Do Environmental Shocks and Budgetary Constraints on Public Organizations Increase Employee Turnover?

Michael S. Hayes

Assistant Professor
Department of Public Policy and Administration
Rutgers University-Camden

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Abstract

Previous public management and organizational theory literature focuses primarily on the employee- and organizational-level characteristics that influence employee turnover. However, other potential determinants of employee turnover, such as factors external to the organization, are understudied. The current paper addresses this gap in the literature by examining the effect of the interaction between environmental shocks and budgetary constraints on employee turnover. Using a nationally representative teacher-level dataset, this paper tests the hypothesis that, after the passage of the No Child Left Behind Act (NCLB), teachers in states with binding tax and expenditure limitations (TELs) on school districts become more likely to turnover than their counterparts in other states. This paper finds evidence to support this hypothesis. Following the passage of NCLB, a teacher in a state with a binding TEL is 8.7 percentage points more likely to leave the teaching profession relative to all other teachers. This result is primarily driven by those teachers in states without a prior school accountability policy. Overall, this study adds to prior research on public employee turnover, TELs, and school accountability.

Introduction

Understanding the factors that influence employee turnover is important because personnel decisions have important repercussions for organizations and organizational performance (Kim, 2002; Meier & Hicklin, 2007; Pitts, 2005; Ronfeldt, Loeb, & Wyckoff, 2013; Shaw, Delery, & Jenkins, 2005). For example, in the context of public education, Guarino, Santibanez, & Daley (2006) suggest that the most effective teachers are more likely to leave their school relative to the less effective teachers. However, there is also research that suggests removing ineffective teachers through performance-assessment reforms can improve student outcomes (Adnot et al., 2017). Either way, actual turnover – even healthy turnover – has significant financial costs on organizations (e.g. Meier & Hicklin, 2007; Park & Shaw, 2013). For example, estimates of the cost of teacher turnover range between $12,000 to $52,500 per teacher (Alliance for Excellent Education, 2005; Texas Center for Educational Research, 2000).

The literature on employee turnover in public management and organizational theory focuses primarily on how employee- and organizational-level characteristics influence employee turnover. However, other determinants of employee turnover, such as factors external to the organization, are understudied (Mobley et al., 1979; Moynihan & Pandey, 2008; Meier & O'Toole, 2009; Llorens & Stazyk, 2011). The current study contributes to this literature by focusing on the interaction of two external factors: environmental shocks to organizations and budgetary constraints on organizations.[1]

[1] The current study defines an environmental shock similar to Meier and O'Toole (2009). Instead of a cut to school budgets, the current study operationalizes an environmental shock as school districts needing to raise additional revenue to fund the No Child Left Behind Act of 2001 (NCLB) and to buffer teachers from the non-fiscal shocks of NCLB.

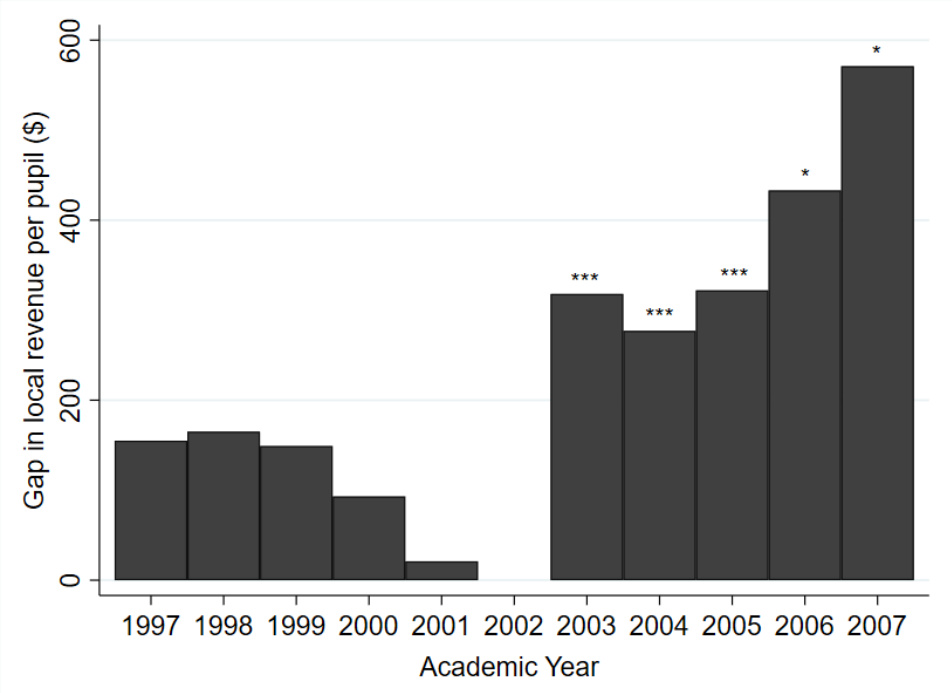
Specifically, the current study examines how the passage of the No Child Left Behind Act of 2001 (NCLB) and state-imposed binding tax and expenditure limitations (TELs) on school districts interact to affect the likelihood of teacher turnover. Previous research suggests that the passage of NCLB created an environmental shock by placing a significant financial burden on school districts by requiring them to invest in "highly qualified teachers" and designing and implementing new student assessments (Author, 2015; Dee, Jacob, & Schwartz, 2013; Goertz, 2005; McGuinn, 2005).[2] At the same time, the passage of NCLB had non-financial effects on teachers, such as diminishing teachers' classroom autonomy, reducing teachers' perceived job security, and increasing teachers' stress levels (Daly & Chrispeels, 2005; Figlio & Loeb, 2011; Luna & Turner, 2001; Reback, Rockoff, & Schwartz, 2014). Interestingly, there has been mixed evidence on the impact of the passage of the NCLB on teachers' job attitudes, satisfaction, and mobility (Feng, Figlio, & Sass, 2018; Grissom, Nicholson-Crotty, & Harrington, 2014; Reback, Rockoff, & Schwartz, 2014; Sun, Saultz, & Ye, 2017)

One possible reason for this mixed evidence on teacher mobility is that teachers were not impacted equally by the fiscal and non-fiscal shocks of the passage of NCLB. Some states, however, impose budgetary constraints on school districts. Common state-imposed budgetary constraints on school districts are binding TELs, which restrict districts' abilities to raise additional revenue or increase expenditures. School districts in states with binding TELs were less likely to be able to respond to the environmental shock of NCLB by raising additional own-source revenue (Author, 2015). For example, as Figure 1 shows, the gap in local revenue per pupil between school districts in states without binding TELs compared to those school districts

[2] School systems needed to increase the number of "highly qualified teachers" in classrooms. Under NCLB, a highly qualified teacher is fully certified, holds a bachelor's degree, and shows competence in subject knowledge and teaching skills. All Title I classrooms must have a highly qualified teacher by the 2002-2003 school year.

in states with binding TELs increased following the passage of the NCLB act. As shown in Figure 1, there was a statistically insignificant gap in per-pupil local revenue during the pre-NCLB years. However, in the first year of the passage of NCLB, this gap in local revenue increased by more than $300 per pupil relative to the 2001-02 academic year and continued to grow over the next several academic years. This suggests that school districts in states without binding TELs were able to increase local revenue more than school districts with binding TELs following the passage of NCLB.

Figure 1 – Gap in local school district revenue between states without and with binding TEL



Notes: This figure is based on the author's calculations and the full analysis is available on request. Figure 1 reports coefficients from an event study analysis that estimates the gap in local revenue per pupil between school districts without binding TELs compared to those with binding TELs for academic years before the passage of the NCLB and academic years during the implementation of the NCLB. 2003 is the 2002-03 academic year and the first year of NCLB. The base year is the 2001-02 academic year, which is the last year before the implementation of NCLB. Data comes from all U.S. public school districts reported in the Local Education Agency Finance Survey (F-33) collected by the National Center for Education Statistics. Standard errors are reported in parentheses and are clustered at the state-level, *** p<0.01, ** p<0.05, * p<0.1.

The current study tests the hypothesis that the environmental shock of NCLB increases the likelihood of teacher turnover relatively more in states with binding TELs compared to states without binding TELs. Using a nationally representative teacher-level dataset, the current study uses a difference-in-difference type strategy to examine the change in the likelihood of teacher turnover between teachers in states with and without binding TELs on school districts following the passage of NCLB. The main results suggest the likelihood of turnover increased relatively more for teachers in states with binding TELs relative to all other teachers after the passage of the NCLB. Interestingly, teachers did not necessarily move to another school, but it appears that these teachers were exiting the teaching profession altogether. For example, following NCLB, a teacher in a state with a binding TEL is 8.7 percentage points more likely to leave the teaching profession relative to all other teachers. This higher likelihood of leaving the teaching profession is even higher in states without a school accountability policy prior the passage of NCLB.

The remainder of this paper is organized into five sections. Section 2 reviews the relevant literature and presents testable hypotheses. Sections 3 and 4 describe the dataset and the empirical methodology. Section 5 presents the main results and section 6 concludes with a discussion of the implications of these results.

Literature Review and Theory

The current study sits at the intersection of three literatures: the determinants of employee turnover, the fiscal and non-fiscal shocks caused by NCLB, and tax and expenditure limitations (TELs). In this section, I use the key findings from these literatures to develop testable hypotheses, which I test empirically later in the paper.

Determinants of Public-Sector Employee Turnover

Numerous predictors of employee turnover have been found in prior research. For thorough reviews from the public management and education policy literatures, see Grissom, Viano, & Selin (2016), Guarino, Santibanez, & Daley (2006), Moynihan & Pandey (2008), and Pitts, Marvel, & Fernandez (2011). Below, I summarize the various employee- and organizational-level predictors of employee turnover found in these prior reviews. Additionally, I utilize these previous studies to identify appropriate control variables for the empirical model.

The decision to leave an organization is influenced by many employee demographics including age, years of work experience, race, gender, and worker qualifications. First, older and more experienced employees are more likely to remain in the same organization (e.g. Guarino, Santibanez, & Daley (2006); Lambert, Hogan, & Barton, 2001). Second, there are mixed findings on whether turnover is related to employee race/ethnicity (Blau & Kahn, 1981; Choi, 2009; Ingersoll, 2001; Kellough & Osuna, 1995; Kirby, Berends, & Naftel, 1999). Third, recent research suggests female employees are less likely to leave their organization than their male counterparts (Guarino, Santibanez, & Daley, 2006). Lastly, the likelihood of a teacher leaving their school is higher if the teacher has a graduate degree, higher standardized test scores, and less teaching experience (Borman & Dowling, 2008).

Organizational characteristics also influence the likelihood of employee turnover. Not surprisingly, employee satisfaction with pay, benefits, and career advancement are strong predictors of turnover. Research finds higher salaries and more generous benefits decrease the likelihood of employee turnover (Blau and Kahn, 1981; Borman and Dowling, 2008; Grissom and Anderson, 2012; Grissom and Mitani, 2016; Shaw et al., 1998). Additionally, previous research suggests that organizations with more opportunities for career advancement and promotion have lower employee turnover rates (Lee and Whitford, 2008; Selden and Moynihan,

2000). One possible explanation for this negative relationship between opportunities for career advancement and turnover intention is that access to more opportunities for career advancement promotes higher levels of job satisfaction and organizational commitment (Pitts, Marvel, & Fernandez, 2011). The employee's relationship with his or her supervisor is another important factor. More effective public managers tend to lower the likelihood of employee turnover. For example, public managers can decrease rates of employee turnover through better communication, providing more role clarity, and creating a sense of trust (Kim, 2002; Kim, 2005; Pitts, Marvel, & Fernandez, 2011). Grissom (2011) also finds that schools with more experienced principals have relatively lower rates of teacher turnover.

Schools with more economically disadvantaged students have relatively higher turnover rates (Ingersoll, 2001; Hanushek, Kain, & Rivkin, 2004). Similarly, schools located in an urban area have higher teacher turnover rates relative to schools located in suburban areas (Ingersoll, 2001; Lankford et al., 2002). This may be related to school resources, as previous research suggests that schools with higher levels of administrative support have relatively lower teacher turnover rates (Mintzberg, 1979; O'Toole and Meier, 1999; Ingersoll, 2001; Boyd et al., 2010). Additionally, teachers with smaller class sizes and more instructional support are more likely to remain teaching in their school (Loeb, Darling-Hammond, Luczak, 2013).

Overall, previous research demonstrates that various employee- and organizational-level factors influence employee turnover. However, other determinants of employee turnover, such as factors external to the organization, are understudied. The current study contributes to this literature by examining how factors external to the organization influence the likelihood of employee turnover. Specifically, the current study hypothesizes and tests whether environmental

shocks and budgetary constraints affect public employees' decision to move to another organization or leave the profession altogether.

The Fiscal and Non-Fiscal Shocks Associated with the Passage of NCLB

There is surprisingly little research on external factors that impact employee turnover (Meier and O'Toole, 2009). Meier and O'Toole (2009) find environmental shocks on organizations, defined in their study as budgetary shocks, have negative effects on organizational performance. If environmental shocks negatively affect organizational performance, it is possible that these shocks also impact organizations' personnel decisions and employee morale. A recent major environmental shock on public school systems and their teachers was the passage of NCLB, which included both fiscal and non-fiscal shocks.

The fiscal shock of the passage of NCLB is the financial burden that this law put on state governments and school districts. The passage of NCLB required state governments and school districts to make two major investments. First, state governments and school districts had to design and implement annual assessments of students' math and reading achievement by the 2005-06 academic year.[3] Second, schools had to increase the hiring of "highly qualified teachers."[4] See Goertz (2005), Dee, Jacob, & Schwartz (2013), and McGuinn (2004) for reviews of the key features and implementation costs of NCLB.

Previous research suggests that NCLB was an underfunded federal mandate. Indeed, a 2003 survey found that almost 90% of superintendents and principals characterized NCLB as an

[3] All grades between 3rd and 8th must assess student math and reading skills every year after the passage of NCLB, including English Language Learner (ELL) students and students with special needs.
[4] Under NCLB, a highly qualified teacher is fully certified, holds a bachelor's degree, and shows competence in subject knowledge and teaching skills. All Title I classrooms must have a highly qualified teacher by the 2002-2003 school year.

underfunded mandate (Olson, 2013). For example, the Government Accountability Office (2003) estimated that states designed and implemented up to eleven new student tests at an estimated total cost of $7 billion. However, the federal government authorized only $2.34 billion to fund public school systems in designing and implementing these new student assessments. Similarly, Dee, Jacob, & Schwartz (2013) find that, in the years following the passage of NCLB, federal education revenues increased by $100 per-pupil, while state and local education revenues increased by $448 per-pupil.

NCLB may also have non-fiscal shocks on teachers. NCLB incentivized teachers, schools, and administrators to increase student performance on standardized tests while simultaneously placing a tremendous amount of pressure on teachers. Interestingly, there has been mixed evidence on the impact of the passage of the NCLB on teachers' job attitudes, satisfaction, and mobility. Grissom, Nicholson-Crotty, and Harrington (2014) use data from the School and Staffing Survey (SASS) to measure the impact of the NCLB on work environments and job attitudes. They find a small positive impact on classroom control and administrative support; however, a negative effect on teacher cooperation. In contrast, Reback, Rockoff, and Schwartz (2014) find evidence of reductions in job security and classroom autonomy following the passage of the NCLB. Hanushek and Raymond (2010) find evidence that a low accountability rating increases the likelihood of teachers moving out of tested grades.

Most relevant to the current study is Sun, Saultz, and Ye (2017) which estimates the national trend in teacher turnover rates before the after the passage of NCLB. Using teacher turnover data between 1993 and 2008, they find no evidence that teachers were more likely to voluntarily leave their school or the teaching profession following the passage of the NCLB. However, they do find a modest increase in the likelihood of a teacher transferring involuntarily

to another school, especially in disadvantaged schools. Sun, Saultz and Ye (2017) extend their analysis by testing for heterogeneous effects of NCLB on teacher mobility by type of teacher and type of school.

Building on Sun, Saultz, and Ye (2017), the current study examines another possible heterogeneous effect of the passage of NCLB on teacher turnover. One possible reason for the mixed evidence is that teachers were not impacted equally by the fiscal and non-fiscal shocks of the passage of NCLB. After the passage of NCLB, there may have been fewer resources available to improve current teacher's working conditions, such as reducing class sizes, hiring more teacher aides, increasing salaries/benefits, and improving opportunities for career advancement. As a result, the effect of NCLB may have been stronger in financially constrained states and school districts. For example, Feng, Figlio, and Sass (2018) find that Florida teachers in a school that experience a sudden reduction their school accountability rating are more likely to leave their school, especially in the lowest performing schools. Low performing schools also tend to have fewer resources.

It is unclear how different school systems were able to buffer teachers from the environmental shock of NCLB. One possible buffer was the ability of school systems to raise additional revenue to pay for the required NCLB investments. By increasing tax revenue, a school district can fund the required NCLB investments, while also keeping resources available to buffer teachers from the non-fiscal shocks of NCLB. The ability to raise additional revenue, however, is a function of the budgetary constraints imposed on school districts by states. One common budgetary constraint on school districts is a TEL.

Budgetary Constraints on School Districts: Tax and Expenditure Limitations (TELs)

A TEL is a law that restricts governments' abilities to increase the amount of revenue generated and/or funds spent in their jurisdictions. Voters support the enactment of TELs because they perceive it as a "win-win" situation since they expect to receive lower tax burdens, while also keeping the same level of government services (Mullins and Wallin, 2004). The enactment of a TEL, however, creates a host of economic distortions because the governments affected by TELs are less likely to meet the service needs of their citizens (Mullins and Joyce, 1996; Mullins, 2004).

State governments impose TELs on various types of governments: state governments, municipalities, county governments, and school districts. The current study focuses on TELs placed on school districts. Joyce and Mullins (1991) distinguished between six different types of TELs, including limits on changes to the property tax rate, limits on changes to property tax levy, limits on changes to general expenditures, limits on changes to general revenue collection, and limits on changes to property value assessments.

The distinction between non-binding and binding TELs is important, as non-binding TELs are less likely to restrict governments' abilities to increase revenues or expenditures. Examples of non-binding TELs include limits on property tax rates and limits on increases in the assessment values of properties. For example, a government constrained by a limit on its property tax rate can still increase revenues by increasing the assessment value of properties in its jurisdiction. These TELs can be binding only if there is both a property tax limit and limits on increasing the assessment value of properties.

More generally, a TEL must meet one of three criteria to be considered binding. First, a TEL is binding if there are limits on either general revenue or general expenditures. Limits on general revenue or expenditures are both examples of binding TELs, as they explicitly restrict

the amount of revenue collected or money spent by a government. Second, a limit on the property tax levy is a binding TEL because it explicitly restricts the growth in property tax collection. Lastly, a binding TEL can arise from the combination of a limit on the property tax rate and a limit on increasing the assessment value of properties.

Stallmann et al. (2017) provide a thorough literature review of the effects of TELs, for both state-level and local-level TELs. The current study focuses primarily on TELs on local governments. Generally, the body of research on local-level TELs find that stricter TELs are associated with reductions in local general expenditures (e.g. Dye and McGuire, 1997; Figlio and O'Sullivan, 2001; Maher and Deller, 2013). Additionally, previous studies suggest that stricter TELs are associated with lower property tax revenues, and also local governments attempt to circumvent TELs by becoming more dependent on alternative sources of revenue like state aid and user fees (e.g. Kioko, 2011; Kioko and Martell, 2012; Skidmore, 1999; Sun, 2014).

More specifically, there are previous studies that examine the effect of TELs in the context of public education. Dye, McGuire, and McMillen (2005) find TELs increasingly restrict growth in education revenue collection over time. They find school districts, shortly after the enactment of a TEL, have the ability to protect instructional expenditures by reducing administrative expenditures. In the long-run, however, school districts are forced to reduce instructional expenditures. Shadbegian (2003) finds school districts are forced to rely on non-property tax revenue sources, which are less stable forms of revenue relative to property tax revenue sources. One form of non-property tax revenue for school districts is state aid (Mullins and Joyce, 1996; Shadbegian, 2003). Previous studies also suggest TELs are associated with lower starting teacher salaries, higher student to teacher ratios, and a reduction in teacher quality of new incoming teachers, and lower student performance (Downes and Figlio, 1999; Figlio,

1997; Figlio, 1998; Figlio and Reuben, 2001). Interestingly, Davis, Vedder, and Stone (2016) suggest that TELs reduce student performance, primarily due to the fact that TELs disrupt the ability of local school districts to plan and budget.

Lastly, Author (2015) finds, after the passage of NCLB, states' shares of education funding increased relatively more in states with binding TELs on school districts compared to all other states. One possible explanation for this result is that school districts without binding TELs became relatively less reliant on state funding compared to school districts with binding TEL following the passage of NCLB. They were less dependent on state funding because there was no law restricting their abilities to raise local revenue. In fact, Figure 1 shows that the gap in local revenue collection between school districts in states without and with binding TELs increased substantially following the passage of NCLB.

In summary, prior research suggests that NCLB may have negatively impacted teachers in both fiscal and non-fiscal ways. It is unlikely that all teachers were impacted equally. School districts with the abilities to provide additional resources to schools and teachers are more likely to buffer teachers from the negative effects of the NCLB. This is especially true for school districts in states without binding TELs because there was no legal constraint on raising expenditures or revenues. As a result, I expect that teachers in states with binding TELs were less likely to remain in the same school compared to all other teachers. However, it theoretically unclear whether or not teachers in states with binding TELs would move to another school, or decide to leave the teaching profession altogether. It is possible that the impacted teachers moved to another school that provided better resources or working conditions. At the same time, it is possible that teachers in states with binding TELs were more likely to leave the teaching

profession, especially since a binding TEL is placed on all school districts in the state. The current study's empirical analysis will test these hypotheses.

By testing these hypotheses, the current study makes three unique contributions to the literatures on public employee turnover, TELs, and school accountability. First, the current study adds to the growing body of public management research examining environmental shocks on employee turnover (Mobley et al., 1979; Moynihan and Pandey, 2008; Meier and O'Toole, 2009; Llorens and Stazyk, 2011). Second, the current study extends prior work on how TELs impact school outcomes. Specifically, this is the first study to examine the relationship between TELs and employee turnover. Lastly, the current study adds to prior research on the impact of the NCLB on teacher mobility. Specifically, the current study extends the work by Sun, Saultz, and Ye (2017) by examining whether there is a differential effect of the passage of NCLB on teacher turnover between states with and without binding TELs.

Data

The dataset comprises of a pooled, cross section of public-school teachers. The nationally representative data on teachers comes from the restricted-use versions of the 1999-00 and 2003-04 Schools and Staffing Surveys (SASS) and the 2000-01 and 2004-05 Teacher Follow-up Surveys (TFS).[5] The TFS follows up with approximately 5,300 randomly sampled SASS respondents the following year to see if and where they are still teaching.[6] Specifically, I use the teacher, principal, school, and school district questionnaires from SASS and TFS to collect information on teacher mobility and teacher demographics. Teacher mobility across schools, and

[5] All four surveys are collected by the National Center for Education Statistics (NCES). See http://nces.ed.gov/surveys/sass/index.asp for additional information.
[6] Numerous studies have used the SASS and TFS to examine teacher mobility on a national scale (e.g. Ingersoll, 2001; Shen, 1997; Grissom, 2011; Grissom, 2012).

attrition from the teaching profession is measured by comparing each SASS to its corresponding TFS, the latter of which asks a random subsample of the previous year's SASS teachers if they are still teaching, if they are still teaching in the same school, and if they are still teaching in the same district. Because the TFS only surveys a subsample of the SASS sample, the current analysis will be restricted to teachers surveyed in both the SASS and TFS.

The SASS and TFS data are then augmented with district- and state-level data from various sources including the U.S. Census Statistical Abstracts, Bureau of Economic Analysis, Bureau of Labor Statistics, 2000 Decennial Census, Local Education Agency Finance Survey (LEAFS), and a TEL inventory collected by Mullins and Wallin (2004). Descriptive statistics for all variables are reported in Table 1. The remainder of this section describes the analytic sample and the dependent, independent, and control variables.

Analytical Sample

The SASS surveyed approximately 85,300 teachers between 1999-00 and 2003-04.[7] I construct the analytical sample in four steps. First, I drop any SASS teachers not surveyed in the TFS, leaving 9,450 teachers. Second, an additional 2,400 teachers are removed from the sample because these teachers could not be linked to the SASS school, principal, or district questionnaires. Third, teachers from the District of Columbia and Hawaii are eliminated from the sample, as DC and Hawaii both only contain one school district. This is consistent with previous TEL studies (e.g. Mullins and Joyce, 1996; Shadbegian, 2003). However, the results are robust to including DC and Hawaii in the sample. Fourth, teachers who retired between the SASS and TFS survey years are eliminated from the sample because it is unclear whether or not these teachers

[7] In accordance with NCES regulations, sample sizes are rounded to the nearest 50 observations.

retired for reasons other than the expected relationship described in the previous section. Lastly, the sample is restricted to full-time, regular, self-contained, and non-charter public elementary school teachers who have an observation for all variables.[8] These restrictions yield an analytical sample of approximately 1,500 teachers.

Unfortunately, due to National Center of Education Statistics (NCES) disclosure rules, I cannot disclose the exact number of sampled teachers from each state. I can say that all 49 states in the sample have at least 5 teachers in the analytical sample, and 43 of the 49 states have at least 15 teachers. I examine the representativeness of the analytical sample by comparing basic descriptive statistics between the full sample of SASS teachers and the analytical sample. For example, teacher demographics for the analytical sample are qualitatively similar to those of the full sample of teachers surveyed in the 1999-00 SASS. There are a few notable exemptions to this claim. The analytical sample has more female teachers, less experienced teachers, and less teachers with a master's degree compared to the full sample of teaches in the 1999-00 SASS. I account for these differences by running the regressions with and without SASS provided sampling weights, which account for unequal probabilities of sample selection. The results are robust to not using these sampling weights.

[8] Regular teachers are any teachers not considered substitutes or student teachers. Self-contained teachers teach multiple subjects to the same class of students for the entire day. Non-charter teachers teach in public schools that are not considered a charter school.

Table 1: Descriptive Statistics for Analytical Sample

Variable	Mean	SD
Teacher Mobility		
Stayer	0.49	-
Mover	0.30	-
Leaver	0.21	-
Independent Variables		
After the Implementation of NCLB Indicator (NCLB)	0.56	-
Binding District TEL (TEL)	0.38	-
State had a prior school accountability policy (PRIOR)	0.55	-
Teacher Controls		
Black	0.08	-
Hispanic	0.06	-
Female	0.82	-
Age	40.48	11.25
Total Teaching Experience	11.97	9.25
Teaching Experience in Current School	6.44	6.93
Earned Master's Degree	0.40	-
Log of Real Base Salary	10.03	0.26
School/Principal Controls		
Title I School	0.66	-
% Black Student	0.18	0.27
% Hispanic Students	0.17	0.26
% Free and Reduced Lunch	0.50	0.30
Log of Total School Enrollment	6.20	0.58
School in Urban Area	0.28	-
School in Suburban Area	0.49	-
School in Rural Area	0.23	-
Teacher to Administrator Ratio	25.39	9.24
Teacher Aid to Teacher Ratio	0.20	0.23
Principal’s Total Experience	8.40	7.30
Principal’s Experience in Current School	4.71	4.82

Table 1 (Cont.): Descriptive Statistics by Sample Restriction

Variable	Mean	SD
District Controls		
Student to Teacher Ratio	16.95	10.23
Compensation Incentive: Less Desirable Location	0.12	-
Compensation Incentive: Pay for Shortages	0.23	-
Ratio of State to District Education Funding	1.74	1.47
Proportion of Funding from Non-property tax base	0.40	0.31
Union Status: Collective Bargaining	0.61	-
Union Status: Meet and Confer	0.09	-
Union Status: None	0.30	-
Current Expenditures per pupil ($)	4,325.19	1,1164.51
State Characteristics		
Republican Governor Indicator	0.62	-
% Elderly	0.12	0.02
Real Personal Income per Capita ($)	9.84	0.12
Annual Unemployment Rate (%)	5.11	1.08
TEL imposed on State Government	0.71	-
Ratio of Average Daily Attendance to Population	0.16	0.02
Number of Teachers	1,500	
Number of States	49	
Number of Survey Years	2	

Notes: The overall sample includes all SASS and TFS surveyed, full-time, regular, self-contained, and non-charter public elementary teachers who have an observation for all variables. Any teacher located in DC or Hawaii are eliminated from the sample.

Dependent Variable

The outcome of interest is teacher turnover, which is coded as a categorical variable that takes 3 values: stayers, movers, and leavers. Three dependent variables are created using the TFS, which asks the SASS sampled teacher one year later to describe their teaching status and location. Stayers are teachers who reported in the TFS survey that they remained in the same school. Movers are teachers who reported that they remained a public-school teacher, but relocated to another school, district, or state.[9] Lastly, leavers are teachers who reported that they were no longer a full-time, public teacher.

[9] As a robustness check, I conduct an alternative analysis using two mover variables: school mover and district/state mover. There is no practical or statistical difference between the main coefficients for the school mover and

Independent Variables

There are three primary variables of interest in this study: presence of a binding TEL on school districts indicator, the No Child Left Behind Act implementation year indicator, and an indicator for whether or not the teacher taught in a state with a prior school accountability policy. First, the data source for state-imposed TELs is Mullins and Wallin (2004), a collection for all states identifying the year each type of TEL was enacted. Using this collection, I construct the binding TEL on school districts indicator, which is a dummy variable that equals one if the state imposes a binding TEL on school districts in a particular year, and zero otherwise.[10] Second, there is an indicator for the No Child Left Behind Act implementation year, which equals one if the time period is during the implementation of the NCLB, and zero otherwise. The implementation of NCLB started in the 2002-03 school-year. All observations during or after the 2002-03 school-year are coded with a one.

The last variable of interest is an indicator for whether a state enacted a school accountability policy prior to the passage of NCLB. The financial shock to states from the passage of NCLB is likely less severe in states that enact school consequential accountability policies prior to the passage of NCLB. For example, states with state-imposed school consequential accountability policies developed and invested in creating student exams prior to the passage of NCLB (See, Dee and Jacob, 2011). Generally, consequential school accountability policy consists of two components: a public report of schools' education outcomes and the attachment of consequences to schools' education outcomes. Hanushek and Raymond (2005)

district/state mover models. Therefore, the main analysis combines school, district, and state movers in one mover category.

[10] There are some school districts in the United States that dependent on another government to raise revenue on their behalf (i.e. Rhode Island school district depend on municipalities). The binding TEL on school districts indicator is coded one for states with school districts that dependent on government that is constrained by a binding TEL.

provided a complete list of states with consequential school accountability policies by year of enactment.[11] The prior school accountability policy indicator is a dummy variable that equals one if the state enacts a consequential school accountability policy prior to the passage of NCLB, and zero otherwise.

Statistical Controls

Previous studies illustrate the importance of teacher- and school-level characteristics in predicting teachers' decisions to leave a school (Ingersoll, 2001; Guarino Santibanez, & Daley, 2006). Accordingly, the regression models control for relevant teacher, school, school district, and state characteristics. I take data from the SASS teacher, principal, school, and district questionnaires to create these control variables. Teacher characteristics include indicators for race, gender, whether the teacher holds a Master's Degree, age, years of full-time teaching experience, years of experience in current school, and academic base salary.[12]

School characteristics include indicators for principal experience, whether the school is a Title I school, and whether the school resides in an urban, suburban, or rural area. A school is considered a Title I school if the school receives any Title I funding from the federal government. Title I funding is given to schools with a large proportion of students who come from households that are below the poverty level.[13] School covariates also include student demographics, total student enrollment, teacher to administrator ratio, and teacher aide to teacher

[11] See Table 1 in Hanushek and Raymond (2005)
[12] The main results are robust when not including teachers' academic base salary in the analysis. To be consistent with previous teacher turnover studies, quadratic variables are created for age and experience (Ingersoll, 2001; Kirby et al., 1999).
[13] For more information about Title I funding, see http://www2.ed.gov/programs/titleiparta/index.html

ratio. The teacher to administrator ratio is equal to the number of full-time equivalent teachers divided by the number of principals or vice principals.

District characteristics include five school district policy indicators. First, there is a "less desirable location incentive policy indicator," which is a dummy variable that equals one if the district provides additional compensation to recruit or retain teachers in less desirable locations and zero otherwise. For example, "less desirable location" schools are those located in low income areas. Second, there is a pay-for-shortage policy indicator, which is a dummy variable that equals one if the district provides extra compensation to attract teachers in fields that currently are currently experiencing shortages of teachers and zero otherwise.

Third, there is a dummy variable for whether or not a district has a collective-bargaining agreement with union. Fourth, there is a dummy variable for whether or not a district has a meet-and-confer agreement with union.[14] Fifth, there is a dummy variable for whether or not a district has no union agreement. It is important to control for these five district policy variables because they proxy for the preferences that officials and voters in the school district have in terms of their desire to provide extra resources to teachers. For example, school districts that enact a pay-for-shortage compensation policy are more likely to provide additional resources to teachers during an environmental shock.

There are also four other district-level finance variables including the ratio of education funding from state to local sources, total current expenditures per pupil, student to teacher ratio, and the total amount of local revenue from non-property tax revenue. These variables come from

[14] The meet and confer agreement is a more informal union agreement relative to a collective-bargaining agreement. For example, a meet and confer agreement does not legally bound the employer to the agreement. For more information, see http://www.aft.org/about/union101/

the Local Education Agency Finance Survey (LEAFS). Controlling for these variables is important as previous studies find local governments increase revenue from non-property tax revenue sources after an enactment of TELs (Mullins and Joyce, 1996; Shadbegian, 2003). LEAFS publishes detailed revenue and expenditure data on all school districts in the United States.[15]

State-level socioeconomic and policy characteristics may also influence the likelihood of teacher turnover. There are five socioeconomic variables, including real state personal income per capita, state population, average daily attendance, annual unemployment rate, and the proportion of 65 year or older individuals in the state. Average daily attendance is calculated by adding the total number of students attending school for each day of the school year, and dividing that number by the total number of days in the school year.[16] Lastly, state-level policy variables include a republican governor indicator.

Various data sources are used to create the five socioeconomic variables. The inclusion of socioeconomic variables is based on previous theoretical frameworks (Borcherding and Deacon, 1972; Bergstrom and Goodman, 1973; Shadbegian, 2003). First, data from Bureau of Economic Analysis is used to construct state real personal income per capita and total state population variables.[17] Assuming that education is a normal good, a higher level of state income should be positively associated with higher citizen preferences to fund government services like public education. Consistent with Shadbegian (2003), a higher state population should have a negative

[15] The first year of published data on all school districts was for the 1990-91 school year. See, http://nces.ed.gov/ccd/f33agency.asp
[16] For more information, see http://www.ncpublicschools.org/fbs/accounting/data/
[17] See, the Bureau of Economic Analysis website for data, http://www.bea.gov/iTable/iTable.cfm?reqid=70&step=1&isuri=1&acrdn=4#reqid=70&step=1&isuri=1.

effect on state aid to school districts because of economies of scale which reduce the per-pupil cost of educating students.

Second, data from the Bureau of Labor Statistics is used to create the annual state unemployment rate.[18] A higher unemployment rate should have a negative impact on state aid per pupil because higher unemployment rates should reduce state income and sales tax revenue collection. Lastly, data from the National Public Education Financial Survey is used to create the state average daily attendance variable.[19] Similar to state population, a higher level of average daily attendance should have a negative impact on state aid per pupil due to economies of scale in the production of education.

Lastly, this analysis attempts to control for differences in state-level policies. First, the data source for the political party of the governor variable comes from the United States Census Statistical Abstracts.[20] The data-set includes a variable of the political party of state governor, which is a dummy variable that equals one if there is a republican state governor, and zero otherwise. In addition to political party of the governor, states differ in their education policies. For example, various states enacted court-ordered and/or statutory education finance reform policies, and previous research shows that these education finance reform policies have positive effects on state government education funding (Blankenau and Skidmore, 2004). The current study does not include an indicator for education finance reform because no states changed their

[18] See, the Bureau of Labor Statistics' website for data, http://www.bls.gov/lau/
[19] The definition of average daily attendance is the same as definition mentioned above expect that this variable is aggregated to the state-level instead of the school district level. See, the National Center for Education Statistics and the Common Core of Data for data source, http://nces.ed.gov/ccd/stfis.asp
[20] http://www.census.gov/prod/2/gen/96statab/election.pdf

policy between 1999-00 and 2003-04. Therefore, these variables are assumed to be absorbed in the state fixed effects described later in the methodology section.

Methodology

The empirical analysis examines whether there is a differential effect of the passage of the NCLB on teacher turnover between teachers in binding TEL and non-binding TEL states. To test for this, I estimate the following baseline linear probability model (LPM) for each category of teacher turnover by Ordinary Least Squares (OLS):

$$(1) \qquad y_{ist} = \tau\, TEL_s \times NCLB_t + \beta X_{ist} + \theta_s + \delta_t + e_{ist}$$

where y is a binary indicator of teacher i, in state s, in year t, experiencing a type of teacher turnover; TEL is a school district binding TEL indicator; $NCLB$ is a NCLB year indicator; X is a vector of teacher, school, district, and state controls listed in Table 1; θ is a state fixed effect; δ is a year fixed effect, and e is an error term. The coefficient of interest in equation (1) is τ, which is expected to be negative and statistically significant when the dependent variable is the stayer category of turnover. Otherwise, this coefficient is expected to be positive and statistically significant when the dependent variable is the leaver category of turnover.

The empirical model conditions on state fixed effects, which control for all time invariant unobserved heterogeneity across states. State fixed effects control for long-term economic and political preferences of the state that do not vary over time.[21] It is important to mention that the state fixed effects also control for whether or not the state had a binding TEL on school districts because this variable does not vary over time during the time period between 1999 and 2003. Therefore, the un-interacted TEL indicator is not included in equation (1) because it is already

[21] For example, the state fixed effects will control for state resistance to the implementation of NCLB (Shelly, 2008).

absorbed in the state fixed effect. Unfortunately, the analytical sample only contains approximately 1,500 teachers in 1,050 school districts. In many cases, there is only one teacher per school district, and this reduces the degrees of freedom when using district fixed effects. Therefore, the preferred specification includes all controls and state fixed effects. However, the main results remain qualitatively similar with and without state fixed effects.

The year fixed effects control for time-specific shocks that impact all states in a particular year. Therefore, the un-interacted NCLB indicator is not included in the equation (1) because it is already absorbed in the year fixed effect. I find similar results when I run alternative versions of equation (1) where I remove the year fixed effect and include the NCLB indicator. Additionally, as a robustness check, I run alternative versions of Equation (1) with and without control variables, and I find qualitatively similar results. Standard errors are robust to state-level clustering, which makes inference robust to serial correlation within states over time and heteroskedasticity.

To give a causal interpretation to τ, we must assume that nothing else other than the passage of NCLB affected states with TELs differently than states without TELs between 1999 and 2003. The two most common state-level education policies being enacted in the 1990s and early 2000s were prior school accountability policies and education finance reforms. Both of these factors are controlled for in the study's research design. As mentioned above, the model includes an indicator for whether or not the state enacted a school accountability policy prior to the passage of NCLB. Additionally, the empirical model includes state fixed effects that absorb the variation in education finance reforms across states because no state implemented an education finance reform during the time period of this study. It is possible that other types of state or district-level education policies were being enacted during this time period. For example,

a state with a TEL, Oregon, established the Quality Education Commission in 2001 to determine the amount of funding that would be required to meet the state's education quality objectives. At the same time, a state without a TEL, Georgia, enacted new state professional development standards in 2003 that were designed to link teacher professional development with the state's new education content standards. Both of these policies may have impacted the likelihood of teacher turnover during this time period. Unfortunately, it is impossible to control for all potential state- and school district-specific policy events that may have affected the likelihood of teacher turnover differently in states with TELs compared to all other states during this time period. Therefore, I caution readers that the main results can only offer a credible, descriptive estimate of the differential effect of the passage of NCLB on teacher turnover between states with and without TELs.

There are at least two reasons the main analysis utilizes linear probability models in lieu of alternative modelling strategies that use Maximum Likelihood Estimation (MLE). First, the calculation of average partial effects (APE) of interaction variables is significantly more complicated when using MLE than when using OLS.[22] For example, Ai and Norton (2003) argue that a non-linear model, like a logit model, can provide the wrong sign for the coefficient of an interaction term. Second, the consistency of multinomial logit model (MNL) coefficient estimates relies on the independence of irrelevant alternatives assumption (IIA). The IIA restriction assumes outcome categories are not nested. The turnover categories are likely nested because, for example, the probability of leaving the school is correlated with the probability of leaving the teaching profession.[23] Nonetheless, alternative versions of equation (1) are estimated

[22] See Ai and Norton (2003) and Puhani (2012) for a full explanation of the issues with calculating APEs in non-linear models.
[23] See, on p. 501, Wooldridge (2010) for their illustration of the IIA problem using the "red bus/blue bus" example.

using a logit, probit, and MNL as a sensitivity analysis. This sensitivity analysis finds similar results, which is reported in Appendix Table A.2.

Results

Main Results

The first column in Table 2 reports the main coefficient of interest from equation (1) when the dependent variable is stayer. The main variable of interest is the interaction of the NCLB implementation year indicator and the binding TELs on school districts indicator. In column 1, the coefficient in Row 1 of Table 2 is -0.052 and is the expected sign. It suggests, on average, a teacher in a state with a binding TEL is 5.2 percentage points less likely to remain the same school relative to all other teachers following the passage of the NCLB. This is a practically significant result since it is equivalent a 10% reduction in the likelihood of remaining in the same school. However, it is important to note that the coefficient is not statistically significant. One possible reason for this statistically insignificant result is that examining only the change in the likelihood of staying in the same school only provides one piece of the puzzle when understanding the effect on teacher turnover.

To investigate this further, columns 2 and 3 report corresponding regression results where the dependent variable is the mover and leaver indicator, respectively. In column 2, the coefficient in Row 1 of Table 2 is -0.035. It suggests that, following the passage of the NCLB, a teacher in a state with a binding TEL is 3.5 percentage points less likely to move to another school relative to all other teachers following the passage of the NCLB. While this coefficient is practically significant, it is not statistically significant.

In column 3, the coefficient in Row 1 of Table 2 is 0.087 and is the expected sign. This coefficient suggests that, following the passage of the NCLB, a teacher in a state with a binding TEL is 8.7 percentage points more likely to leave the teaching profession relative to all other teachers. This coefficient is statistically significant, and it equivalent to more than a 25% increase in the likelihood of leaving the teaching profession. Altogether, it appears the likelihood of turnover increased relatively more for teachers in states with binding TELs relative to all other teachers after the passage of the NCLB. Moreover, teachers did not decide to move to another school, but it appears that these teachers were exiting the teaching profession altogether.

Table 2. Baseline Estimates of Teacher Turnover (OLS)

	Stayer	Mover	Leaver
	(1)	(2)	(3)
Row 1: No controls and no state FEs			
NCLB × TEL	-0.052	-0.035	0.087**
	(0.054)	(0.051)	(0.042)
Row 2: Add state FEs			
NCLB × TEL	-0.027	-0.055	0.082**
	(0.053)	(0.051)	(0.040)
Row 3: Adds teacher controls			
NCLB × TEL	-0.030	-0.048	0.078*
	(0.053)	(0.051)	(0.046)
Row 4: Adds school/districts controls			
NCLB × TEL	-0.023	-0.056	0.079*
	(0.053)	(0.052)	(0.047)
Row 5: Adds state controls			
NCLB × TEL	-0.047	-0.046	0.093
	(0.084)	(0.060)	(0.067)

Notes: N = 1,500 teachers, 1,050 school districts, and 49 states. NCLB is a binary indicator that equals 1 if the teacher was surveyed in the NCLB-era and 0 otherwise. TEL is a binary indicator that equals 1 if the teacher taught in state with a binding school district tax and expenditure limitations (TEL) and 0 otherwise. Each cell reports the estimate of τ for a unique regression of Equation 1 that controls for state and year fixed effects (FEs). Row 1 reports the estimate of τ from Equation 1 where no state fixed effects are included, but the TEL indicator is added into the model. All other control variables are included in the model in levels, but are not reported in the interest of brevity. The other control variables from Row 5 are reported in Appendix Table A.1. Standard errors are reported in parentheses and are clustered at the state-level, *** p<0.01, ** p<0.05, * p<0.1.

The next several rows in Table 2 include additional controls described in the data and methodology sections. Notably, Rows 2 through 5 provide qualitatively similar results compared to the results reported in Row 1. For example, in Column 3, the coefficient reported in Row 5 is 0.093, which is slightly larger than the coefficient reported in Row 1. It is important to note that the statistical significance of the main coefficient of interest in Column 3 does diminish slightly as additional controls are added to the regression model. The loss of statistical significance is likely the result of including these additional control variables, which reduce degrees of freedom

and statistical power. Nevertheless, it reassuring that the magnitude of the coefficient remains stable across the different model specifications.[24]

Appendix Table A.1 reports the coefficients from Row 5 for all other variables in equation (1). Not surprisingly, many of the coefficients are not statistically significant, with the exception of the female indicator, number of years teaching at school, master's degree indicator, school located in an urban area indicator, and student to teacher ratio. Female teachers are less likely to leave the teaching profession relative to male teachers, which is consistent with previous turnover research (Guarino Santibanez, & Daley, 2006;). Teachers with more years of experience at their current school are more likely to remain in their school (e.g. Grissom, Viano, & Selin, 2016). Having a master's degree or teaching in an urban area increases the likely that a teacher leaves the profession relative to all other teachers. Overall, the majority of the coefficients are of their expected sign, and the lack of statistical significance on some of the control variables is likely the result of a lack of statistical power.

Heterogeneity across states with and without prior school accountability policies

As discussed in the literature review section, it is possible that the differential effect of the passage of the NCLB on teacher turnover between teachers in states with binding TEL and all other teachers was even larger for teachers in states without a school accountability enacted before the passage of NCLB. Roughly half of the states enacted their own consequential school accountability policy prior to the passage of NCLB (Hanushek and Raymond, 2005). To investigate this, equation (1) is estimated separately for teachers in states without a prior school

[24] Appendix Table A.2 reports quantitively similar results when an alternative version of equation (1) is estimated by maximum likelihood estimation (MLE). For example, the main results are robust to using logit, probit, or multinomial logit (MNL) models.

accountability policy and then again for only teachers in states with a prior school accountability policy. Table 3 reports the results of this analysis. All regressions in Table 3 include state fixed effects, year fixed effects, and all of the control variables.

Table 3. Heterogeneity in Teacher Turnover by Prior School Accountability Status

	No Prior Accountability			Prior Accountability		
	Stayer	Mover	Leaver	Stayer	Mover	Leaver
	(1)	(2)	(3)	(4)	(5)	(6)
NCLB × TEL	-0.047	-0.103	0.150**	-0.024	-0.006	0.030
	(0.062)	(0.076)	(0.065)	(0.097)	(0.085)	(0.064)
State FEs	√	√	√	√	√	√
Teacher Controls	√	√	√	√	√	√
School Controls	√	√	√	√	√	√
State Controls	√	√	√	√	√	√
Adjusted R^2	0.10	0.04	0.06	0.11	0.07	0.03
F-stat	3.64	9.85	6.21	9.20	8.76	2.57
F-stat (p-value)	(0.003)	(0.000)	(0.000)	(0.000)	(0.000)	(0.03)
N Teachers		700			800	
N School Districts		500			550	
N States		26			23	

Notes: NCLB is a binary indicator that equals 1 if the teacher was surveyed in the NCLB-era and 0 otherwise. TEL is a binary indicator that equals 1 if the teacher taught in state with a binding school district tax and expenditure limitations (TEL) and 0 otherwise. Each cell reports the estimate of τ for a unique regression of Equation 1 that controls for state and year fixed effects (FEs). Columns 1, 2, and 3 include only sampled teachers in states without a school accountability policy implemented prior to the passage of NCLB. Columns 4, 5, and 6 include sampled teachers in states with a prior school accountability policy. All other control variables are included in the model in levels, but are not reported in the interest of brevity. Standard errors are reported in parentheses and are clustered at the state-level, *** p<0.01, ** p<0.05, * p<0.1.

Columns 1 through 3 of Table 3 report the main coefficient of interest from equation (1) for only teachers located in a state without a prior school accountability policy. The coefficient of interest in Column 3 is 0.150. This suggests that, following the passage of NCLB in states without a prior school accountability, teachers in states with a binding TEL are 15 percentage points more likely to leave the teaching profession relative to all other teachers. This is not only

statistically significant, but this coefficient is almost 50% larger than the similar coefficient reported in Row 5 of Table 2.

Columns 4 through 6 of Table 3 report the main coefficient of interest from equation (1) for teachers located in a state with a prior school accountability policy. Interestingly, the coefficient of interest in Column 6 is 0.030, and this is substantially smaller in magnitude compared to the coefficient of interest in Column 3. Altogether, the results from Table 3 suggest that the differential effect of the NCLB on teacher turnover between teachers in states with binding TEL and those teachers without a binding TEL is primarily driven by those teachers in states without a prior school accountability policy.

Sensitivity analysis

In summary, following the passage of the NCLB, teachers in states with binding TELs were more likely to leave the teaching profession relative to all other teachers, especially for teachers in states without a prior school accountability policy. However, the current results do not provide the exact reason why these teachers are leaving the profession. It is possible that these teachers are leaving the profession by chance and for reasons unrelated to the environment shock of the passage of the NCLB. I test this by conducting a sensitivity analysis that further probes for the reasons why surveyed teachers left the profession.

I use data from the TFS, which ask former teachers to rank the importance of various possible reasons for leaving the profession. Across the two survey years, 2000-01 and 2004-05, there is a set of seven common reasons: change in residence; pregnancy or child care; health issue; involuntary decision; seeking better salary or benefits; desire to begin a new career; and

dissatisfied with teaching assignment or responsibilities.[25] The former teachers were asked to select the importance of each reason on a scale of 1 (not at all important) to 5 (extremely important). Some of these reasons are unrelated to the environment shock of the NCLB, especially many of the personal reasons like change in residence or pregnancy. Instead, possible related reasons to the environmental shock of the passage of NCLB include seeking better salary or benefits, desire to begin new career, and dissatisfied with teaching assignment or responsibilities.

Using this data and the subsample of approximately 300 leavers from the analytical sample, I estimate a similar version of equation (1), but dependent variable takes on one of the seven common reason variables mentioned above. The analysis uses an ordered logit model because the dependent variables are categorical. Table 4 reports the average partial effects (APE) from all seven ordered logit models.[26]

As expected, there is no evidence that the main results are being driven by unrelated reasons for leaving the teaching profession like change in residence, pregnancy, and health issues. Additionally, there is no statistically significant evidence that involuntary turnover is driving the main result. However, there is evidence that teachers are leaving the profession due to being dissatisfied with their teaching assignment or responsibilities. For example, the APE in column 5 is 0.181 when the dependent variable is the dissatisfied with teaching assignment or responsibilities. This suggests that, following the passage of the NCLB, leavers in states with binding TELs are 18 percentage points more likely to say that being dissatisfied with their

[25] Involuntary decision could include being laid off, having their school closed, or being reassigned to another school.
[26] Average partial effects measure the effect of a 1-unit change in an element of X on Pr(y = 1/x) and are directly comparable to the OLS coefficient estimate. See, Wooldridge (2010) for more details.

teaching assignment or responsibilities was extremely important in making their decision to leave the profession relative to leavers in states without a binding TEL.

Table 4. Ordered Logit Average Partial Effects (APEs)

	How important was the following in deciding to leave teaching?				
	Not at all	Slightly	Somewhat	Very	Extremely
	(1)	(2)	(3)	(4)	(5)
A. Change in residence					
NCLB × TEL	0.085	-0.004	-0.008	-0.025	-0.049
	(0.103)	(0.005)	(0.011)	(0.031)	(0.059)
B. Pregnancy/child care					
NCLB × TEL	0.054	-0.000	-0.000	-0.001	-0.052
	(0.086)	(0.001)	(0.001)	(0.002)	(0.083)
C. Health issue					
NCLB × TEL	-0.006	0.001	0.001	0.001	0.002
	(0.108)	(0.014)	(0.028)	(0.021)	(0.044)
D. Involuntary decision					
NCLB × TEL	-0.153	0.014	0.025	0.029	0.084
	(0.101)	(0.011)	(0.019)	(0.021)	(0.058)
E. Salary/Benefits					
NCLB × TEL	-0.048	0.002	0.008	0.011	0.027
	(0.108)	(0.004)	(0.017)	(0.026)	(0.061)
F. Desire for new career					
NCLB × TEL	-0.082	0.001	0.008	0.022	0.051
	(0.117)	(0.002)	(0.013)	(0.032)	(0.072)
G. Dissatisfied with teaching assignment					
NCLB × TEL	-0.384***	0.051***	0.055***	0.097***	0.181***
	(0.115)	(0.018)	(0.020)	(0.033)	(0.063)

Notes: N = 300 teachers. NCLB is a binary indicator that equals 1 if the teacher was surveyed in the NCLB-era and 0 otherwise. TEL is a binary indicator that equals 1 if the teacher taught in state with a binding school district tax and expenditure limitations (TEL) and 0 otherwise. The APEs were calculated from running a set of ordered logit models similar to equation (1), except the dependent variable is replaced with one of the reasons for leaving the teaching profession shown above. Standard errors are reported in parentheses and are clustered at the state-level, *** p<0.01, ** p<0.05, * p<0.1.

There are at least two limitation of this sensitivity analysis. First, without more detailed information, it is impossible to say exactly what particular aspect of their teaching assignment or responsibilities motivated teachers in states with binding TELs to be more likely to leave the profession following the passage of the NCLB. Second, the subsample of 300 leavers is quite small, which reduces the statistical power to identify statistically significant results.

Discussion and Conclusion

The current study examines whether an environmental shock on public organizations are strongest in states with budgetary constraints, like a binding TEL. Specifically, using nationally representative data on U.S. public school teachers, the current study estimated the effect of the passage of NCLB on teacher turnover between states with binding TELs and states without binding TELs. The results suggest that the likelihood of turnover increased relatively more for teachers in states with binding TELs relative to all other teachers after the passage of the NCLB. Moreover, teachers did not decide to move to another school, but it appears that these teachers were exiting the teaching profession altogether. For example, following the passage of NCLB, a teacher in a state with a binding TEL is 8.7 percentage points more likely to leave the teaching profession relative to all other teachers. This result is primarily driven by those teachers in states without a prior school accountability policy. Additionally, the current study finds some evidence that suggests exiting teachers left due to dissatisfaction with teaching duties and responsibilities, which is consistent with some prior research on the negative effects of NCLB on teacher attitudes (Reback, Rockoff, and Schwartz, 2014). Overall, in the context of NCLB and binding TELs, it appears that environmental shocks and budgetary constraints increase the likelihood of employee turnover in the public sector.

The current study adds to three existing bodies of research. First, it adds to the existing public management research on how environmental shocks and budgetary constraints can impact public employee turnover (Mobley et al., 1979; Moynihan & Pandey, 2008; Meier & O'Toole, 2009; Llorens & Stazyk, 2011). Second, it contributes to prior education policy research on the effect of NCLB on teacher attitudes and mobility (Feng, Figlio, & Sass, 2018; Grissom, Nicholson-Crotty, & Harrington, 2014; Reback, Rockoff, & Schwartz, 2014; Sun, Saultz, & Ye, 2017). Specifically, the current study finds evidence that the effect of the passage of NCLB on teacher turnover varies depending on whether the teacher taught in a state with a budgetary constraint like a binding TEL. Lastly, the current study adds to prior research on TELs by being the first study to examine the relationship between TELs and employee turnover.

The findings in this study also provide at least four implications for policymakers and public managers. First, the findings highlight the potential unintended consequences of federal policies that are implemented without consideration of how the policy will interact with existing state and local policy. Specifically, federal policymakers did not consider the consequences of the interaction of unfunded federal mandates and state-level budgetary constraints on public organizations. The main goal of NCLB was to reduce the achievement gap between disadvantaged and non-disadvantaged students. However, these results show that there was an increase in teacher turnover rates in school districts with budgetary constraints. While it is unclear whether these exiting teachers were more or less effective, teacher turnover is nonetheless costly given the financial burden of replacing teachers, especially in districts that have fewer resources available.[27]

[27] Previous research shows effective teachers are more likely to leave low-performing schools (See, Boyd et al. 2005; Horng, 2009)

Second, these findings suggest policymakers might want to design compensation and transfer policies that encourage teachers to remain in schools, especially those in distressed areas (Fullbeck and Farley, 2012). For example, Denver's teacher compensation policy, Teacher ProComp, allows the district to attract and retain the most effective teachers by offering teacher bonuses.[28] For example, the district can provide a 6.4% bonus to teachers in schools with a high percentage of students on free and reduced lunch. Additionally, Simon and Johnson (2015) suggest that improving the working environment in schools might be a better solution to reduce teacher turnover than marginal increases in teacher salaries, particularly in schools located in an economically distressed area. For example, Simon and Johnson (2015) suggest various policy solutions including: retaining and attracting quality principals; providing more time for teachers to lesson plan; teacher teams; and school-site hiring. Many of these solutions will require additional resources for schools and principals.

Third, state-level policymakers could give all school districts in the state more flexibility to raise revenues or expenditures during a fiscal shock created by an underfunded federal mandate. This is especially important because some school districts will be able to circumvent the binding TEL, while others may not (Stallman et al., 2017). For example, it is possible that some school districts can circumvent a binding TEL during a fiscal shock through a successful vote by its citizens to override the TEL. If some school districts do not have the power to override the TEL, there could be significant variation in how an environmental shock can impact employee turnover within a state. One way for the state to provide more flexibility during an environmental shock is put a short-term moratorium on the enforcement of a binding TEL. Alternatively, states could assist public managers by providing them with more autonomy over

[28] For more information, see http://denverprocomp.dpsk12.org/about/overview.

the organization's budget. Specifically, principals can be given more control over reallocating resources within the school so the principal can transfer more resources to the teachers impacted the most by the underfunded mandate.

Although I believe the findings are considerable, this study is not without limitations. First, employee turnover can be beneficial for organizations, and in the context of education, dismissing ineffective teachers will likely improve short- and long-term outcomes for students and society. Unfortunately, the current study cannot address whether or not the increase in teachers exiting the profession would positively or negatively impact organizational performance. Moving forward, it would be important to measure the effect on teacher quality or student outcomes. I leave this for future research that utilizes data on student test scores. Second, for numerous reasons, the models are not able to condition on all observable and unobservable teacher characteristics that likely impact teacher turnover. While the main results are robust to alternative modeling strategies that include and do not include controls, I caution readers that the main results are only a descriptive interpretation of the effect of the passage of NCLB on teacher turnover between states with and without TELs.

Third, the current study does not use annual teacher turnover data in all states for multiple years prior to and after the passage of NCLB. This ideal data would allow me to control for state-specific linear trends to test the parallel slopes assumption. Unfortunately, the SASS does not collect turnover data annually, and the current study can only use the 1999-00 and 2003-04 SASS survey years because it is the closest SASS data available before and after the passage of NCLB. This is not ideal because I can't observe teacher turnover during the first year of the implementation. Therefore, it is possible that the main result underestimates the true effect of the

passage of the NCLB on teacher turnover between states with binding TELs and states without binding TELs.

On a related note, I strategically selected to not include the 1993-94 SASS because there is a significant time gap between the 1993-94 SASS and the 1999-00 SASS surveys. During this gap, a lot of economic changes and policy changes took place, which prevents me to reliably control for time trends before the passage of NCLB. For example, there were multiple changes in TEL laws prior to the 1999-00 academic year. It is beneficial that there is no variation in the binding TEL indicator within-states between the 1999-00 and 2003-04 survey years because it would be impossible for my study to determine whether the main findings were the result of the passage of the NCLB act, or because of the change in the state's TEL status.

Lastly, the relationship between environmental shocks and budgetary constraints and their combined impact on public organizations may be different when examined in other organizational and economic contexts. For example, the current study relies heavily on a unique environmental shock on public organization, the passage of the NCLB. It is possible that public employees outside of the education sector might respond differently to environmental shocks and budgetary constraints. Consequently, future research should validate the current study's findings in other settings and contexts.

Appendix Table A.1. Full Regression Results from Row 5 in Table 2 (OLS)

	Stayer	Mover	Leaver
	(1)	(2)	(3)
NCLB × TEL	-0.047	-0.046	0.093
	(0.084)	(0.060)	(0.067)
Teacher Controls			
Black	0.102	-0.067	-0.035
	(0.065)	(0.057)	(0.046)
Hispanic	0.042	-0.056	0.014
	(0.031)	(0.056)	(0.056)
Female	0.017	0.061*	-0.078**
	(0.037)	(0.031)	(0.034)
Age	0.001	-0.003	0.002
	(0.010)	(0.011)	(0.008)
Age^2	0.000	-0.000	-0.000
	(0.000)	(0.000)	(0.000)
Total Teaching Experience	-0.010	0.007	0.003
	(0.007)	(0.006)	(0.006)
Total Teaching $Experience^2$	0.000	-0.000	-0.000
	(0.000)	(0.000)	(0.000)
Total Experience at Current School	0.014**	-0.013**	-0.001
	(0.007)	(0.006)	(0.007)
Total Experience at Current $School^2$	-0.000	0.000	0.000
	(0.000)	(0.000)	(0.000)
Holds a Master's Degree	-0.087***	0.032	0.056**
	(0.029)	(0.029)	(0.028)
Log of Academic Base Salary	0.146*	-0.112	-0.034
	(0.083)	(0.074)	(0.070)
School/Principal Controls			
Title I school	0.029	-0.018	-0.011
	(0.033)	(0.028)	(0.023)
% Black students	-0.038	-0.036	0.074
	(0.087)	(0.080)	(0.064)
% Hispanic students	-0.032	0.024	0.008
	(0.085)	(0.078)	(0.069)
% Free and reduced-price lunch students	-0.034	0.065	-0.031
	(0.084)	(0.083)	(0.054)
Log of Total School Enrollment	0.041*	-0.032	-0.010
	(0.023)	(0.029)	(0.021)

Notes: N = 1,500 teachers, 1,050 school districts, and 49 states. NCLB is a binary indicator that equals 1 if the teacher was surveyed in the NCLB-era and 0 otherwise. TEL is a binary indicator that equals 1 if the teacher taught in state with a binding school district tax and expenditure limitations (TEL) and 0 otherwise. Each column reports all coefficients from a unique regression of Equation 1 that controls for state and year fixed effects (FEs). Standard errors are reported in parentheses and are clustered at the state-level, *** p<0.01, ** p<0.05, * p<0.1.

Appendix Table A.1 (Cont.). Full Regression Results from Row 5 in Table 2 (OLS)

	Stayer	Mover	Leaver
	(1)	(2)	(3)
School/Principal Controls (Cont.)			
Located in Urban Area	-0.083**	0.021	0.062**
	(0.040)	(0.036)	(0.029)
Located in Rural Area	-0.040	0.033	0.007
	(0.045)	(0.034)	(0.034)
Teacher to Administration Ratio	0.003**	-0.001	-0.002*
	(0.002)	(0.001)	(0.001)
Teacher Aid to Teacher Ratio	0.029	-0.012	-0.017
	(0.060)	(0.061)	(0.041)
Principal's Total Years of Experience	-0.003	0.005	-0.002
	(0.006)	(0.006)	(0.004)
Principal's Total Years of Experience^2	0.000	-0.000	0.000
	(0.000)	(0.000)	(0.000)
Principal's Experience at Current School	0.008	-0.011	0.002
	(0.009)	(0.008)	(0.005)
Principal's Experience at Current School^2	-0.000	0.000	-0.000
	(0.000)	(0.000)	(0.000)
District Controls			
Student to Teacher Ratio	-0.003***	0.002*	0.001
	(0.001)	(0.001)	(0.001)
Teacher Incentive Policy: Location	-0.053	-0.019	0.072
	(0.048)	(0.061)	(0.047)
Teacher Incentive Policy: Shortage	-0.012	0.037	-0.025
	(0.032)	(0.044)	(0.026)
State Share of Education Revenues	0.001	-0.003	0.002
	(0.011)	(0.011)	(0.009)
Local Revenues from non-property taxes	-0.094	0.098	-0.004
	(0.087)	(0.087)	(0.079)
Union Type: Collective Bargaining	-0.099*	0.110**	-0.012
	(0.053)	(0.054)	(0.044)
Union Type: Meet and Confer	-0.054	0.004	0.051
	(0.071)	(0.063)	(0.047)
Total Current Expenditures per pupil	-0.000	0.000	-0.000
	(0.000)	(0.000)	(0.000)

Notes: N = 1,500 teachers, 1,050 school districts, and 49 states. NCLB is a binary indicator that equals 1 if the teacher was surveyed in the NCLB-era and 0 otherwise. TEL is a binary indicator that equals 1 if the teacher taught in state with a binding school district tax and expenditure limitations (TEL) and 0 otherwise. Each column reports all coefficients from a unique regression of Equation 1 that controls for state and year fixed effects (FEs). Standard errors are reported in parentheses and are clustered at the state-level, *** p<0.01, ** p<0.05, * p<0.1.

Appendix Table A.1 (Cont.). Full Regression Results from Row 5 in Table 2 (OLS)

	Stayer	Mover	Leaver
	(1)	(2)	(3)
State Controls			
Republican Governor	-0.054	0.039	0.015
	(0.038)	(0.039)	(0.033)
% 65 years or older	6.088	-27.094***	21.006**
	(9.080)	(6.730)	(7.890)
Log of Real Personal Income	-0.330	-1.819	2.149
	(1.670)	(1.217)	(1.420)
% Unemployed	0.009	-0.040	0.031
	(0.040)	(0.033)	(0.041)
State TEL	-0.090	-0.081	0.172***
	(0.094)	(0.075)	(0.049)
Average Daily Attendance per capita	8.664	-17.992***	9.327
	(9.461)	(6.037)	(8.223)
Adjusted R^2	0.12	0.07	0.06
F-stat	28.42	18.77	24.25
F-stat (p-value)	(0.000)	(0.000)	(0.000)

Notes: N = 1,500 teachers, 1,050 school districts, and 49 states. NCLB is a binary indicator that equals 1 if the teacher was surveyed in the NCLB-era and 0 otherwise. TEL is a binary indicator that equals 1 if the teacher taught in state with a binding school district tax and expenditure limitations (TEL) and 0 otherwise. Each column reports all coefficients from a unique regression of Equation 1 that controls for state and year fixed effects (FEs). Standard errors are reported in parentheses and are clustered at the state-level, *** p<0.01, ** p<0.05, * p<0.1.

Appendix Table A.2. Reported Average Partial Effects (APE) Using Alternative Models

	Stayer	Mover	Leaver
	(1)	(2)	(3)
Row 1: Linear Probability Models			
NCLB × TEL	-0.047	-0.046	0.093
	(0.084)	(0.060)	(0.067)
Row 2: Logit Model			
NCLB × TEL	-0.043	-0.043	0.114**
	(0.080)	(0.061)	(0.059)
Row 3: Probit Model			
NCLB × TEL	-0.045	-0.046	0.101*
	(0.080)	(0.061)	(0.058)
Row 4: Multinomial Logit (MNL)			
NCLB × TEL	-0.052	-0.051	0.103*
	(0.077)	(0.062)	(0.059)

Notes: N = 1,500 teachers, 1,050 school districts, and 49 states. NCLB is a binary indicator that equals 1 if the teacher was surveyed in the NCLB-era and 0 otherwise. TEL is a binary indicator that equals 1 if the teacher taught in state with a binding school district tax and expenditure limitations (TEL) and 0 otherwise. Each average partial effect (APE) estimate of is from a separate regression of Equation 1 that controls for state and year fixed effects (FEs). Row 1 is the exact results from Row 5 in Table 2. The remaining rows are analogous regressions using a different model/estimator. Standard errors are reported in parentheses and are clustered at the state-level, *** p<0.01, ** p<0.05, * p<0.1.

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