott districts, and current instructional expenditures 15% above labor market averages, current instructional staffing expenditures per pupil were less than 15% above labor market averages and declined slightly – in relative terms – from 2005 to 2007.
- Again, the relative position of DFG C to H districts improved during the period from 2005 to 2007.

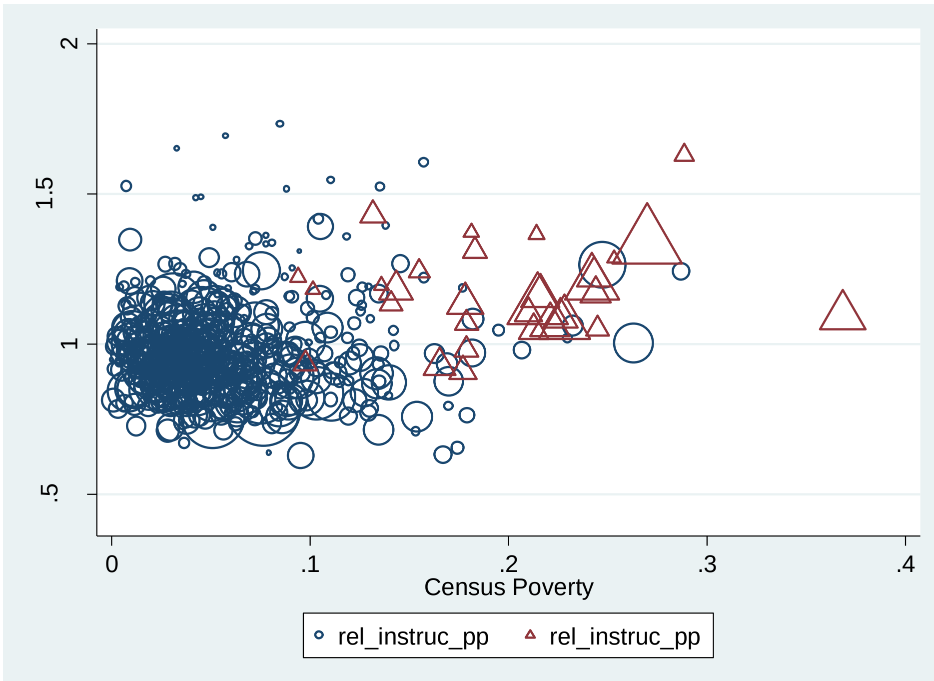
Figure 13
Relative Current Spending per Pupil 2006-07
(Abbott Districts in Red Triangles)



Budgeted appropriation for 2006-07
Data Source: NJDOE Comparative Spending Guide 2003-2007

- On average, when compared against all other districts in the same labor market, higher poverty districts in New Jersey spent more per pupil than lower poverty districts. But this was not uniformly the case.

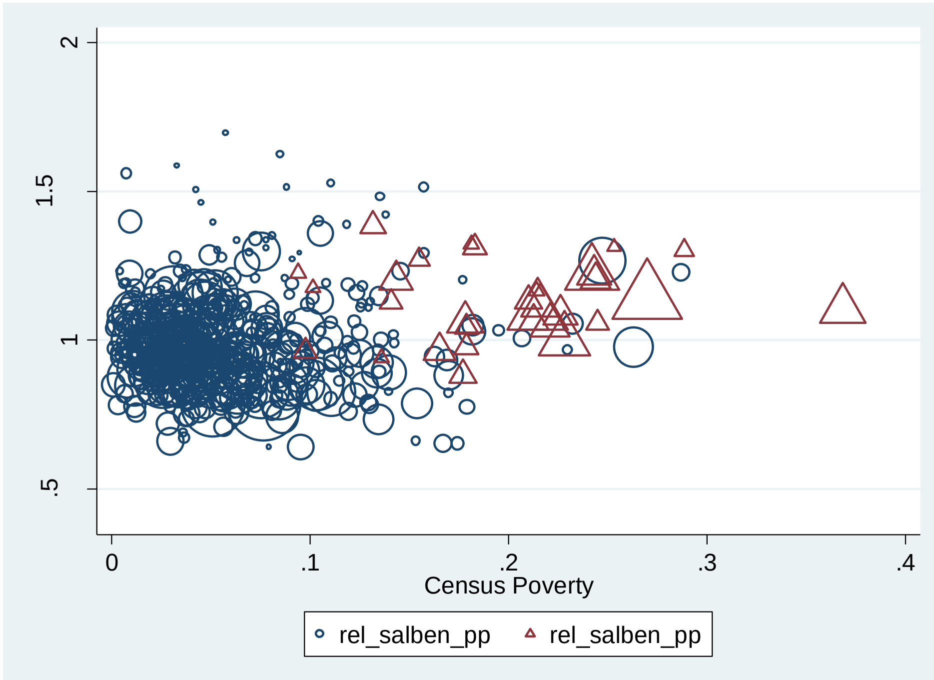
Figure 14
Relative Current Spending Instructional per Pupil 2006-07
(Abbott Districts in Red Triangles)



Budgeted appropriation for 2006-07
Data Source: NJDOE Comparative Spending Guide 2003-2007

- While higher poverty districts were reasonably well positioned with respect to lower poverty districts in their same labor market with regard to current operating spending per pupil, the margin of difference was smaller for current instructional spending per pupil.

Figure 15
Relative Current Instructional Salaries and Benefits per Pupil 2006-07
(Abbott Districts in Red Triangles)



Budgeted appropriation for 2006-07
Data Source: NJDOE Comparative Spending Guide 2003-2007

- While higher poverty districts were reasonably well positioned with respect to lower poverty districts in their same labor market with regard to current operating spending per pupil, the margin of difference was much smaller for relative total instructional salaries per pupil, which in many cases were approximately the same as the average for other districts in the same labor market.

Analysis 4
Labor market centered analysis of certified staff wages in 2006-07

In Analysis 4 we evaluate more precisely the relative competitiveness of certified staff wages in labor market context. It is conceivable that current spending levels for certain districts would be sufficient to support competitive teacher salaries. However, a district may choose to allocate those resources either toward increasing teacher quantity or teacher quality. It is critically important that we begin to better understand these tradeoffs given the increased interest in recent years in the role of teacher quality in influencing student outcomes.

Data

For this analysis we use data from the statewide certified staffing files, focusing primarily on 2006-07 but reconciling those data with data from previous years where necessary. Table 4 displays, as an example, the distribution of teachers holding primary job codes as elementary teachers including those teaching in grades 6 through 8.

Table 4
Distribution of Elementary (Jobcode 1000 to 1007) Teachers by CBSA in 2006-07

CBSA_NAME	Freq.	Percent	Cum.
Allentown-Bethlehem-Easton, PA-NJ MSA	528	1.44	1.44
Atlantic City, NJ MSA	1,405	3.83	5.27
Camden, NJ Metropolitan Division	5,335	14.56	19.83
Edison, NJ Metropolitan Division	8,734	23.83	43.67
New York-Wayne-White Plains, NY-NJ Metr	8,068	22.02	65.68
Newark-Union, NJ-PA Metropolitan Divisi	9,911	27.05	92.73
Ocean City, NJ MSA	365	1	93.73
Trenton-Ewing, NJ MSA	1,441	3.93	97.66
Vineland-Millville-Bridgeton, NJ MSA	858	2.34	100
Total	36,645	100	

Table 5 displays the distribution of all certified staff by job code for 2006-07.

Table 5
Distribution of Certified Staff 2006-07 by Aggregated Primary Assignment Code (JOBCODE1)

Aggregated Main Assignment	Freq.	Percent	Cum.
arts/music teacher	6,849	4.85	**4.85**
bus/tech/family teacher	3,408	2.41	**7.26**
coordinator	460	0.33	**7.58**
director	692	0.49	**8.07**
elementary teacher	38,433	27.19	**35.26**
english teacher	10,162	7.19	**42.45**
in school suspension	153	0.11	**42.56**
language teacher	4,328	3.06	**45.62**
ld/reading/speech	5,060	3.58	**49.21**
library/media	1,841	1.3	**50.51**
math teacher	6,676	4.72	**55.23**
middle teacher	7,503	5.31	**60.54**
occ/phys/nurse & social work	7,441	5.26	**65.8**
other admin	1,495	1.06	**66.86**
phys ed teacher	6,937	4.91	**71.77**
principal	4,074	2.88	**74.65**
science teacher	4,829	3.42	**78.07**
social studies teacher	4,405	3.12	**81.19**
special education	18,771	13.28	**94.47**
supervisor	2,319	1.64	**96.11**
support services	4,295	3.04	**99.15**

teacher coordinator	121	0.09	**99.23**
vocational teacher	1,085	0.77	**100**
Total	141,337	100	

For this and other analyses, we define labor markets primarily according to the approach used by the National Center for Education Statistics in the Comparable Wage Index. We take this approach for a handful of reasons. First, adopting this approach, we may make use of additional data from the Integrated Public Use Microdata System (IPUMS) including decennial census and annual American Community Survey Data to determine the relationship between teacher and non-teacher wages within CBSAs (see Ondrich, Pas and Yinger, 2007). That is, we may evaluate not only the relative competitiveness of teacher wages in one district within a labor market, but also teacher wages within the labor market to non-teacher wages in the same labor market, at comparable degree level and age.

Second, because this approach is based on the Census Core Based Statistical Area system we are able to integrate a variety of other census population variables into subsequent analyses. Third and perhaps most importantly, CBSAs are logical labor market units within and throughout which workers might commute to a variety of comparable jobs. CBSAs consist of multiple counties. Counties are typically geographically too small to be considered labor markets and counties are often far more socio-economically, racially and ethnically homogeneous than CBSAs. Our analyses in this section involve evaluation of within labor market differences in population characteristics and in financial resources, including teacher salaries.

Data from IPUMS include the following unweighted and weighted samples of non-teachers with a BA, MA or professional degree by metropolitan area.

Table 6

Distribution of Non-Teachers in IPUMS and ACS by Metro Area Place of Work

	Unweighted		**Weighted**	
Metropolitan Area	**Census 2000**	**ACS 2005**	**Census 2000**	**ACS 2005**
Atlantic City, NJ	1,153	310	22,907	29,229
Monmouth-Ocean, NJ	3,368	909	66,979	79,462
Bergen-Passaic, NJ	5,875	1,331	121,734	139,404
Jersey City, NJ	1,941	473	40,743	48,246
Middlesex-Somerset-Hu	7,063	1,564	140,493	152,030
Newark, NJ	10,703	2,470	214,639	239,008
Philadelphia, PA/NJ	3,509	994	69,401	87,830
Trenton, NJ	2,169	614	44,712	61,027
Vineland-Milville-Bri	**337**	**80**	**6,421**	**8,153**

Analysis

To a large extent, the purpose of the products of this subsection is to serve other sections of our analyses. The primary goal of this analysis is to construct a series of relative wage or wage competitiveness indices for teachers across schools and districts, within their respective labor markets. Recent work by Ondrich, Pas and Yinger (2007) reveals the importance of teacher wages relative to other teacher wages in the same labor market and teacher wages relative to non-teaching labor market opportunities in the same labor market. In addition, preliminary analysis of teacher wages in New Jersey indicates that the relative competitiveness of wages in schools and districts may vary by career stage and degree level. For example, wages for novice teachers with only a bachelors' degree may be relatively competitive in high poverty urban districts compared to more affluent neighbors, but wages for experienced teachers with advanced degrees may not be.

Our first approach is to evaluate categories of teachers and their wages relative to teachers in other districts in the same labor market and relative to non-teachers in the same labor market. For comparisons against non-teachers, we use data from Census 2000 and from the American Community Survey of 2005 (and 2006) which each have data down to the metropolitan area and public use micro data area as a place of work. Public Use Micro-Data Areas may be aligned with or collapsed into Core Based Statistical Areas.

$$\textbf{Teacher Wage}_d\textbf{/Non-Teacher Wage}_{cbsa}$$

For each Core Based Statistical Area, we compare salaries of teachers at the following career stages, to salaries (income from wages) of non-teachers with the same degree level and at comparable age in the same CBSA and year (2000, 2005, 2006).

1. Novice Teacher with BA (first 3 years of work, mean age is 32, mode is 26 in 2007)
2. Novice Teacher with MA (mean age is 36, mode is 27 in 2007)
3. 5 to 10 Year Teacher with MA
4. 10 to 15 Year Teacher with MA

We also intend to construct separate indices for teachers by grade level.

Next, we compare teacher wages in each district, at the 4 above career stages and at the elementary, middle and secondary level to average teacher wages in the Core Based Statistical Area. In this case, data in both the numerator and denominator are from the statewide certified staffing files.

$$\textbf{Teacher Wage}_d\textbf{/Teacher Wage}_{cbsa}$$

Our second method involves constructing teacher wage models first statewide and then for each labor market using data from the statewide certified staffing files in 2003, 2006 and 2007. The intent of this analysis is to discern whether the structure of teacher wages differs across labor markets in NJ. For example, are there different returns to experience in one labor market versus another? Are there different returns to education level? We begin with a statewide teacher wage model:

$$\textbf{Salary} = f\textbf{(Total Exper., NJ Exper., District Exper., Degree, Primary Job Code, Labor Market)}$$

Our statewide model includes fixed effects for labor market in order to determine average differences in wages, all else equal, between labor markets. This model may be subsequently used to generate wage residuals for groups of teachers by job code, experience and degree level in districts. That is, this statewide wage equation may be used for creating indices similar to those above – measures of the relative wage of teachers in each district, at specific experience and degree levels, compared to labor market averages.

Our individual labor market models of wages are estimated similarly to the above equation, but dropping the labor market fixed effect since independent models are estimated. The initial objective is to discern whether the wage structure differs by labor market. If it does, then separate sets of wage residuals are produced for teachers by job code, experience and degree level in districts within labor markets.

A related question to be addressed in this subsection is whether there exists a rational relationship between the relative competitiveness of fiscal resources of school districts addressed in Analysis 3, and the relative competitiveness of teacher salaries. Increased fiscal resources may be leveraged to purchase either increased quantities of teachers and other school staff, or to increase the salaries of teachers and other school staff.

- How do labor market relative wage indices across districts relate to labor market relative operating expenditures and instructional expenditures across districts?

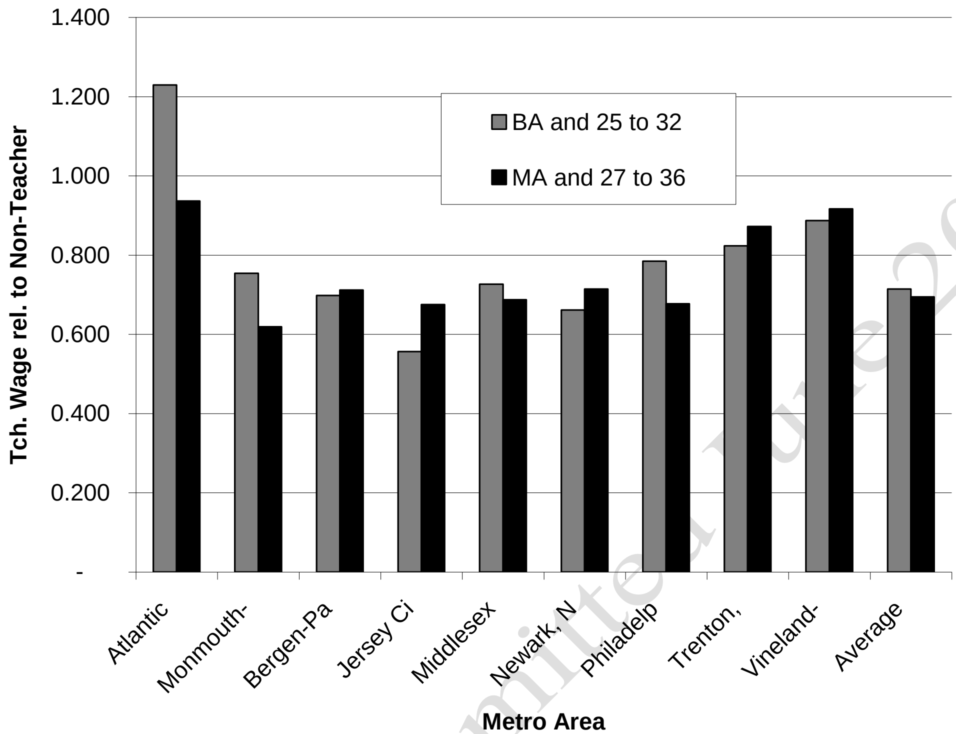
- How do wage residuals of school districts within labor markets relate to labor market relative operating expenditures and instructional expenditures across districts?

While it seems intuitive that districts with relatively higher current expenditures and current expenditures on instruction would also show higher relative wage indices and higher wage residuals, those expenditures may be allocated to either staffing quantity or wages. Decomposing the analysis by career stage may also tell us more precisely where the additional dollars are being allocated. Preliminary analyses suggest that poorer urban districts may be paying a higher than expected relative wage for novice teachers with bachelors degrees but lower than expected relative wage for more experienced teachers with a masters' degree.

Finally, these indices of the relative competitiveness of wages may be calculated down to the school level and may be aligned with the 90 focus schools in this study allowing us to evaluate the relative competitiveness of teacher wages in schools identified as relative over and relative under performers and allowing us to consider relative competitiveness of school level wages in the evaluation of school level resource allocation.

Findings

Figure 16
Ratio of Teacher to Non-Teacher Wages by Labor Market, Degree and Age (ACS)

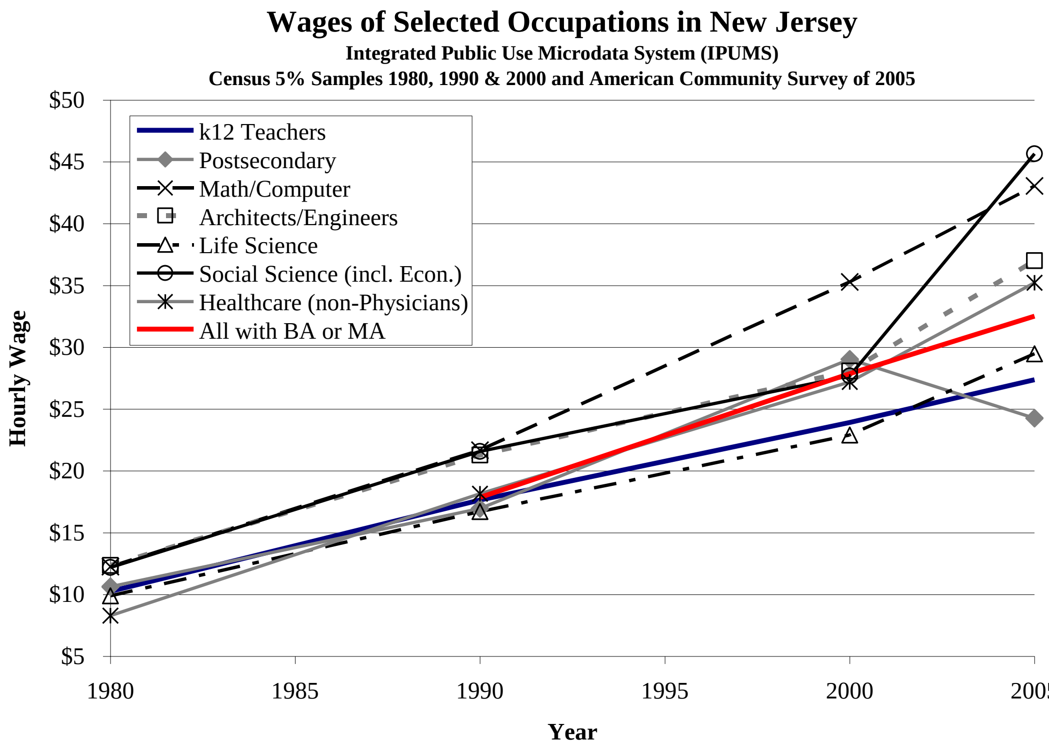


Data Source: Integrated Public Use Microdata System (IPUMS), Census 2000 and American Community Surveys (ACS) of 2005 & 2005. Teachers identified by occupation (teacher) and industry (elementary and secondary education) and compared against non-teachers on *wages from income.*

- In many labor markets across New Jersey, individuals identified as elementary and secondary teachers in Census data earn substantially less than their comparably educated peers of comparable age.
- Individuals with a Bachelors Degree and between 25 and 32 years of age earned less than 80% of peer wages in the Monmouth County area, Bergen-Passaic, Jersey City, Middlesex, Newark and Philadelphia. These individuals earned less than 60% of peer wages in Jersey City.
- Individuals with a Masters Degree and between 27 and 36 years of age lagged behind their peers in the same labor markets.

Figure 17

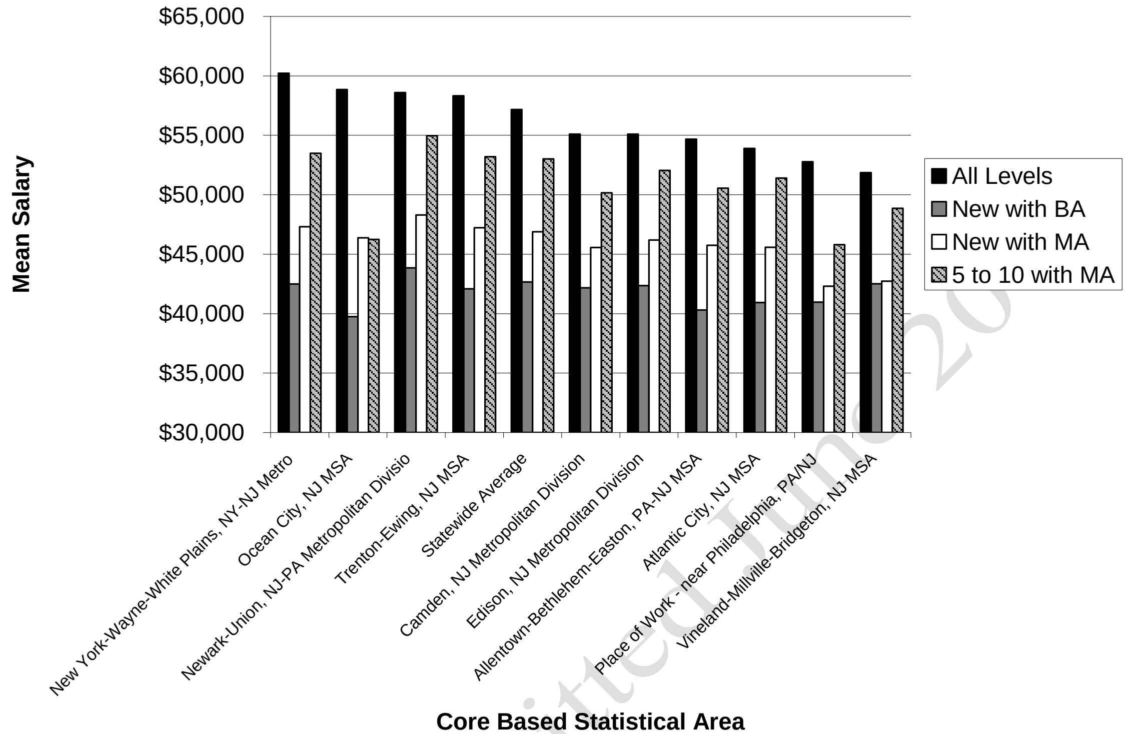
Long-run Relative Competitiveness of New Jersey Teacher Salaries



Source: Bruce D. Baker, Presentation on Dec. 6, 2007.

- On hourly wages, New Jersey's elementary and secondary teachers (blue line) have lagged behind other professions since 1980, and since 1990 have diverged, lagging behind salaries of all workers holding a BA or MA (red line) in New Jersey.

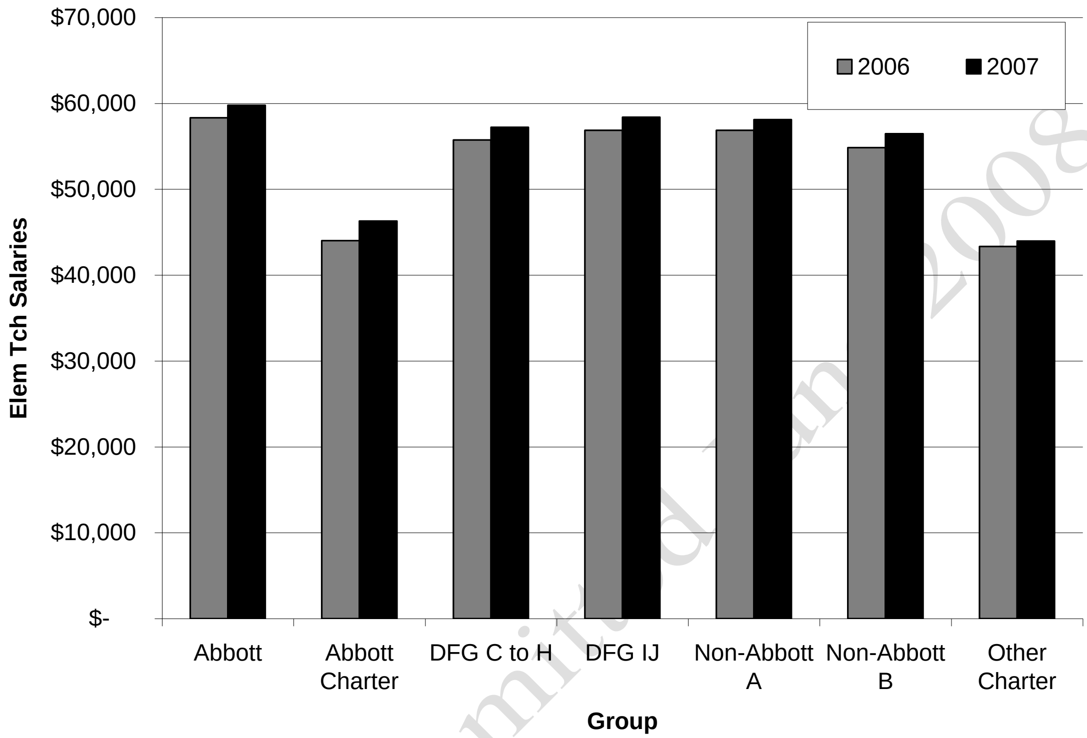
Figure 18
Average Teacher Salaries* by Labor Market**



*Average of 2005-06 and 2006-07
**Labor Market as defined in the National Center for Education Statistics Education Comparable Wage Index. Largely aligned with Core Based Statistical Areas in New Jersey.
Data Source: NJDOE Certificated Staff Status Database 2006 & 2007

- Existing teacher salaries varied widely across New Jersey labor markets, on average – not controlling for specific experience and degree levels. The highest average salaries tend to be in the immediate NY metropolitan area and Newark metropolitan area.
- Within specific degree and experience categories there appears to be substantially less variation, especially for early career teachers. There is greater variation for teachers with 5 to 10 years and a Masters degree, with the highest salaries occurring in the Newark metropolitan area (though not necessarily Newark City) and lowest near Philadelphia.

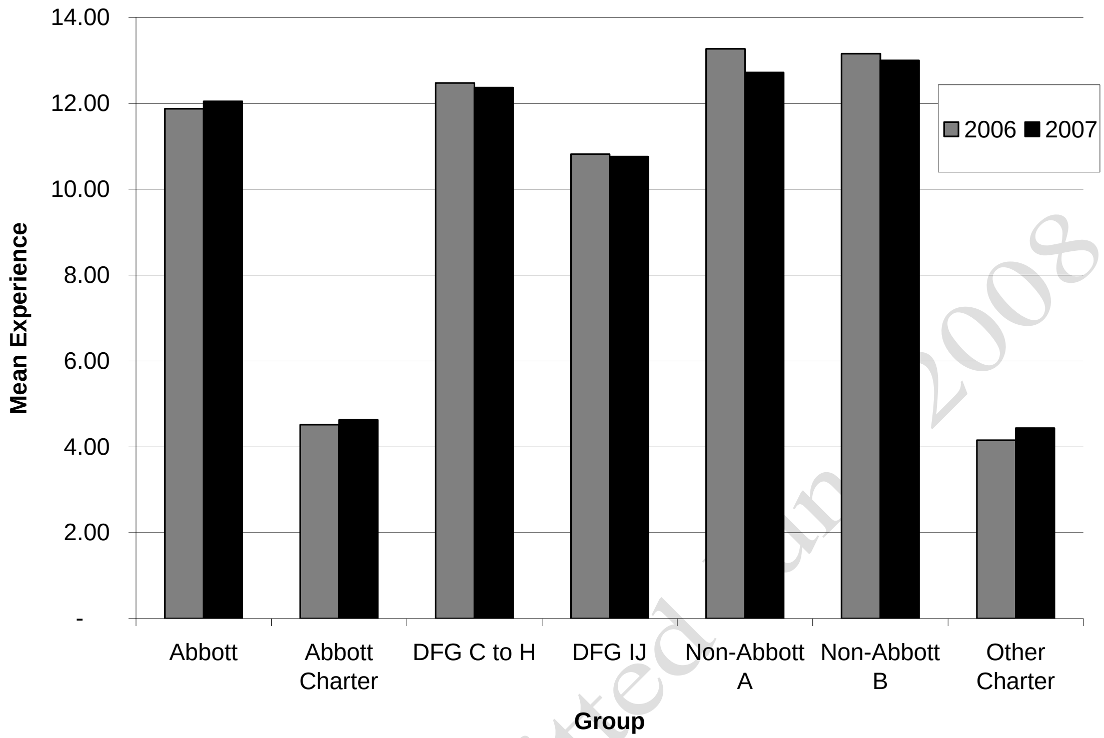
Figure 19
Elementary Teacher Average Salaries



Data Source: NJDOE Certificated Staff Status Database 2006 & 2007

- On average, teacher salaries for elementary teachers are relatively consistent across groupings, with salaries in Abbott districts slightly higher.
- Average salaries tend to be quite low in both charter schools located in Abbott districts and other charter schools. These figures are not corrected for experience and degree level.

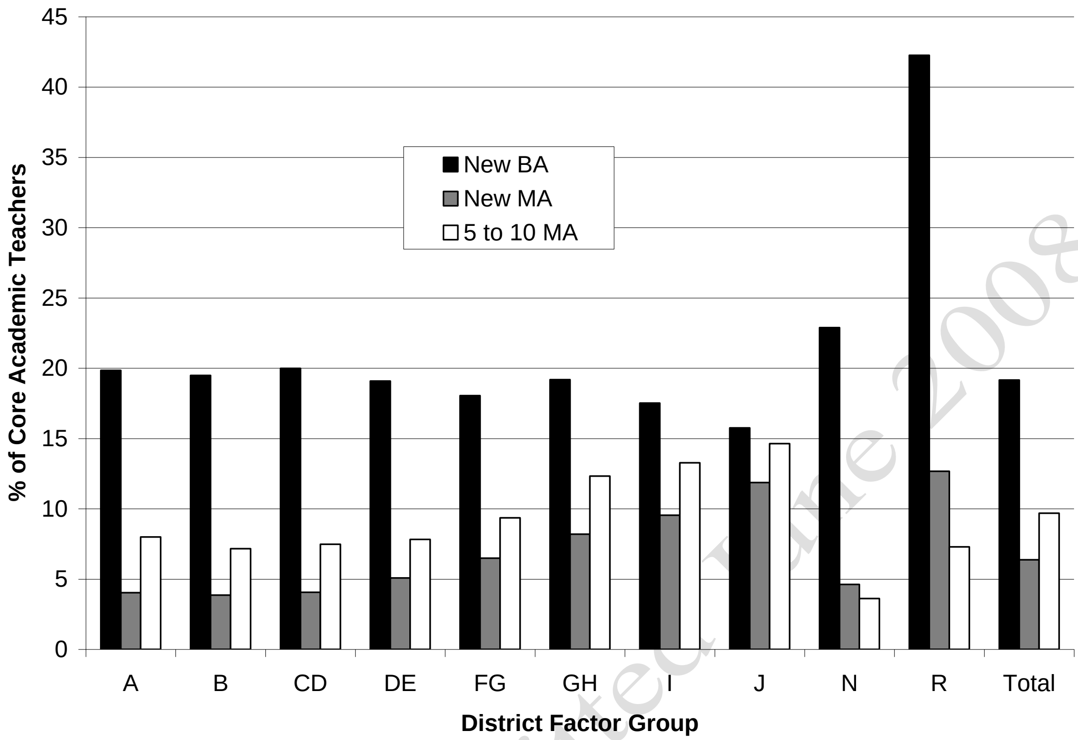
Figure 20
Elementary Teacher Average Experience Teaching in New Jersey



Data Source: NJDOE Certificated Staff Status Database 2006 & 2007

- Teacher mean in-state experience levels are highest in Non-Abbott A and Non-Abbott B districts, but only slightly lower in Abbott and DFG C to H districts. Experience levels are somewhat lower in DFG IJ districts, possibly as a function of some relatively large and rapidly growing DFG I districts.
- Mean in-state experience levels are very low in charter schools both in Abbott districts and elsewhere.

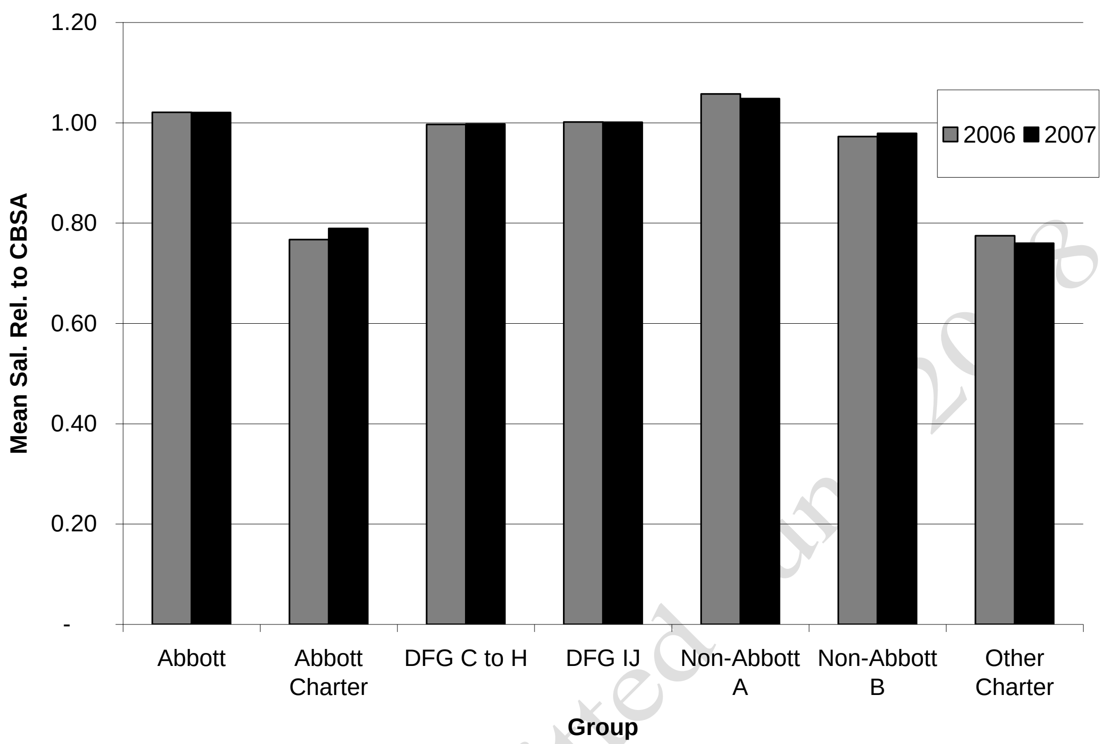
Figure 21
Core Academic Teacher Mean Experience (Category) by District Factor Group



Data Source: NJDOE Certificated Staff Status Database 2006 & 2007

- Focusing on "Core Academic" teachers (as defined by Goertz and colleagues in this report), and categorizing teachers by experience groups, the share of "new teachers with a BA only" declines gradually when moving from DFG A to DFG J. Meanwhile, the share of new teachers with and MA and more experienced teachers with an MA increases quite substantially when moving from DFG A to DFG J.
- Percentages of new teachers with only a BA are very high in charter schools.

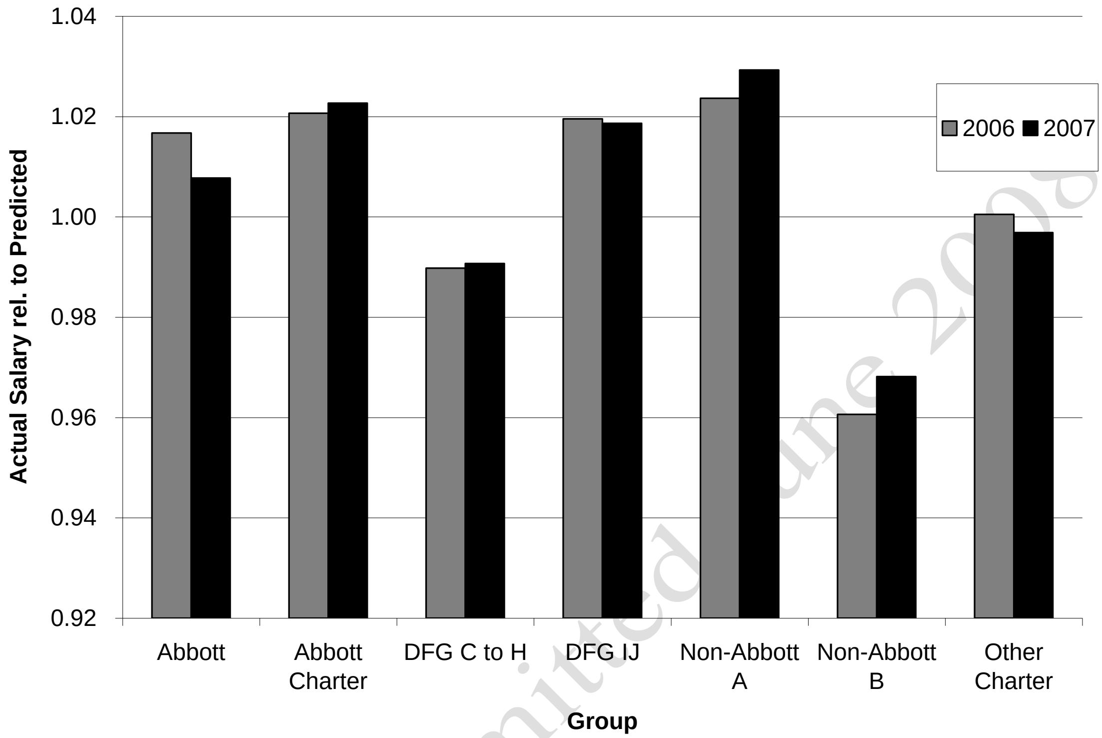
Figure 22
Teacher Salaries Relative to Mean for Other Schools in Same CBSA



Data Source: NJDOE Certificated Staff Status Database 2006 & 2007

- Relative to average salaries of other teachers in the same core based statistical area, teacher salaries in Abbott districts, DFG C to H and DFG IJ are relatively average – around the same as others sharing the labor market – when not corrected for experience, degree level or job code.
- Salaries in Non-Abbott A districts are slightly higher and charter school salaries, on average, are much lower than labor market averages, when not corrected for experience, degree level or job code.

Figure 23
Ratio of Actual Certified Staff Salaries to Predicted Salary for Each Job, Degree Code, Experience Level, Labor Market and Year
"Relative Competitiveness of Salary"



Data Source: NJDOE Certificated Staff Status Database 2006 & 2007

- Using a regression model to correct salaries for experience, degree level, job code and between labor market variation, we find that Abbott district salaries are less than 2% above salaries of comparable teachers in the same labor market.
- While average salaries in charter schools are low, salaries at constant degree level, experience and job code for teachers in Abbott located charters are about 2% above others in the same labor market.
- Salaries are 4% below competitive levels for teachers in Non-Abbott B districts.

Analysis 5
Within district equity of staffing resource allocation across schools in 2006-07

New Jersey school districts do not report school level expenditures. For Analysis 5 we use data from the statewide certified staffing file to construct school level personnel budgets. Our goal is to use these school level personnel budget estimates to evaluate resource equity at the school level within and across school districts. Among other things, we evaluate the distribution of personnel budgets per pupil across elementary schools within the state's largest school districts. We estimate school level expenditure functions in order to determine school characteristics associated with variation in per pupil resources across schools. Ideally, we would find in such an analysis that variation in resources across elementary schools within a large district are a predictable function of variations in student population characteristics.

Data

For this analysis we use data on all certified staff from 2003-04 through 2005-06 in order to estimate school level staffing expenditures per pupil for all schools statewide in New Jersey. School level personnel expenditures are calculated as the sum salaries of all certified staff assigned to specific school buildings by building code. These compiled salaries are then merged with data on school characteristics from 2003-04 through 2005-06, as used in the screening of schools.

Because the analysis involves schools of comparable grade level within districts, districts included in the analysis must have sufficient numbers of schools of comparable grade level. Table 7 summarizes the number of matched elementary schools over the 3 year period in each of the state's 19 large school districts (those with over 10 elementary schools in the data set matched over time).

Table 7

Districts with 10 or more elementary schools based on data compiled for screening analysis

	Number of Elementary Schools			
Dist Name	**2004**	**2005**	**2006**	**Total**
BAYONNE	10	10	10	30
CAMDEN CITY	19	19	19	57
CHERRY HILL TOWNSHIP	12	12	12	36
CLIFTON	13	13	13	39
EAST ORANGE	12	12	12	36
EDISON TOWNSHIP	10	10	10	30
ELIZABETH	17	17	17	51
HAMILTON TOWNSHIP	17	17	17	51
HOWELL TOWNSHIP	10	10	10	30
JERSEY CITY	27	27	27	81
MIDDLETOWN TOWNSHIP	12	12	12	36
NEWARK	49	49	49	147
OLD BRIDGE TOWNSHIP	12	12	12	36
PARSIPPANY-TROY HILLS	10	10	10	30
PATERSON	30	30	30	90
PLAINFIELD	10	10	10	30
TOMS RIVER REGIONAL	12	12	12	36
TRENTON	17	17	17	51
WOODBRIDGE TOWNSHIP	16	16	16	48
Total	315	315	315	945

Analysis

Analyses in this section occur at multiple levels. First, we evaluate the relative equity of funding across all schools statewide, all schools within each labor market and finally across all schools within large school districts. One goal is to discern the extent of variance in school level resources that exists within and between districts at comparable grade level. A subsequent goal is to discern the extent of that variance across schools at comparable grade level, within and between school districts that is predictable by a standard array of cost factors. That is, how much of the variance in spending that exists across schools is variance that is legitimately associated with differences in the costs of providing equal educational opportunity.

These analyses begin with estimation of the variance – coefficients of variation – between schools statewide, between schools within labor markets and between schools within districts within labor markets. In each case, schools are compared with schools of comparable grade level based on the groups of schools used in our screening analysis.

The second step in our analysis involves estimating slopes of the relationship between school level subsidized lunch rates and school level certified staffing expenditures per pupil. In short, this analysis asks how much of the variance in resources is a function of the single student population characteristic – students qualifying for free/reduced lunch. Again, we evaluate these slopes at three levels – across schools statewide, across schools within labor markets and across schools within districts.

Finally, we estimate a series of expenditure functions to with our school level certified staffing expenditures per pupil as the dependent variable, and with various school level cost factors as independent variables – including economies of scale, grade ranges served and student population characteristics. We estimate these models at two levels, but in two separate sets. In the first set of models, we estimate a 2-level model of schools nested in districts statewide. In the second set of models we estimate a 2-level model of schools nested in districts for each labor market. One goal is to determine the extent of within district and between district spending variation that can be predicted as a function of differences in major cost pressures across schools.

Preliminary analysis of data from 2005-06 suggests that approximately 40% of within district variance is explainable as cost variation compared with approximately 60% of between district variation, for elementary schools including districts with 10 or more elementary schools. The parameter estimate between natural log of certified staff expenditures and percent free/reduced lunch is .31 for the fixed effect (within district) model and .54 for the between district model, suggesting that poverty related differences in funding are greater (more progressive) across than within districts.

Findings

Table 8

Regression analysis of the relationship between certified staff salaries per pupil and school subsidized lunch rates – New York CBSA

	NY CBSA			Paterson			Jersey City		
DV=Sal. Per Pupil	*Coef.*	*Std. Err.*	*P>t*	*Coef.*	*Std. Err.*	*P>t*	*Coef.*	*Std. Err.*	*P>t*
% Free Lunch	0.501	0.044	*	0.614	0.284	*	0.684	0.345	**
Year = 2005	0.039	0.007	*	-0.010	0.046		0.160	0.027	*
Year = 2006	0.069	0.007	*	0.075	0.048		0.151	0.017	*
Schlevel K-8	-0.064	0.056		(dropped)			(dropped)		
Schlevel Other	-0.297	0.241		(dropped)			(dropped)		
Constant	8.357	0.016	*	8.419	0.138	*	8.259	0.230	*
R-squared	0.319			0.178			0.226		

*p<.05, **p<.10

Estimated with Robust Standard Errors clustered by School ID

- Controlling for other school characteristics and focusing on schools in the New York core based statistical area, total certified salaries per pupil (a school level expenditure figure) are higher on average in schools with higher rates of children qualifying for free lunch.
- The school level spending differential associated with school poverty is greater within Paterson and Jersey City school districts than across all schools in the labor market.

Table 9

Regression analysis of the relationship between school demographics and teacher characteristics – New York CBSA

	Salary per Pupil			Class Size			Salary Ratio (to Predicted)			% New Teachers with BA Only		
	Coef.	*Std. Err.*	*P>t*	*Coef.*	*Std. Err.*	*P>t*	*Coef.*	*Std. Err.*	*P>t*	*Coef.*	*Std. Err.*	*P>t*
% Free Lunch	0.288	0.066	*	-0.020	0.043		-0.031	0.019		0.107	0.030	*
% LEP/ELL	0.001	0.001		0.001	0.001		0.000	0.000		-0.001	0.001	*
% Special Education	0.195	0.123		-0.091	0.079		-0.005	0.035		0.004	0.053	
Paterson	0.223	0.043	*	0.067	0.033	*	0.016	0.008	**	0.015	0.016	
Jersey City	0.152	0.045	*	0.000	0.033		0.014	0.009		0.037	0.017	*
Schlevel K-8	-0.066	0.065		0.088	0.039	*	0.059	0.022	*	0.064	0.033	**
Schlevel Other	0.004	0.140		-0.052	0.077		0.148	0.010	*	0.048	0.129	
Year = 2005	0.041	0.009	*	0.015	0.004	*	0.002	0.001		-0.007	0.002	*
Year = 2006	0.076	0.009	*	0.010	0.005	*	0.002	0.001	**	-0.008	0.003	*
Constant	8.342	0.024	*	2.965	0.014	*	0.975	0.008	*	0.164	0.010	*
R-squared	0.367			0.042			0.052			0.161		

*p<.05, **p<.10

Estimated with Robust Standard Errors clustered by School ID

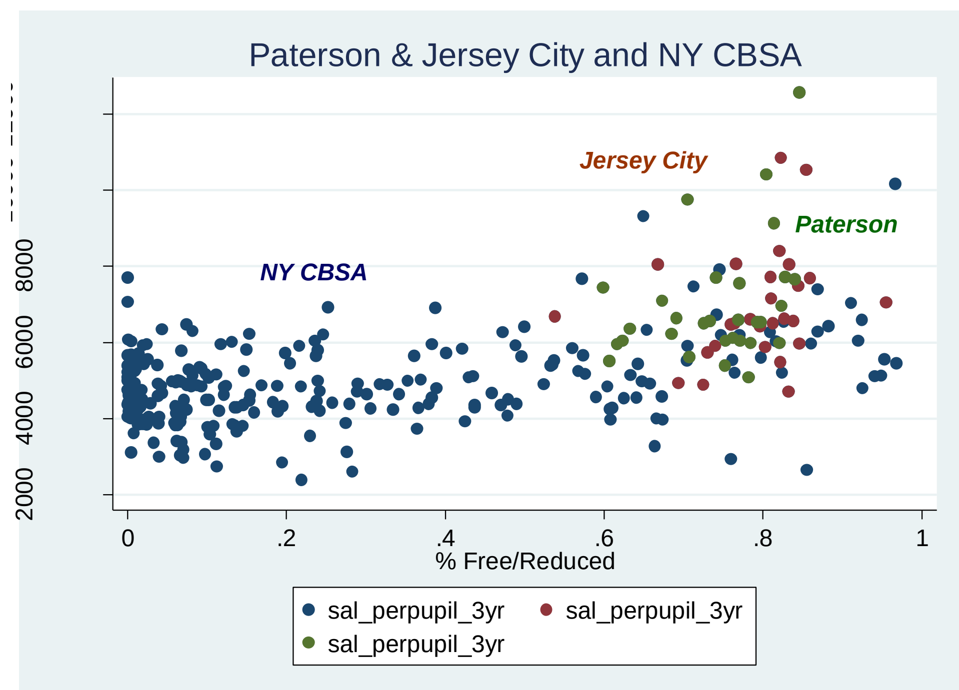
- Including dummy indicators for schools located in the major urban districts in the NY CBSA finds that certified staff spending per pupil is higher in Paterson and

Jersey City than in the rest of the CBSA, but class sizes remain marginally larger in Paterson. Salary ratios are marginally higher in Paterson (p<.10).

- The percent of new teachers with a BA only is higher, on average in higher poverty schools and in Jersey City specifically.

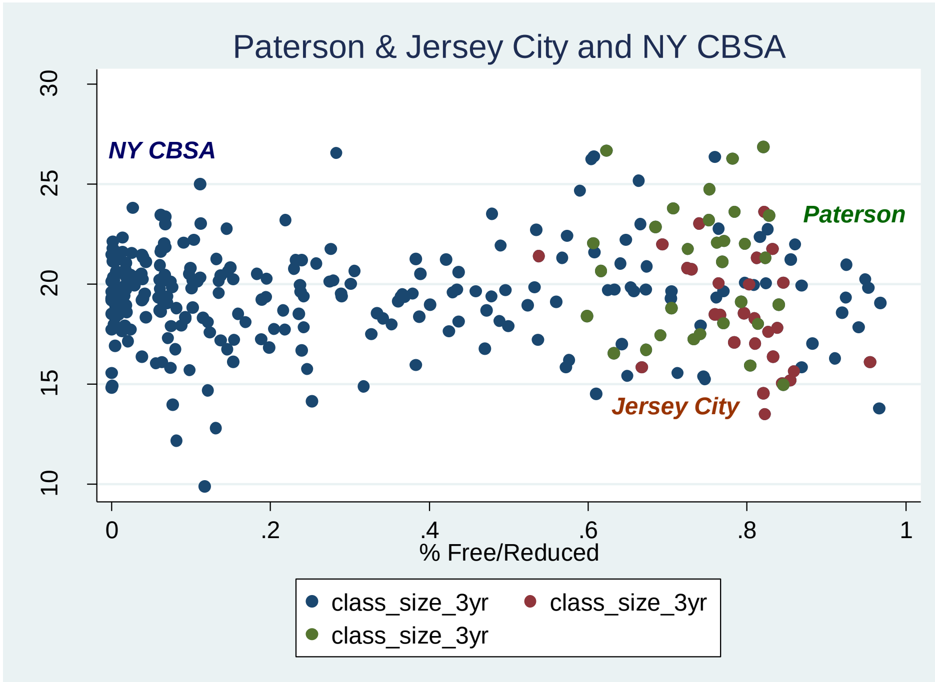
Figure 24

Relationship between School Subsidized Lunch rate and Aggregate Certified Staff Salaries per Pupil



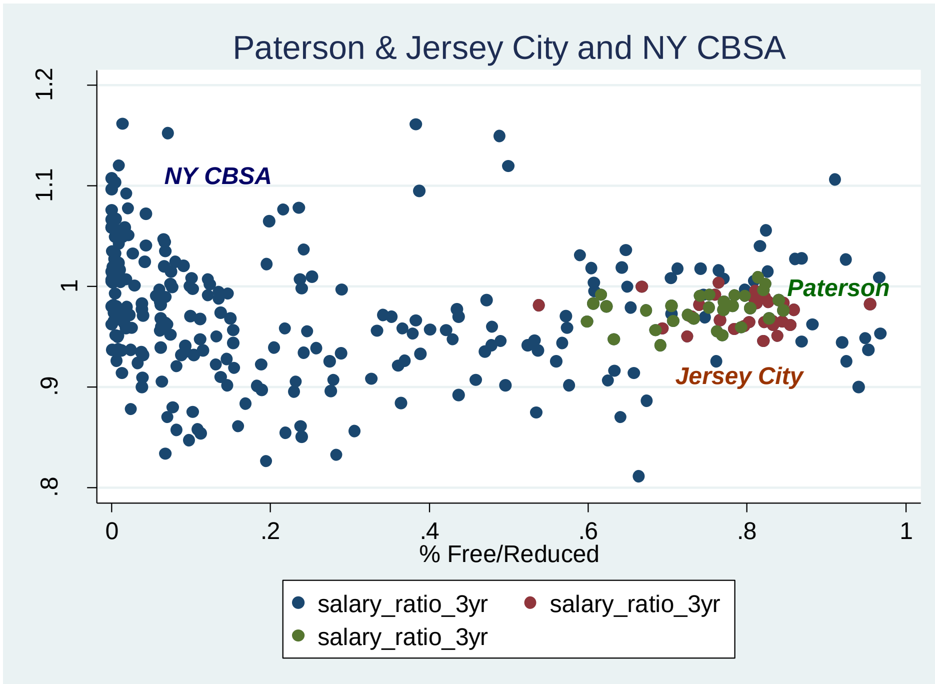
- While average certified staff expenditure per pupil is marginally higher in Jersey City and Paterson than in the rest of their metro area, schools in these city districts do not share any sizeable systematic differential as might be necessary given their high poverty rates and given the number of very low poverty schools in the same labor market.

Figure 25
Relationship between School Subsidized Lunch rate and Schoolwide Class Size



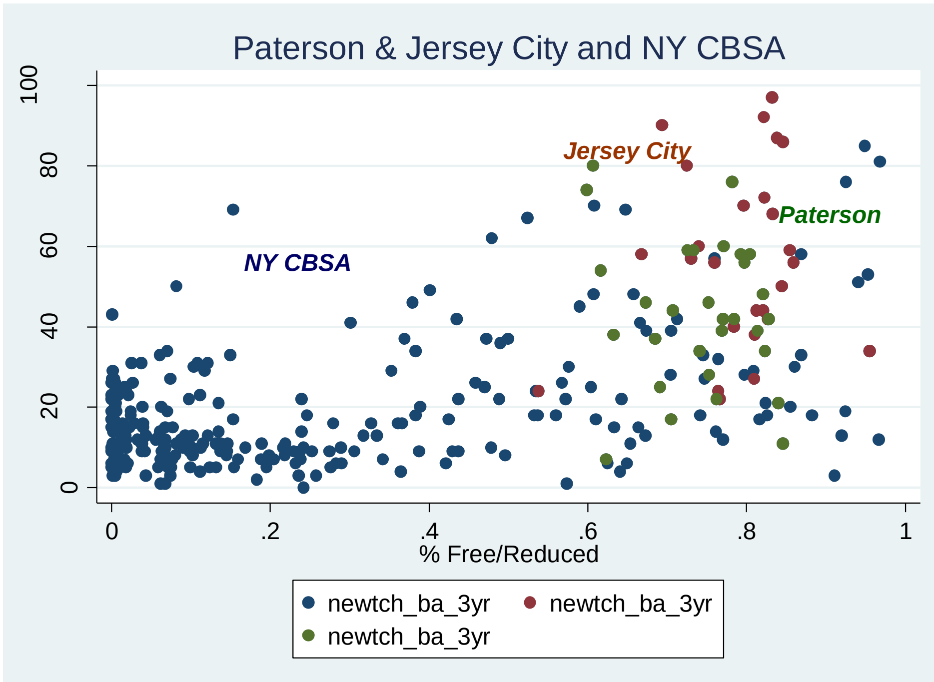
- On average, class sizes in Jersey City and Paterson are roughly comparable to class sizes, though more scattered (perhaps), in lower poverty schools in the same labor market.

Figure 26
Relationship between School Subsidized Lunch rate and *Salary Competitiveness*



- On average, relative salaries (controlling for experience, degree and position) are somewhat less than competitive in Paterson and Jersey City, especially when compared with their lower poverty peers in the same labor market.

Figure 27
Relationship between School Subsidized Lunch rate and % New Teachers (<=3 years) with BA Only



- On average, many high poverty schools in the NY CBSA have very high rates of new teachers with a BA only, including many schools in Jersey City and some in Paterson.

Table 10
Regression analysis of the relationship between certified staff salaries per pupil and school subsidized lunch rates – Trenton CBSA

	Trenton CBSA				Trenton District				Hamilton Township		
DV=Sal. Per Pupil	*Coef.*	*Std. Err.*	*P>t*		*Coef.*	*Std. Err.*	*P>t*		*Coef.*	*Std. Err.*	*P>t*
% Free Lunch	0.309	0.105	*		0.424	0.414			0.453	0.114	*
Year = 2005	-0.049	0.015	*		-0.125	0.037	*		-0.032	0.025	
Year = 2006	0.026	0.015	**		0.015	0.032			-0.027	0.025	
Schlevel K-8	0.174	0.055	*		(dropped)				(dropped)		
Schlevel Other	-0.150	0.083	**		-0.146	0.093			(dropped)		
Constant	8.426	0.046	*		8.443	0.255	*		8.233	0.034	*
R-squared	0.159				0.248				0.270		

*p<.05, **p<.10
Estimated with Robust Standard Errors clustered by School ID

- Overall, in the Trenton CBSA, certified staff expenditures per pupil are higher in higher poverty schools. This relationship was much noisier within Trenton, to the point that while the slope was more positive, the relationship was not significant.

Table 11

Regression analysis of the relationship between school demographics and teacher characteristics – Trenton CBSA

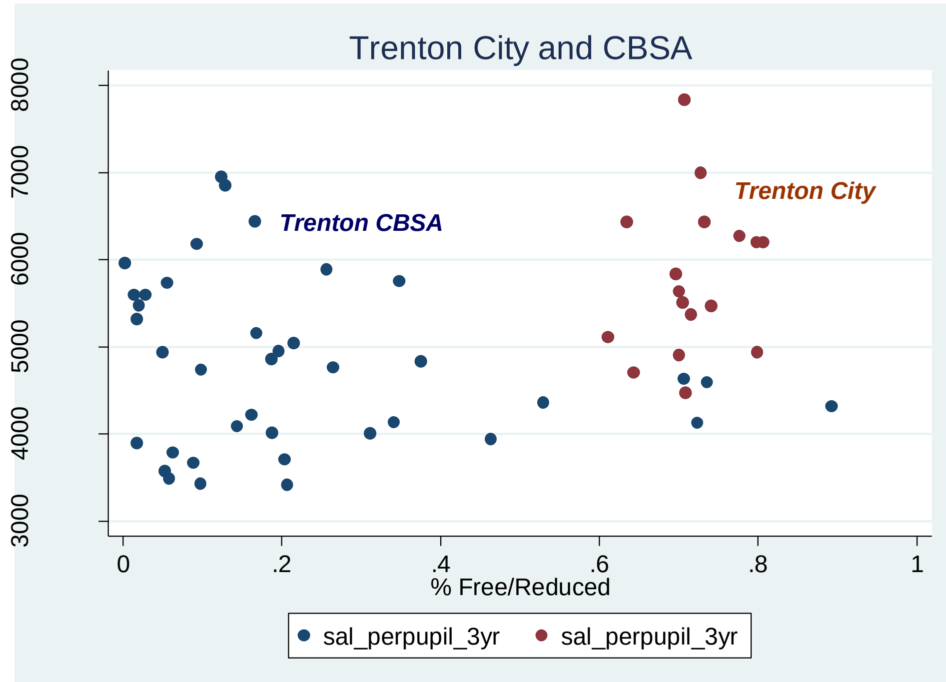
	Salary per Pupil			Class Size			Salary Ratio (to Predicted)			% New Teachers with BA Only		
	Coef.	*Std. Err.*	*P>t*	*Coef.*	*Std. Err.*	*P>t*	*Coef.*	*Std. Err.*	*P>t*	*Coef.*	*Std. Err.*	*P>t*
% Free Lunch	-0.182	0.145		-0.337	0.080	*	-0.187	0.056	*	0.300	0.079	*
% LEP/ELL	0.003	0.001	*	0.000	0.001		0.002	0.000	*	-0.001	0.000	
% Special Education	0.285	0.240		-0.006	0.115		-0.090	0.064		-0.074	0.108	
Trenton City	0.304	0.058	*	0.115	0.042	*	0.034	0.021		-0.226	0.036	*
Schlevel K-8	0.155	0.056	*	0.064	0.023	*	0.003	0.013		-0.048	0.021	*
Schlevel Other	-0.228	0.063	*	0.112	0.068		0.010	0.007		0.006	0.017	
Year = 2005	-0.037	0.023		0.017	0.009	**	-0.006	0.005		-0.015	0.008	**
Year = 2006	0.028	0.025		0.015	0.009	**	-0.008	0.005		-0.010	0.008	
Constant	8.414	0.067	*	2.993	0.028	*	1.040	0.017	*	0.180	0.028	*
R-squared	0.280			0.320			0.310			0.410		

*p<.05, **p<.10

Estimated with Robust Standard Errors clustered by School ID

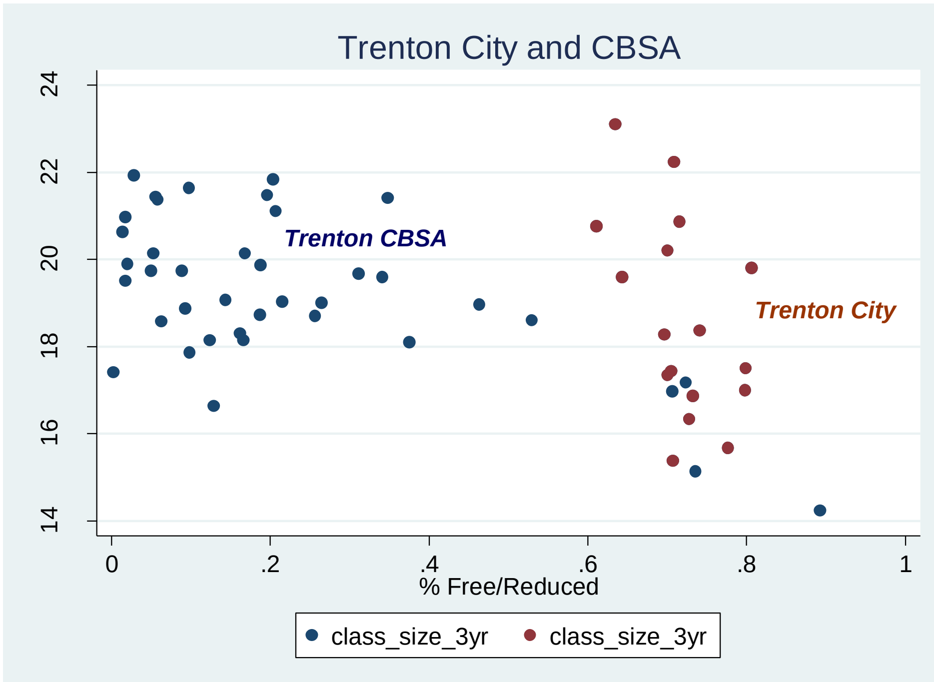
- On average, certified staff spending per pupil was higher in Trenton schools than in other schools in the same labor market. The majority of the positive relationship between poverty and certified staff spending per pupil in this labor market was a function of higher spending in Trenton schools.
- On average, across the labor market, class sizes were smaller in higher poverty schools but larger in Trenton, if controlling for poverty (in this case, however, Trenton makes up nearly all of the higher poverty schools).
- While higher poverty schools had more new teachers with a BA only, controlling for poverty, Trenton city had fewer new teachers with a BA only. But again, Trenton schools include nearly all of the high poverty schools in this labor market.

Figure 28
Relationship between School Subsidized Lunch rate and Aggregate Certified Staff Salaries per Pupil



- Overall, the relationship between poverty and certified staffing expenditures per pupil is quite scattered across schools in the Trenton CBSA and within Trenton City.

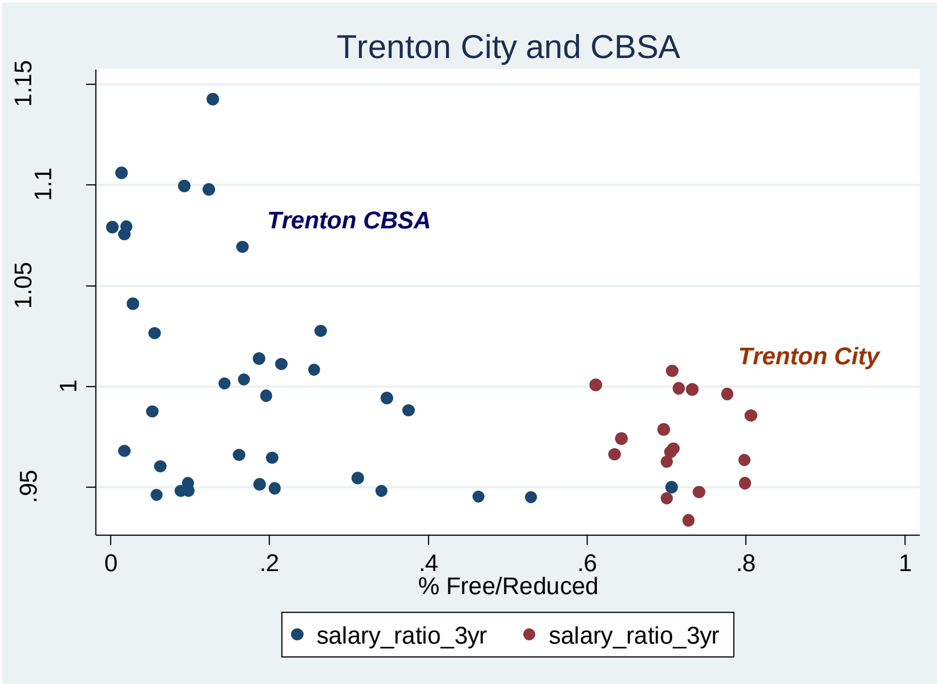
Figure 29
Relationship between School Subsidized Lunch rate and Schoolwide Class Size



- While many Trento schools display lower class sizes than those in neighboring lower poverty districts, some do not, and in fact show larger class sizes.

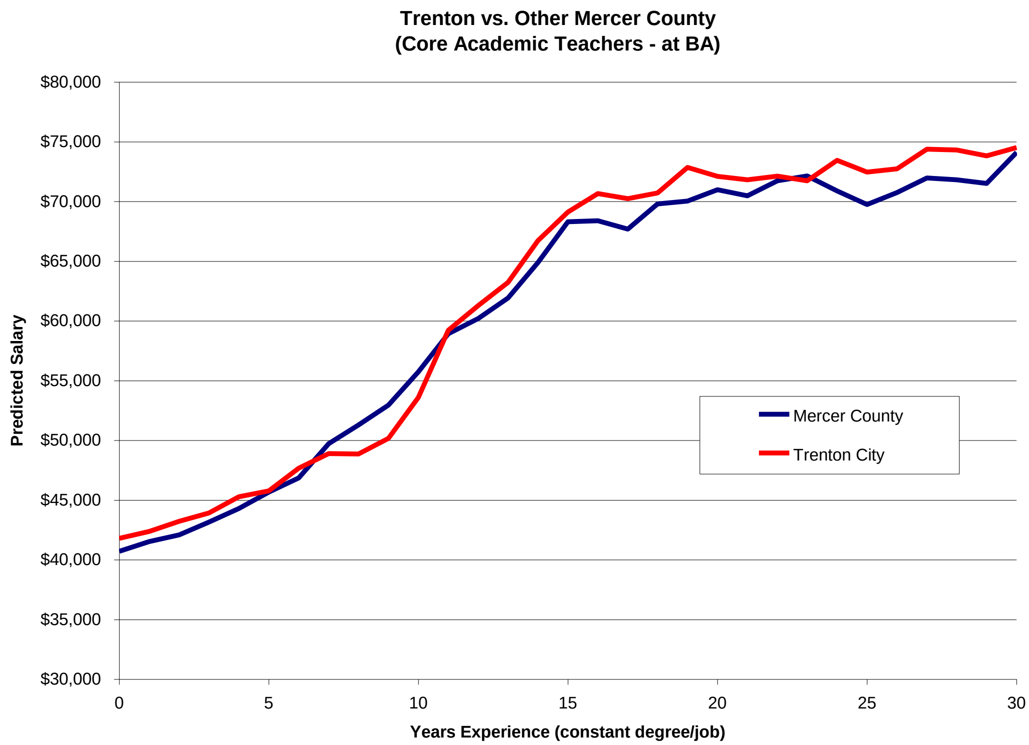
Figure 30

Relationship between School Subsidized Lunch rate and *Salary Competitiveness*



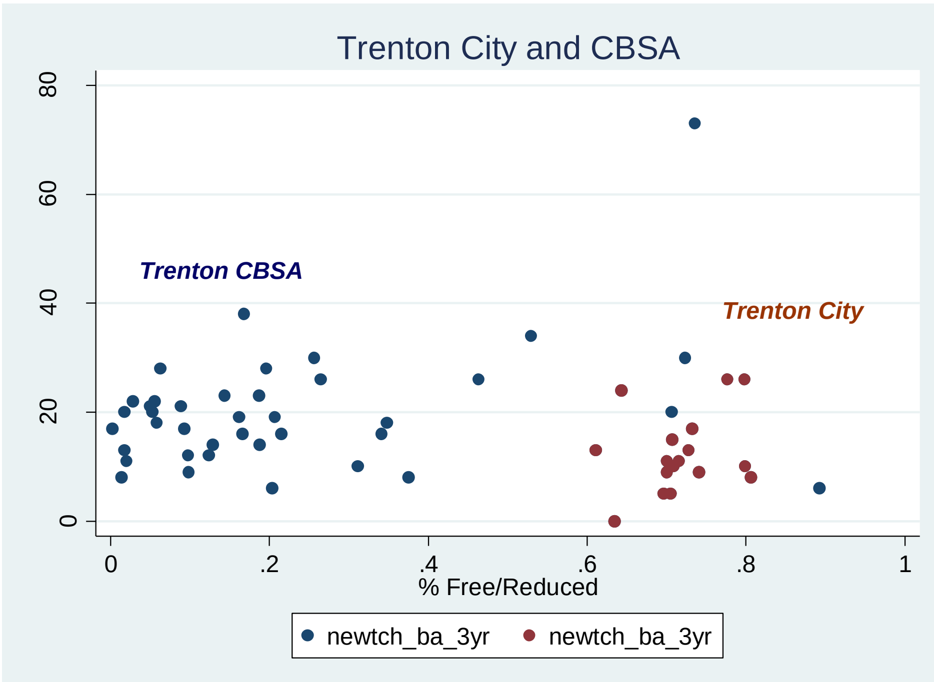
- The relative competitiveness of teacher salaries appears to be a significant problem in Trenton, with teacher salaries falling between 95% and 100% of salaries in neighboring districts at comparable experience, degree level and position code.

Figure 31
Experience Component of Trenton vs. other Mercer County Districts



- At most experience levels, controlling for degree and focusing on core academic teachers, Trenton City teachers' salaries run parallel to others within the same county. Salaries lag slightly behind for teachers with 6 to 12 years experience, while the most senior teachers in Trenton have a slight salary advantage.

Figure 32
Relationship between School Subsidized Lunch rate and % New Teachers (<=3 years) with BA Only



- Unlike Jersey City, Trenton does not appear to have particularly high shares of new teachers with a BA only. In fact, those shares are quite low.

Table 12
Regression analysis of the relationship between certified staff salaries per pupil and school subsidized lunch rates – Camden CBSA

	Camden CBSA				Camden District		
DV=Sal. Per Pupil	*Coef.*	*Std. Err.*	*P>t*		*Coef.*	*Std. Err.*	*P>t*
% Free Lunch	0.327	0.062	*		0.607	0.560	
Year = 2005	0.059	0.007	*		0.124	0.025	*
Year = 2006	0.102	0.008	*		0.144	0.024	*
Schlevel K-8	0.105	0.062	**		(dropped)		
Schlevel Other	-0.287	0.033	*		(dropped)		
Constant	8.324	0.018	*		8.110	0.432	*
R-squared	0.172				0.194		

*p<.05, **p<.10
Estimated with Robust Standard Errors clustered by School ID

- Across schools in the Camden CBSA, schools with higher poverty shares have higher certified staffing expenditures per pupil. The relationship was noisier within Camden.

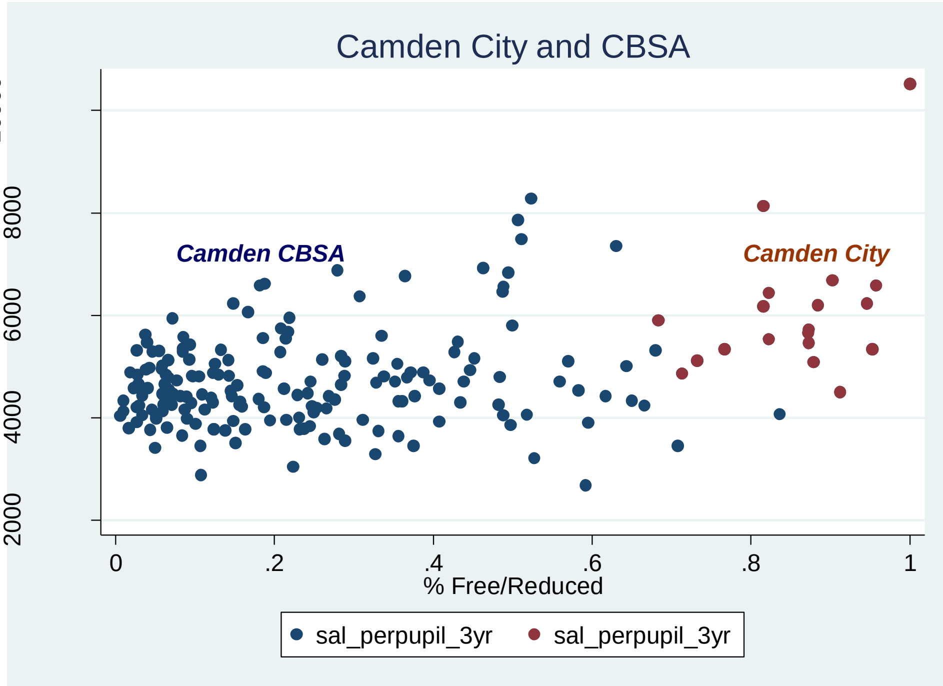
Table 13
Regression analysis of the relationship between school demographics and teacher characteristics – Camden CBSA

	Salary per Pupil				Class Size				Salary Ratio (to Predicted)				% New Teachers with BA Only		
	Coef.	*Std. Err.*	*P>t*		*Coef.*	*Std. Err.*	*P>t*		*Coef.*	*Std. Err.*	*P>t*		*Coef.*	*Std. Err.*	*P>t*
% Free Lunch	0.116	0.126			-0.017	0.068			-0.101	0.028	*		0.113	0.046	*
% LEP/ELL	0.000	0.002			-0.001	0.002			0.002	0.001	*		-0.001	0.001	
% Special Education	0.443	0.147	*		-0.257	0.098	*		-0.006	0.041			-0.097	0.051	**
Camden City	0.166	0.093	**		-0.124	0.055	*		0.027	0.019			-0.079	0.032	*
Schlevel K-8	0.114	0.077			0.088	0.026	*		-0.001	0.011			0.034	0.016	*
Schlevel Other	-0.149	0.093			-0.056	0.065			(dropped)				0.206	0.036	*
Year = 2005	0.047	0.015	*		0.003	0.008			0.006	0.004			0.011	0.005	*
Year = 2006	0.088	0.014	*		0.004	0.008			0.004	0.003			0.012	0.005	*
Constant	8.274	0.031	*		2.957	0.021	*		1.031	0.009	*		0.159	0.012	*
R-squared	0.244				0.203				0.088				0.135		

*p<.05, **p<.10
Estimated with Robust Standard Errors clustered by School ID

- On average, certified staffing expenditures per pupil were marginally higher in Camden schools and class sizes smaller than for other schools in the same labor market, holding poverty levels constant. As in other labor markets, most of the highest poverty schools are concentrated within the single urban core district.

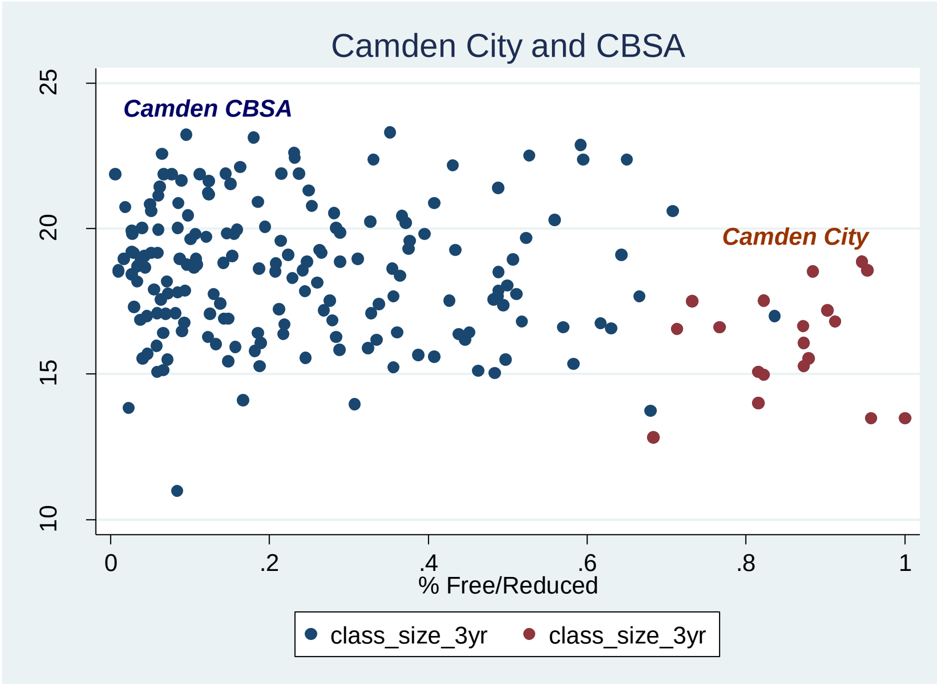
Figure 33
Relationship between School Subsidized Lunch rate and Aggregate Certified Staff Salaries per Pupil



- Certified staff expenditures per pupil are marginally higher in Camden schools than others in the same labor market, though some other schools spend much more.

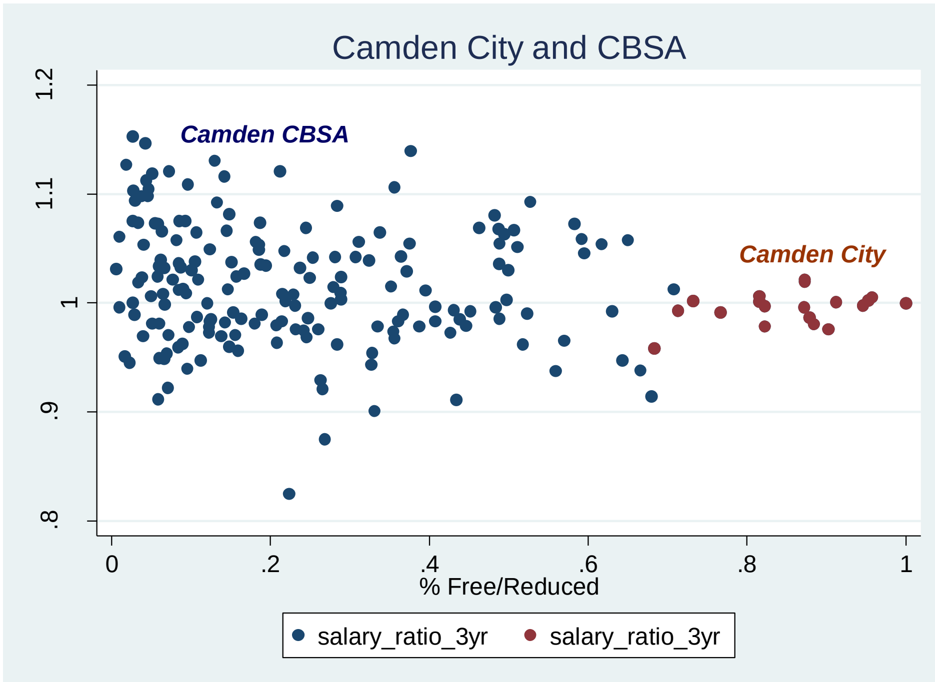
Figure 34

Relationship between School Subsidized Lunch rate and Schoolwide Class Size



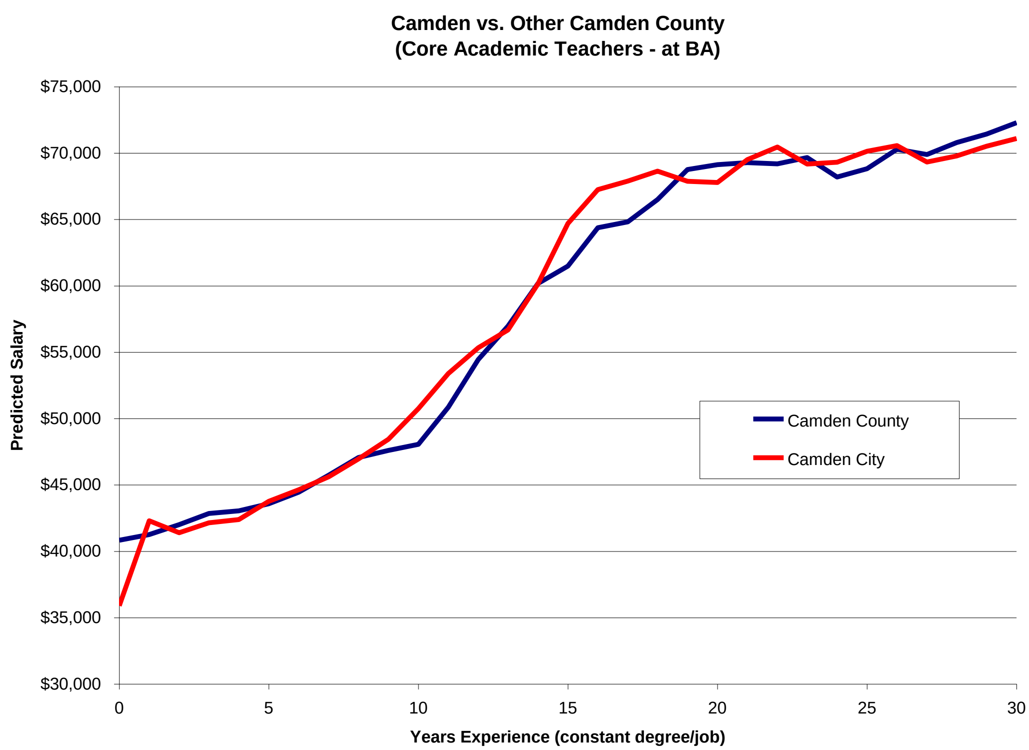
- Schoolwide class sizes are lower in Camden City schools than for many other schools in the Camden CBSA.

Figure 35
Relationship between School Subsidized Lunch rate and *Salary Competitiveness*



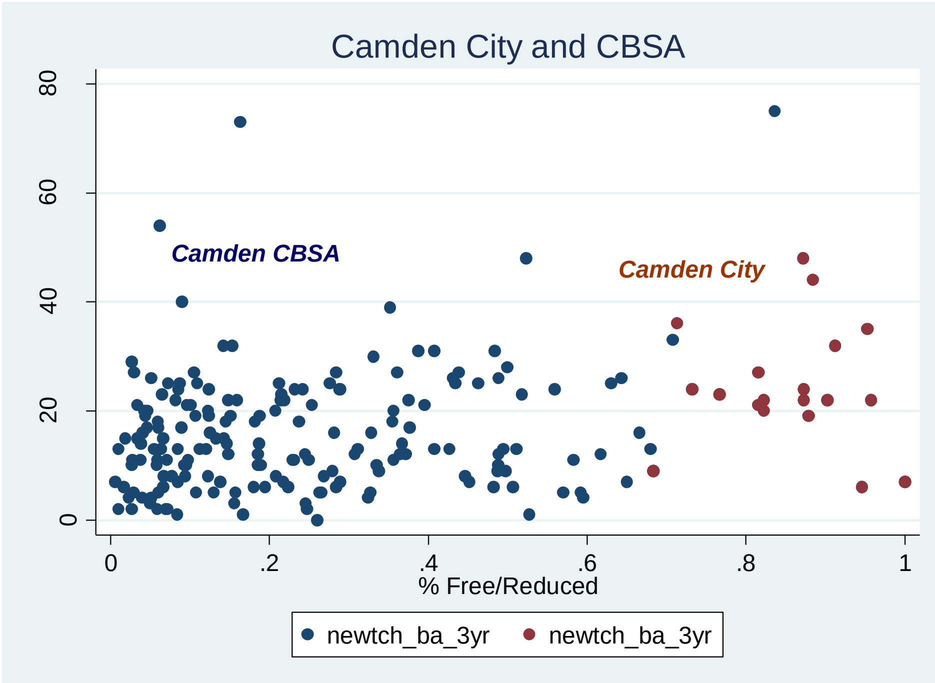
- Relative salaries in Camden City are roughly average compared to schools in the same labor market.

Figure 36
Experience Component of Camden Salaries versus other Camden County



- In Camden City, teacher wage growth with experience, controlling for degree level and among only core academic teachers, is comparable to wage growth with experience in other schools in Camden County.

Figure 37
Relationship between School Subsidized Lunch rate and % New Teachers (<=3 years) with BA Only



- Camden City schools have comparable (perhaps slightly higher) rates of new teachers with a BA only when compared to other schools in the same CBSA.

Table 14
Regression analysis of the relationship between certified staff salaries per pupil and school subsidized lunch rates – Newark CBSA

	Newark CBSA				Newark				Elizabeth		
DV=Sal. Per Pupil	*Coef.*	*Std. Err.*	*P>t*		*Coef.*	*Std. Err.*	*P>t*		*Coef.*	*Std. Err.*	*P>t*
% Free Lunch	0.379	0.042	*		0.824	0.171	*		0.276	0.256	
Year = 2005	0.068	0.007	*		0.286	0.041	*		0.047	0.029	
Year = 2006	0.109	0.008	*		0.327	0.040	*		0.056	0.030	**
Schlevel K-8	0.011	0.059			(dropped)				(dropped)		
Schlevel Other	-0.346	0.396			-0.077	0.049			(dropped)		
Constant	8.395	0.013	*		8.206	0.114	*		8.409	0.173	*
R-squared	0.211				0.288				0.192		

*p<.05, **p<.10
Estimated with Robust Standard Errors clustered by School ID

- In the Newark CBSA, certified staffing expenditures are higher in higher poverty schools and this relationship is even stronger and steeper within Newark than across the labor market.

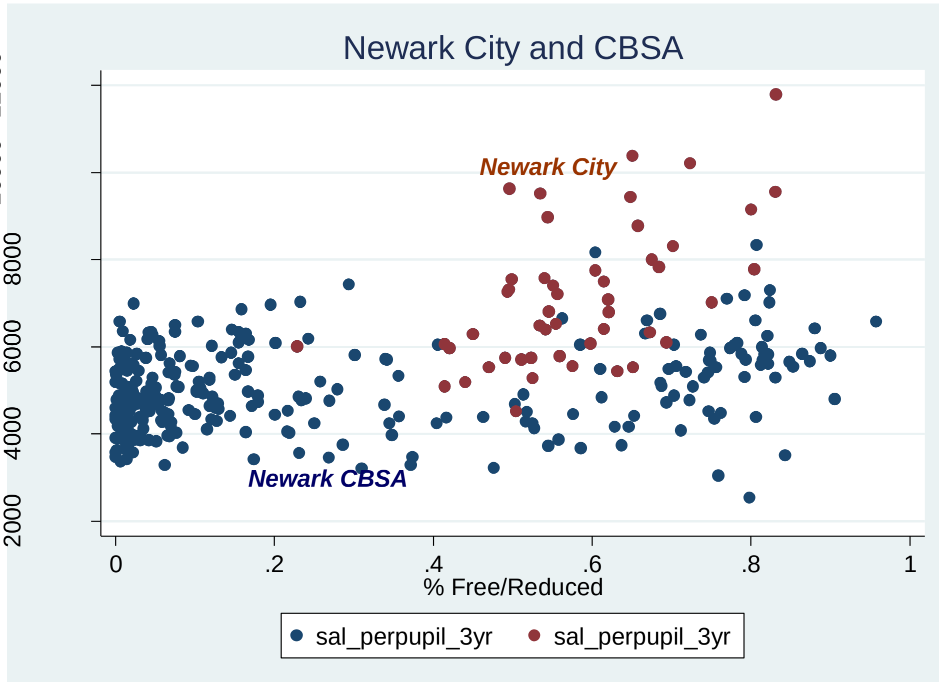
Table 15
Regression analysis of the relationship between school demographics and teacher characteristics – Newark CBSA

	Salary per Pupil			Class Size			Salary Ratio (to Predicted)			% New Teachers with BA Only		
	Coef.	*Std. Err.*	*P>t*	*Coef.*	*Std. Err.*	*P>t*	*Coef.*	*Std. Err.*	*P>t*	*Coef.*	*Std. Err.*	*P>t*
% Free Lunch	0.272	0.035	*	-0.087	0.028	*	-0.033	0.011	*	0.081	0.018	*
% LEP/ELL	-0.001	0.001		0.001	0.001		-0.001	0.000	*	0.000	0.001	
% Special Education	0.631	0.126	*	-0.482	0.085	*	0.010	0.037		-0.026	0.057	
Newark City	0.222	0.032	*	-0.043	0.025	**	0.063	0.004	*	-0.074	0.010	*
Schlevel K-8	0.050	0.045		0.070	0.030	*	-0.032	0.021		-0.011	0.026	
Schlevel Other	-0.351	0.177	*	0.015	0.027		-0.018	0.006	*	0.271	0.151	**
Year = 2005	0.057	0.009	*	0.002	0.005		0.001	0.002		-0.005	0.003	
Year = 2006	0.107	0.010	*	0.001	0.005		0.000	0.002		-0.004	0.003	
Constant	8.300	0.022	*	3.021	0.014	*	0.995	0.006	*	0.172	0.010	*
R-squared	0.381			0.138			0.155			0.137		

*p<.05, **p<.10
Estimated with Robust Standard Errors clustered by School ID

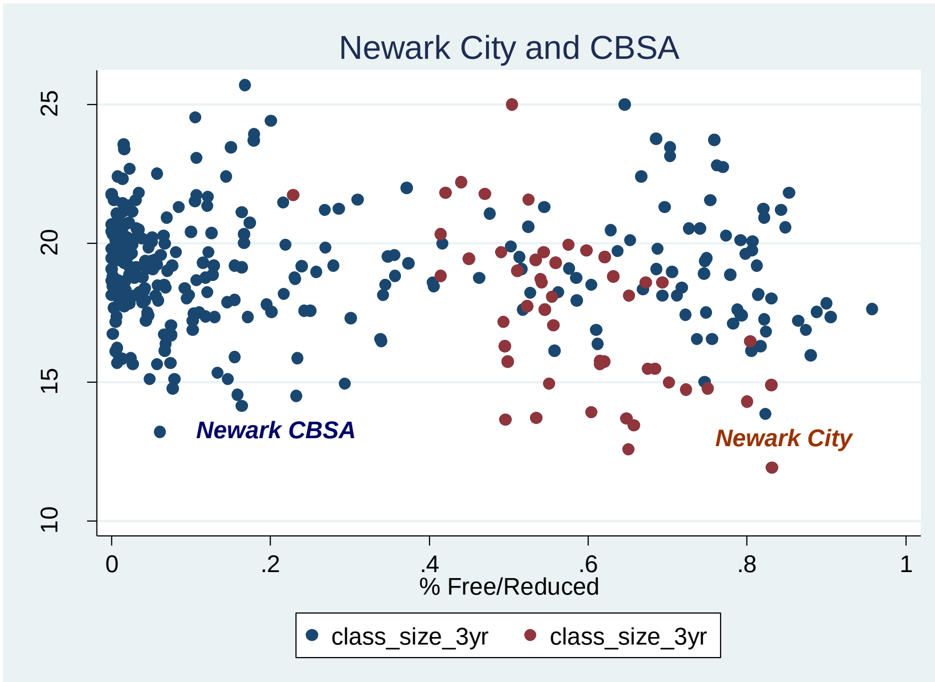
- On average, certified staffing expenditures were higher in Newark than in the CBSA, class sizes were marginally smaller in Newark (controlling for poverty) competitive salaries slightly higher in Newark, but lower on average in higher poverty schools, and the percent of new teachers with a BA only was lower in Newark but higher on average in higher poverty schools.

Figure 38
Relationship between School Subsidized Lunch rate and Aggregate Certified Staff Salaries per Pupil



- Unlike other NJ urban centers, school level certified staffing expenditures per pupil are relatively high in Newark compared to other schools in the same labor market (CBSA). This is especially true when comparing Newark City schools to other high poverty schools in the same labor market.

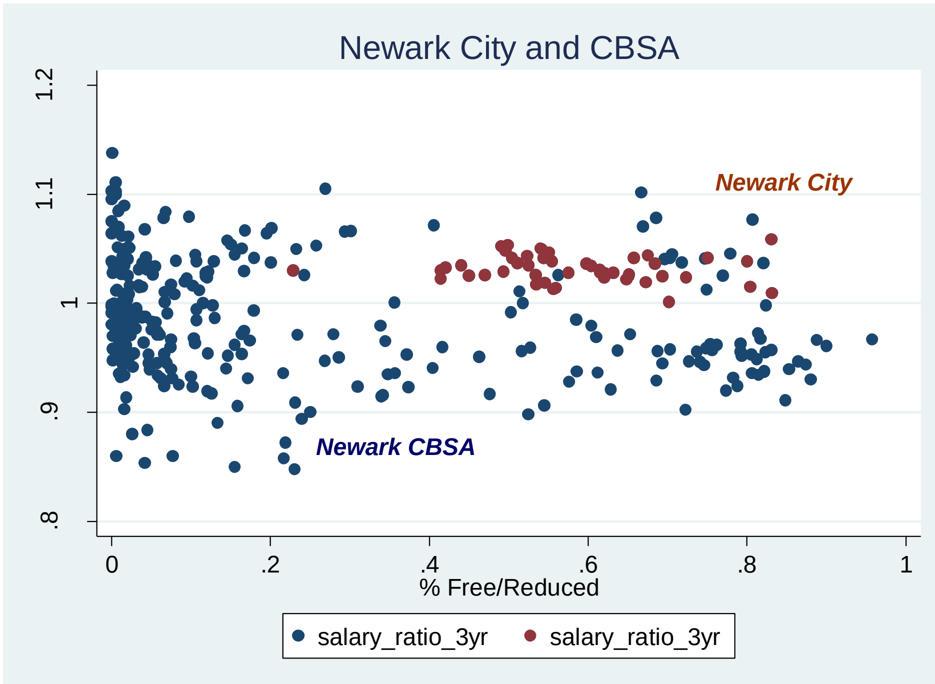
Figure 39
Relationship between School Subsidized Lunch rate and Schoolwide Class Size



- It would appear that Newark City schools have leveraged substantial portions of the additional total funding toward increasing teacher quantity, or decreasing class sizes to average levels much lower than other schools in the same labor market, especially other higher poverty schools in the same labor market.

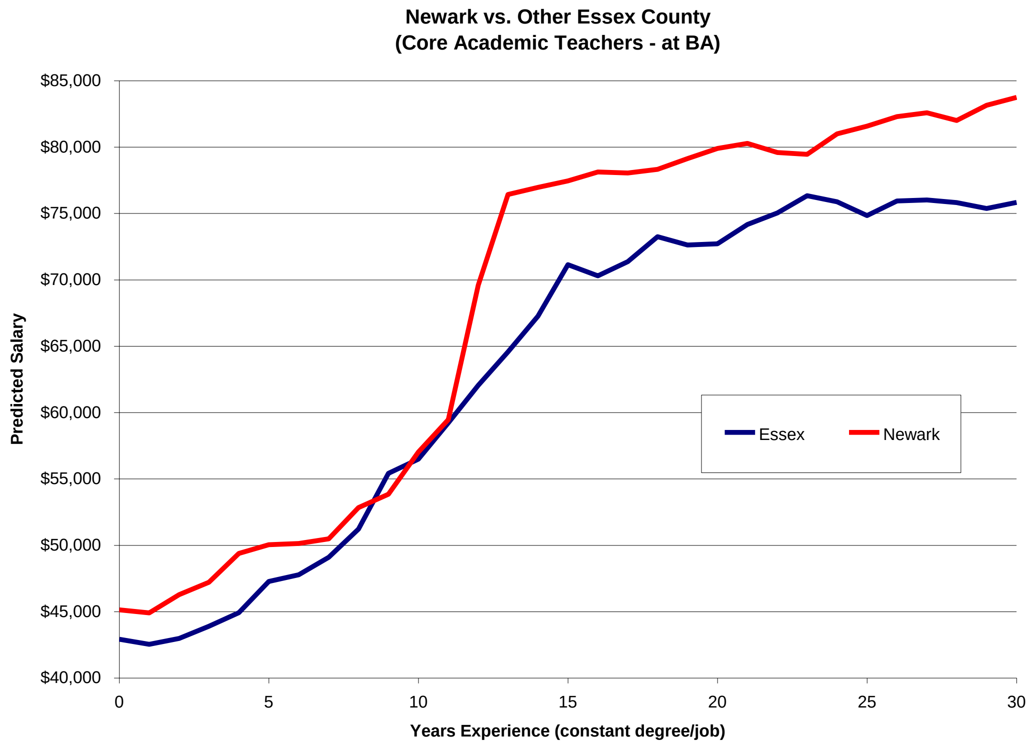
Figure 40

Relationship between School Subsidized Lunch rate and *Salary Competitiveness*



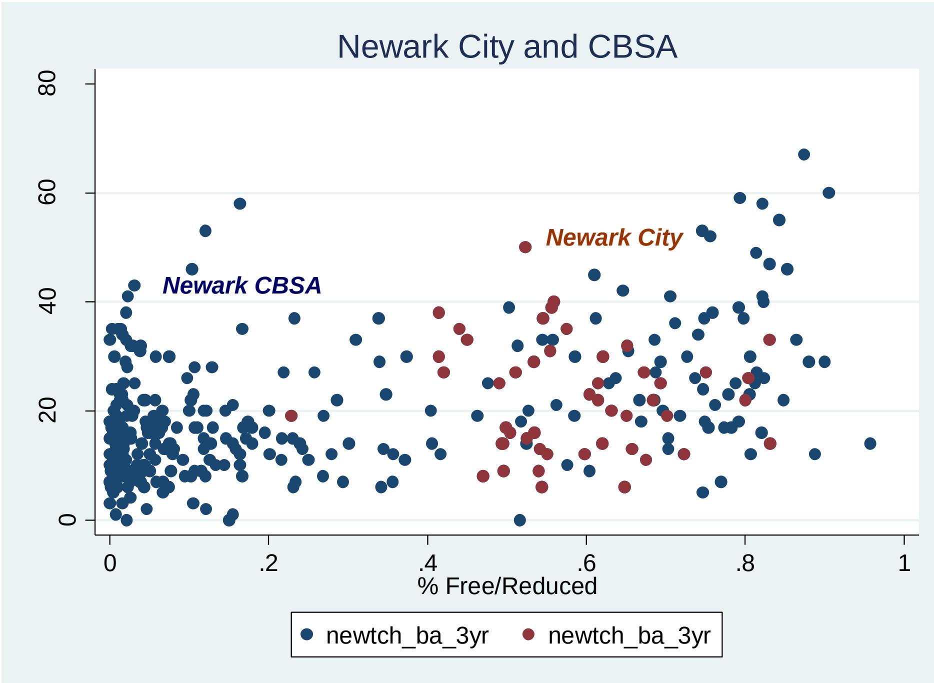
- Corrected salaries in Newark are slightly above the average for the core based statistical area, and are constant across schools by poverty within Newark. Salaries in Newark schools are much higher than corrected salaries in other high poverty schools in the same labor market.

Figure 41
Experience Component of Newark Salaries versus other Essex County



- Isolating the experience component of Newark salaries and salaries for other core academic teachers in Essex county shows that Newark has elevated early career teacher salaries somewhat, but those salaries become less competitive for teachers between 6 and 12 years experience. Salaries in Newark appear substantially *backloaded*, with senior teacher salaries significantly higher in Newark than in other Essex county districts.

Figure 42
Relationship between School Subsidized Lunch rate and % New Teachers (<=3 years) with BA Only



- Newark City schools show no discernable pattern of having higher than usual rates of new teachers with a BA only. However, many other very high poverty (higher than Newark) schools do show very high rates of new teachers with a BA only.

Analysis 6
Statewide mapping of school level distribution of certified staff position codes, 2005-06 and 2006-07

Analysis 6 in this section provides an overview of the distribution of teachers by their primary area of teaching in New Jersey public schools. The goal is to determine how the distribution of teachers by assignment type varies across school and district types. For example, do higher poverty schools and districts have more support staff relative to core instructional staff? Do schools not meeting outcome standards or under greater pressure to meet outcome standards in math and reading have greater numbers of teachers proportionately assigned to these areas? And, do these same schools as a result have fewer teachers proportionately allocated to areas such as physical education, art and music?

Data

For this analysis, we make use of data from the statewide certified staffing files from 2005 -06 and 2006-07. In each year, there are approximately 130 thousand to 150 thousand cases distributed across a variety of job classification codes ranging from building administrative codes to core classroom teachers to various school support staff positions. Table 16 below summarizes the distribution of primary job codes for 2006-07 statewide. Job Codes in Table 1 have been substantially aggregated.

Table 16

Distribution of Certified Staff 2006-07 by Aggregated Primary Assignment Code (JOBCODE1)

Aggregated Main Assignment	Freq.	Percent	Cum.
arts/music teacher	6,849	4.85	**4.85**
bus/tech/family teacher	3,408	2.41	**7.26**
coordinator	460	0.33	**7.58**
director	692	0.49	**8.07**
elementary teacher	38,433	27.19	**35.26**
English teacher*	10,162	7.19	**42.45**
in school suspension	153	0.11	**42.56**
language teacher	4,328	3.06	**45.62**
ld/reading/speech	5,060	3.58	**49.21**
library/media	1,841	1.3	**50.51**
math teacher	6,676	4.72	**55.23**
middle teacher	7,503	5.31	**60.54**
occ/phys/nurse & social work	7,441	5.26	**65.8**
other admin	1,495	1.06	**66.86**
phys ed teacher	6,937	4.91	**71.77**
principal	4,074	2.88	**74.65**
science teacher	4,829	3.42	**78.07**
social studies teacher	4,405	3.12	**81.19**
special education	18,771	13.28	**94.47**
supervisor	2,319	1.64	**96.11**
support services	4,295	3.04	**99.15**
teacher coordinator	121	0.09	**99.23**
vocational teacher	1,085	0.77	**100**
Total	141,337	100	

*includes English as second language and reading/language arts support

Analysis

One goal of this analysis is to provide a baseline and context of staffing distribution across districts and schools of varied types and grade levels to inform our analysis of our 90 focus schools. Our analyses of focus schools will explore in much greater detail, differences in the allocation of staff within and across higher and lower performing elementary, middle and high schools distributed across districts of different types. As such, it is important that we understand how staffing resources are distributed on average, statewide, across districts of different types and schools of different levels.

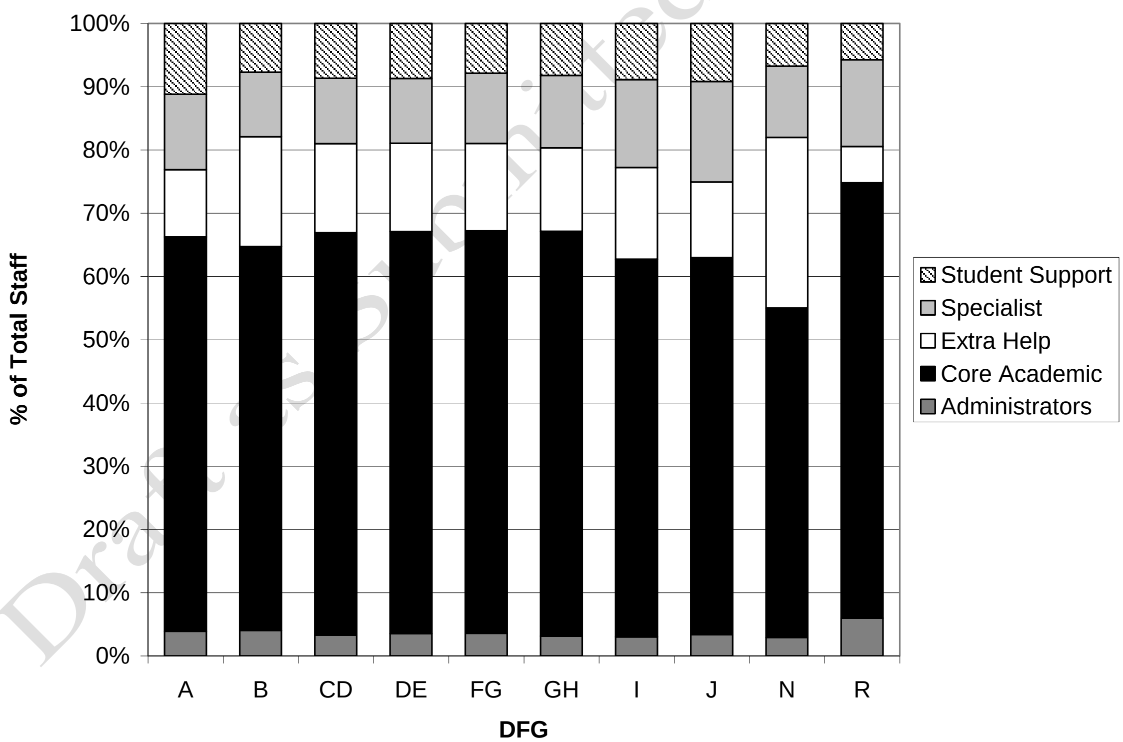
These analyses involve primarily tabulations of major job codes, focusing on each certified staff member's primary job code (Job Code 1). We include tabulations by:

1. School grade level
2. District factor group

In this analysis we map both the **"intensity"** of staffing and the **"distribution"** of staffing. Intensity of staffing is measured in terms of certified staff per 1000 students. For specialized staff, we may also measure the **"targeted intensity"** of staff, or number of certified staff per target student population (e.g. special education staff per special education student). Distribution of staffing is measured in terms of the shares of total certified staff allocated to any single category.

Findings

Figure 43
Shares of Certified Staff Allocated to Aggregate Categories in 2006-07
Elementary Schools*

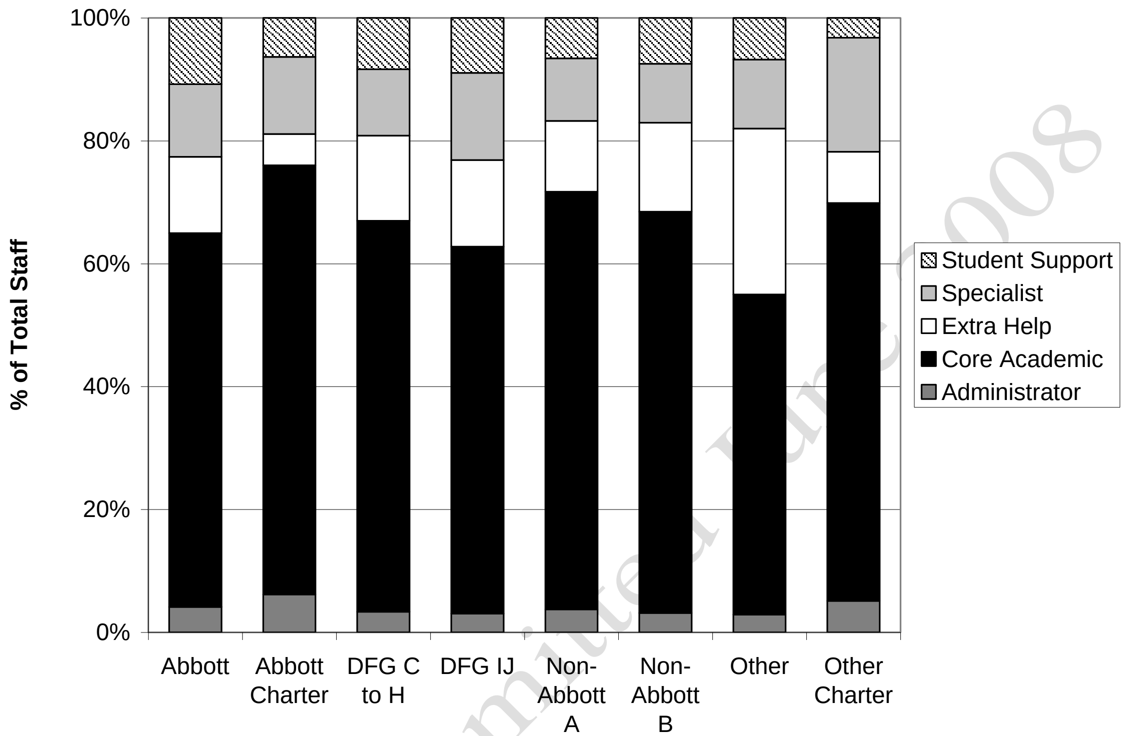


*Schools reporting 4th grade scores 2004 to 2006
Data Source: NJDOE Certificated Staff Status Database 2006 & 2007

- In Elementary schools, rates of specialists increase marginally in higher DFG schools.

- Core academic teachers make up the largest share in charter schools.

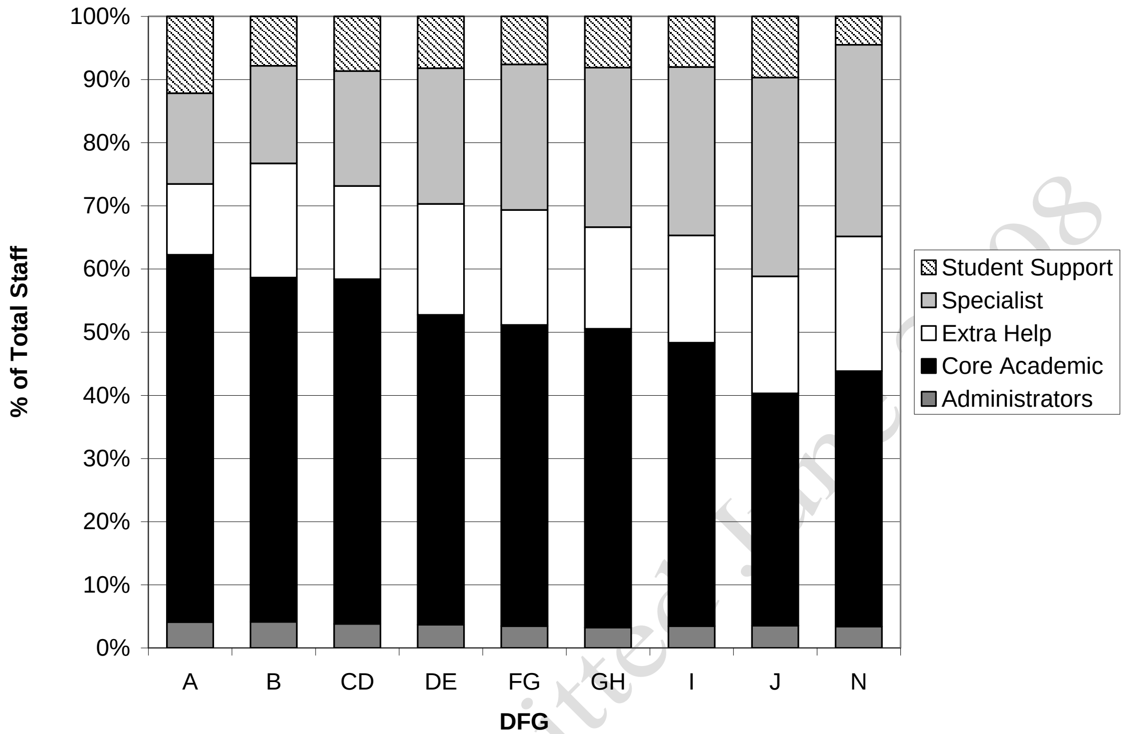
Figure 44
Shares of Certified Staff Allocated to Aggregate Categories in 2006-07
Elementary Schools*



*Schools reporting 4th grade scores 2004 to 2006
Data Source: NJDOE Certificated Staff Status Database 2006 & 2007

- When reorganized into different groupings, if becomes even more apparent that charter schools located in Abbott districts have allocated very high shares of teachers to core academic areas.

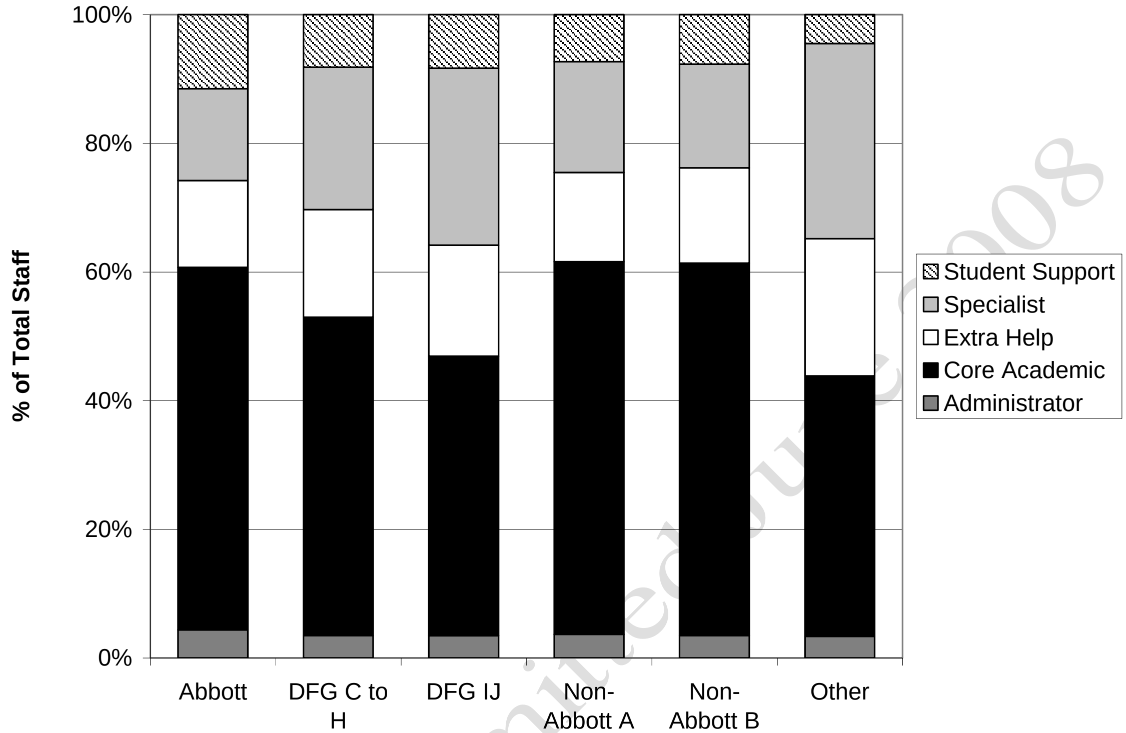
Figure 45
Shares of Certified Staff Allocated to Aggregate Categories in 2006-07
Middle Schools*



*Schools reporting 8th grade scores 2004 to 2006
Data Source: NJDOE Certificated Staff Status Database 2006 & 2007

- At the middle school level (or in schools providing 8th grade assessment data), shares of teachers allocated to core academic areas decline in wealthier factor groups and shares of teachers allocated to specialist (music, art, etc.) increase. This pattern may be indicative of significant equity concerns regarding the availability of co-curricular opportunities in higher poverty schools.

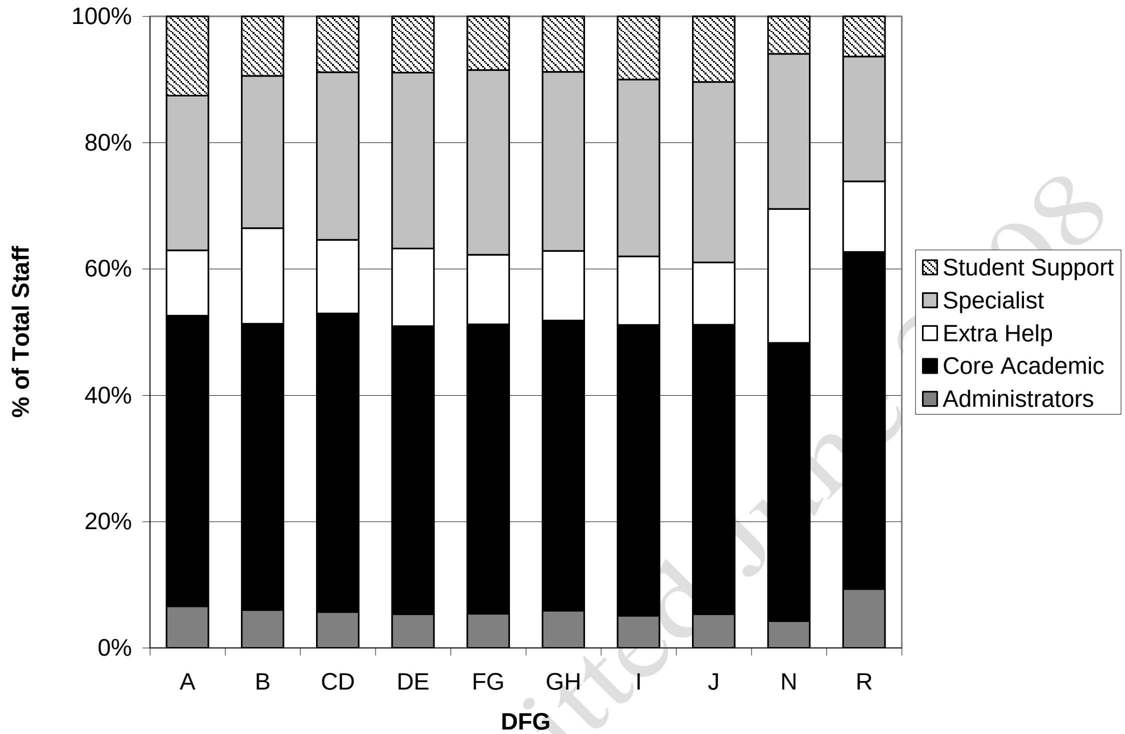
Figure 46
Shares of Certified Staff Allocated to Aggregate Categories in 2006-07
Middle Schools*



*Schools reporting 8th grade scores 2004 to 2006
Data Source: NJDOE Certificated Staff Status Database 2006 & 2007

- Figure 46 reinforces the findings of the previous figure.

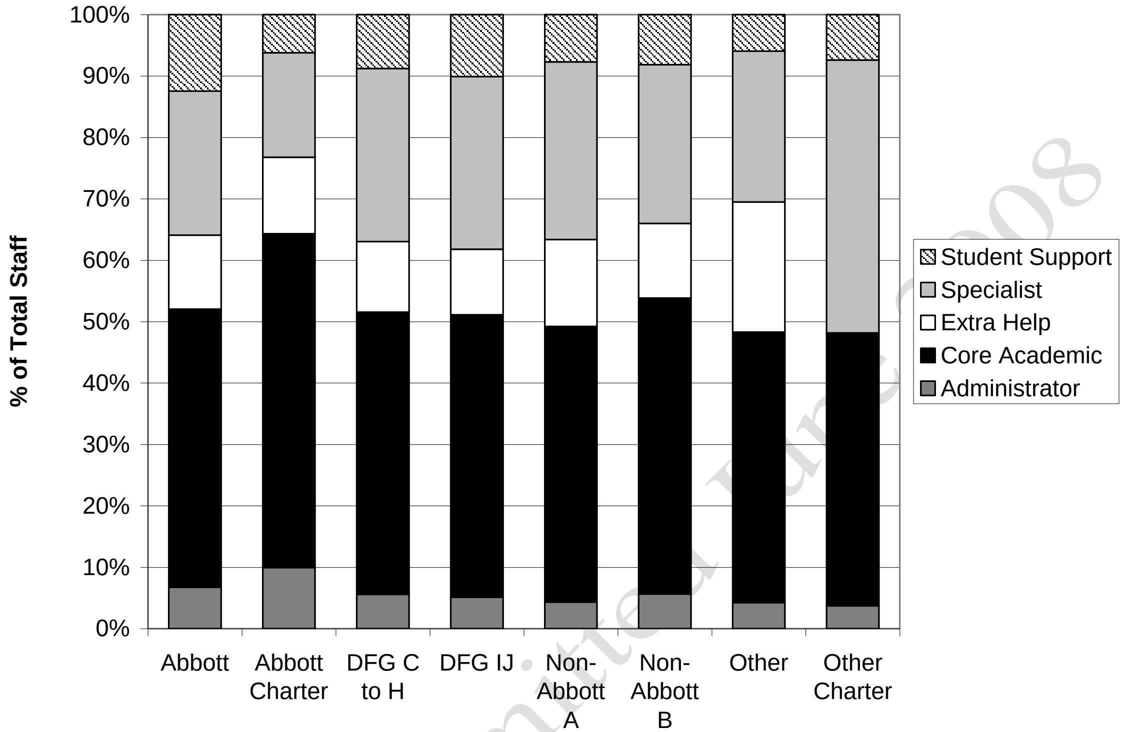
Figure 47
Shares of Certified Staff Allocated to Aggregate Categories in 2006-07
High Schools*



*Schools reporting HSPA scores 2004 to 2006
Data Source: NJDOE Certificated Staff Status Database 2006 & 2007

- At the high school level, Charters again allocated larger shares of teachers to core academic responsibilities. Charters also carry higher administrative staffing overhead.

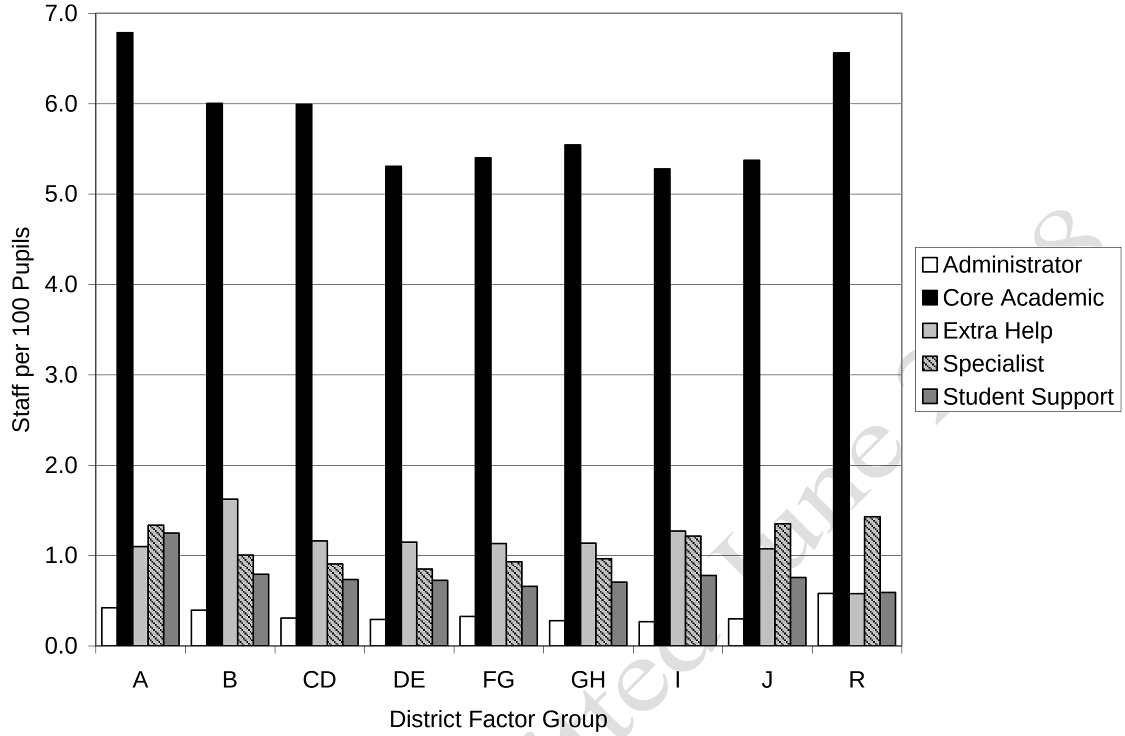
Figure 48
Shares of Certified Staff Allocated to Aggregate Categories in 2006-07
High Schools*



*Schools reporting HSPA scores 2004 to 2006
Data Source: NJDOE Certificated Staff Status Database 2006 & 2007

- Figure 48 confirms findings of the previous figure. Notably, when separate out, charters outside of Abbott districts have much higher shares of specialists and lower shares of core academic teachers. Charters in Abbotts have the highest administrative shares.

Figure 49
Elementary Staff by Aggregate Grouping per 100 Students

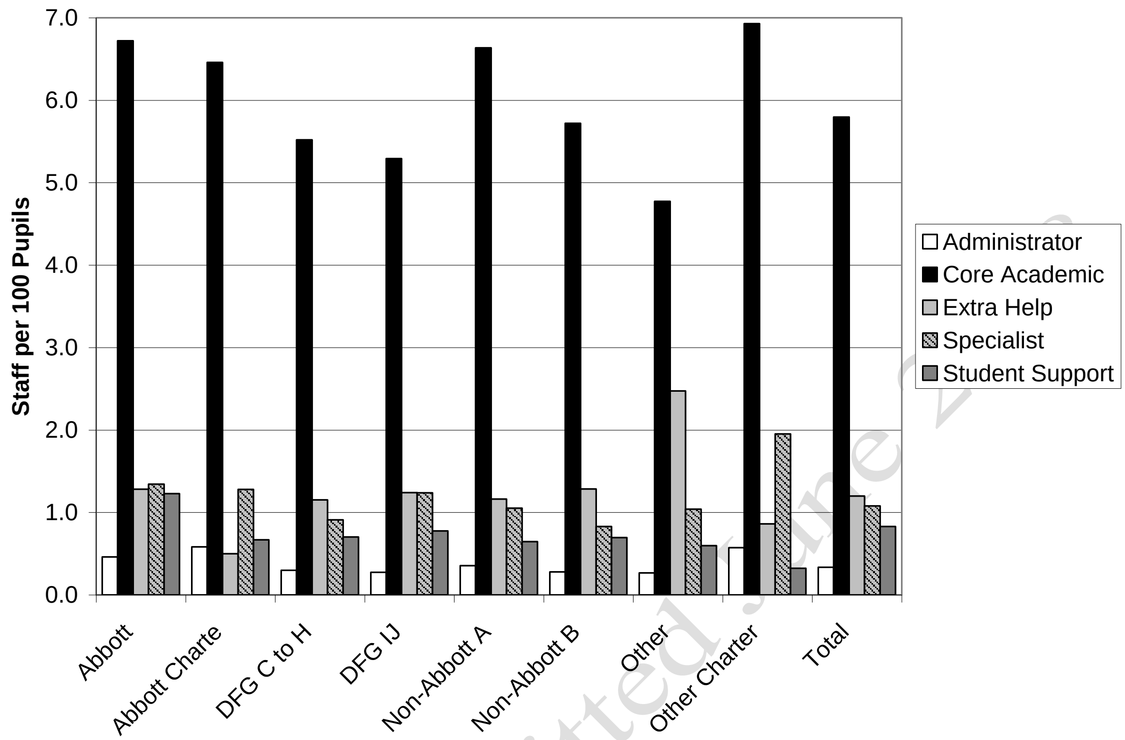


*Schools reporting 4th grade scores 2004 to 2006
Data Source: NJDOE Certificated Staff Status Database 2006 & 2007

- Elementary schools in districts in wealthier factor groups tend to have fewer core academic teachers per pupil (perhaps related to larger class sizes).

Figure 50

Elementary* Staff by Aggregate Grouping per 100 Students

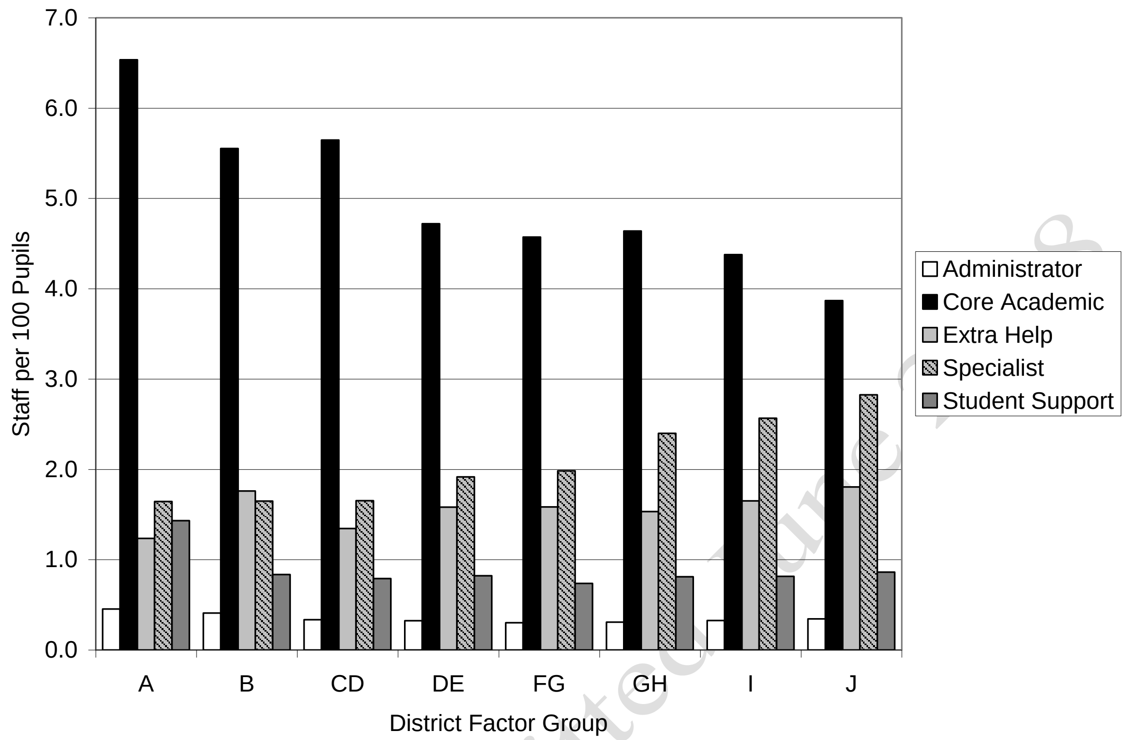


*Schools reporting 4th grade scores 2004 to 2006

Data Source: NJDOE Certificated Staff Status Database 2006 & 2007

- Figure 50 reaffirms the findings of Figure 49.

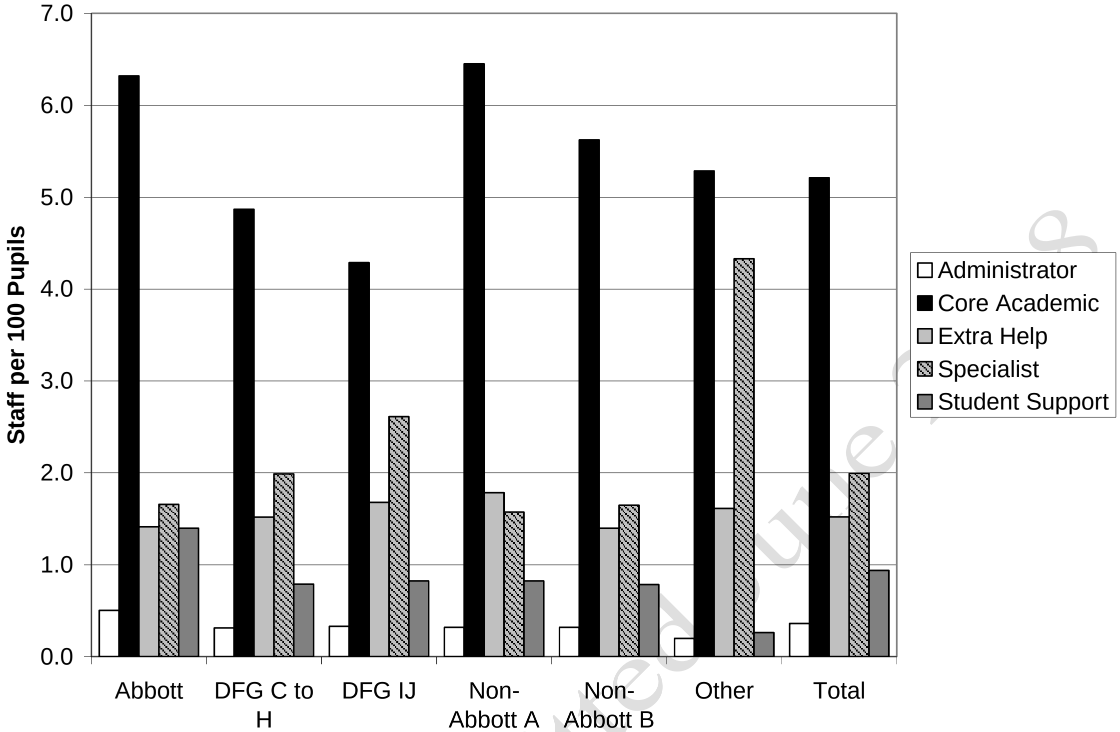
Figure 51
Middle School* Staff by Aggregate Grouping per 100 Students



*Schools reporting 8th grade scores 2004 to 2006
Data Source: NJDOE Certificated Staff Status Database 2006 & 2007

- Middle schools in districts in wealthier factor groups tend to have fewer core academic teachers per pupil (perhaps related to larger class sizes) but have more specialists per pupil.
- Middle schools in poorer factor groups tended to have higher student support shares, but extra help shares were relatively constant, by factor group, and highest in DFG J.

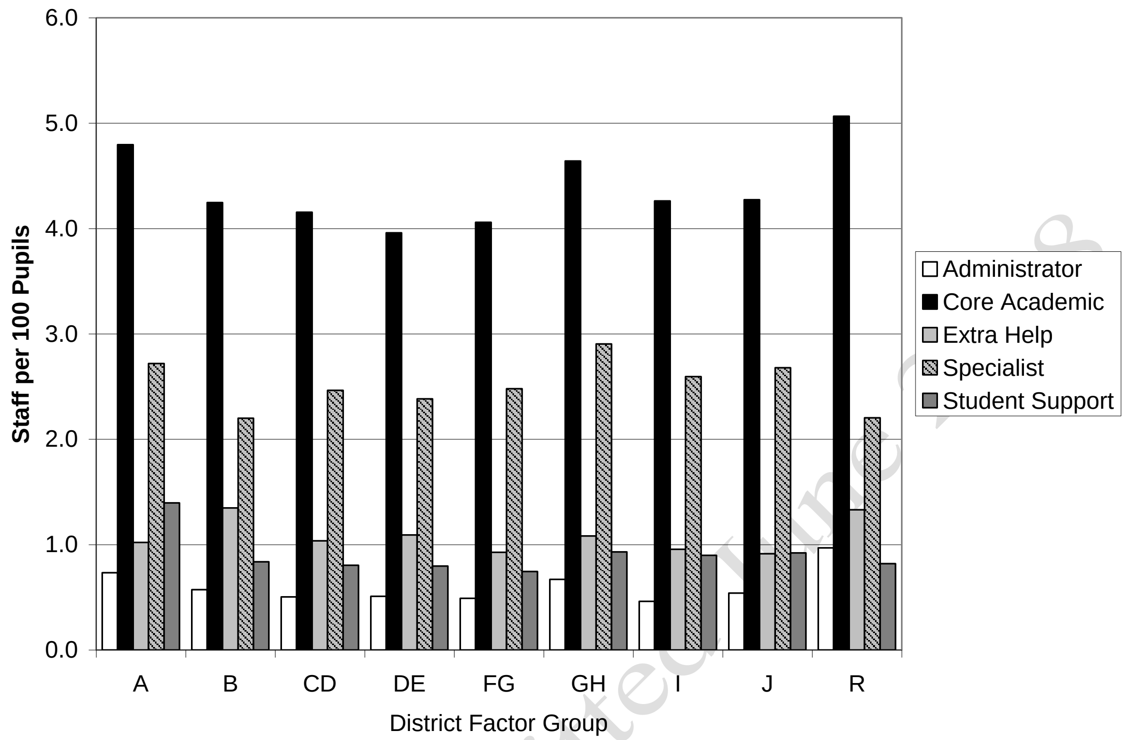
Figure 52
Middle School* Staff by Aggregate Grouping per 100 Students



*Schools reporting 8th grade scores 2004 to 2006
Data Source: NJDOE Certificated Staff Status Database 2006 & 2007

- At the middle level, consistent with the previous figure, schools in DFG IJ appear to have much higher rates of specialist teachers per pupil, but lower rates of core academic teachers. These districts also have higher rates of extra help teachers but less student support.

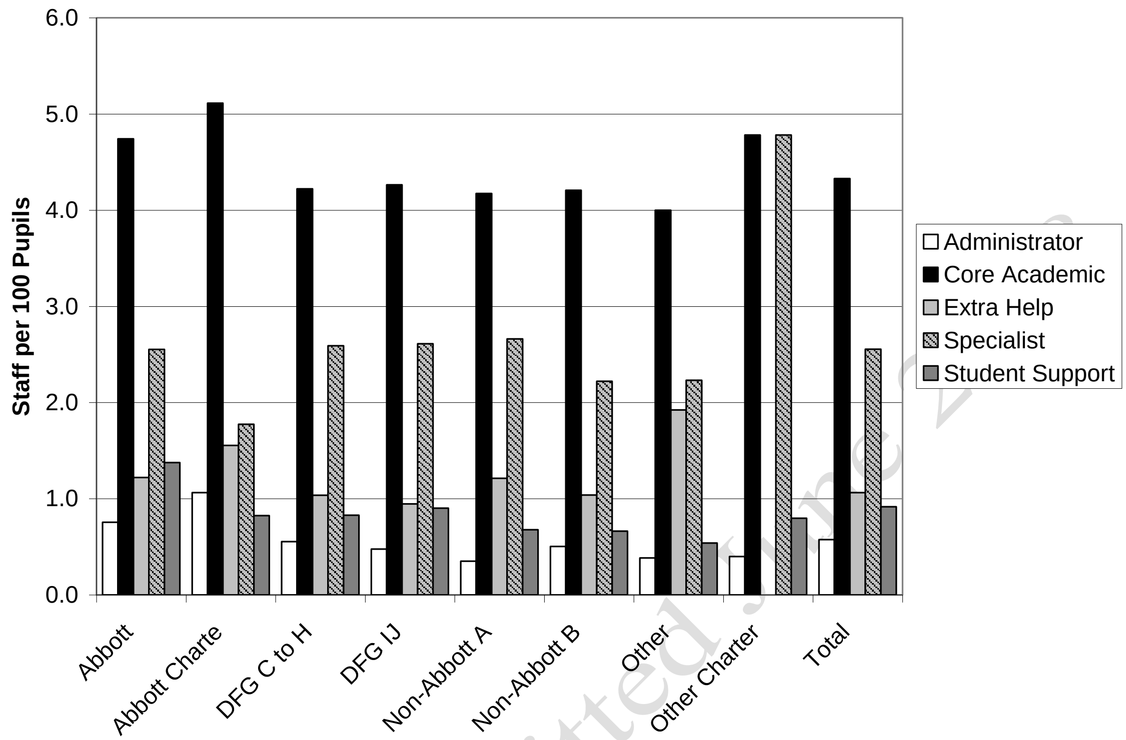
Figure 53
High School* Staff by Aggregate Grouping per 100 Students



*Schools reporting HSPA scores 2004 to 2006
Data Source: NJDOE Certificated Staff Status Database 2006 & 2007

- At the high school level intensity of core academic teachers is highest in DFG A and in charter schools and relatively low in the middle factor groups.
- Concentration of specialists is relatively constant by factor group, with a dip in the middle factor groups.
- DFG A schools have higher rates of student support.

Figure 54
High School* Staff by Aggregate Grouping per 100 Students



*Schools reporting HSPA scores 2004 to 2006
Data Source: NJDOE Certificated Staff Status Database 2006 & 2007

- Figure 54 confirms the findings of Figure 53, revealing especially the high rates of core academic teachers in charters located in Abbott districts.

Analysis 7
School Resources and the Production of Outcomes

Data

This analysis combines data from the original screening models with computed staffing expenditures per pupil, and other measures of the school staff from years 2004 to 2006. Staffing expenditures per pupil and other staffing measures will be computed from the statewide staffing database.

Analysis

Recall that the models used in the screening analysis included only school and district level demographic measures as predictors of school level performance. In this analysis, we test whether aggregated or disaggregated resource measures contribute to explaining differences in student outcomes across schools, controlling for the various student demographic measures.

We use the following school level measures of resources:

1. School aggregated per pupil spending
2. % Novice Teachers with BA
3. Labor Market Relative Salary of Teachers
4. Class size (schoolwide)
5. School Size (enrollment)

With these resource measures, we run the following tests:

(a) $\text{Standardized Residuals}_{\text{screening}} = f(\text{aggregate resources})$

(b) $\text{Standardized Residuals}_{\text{screening}} = f(\text{resource use})$

(c) $\text{Outcomes} = f(\text{aggregate resources, students, school, district})$

(d) $\text{Standardized Residuals}_{\text{production}} = f(\text{resource use})$

(e) $\text{Outcomes} = f(\text{resource use, students, school, district})$

That is, we first test whether our various resource measures (aggregate and resource use measures) explain any portion of the remaining variance from the screening models. That is, might resource differences explain a portion of why a school was identified as a higher or lower than expected performer?

Next, we include resource measures in the screening models directly. In this case, the screening model becomes a school-level production function. In one set of models we include our aggregate resource measure (school aggregated per pupil staffing expenditures) and in other models we include combinations of measures of resource use.

Finally, we evaluate the residuals of our production function models including various resource measures in order to discern which schools remain significant outliers after controlling for differences in resources.

Findings

Table 55 shows the regression models in which the screening model residuals are partially explained as a function of resource measures – Salary Ratio to Expected, Class Size and Share of New Teachers (<=3 years) with a BA only. Table 55 shows that the resource measures explain relatively little of the remaining variations in state assessments after controlling for demographic characteristics. But, the resource measures do explain some variation. Schools where teacher salaries are higher than others at same experience, degree and position in the same labor market, tended to have higher than expected NJASK and GEPA outcomes. And, schools with more novice teachers with only a bachelors degree had lower than expected outcomes.

Table 55
OLS Residuals as a Function of Resource Measures
Unit = School (x 3 years)

	NJASK			GEPA			HSPA		
DV=OLS Standardized Residual [1]	*Coef.*	*Std. Err.*	*P>t*	*Coef.*	*Std. Err.*	*P>t*	*Coef.*	*Std. Err.*	*P>t*
Salary Ratio	0.952	0.270	*	1.131	0.414	*	0.514	0.523	
Class Size	-0.002	0.007		0.012	0.008		0.060	0.012	*
% New Teachers with BA	-0.384	0.214	**	-0.935	0.318	*	-0.898	0.495	**
Enrollment (ln)	-0.166	0.040	*	-0.113	0.049	*	-0.382	0.058	*
Year=2005	-0.003	0.039		-0.003	0.056		0.004	0.071	
Year=2006	-0.002	0.039		-0.003	0.056		0.010	0.071	
Constant	0.170	0.346		-0.471	0.471		1.080	0.607	**
R-squared	0.010			0.013			0.055		
[1] residual from screening models									

*p<.05, **p<.10, estimated with robust standard errors

Table 56 shows that when we add the aggregate certified staffing salaries per pupil measure, and a regional cost adjustment measure into the screening model, aggregate salaries per pupil are positively associated with GEPA and HSPA outcomes. That is, schools with higher per pupil staffing budgets have higher GEPA and HSPA outcomes. These staffing budgets may be higher due to teacher experience distributions, higher salaries or increased teacher quantity.

Table 56
Math/Language Scores as a Function of Aggregate Resources & Screening Model Factors
Unit = School (x 3 years)

	NJASK			GEPA			HSPA		
DV=Math/Language Total (ln)	*Coef.*	*Std. Err.*	*P>t*	*Coef.*	*Std. Err.*	*P>t*	*Coef.*	*Std. Err.*	*P>t*
Salary per Pupil (ln)	-0.001	0.003		0.017	0.004	*	-0.005	0.006	
NCES ECWI 2005	0.001	0.007		-0.008	0.009		-0.035	0.014	*
% Free/Reduced (3yr)	-0.086	0.004	*	-0.103	0.005	*	-0.053	0.011	*
% Special Education (3yr)	-0.122	0.012	*	-0.172	0.015	*	-0.234	0.022	*
% LEP/ELL (3yr)	-0.022	0.009	*	-0.065	0.015	*	-0.368	0.035	*
% Asian (3yr)	0.025	0.007	*	0.027	0.011	*	0.085	0.015	*
% Black (3yr)	-0.055	0.003	*	-0.096	0.004	*	-0.132	0.007	*
Urban x Free Lunch	-0.018	0.004	*	-0.039	0.005	*	-0.013	0.011	
% Female Adults with Graduate Degree	0.162	0.016	*	0.226	0.021	*	0.274	0.028	*
Elem/Middle				0.011	0.002	*			
Middle/High				-0.016	0.003	*			
DFG I&J	0.006	0.002	*	0.013	0.003	*	0.022	0.004	*
Enrollment (ln)	-0.007	0.001	*	-0.001	0.002		-0.010	0.002	*
Year=2005	0.012	0.001	*	-0.001	0.002		0.018	0.003	*
Year=2006	0.017	0.001	*	0.006	0.002	*	0.019	0.003	*
Constant	6.168	0.028	*	5.974	0.038	*	6.272	0.055	*
R-squared	0.640			0.821			0.788		

*p<.05, **p<.10, estimated with robust standard errors

Table 57 evaluates whether more specific resource allocation measures – salary ratio, class size (teacher quantity) or teacher experience and degree level explain remaining variation in outcomes, after including the overall resource measure. Again, the relative competitiveness of salaries appears important at the elementary level. The most consistent finding is that schools with higher percentages of new teachers with a BA only, have consistently lower outcomes, at constant demographics and spending.

Table 57
OLS Residuals of Model Including Aggregate Resources as a Function of Resource Measures
Unit = School (x 3 years)

	NJASK			GEPA			HSPA		
DV=OLS Residual for Model with Resources	*Coef.*	*Std. Err.*	*P>t*	*Coef.*	*Std. Err.*	*P>t*	*Coef.*	*Std. Err.*	*P>t*
Salary Ratio	0.965	0.271	*	0.719	0.415	**	0.336	0.532	
Class Size	-0.003	0.007		0.021	0.008	*	0.057	0.012	*
% New Teachers with BA	-0.425	0.214	*	-0.690	0.319	*	-1.087	0.504	*
Enrollment (ln)	0.003	0.040		-0.059	0.049		-0.157	0.059	*
Year=2005	-0.001	0.039		-0.001	0.056		-0.004	0.072	
Year=2006	0.000	0.039		-0.002	0.056		0.002	0.072	
Constant	-0.841	0.347	*	-0.631	0.472		-0.194	0.618	
R-squared	0.005			0.008			0.031		

*p<.05, **p<.10, estimated with robust standard errors

Table 58 merely confirms, by alternative specification, the findings in Table 57. When resource use measures are added to the original screening models, schools with more competitive salaries and fewer new teachers with a BA only, have higher math and language arts outcomes.

Table 58
Math/Language Scores as a Function of Resource Measures & Screening Model Factors
Unit = School (x 3 years)

	NJASK			GEPA			HSPA		
DV=Math/Language Total (ln)	*Coef.*	*Std. Err.*	*P>t*	*Coef.*	*Std. Err.*	*P>t*	*Coef.*	*Std. Err.*	*P>t*
Salary Ratio	0.042	0.011	*	0.044	0.015	*	0.020	0.020	
Class Size	0.000	0.000		0.000	0.000		0.002	0.000	*
% New Teachers with BA	-0.018	0.008	*	-0.038	0.011	*	-0.051	0.017	*
% Free/Reduced (3yr)	-0.080	0.004	*	-0.094	0.005	*	-0.035	0.010	*
% Special Education (3yr)	-0.119	0.012	*	-0.156	0.014	*	-0.183	0.020	*
% LEP/ELL (3yr)	-0.042	0.010	*	-0.068	0.015	*	-0.521	0.034	*
% Asian (3yr)	0.025	0.007	*	0.031	0.011	*	0.077	0.014	*
% Black (3yr)	-0.059	0.004	*	-0.096	0.005	*	-0.135	0.007	*
Urban x Free Lunch	-0.024	0.004	*	-0.041	0.005	*	-0.059	0.012	*
% Female Adults with Graduate Degree	0.158	0.016	*	0.231	0.021	*	0.289	0.025	*
Elem/Middle				0.011	0.002	*			
Middle/High				-0.012	0.003	*			
DFG I&J	0.005	0.002	*	0.013	0.003	*	0.014	0.003	*
Enrollment (ln)	-0.006	0.002	*	-0.004	0.002	*	-0.012	0.002	*
Year=2005	0.012	0.001	*	0.000	0.002		0.018	0.002	*
Year=2006	0.017	0.001	*	0.007	0.002	*	0.018	0.002	*
Constant	6.124	0.014	*	6.077	0.017	*	6.138	0.022	*
R-squared	0.644			0.822			0.831		

*p<.05, **p<.10, estimated with robust standard errors

Table 59 presents one final shot at the same question, comparing schools that had performance levels more than 1 standard deviation above predicted levels (given demographics) and schools that were 1 standard deviation below predicted levels. The model is a logistic regression, estimating the odds associated with being in the high performer group. Including only these extreme subsets, the influence of relative salary is negated. But, schools with higher shares of novice teachers with a BA only, are much less likely to be in the high performer group. Larger schools are also less likely to be in the higher performer group.

Table 59
Logisitic regression of high/low (>1stev) residual schools (high = 1, low = 0) as a function of resource measures

	NJASK			GEPA			HSPA		
DV High Performer (vs. Low)	*Odds Ratio*	*Std. Err.*	*P>z*	*Odds Ratio*	*Std. Err.*	*P>z*	*Odds Ratio*	*Std. Err.*	*P>z*
Salary Ratio	4.508	5.305		11.277	19.907		1.665	6.711	
Class Size	1.008	0.028		1.040	0.035		1.274	0.113	*
% New Teachers with BA	0.240	0.202	**	0.077	0.097	*	0.000	0.000	*
Enrollment (ln)	0.557	0.085	*	0.705	0.132	**	0.251	0.094	*
Year=2005	1.027	0.163		0.864	0.201		0.624	0.311	
Year=2006	1.093	0.177		0.751	0.166		1.438	0.698	

*p<.05, **p<.10, estimated with robust standard errors

Analysis 8
District Resources and the Production of Outcomes

Data

Our district level resource and production analyses use a 4 year panel of 549 public school districts. Of those, 436 districts are used in a model of the production of 4th and 8th grade outcomes on reading and math assessments, and 216 districts are used in a model of the production of outcomes across all grade levels.

Analysis

For this set of analyses, we address three questions:

Question 1 – Are district aggregate resources associated with variation in outcomes at the district aggregate level?

First, we evaluate at the district level with our 436 and 216 district panels whether district aggregate financial resource measures (expenditures per pupil) are positively associated with district aggregate measures of student outcomes, applying a relatively conventional district level education production function.

$$\mathbf{Outcomes_d = f(Expenditure_d, Students_d, District_d, Location_d)}$$

Where outcomes are district average math and reading outcomes for grades 4 and 8 (436 district panel) or all grades (216 district panel). Expenditures are the current annual operating expenditures per pupil, students include a variety of student economic and demographic measures, district includes a variety of district factors including district size and population density, and location includes a dummy variable (fixed effect) for labor market or core based statistical area, such that districts are compared on outcomes among those districts in their same labor market.

Findings

Table 60 displays the regression model output for our school district level production functions for 4th and 8th grade outcomes, and for all grades outcomes. In short, the models show that on average, after accounting for school district demography and major cost factor such as competitive wages (Education Comparable Wage Index, ECWI) and economies of scale, district level resources are positively associated with outcomes. That is, districts that spend more, on average have higher test scores. Note that this finding is consistent with the literature reviewed herein. A potential shortcoming of this finding is that the finding is susceptible to aggregation bias – that the averaging of fiscal resource measures and outcome measure to the district level may in fact overstate the clarity and magnitude of the relationship between money and outcomes (Hanushek, Rivken and Taylor, 19989). Table 60 also appears to show that smaller school districts appear to perform less well than district with greater than 2,000 students.

Table 60

OLS Production Functions of Math/Language Scores

	4th & 8th Grade			All Grades		
DV = Math/Language Scores	*Coef.*	*Std. Err.*	*P>t*	*Coef.*	*Std. Err.*	*P>t*
Total Current Expend per Pupil (ln)	**0.127**	**0.026**	*****	**0.131**	**0.034**	*****
Student Population						
% Disability	-0.505	0.099	*	-0.631	0.132	*
% Free Lunch	-0.644	0.094	*	-0.628	0.100	*
% Black	-0.218	0.051	*	-0.265	0.045	*
Black x Poverty	-1.125	0.373	*	-0.933	0.241	*
% Hispanic	-0.017	0.095		0.077	0.089	
% Asian	0.045	0.070		0.149	0.066	*
% Home Lange English	0.069	0.072		0.199	0.069	*
Region/Location/Size						
NCES ECWI	0.218	0.054	*	0.178	0.066	*
Enrollment 100 to 299	-0.044	0.019	*	(dropped)		
Enrollment 300 to 499	-0.048	0.017	*	(dropped)		
Enrollment 500 to 799	-0.057	0.013	*	-0.108	0.022	*
Enrollment 800 to 1199	-0.037	0.010	*	-0.029	0.013	*
Enrollment 1200 to 1499	-0.044	0.021	*	-0.020	0.016	
Enrollment 1500 to 1999	-0.023	0.010	*	-0.020	0.009	*
Enrollment over 2000 (Base Comparison)						
Elementary Grades Only	0.063	0.009	*	(dropped)		
Year						
Year=2003	0.007	0.002	*	0.010	0.002	*
Year=2004	0.002	0.005		0.012	0.006	*
Year=2005	0.007	0.008		0.025	0.009	*
Constant	-1.593	0.266	*	-1.668	0.320	*
R-squared	0.864			0.917		

*p<.05, **p<.10, estimated with robust standard errors

Table 61 takes an alternative approach to the 4 year panel of data. In Table 60 we are asking whether districts that have more resources, and/or different characteristics, achieve more or less than other districts. The findings in Table 60 are largely cross-sectional, averaged across years. They are differences across districts. Table 61 evaluates whether changes in district characteristics are associated with changes in student outcomes, over a relatively short window of time. Due to the short time window, causal effects are somewhat suspect. Nonetheless, Table 61 shows that districts where resource levels increased, also saw increases in all grades performance. The same effect was not there for 4th and 8th grade outcomes. This difference in finding may be a result of difference in the sample of districts, where the sample of districts with all grades outcomes are all unified K-12 districts, but the broader sample includes many elementary districts which may respond differently to resource changes.

Table 61
Fixed Effects Regression (xtreg) Production Functions 2003 - 2005

	4th & 8th Grade			All Grades		
DV = Math/Language Scores	*Coef.*	*Std. Err.*	*P>t*	*Coef.*	*Std. Err.*	*P>t*
Total Current Expend per Pupil (ln)	0.023	0.027		0.077	0.031	*
Students						
% Disability	0.024	0.030		-0.017	0.042	
% Free Lunch	0.247	0.084	*	0.258	0.100	*
% Hispanic	0.025	0.096		0.307	0.125	*
% Black	-0.486	0.130	*	-0.189	0.150	
Black x Poverty	-0.200	0.206		-0.420	0.205	*
% Asian	-0.410	0.153	*	-0.352	0.173	*
Region/Location/Size						
NCES ECWI	0.344	0.042	*	0.375	0.054	*
Enrollment 100 to 299	0.079	0.021	*	(dropped)		
Enrollment 300 to 499	0.104	0.025	*	(dropped)		
Enrollment 500 to 799	0.073	0.025	*	0.004	0.041	
Enrollment 800 to 1199	0.082	0.024	*	0.046	0.033	
Enrollment 1200 to 1499	0.057	0.021	*	0.047	0.022	*
Enrollment 1500 to 1999	0.033	0.016	*	0.027	0.013	*
Constant	-0.978	0.218	*	-1.575	0.266	*
R-squared						
Within	0.343			0.594		
Between	0.181			0.005		
Overall	0.186			0.002		

*p<.05, **p<.10, estimated with robust standard errors

Question 2 – Are resource allocation measures associated with variation in outcomes at the district aggregate level?

Next, we insert into the district level production function model, a handful of district level resource allocation measures, including those explored in the district level financial resource allocation section of this report.

1. % allocated to classroom instruction
2. % allocated to classroom salaries
3. % allocated to support services

In our models of district level resource allocation, we retain our measure of current operating expenditures per pupil.

$$\textbf{Outcomes}_d = \textbf{f}(\textbf{Expenditure}_d, \textbf{Allocation}_d, \textbf{Students}_d, \textbf{District}_d, \textbf{Location}_d)$$

The goal in this model is to discern whether, at current spending levels, the differentiation of spending across broad categories as reported in the comparative spending guide, is associated with differences in performance outcomes.

Findings

Several alternative regression models were run, substituting percentages of resource allocated to various broad function areas, such as classroom instruction, student support and other Comparative Spending Guide categories, but in the end, none of these measures of resource allocation displayed systematic relationships to student outcomes either in cross-sectional and random effects models, or over time and fixed effects models.

Question 3 – Which districts are significant outliers from the statewide production function?

As in previous analyses in this section, we explore those districts which appear to have higher and lower than expected outcomes, given their students, other external conditions and current spending levels. The following series of figures illustrate the distribution of school districts, in different categories, that achieved outcomes higher and/or lower than expected. Note that "expectation" is based on the available data including the precision and accuracy of that data for characterizing the districts in question. So, there may be any number of reasons aside from actual effectiveness or efficiency, for why these districts spread out as they do.

Figure 55 shows the relationship between the production function residuals for 4th and 8th grade and the production function residuals for all grades (as such, elementary districts are excluded. Districts with positive residuals are those where actual performance levels on math and language arts are higher than were predicted. Districts in DFG A are highlighted in Red and labeled by name in order to display how these economically disadvantaged districts spread across the entire continuum of residuals. Like districts in any other DFG, some do very well, some do less well, and most are clustered near the middle. Union City appears to significantly outperform expectations and Trenton appears to underperform expectations.

Figure 55
Production Function Residuals (all grades and 4th & 8th only)
DFG A in Red (K-12 Unified Only)

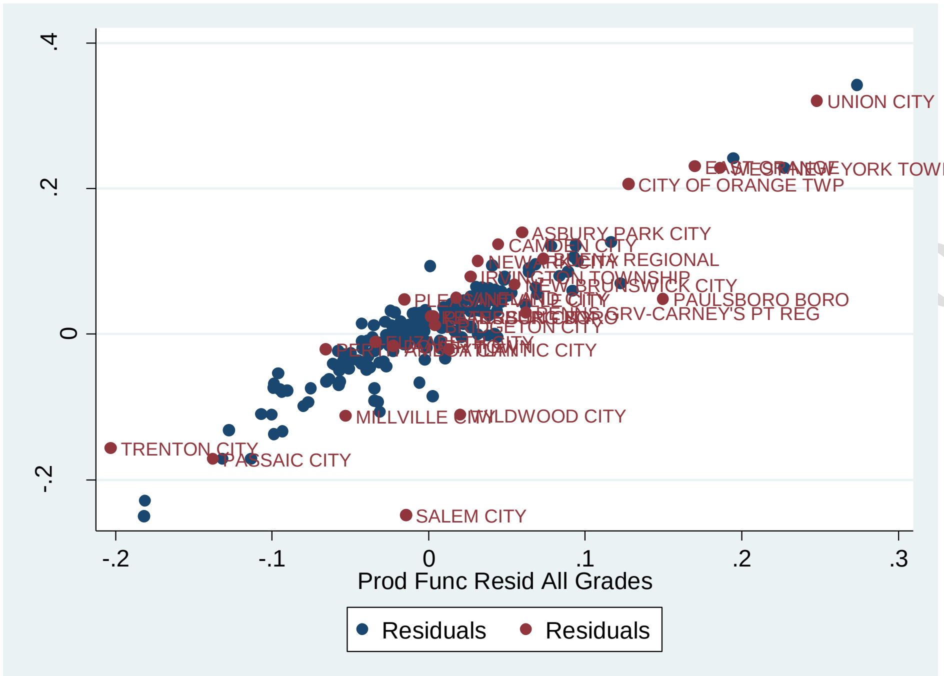


Figure 56 shows the distribution of the relatively small subset of DFG J districts which offer grades K-12. These districts distribute across the middle of the pack, but do vary with Glen Rock appearing to do less well, though only marginally so.

Figure 56

Production Function Residuals (all grades and 4th & 8th only)

DFG J in Red (K-12 Unified Only)

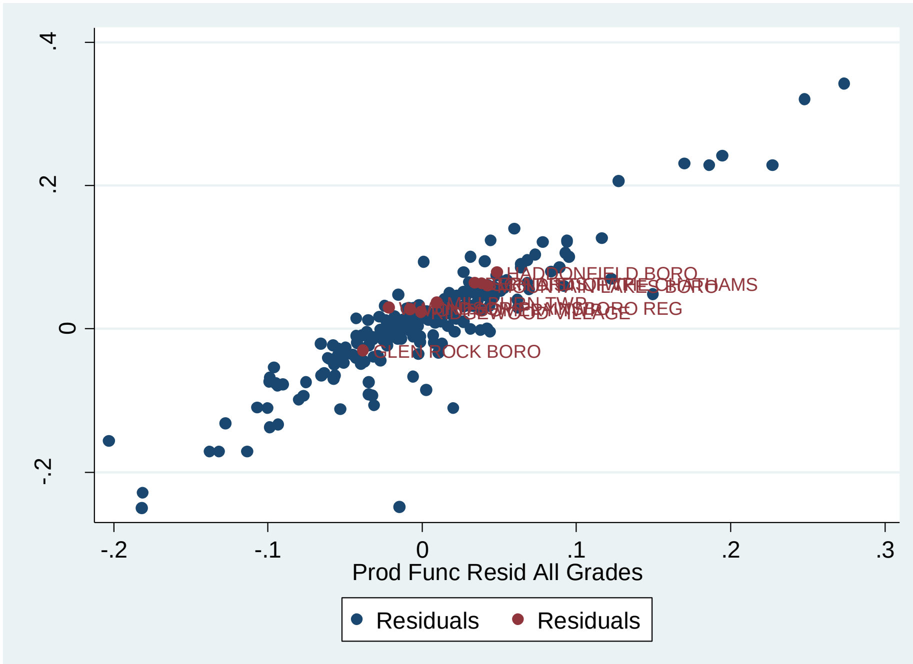
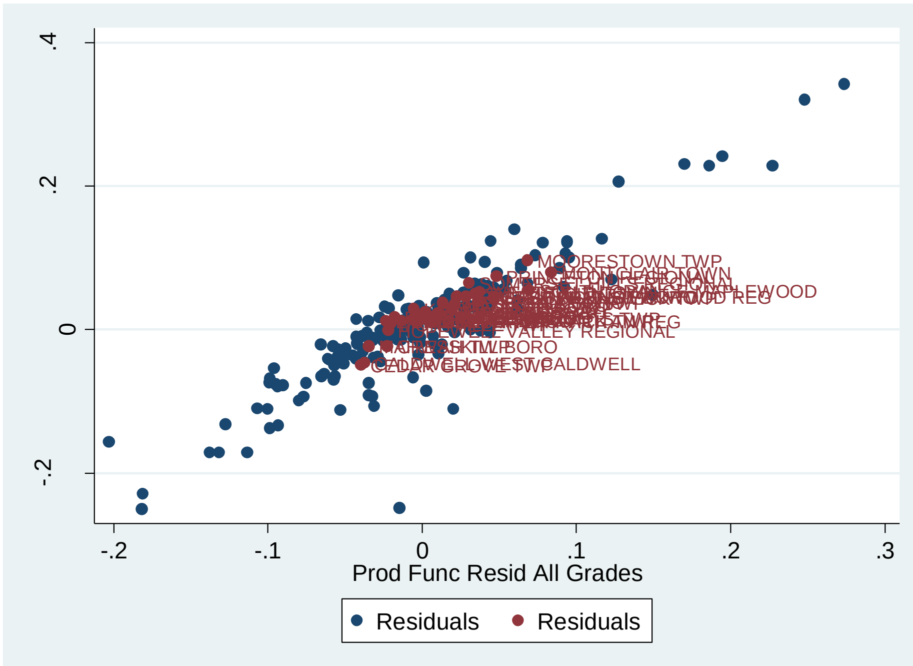


Figure 57 shows the distribution of DFG I districts. In general, the larger the group of districts highlighted, regardless of socioeconomic conditions, the districts spread more widely across the continuum. This finding suggests that the estimated models do a reasonable job of accounting for socioeconomic differences across districts. In this case, Moorestown appears toward the higher end of the pack.

Figure 57
Production Function Residuals (all grades and 4^{th} & 8^{th} only)
DFG I in Red (K-12 Unified Only)



Analysis 9
District factors influencing resource differences across districts – the expenditure function

Data

Analyses in this section rely on the same two 4 year panels of district level data including 436 districts for which grades 4 and 8 reading and math outcomes were compiled and 216 districts for which all grade outcomes were compiled.

Analysis

This section involves three major analyses, beginning with an analysis of variations in spending across New Jersey school districts and moving to an analysis of variations in the costs of producing educational outcomes across those districts. We conclude with an evaluation of those districts which appear to spend more or less than expected toward achieving specific outcome levels.

We begin this section with an analysis of factors associated with spending variation across school districts. We begin with a test of the extent to which spending varies across New Jersey school districts as a function of expected cost and need factors, including differences in student population characteristics, differences in district characteristics that might affect costs and differences in location across the state that might affect regional wage variation or other costs.

Expenditures = *f*(Students, District, Location)

Next, we add to our models measures of district fiscal capacity which may influence the amount a district's voters choose, or are able to spend on their schools. That is, in addition to factors associated with costs of producing constant outcome levels, we include factors that may influence a districts' choice or ability to spend more, ideally toward achieving higher outcome levels. It is relatively well understood in state systems where local voters retain control over local district spending, that one reason some school districts spend more than others is *because they can.*

Expenditures = *f*(Students, District, Location, Local Demand Factors)

Typically, local demand related factors are broken down into factors associated with the fiscal capacity of a school district and its patrons, such as the median family or household income of the patrons, measures of the price in local property taxes of an additional $1 of school revenue which may be captured via measures of the share of the local property tax based owned by local homeowners, and measures of the tastes for public schooling of local voters, which may include shares of local voters with children attending public schools, shares of voters who are beyond retirement age or educational backgrounds of local voters. Ideally, in an equitable state school finance system, expenditure variation across local public school districts would be more significantly a function of variations in needs and costs across districts and less a function of variation in local fiscal capacity, tastes and tax price.

Findings

Table 62 shows the factors associated with spending differences across New Jersey School districts (549 districts including non-K-12). Model 1 in the table evaluates spending with respect to commonly addressed "cost" pressures faced by school districts, including demographic characteristics that might be associated with performance outcomes, economies of scale and competitive wages across regions of the state (See Duncombe and Yinger, 2008; Baker and Duncombe, 2004; Baker, 2005). Model 2 in the table adds in factors associated with differences in the local capacity to spend on schools, the price of an additional $1 in taxes to the average homeowner and a proxy for the tastes for spending more on K-12 schools (% of population over 65).

Districts elementary grades only tend to spend less on average than districts including high school grades. In most recent studies of economies of scale in education, both spending levels and underlying costs have been found to level off or minimize for districts enrolling about 2,000 students. In New Jersey, spending appears to rise for districts enrolling fewer than 800 students. Spending is also higher in those parts (metropolitan areas including many districts) of the state where private sector wages are higher.

When demand factors are included, we find that spending is higher in districts with higher per capita income, districts where less of the cost of each additional $1 in revenue falls on the local homeowner voter, higher in districts where a greater share of children in the district remain in attendance within the district (as opposed to those who've moved on to the regional high school) and spending is lower in districts with higher shares of population over 65 years of age. Demand factors add substantially to the model R-squared, meaning that much of the variation in resources across New Jersey school districts remains associated with economic and demographic conditions as much if not more so than costs. That is, the resources available to New Jersey schoolchildren remain largely a function of local economic and demographic variations which favor higher income, lower tax price, communities with greater shares of children in local public schools.

Table 62

Expenditure functions of NJ school districts with & without demand factors

	Model 1			Model 2		
DV = Total Oper. Expend per Pupil	*Coef.*	*Std. Err.*	*P>t*	*Coef.*	*Std. Err.*	*P>t*
Student Factors						
% Special Education	0.501	0.147	*	0.616	0.141	*
% Free Lunch	0.341	0.089	*	0.633	0.092	*
% Black	-0.076	0.059		-0.047	0.057	
% Hispanic	-0.164	0.117		-0.229	0.111	*
% Asian	0.250	0.138	**	0.036	0.120	
% Home Language is English	0.183	0.102	**	0.063	0.092	
NCES ECWI	0.554	0.090	*	0.330	0.077	*
Enrollment & Grade Level						
Enrollment 100 to 299	0.199	0.033	*	0.175	0.029	*
Enrollment 300 to 499	0.077	0.031	*	0.065	0.025	*
Enrollment 500 to 799	0.066	0.026	*	0.055	0.021	*
Enrollment 800 to 1199	0.027	0.022		0.030	0.020	
Enrollment 1200 to 1499	0.018	0.024		0.034	0.023	
Enrollment 1500 to 1999	0.003	0.019		0.010	0.016	
Enrollment Over 2,000 (Base Group)						
Elementary Grades Only	-0.131	0.019	*	-0.135	0.016	*
Demand Related Variables						
Per Capita Income (ln)				0.228	0.026	*
Tax Share				-0.104	0.021	*
Ratio of Res. To Total Enrollment				0.120	0.043	*
% Population over 65				-0.301	0.103	*
Year						
Year = 2003	-0.014	0.004	*	-0.020	0.004	*
Year = 2004	0.015	0.008	**	0.007	0.008	
Year = 2005	0.041	0.012	*	0.029	0.012	*
Constant	8.166	0.180	*	5.993	0.274	*
R-squared	0.278				0.445	

*p<.05, **p<.10, estimated with robust standard errors

Figure 58 shows those districts that appear to spend much more than expected considering both cost factors and demand factors but not considering differences in outcomes. Some of these differences might be expected. For example, districts such as Newark and Camden appear in the figure in part because we have not explicitly controlled for the effect of Abbott litigation funding. These districts while very high in need factors, have very low fiscal capacity and receive additional funds not picked up by the model. When controlling for outcome variation, we would hope that these additional "unpredicted" funds lead to improved outcomes and moderate at least somewhat the relative position of districts such as Camden and Newark.

Figure 58

Districts spending more than predicted given cost pressures and demand factors

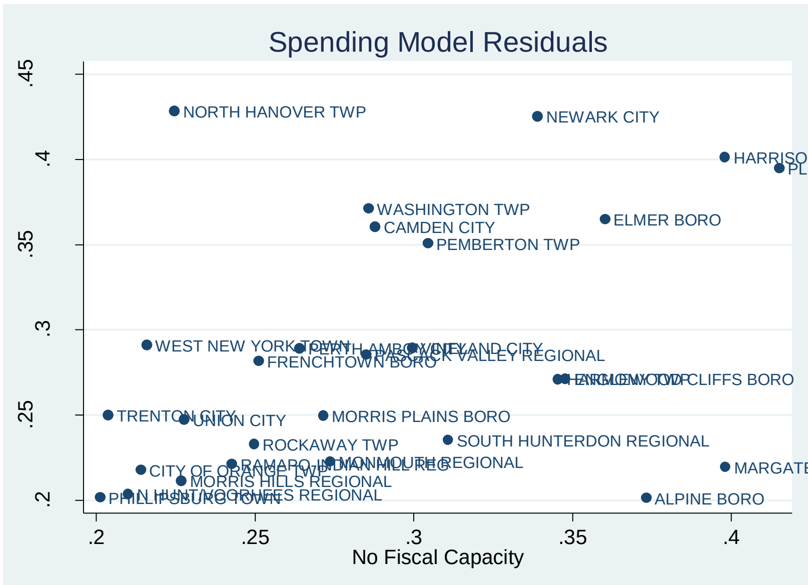
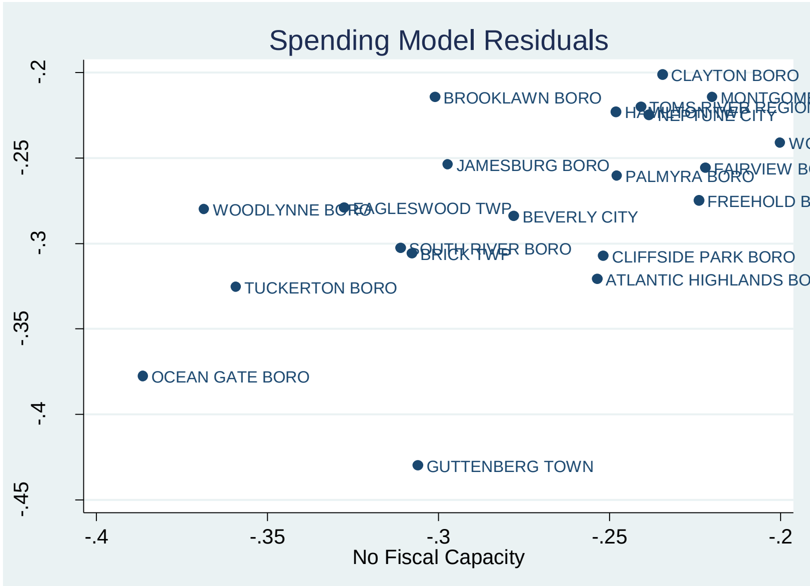


Figure 59 displays those districts which appear to spend much less than predicted given cost factors and demand factors but not considering outcome variation. One might argue that many of the districts in the figure are "quirky" districts with attributes not fully addressed in our model. For example, Guttenberg spends less than expected, in a case where expectations are driven substantially by the high labor costs of being so close to New York City. Freehold Boro is also on the list, and like Guttenberg, Freehold Boro has in recent years become a largely Hispanic district. We do find that in the model including demand factors, districts with higher Hispanic populations tend to spend less. By contrast, Montgomery Township is a rapidly growing district with rapidly expanding asian population. It remains difficult to discern any particular pattern among these districts at this point, however, many are Boro rather than township districts which may relate to increased population density, convenient school proximity and reduced transportation costs (even though population density factors failed to yield meaningful results in our models).

Figure 59

Districts spending less than predicted given cost pressures and demand factors



Analysis 10

District factors influencing resource differences across districts including outcome variation – the "Cost" Function

Evaluating more precisely those factors which influence the costs of producing educational outcomes across New Jersey school districts requires estimation of an education cost function, which is a variation on the education spending function. The education cost function, as discussed in the literature review to this section, is like the previous expenditure function but also includes a measure of student outcomes. The goal is to determine how spending varies across districts at constant outcomes. Or, how much spending is associated with given outcome levels at given student populations, district factors and location. Within this framework we may determine how much additional spending is associated with achieving certain outcome levels with certain populations. It is less appropriate, however for us to attempt to extrapolate future spending needed to achieve outcome levels not regularly achieved.

The cost function model is expressed as:

Expenditures = *f*(Outcomes, Students, District, Location, Fiscal Capacity, Public Monitoring)

Where district level current expenditures per pupil are modeled as a function of student outcomes, student population characteristics, district factors including economies of scale and grade range, location and geographic wage variation factors, and where we include other factors that may explain differences in spending which are largely though not entirely the same as the demand factors in our expenditure function. The goal in this case is to identify variation in spending at constant cost factors and at constant outcomes. That is, variations in spending across school districts that have little relation to marginal returns on the measured student outcomes. A significant portion of the analysis herein is dedicated to identifying those factors which explain spending variation left over after considering major cost factors including student outcomes, treated as endogenous as per our discussion in the framing of this section. On the one hand, these factors that contribute to spending variation not related to cost factors and reading and math outcomes may be perceived as factors associated with inefficiency. But, as discussed previously, they may also be factors associated with variations in spending that contribute to other, unmeasured but still important schooling outcomes.

Findings

Table 63 displays the results of Ordinarly Least Squares (OLS, or typical, average response regression) models and a Stochastic Frontier Model. The difference between the first OLS model and second is the inclusion of "demand" measures in the second model, which prove problematic in that they eliminate the positive relationship between outcomes and spending, negating the centerpiece of the cost model. This problem speaks to the need for correcting the outcome measure for endogeneity in a subsequent set of models.

Note that the parameters in the OLS model 1 and in the stochastic frontier model are very similar, as has been found to be the case in other studies (Ruggiero, 1999). In both models, outcomes are positive associated with spending. That is, higher outcomes require higher spending, all else equal. In the OLS models, school districts with 100 to 300 students are more costly to operate at constant outcomes. In the SFA model, school districts with up to 799 students are more costly to operate at constant outcomes. If these districts exist by necessity of geographic remoteness, it may be reasonable for the state to cover these costs. Else consolidation might be an option.

As one might expect, school districts with higher special education populations have higher spending per pupil at constant outcomes, and school districts with higher poverty rates have higher spending at constant outcomes. Or, one might infer that these districts have higher costs of achieving constant outcomes. School districts in regions with higher competitive wages also have higher costs (or at least higher spending associated with constant outcomes).

Table 63

OLS and SFA Single Stage Expenditure/Cost Models (grade 4 & 8 outcomes)

N = 430	Model 1				Model 2				Model 3 (SFA)		
DV = Total Oper. Expend per Pupil	*Coef.*	*Std. Err.*	*P>t*		*Coef.*	*Std. Err.*	*P>t*		*Coef.*	*Std. Err.*	*P>z*
Outcomes 4th & 8th Grade (ln)	0.300	0.088	*		-0.016	0.083			0.299	0.042	*
Student Factors											
% Special Education	0.599	0.161	*		0.777	0.152	*		0.538	0.086	*
% Free Lunch	0.688	0.108	*		0.763	0.096	*		0.595	0.058	*
% Black	0.010	0.065			-0.074	0.062			0.057	0.034	**
% Hispanic	-0.246	0.120	*		-0.297	0.114	*		-0.244	0.058	*
% Asian	0.271	0.144	**		0.118	0.123			0.264	0.059	*
% Home Language is English	0.131	0.108			0.030	0.102			0.141	0.049	*
NCES ECWI	0.449	0.108	*		0.361	0.078	*		0.522	0.049	*
Enrollment & Grade Level											
Enrollment 100 to 299	0.195	0.037	*		0.171	0.034	*		0.187	0.016	*
Enrollment 300 to 499	0.045	0.035			0.029	0.028			0.050	0.015	*
Enrollment 500 to 799	0.040	0.029			0.012	0.024			0.046	0.014	*
Enrollment 800 to 1199	-0.010	0.024			-0.024	0.021			-0.005	0.012	
Enrollment 1200 to 1499	-0.006	0.024			-0.028	0.022			0.004	0.015	
Enrollment 1500 to 1999	0.009	0.019			0.002	0.016			0.014	0.012	
Enrollment over 2000 (Base)											
Elementary Grades Only	-0.084	0.021	*		-0.065	0.018	*		-0.094	0.011	*
Demand Related Variables											
Per Capita Income (ln)					0.236	0.029	*				
Tax Share					-0.103	0.023	*				
Ratio of Res. To Total Enrollment					0.211	0.045	*				
% Population over 65					-0.138	0.129					
Year											
Year = 2003	-0.015	0.004	*		-0.020	0.004	*		-0.015	0.009	**
Year = 2004	0.016	0.008	**		0.006	0.008			0.009	0.010	
Year = 2005	0.041	0.013	*		0.028	0.013	*		0.031	0.011	*
Constant	8.357	0.219	*		5.714	0.325	*		8.137	0.092	*
R-squared	0.311				0.480						

*p<.05, **p<.10, estimated with robust standard errors

Table 64 provides estimates from our OLS and SFA cost models of all grades outcomes across 216 unified K-12 school districts. Again in Model 1 and in the SFA model outcomes are positively associated with spending. Interestingly, no economies of scale effects are detected, but fewer very small unified K-12 districts exist. Special education and poverty rates remain positively associated with expenditures, but so too do Asian populations, despite their generally positive effect on outcomes in the New Jersey data. One might infer that the Asian populations in this case are serving as a proxy for tastes for higher school spending, since this coefficient is muted though not eliminated in the model including demand factors.

Table 64
OLS and SFA Single Stage Expenditure/Cost Models (all grades outcomes)

N=216	Model 1				Model 2				Model 3 (SFA)		
DV = Total Oper. Expend per Pupil	*Coef.*	*Std. Err.*	*P>t*		*Coef.*	*Std. Err.*	*P>t*		*Coef.*	*Std. Err.*	*P>z*
Outcomes All Levels (ln)	0.285	0.118	*		-0.137	0.110			0.282	0.059	*
Student Factors											
% Special Education	0.729	0.243	*		0.964	0.210	*		0.686	0.131	*
% Free Lunch	0.807	0.116	*		0.803	0.112	*		0.797	0.066	*
% Black	0.013	0.077			-0.113	0.074			0.016	0.038	
% Hispanic	-0.129	0.121			-0.179	0.119			-0.127	0.063	*
% Asian	0.338	0.120	*		0.244	0.122	*		0.357	0.066	*
% Home Language is English	0.208	0.109	**		0.076	0.112			0.219	0.056	*
NCES ECWI	0.548	0.126	*		0.445	0.106	*		0.595	0.062	*
Enrollment											
Enrollment 500 to 799	0.078	0.095			0.078	0.057			0.080	0.084	
Enrollment 800 to 1199	0.016	0.028			0.012	0.030			0.018	0.017	
Enrollment 1200 to 1499	-0.014	0.032			-0.025	0.027			-0.011	0.018	
Enrollment 1500 to 1999	0.032	0.020			0.016	0.019			0.033	0.012	*
Enrollment over 2000 (Base)											
Demand Related Variables											
Per Capita Income (ln)					0.284	0.036	*				
Tax Share					0.002	0.026					
Ratio of Res. To Total Enrollment					0.208	0.087	*				
% Population over 65					0.101	0.141					
Year											
Year = 2003	-0.021	0.004	*		-0.013	0.006	*		-0.021	0.011	**
Year = 2004	0.005	0.010			0.026	0.012	*		0.000	0.012	
Year = 2005	0.017	0.016			0.054	0.019	*		0.010	0.014	
Constant	8.081	0.251	*		5.052	0.418	*		7.922	0.118	*
R-squared	0.393				0.522						

*p<.05, **p<.10, estimated with robust standard errors

Table 65 provides the results of our two stage least squares models of district spending using 4th and 8th grade outcomes and instrumenting those outcomes with a series of measures related to the local competitive context of each school district. When corrected for endogeneity, outcomes are strongly associated with spending levels, but the coefficients on the outcome measure are quite large and relatively unstable (large standard errors and substantial changes with model specification). Special education populations, poverty and racial composition, especially when interacted with population density, strongly affect the spending associated with achieving constant outcomes.

Further, per pupil spending associated with constant outcomes appears to climb with relative consistency for districts enrolling fewer than 800 students. While these models reveal potentially interesting cost pressures of school districts, their prediction accuracy as measured against a 10% randomly extracted sample of districts is relatively low.

Table 65
Instrumental Variables, 2SLS Cost Function Models (grade 4 & 8 outcomes)

N = 430		Model 1			Model 2			Model 3	
DV = Total Oper. Expend per Pupil	*Coef.*	*Std. Err.*	*P>z*	*Coef.*	*Std. Err.*	*P>z*	*Coef.*	*Std. Err.*	*P>z*
Outcomes 4th & 8th Grade (ln)	2.486	0.556	*	3.425	1.251	*	2.170	0.448	*
Student Cost Factors									
% Special Education	1.389	0.381	*	1.619	0.601	*	1.442	0.341	*
% Free Lunch	2.134	0.473	*	4.244	1.470	*	1.598	0.375	*
% Black	0.899	0.226	*						
Poverty x Density				0.000	0.000	*			
Black x Poverty							4.711	0.908	*
% Home Language is English	0.129	0.106		0.426	0.176	*	0.007	0.098	
NCES ECWI	-0.036	0.169		0.087	0.275		-0.146	0.160	
Economies of Scale & Organization									
Enrollment 100 to 299	0.215	0.058	*	0.183	0.078	*	0.184	0.047	*
Enrollment 300 to 499	0.134	0.055	*	0.109	0.082		0.103	0.044	*
Enrollment 500 to 799	0.161	0.047	*	0.129	0.073	**	0.127	0.036	*
Enrollment 800 to 1199	0.075	0.040	**	0.061	0.058		0.051	0.030	**
Enrollment 1200 to 1499	0.117	0.070	**	0.122	0.126		0.072	0.043	**
Enrollment 1500 to 1999	0.070	0.030	*	0.041	0.038		0.051	0.026	*
Elementary Grades Only	-0.220	0.042	*	-0.276	0.086	*	-0.204	0.034	*
Indirect Efficiency									
Tax Share (ln)	-0.077	0.031	*	-0.016	0.056		-0.086	0.025	*
Ratio of % Households No Children	-0.197	0.096	*	-0.142	0.121		-0.165	0.080	*
Year									
Year = 2003	-0.039	0.008	*	-0.049	0.012	*	-0.033	0.007	*
Year = 2004	-0.020	0.015		-0.043	0.022	**	-0.006	0.012	
Year = 2005	-0.030	0.025		-0.073	0.039	**	-0.005	0.020	
Constant	9.334	0.349	*	9.064	0.550	*	9.543	0.330	*
Instrument Tests									
Partial F	6.820			3.820			7.270		
Hansen J	0.530			0.270			0.309		
Split Cross Validation Tests									
Correl. With Actual	0.346			0.265			0.481		
MAPE	15.3%			17.5%			13.7%		

*p<.05, **p<.10, estimated with robust standard errors

Finally, Table 66 displays the results of our two stage least squares cost models on all outcome levels across the 216 unified K-12 school districts. Again, outcomes are positively associated with spending with coefficients in more reasonable ranges than in our 4th and 8th grade outcomes model. Further, the models show somewhat improved prediction accuracy against hold-out samples. But, our bureaucratic efficiency variables add nothing to our unified district models. That is, we are unable (as of yet) to identify additional factors that predict spending variation that are not associated with cost factors or too deeply entangled with the factors we use for instrumenting our outcome measure.

Again, we find that districts enrolling fewer than 800 students show higher per pupil costs of achieving constant outcome levels. Again, it may be reasonable to support these higher costs of small districts if consolidation is not an option geographically. Finally, disability concentrations, poverty and the intersection between black populations and high population density are consistently strong predictors of higher per pupil costs.

Table 66

Instrumental Variables, 2SLS Cost Function Models (all grade outcomes)

N=216	Model 1			Model 2			Model 3		
DV = Total Oper. Expend per Pupil	Coef.	Std. Err.	P>z	Coef.	Std. Err.	P>z	Coef.	Std. Err.	P>z
Outcomes All Grades (ln)	1.599	0.385	*	1.430	0.480	*	1.671	0.389	*
Student Cost Factors									
% Special Education	1.412	0.370	*	1.105	0.361	*	1.525	0.372	*
% Free Lunch	1.529	0.321	*	2.079	0.580	*	1.321	0.321	*
% Black	0.598	0.170	*						
Poverty x Density				0.000	0.000	**			
Black x Poverty							3.500	0.717	*
% Home Language is English	0.059	0.089		0.296	0.104	*	-0.052	0.091	
NCES ECWI	0.257	0.147	**	0.560	0.162	*	0.076	0.144	
Economies of Scale & Organization									
Enrollment 500 to 799	0.207	0.088	*	0.104	0.099		0.138	0.050	*
Enrollment 800 to 1199	0.053	0.038		0.001	0.033		0.038	0.029	
Enrollment 1200 to 1499	0.040	0.041		0.031	0.047		-0.002	0.040	
Enrollment 1500 to 1999	0.061	0.022	*	0.032	0.021		0.048	0.019	*
Indirect Efficiency									
Tax Share (ln)	-0.012	0.034		0.015	0.040		-0.042	0.037	
Ratio of % Households No Children	-0.102	0.079		-0.029	0.084		-0.126	0.078	
Year									
Year = 2003	-0.033	0.008	*	-0.036	0.009	*	-0.033	0.008	*
Year = 2004	-0.018	0.017		-0.030	0.020		-0.014	0.018	
Year = 2005	-0.030	0.028		-0.048	0.033		-0.023	0.029	
Constant	8.781	0.266	*	8.169	0.286	*	9.164	0.269	*
Instrument Tests									
Partial F	34.700			20.570			25.230		
Hansen J	0.760			0.097			0.465		
Split Cross Validation Tests									
Correl. With Actual	0.150			0.216			0.362		
MAPE	12.0%			11.2%			11.1%		

*p<.05, **p<.10, estimated with robust standard errors

Finally, in this section as in others, we explore those districts showing the largest residual differences between current spending and the predicted costs of achieving current outcomes, first holding efficiency factors constant and second, allowing those factors to vary.

Residual Distributions

In this final section of our production, cost and efficiency analysis, we evaluate the residuals and efficiency ratios of our various OLS, SFA and 2SLS cost models. Table 67 displays the correlations between the residuals of our OLS and 2SLS models, and the technical efficiency indices from various stochastic frontier models. The stochastic frontier model reported fully in this section is the single stage stochastic frontier model including a year dummy variable. It is the stochastic frontier model most similar to the OLS model. In addition, we estimated panel SFA models assuming time invariant (ti) and time variant inefficiency (tvd). We note however, that the technical efficiency ratios are nearly identical across these models, correlated at .946 and higher.

Further, the SFA technical efficiency measures are relatively highly correlated with our OLS models at over .8 for all grade levels (216 unified K-12 districts) and between .75 and .8 for 4th and 8th grade outcomes. Again, the larger sample of school districts with mixed grade configurations and other structural differences appears more noisy. 2SLS model residuals appear less highly correlated with both SFA and OLS model residuals. This occurs because of the modified-input outcome relationship that results when correcting the "outcomes" measure for endogeneity. Because indirect efficiency measures in the 2SLS model were relatively weak, model residuals vary little when holding those factors constant. Further investigation is needed to identify a richer set of indirect predictors of district inefficiency.

Table 67

Correlations of residuals and technical efficiency across models

	IV Reg Cost Function	XT Frontier (tvd)	XT Frontier (ti)	XT Frontier (year dummy)	OLS Cost Model (with capacity measures)
All Grade Level Outcomes					
IV Reg Cost Function	1				
XT Frontier (tvd)	0.6411	1			
XT Frontier (ti)	0.6297	0.9774	1		
XT Frontier (year dummy)	0.6317	0.9715	0.9571	1	
OLS Cost Model (with capacity measures)	0.5826	0.8590	0.8393	0.8216	1
4th and 8th Grade Level Outcomes					
IV Reg Cost Function	1				
XT Frontier (tvd)	0.4370	1			
XT Frontier (ti)	0.4407	0.9846	1		
XT Frontier (year dummy)	0.4864	0.9628	0.9462	1	
OLS Cost Model (with capacity measures)	0.5109	0.7836	0.7664	0.7581	1

The next series of figures provide visual representation of the various model residuals with specific subsets of districts highlighted. Figure Z.9 shows the relationship between the residuals of the 2 stage least squares models of 4th and 8th grade, and all grades outcomes. A "high" residual value means that the district spends more than expected, given its conditions and outcomes. Gloucester city falls into this category as does Trenton. Notably, however, while Newark fell high on our spending model excluding outcomes, Newark is nearer the middle of the pack in Figure 60. Hoboken and Union City spend much less than expected given their current outcomes and conditions.

Figure 60
Residuals of Instrumental Variables Cost Models
(Abbott districts in Red, IJ in Green)

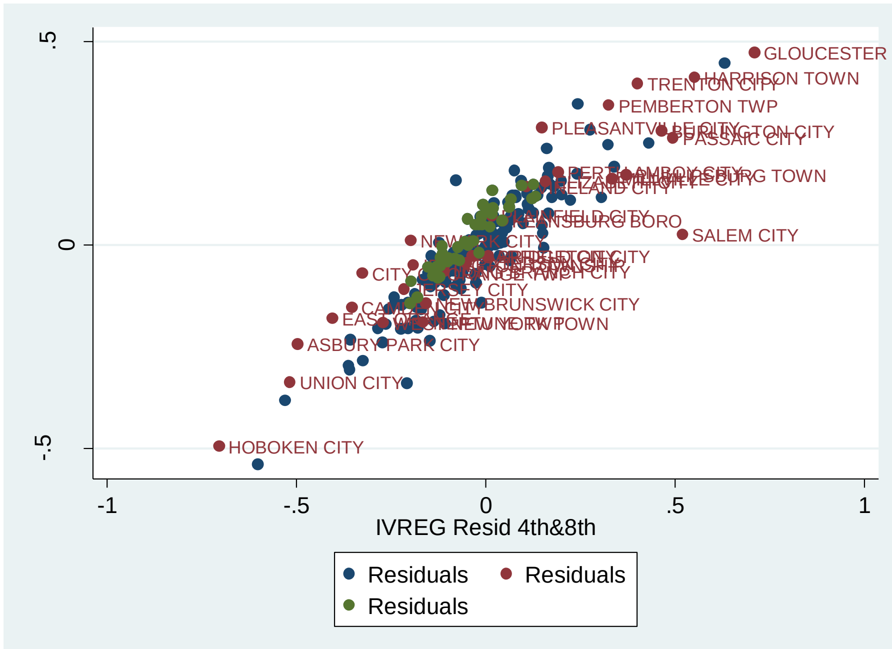


Figure 61 displays the residuals of the OLS and SFA models. Again, higher residuals indicated spending above expectations. Under the OLS and SFA models Newark does move back to its relatively high position, along with other districts having higher than expected spending. We note however, that these single stage models, though they contain an outcome measure, differ little from the spending regression with no outcome measure. It is when outcomes are corrected for endogeneity that Newark's position in particular changes. Under the 2SLS model, Newark ranks 158th of 216, but moves to 212 and 215 when outcomes are not instrumented. Others, especially Pleasantville and Gloucester rank low on both 2SLS and single stage OLS and SFA models.

Figure 61
Residuals of OLS and SFA Models
(Abbott districts in Red, IJ in Green)

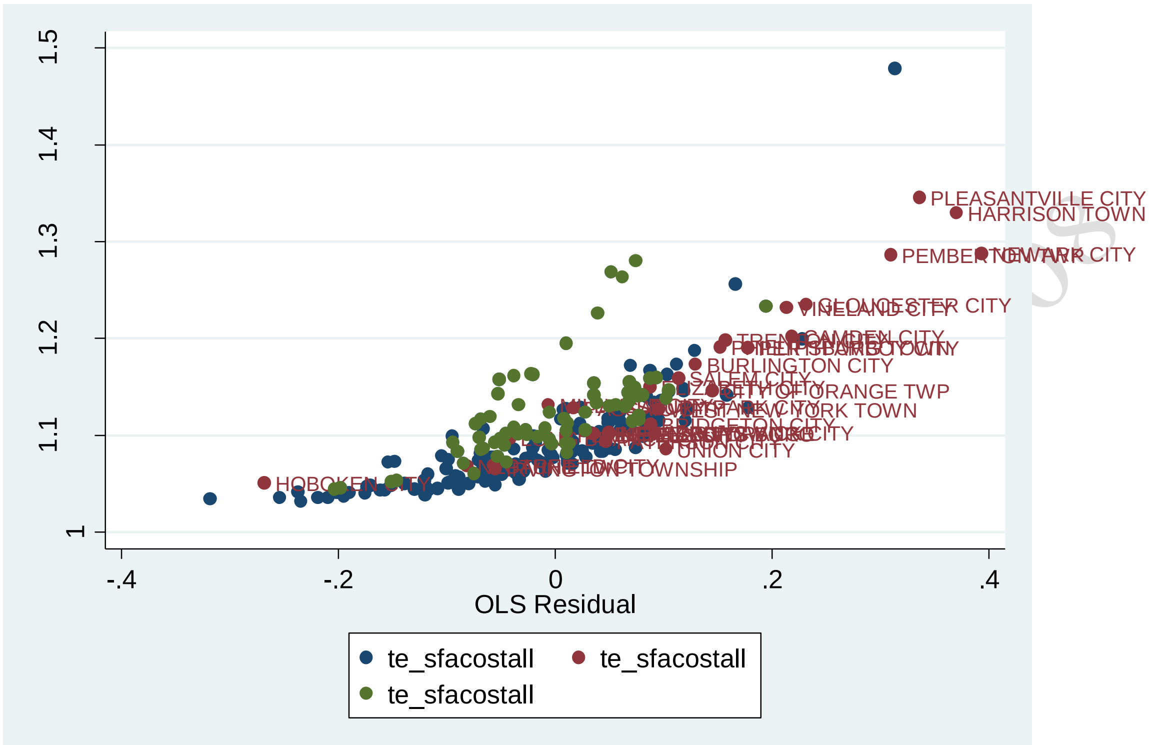


Figure 62 and Figure 63 graph the average residuals and average technical efficiency ratios for districts by factor group. In Figure 62 one can see that DFG A districts spend much more than expected when considering their low fiscal capacity but not considering their outcomes (the highest, gray bar). When capacity is not considered, DFG A districts have a smaller margin of spending more than expected (black bar). When outcomes are included, the differential also drops. But, it would seem from the pattern of residuals, that the a substantial portion of spending over expectations in DFG A districts is a function of spending more than their low capacity would predict. When outcome measures are corrected for endogeneity, the margin of “overspending” (spending higher than predicted) in DFG A districts declines substantially. That is, these largely poor, urban districts spend in line with expectations given cost pressures and outcomes. Districts in DFG CD, on average spend much less than expected given their outcomes and conditions. The margin is reduced when outcomes are corrected for endogeneity, but remains large.

Figure 62
Mean Residuals of Cost and Spending Models by DFG 2000

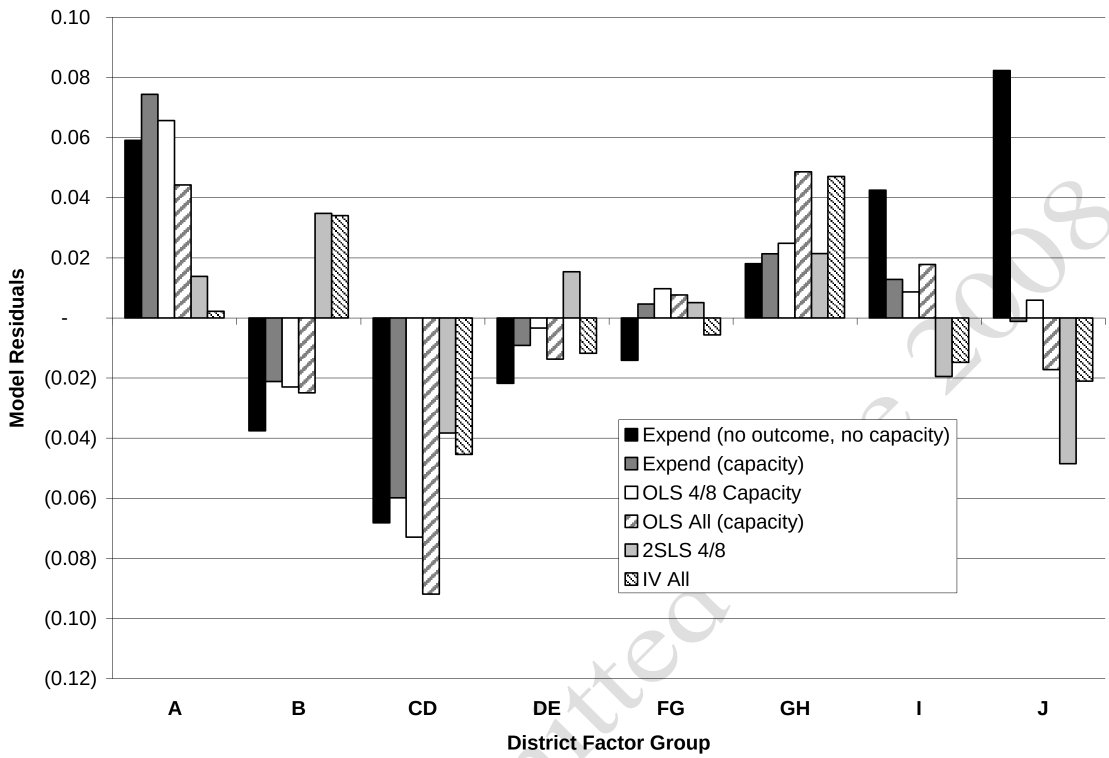
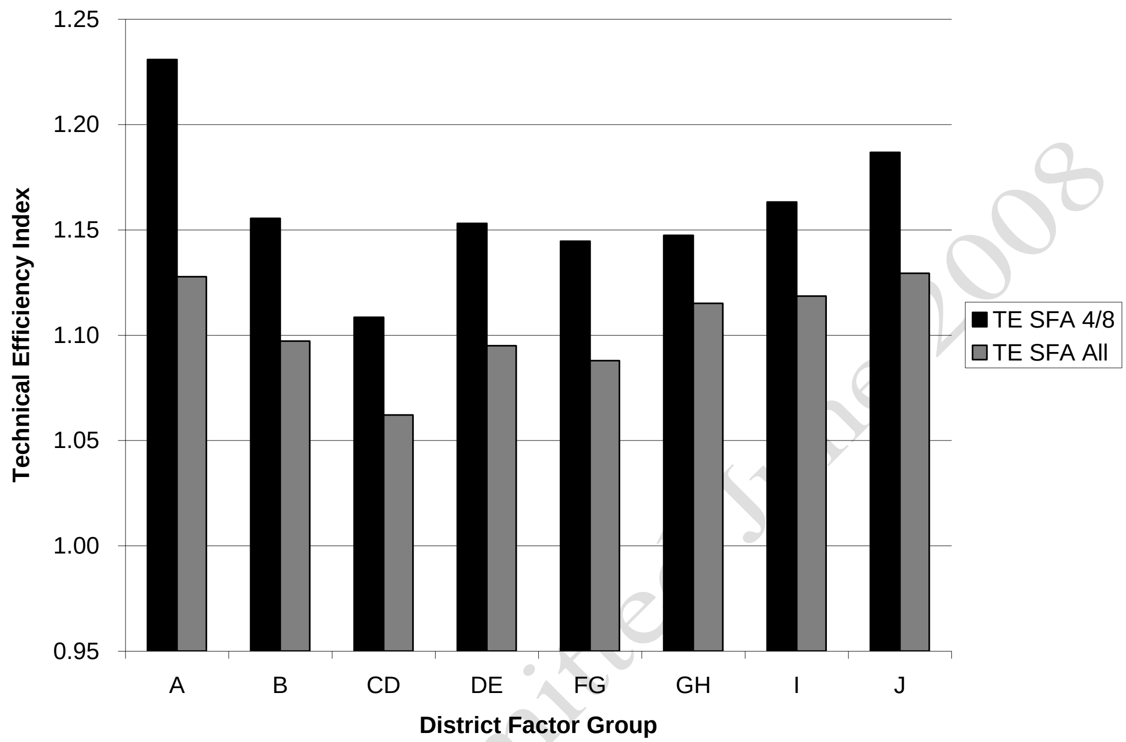


Figure 63 summarizes the technical efficiency ratios for districts by DFG. Recall that these SFA models are largely the same as the OLS models, and as expected reveal spending higher than expected in DFG A districts. These SFA models do not control for fiscal capacity and public monitoring since it is assumed that variations in spending resulting from these factors but not associated with outcomes are inefficiency and should be left in the technical efficiency (inefficiency) margin. A notable difference between these findings and the OLS models including capacity variables, is that the technical efficiency ratios rise for DFG I and J districts. That is, as one might expect, these districts spend more than expected given their outcomes and cost factors when compared with districts in DFG CD.

A final notable feature of Figure 63 is that there is both less variation and overall lower average levels of inefficiency in the model including all outcome levels. We suspect that this is because this sample includes only unified K-12 districts, and not because high school outcomes are necessarily more efficiently produced, on average.

Figure 63
Mean Technical Efficiency Ratios from Cost Models by DFG 2000



HIGH/LOW PERFORMER ANALYSIS

This section includes 6 analyses.

1. School level distribution of certified staff by position code in higher and lower performing schools in 2006-07
2. School level distribution of certified staff by qualifications in higher and lower performing schools in 2006-07
3. School level distribution of certified staff by qualifications in higher and lower performing schools from 90 school subset
4. Differences in key resource variables between extreme high and low performing schools
5. Differences in school climate related indicators between higher and lower performing schools
6. Differences in teachers' own race/ethnicity in relation to student populations in higher and lower performing schools

In the previous section, several analyses addressed factors associated with school and district level performance outcomes, across the full range of performance outcomes. In this section, we evaluate specifically differences in resource characteristics of elementary, middle and high schools identified as performing more than one standard deviation above their expected performance (based on screening models for 90 schools) and schools performing more than one standard deviation below their expected performance. These subsets of higher and lower performing schools are the subsets from which the 90 schools sample is drawn for more detailed, subsequent analysis including site visits.

The first analysis in this section summarizes staffing distributions and staffing characteristics in higher and lower performing schools based on data from 2005-06 and 2006-07. The first analysis attempts to discern whether there are differences in the allocation of staff by broad position description between higher and lower performing schools. To foreshadow, the answer to this question is No!

The second analysis evaluates whether there are differences between higher and lower performing schools in terms of teacher qualifications. The third analysis follows up the second by addressing similar questions but within the 90 schools sample. This section of the report concludes with a summary of resource measures across higher and lower performing schools.

The final two analyses related to questions which emerged from more in-depth analysis of our 90 schools sample. Specifically, we became interested in whether certain measures collected at the school level might serve as indicators of school climate, specifically as a workplace for teachers. We expect for example, that school work climate would be associated with rates of teacher absence. And further, that negative work environments, captured in higher teacher absence rates might characterize lower rather than higher performing schools – all else equal. In addition, we explore the relationship between teacher and student race and high versus lower performance, as some research in the past has indicated that white female teachers may hold lower expectations than black teachers specifically for black male students. (need citations)

Analysis 1
School level distribution of certified staff by position code in higher and lower performing schools in 2006-07

For this analysis, we pursue questions similar to those in Analysis 1, but with specific emphasis on the 90 focus schools and combining data gathered from site visits and surveys with data from the statewide data system. In addition, in this analysis we not only explore the distribution of teacher assignments by grade level and factor group, but also by the performance category into which schools were placed. Of primary interest is whether the allocation of personnel differs in higher versus lower performing schools, considering grade level and factor group norms.

Data

Data for this analysis are the same as in the previous, with emphasis on staffing data from 2006-07. We focus on the 90 schools which have been identified in groups of 15 higher and 15 lower performing schools across elementary, middle and secondary grades. Each school also received surveys and was asked to submit a roster of school staff. School rosters and survey responses about staffing are for the current school year 2007-08, creating the possibility of some staffing changes. We attempt to the extent possible to reconcile staffing rosters generated from statewide staffing data bases with staffing rosters provided by schools.

Analysis

Like the previous analysis our goal is to map the distribution of certified staff by relatively broad categories of job codes. We map those staffing distributions by both school grade level and by district factor group. In this analysis, however, our interest is in the differences if any in staffing intensity and distribution by school performance group.

As in the previous analysis, we map both the **"intensity"** of staffing and the **"distribution"** of staffing across our 90 schools. Intensity of staffing is measured in terms of certified staff per 1000 students. For specialized staff, we may also measure the targeted intensity of staff, or number of certified staff per target student population (e.g. special education staff per special education student). Distribution of staffing is measured in terms of the shares of total certified staff allocated to any single category (e.g. % of total certified staff allocated to English language support).

Findings

Table 68 displays the percentage allocations of staff by broad category across the larger group of higher and lower performing schools and the 90 schools subset. In short, there are few clear patterns of difference between higher performing and lower performing schools in terms of percentage allocations of staff.

Table 68
Staffing shares within Higher and Lower Performers

Group	Administrators	Core Academic	Extra Help	Specialist	Student Support
RU High Elem	3.1%	57.8%	16.6%	12.9%	9.7%
Other High Elem (>1stev)	4.0%	63.8%	11.4%	11.0%	9.7%
RU Low Elem	3.9%	61.3%	10.6%	12.0%	12.2%
Other Low Elem (>1stev)	4.1%	59.2%	14.0%	12.3%	10.4%
RU High Middle	4.3%	52.9%	9.7%	16.8%	16.2%
Other High Middle (>1stev)	4.5%	55.8%	11.9%	19.1%	8.8%
RU Low Middle	4.4%	54.3%	14.4%	17.7%	9.1%
Other Low Middle (>1stev)	3.9%	52.3%	14.3%	20.1%	9.3%
RU High HS	5.4%	47.6%	11.0%	27.0%	9.0%
Other High HS (>1stev)	8.6%	45.7%	9.0%	26.3%	10.4%
RU Low HS	6.7%	41.0%	13.7%	22.6%	16.0%
Other Low HS (>1stev)	6.8%	47.9%	7.6%	23.4%	14.2%

Data Source: NJDOE Certificated Staff Status Database 2006 & 2007

Similarly, there are few if any discernable patterns in the number of staff per pupil by broad category across higher and lower performing schools or across the high and low performing subset of schools used in follow up study.

Table 69
Staff per 100 students within Higher and Lower Performers

Group	Administrators	Core Academic	Extra Help	Specialist	Student Support
RU High Elem	0.337	6.481	1.833	1.590	1.345
Other High Elem (>1stev)	0.387	6.029	1.039	1.006	0.876
RU Low Elem	0.387	6.453	1.076	1.196	1.283
Other Low Elem (>1stev)	0.426	6.103	1.347	1.294	1.080
RU High Middle	0.391	5.530	1.126	1.726	1.497
Other High Middle (>1stev)	0.482	6.001	1.293	2.222	1.010
RU Low Middle	0.359	5.576	1.197	1.826	0.899
Other Low Middle (>1stev)	0.413	5.654	1.466	1.961	1.075
RU High HS	0.706	4.644	1.170	2.586	0.950
Other High HS (>1stev)	1.065	5.789	0.684	3.122	1.300
RU Low HS	0.765	4.124	1.419	2.307	1.610
Other Low HS (>1stev)	0.725	4.620	0.909	2.294	1.576

Data Source: NJDOE Certificated Staff Status Database 2006 & 2007

Analysis 2
School level distribution of certified staff by qualifications in higher and lower performing schools in 2006-07

In this subsection, we explore the distribution of teaching credentials based on a limited set of available parameters on teacher experience, degree level and certification type and status across varied classifications of schools and districts. In short, our goal is to determine the extent of disparity, if any, in the distribution of teaching qualifications across schools and districts by wealth and student population characteristics and to compare these findings with findings from our related analyses on the distribution of wages within and across labor markets. One purpose of this analysis is to provide baseline information and context for subsequent analysis of our focus schools.

Data

For this analysis we focus on data from the most recent two years of the statewide certified staffing database which provide us with the greatest breadth of information on teacher qualifications. Our interest is in teachers whose primary job codes are associated with core curricular areas (LIST/APPENDIX). The certified staffing database provides information on the following for 2006-07:

1. Experience (Total, NJ, District)
2. Degree Level
3. Alternate vs. Traditional Certification
4. Certification Type
    a. Standard
    b. Provisional
    c. Emergency
    d. Temporary
    e. Conditional
    f. Non-citizen
    g. Certificate of Eligibility (CE) only (for people not yet entered into the provisional program)
    h. Certificate of Eligibility with Advanced Standing (CEAS) only (for people not yet entered into the provisional program)
5. Highly qualified (Yes or No only in 2005)
    a. No, is not highly qualified.
    b. Doesn't need to be highly qualified.
    c. Yes, passed the Praxis/NTE.
    d. Yes, by the House Matrix.
    e. Yes, has 30 credits in content area.
    f. Yes, has graduate or undergraduate degree in subject area.
    g. Yes, is Nationally Board Certified.
6. National Board Certified

Analysis

Analyses in this section involve primarily tabulations of the above listed qualifications across schools by grade level and across districts by factor group. We also explore differences by specific district demographic measures including poverty and racial composition, differences by available financial resources (relative current spending and relative current instructional spending) and by labor market relative salaries. The unit of analysis is the individual teacher.

In addition to tabulating across broad categories the percentages of teachers falling into different categories, we construct a series of teacher team quality indicators for teachers in core curricular areas for each school statewide including our 90 focus schools. That is, we shift the unit of analysis from individual teachers and the distribution of those individuals to schools and the teams of teachers assigned to specific schools. Our school aggregate teacher team indicators include:

1. School % of novice (<3yrs total exper) teachers with BA only
2. School % of teachers who are not highly qualified
3. School % of teachers with non-standard certification

We evaluate the relationship between these school level measures and school level demographics and district level relative financial resources (labor market) and relative salaries (labor market).

Findings

Figure 64 provides preliminary evidence, within the elementary school data set, that lower performing schools in some factor groups tend to have higher shares of new teachers with a BA (in DFG A through CD). However, this pattern is reversed in DFG DE and GH. On average, there appears to be little difference.

Concurrently, higher performing elementary schools in some DFGs, show much higher rates of teachers with 5 to 10 years experience and a masters' degree. This pattern reverses in DFG B, GH, N and R, but a small difference persists on average.

Figure 64

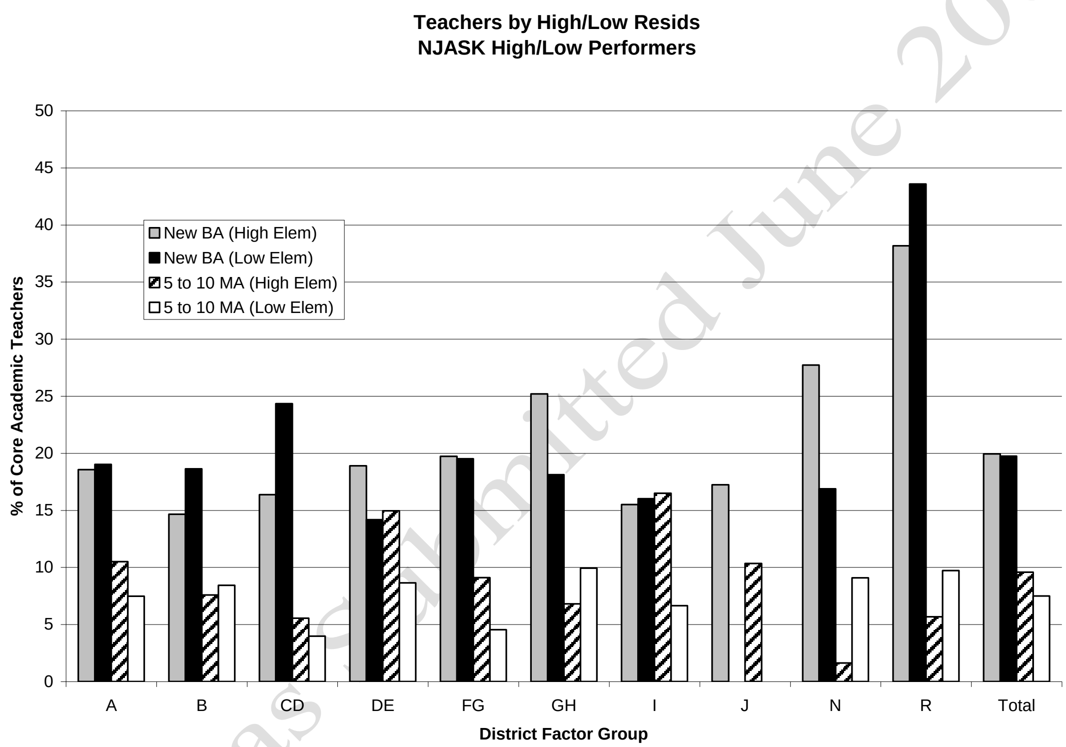


Figure 65 paints a similar picture for high schools. In DFG A, DE, FG and GH higher performing schools have much lower shares of new teachers with a BA only. On average, higher performing schools appear to have slightly lower rates of new teachers with a BA only and higher rates of teachers with 5 to 10 years experience and a masters degree.

Figure 65

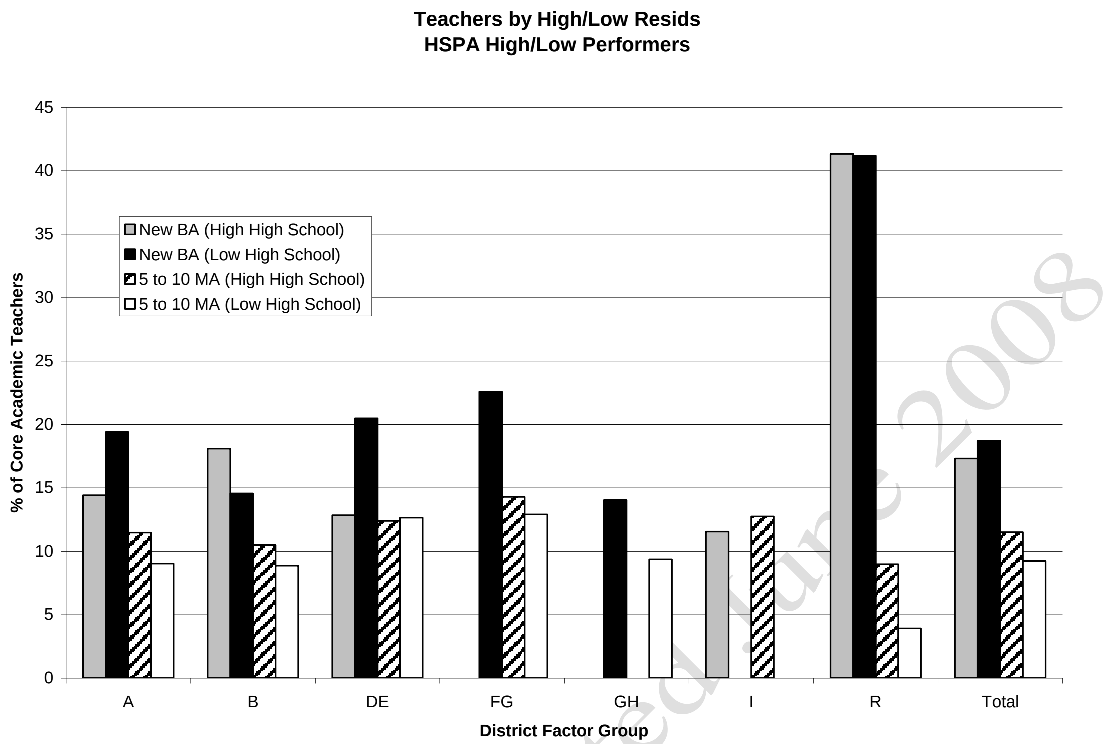


Table 70 reveals slightly elevated rates of new teachers with a BA only in lower performing schools in some groups, slightly higher rates teachers with an MA and 5 to 10 years experience in higher performing schools, higher rates of alternative certification and lower rates of standard certification in lower performing schools.

Table 70
Elementary School* Teacher Qualifications in Lower and Higher Performing Schools

	New Teachers with BA			5 to 10 with MA			Alt. Certification			Standard Certification	
Group	Low Performer	High Performer		Low Performer	High Performer		Low Performer	High Performer		Low Performer	High Performer
Abbott	17.2%	15.6%		10.4%	11.7%		17.0%	10.8%		86.7%	89.3%
Abbott Charter	35.1%	33.5%		11.3%	8.1%		33.8%	30.0%		64.9%	73.5%
DFG C to H	16.2%	15.7%		8.1%	9.9%		4.0%	3.2%		94.3%	93.3%
DFG IJ	14.9%	15.0%		8.5%	15.5%		5.1%	2.0%		91.9%	93.5%
Non-Abbott A	18.7%	4.5%		10.7%	12.7%		8.0%	9.1%		93.0%	91.8%
Non-Abbott B	14.0%	11.7%		9.4%	5.2%		3.6%	6.5%		94.3%	98.1%
Other	20.8%	25.6%		10.4%	4.9%		6.5%	7.3%		93.5%	95.7%
Other Charter	33.9%	27.8%		14.5%	16.7%		25.8%	33.3%		72.6%	88.9%

At the middle level, patterns are similar. Within Abbott districts in particular, lower performing schools tended to have higher shares of new teachers with only a BA, lower shares of teachers with 5 to 10 years and an MA, much higher shares of alternatively certified teachers and lower shares of standard certified teachers.

Table 71
Middle School* Teacher Qualifications in Lower and Higher Performing Schools

	New Teachers with BA		5 to 10 with MA		Alt. Certification		Standard Certification	
Group	Low Performer	High Performer	Low Performer	High Performer	Low Performer	High Performer	Low Performer	High Performer
Abbott	17.7%	14.5%	9.5%	11.5%	18.0%	8.0%	86.7%	90.6%
DFG C to H	15.8%	16.1%	11.5%	6.0%	6.7%	6.8%	89.7%	93.2%
DFG IJ	19.8%	13.8%	15.3%	13.2%	4.5%	2.6%	91.6%	93.7%
Non-Abbott A	12.2%	10.0%	9.8%	4.0%	14.6%	4.0%	70.7%	96.0%
Non-Abbott B	19.0%	10.7%	8.7%	7.1%	10.0%	4.7%	85.5%	96.4%
Other	14.1%		7.7%		5.1%		89.7%	

At the high school level, the patterns were again similar. In Abbott schools in particular, lower performers had higher shares of new teachers with a BA, lower shares of teachers with 5 to 10 years and an MA, higher shares of alternative certification and lower shares of standard certification.

Table 72
High School* Teacher Qualifications in Lower and Higher Performing Schools

	New Teachers with BA		5 to 10 with MA		Alt. Certification		Standard Certification	
Group	Low Performer	High Performer	Low Performer	High Performer	Low Performer	High Performer	Low Performer	High Performer
Abbott	13.2%	12.1%	9.8%	12.5%	15.1%	12.5%	86.7%	88.1%
Abbott Charter	31.8%	35.6%	7.6%	11.0%	37.9%	37.0%	71.2%	67.8%
DFG C to H	13.1%	9.2%	10.0%	12.2%	11.4%	7.2%	89.7%	95.4%
DFG IJ		10.9%		15.2%		19.9%		84.8%
Non-Abbott B		20.3%		17.7%		10.1%		86.1%

Table 73 presents the odds ratios from a logistic regression using individual teacher level data to predict the likelihood that a teacher is a new teacher with a BA only. At the elementary level, teachers in schools with higher competitive salaries were less likely, though not significant, to be new with a BA only. Teachers in schools with larger class sizes were more likely to be new with a BA only. Teachers in schools with higher black student concentration were much more likely to be new teachers with a BA only.

Patterns were similar at the high school level, especially where school racial composition is concerned. Teachers in schools with more black students (proportionately) were substantially more likely to be new teachers with a BA only.

Table 73
Logistic Regression of Predictors of a New Teacher with BA Only

	Elementary			Middle			High		
DV = New with BA	Odds Ratio	Std. Err.	P>z	Odds Ratio	Std. Err.	P>z	Odds Ratio	Std. Err.	P>z
School Mean Salary Ratio to Predicted	0.843	0.106		0.917	0.139		0.223	0.041	*
Class Size	1.010	0.003	*	1.001	0.002		1.000	0.003	
% Black	1.251	0.055	*	1.095	0.058	**	1.091	0.066	
% Free Lunch	1.138	0.054	*	1.239	0.075	*	1.413	0.130	*
% LEP/ELL	0.758	0.084	*	0.819	0.139		0.525	0.141	*
Year = 2007	0.935	0.016	*	0.935	0.018	*	0.918	0.019	*

includes fixed effect for CBSA
*p<.05, **p<.10

Table 74 adds to the logistic regression analysis, an indicator that the school is a high, versus low performing school. Table 74 shows that teachers in high performing schools are nearly 8% less likely to be new with a BA at the elementary level, nearly 20% less likely to be new with a BA at the middle school level, but there was no difference at the high school level.

Table 74
Logistic Regression of Predictors of a New Teacher with BA Only including Performance Category

	Elementary				Middle				High		
DV = New with BA	Odds Ratio	Std. Err.	P>z		Odds Ratio	Std. Err.	P>z		Odds Ratio	Std. Err.	P>z
School Mean Salary Ratio to Predicted	0.806	0.233			2.063	0.883	**		6.350	4.076	*
Class Size	1.008	0.007			1.037	0.009	*		0.966	0.012	*
% Black	1.449	0.105	*		1.047	0.115			0.539	0.086	*
% Free Lunch	0.909	0.081			1.143	0.125			5.798	1.570	*
% LEP/ELL	1.174	0.172			0.901	0.236			0.046	0.043	*
High (versus Low)	0.924	0.033	*		0.797	0.040	*		1.104	0.083	
Year = 2007	0.929	0.032	*		0.916	0.044	**		0.884	0.056	**

includes fixed effect for CBSA
*p<.05, **p<.10

Table 75 provides estimates from a logistic regression of the likelihood that a teacher has 5 to 10 years experience and a masters degree. Where competitive salaries were higher, the likelihood of teachers have 5 to 10 years and a masters degree was much higher. Teachers in higher poverty schools were much less likely to have 5 to 10 years experience and a masters degree.

Table 75
Logistic Regression of Predictors of a Teacher with 5 to 10 Years and an MA

	Elementary				Middle				High		
DV = 5 to 10yrs & MA	Odds Ratio	Std. Err.	P>z		Odds Ratio	Std. Err.	P>z		Odds Ratio	Std. Err.	P>z
School Mean Salary Ratio to Predicted	6.093	0.946	*		3.891	0.738	*		10.597	2.108	*
Class Size	0.990	0.004	*		1.005	0.003	**		0.998	0.004	
% Black	0.939	0.053			1.010	0.070			0.886	0.067	
% Free Lunch	0.647	0.038	*		0.605	0.047	*		0.539	0.061	*
% LEP/ELL	1.995	0.248	*		2.430	0.489	*		1.266	0.384	
Year = 2007	1.159	0.024	*		1.162	0.028	*		1.160	0.028	*

includes fixed effect for CBSA
*p<.05, **p<.10

Table 76 introduces the high performance (versus low performance) indicator into the logistic regression. Teachers in high performing elementary and high schools were 13 to 43% more likely (respectively) than teachers in low performing elementary and high schools to have 5 to 10 years experience and a masters degree.

Table 76
Logistic Regression of Predictors of a Teacher with 5 to 10 Years and an MA, including Performance Category

	Elementary				Middle				High		
DV = 5 to 10yrs & MA	Odds Ratio	Std. Err.	P>z		Odds Ratio	Std. Err.	P>z		Odds Ratio	Std. Err.	P>z
School Mean Salary Ratio to Predicted	2.440	0.945	*		0.121	0.065	*		2.013	1.535	
Class Size	0.983	0.009	**		1.052	0.013	*		0.986	0.014	
% Black	0.701	0.066	*		1.488	0.210	*		0.712	0.137	**
% Free Lunch	1.369	0.155	*		0.849	0.117			1.034	0.330	
% LEP/ELL	1.149	0.204			2.842	0.807	*		3.024	3.126	
High (versus Low)	1.132	0.053	*		1.129	0.074	**		1.430	0.120	*
Year = 2007	1.190	0.054	*		1.225	0.077	*		1.183	0.087	*

includes fixed effect for CBSA
*p<.05, **p<.10

Table 77 provides a logistic regression of the likelihood that a teacher holds alternative route certification. Teachers in higher poverty schools are much more likely to hold alternative route certification.

Table 77
Logistic Regression of Predictors of a Teacher with Alt. Route Certification

	Elementary				Middle				High		
DV = Alt. Route Cert	Odds Ratio	Std. Err.	P>z		Odds Ratio	Std. Err.	P>z		Odds Ratio	Std. Err.	P>z
School Mean Salary Ratio to Predicted	0.111	0.023	*		0.469	0.102	*		0.074	0.016	*
Class Size	1.029	0.005	*		1.001	0.004			1.027	0.004	*
% Black	1.821	0.099	*		1.142	0.076	*		1.088	0.073	
% Free Lunch	10.466	0.651	*		5.552	0.415	*		3.815	0.388	*
% LEP/ELL	1.234	0.154	**		0.503	0.105	*		0.257	0.081	*
Year = 2007	1.085	0.027	*		1.088	0.029	*		1.145	0.028	*

includes fixed effect for CBSA
*p<.05, **p<.10

Table 78 adds the high performance indicator to the alternative route models. In high performing elementary and middle schools, teachers were much less likely to hold alternative route certification, when compared to low performing elementary and middle schools. This pattern is reversed in high schools. Teachers were more likely to hold alternative route certification in higher performing high schools.

Table 78
Logistic Regression of Predictors of a Teacher with Alt. Route Certification, including Performance Category

	Elementary			Middle			High		
DV = Alt. Route Cert	Odds Ratio	Std. Err.	P>z	Odds Ratio	Std. Err.	P>z	Odds Ratio	Std. Err.	P>z
School Mean Salary Ratio to Predicted	0.051	0.020	*	0.136	0.074	*	0.105	0.073	*
Class Size	1.061	0.009	*	1.046	0.012	*	1.130	0.015	*
% Black	1.718	0.156	*	1.045	0.148		0.195	0.037	*
% Free Lunch	11.770	1.470	*	9.382	1.411	*	15.766	4.658	*
% LEP/ELL	0.803	0.150		0.062	0.026	*	0.001	0.001	*
High (versus Low)	0.794	0.036	*	0.530	0.036	*	1.346	0.108	*
Year = 2007	1.004	0.043		0.981	0.057		1.179	0.077	*

includes fixed effect for CBSA
*p<.05, **p<.10

Analysis 3
Detailed mapping of the distribution of teachers by qualifications across 90 focus schools

Analysis 4 follows the same basic approach as analysis 3 within the staffing resource analysis framework, but addresses more specifically our 90 focus schools. In addition to evaluating the distribution of teacher credentials and relative wages by such classifications as district factor group, job code and grade level, we explore differences in teacher qualifications by the performance groups to which schools were assigned in our preliminary screening. For example, is there a relationship between the percent of novice teachers and/or degree levels and the performance groups into which schools fall? Are schools where salaries are more competitive with their surrounding labor market more likely to fall into the higher performing group of schools?

Data

For this analysis we focus on staffing data from 2006-07 for our 90 focus schools and as noted previously, attempt to reconcile 2006-07 state administrative data on teachers with school level rosters provided by local school officials. We focus on the previously listed teacher qualifications.

Analysis

As in our statewide analysis, the analysis of staffing credentials in our focus schools involves primarily tabulations of teacher qualifications by grade level, district factor group and also by school performance category. This section also includes a handful of relatively simple logistic regression models addressing the likelihood that individual teaches are highly qualified, fully certified, non-novice or hold advanced degrees. Of primary interest to us is whether there are differences in these likelihoods by school performance category. That is, are teachers in higher performing elementary schools more likely than those in lower performing ones to be highly qualified, non-novice, fully certified or hold advanced degrees? Our basic model may be expressed:

$$\textbf{Teacher Qualification}_t = f(\textbf{Performance Category}_s, \textbf{Student Demographics}_s, \textbf{School Characteristics}_s, \textbf{Relative Salaries}_s)$$

Where each teacher qualification measure is reduced to a dichotomous coding (1=yes) for each individual teacher "t," where performance category is also dichotomous (high = 1, low = 0) for each school "s," student demographics include race and poverty measures for each school "s," school characteristics include grade level and range for each school "s," and relative salary refers to the index of school level salary for teachers to the labor market mean, for each school "s."

Next, using our school level teacher team quality indicators constructed in the previous analysis, we evaluate whether there are differences in the aggregate teacher team characteristics in higher versus lower performing schools of comparable grade level, with consideration for school demographics. We begin with simple comparisons of the mean characteristics of teacher teams in higher versus lower performing schools at comparable grade level. We conclude with relatively simple regression models (truncated at 0% and 100% for the dependent variable) of the relationship between teacher team attributes and school performance, controlling for school demographics and relative wages. Notably, due to aggregation our sample size is substantially reduced in this analysis with only 30 schools at each grade level, requiring that we identify the most parsimonious model possible (single school demographic measure "poverty").

Findings

Table 79 replicates the previous logistic regression model of all higher/lower performing schools with just the high/low performing 90 schools subset. Table 79 shows that teachers in elementary schools with higher black student concentration are much more likely to be new and hold only a BA. The pattern is reversed for high schools and only marginally significant for the middle schools.

Teachers in higher performing middle schools were less likely to be new with only a BA. The pattern for high schools was reversed.

Table 79
Logistic Regression of Predictors of New Teacher with BA – Rutgers Sample Schools Only

	Elementary				Middle				High		
DV = New with BA	Odds Ratio	Std. Err.	P>z		Odds Ratio	Std. Err.	P>z		Odds Ratio	Std. Err.	P>z
School Mean Salary Ratio to Predicted	0.462	0.561			0.022	0.029	*		11.425	13.987	*
Class Size	1.024	0.021			1.070	0.024	*		0.964	0.023	
% Black	2.330	0.581	*		1.818	0.590	**		0.334	0.078	*
% Free Lunch	1.218	0.301			1.832	0.618	**		11.311	4.911	*
% LEP/ELL	2.595	0.889	*		0.923	0.707			0.002	0.002	*
High (versus Low)	0.944	0.092			0.680	0.075	*		1.295	0.157	*
Year = 2007	0.873	0.076			0.791	0.077	*		0.900	0.077	

includes fixed effect for CBSA
*p<.05, **p<.10

Table 80 shows the logistic regression results for teachers with 5 to 10 years and a masters degree. In higher performing schools at all grade levels, teachers were much more likely to have 50 to 10 years experience and a masters degree.

Table 80
Logistic Regression of Predictors of 5 to 10 year Teacher with MA – Rutgers Sample Schools Only

	Elementary				Middle				High		
DV = 5 to 10yrs & MA	Odds Ratio	Std. Err.	P>z		Odds Ratio	Std. Err.	P>z		Odds Ratio	Std. Err.	P>z
School Mean Salary Ratio to Predicted	4.865	7.018			0.103	0.182			1.676	2.712	
Class Size	0.911	0.022	*		1.011	0.029			0.939	0.028	*
% Black	0.310	0.099	*		1.895	0.750			1.280	0.404	
% Free Lunch	0.671	0.196			0.267	0.110	*		0.368	0.202	**
% LEP/ELL	0.436	0.227			25.569	22.040	*		380.415	640.727	*
High (versus Low)	1.436	0.169	*		1.376	0.182	*		1.701	0.263	*
Year = 2007	1.267	0.133	*		1.360	0.163	*		1.151	0.118	

includes fixed effect for CBSA
*p<.05, **p<.10

Table 81 displays the logistic regression results for the likelihood that a teacher has alternative route certification. In higher performing elementary and middle schools teachers were much less likely to have received alternative route certification. But in higher performing high schools they were more likely to have received alternative route certification. Alternative route certification is highly associated with poverty.

Table 81
Logistic Regression of Predictors Alt Route Certified Teacher – Rutgers Sample Schools Only

	Elementary				Middle				High		
DV = Alt. Route Cert	Odds Ratio	Std. Err.	P>z		Odds Ratio	Std. Err.	P>z		Odds Ratio	Std. Err.	P>z
School Mean Salary Ratio to Predicted	0.093	0.123	**		0.238	0.408			0.136	0.166	
Class Size	1.074	0.024	*		1.090	0.030	*		1.091	0.029	*
% Black	3.033	0.849	*		1.518	0.611			0.195	0.050	*
% Free Lunch	5.739	1.746	*		21.230	9.880	*		18.462	8.711	*
% LEP/ELL	1.180	0.503			0.021	0.022	*		0.000	0.000	*
High (versus Low)	0.622	0.067	*		0.441	0.064	*		2.391	0.297	*
Year = 2007	1.094	0.101			0.790	0.093	*		1.515	0.151	*

includes fixed effect for CBSA
*p<.05, **p<.10

Analysis 4
Differences in key resource variables between extreme high and low performing elementary, middle and secondary schools

Data

This analysis makes use of the same data used in the previous regression models, but approaches the question with descriptive analysis of the various school resource measures across the higher and lower performing schools in the sample. Again, higher or lower performing is based on the original screening models. In this case, higher and lower performing schools are those with standardized residuals greater than 1 standard deviation away from the mean.

Analysis

This analysis will involve simple comparisons of group means for higher and lower performing schools on the following measures:

1. School aggregated per pupil spending
2. % Novice Teachers with BA
3. Labor Market Relative Salary
4. Class size
5. School Size

Findings

Table 82 provides descriptive characteristics for resource data for the schools that were more than 1 standard deviation above their predicted performance levels and more than one standard deviation below their predicted performance levels when controlling for demographic characteristics in the screening models. One can see that on average, schools in the higher performance category, tended to have slightly higher staffing expenditures per pupil, tended to have slightly lower percentages of novice teachers with a BA only, and tended to be smaller in enrollment, especially at the high school level. The findings regarding school size are surprisingly consistent with findings of a comprehensive review of economies of scale in education by Andrews, Duncombe and Yinger (2002) which found an optimal elementary school size of 300 to 500 students and optimal high school size of 600 to 900 students, with school districts able to minimize costs between 2,000 and 5,000 students.

Table 82
Average resource measures for schools with standardized residuals 1 standard deviation above (high) or below (low) predicted (screening models)

	Total Cert. Salaries per Pupil		Ratio of Actual to Predicted Salaries*		Schoolwide Class Size		% Teachers with BA Only		Enrollment	
	Low	*High*	*Low*	*High*	*Low*	*High*	*Low*	*High*	*Low*	*High*
NJASK										
2004	$ 5,212	$ 5,301	0.987	1.000	18.47	18.24	20.8%	17.7%	499.28	399.30
2005	$ 5,388	$ 5,497	0.995	0.993	18.85	18.72	20.2%	19.2%	463.31	433.55
2006	$ 5,666	$ 5,711	0.992	0.993	18.86	18.77	19.4%	18.9%	488.78	439.36
3yr Mean	$ 5,410	$ 5,497	0.991	0.996	18.72	18.57	20.2%	18.6%	483.74	423.53
GEPA										
2004	$ 5,366	$ 5,546	0.985	0.986	19.07	19.16	19.0%	17.4%	611.04	513.42
2005	$ 5,726	$ 6,156	0.984	0.994	19.22	19.33	19.2%	18.2%	570.69	582.09
2006	$ 6,116	$ 6,329	0.987	0.996	19.40	19.12	20.2%	18.4%	592.87	563.69
3yr Mean	$ 5,765	$ 5,988	0.986	0.992	19.24	19.19	19.6%	18.0%	592.14	550.45
HSPA										
2004	$ 6,084	$ 6,294	1.001	0.991	18.29	19.03	20.1%	17.2%	1,136.71	783.29
2005	$ 6,470	$ 6,790	0.979	1.009	18.38	18.38	19.3%	16.1%	1,064.02	821.75
2006	$ 6,469	$ 6,825	0.991	0.992	18.59	18.50	21.3%	17.4%	1,234.02	809.68
3yr Mean	$ 6,346	$ 6,645	0.990	0.997	18.42	18.63	20.2%	17.0%	1,139.82	804.94

*Extent to which school average salaries are higher or lower than their labor market mean, controlling for degree levels, experience and assignment

Analysis 5
Differences in school climate related indicators between higher and lower performing schools

Data

This analysis draws primarily on the three data sets constructed for the preliminary school screening models – one for elementary schools, one for middle schools and one for secondary schools – where grade levels were determined by whether NJASK, GEPA or HSPA was administered to students. Notably, there are many schools which appear as serving both elementary and middle, or middle and secondary students.

This analysis merges onto the 2004 to 2006 panels, additional data from the school reports on faculty attendance rates, student suspension rates and student mobility rates. For each measure, 3-year averages are used. Faculty mobility rates were also tested but are not reported.

Analysis

This analysis begins with descriptive comparisons of mean rates of faculty attendance, student suspension and student mobility across schools identified as being more than 10 standard deviation over and more than 1 standard deviation under predicted performance.

Next, I estimate logistic regression models to identify predictors that a school is a high rather than lower performer (with the middle of the distribution excluded). Specifically, I estimate whether higher faculty attendance, higher student suspension rates and/or higher student mobility rates are predictors of a school being a high performing school, controlling for other school resource factors. I do not include controls for demographics and other socio-economic characteristics at this state because those characteristics were included in identifying whether the school was higher or lower performing.

Findings

Table 83
Mean characteristics of higher and lower performing schools by grade level

	Elementary		Middle		High School	
	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
Faculty Attendance						
Low Performing	95.65	1.88	95.61	1.77	94.55	2.88
High Performing	96.08	1.80	95.80	1.83	96.07	1.70
Student Suspension						
Low Performing	4.76	5.45	9.30	9.00	17.14	11.50
High Performing	2.88	3.98	6.97	8.10	12.97	12.85
Student Mobility						
Low Performing	16.97	9.45	17.10	11.12	21.73	14.09
High Performing	16.29	10.79	13.38	8.19	10.20	10.45

- On average, it would appear that higher performing elementary schools have slightly higher rates of faculty attendance, lower suspension rates for students and comparable if not slightly lower rates of student mobility.
- On average, it would appear that higher performing middle schools have slightly lower rates of student suspension and lower rates of student mobility.
- On average, it would appear that higher performing high schools have slightly higher faculty attendance rates, lower student suspension rates and much lower student mobility rates.

Table 84
Logistic regression of "high performing" schools

	Elementary			Middle			High School		
DV - High Performer	**Odds Ratio**	**Std. Err.**	**P> z**	**Odds Ratio**	**Std. Err.**	**P> z**	**Odds Ratio**	**Std. Err.**	**P> z**
Faculty Attendance	1.126	0.048	*	0.969	0.058		1.339	0.186	*
Student Suspension	0.918	0.016	*	0.983	0.012		1.002	0.028	
Student Mobility	1.019	0.008	*	0.961	0.011	*	0.915	0.026	*
Class Size	0.977	0.029		1.014	0.035		1.064	0.102	
Salary Ratio	9.001	10.829	**	16.465	29.783		91163.80	442532.8	*
% New Tch w/BA	0.348	0.306		0.126	0.168		0.000	0.000	*
Enrollment (100s)	0.914	0.031	*	0.969	0.034		0.914	0.040	*
Year	1.041	0.086		0.873	0.099		1.263	0.357	

*p<.05, **p<.10

- Logistic regression models largely confirm the findings of the descriptive table above. Faculty attendance is statistically significantly higher in high performing elementary and high schools but not middle schools.
- Student mobility is slightly higher in high performing elementary schools but lower in high performing middle and high schools.
- Student suspension rates are lower in higher performing elementary schools, but there are not differences at other grad levels.
- As per earlier findings, class size is unrelated to high performing schools, salary ratios are higher in high performing elementary and high schools, but with

variable significance, and higher performing elementary and high schools tend to be smaller in total enrollment.

Analysis 6
Differences in teachers' own race/ethnicity in relation to student populations in higher and lower performing schools

Data

For this analysis, I use teacher level data from 2005-06 and 2006-07 to explore the relationship between teachers' race, student population racial composition and student outcomes. As in the previous analysis, I merge additional school level data on student suspension rates for the final analysis evaluating whether the match between teacher and student race is associated with suspension rates.

Analysis

Analyses in this section begin with descriptive tables summarizing the student population % black share across (a) higher and lower performing schools and (b) teachers who are black versus those who are non-black. Next, I summarizes student population % black shares across (a) higher and lower performing schools and (b) teachers who are white versus those who are non-white. Separate analyses were conducted for other races and intersections between ethnicity and language proficiency, but findings were unclear. The most striking dichotomy in New Jersey remains the black-white dichotomy.

Beyond descriptive comparisons, I run logistic regression models to identify predictors that a school – in which the teacher teaches – is a higher performing school versus a lower performing one (with the middle of the distribution excluded). First, I run a simple model in which I evaluate whether teacher race, student race and the interaction of the two are associated with being a high performing school. Next, I include additional covariates.

Finally, given the previous finding that suspension rates are lower in higher performing elementary schools, I evaluate whether the match between teacher race and student population racial composition is associated with differential suspension rates. A linear regression model is estimated.

Findings

Table 85

Mean student population % black among higher and lower performing schools of black and non-black teachers

	Non-Black Teacher	Black Teacher	Non-Black Teacher	Black Teacher	Non-Black Teacher	Black Teacher
Low Performing						
Mean% (students)	**27.5%**	**61.4%**	**23.8%**	**58.4%**	**36.8%**	**68.3%**
Stdev	26.9%	29.6%	23.8%	29.3%	30.9%	25.5%
# Teachers	10,112	2,532	5,835	1,652	4,025	1,895
High Performing						
Mean% (students)	**24.2%**	**73.3%**	**19.7%**	**74.1%**	**38.5%**	**55.9%**
Stdev	28.3%	29.4%	26.8%	27.1%	25.4%	18.4%
# Teachers	8,864	1,748	4,612	744	2,045	435

- Among black teachers in low performing elementary schools, the average % black students in attendance was 61%. Among black teachers in higher performing schools, the average % black students in attendance was 73.3%. There appears to be a higher rate of "success" where black teachers are in schools serving black student populations – at the elementary level.
- The pattern for middle schools is comparable to that for elementary schools, whereby high performing middle schools with black teachers have disproportionately higher shares of black teachers.
- The patterns for elementary and middle schools does not hold for high schools.

Table 86

Mean student population % black among higher and lower performing schools of white and non-white teachers

	Non-White Teacher	White Teacher	Non-White Teacher	White Teacher	Non-White Teacher	White Teacher
Low Performing						
Mean% (students)	**49.7%**	**26.8%**	**47.6%**	**22.9%**	**63.5%**	**34.2%**
Stdev	31.6%	27.2%	30.7%	23.9%	27.5%	30.8%
# Teachers	4,163	8,481	2,590	4,897	2,560	3,360
High Performing						
Mean% (students)	**54.3%**	**24.0%**	**48.4%**	**20.1%**	**53.1%**	**37.1%**
Stdev	37.8%	27.9%	39.4%	26.6%	19.7%	25.7%
# Teachers	2,918	7,694	1,360	3,996	686	1,794

- The pattern for white teachers and black students is largely the inverse of the pattern for black students and black teachers since the two remain the dominant races in New Jersey. Where teachers are white and schools are higher performing, the shares of children who are black are slightly lower at the elementary and middle school level. Shares of children who are black are slightly higher in high performing high schools compared to lower performing ones (37.1 to 34.2).

Table 87
Logistic regression of interaction of teacher race and student population racial composition on likelihood that school is high performing

	Elementary				Middle				High		
DV = High Performer	Odds Ratio	Std. Err.	P> z		Odds Ratio	Std. Err.	P> z		Odds Ratio	Std. Err.	P> z
Teacher is Black	0.276	0.103	*		0.128	0.077	*		1.651	1.408	
Students % Black	0.642	0.286			0.522	0.412			1.221	1.433	
Black Teacher x % Black Students	6.192	3.754	*		14.462	15.57	*		0.115	0.157	
Year	0.982	0.013			0.958	0.033			1.061	0.031	*

*p<.05, **p<.10
Robust standard errors clustering teachers in schools

- Where the teacher is black, a school is only 27.6% as likely to be a higher performing school. But, while schools of black teachers are less likely to be higher performing, there exists a strong positive interaction whereby schools of black teachers with higher concentrations of black students are more likely (than schools of black teachers with lower concentrations of black students) to be high performing. This relationship occurs at the elementary and middle school level, but not at the high school level.

Table 88
Logistic regression of interaction of teacher race and student population racial composition on likelihood that school is higher performing with additional covariates

	Elementary				Middle				High		
DV = High Performer	Odds Ratio	Std. Err.	P> z		Odds Ratio	Std. Err.	P> z		Odds Ratio	Std. Err.	P> z
Teacher is Black	0.302	0.107	*		0.132	0.085	*		4.444	4.503	
Students % Black	0.748	0.430			0.446	0.437			2.383	4.133	
Black Teacher x % Black Students	**5.211**	**2.959**	*		**11.680**	**13.30**	*		**0.032**	**0.046**	*
Teacher is Hispanic	0.998	0.210			0.324	0.119	*		0.853	0.281	
Students % ELL	1.295	1.356			0.798	1.609			0.001	0.017	
Hispanic Teacher x % ELL Students	0.361	0.384			350.504	480.0	*		9.217	25.60	
Salary Competitiveness Ratio	1.603	0.644			1.588	0.932			3.913	3.873	
Schoolwide Class Size	1.021	0.055			0.921	0.071			1.000	0.110	
% Free Lunch	0.801	0.533			1.287	1.197			0.107	0.322	
NJ Experience (ln)	0.973	0.036			1.064	0.047			0.854	0.081	**
MA or Higher	1.148	0.081	*		1.046	0.098			1.114	0.128	
Alternate Route Certification	0.781	0.131			0.602	0.135	*		0.943	0.311	
Year	0.987	0.032			0.925	0.054			1.095	0.060	**

*p<.05, **p<.10
Robust standard errors clustering teachers in schools

- When the list of covariates is expanded, the finding still holds that while on average, the schools of black teachers are less likely to be high performing (except high schools), schools of black teachers with higher concentrations of black students are more likely to be high performing. The second finding (interaction) should always, however be considered along with the first (main effect).

- A similar positive race/ethnicity matching effect was not generally found for Hispanic teachers and students (not included herein), but a positive interaction was found between Hispanic teachers and ELL children at the middle school level (though the estimate was unstable).

Table 89

Regression of student suspension rates including interactions between teachers' own race and student population racial composition

DV=Suspension Rate	Odds Ratio	Std. Err.	P>z
Middle School	4.313	0.407	*
High School	11.452	0.581	*
Teacher is Black	3.026	0.577	*
Students % Black	7.614	1.500	*
Black Teacher x % Black Students	**-9.025**	**1.191**	*****
Teacher is Hispanic	-0.646	0.355	**
Students % ELL	-10.681	3.367	*
Hispanic Teacher x % ELL Students	-2.757	2.188	
Salary Competitiveness Ratio	0.024	0.607	
Schoolwide Class Size	-0.015	0.064	
% Free Lunch	9.132	1.584	*
NJ Experience (ln)	-0.013	0.049	
MA or Higher	-0.702	0.090	*
Alternate Route Certification	-0.141	0.278	
Year	-0.041	0.035	
Constant	82.124	70.286	
R-squared	0.390		

*p<.05, **p<.10

Robust standard errors clustering teachers in schools

- On average, middle and secondary schools have higher rates of student suspensions.
- Schools where the teacher is black and where more students are black tend to have higher rates of student suspensions.
- However, schools where the teacher is black and where the share of students that are black are higher tend to have lower suspension rates.
- Schools where poverty is higher tend to have higher suspension rates.
- Schools where teachers have an MA or higher tend to have lower suspension rates.

ENDNOTES

[1] Following the 1984 report *A Nation at Risk.*

[ii] Entire states such as Rhode Island adopted these resource tracking systems (IN$ITE)

[iii] Speakman, S., Cooper, B.S., Sampieri, R., May, J., Holmsbeck, H., Glass, B. (1996) Bringing Money to the Classroom: A Systematic Resource Allocations Model Applied to the New York City Public Schools. In Picus and Wattenbarger (Eds) *Where Does the Money Go? Resource Allocation in Elementary and Secondary Schools.* (Thousand Oaks, CA: Corwin Press, 1996): 106-131

[iv] Though several methodologically weak production function studies did find cross school correlations between % of expenditures on instruction and school aggregate test scores.

[v] http://www.nysut.org/files/nysut_gap_071026_Odden.pdf

[vi] Wenglinsky, H. (1997) How Money Matters: The effect of school district expenditure on academic achievement. *Sociology of Education* 70 (3) 221-237

[vii] Ferguson, Ronald F. and Helen F. Ladd (1996), "How and Why Money Matters: An Analysis of Alabama Schools," in *Holding Schools Accountable: Performance Based Education,* Helen F. Ladd (editor), The Brookings Institution: Washington D.C.

[viii] Jacques, C., Borsen, B.W. (2002) Relationship between types of school district expenditures and school district performance. *Applied Economics Letters* 2002 (9) 997-1002

[ix] Bedard, K., Brown, W.O. (2000) The Allocation of Public School Expenditures. Working Paper. Department of Economics. Claremont Colleges.

[x] Brewer, D.J. (1996) Does More School Administration Lower Educational Productivity? Some Evidence on the "Administrative Blob" in New York Public Schools. Economics of Education Review 15 (2) 111-125

[xi] Marlow's finding seems counterintuitive and may be explained by factors overlooked in Marlow's analysis. Among other things, more recent studies have shown that districts with higher overall spending or higher fiscal capacity to spend tend to spend proportionately more on administration. Many of those same higher spending, higher fiscal capacity school districts also serve more advantaged student populations and/or benefit from stronger community support. Marlow, M.L. (2001) Bureaucracy and Student Performance in US Public Schools. *Applied Economics* 33 (10) 1341-1350.

[xii] Huang, G.G., Yu, B. (2002) District Fiscal Policy and Student Achievement: Evidence from Combined NAEP-CCD Data. *Education Policy Analysis Archives* 10 (38)

[xiii] Baker, B.D. (2003) State Policy Influences on the Internal Allocation of School District Resources: Evidence from the Common Core of Data. *Journal of Education Finance* 29 (1) 1-24

[xiv] Monk, D.H., Hussain, S. (2000) Structural Influences on the Internal Allocation of School District Resources: Evidence from New York State. *Educational Evaluation and Policy Analysis* 22 (2000) 1 – 26

[xv] Brent, B.O., Roellke, C., Monk, D.H. (1997) Understanding Teacher Resource Allocation in New York State Secondary Schools: A Case Study Approach." *Journal of Education Finance* 23 (1997) 207-233

[xvi] Goertz, M.E. & Natriello, G. (1999) Court-Mandated School Finance Reform: What Do the New Dollars Buy? In Ladd, Chalk and Hansen (Eds.) pp. 99-135 Equity and Adequacy in Education Finance: Issues and Perspectives. Committee on Education Finance, Commission on Behavioral and Social Sciences and Education, National Research Council (Washington, DC: National Academy Press)

[xvii] Jane Hannaway, Shannon McKay and Yasser Nakib (2002) Reform and Resource Allocation: National Trends and State Policies. *Developments in School Finance 1999 – 2000.* Office of Educational Research and Improvement, National Center for Education Statistics (Washington, DC: U.S. Department of Education).

[xviii] Lankford, H. & Wyckoff, J. (1999) The Allocation of Resources to Special Education and Regular Instruction in New York State. In Parrish, Chambers & Guarino (Eds) pp. 147-175 Funding Special Education (Thousand Oaks, CA: Corwin Press)

[xix] Richard Rothstein with Karen Hawley Miles, Where's the Money Gone? Changes in the Level and Composition of Education Spending (Washington, DC: Economic Policy Institute, 1995).

[xx] Baker, B.D., Green, P.C., Richards, C.E. (2008) Financing Education Systems. New York, Merrill-Prentice-Hall.

[xxi] Carr, M., Gray, N., and Holley, M. (2007, Sept. 20). *Shortchanging Disadvantaged Students: An analysis of intra-district spending patterns in Ohio*. Policy Report No. 14. Columbus: The Buckeye Institute for Public Policy Solutions. Retrieved Oct. 10, 2007, from http://www.buckeyeinstitute.org/docs/Shortchanging_Disadvantaged_Students.pdf

[xxii] Burke, Sarah, M. 1999. "An Analysis of Resource Inequality at the State, District, and School Levels." *Journal of Education Finance*, 24, 4, 435-458

[xxiii] Stiefel, Leanna, Ross Rubenstein, and Robert Berne. 1998. Intra-District Equity in Four Large Cities: Data, Methods and Results." *Journal of Education Finance* 23, 4:447-467.

[xxiv] Rubenstein, R., Schwartz, A.E., Stiefel, L., Bel Hadj Amor, Hella (2007) From districts to schools: The distribution of resources across schools in big city school districts. *Economics of Education Review* 26 (5) 532-545

[xxv] Koski, W.S., Horng, E.L. (2007) Facilitating the Teacher Quality Gap? Collective Bargaining Agreements, Teacher Hiring and Transfer Rules, and Teacher Assignment Among Schools in California. *Education Finance and Policy* 2 (3) 262-300

[xxvi] Roza, M., Hawley-Miles, K. (2004) Understanding Student-based Budgeting as a Means to Greater School Resource Equity. Center on Reinventing Public Education: University of Washington. Working Paper

[xxvii] In Cincinnati, for example, Baker (2007) shows that the correlation across schools between poverty rate and gifted student percent is -.88.

[xxviii] Roza, M., Guin, K., Gross, B., Deburgomaster, S. (2007) Do districts fund schools fairly? *Education Next.* Fall, 68-73

[xxix] Baker (2007) explains how mixing schools of varied grade level and including districts which may have only one school at each grade level can produce erroneous results.

[xxx] Baker, B.D., Green, P.C. (2005) Tricks of the Trade: Legislative Actions in School Finance that Disadvantage Minorities in the Post-Brown Era *American Journal of Education* 111 (May) 372-413

[xxxi] Baker, B.D., Duncombe, W.D. (2004) Balancing District Needs and Student Needs: The Role of Economies of Scale Adjustments and Pupil Need Weights in School Finance Formulas. *Journal of Education Finance* 29 (2) 97-124

[xxxii] Ferguson, R.F. (1991). Paying for public education: New evidence on how and why money matters. *Harvard Journal of Legislation, 28*: 465-498.

[xxxiii] Sanders, W. & Horn, S. (1998). Research findings from the Tennessee Value-Added Assessment System (TVAAS) Database Implications for evaluation and research. *Journal of Personnel and Evaluation in Education, 12*(3), 247-256.

[xxxiv] Sanders, W. L. and Rivers, J. C. (1996). Cumulative and residual effects of teachers on future student academic achievement. Knoxville, TN:University of Tennessee Value-Added Research and Assessment Center.

[xxxv] Lankford, H., Loeb, S. & Wyckoff, J. (2002). Teacher sorting and the plight of urban schools. *Educational Evaluation and Policy Analysis 24*(1) 37-62

[xxxvi] Ingersoll, R. (1999). The problem of underqualified teachers in American Secondary schools. *Educational Researcher*, 28(2): 26-37.

[xxxvii] Esch, C.E., Chang-Ross, C.M., Guha, R.,Tiffany Morales, J.& Shields, P. (2004). California's teaching force. 2004: Key issues and trends. Santa Cruz, CA: The Center for Teaching and Learning. Fuller, E. (2004). Number and Percentage of Texas Public School Teacher Full-Time Equivalents Assigned In-Field, Out-of-Field, and Not Fully Certified (1995-2004). Unpublished manuscript. The University of Texas at Austin.

[xxxviii] Peske, Heather & Haycock, Kati. (2006). Teaching inequality: How poor and minority students are shortachanged on teacher quality. Washington, DC: The Education Trust.

[xxxix] Hanushek, E. A., Kain, J. F., & Rivkin, S. G. (2004). Why public schools lose teachers. Journal of Human Resources**,** *39*(2).

[xl] Hanushek, E.A., Kain, J.F. & Rivken, S.G. (1999). Do higher salaries buy better teachers? NBER working paper #7082. National Bureau of Economic Research. Murnane, R.J. & Olsen, R. (1989). The effects of salaries and opportunity costs on length of state in teaching. Evidence from Michigan. *Review of Economics and Statistics 71* (2) 347-352

[xli] Figlio, D.N. (1997). Teacher Salaries and Teacher Quality. *Economics Letters 55*(August), 267-271.Figlio, D.N. (2002). Can Public Schools Buy Better-Qualified Teachers?" *Industrial and Labor Relations Review 55*(4), 686-699. Loeb, S. & Page, M. (2000). Examining the link between teacher wages and student outcomes: the importance of alternative labor market opportunities and non-pecuniary variation. *Review of Economics and Statistics 82* (3), 393-408. Loeb, S. & Page, M. (1998). Examining the link between wages and quality in the teacher workforce. Department of Economics, University of California, Davis.

[xlii] Imazeki, J. (2001). Moving On or Moving Out? Determinants of Job and Career Changes for Teachers. Working Paper, Department of Economics, San Diego State University.

[xliii] Goldhaber, D. Gross, B., Player, D. (2007). Are Public Schools Really Losing Their Best? Assessing the Career Transition of Teachers and Their Implications for the Quality of the Teacher Workforce. A Paper Presented at the Annual Conference of the American Education Finance Association. Baltimore, MD.

[xliv] See, for example, Eric Hanushek (1996) School Resources and Student Performance. In Gary Burtless (ed.) pp. 43-73. *Does Money Matter?* Washington, DC: Brookings Institution. Larry Hedges and Rob Greenwald (1996) Have Times Changed? The Relation between School Resources and Student Performance. In Gary Burtless (ed.) pp. 74-92. *Does Money Matter?* Washington, DC: Brookings Institution.

[xlv] Krueger, A. (2002) Inequality: Too much of a good thing? CEPS Working Paper #87. Princeton University

[xlvi] Borman and Dowling (2006) find: " Specifically, both the racial/ethnic and social class composition of a student's school are approximately 150% more important than a student's individual race/ethnicity or social class for understanding educational outcomes. In dramatic contrast to previous analyses of the Coleman data, these findings reveal that school context effects dwarf the effects of family background." See: http://www.wceruw.com/news/coverStories/coleman_report_40_years.php

[xlvii] Corrine Taylor (1997) Does Money Matter? An Empirical Study Introducing Resource Costs and Student Needs to Educational Production Function Analysis. In William Fowler (Ed.)

Developments in School Finance 1997. Washington, DC: National Center for Education Statistics, Office of Educational Research and Improvement.

[xlviii] Duncombe, W.D., Yinger, J. (2008) Measurement of Cost Differentials. In H.F. Ladd and E.B Fiske (eds) pp. 238-256. Handbook of Research in Education Finance and Policy. New York: Routledge

[xlix] Duncombe, W., Yinger, J. (2007) A Comment on School District Level Production Functions Estimated Using Spending Data. Maxwell School of Public Affairs. Syracuse University.

[l] Eric A. Hanushek, Steven G. Rivken & Lori Taylor (1996) Aggregation and the Estimated Effects of School Resources. *Review of Economics and Statistics.*

[li] Harold Wenglinsky (1997) School District Expenditures, School Resources and Student Achievement: Modeling the Production Function. In William Fowler (Ed.) Developments in School Finance 1997. Washington, DC: National Center for Education Statistics, Office of Educational Research and Improvement.

[lii] David N. Figlio (1999) Functional Form and the Estimated Effects of School Resources. *Economics of Education Review* 18 (2) 242-252

[liii] Figlio, D. N. (1999). Functional form and the estimated effects of school resources. *Economics of Education Review, 18*(2), 242–252.

[liv] Duncombe, W., Yinger, J. (2007) Understanding the Incentives in California's Education Finance System. http://irepp.stanford.edu/documents/GDF/STUDIES/04-Duncombe-Yinger/4-Duncombe-Yinger(3-07).pdf

[lv] Finn, J.D., Achilles, C.M. (1999) Tennessee's Class Size Study: Findings, Implications, Misconceptions. *Educational Evaluation and Policy Analysis* 21 (2) 97-109.

[lvi] Barnett, W.S. (1995) The Long-term effects of early childhood programs on cognitive and school outcomes. *Future of Children* 5 (3) 25-50.

[lvii] Alexander, K., Entwisle, D.R., Olson, L. (2001) Schools, Achievement and Inequality: A Seasonal Perspective. *Educational Evaluation and Policy Analysis* 23 (2) 171-191. Borman, G.D., Dowling, N.M. (2006) Longitudinal Effects of Multi-year Summer School: Evidence from the Teach Baltimore Randomized Field Trial. *Education Evaluation and Policy Analysis* 28 (1) 25-48

[lviii] Comprehensive school reform models are another form of educational reform associated with increases in schooling quantity. We characterize the research on the effectiveness of comprehensive school reforms, including Roots and Wings/Success for All as mixed, at best. While meta-analyses of largely proprietary studies indicate positive effects, more rigorous empirical studies across models raise significant questions about these effects. See, for example Bifulco, Robert, William Duncombe, and John Yinger. 2005. "Does Whole-School Reform Boost Student Performance? The Case of New York City." *Journal of Policy Analysis and Management* 24:47-72. see also Borman, Geoffrey D, Gina M. Hewes, Laura T.

Overman, and Shelly Borwn. 2003. "Comprehensive School Reform and Achievement: A Meta-Analysis." *Review of Educational Research* 73:125-230.

[lix] Hanushek, E., Rivken, S. (2007) School Quality and the Black-White Achievement Gap. Education Working Paper Archive. University of Arkansas, Department of Education Reform

[lx] Richard J. Murnane and Randall Olsen (1989) The effects of salaries and opportunity costs on length of state in teaching. Evidence from Michigan. *Review of Economics and Statistics* 71 (2) 347-352.

[lxi] David N. Figlio (1997) Teacher Salaries and Teacher Quality. *Economics Letters* 55 267-271. David N. Figlio (2002) Can Public Schools Buy Better-Qualified Teachers?" *Industrial and Labor Relations Review* 55, 686-699. Ronald Ferguson (1991) Paying for Public Education: New Evidence on How and Why Money Matters. *Harvard Journal on Legislation.* 28 (2) 465-498.

[lxii] Susanna Loeb and Marianne Page (2000) Examining the link between teacher wages and student outcomes: the importance of alternative labor market opportunities and non-pecuniary variation. *Review of Economics and Statistics* 82, 393-408. Susanna Loeb and Marianne Page (19980 Examining the link between wages and quality in the teacher workforce. Department of Economics, University of California, Davis.

[lxiii] Jennifer Imazeki (2001) Moving On or Moving Out? Determinants of Job and Career Changes for Teachers. Working Paper, Department of Economics, San Diego State University. P. 30

[lxiv] In one attempt, Jepsen and Rivken (2003) does show that the positive effects of class size reduction in California were diminished in predominantly black schools, and argues that this effect occurs because of the labor market disadvantage of these schools – specifically that the decrease in class size was accompanied by a decrease in teacher quality in these schools. Rivken notes: “These larger transition costs and smaller longer term benefits are consistent with the possibility that teacher labor market disadvantages for these schools led to a deterioration in teacher quality that offsets much if not all of the benefits of smaller classes” (p. 1). Jepsen, C., Rivken, S. (2003) What is the tradeoff between smaller class sizes and teacher quality? Amherst College, Amherst, MA.

[lxv] For an exceptional overview of this topic, see Thomas Downes (2002) Do State Governments Matter? A Review of the Evidence on the Impact on Educational Outcomes of the Changing Role of the States in the Financing of Public Education. Working Paper, Federal Reserve Bank of Boston.

[lxvi] Thomas Downes and David Figlio (1998) School Finance Reforms, Tax Limits and Student Performance: Do Reforms Level Up or Level Down? Working Paper 98-05. Department of Economics, Tufts University.

[lxvii] Thomas Downes and Mona Shah (1995) The effect of school finance reform on th level and growth of per pupil expenditures. Working Paper. Department of Economics, Tufts University.

[lxviii] Thomas Downes (2003) School Finance Reform and School Quality: Lessons from Vermont. Paper presented at the American Education Finance Association annual meeting. Orlando, FL. Note that since Downes' analyses, Vermont has modified Act 60 to increase the foundation level of funding to $6,800 per pupil over the next few years. Downes' study only the effects of the increase to $5,100 per pupi.

[lxix] Ann Flanagan and Sheila Murray (2003) A Decade of Reform: The Impact of School Reform in Kentucky. Paper presented at the American Education Finance Association annual meeting. Orlando, FL.

[lxx] "Does Money Matter? Regression-Discontinuity Estimates from Education Finance Reform in Massachusetts," *NBER Working Paper 8269*, May 2001

[lxxi] John Deke (2003) A Study of the impact of public school spending on postsecondary educational attainment using statewide school district financing in Kansas.

[lxxii] Duncombe, W.D. and Yinger, J.M. (2000). Financing Higher Performance Standards: The Case of New York State. *Economics of Education Review*, *19* (3), 363-86. Duncombe, W., Yinger, J. (1998) "School Finance Reforms: Aid Formulas and Equity Objectives." *National Tax Journal* 51, (2): 239-63. Duncombe, W., Yinger, J. (1997). Why Is It So Hard to Help Central City Schools? *Journal of Policy Analysis and Management, 16,* (1), 85-113. Imazeki, J., Reschovsky, A. (2004) Is No Child Left Beyond an Un (or under)funded Federal Mandate? Evidence from Texas. *National Tax Journal* 57 (3) 571-588. Downes, T., Pogue, T. (1994). *Adjusting School Aid Formulas for the Higher Cost of Educating Disadvantaged Students. National Tax Journal XLVII* , 89-110

[lxxiii] Ondrich, J., Pas, E., Yinger, J. (2007) The Determinants of Teacher Attrition in Upstate New York. http://student.maxwell.syr.edu/elpas/attrition_upstate.pdf

[lxxiv] Hanushek, E., Rivken, S. (2007) School Quality and the Black-White Achievement Gap. Education Working Paper Archive. University of Arkansas, Department of Education Reform.

[lxxv] Indeed some low fiscal capacity communities might also choose to divert funding from efforts directly associated with the measured outcomes, but the track record of estimation of cost models of this type finds relative consistency (positive significant relationship) in the relationship between fiscal capacity and spending holding outcomes constant.

[lxxvi] Gronberg, T., Jansen, D., Taylor, L., Booker, K. (2004) *School Outcomes and Schools Costs: The Cost Function Approach*. (College Station, TX: Busch School of Government and Public Service, Texas A&M University). Retrieved March 1, 2006 from http://bush.tamu.edu/research/faculty_projects/txschoolfinance/papers/SchoolOutcomesAndSchoolCosts.pdf

[lxxvii] Robert Bifulco & William Duncombe (2000) Evaluating School Performance: Are we ready for prime time? In William Fowler (Ed) Developments in School Finance, 1999 – 2000. Washington, DC: National Center for Education Statistics, Office of Educational Research and Improvement. Robert Bifulco and Stewart Bretschneider (2001) Estimating School

Efficiency: A comparison of methods using simulate data. *Economics of Education Review* 20

[lxxviii] Others, including Bifulco and Duncombe, however, point out that this advantage only exists if the distribution of the noise in the data is correctly specified in the SFA model, a choice that must be made by the researcher, and made somewhat blindly.

[lxxix] Ruggiero, J. (2007) A comparison of DEA and Stochastic Frontier Model using panel data. *International Transactions in Operational Research* 14 (2007) 259-266

[lxxx] Budget type classification, including district grade ranges and special districts (county vocational and special education)

[lxxxi] Based on Indicator 1 of the NJDOE comparative spending guide.

[lxxxii] Based on Indicator 2 of the NJDOE comparative spending guide.

[lxxxiii] Based on Indicator 3 of the NJDOE comparative spending guide.

[lxxxiv] Based on Indicator 6 of the NJDOE comparative spending guide.