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Abstract
Although school accountability incentives and standards, such as district-mandated goals and state sanctions for poor performance, are increasingly common, few studies have investigated their effectiveness. The author of this paper seeks evidence on whether such policies affect public secondary principal pay and school performance. An analysis of cross-sectional variation in data from the 1999–2000 Schools and Staffing Survey indicates that accountability policies coincided with lower college matriculation rates and lower principal pay, particularly for the best principals. On the other hand, the policies were associated with higher student retention rates at the worst schools. Though principals at those schools may not have been directly rewarded through accountability policies, these principals appear to have acted as agents for students in danger of dropping out.

Keywords
Compensation and Performance, School Principals

PRINCIPALS AS AGENTS? INVESTIGATING ACCOUNTABILITY IN THE COMPENSATION AND PERFORMANCE OF SCHOOL PRINCIPALS

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Although school accountability incentives and standards, such as district-mandated goals and state sanctions for poor performance, are increasingly common, few studies have investigated their effectiveness. The author of this paper seeks evidence on whether such policies affect public secondary principal pay and school performance. An analysis of cross-sectional variation in data from the 1999–2000 Schools and Staffing Survey indicates that accountability policies coincided with lower college matriculation rates and lower principal pay, particularly for the best principals. On the other hand, the policies were associated with higher student retention rates at the worst schools. Though principals at those schools may not have been directly rewarded through accountability policies, these principals appear to have acted as agents for students in danger of dropping out.

In recent years, accountability standards have been implemented in many schools, tying compliance to school resources, reputation, and, at times, educator pay. Of the various actors with the power to respond to such initiatives, none is more central than the school principal, described by Cooley and Shen (2003) as "the key to accountability." Often viewed as the agent for parents, school boards, and communities, the school principal was essential to improvements in school quality long before explicit accountability policies appeared, and the principal's role in efforts to align the interests of all constituents is obvious. Unfortunately, little is known about either the specific role of principals in effecting strong school performance or the factors that enable a principal to respond to incentives and improve school quality. To investigate these issues I examine how accountability is related to principal compensation and student outcomes, and I attempt to identify factors that likely hinder or enable improvement. *Accountability,* in this context, includes district- and school-level factors such as performance goals, school reports, and sanctions, as well as state-level sanctions for poor performance. A school is assumed to be "accountable" if it is subject to at least one of these measures, whether or not it has directly faced sanctions.

The relationship between accountability and salary or school performance reveals the manner in which school principals act as agents. I examine the relationship between a principal's performance and pay in a few distinct ways. First, the marginal effect of principal characteristics on salary reflects

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Copies of the computer programs used to generate the results presented in the paper are available from the author at Campus Box 4200, Normal, IL 61790–4200; smbillg@ilstu.edu. The author does not have authorization to release the data used in the study, but researchers can apply to the National Center for Education Statistics for a restricted-use license to use the data.

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the "returns" to education, experience, and other human capital factors. OLS parameters reveal the returns for principals who earn salaries near the middle of the salary distribution. I augment these results using quantile regression, with estimates obtained across the conditional salary distribution. This procedure enables a comparison of the returns for the lowest-paid principals (controlling for observable characteristics) through the highest-paid. Since quantile regression does not involve partitioning the data by values of the dependent variable, these comparisons are particularly meaningful.

Once an analysis controls for principal and school characteristics that are known to be closely associated with salary, the remaining variation in pay arises from factors that are unobserved in the survey data. These factors may include communication skills, motivation and effort, local and state politics, and the principal's leadership ability. Most of these reflect how well a principal functions on the job, and following the same analytical framework used in some other salary studies, we interpret the error distribution as revealing variation in performance. Therefore, comparing parameter estimates throughout the conditional distribution of salary reveals whether returns to experience and other credentials are greater for the best-performing or the worst-performing principals. In this study, I specifically focus on the relationship between accountability (such as the presence of required goals from the district) and principal salary. The results can be used to predict which principals are likely to be penalized and which are likely to be rewarded in the presence of these standards. In this way, quantile regression provides a unique opportunity to learn about the potential effectiveness of new accountability measures, across principals and schools of diverse quality.

I then apply a similar method to examine school outcomes that reflect principal performance. I investigate whether accountability—the possibility of district sanctions for poor performance, for instance—coincides with better outcomes, as measured by college attendance and high school retention rates. As above, the conditional distribution of school outcomes reflects school (and principal) performance. Controlling for finances, school size, pupil-teacher ratios, poverty rates, and so on, variation in the school outcome is likely explained by a principal's particular managerial skill, as well as his or her ability to motivate teachers and students. Therefore, we can learn whether accountability standards correspond to better performance from the best or the worst principals.

To explore these issues, I use national cross-sectional data on secondary schools. The analysis comprises OLS and quantile regressions, as well as two-stage models to address potential endogeneity. If the intention of accountability is to reward the best principals and punish the worst, these standards should be negatively correlated with bad performance and positively correlated with good performance. Alternatively, if accountability is meant to induce better outcomes for struggling schools, we would expect positive relationships among the worst schools, and no substantial impact at the best schools.

1 School Principals, Student Outcomes, and Accountability

1.1 Pay for Performance for School Managers

A school principal manages a school by hiring and evaluating teachers, organizing curricula, and setting standards and policy for students, faculty, and staff, among other tasks. Though other constituents such as the district, the school board, teacher unions, and parents affect the functioning of a school, the principal is primarily responsible for the school's operation. The principal is therefore expected to make decisions that reflect the best interest of the district and the school board. In this way, the principal is the agent and the district/school board is the principal, and principal-agent models for firm managers (for example, CEOs) are theoretically relevant to understanding principals as school managers.

Perhaps the best known and most straightforward example of a practice aimed at aligning interests between principal and agent in the for-profit sector is the correlation between

a firm manager's compensation and the firm's performance. The link between stock returns and pay is well documented (see, for example, Jensen and Murphy 1990; Gibbons and Murphy 1990; Hallock and Murphy 1999; Hallock et al. 2003). Performance is certainly harder to measure in not-for-profit organizations than in for-profit firms, since there are no clear indicators such as stock prices, but Hallock (2002) did report several important determinants of managers' salaries at charitable and religious non-profit firms. Notably, he found some evidence that fiscal responsibility, measured by the proportion of total expenses devoted to program services, increases salary. Also, as in the case of for-profit firms, organization size (and hence, as a rule, the manager's responsibility) is positively related to salary. Indeed, schools with higher enrollments may also offer higher salaries, *ceteris paribus,* reflecting the increased demands associated with more students.

A principal's salary is also determined by expertise, as measured by education and experience. Stone (1985) found that education, experience, and district environment were positively correlated with pay. Using New York State data, Ehrenberg et al. (1988) found that salaries of school superintendents were positively affected by low tax rates and high student achievement on test scores. Meier and O'Toole (2002), studying superintendents in Texas schools, found that revenue per pupil, experience, education, and past school performance on test scores were important salary determinants.

The above considerations suggest three testable hypotheses for models of school principals' salary: (1) the correlation between school quality (such as pupil-teacher ratio) and principal pay should be highest for the best principals; (2) returns to size should be positive; and (3) returns to expertise should increase dispersion in principal salaries.

1.2 School Accountability

An assumption behind the implementation of accountability standards for educators is that educators affect student outcomes. Empirical evidence indeed supports that belief, in application both to teachers and to principals. Eberts and Stone (1988) found that principals affect student achievement by choosing curricula, evaluating teachers, and appropriately allocating teachers' time. Brewer (1993) found that principals can affect test scores by hiring good teachers and setting academic goals. Principal salaries are also positively related to test score gains.

Clear policy implications arise from empirical analyses of principal salary and school performance. As schools, districts, and states increasingly measure and demand "accountability," the role of the principal in improving school outcomes becomes even more important. A relevant body of literature examines the impact of incentives and accountability on educators and schools. Jacobson (1989) examined a New York State school district that implemented an incentive pay plan aimed at reducing absenteeism. Specifically, teachers received a bonus for each day absent less than seven. Though teachers did not know the exact amount of the bonus they would receive, absenteeism was substantially reduced as a result of the plan. Ladd (1999) investigated the Dallas school accountability and incentive program using panel data for urban schools in Texas. She found that the program positively affected seventh grade test scores, though only for whites and Latinos. In addition, dropout rates significantly declined in Dallas relative to schools in other areas, suggesting another positive effect of school accountability. Furthermore, using National Assessment of Educational Progress data, Palmer (2002) found that financial incentives linked to statewide tests were positively correlated with student improvements in reading.

While test score gains are a common measure of school performance (Hanushek et al. 1996; Eberts and Stone 1988; Brewer 1993), additional measures of performance are likely to be relevant. For instance, the percentage of students who pursue a college education after high school graduation is an important measure of performance, and it is apparent that many consider college matriculation an important indicator of a school's success. Another potentially valuable indicator is a school's dropout rate, which is particularly relevant for struggling schools. Furthermore,

it is entirely possible that accountability standards have heterogeneous effects on educational outcomes, in that struggling schools may see improvements as a result, but high-quality schools may not.

1.3 The Impact of Accountability on School Principals

Presumably, if a school must meet a certain performance goal, the principal is primarily responsible for the goal's attainment. I therefore investigate how principals react to accountability standards. One aspect of this topic is the manner in which accountability affects the best and the worst principals and schools.

It is reasonable to expect a monotonically increasing impact of accountability on school performance. That is, the best schools are likely to experience the most positive relationship between accountability and performance, perhaps due to involved parents who want the school to succeed, or because the principal is a skilled manager who hires the right people and sets appropriate goals. Perhaps the best schools simply have the best resources, and are thus well equipped to meet any goals or standards set for them. The weakest schools are likely to experience stronger negative correlations between accountability and performance, if accountability initiatives tend to be applied disproportionately to struggling schools. On the other hand, accountability standards are arguably meant to aid the schools that appear to be the weakest. A more positive correlation for weaker schools could reflect the presence of principals who take daring and effective steps for remediation, or greater efforts by teachers who are worried about losing their jobs, or "teaching to the test" and similar strategies aimed at meeting standards. A variety of hypotheses are certainly plausible, as we can expect that the effects of standards depend on (unobserved) school performance or quality.

This analysis incorporates not only accountability indicators, but also controls for factors that are likely to influence a principal's efficacy in implementing improvements. Such factors include parental involvement, the principal's relationship with the teaching staff, barriers to dismissal (which can be the result of bargaining with a union), problems with students, and autonomy in hiring teachers and in setting student performance standards. The worst principals may be unable to make substantial changes if, for instance, parents are not involved, or it is very difficult to dismiss poor teachers. Indeed, a negative relationship between accountability and performance may be due to any or all of these problems. Conversely, principals who thrive under accountability standards may do so because, for instance, they are able to exercise considerable influence over curriculum development and teacher hiring.

2 Data and Estimation Techniques

2.1 Data Sources

Most of the data for the secondary schools in this study are compiled from the 1999–2000 restricted-use Schools and Staffing Survey (SASS) administered by the National Center for Education Statistics. Information from the SASS about districts, principals, and schools is combined with dropout rate data from the 1999–2000 Common Core of Data. In addition, community characteristics from the 2000 U.S. Census are merged to the school-level data by Zip code.

The SASS data provide detailed information on public secondary school principals, including demographic characteristics, as well as specific tasks and assessments of school problems and strengths. For instance, a principal's self-reported influence over curriculum and hiring is available. Particularly valuable are data on accountability. For example, schools that must meet district-set goals are identified, as well as schools in states with sanctions for poor performance. Furthermore, the cross-sectional variation in the SASS reveals which schools, which principals, and which accountability measures are most highly correlated with strong (and weak) school performance. Particular student outcomes used to measure school performance include the percentage of the previous year's seniors who pursued a four-

Table 1. Summary Statistics for Principals and Their Secondary Schools.

Variable Name	*Mean*	*St. Dev.*
Principal Salary	67028.76	15432.940
Teaching Experience	13.727	7.270
Principal Experience	8.580	7.751
Enrollment	729.410	585.429
Pupil-Teacher Ratio	14.753	4.170
% Minority Enrollment	26.602	30.386
% Expenditures for Instruction	52.970	7.158
Core Expenditures per Pupil	4185.01	1241.048
% Households with Children	0.347	0.075
% Adult Population with B.A. or B.S.	0.196	0.127
School Required to Meet Goals	0.809	0.393
School Receives Report from District	0.946	0.226
Serious Problems with Parental Involvement	0.156	0.363
Principal's Influence:		
Exceeds District's on Performance Standards	0.497	0.500
Exceeds District's on Hiring Teachers	0.687	0.464
Exceeds Teachers' on Hiring Teachers	0.762	0.426
Percent of Graduates Who Attend 4-Year College	41.590	21.447
9th–12th-Grade Dropout Rate	6.596	26.729

Data: National Center for Education Statistics, Schools and Staffing Survey 1999–2000, 2000 Common Core of Data; 2000 U.S. Census. Based on a bootstrap sample of 5,000 observations, generated with NCES sampling weights.

year college education and the retention rate (based on the 9th–12th-grade dropout rate).

Summary statistics for the secondary schools in this analysis appear in Table 1.[1] Public school principals earned $67,028 on average, had taught for 14 years, and had over 8 years of experience as principal. Average high school enrollment was 729, which is very close to the statistic reported in the Common Core of Data (CCD) for the same year. The school-level pupil-teacher ratio in this sample was 15, which is slightly lower than the district-level ratio (16) reported by the CCD. On average, 53% of expenditures were used for instruction, and core expenditures per pupil averaged $4,185. Nearly all schools received performance reports from their districts, while 81% of schools were required to meet specific goals. A majority (63%) of schools in this sample were located in states that sanctioned poor performance, but only 17% of principals faced possible sanctions from their district. Not all districts with sanctions were located in states with sanctions. Fifty percent of principals in the sample claimed to have greater influence on standards for students than did their districts, school boards, or state education departments, and their influence on hiring teachers was (again, by their account) even more extensive. Finally, as measures of school performance, 42% of public high school seniors pursued four-year college education, and the average 9th–12th-grade dropout rate was 7%. This statistic, the *event* dropout rate provided by the district, represents the percentage of students who dropped out in the previous year, and it is to be distinguished from the oft-reported *status* dropout rate, which is the percentage of all individuals aged 16–24 who are high school dropouts.

2.2 OLS Regression Specification

If school principals act as agents, their salary should reflect their expertise and performance on the job. A baseline specification for the determinants of salary is generated with a simple OLS regression:

[1]Descriptive statistics are reported for bootstrap samples of 5,000 observations (also used in regression analyses below), generated using NCES sampling weights. Appropriately weighted means from the original sample are virtually identical.

$$(1) \qquad E(lSalary|x) = x\beta.$$

Here x is a matrix of principal, school, district, and community characteristics. Parameter estimates reveal mean effects, as $E(lSalary|x)$ represents the conditional mean of *lSalary*. For example, the coefficient on teaching experience reveals the mean impact on salary from an additional year of teaching experience. The variation in salary contributing to this impact is due to teaching experience and unobservable factors that are contained within the error term, ε, so that the estimated OLS parameter is the impact of experience at the mean of ε. Assuming that all relevant information is already included in the regression, the residual reflects variation in salary that is due either to random luck or performance that is unobserved by researchers. Presumably, if school principals are agents, their salary reflects their performance on many tasks that are not included in a survey such as the SASS. Thus, the mean of the conditional salary distribution is assumed to represent the mean unobserved performance.[2] This notion of the residual as unobserved performance is very similar to the labor economics literature's interpretation of the error term as innate ability (see, for example, Arias et al. 2001; Schultz and Mwabu 1998; Billger 2003).

The initial specification for the determinants of a public secondary school principal's salary includes a variety of covariates that have been reported in previous studies:[3]

$$(2) \qquad lSalary = \alpha_S + P\beta_S + S_S\gamma_S + C\delta_S + A\eta_S + \varepsilon_S,$$

where P includes characteristics of the principal—highest degree attained, age, experience as teacher, experience as principal, gender, and race/ethnicity—and the S subscript denotes parameters for this salary model. School characteristics are in the vector S_S: urban location indicators, ln(enrollment), percentage minority enrollment, pupil-teacher ratio, ln(per pupil expenditures), percentage of expenditures for instruction, and percentage of students eligible for free lunches. Community characteristics from the Census (merged by Zip code) are represented by C, and include the percentage of households with children and the percentage of the adult population with a B.A. or B.S. Accountability measures are contained in A and include the following: (1) the principal reports that the school is required to meet specific educational goals by the district, state, or both, (2) the school receives a performance report from the district, (3) the school is located in a state that sanctions districts for poor performance, and (4) the school is in a district that sanctions schools for poor performance.

Additional variables relevant to the structure of principal pay would certainly contribute to this analysis. For instance, the presence of merit pay may correlate with salary levels. It would also be interesting to know how much of pay depends on performance goals, and how large merit bonuses are. Unfortunately, the 1999–2000 SASS survey does not report this information. There are some data indicating whether teachers could receive merit pay, but no specific amounts are revealed. It is indeed possible that schools with merit pay for teachers also have it for principals, but without solid data, there is no way to be certain. Thus, the omitted principal salary structure variables could lead to biased results on the accountability parameters. Perhaps the marginal effect of required goals and state sanctions is much lower when principals face formal incentive pay structures.

I also consider two educational outcomes that reflect school performance: the college attendance rate and the student retention rate,

$$(3) \qquad \text{Outcome}_j = \alpha_j + S_O\gamma_j + C\delta_j + A\eta_j + \varepsilon_j,$$

where j takes two values: (1) the percentage of last year's graduates who have decided to pursue further education at a four-year college, and (2) the school's retention rate, defined as 100 minus the 9th–12th-grade

[2] It may certainly be true that residual variation results from factors other than performance, but it nevertheless seems reasonable to assume that higher conditional salaries are largely determined by the strong performance of the principal.

[3] Previous studies incorporating similar variables include Stone (1985), Ehrenberg et al. (1988), Ballou and Podgursky (1995), and Meier and O'Toole (2002).

dropout rate. The school characteristics (S_O) expected to relate to these outcomes include ln(enrollment), percentage minority enrollment, pupil-teacher ratio, school location, ln(per pupil expenditure), student attendance rate, and free lunch eligibility. Community characteristics (C) and accountability variables (A) are as defined for equation (2) above.

2.3 Quantile Regression

As discussed above, the error term in salary regressions reflects unobserved performance. Positive correlations between unobserved performance (ε) and expertise reveal that the best principals see higher returns to their education and experience. Positive relationships between unobserved performance and accountability measures similarly suggest that, in the presence of such standards, better principals receive substantially augmented salary in the presence of accountability.

To investigate these relationships, I perform quantile regressions that provide parameter estimates throughout the conditional distribution of the dependent variable.[4] The results reveal the effect of the covariates on the dependent variable across higher and lower values of the error term. For instance, lower quantiles of the conditional distribution of principal salary represent the principals who receive low salaries, given their education, experience, and school and community characteristics. While OLS provides a single parameter estimate for the mean of the conditional distribution of salary, quantile regression estimates reveal variation across the distribution of pay. In other words, OLS provides the solution to minimizing the weighted sum of squared residuals, while a particular θ^{th} regression quantile is the solution to

$$(4) \qquad \min_{\beta \in R^K} \Big[\sum_{i \in (i: y_i \geq x_i'\beta)} \theta |y_i - x_i'\beta| + \sum_{i \in (i: y_i < x_i'\beta)} (1-\theta)|y_i - x_i'\beta| \Big],$$

where $\theta \in (0,1)$. This involves the weighted sum of absolute deviations, obtaining particular quantiles by appropriately weighting the residuals.

As a corollary to the OLS specification presented in (1), I estimate the regression

$$(5) \qquad Quant_\theta(y|x) = x\beta_\theta,$$

where y is the dependent variable, alternately ln(salary), college attendance, and retention rate. θ represents the quantile in the conditional distribution of y. $\theta = 0.5$ corresponds to the conditional median, and remaining quantiles reflect differential weighting of the positive and negative residuals. For instance, parameter estimates at $\theta = 0.1$ reveal the marginal impact at the tenth percentile of the conditional salary distribution. This is certainly not identical to partitioning the data and running a regression with only the lowest 10% of salary earners.

In quantile regressions of ln(salary), the conditional distribution is related to the unobserved performance of the school principal. A similar interpretation applies to regressions of educational outcomes such as test scores and college attendance rates, wherein the conditional distribution reflects unobserved performance of the school. Some previous studies have used quantile regression in this manner. For example, Levin (2001) found that lower-ability students received the most substantial gains from taking classes with peers of similar ability. Eide and Showalter (1998) found that per-pupil expenditures had statistically significant effects on test scores for only the lowest-performing students. Figlio (1999) also found that coefficient estimates differed across conditional quantiles. In this study I estimate regressions for salary and for school outcomes, incorporating indicators of accountability. Thus, quantile coefficient estimates reveal the correlation between accountability and unobserved performance.

2.4 Principal Authority and Autonomy

Principals are managers for their schools, but they generally do not have the same power that private sector corporate managers have. As Chubb and Moe (1988:1077) stated, "The principal operates at the boundary of the

[4]Koenker and Hallock (2001) provided an introduction to the quantile regressions technique that was developed in Koenker and Bassett (1978).

organization and is, more than any other single person, responsible for negotiating successfully with the environment—responding to demands and pressures from parents, unions, administrators, and school boards, and dealing with external disruptions such as budget cuts, policy conflicts, and demographic changes." Thus, the presence of many stakeholders may well hinder a principal's effectiveness. Within this environment, it is essential for principals to have clear goals, rigorous academic requirements, independence from school boards, and strong teacher and parent involvement. Friedkin and Slater (1994) further highlighted the importance of principal-teacher relations. Compared to a principal who is disliked or ignored by teachers, one who has teachers' respect is probably better able to persuade them to follow advice and cooperate in integrating goals throughout the school. Unfortunately, much of the data required to adequately address these issues are not available, but the SASS does provide some measures of principal authority and autonomy.[5]

I consider the following conditions: (1) the principal's influence on student performance standards exceeds the district's, (2) the principal's influence on hiring exceeds the district's, (3) the principal's influence on hiring exceeds the teachers', (4) the principal claims there is a serious problem with parental involvement at the school, and (5) the district has a bargaining agreement with teachers (a barrier to dismissing teachers). How these conditions may affect pay and performance is discussed further in section 3.

It is possible that other factors could also reflect a principal's power in a school. Potentially relevant options include the principal's overall rating of teaching staff (signaling whether the principal/teacher relationship is amicable) and the presence of problems with violence and drugs. However, the inclusion of these two controls had no clear impact on results, and they are omitted because these factors are likely reflected in other covariates.

2.5 Potential Endogeneity in Accountability, Principal Salary, and School Outcomes

Any significant relationship between accountability and salary could certainly reflect endogeneity. That is, the unobserved factors that cause a school to face required goals may be correlated with the unobservable characteristics of the principal, yielding parameter estimates that do not reveal the true relationship. For instance, if poor teaching contributes to low retention rates, it is quite possible that poor teaching also coincides with required goals for the entire school. To address this sort of endogeneity, I use 2SLS and two-stage least absolute deviation (2SLAD) models.[6]

Initially, let us revisit equation (3) for college attendance rate:

$$(6) \qquad \textit{college attendance} = \alpha + S_O\gamma + C\delta + A\eta + \varepsilon,$$

where A are accountability variables, each of which may be endogenous. For an individual accountability variable—district sanctions, for example—consider a simple model:

$$(7) \qquad \textit{district sanctions} = X\zeta + Z\varphi + \nu,$$

where X contains all exogenous variables (those within S_O and C) and Z are instruments correlated with district sanctions but not with the percentage of students attending college. If there is a statistically significant correlation between A and ε, accountability measures are endogenous.

2SLS involves first stage OLS regressions like equation (7) for all endogenous variables, obtaining predicted values to use in the subsequent estimation of equation (6). 2SLAD, developed by Amemiya (1982), is very similar, with first-stage OLS to obtain predicted values, and second-stage quantile

[5]Ballou and Podgursky (1995) studied teacher ratings of principals. These data are provided by teachers, with only a very small sample of them from each school. Rather than derive averages in that case, I incorporate principal-level data.

[6]An evaluation of the instruments following the procedures recommended in Bound et al. (1995) reveals that state effects are quite good instruments for all accountability measures, though weaker for required goals.

regressions. For reliable standard errors with 2SLS, I simultaneously estimate the first- and second-stage equations. In addition, 2SLAD estimates result from 1,000 bootstrapping repetitions.

Valid instruments are especially important for these techniques. I use state fixed effects, which are correlated with accountability through policies and state/regional differences in school administration. It is possible that states also vary in the main outcomes (salary, college matriculation, and retention). However, it is not likely that state fixed effects are correlated with these variables in models that control for school and community characteristics; the conditional correlation is likely quite small. Average differences in salaries and student outcomes do exist across states, but these trends are largely determined by school, district, and community characteristics that are included in the structural models in this analysis.

To strengthen this intuitive explanation, I have also tested the quality of state fixed effects as instruments. The importance of quality instruments is well known, and my method is informed by Bound et al. (1995) and Stock and Yogo (2005). I first separately test for endogeneity for each accountability variable. I use only statistically significant regressors from the structural model, such as equation (6), and then estimate the reduced form for each measure, such as equation (7). From this I obtain residual estimates ν, and I then include these in the structural models. F-tests on the joint significance of the parameters on the predicted residuals reject the null in most cases; it appears that most accountability measures are indeed endogenous.

I proceed to check the strength of the state fixed effect instruments in the reduced form regressions like equation (7). In all cases—for all outcomes of interest—the F-tests result in p-values that are equal to zero. Furthermore, most F-statistics are quite high, well over 10 and sometimes over 100. I further discuss the validity of state fixed effects as instruments for each outcome in the results section below. I also considered other instruments that seem highly correlated with accountability but may not be correlated with salary or school outcomes: a measure of a principal's influence on standards (relative to the state) and an indicator of merit pay for teachers. While both are unconditionally correlated with the accountability variables, they are not conditionally correlated with them. In the first stage regressions that include school and community covariates, the parameters on relative influence and teacher merit pay do not test significantly different from zero, so neither measure is a good instrument for accountability.

3 Principal Pay and Performance

3.1. Principal Salary

Estimation results for equation (2) appear in Table 2. Standard errors are robust to heteroskedasticity, and quantile regression estimates result from 1,000 bootstrapping repetitions. OLS results show that conditional on principal, school, and community characteristics, principals at schools that were required to meet goals earned 2% lower salaries, on average. The coefficients on state and district sanctions also have a statistically significant negative correlation with pay. In comparison, quantile regression parameters reveal correlations between salary and the covariates throughout the conditional salary distribution, not just at the mean. Controlling for principal, school, and community characteristics, accountability standards are negatively correlated with principal salary throughout the distribution. Schools that were required to meet goals and schools whose states or districts sanctioned poor performance paid lower salaries, *ceteris paribus*. It also appears that the relationship between accountability and pay was not uniform across schools. That is, F-tests for equality of estimates across conditional quantiles reveal that mean estimates do not reflect the entire distribution of effects.

It appears that principals were paid less if they managed in a district that sanctioned some schools (regardless of whether their school was sanctioned). This relationship explains some of the particularly low salaries. Stated differently, more negative estimates at lower quantiles suggest that the worst

Table 2. School Accountability and Principal Salaries.
Dependent Variable = ln(Principal Salary)

Panel A

Independent Variable	*OLS*	*Q 0.1*	*Q 0.25*	*Q 0.5*	*Q 0.75*	*Q 0.9*	*Test across Quantiles*[a]
School Required to Meet Goals	–0.015*** (0.005)	0.004 (0.011)	–0.023*** (0.008)	–0.015*** (0.005)	–0.010* (0.006)	–0.019** (0.009)	2.28*
School Receives Report from District	0.013 (0.008)	–0.016 (0.015)	0.014 (0.012)	0.015* (0.008)	0.029*** (0.010)	0.001 (0.013)	2.81**
State Sanctions Schools for Poor Performance	–0.009** (0.004)	–0.028*** (0.009)	–0.014** (0.006)	–0.007 (0.005)	–0.013** (0.005)	–0.001 (0.007)	2.17*
District Sanctions Schools for Poor Performance	–0.013** (0.005)	–0.037** (0.015)	–0.022*** (0.008)	–0.004 (0.007)	0.010 (0.007)	0.004 (0.008)	3.56***
R-Squared	0.718						

Panel B

Independent Variable	*OLS*	*Q 0.1*	*Q 0.25*	*Q 0.5*	*Q 0.75*	*Q 0.9*	*Test across Quantiles*[a]
School Required to Meet Goals	–0.015*** (0.005)	–0.001 (0.010)	–0.022*** (0.008)	–0.017*** (0.005)	–0.015** (0.006)	–0.005 (0.009)	1.55
School Receives Report from District	0.013 (0.008)	–0.002 (0.013)	0.015 (0.011)	0.015 (0.009)	0.019* (0.011)	0.026* (0.013)	0.64
State Sanctions Schools for Poor Performance	–0.010** (0.004)	–0.024*** (0.008)	–0.012** (0.006)	–0.009* (0.005)	–0.018*** (0.006)	0.009 (0.007)	4.93***
District Sanctions Schools for Poor Performance	–0.013** (0.005)	–0.041*** (0.013)	–0.022** (0.009)	–0.005 (0.007)	0.005 (0.008)	–0.004 (0.008)	3.23***
Principal's Influence:							
Exceeds District's on Performance Standards	0.005 (0.004)	–0.014* (0.008)	–0.006 (0.006)	0.001 (0.005)	0.001 (0.005)	0.033*** (0.006)	9.76***
Exceeds District's on Hiring Teachers	–0.004 (0.004)	–0.002 (0.010)	0.004 (0.006)	0.002 (0.006)	–0.017*** (0.006)	–0.015** (0.007)	3.28**
Exceeds Teachers' on Hiring Teachers	0.009** (0.004)	0.002 (0.009)	0.012* (0.007)	0.015** (0.006)	0.007 (0.006)	0.010 (0.008)	0.86
Serious Problem with Parental Involvement	0.019*** (0.005)	–0.0005 (0.013)	0.007 (0.009)	0.021** (0.009)	0.021** (0.009)	0.056*** (0.014)	3.21**
R-Squared	0.721						

Panel C

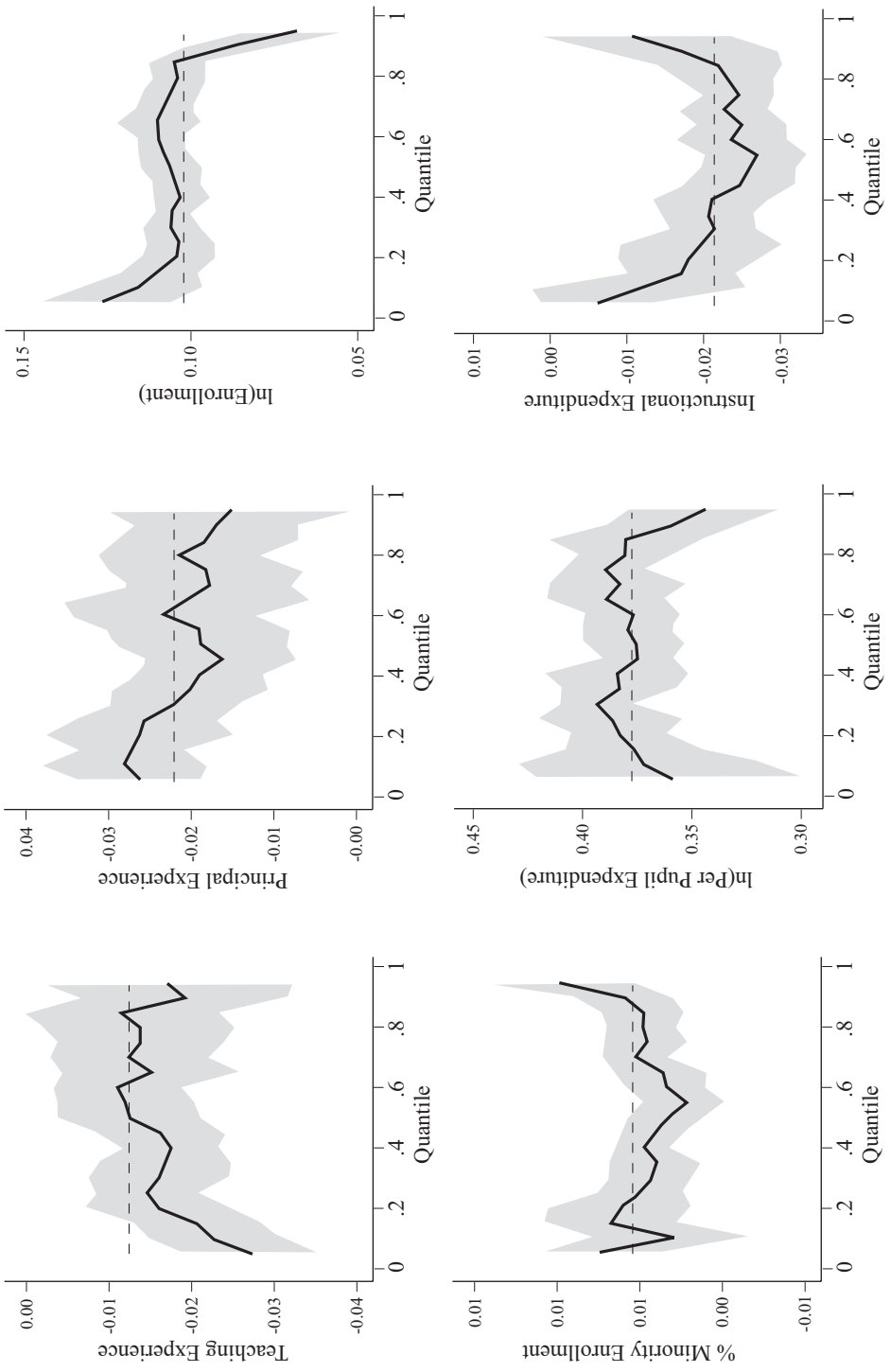
Independent Variable	*2SLS*	*Q 0.1*	*Q 0.25*	*Q 0.5*	*Q 0.75*	*Q 0.9*	*Test across Quantiles*[a]
School Required to Meet Goals	–0.032 (0.020)	0.024 (0.033)	–0.015 (0.026)	–0.034 (0.028)	–0.058** (0.024)	–0.100*** (0.027)	2.32*
State Sanctions Schools for Poor Performance	–0.016* (0.009)	–0.037** (0.019)	–0.036*** –(0.108)	–0.025** (0.011)	–0.005 (0.012)	0.045*** (0.013)	6.21***
District Sanctions Schools for Poor Performance	–0.114*** (0.022)	–0.145*** (0.034)	0.030*** (0.025)	–0.068*** (0.025)	–0.137*** (0.030)	–0.196*** (0.030)	4.06***

NCES sampling weights were incorporated into bootstrap samples with 5,000 principals. Robust standard errors are reported, and quantile regression estimates result from 1,000 bootstrap repetitions. Additional regressors are as reported in section 2 of the text.

[a]F-statistic for testing null hypothesis that parameter estimates are equal across quantiles 0.1, 0.25, 0.5, 0.75, and 0.9.

*Statistically significant at the .10 level; **at the .05 level; ***at the .01 level.

Figure 1. OLS and Quantile Regression Parameter Estimates for Effects on ln (Principal's Salary).



Data: Public Secondary Schools from 1999-2000 SASS, 2000 U.S. Census. Quantiles along the x-axis represent quantiles in the conditional distribution of ln(Principal Salary). The dotted lines represent OLS parameter estimates. Quantile regression estimates are presented with 95% confidence intervals. Additional regressors are as defined in the text in equation (2).

principals appeared in districts that used sanctions. Given that the data are cross-sectional and not longitudinal, the duration of such accountability is unknown. Perhaps the standards were only recently implemented, and negative correlations therefore simply reveal that lower-paid principals were at schools with this accountability. Coefficient estimates that become less negative toward upper quantiles suggest that the largest wage penalties associated with facing standards were placed on the worst principals.

Coefficient estimates for most additional regressors appear in Figure 1. Each graph displays parameter estimates for quantiles in the conditional distribution of ln(salary). OLS estimates only the mean effect, and each dotted line reveals the single OLS parameter for each covariate. Quantile regression estimates are plotted from 0.05 through 0.95, surrounded by 95% confidence intervals. If these estimates deviate substantially from the dotted line, quantile regression imparts valuable additional information about the variation in effects throughout the conditional salary distribution. The returns to experience appear quite well estimated by OLS, but the mean impact of school size is upwardly biased for the best-paid principals. If quantiles in the conditional salary distribution reflect unobserved performance, the worst principals received a higher return than the best. Another possible explanation for this result is that school size compressed principal salaries, augmenting otherwise low pay. Per-pupil expenditures appear to have been uniformly correlated with principal salaries, but instructional expenditures yielded significantly lower pay near the median of the salary distribution. On the other hand, the negative relationship was weaker for the best- and the worst-paid principals.

Returning to accountability, it remains possible that the impact of accountability reflects, at least in part, a principal's inability to make institutional changes that would have improved the school and his or her salary. To investigate this possibility, I incorporate additional authority/autonomy controls as described in section 2.4 above. In Panel B of Table 2 we see that the negative relationship between required goals and salary remains, and generally decreases in magnitude in higher quantiles of the conditional distribution of salary. This is also true for the presence of district or state sanctions for poor performance. The correlation between accountability and salary remains more negative for low-performing principals; this does not appear to be mitigated by principal autonomy. However, as seen in the top quantile estimates, the highest-paid principals may indeed have been so highly paid because of their extensive influence (in setting performance standards and in hiring teachers) and their ability to overcome problems posed by low parental involvement. F-test results for the equality of coefficients across the quantiles reveal that these effects were not equal throughout the distribution of unobserved principal performance.

I next address endogeneity using 2SLS and 2SLAD, as described above; the results appear in Panel C. Since the presence of a report from the district has no statistically significant correlation with salary, I omit it from this section. F-tests on the instruments in the first stage regressions reveal that the state fixed effects are always significant at the 1% level, and are particularly strong instruments for state sanctions and required goals. There is now more significant variation across quantiles for all three accountability measures, and the negative relationships remain. The most negative results appear for the (conditionally) highest-paid principals. On the other hand, there is a small positive relationship between state sanctions and principal pay for the best principals. Furthermore, the parameters increase (are less negative/more positive) with higher quantiles, suggesting that state sanctions increased the dispersion of principal pay—which likely was an intended consequence of accountability. Nonetheless, these estimates do not provide consistent evidence in line with the goal of rewarding the best and punishing the worst, since district sanctions and required goals exhibit the opposite result.

3.2 College Attendance Rate

Results for regressions of college attendance, as in equation (3), appear in Table 3.

Table 3. School Accountability and College Attendance Rates.
Dependent Variable = College Attendance Rate

Panel A

Independent Variable	*OLS*	*Q 0.1*	*Q 0.25*	*Q 0.5*	*Q 0.75*	*Q 0.9*	*Test across Quantiles*
School Required to Meet Goals	–0.036 (0.919)	–0.955 (1.378)	1.462 (1.305)	0.492 (1.007)	1.139 (1.103)	2.324 (1.753)	1.07
School Receives Report from District	–3.713** (1.493)	–0.975 (3.348)	–5.403*** (1.916)	–4.032** (1.615)	0.353 (2.084)	0.582 (2.348)	2.48**
State Sanctions Schools for Poor Performance	–4.839*** (0.808)	–6.171*** (1.227)	–4.502*** (1.031)	–5.807*** (0.966)	–4.822*** (1.053)	–3.558*** (1.300)	1.15
District Sanctions Schools for Poor Performance	3.509*** (1.067)	4.542*** (1.474)	3.072** (1.491)	2.242 (1.540)	3.387* (1.879)	5.257 (3.489)	0.56
R-Squared	0.274						

Panel B

Independent Variable	*OLS*	*Q 0.1*	*Q 0.25*	*Q 0.5*	*Q 0.75*	*Q 0.9*	*Test across Quantiles*
School Required to Meet Goals	0.026 (0.923)	–1.068 (1.406)	0.549 (1.171)	0.630 (1.092)	1.255 (1.125)	2.983* (1.531)	1.11
School Receives Report from District	–0.371** (1.489)	0.563 (3.134)	–5.214*** (1.800)	–3.476** (1.737)	–1.109 (1.871)	0.559 (2.775)	2.20*
State Sanctions Schools for Poor Performance	–4.468*** (0.832)	–4.921*** (1.214)	–3.630*** (0.771)	–6.146*** (1.159)	–2.832** (1.271)	–3.316** (1.366)	2.85**
District Sanctions Schools for Poor Performance	3.371*** (1.066)	4.623** (1.957)	3.798*** (1.290)	2.058 (1.504)	2.705 (2.062)	7.089** (2.956)	1.22
Principal's Influence:							
Exceeds District's on Performance Standards	–2.125*** (0.725)	–1.504 (1.111)	–3.100*** (0.982)	–2.862*** (1.040)	–0.447 (1.055)	0.653 (1.647)	2.13*
Exceeds District's on Hiring Teachers	0.558 (0.831)	–0.421 (1.295)	0.865 (0.997)	1.506 (1.298)	0.818 (1.198)	–0.021 (1.609)	0.48
Exceeds Teachers' on Hiring Teachers	1.396 (0.887)	1.471 (1.371)	–0.241 (1.115)	1.819 (1.543)	1.661 (1.418)	0.542 (1.795)	0.89
Serious Problem with Parental Involvement	–1.755** (1.015)	–0.662 (1.306)	–0.882 (1.177)	0.287 (1.433)	–3.235* (1.789)	–3.987** (1.720)	1.58
R-Squared	0.283						

Panel C

Independent Variable	*2SLS*	*Q 0.1*	*Q 0.25*	*Q 0.5*	*Q 0.75*	*Q 0.9*	*Test across Quantiles*
School Receives Report from District	–18.502*** (6.550)	–25.903*** (9.648)	19.561 (12.964)	–9.322 (13.953)	–16.270 (16.212)	1.224 (18.869)	0.69
State Sanctions Schools for Poor Performance	–6.039*** (1.284)	–7.311*** (1.997)	–6.790*** (1.619)	–8.727*** (1.975)	–4.575** (2.114)	–4.732*** (2.941)	1.13

See notes to Table 2.

Conditional on school and community characteristics, required goals had no statistically significant impact, but school reports and state sanctions were associated with lower college attendance rates. Interestingly, the negative relationship between state sanctions and

this student outcome appears quite uniform throughout the estimated quantiles, rather than most strongly affecting the worst schools. A test for equality of the parameters across quantiles reveals no statistically significant difference. Conditional on the presence of state sanctions, district sanctions imply better performance, regardless of school quality.

Coefficient estimates for additional school characteristics appear in Figure 2. Substantial variation exists across quantiles of the conditional distribution of college attendance rate, mirroring results in previous studies of test score gains. For instance, the impact of increased per-pupil expenditure is more positive at lower quantiles than for the higher-performing schools. The negative impact of poverty, as measured by lunch program eligibility, is strong for all schools. The impact of size also appears more positive for the lowest-quality schools, and differs substantially from OLS estimates. Furthermore, higher minority enrollment is correlated with better college matriculation among the conditionally best schools. High pupil-teacher ratios appear similarly detrimental to all but the highest-quality secondary schools. Finally, a well-educated community implies better outcomes, though mostly among median schools.

I next incorporate measures for environmental factors that may have constrained principals from significantly improving school performance. Some possible constraints are low autonomy in hiring, little parental involvement, and barriers to dismissing teachers. Results appear in Panel B of Table 3. Controls include influence and parental involvement (as in the salary regressions above), as well as the presence of a bargaining agreement with teachers, rating of teaching staff, barriers to dismissing poor teachers, and whether the principal's main goal is academic excellence.

The estimated impact of accountability on college attendance is only somewhat altered by the inclusion of these variables. A possible predictor for strong performance among the best schools is the presence of required goals, as seen with the statistically significant positive coefficient at the 90th quantile. In addition, the effect of state sanctions is most negative at the median, not the tails. Principal autonomy also hindered performance at the median of (conditional) school quality. Alternatively, problems with parental involvement were also negatively correlated with school performance, though only at better schools, suggesting that low parental involvement had a stronger impact on otherwise strong schools than on weaker schools.

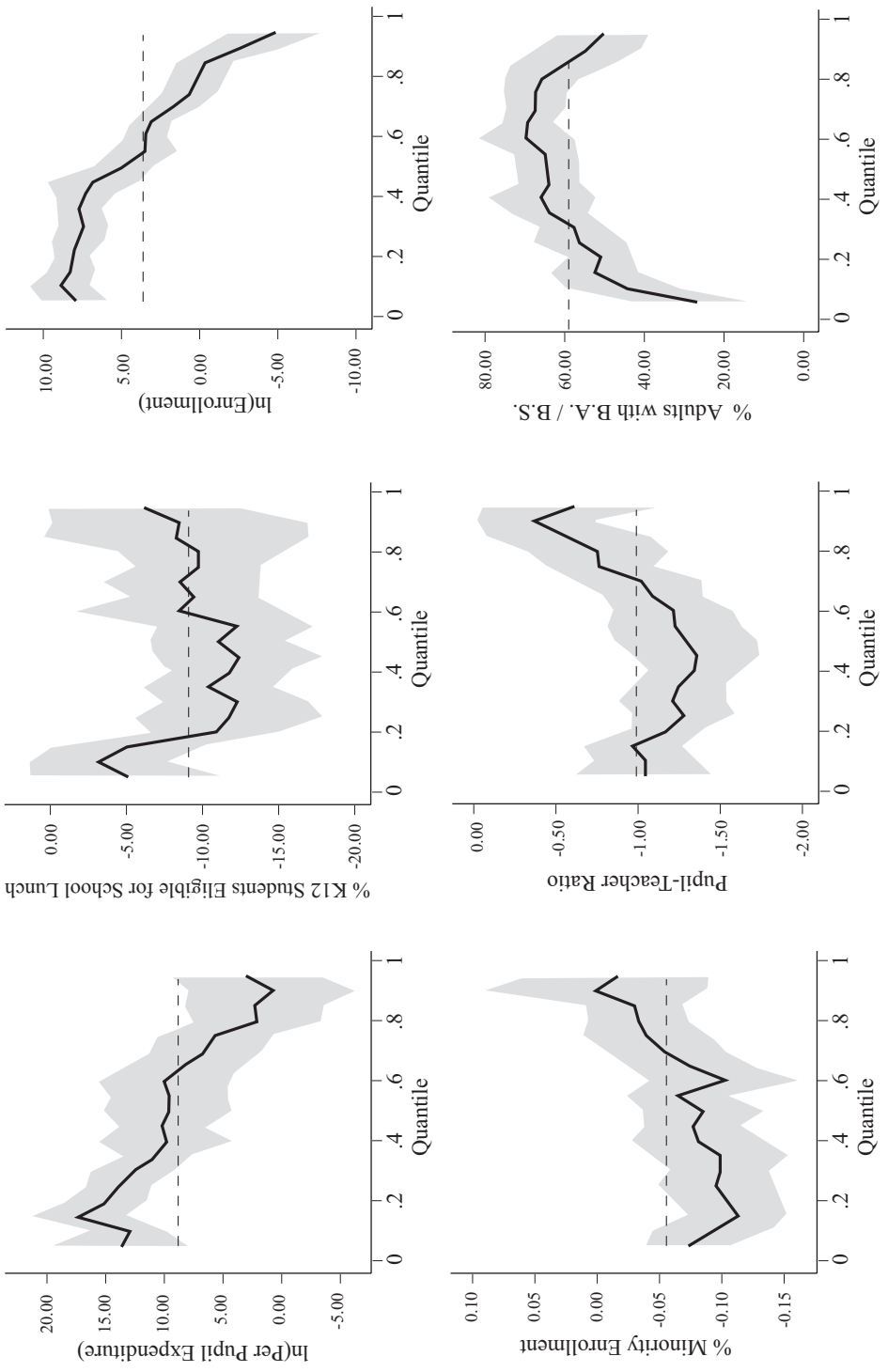
Additional specifications control for endogeneity in accountability and school performance. Only school reports and state sanctions appear both statistically significant and endogenous, so they are the focus here. Again, F-tests on the state fixed effect instruments in reduced form regressions for state sanctions and reports from the district reject the null at 1%. Results in Table 3, Panel C, reveal that school reports from the district coincide with lower performance for only the worst schools. This could certainly reveal that only the struggling schools received performance reports. On the other hand, there is a negative relationship between state sanctions and college attendance throughout the entire distribution. This evidence does not support the notion that sanctions improved school performance.

3.3 Student Retention Rates

Regression estimates for the impact of accountability on retention rates (equation 3) appear in Table 4. OLS results suggest that required goals were associated with lower retention rates, though that pattern is not well supported in quantile regression estimates. On the other hand, state sanctions were correlated with better retention at the worst schools and lower retention at the best. District sanctions yield similar results. Schools at or just below the median experienced higher retention in the presence of sanctions, but the relationship was negative above the median. Parameter tests across quantiles reveal statistically significant differences in the relationship between sanctions and school performance.

Additional covariates explain some of the magnitude of these relationships, but generate few changes in the results, as seen in Panel B. Estimates suggest that the principal's envi-

Figure 2. OLS and Quantile Regression Parameter Estimates for Effects on College Attendance Rate.



Data: Public Secondary Schools from 1999-2000 SASS, 2000 U.S. Census. Quantiles along the x-axis represent quantiles in the conditional distribution of College Attendance Rate. The dotted lines represent OLS parameter estimates. Quantile regression estimates are presented with 95% confidence intervals. Additional regressors are as defined in the text in equation (3).

Table 4. School Accountability and Student Retention Rates.[a]
Dependent Variable = Retention Rate

Panel A

Independent Variable	*OLS*	*Q 0.1*	*Q 0.25*	*Q 0.5*	*Q 0.75*	*Q 0.9*	*Test across Quantiles*
School Required to Meet Goals	–0.359*** (0.124)	–0.086 (0.077)	–0.015 (0.028)	0.027* (0.016)	0.028 (0.017)	0.012 (0.010)	1.26
School Receives Report from District	–0.158 (0.219)	0.131 (0.169)	0.064 (0.081)	0.009 (0.024)	0.056*** (0.021)	0.029 (0.024)	1.47
State Sanctions Schools for Poor Performance	0.517*** (0.105)	0.238*** (0.057)	0.037 (0.026)	0.046*** (0.015)	–0.0001 (0.016)	–0.032*** (0.009)	10.35***
District Sanctions Schools for Poor Performance	–0.034 (0.133)	–0.078 (0.152)	0.045* (0.026)	0.046*** (0.017)	–0.027* (0.016)	–0.002 (0.011)	5.95***
R-Squared	0.043						

Panel B

Independent Variable	*OLS*	*Q 0.1*	*Q 0.25*	*Q 0.5*	*Q 0.75*	*Q 0.9*	*Test across Quantiles*
School Required to Meet Goals	–0.403*** (0.123)	–0.057 (0.061)	–0.014 (0.031)	0.011 (0.017)	0.021 (0.018)	0.015 (0.011)	0.51
School Receives Report from District	–0.191 (0.217)	0.212 (0.162)	0.038 (0.112)	0.004 (0.027)	0.044* (0.026)	0.050*** (0.019)	1.09
State Sanctions Schools for Poor Performance	0.355*** (0.108)	0.142** (0.060)	0.011 (0.032)	0.048*** (0.016)	0.006 (0.017)	–0.031*** (0.009)	7.01***
District Sanctions Schools for Poor Performance	–0.033 (0.132)	–0.166 (0.127)	0.051 (0.037)	0.043** (0.020)	–0.016 (0.017)	–0.005 (0.016)	3.68***
Principal's Influence:							
Exceeds District's on Performance Standards	0.305*** (0.094)	–0.083* (0.050)	–0.009 (0.027)	0.0004 (0.012)	–0.027** (0.011)	0.010 (0.008)	3.98***
Exceeds District's on Hiring Teachers	–0.233** (0.103)	0.102** (0.046)	0.034 (0.032)	–0.030** (0.014)	–0.001 (0.013)	0.006 (0.009)	3.77***
Exceeds Teachers' on Hiring Teachers	–0.305*** (0.112)	–0.121** (0.051)	–0.153*** (0.032)	–0.059*** (0.014)	–0.046*** (0.012)	–0.019** (0.008)	4.98***
District Has Bargaining Agreement with Teachers	–0.691*** (0.114)	–0.330*** (0.049)	–0.113*** (0.031)	–0.035** (0.017)	–0.021 (0.016)	0.001 (0.010)	11.20***
Serious Problem with Parental Involvement	0.057 (0.134)	–0.173* (0.096)	–0.066* (0.040)	–0.023 (0.019)	–0.027 (0.021)	0.009 (0.017)	1.54
R-Squared	0.061						

Panel C

Independent Variable	*2SLS*	*Q 0.1*	*Q 0.25*	*Q 0.5*	*Q 0.75*	*Q 0.9*	*Test across Quantiles*
School Required to Meet Goals	1.296*** (0.322)	1.551*** (0.334)	0.074 (0.148)	–0.014 (2.121)	–0.094* (0.056)	–0.055 (0.033)	7.58***
School Receives Report from District	–2.852*** (0.753)	–2.972*** (1.004)	–0.653** (0.292)	–0.030 (10.562)	0.269 (0.164)	0.240* (0.126)	3.38***
State Sanctions Schools for Poor Performance	–0.713*** (0.226)	–0.075 (1.004)	0.235*** (0.057)	0.159 (0.327)	0.100*** (0.023)	–0.020 (0.019)	11.67***

See notes to Table 2.
[a]Retention rates are calculated as 100 minus the 9th- through 12th-grade dropout rate.

ronment significantly affected performance. For instance, influence on hiring coincided with retention problems, particularly at the worst schools. The presence of a bargaining agreement (reflecting a principal's difficulty in dismissing poor teachers) was related to lower retention at struggling schools. Perhaps unsurprisingly, problems with parental involvement coincided with (and likely explain) lower retention rates at the worst schools.

Endogeneity is again suspected in this specification. District sanction indicators are not statistically significant, nor are they endogenous in this particular specification, and they are omitted here. Two-stage techniques, again using state fixed effects as instruments, reveal a statistically significant correlation between accountability and retention. As above, F-tests on the instruments in each reduced form accountability model result in rejection of the null at the 1% level. 2SLS results show that retention was negatively related to both state sanctions and district-issued reports, but positively related to required goals. On the other hand, in quantile regression results, receiving a report from the district coincides with lower retention among the worst schools—arguably those intended to benefit the most. There is nonetheless some evidence that struggling schools may have benefited from accountability. Required goals and state sanctions were positively correlated with retention rates at otherwise low-performing schools.

4 Conclusion

This analysis of the relationships between accountability policies, secondary school performance, and principal salaries is an investigation into whether secondary school principals act as agents for parents, school boards, and communities. State sanctions correspond to more negative salaries for the worst principals and higher salaries for the best, suggesting that these sanctions may be an effective reward/punish system. On the other hand, I find that other accountability measures correspond to lower salaries, particularly for the best principals, suggesting that strong performance may not be well rewarded in this labor market. For an agent—the school principal—to see a strong incentive, performance must be rewarded, and principals subject to accountability should receive higher salaries if they manage their schools well.

Evidence on college attendance rates also runs counter to a principal-agent explanation. State sanctions and reports from the district were negatively correlated with this outcome among all schools, whether they were relatively low- or high-quality. Therefore, accountability may not induce principals to work toward sending more graduates to college. However, it appears that principals may have acted as agents in reducing dropout problems. Required goals and state sanctions were positively correlated with high school retention at otherwise struggling schools.

These apparently contradictory findings could reflect the nature of accountability. If educators are indeed asked to "leave no child behind," incentives would focus on weaker students, including those in danger of dropping out of school. There is no similar incentive to improve educational outcomes for stronger students, including otherwise "average" students who may or may not pursue a college education. The results indicating that accountability correlates negatively with principal salaries (for the best principals) are exceptionally puzzling. Perhaps high-performing principals were more likely to be assigned to schools that faced substantial accountability standards but had relatively low resources and low pay. Perhaps, like many teachers, the best principals were not motivated by money, but by their ability to positively affect students. These issues could best be examined using longitudinal data. Unobserved principal and school characteristics are likely very important in determining a principal's pay and performance.

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