Leadership continuity and educational performance in the American states

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Abstract: We use an original data base of state leadership to address the following question: Does continuity of state educational leaders promote state educational performance? To answer that question we analyze state performance since the early 1990s on the National Assessment of Educational Progress reading and math exams for 4th and 8th graders. We account for variation in those measures by examining rates of turnover among chief state school officers and on state boards of education. Overall, our results show that low turnover among state education leaders, especially chief state school officers, is associated with higher performance among several different student groups. Those positives are not ever lasting, however, because the benefits of low turnover decline if leaders remain in office too long.

Introduction

Several books have pondered who governs American education (Masters, Salisbury, and Eliot 1964; Campbell and Mazzoni 1976; Wirt and Kirst 1997; Conley 2003; Howell 2005). Despite that attention from researchers, citizens remain largely unaware of the actors and institutions that influence how the country runs its schools. For example, most people would be hard-pressed to name even a single member of their state's board of education. And no wonder. State boards, which make state policies for elementary and secondary education, have members who tend to win office through low-information elections or through gubernatorial appointments. Despite their low profile, board decisions are frequently consequential, as in many states where they hire state education department leaders, known as chief state school officers, when they approve state curriculum and testing standards, and when they adopt rules governing public school teachers.

Recent history from the state of Kansas illustrates how shifts in state board membership can have potentially huge consequences for policy and ultimately teachers and students. In 1999, led by a conservative Republican bloc, the Kansas state board voted to remove the teaching of evolution and the big bang theory from the state's required science standards. An outcry ensued, including protests from the presidents of Kansas's public universities who predicted that the decision would set the state back and send a terrible signal making difficult for local districts to hire science teachers. The state's Republican governor even threatened to push for legislation to eliminate the board altogether. In 2000, elections swept out this conservative majority and by February 2001 evolution was reinstated in the required state curriculum.

But by 2004 the pendulum had swung back again. The conservative Republican bloc regained power and produced new standards in 2005 that promoted intelligent design and stressed that evolution was merely a theory. Those standards were subsequently discarded when another new board, emerging from the 2006 election cycle, voted in 2007 to reject these amended standards, and to reinstate a more traditional presentation of evolution. During this turbulent eight year period, local school districts struggled to make sense of the moving target of expectations and requirements that Kansas's various state boards had promulgated.

In this paper, we study the impact of leadership turnover on state education performance. The Kansas case provides a clear, albeit extreme, example of how shifting leadership can influence policy implementation. Lacking consistent guidance, due to frequent turnover, local districts struggled to anticipate the demands of the state's education board. Reaching beyond that one particular case, our paper looks broadly at all 50 states and examines turnover of state board members and chief state school officers. We address the following question: Does continuity of state educational leaders promote state educational performance?

In answering that question, it is worth noting two reasons why prior work on this topic is somewhat limited. First, despite their impact on policy, state education board members and chief state school officers have received essentially no recent attention in the political science literature. The most detailed studies are now over thirty years old (Masters, Salisbury, and Eliot 1964; Campbell and Mazzoni 1976). Education scholars have published several accounts that discuss boards and chiefs (Conley 2003; Wirt and Kirst 1997; Lusi 1997), and applied reports on

these actors are easy to find (Burnes et al. 1983; NASBE Study Group on Education Governance 1996). But primarily, that work has been descriptive and lacked theoretical grounding. Second, research on the more general topic of leadership turnover in public bureaucracies does exist, but much focuses on the causes of turnover rather than its effects (Whitaker and DeHoog 1991; Wilson 1994). There are a few notable exceptions beyond state education policy (Hess 1999; Lewis 2007), and we draw upon that work in developing our argument.

We proceed in the following four sections. First, we describe the theoretical framework that orients the paper. Second, we describe our data sources and methods. Third, we present our results, and finally, in our last section, we conclude. Overall, our results show that low turnover among state education leaders, especially chief state school officers, is associated with higher performance among several different student groups. Those positives are not ever lasting, however, because the benefits of low turnover decline if leaders remain in office too long.

Expectations regarding turnover and government performance

Public institutions are frequently designed to limit membership or personnel turnover. Consider several examples from the United States federal government. Senators serve staggered six-year terms, which guarantees that at least two-thirds of the Senate (barring early retirement or death) will return after each election cycle. Career civil service laws ensure continuity in the federal bureaucracy even when elections may shift party control of Congress or the White House. The seven members of the Federal Reserve Board each serve fourteen-year terms, with one member's term expiring every even-numbered year. Among national institutions, the federal judiciary has the greatest potential for continuity, given that judges serve their terms for life.

These many examples illustrate an impulse to limit turnover in government organizations. Concerns about rapid turnover generally assume that an organization's external relations with agents or constituents and its internal capabilities can suffer when members frequently come and go. Slightly different reasons motivate these concerns, and we examine each in turn.

First, frequent turnover in a government organization can prevent it from working effectively with its agents. As the literature on delegation notes, clear, consistent signals from leaders can help policy implementers do their jobs well (Bendor, Glazer, and Hammond 2001; Wilson 1989; Pressman and Wildavsky 1984). When turnover is rapid, especially among an agency's leaders responsible for articulating policy and priorities, those signals can become less clear. Upon attaining their positions, for example, new leaders often announce new initiatives. That can help them please favored constituencies and take advantage of the honeymoon period that incoming leaders often enjoy. But their agents working down the chain of command may find these new initiatives unclear and potentially counterproductive if they clash with other ongoing organizational commitments, or if they are rolled out without careful thought.

Hess (1999) illustrates this in a study of local school superintendents. He demonstrates how the cycle of frequent superintendent turnover can send mixed signals to a district's staff, which in turn undermines student success. Local school boards, especially in urban areas, often hire these new leaders because they promise to deliver agendas to turn around struggling districts. Superintendents present their reforms to distinguish themselves from their predecessors and, importantly, to help them build their resumes for future job opportunities. As

superintendents come and go, typically at three year intervals, the cycle repeats itself. The resulting "policy churn" (Hess 1999) causes districts to spin their wheels and underperform due to constantly shifting expectations.

Second, high turnover can cause a government organization to lose institutional memory, policy expertise, and problem solving abilities (Wilson 1989; Kettl and Fesler 2005: 212-4; Heclo 1977). Internal efficiency can especially suffer when incoming leaders are relatively new to the policy challenges facing the organization. Learning takes time, but simultaneously the world around the organization may be changing rapidly. Keeping up with those external demands and maintaining network relationships with key organizational partners can be impossible when knowledgeable leaders and staff are frequently on the move. As problems confronting government have risen in complexity, concerns over the public sector's "vanishing talent" have become more urgent (National Commission on the Public Service 2003).

Findings from a recent comprehensive study of the federal bureaucracy support the idea that turnover can hamper agency performance. Lewis (2007) compared the management performance of political appointees versus career bureaucrats and found that careerists tended to be better managers. Even though political appointees had higher education levels and more business experience, those factors did not contribute to agency performance. However, the careerists possessed advantages in two areas that were associated with superior management: previous experience in their bureaus and length of their tenure. Those findings suggest that low turnover helps agency managers develop valuable experience and knowledge. Those attributes, in turn, positively affect agency performance.

The inability to send clear signals to agents and the loss of internal capacity suggest why turnover in state leadership for elementary and secondary education may cause states to suffer. Thus, we state our first hypothesis as follows. Hypothesis 1: Lower turnover among chief state school officers and state education board members will enhance state educational performance.

Despite the benefits of low turnover in government organizations, there may be diminishing returns to it as well. Some level of expertise can be valuable, but too much stability can cause an organization to become stale and unable to respond to changing circumstances. Humans are boundedly rational decisionmakers who find it challenging to use their limited cognitive abilities to deal with a complicated world (Jones 2001). One solution to those challenges is to adopt modes of action that simplify otherwise complex problems. Those approaches or models may be effective for a while, but as times change they become less useful. Unfortunately, leaders and other personnel within a government organization may fail to see emerging problems because of the blind spots that form when identification with traditional agency tasks is strong (Wilson 1989). Further, low turnover can sustain lines of authority or influence that end up serving narrow interests rather than the public at large. The dominance of insular policy subsystems can breed indifference to pressing outside concerns and accentuate these organizational blind spots (Baumgartner and Jones 1993).

Thus, while we see benefits of low turnover, we also recognize its potential limits. Personnel turnover in government organizations can bring new needed perspectives and diminish the opportunity for narrow interests to dominate the business of government. We consider this

possibility in our second hypothesis. Hypothesis 2: The benefits for state educational performance of low turnover among chief state school officers and state board members will diminish over time.

Analyzing leadership turnover and state education performance

A basic model relating state leadership turnover to state education performance appears in Figure 1. We focus our substantive analysis on path "a" to see if a direct relationship exists between turnover and performance. Certainly, state boards that maintain consistent membership or state education chiefs who serve for many years do not necessarily influence student performance directly. As the previous section noted, leadership continuity is likely to have some impact on policy content and the signals agents in local school districts receive, which path "b" in the diagram shows. And that policy impact in turn influences student performance through path "c."

For our analysis, we set aside paths "b" and "c." Our focus is on state-level leadership turnover, path "a" again, and as control measures key state population characteristics under path "d." Leaving the policy details in a black box is appealing for at least two reasons. First, the number of policies that potentially influence state education performance is quite large, so it is not entirely clear which policies to include and which to omit. A related point is that examining those policies across several states for several years poses a difficult measurement challenge that we do not attempt in this paper.[1]

Second, and more substantively, we see virtues in examining direct associations between leadership turnover and results in order to test the general assumptions that often animate institutional designers. The working assumption frequently is that minimizing turnover can produce better results, not that it will create particular policies, per se. The authors of the U.S. Constitution, for example, believed the nation would prosper with a system of divided powers and federalism, and that the policy details would take care of themselves. In our case, if low turnover among state education chiefs and on state boards and is valuable as a design goal, then we would likely see associations between turnover and state results, regardless of the particular policy mix that each state employs.

Figure 1 about here

For measures of state education performance, our dependent variable, we use results from the National Assessment of Educational Progress (NAEP) exams in 4th and 8th grade reading and math. Those exams are administered periodically, but not every year, and are based on a complex sampling design that makes them the only comparable measures of student achievement across all states.[2] We use available tests between the years 1992 and 2003 and consider the percent of state students scoring "proficient" or "advanced," the two highest levels of achievement on the NAEP. To provide additional resolution, we consider the NAEP in several different forms. We analyze overall NAEP results for each state, and results for different student groups. The groups are whites, blacks, students eligible for free or reduced price lunch (a proxy

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[1] A larger project, of which this paper is a part, is attempting to consider policy changes over time. For details see the State Education Governance Study web page at http://pmanna.people.wm.edu/edgov/edgov.html.

[2] For more information on the NAEP, see http://nationsreportcard.gov/.

for poverty), and students not eligible for free or reduced priced lunch. We analyze all our dependent variables using ordinary least squares regression with robust standard errors clustered by state.

Two measures enable us to test Hypothesis 1 that low leadership turnover will be associated with higher performance. The first measure is the number of years of experience that the state education chief possessed in the year before the NAEP exam was administered. In other words, we analyze 4th grade NAEP results for reading from the years 1994, 1998, 2002. and 2003. For the 1994 administration of the test, we identified who served as state chief in 1993, and counted the number of years that person had served. Because state chiefs run state education bureaucracies, we hypothesized that more experienced chiefs leading up to the NAEP test would likely be associated with better state performance. That would produce positive signs on model coefficients. We gathered data on chief experience from state web sites and several print directories from archival sources at the National Association of State Boards of Education, the Education Commission of the States, and the archives of the State of New York.

In addition to state chief experience, we also examine the impact of state board of education turnover on performance. Here we created a measure of board continuity, which examines how consistent board membership remains from year to year. To do that, we considered board membership at time t and time $t+1$, where t equals all years between 1983 and 2002, the years for which we obtained board membership directories from the National Association of State Boards of Education. We calculated board continuity by considering the percent of members serving at time t who also served at $t+1$. For example, a board with 9 members in 1991 that had 7 of those members still serving in 1992 would have a continuity measure of 77.8 percent from 1991 to 1992.

We considered average board continuity in the years for which students were in school leading up to the NAEP. Thus, in our model examining 4th grade performance in reading or math, we took the average continuity measures over the prior 4 years, which would reflect all of the years that these 4th grade test-takers were in school. For the 8th grade results, we took average continuity measures over the prior 8 year period. Higher averages would indicate that these students were in school during a period with relatively stable board membership, while low averages would suggest more turnover. As with the chief experience measure, we expect a positive association between stable boards and state performance.

Our chief experience and board continuity measures also help us test Hypothesis 2 that too much experience will diminish state performance. To allow for that possibility we enter a squared measure of chief experience and a squared measure of average board continuity in our models. We expect coefficients for these variables to be negatively signed as the benefits of experience and continuity may drop off or even begin to undermine performance if leaders remain in their positions for several years.

We also include additional control measures. Two capture key state characteristics that would fall under path "d" of Figure 1. For the year of each NAEP administration, we include the percent of the state population that was white and the percent of state residents in poverty. Both measures come from the US Census Bureau. They are important controls given prior research

showing strong correlations between race, poverty, and student achievement (Jencks and Phillips 1998; Haycock 2004). Finally, we also include dummy variables that control for the year that each NAEP test was administered, using the oldest test year in our data as the omitted category. That allows us to account for any shocks or peculiarities present in a given test year. To streamline our presentation, we omit results for our control variables from our main tables. Full results for all variables appear in the paper's appendix.

Relationships between leadership turnover and state education performance

To what extent is low turnover among state education chiefs and board members associated with high student achievement on the NAEP? We address that overall question and our two specific hypotheses by examining 4th and 8th grade performance in reading and math. Overall results in each state, and results for the individual student groups appear in Table 1 for 4th graders and Table 2 for 8th graders. We discuss each table in turn.

Beginning with the 4th grade results for reading and math, Table 1 shows that only 3 of our 40 model coefficients were incorrectly signed. That suggests initially at least that greater chief experience and greater board continuity are positively associated with higher achievement. But it also shows, through the quadratic terms in the models, that too much experience or too much continuity might begin to attenuate state performance.

Comparing levels of statistical significance across the state chief and state board measures shows that chief experience appears to more systematically related to NAEP performance than board continuity. Looking at the linear chief term, more experienced chiefs were associated with higher reading achievement for blacks and students not eligible for free or reduced price lunches, as we expected. Similarly, chief experience was positively associated with overall math performance, in addition to performance of whites and students who were not lunch-eligible.

For all those student groups, the benefits of greater chief experience did diminish over time in a statistically discernible way. It is interesting that the students who were not lunch-eligible were the only student group for which the effect of chief experience was consistent across reading and math. The only other consistent impact for both reading and math was the squared chief experience measure. It was statistically associated with lower achievement in the "all" students group.

Examining the results on reading achievement for black 4th graders shows concretely how experience provides some benefits that nevertheless drop off over time. Taking account of the linear and quadratic term for chief experience, the model predicts a 0.35 percentage point increase for a state with a chief who had served 1 year prior to the NAEP administration. The model predicts a state chief with 2 years of experience to produce a 0.64 percentage point gain. Those gains increase, and max out at 7 years of chief experience, which is associated with a 1.19 percentage point gain. After that, the benefits of experience disappear and the quadratic term begins pulling achievement levels down. For 8 years of experience, the predicted result is a 1.12 percentage point gain. The 13 year mark is the point at which more experience actually produces worse results overall. The model predicts that chiefs serving that long would be associated with an achievement loss of 0.13 percentage points for black students.

Regarding the state board continuity measures in Table 1, although the regression coefficients generally had the expected sign, the statistical association between these variables and student achievement was rather weak overall. The board measures had no discernible statistical association on the math results. For reading, however, greater board continuity was associated with higher achievement overall and for students eligible for subsidized lunches. Those results diminished over time, though, as the negative signs on the squared board continuity measure show.

Table 1 about here

The results for 8th graders appearing in Table 2 are less impressive. Looking across all models, 16 of the 40 model coefficients were incorrectly signed. There were four instances where the statistical relationships were strong and as we expected but those tended to lack consistency across institutions, subjects, and student groups. Greater board continuity was associated with higher reading achievement for blacks and lunch-eligible students. As expected, those benefits dropped off as the negatively signed squared measure of board continuity shows. But for math, board continuity did not have the expected effects in any of the models.

Also on the math results, chief experience did behave as expected for white students and blacks. Greater chief experience benefited achievement for these groups, but it also had a diminishing effect over time through the squared measure of experience. To make this result concrete, we again consider predicted values on math but this time for 8th grade black students. Like the prior predicted results on 4th grade reading for blacks, gains increase (by 0.24 percentage points for a state with a chief who has served 1 year and 0.44 for a state with a chief who has served 2 years) and max out at 7 years of experience. At that point, states are expected to have a 0.84 percentage point gain. As the chief accumulates more years of experience, the gains decrease until the 14 year mark at which point student achievement actually worsens. The model predicts an achievement decline of 0.28 percentage points for states with chiefs who have served this long.

Table 2 about here

Looking across Table 1 and Table 2, we are struck by how the associations between our turnover measures and student performance vary across grade levels, subjects, and student groups. For example, chief experience is associated with black student achievement in 4th grade reading and 8th grade math. Achievement of lunch-eligible students is related to board continuity in the area of 4th and 8th grade reading. And for students not eligible for free lunches, chief experience is associated with 4th grade reading and math performance, but not for similar 8th graders in those subjects. For white students, chief experience had strong associations in 4th and 8th grade math, but not in reading for either grade.

In general, the noticeable relationships between leadership turnover and student achievement suggest some support for our two hypotheses. More consistent results across subject areas or student groups, for example, would have provided much stronger evidence. But still, the number of associations in line with our expectations shows that low turnover among

state education leaders, especially state education chiefs, is associated with better state education performance (Hypothesis 1) even though the benefits of low turnover begin to drop off as leaders remain in their posts for several years (Hypothesis 2).

Implications for future work and institutional design

Designers of public institutions often approach their work with a guiding belief that stability in government organizations can produce positive results for citizens. Stability generates valuable in-house experience and helps these organizations to better manage relationships with their agents down the chain of command. It also helps maintain relationships with other groups, inside and outside government, who are crucial players in their policy networks. In contrast, frequent turnover fosters instability that can keep government organizations busy---as reform agendas cycle in and out---but produce much confusion and ultimately poor performance.

In beginning to show that state education performance is related to turnover among state education chiefs and state board members, our analysis suggests that there may be some value in limiting leadership turnover. We also see that some turnover is good given that the benefits of stability appear to decline over time. These initial results are promising in confirming our theoretical expectations. But because no prior research has examined the impact of state leadership turnover on state education performance, our paper perhaps generates as many questions as it answers. We close with two such questions, framed in general terms, that we plan to consider more deeply as our work moves forward.

First, what is the appropriate way to assess the relationship between leadership turnover and government performance? In considering state NAEP performance, we have approached this question from one perspective by looking at years of experience of the most recent state chief, and an averaged measure of state board continuity over several years. Recall that our results were stronger for the former measure and weaker for the latter.

Those results could mean that state chief turnover is more consequential than board turnover. Because chiefs lead state education agencies, that finding seems to make sense given that agencies have more day-to-day involvement in how the state's education system operates. Even though the policymaking powers of state boards can be strong, most board members serve as part time representatives with little staff support when compared to chiefs. For those reasons, low chief turnover may likely have a greater impact than low board turnover. But still, the weak associations between our state board measures and performance may be an artifact of how we have measured turnover for that particular institution. Work that considered different measurement approaches could help examine that issue.

Second, does the effect of turnover manifest itself in systematically different ways depending on the policy domain in question? Our results showed that turnover tended to have noticeable, but inconsistent impacts across grade levels, student groups, and subjects. What might explain that?

Several possibilities seem plausible. One would be a simple artifact of measurement again. Different measures of turnover may produce different results. A second relates to the

black box of policy that we showed in Figure 1. Earlier we offered reasons to justify our focus on the direct association between leadership and performance. In light of our results, which show noticeable associations between turnover and state NAEP results, future work that looked more deeply at the earlier relationship between turnover and policy may prove fruitful. Consider the subject area differences we observed for reading and math. Across the 4th and 8th grade results in Tables 1 and 2, chief experience was a useful predictor in 5 of the 10 models we examined.   But for reading, it was useful in a statistical sense only for 4th grade reading. Might there be something about the policy processes for elementary and secondary mathematics that is different from reading? And if those differences exist, might they also alter the way that that chief experience can have an impact? Answering that question would require a fuller treatment of turnover, policy content, and student results than we have presented here.

In closing, we are certain that ours will not be the final word on the relationship between leadership turnover and state education performance. Still, we have reasonably established several theoretical reasons why turnover might be undesirable in the short term but perhaps more valuable over longer stretches of time. Given that several of our results, especially regarding state education chiefs, are consistent with those theoretical expectations suggests some guidance for institutional designers as they craft public institutions. Our findings urge these people to create government organizations that preserve leadership experience while simultaneously recognizing, as Thomas Jefferson once argued, that periodic upheavals can be valuable as well.

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Figure and tables discussed in the paper

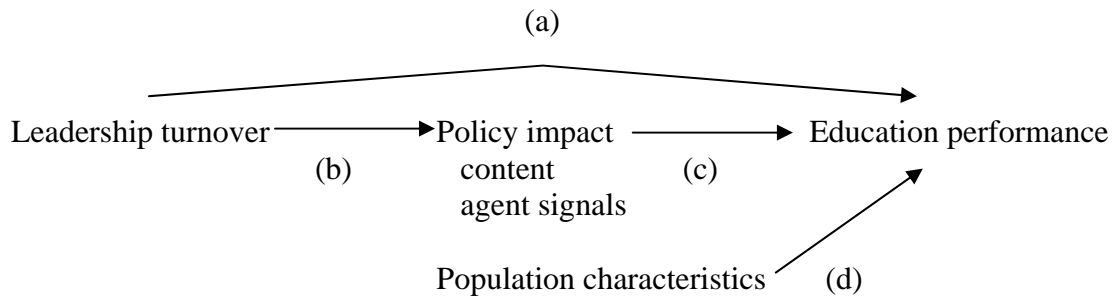Figure 1. A model of leadership turnover and state education performance

(a)

Leadership turnover ⟶ Policy impact ⟶ Education performance
          (b)   content   (c)
                    agent signals

            Population characteristics   (d)

Table 1. Leadership turnover and 4th grade student achievement

NAEP reading	All students	White	Black	Lunch eligible	Not lunch eligible
Chief experience	0.23	0.22	0.38**	0.19	0.67**
	(0.24)	(0.30)	(0.19)	(0.21)	(0.39)
(Chief experience)^2	-0.02*	-0.02	-0.03**	-0.01	-0.05**
	(0.01)	(0.02)	(0.01)	(0.01)	(0.03)
SBE continuity, 4yr avg	1.15**	0.43	0.66	1.77**	1.06
	(0.51)	(0.77)	(0.60)	(0.45)	(0.89)
(SBE continuity, 4yr avg)^2	-0.01**	-0.00	-0.00	-0.01**	-0.01
	(0.00)	(0.00)	(0.00)	(0.00)	(0.01)
States	49	49	40	49	49
N	206	206	171	128	128

NAEP math	All students	White	Black	Lunch eligible	Not lunch eligible
Chief experience	0.35^	0.59**	0.13	-0.07	0.70**
	(0.27)	(0.32)	(0.17)	(0.23)	(0.38)
(Chief experience)^2	-0.03**	-0.04**	-0.02	0.01	-0.05**
	(0.02)	(0.02)	(0.01)	(0.02)	(0.02)
SBE continuity, 4yr avg	0.35	-0.39	0.06	0.47	0.02
	(0.68)	(0.88)	(0.28)	(0.45)	(0.89)
(SBE continuity, 4yr avg)^2	-0.00	0.00	-0.00	-0.00	-0.00
	(0.00)	(0.01)	(0.00)	(0.00)	(0.01)
States	49	49	40	49	49
N	170	170	138	130	130

Note: ^p=.102, *p<.10, **p<.05 in one-tailed tests. Models are OLS regressions with robust standard errors, clustered by state, in parentheses. The dependent variable in all models is the percent of students (in the specified category) scoring proficient or advanced on the NAEP reading and math tests. Results for control variables are omitted, but available in the Appendix. Controls included were percent of white students in the state, percent of state residents in poverty, and dummy variables controlling for year of test, with the earliest test administration serving as the omitted category. "SBE" means "state board of education."

Table 2. Leadership turnover and 8th grade student achievement

NAEP reading	All students	White	Black	Lunch eligible	Not lunch eligible
Chief experience	0.06	0.21	0.15	-0.20	0.27
	(0.29)	(0.36)	(0.38)	(0.25)	(0.36)
(Chief experience)^2	-0.00	-0.02	-0.02	*0.03*	-0.02
	(0.02)	(0.02)	(0.03)	*(0.02)*	(0.02)
SBE continuity, 8yr avg	0.86	-0.14	0.72^	1.70**	-0.08
	(0.85)	(0.94)	(0.56)	(0.66)	(0.95)
(SBE continuity, 8yr avg)^2	-0.01	0.00	-0.00*	-0.01**	0.00
	(0.01)	(0.01)	(0.00)	(0.00)	(0.01)
States	49	49	40	49	49
N	125	125	100	125	125

NAEP math	All students	White	Black	Lunch eligible	Not lunch eligible
Chief experience	0.31	0.53**	0.26*	*-0.45*	0.30
	(0.29)	(0.35)	(0.16)	*(0.27)*	(0.38)
(Chief experience)^2	-0.02	-0.03**	-0.02**	*0.05*	-0.01
	(0.02)	(0.02)	(0.01)	*(0.02)*	(0.03)
SBE continuity, 8yr avg	-0.77	*-1.17*	0.07	*-1.19*	-0.55
	(0.64)	*(0.66)*	(0.40)	*(0.65)*	(0.98)
(SBE continuity, 8yr avg)^2	0.00	*0.01*	-0.00	*0.01*	0.00
	(0.00)	*(0.00)*	(0.00)	*(0.00)*	(0.01)
States	49	49	40	49	49
N	167	167	127	127	127

Note: ^p=.101, *p<.10, **p<.05 in one-tailed tests. Results in italics are statistically significant in the direction opposite of that expected. Models are OLS regressions with robust standard errors, clustered by state, in parentheses. The dependent variable in all models is the percent of students (in the specified category) scoring proficient or advanced on the NAEP reading and math tests. Results for control variables are omitted, but available in the Appendix. Controls included were percent of white students in the state, percent of state residents in poverty, and dummy variables controlling for year of test, with the earliest test administration serving as the omitted category. "SBE" means "state board of education."

Appendix with full regression results

Table A1. Leadership turnover and 4th grade student achievement, full results

NAEP reading	All students	White	Black	Lunch eligible	Not lunch eligible
chiefexpyrprior	0.23	0.22	0.38	0.19	0.67
	(0.24)	(0.30)	(0.19)	(0.21)	(0.39)
chiefexpyrpriorsq	-0.02	-0.02	-0.03	-0.01	-0.05
	(0.01)	(0.02)	(0.01)	(0.01)	(0.03)
contlag4yr	1.15	0.43	0.66	1.77	1.06
	(0.51)	(0.77)	(0.60)	(0.45)	(0.89)
contlag4yrsq	-0.01	-0.00	-0.00	-0.01	-0.01
	(0.00)	(0.00)	(0.00)	(0.00)	(0.01)
whitepct	0.21	-0.00	-0.03	0.16	0.14
	(0.03)	(0.06)	(0.04)	(0.03)	(0.05)
uscbpovpct	-0.71	-0.63	-0.31	-0.07	-0.26
	(0.13)	(0.20)	(0.11)	(0.10)	(0.22)
year1994	0.37	0.90	-0.13	(dropped)	(dropped)
	(0.49)	(0.56)	(0.63)		
year1998	-0.46	0.25	-0.44	-3.79	-4.01
	(0.66)	(0.85)	(0.49)	(0.44)	(0.76)
year2002	2.54	3.68	3.22	(dropped)	(dropped)
	(0.79)	(1.12)	(0.75)		
year2003	2.68	4.13	3.14	-0.62	0.17
	(0.75)	(1.11)	(0.82)	(0.32)	(0.49)
_cons	-24.93	23.17	-9.10	-63.07	-9.57
	(19.25)	(27.08)	(23.22)	(16.67)	(32.70)

NAEP math	All students	White	Black	Lunch eligible	Not lunch eligible
chiefexpyrprior	0.35	0.59	0.13	-0.07	0.70
	(0.27)	(0.32)	(0.17)	(0.23)	(0.38)
chiefexpyrpriorsq	-0.03	-0.04	-0.02	0.01	-0.05
	(0.02)	(0.02)	(0.01)	(0.02)	(0.02)
contlag4yr	0.35	-0.39	0.06	0.47	0.02
	(0.68)	(0.88)	(0.28)	(0.45)	(0.89)
contlag4yrsq	-0.00	0.00	-0.00	-0.00	-0.00
	(0.00)	(0.01)	(0.00)	(0.00)	(0.01)
whitepct	0.13	-0.06	-0.03	0.14	0.06
	(0.03)	(0.06)	(0.03)	(0.03)	(0.05)
uscbpovpct	-0.83	-0.87	-0.15	-0.11	-0.64
	(0.13)	(0.18)	(0.07)	(0.11)	(0.19)
year1996	1.17	1.66	0.64	-1.74	-2.56
	(0.79)	(0.98)	(0.43)	(0.54)	(0.94)
year2000	2.15	3.16	2.00	(dropped)	(dropped)
	(0.94)	(1.17)	(0.63)		
year2003	12.70	16.05	7.07	7.18	12.99
	(0.99)	(1.25)	(0.71)	(0.39)	(0.64)
_cons	4.99	53.73	6.17	-16.52	32.52
	(25.94)	(32.66)	(11.19)	(17.16)	(34.04)

Note: "Dropped" indicates a variable was omitted due to multicollinearity.

Table A2. Leadership turnover and 8th grade student achievement, full results

NAEP reading	All students	White	Black	Lunch eligible	Not lunch eligible
chiefexpyrprior	0.06	0.21	0.15	-0.20	0.27
	(0.29)	(0.36)	(0.38)	(0.25)	(0.36)
chiefexpyrpriorsq	-0.00	-0.02	-0.02	0.03	-0.02
	(0.02)	(0.02)	(0.03)	(0.02)	(0.02)
contlag8yr	0.86	-0.14	0.72	1.70	-0.08
	(0.85)	(0.94)	(0.56)	(0.66)	(0.95)
contlag8yrsq	-0.01	0.00	-0.00	-0.01	0.00
	(0.01)	(0.01)	(0.00)	(0.00)	(0.01)
whitepct	0.24	0.02	-0.02	0.21	0.18
	(0.03)	(0.06)	(0.03)	(0.04)	(0.04)
uscbpovpct	-0.65	-0.56	-0.24	0.04	-0.37
	(0.17)	(0.23)	(0.14)	(0.15)	(0.20)
year2002	1.84	1.79	1.11	3.68	1.95
	(0.60)	(0.66)	(0.63)	(0.61)	(0.66)
year2003	2.04	2.11	2.19	2.74	2.29
	(0.64)	(0.72)	(0.60)	(0.61)	(0.70)
_cons	-13.79	46.30	-11.46	-67.85	29.91
	(32.45)	(34.08)	(21.66)	(25.28)	(34.62)

NAEP math	All students	White	Black	Lunch eligible	Not lunch eligible
chiefexpyrprior	0.31	0.53	0.26	-0.45	0.30
	(0.29)	(0.35)	(0.16)	(0.27)	(0.38)
chiefexpyrpriorsq	-0.02	-0.03	-0.02	0.05	-0.01
	(0.02)	(0.02)	(0.01)	(0.02)	(0.03)
contlag8yr	-0.77	-1.17	0.07	-1.19	-0.55
	(0.64)	(0.66)	(0.40)	(0.65)	(0.98)
contlag8yrsq	0.00	0.01	-0.00	0.01	0.00
	(0.00)	(0.00)	(0.00)	(0.00)	(0.01)
whitepct	0.18	0.01	0.03	0.17	0.14
	(0.04)	(0.06)	(0.02)	(0.05)	(0.05)
uscbpovpct	-0.93	-0.91	-0.16	-0.27	-0.76
	(0.18)	(0.24)	(0.06)	(0.19)	(0.24)
year1996	2.48	3.26	0.43	(dropped)	(dropped)
	(0.79)	(0.96)	(0.56)		
year2000	3.06	3.87	1.24	0.66	1.70
	(1.19)	(1.42)	(0.53)	(0.79)	(0.91)
year2003	7.46	9.61	3.54	3.38	7.32
	(0.98)	(1.20)	(0.60)	(0.79)	(0.88)
_cons	52.63	86.43	3.49	50.82	54.33
	(25.32)	(24.04)	(16.56)	(24.87)	(37.47)

Note: "Dropped" indicates a variable was omitted due to multicollinearity.