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by

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ABSTRACT

We provide empirical evidence on the determinants of voter turnout using the randomized outcomes of a school choice lottery. We show that those losing the lottery to attend their first-choice school are significantly more likely to vote in the ensuing school board election than lottery winners. The effect of losing the school choice lottery on voting is highest among high-income families and among those who participated in prior elections. Aggregating the predicted turnout results up to the precinct level, we find evidence consistent with the hypothesis that losing the school choice lottery caused parents to vote against the incumbent school board chair, causing her to lose the election. These results have potentially important implications for political behavior: in order to maximize their chances of re-election, public officials may seek to minimize losses to high income residents and those with a history of voting rather than choosing welfare maximizing policies. The results also have important implications for the political viability of public school choice programs.

I. Introduction

In recent years public school choice has been gaining support as a possible alternative to traditional student assignment by neighborhood. Proponents argue that school choice could improve education quality by bringing market forces to bear on public school systems, increasing the pressure to produce higher quality public education by allowing students to choose schools separately from neighborhood location. However, just as in product markets, the ability of school choice to improve education through the introduction of market forces depends on the factors that govern demand for product characteristics and the incentive systems of producers. Although consumer behavior may be similar to that in other differentiated products markets (Hastings, Kane and Staiger (2005)), the producers of education – school boards, administrators and teachers – may face very different incentives than firms in traditional products markets do.

In the typical public school district, elected school boards are responsible for allocating resources, setting a policy agenda and hiring the superintendent. They also may determine school assignment mechanisms, define boundaries for geographic school assignment plans, and design school choice mechanisms. School boards are accountable to district residents through elections, implying that voter behavior and voter response to school board policies are key incentive mechanisms that influence school board decisions. Rather than maximizing profits, school boards may instead adopt policies to maximize votes. Therefore, in order to understand local school district policy, it is important to understand the determinants of voting behavior. This paper examines the links between voter behavior and school choice outcomes and draws some implications for the political economy of school choice.

We use school district administrative data and voter registration data for families in Mecklenburg County, North Carolina (which includes the city of Charlotte, the largest city in North Carolina). In 2002, the Charlotte-Mecklenburg school district (CMS) implemented a district-wide school choice plan after its race-based busing plan was terminated by the courts. Under the choice plan, parents in the district submitted their top three choices of schools for their children, and the district assigned students to schools through a lottery system. We match administrative data on students' choices, lottery

numbers, demographics, and school assignments to voter records from the Mecklenburg County Board of Elections for the school board election immediately following the implementation of the school choice plan. We test if losing or winning the lottery to attend one's first-choice school affected the decision to vote. Since lottery outcomes were randomly assigned, they are orthogonal to other factors that may influence voting behavior, such as past voting behavior, income, or a person's political views.

We show that lottery losers are significantly more likely to vote in the school board election than lottery winners. Moreover, this asymmetric effect increases with income and past election participation. The effect is large in magnitude: losing the lottery increases the odds of voting by 34% among past voters with median household income. Our findings are broadly consistent with randomized field trials of get out the vote efforts, which have found effects of similar magnitude from door-to-door canvassing efforts. As in our results, that work suggest larger effects among regular voters in municipal elections (Green and Gerber, 2004). Overall, our evidence supports a model of 'expressive' voting, where experiencing a negative policy outcome such as losing the school lottery motivates people to vote more than a positive outcome does.

Because the voter registration data only contain information on whether or not a person voted, but not how they voted, we use precinct-level election outcome data to test if the predicted effect of losing the lottery on voter turnout, identified by the randomization of lottery outcomes, is consistent with precinct-level election results. We show that our predicted increase in turnout of lottery losers in each precinct is positively associated with the number of votes cast against the incumbent school board chair, suggesting that lottery losers were voting against the incumbent. The incumbent chair lost her bid for re-election by a close margin.

These results are important for several reasons. First, ours is the first paper we know of to study the impact of randomized economic outcomes on voter turnout. The results shed light on the factors that affect the decision to vote. Second, the results may help explain the behavior of elected school officials. To the extent that lottery losers are more likely to vote against incumbents, school board members may have an incentive to maximize the proportion of families getting their first-choice schools. Third, if these asymmetric voter responses hold in other areas of local public policy, then it may be the

case that politicians do best to minimize losses to responsive groups rather than maximize welfare when allocating scarce public goods.

This paper proceeds in four sections. The first section reviews the relevant literatures on school choice and voter behavior. The second section describes the details of the CMS choice plan and lottery, which is followed by a discussion of the school board election and the voter registration data. The fourth section describes the data and presents the results. The final section concludes.

II. Literature Review

The degree to which school choice plans increase competitive pressure on public schools to increase education quality is ultimately an empirical question. Several papers have examined the degree to which demand-side pressures for school quality may or may not lead to increases academic quality in public schools. Many of these papers examine demand side pressures outside of public school choice. For example, Borland and Howsen (1992), Hoxby (2000) and Hanushek and Rivkin (2003) examine the empirical relationship between measures of interdistrict competition and academic quality in reduced form regression frameworks, while other papers such as Hoxby (1994) and Couch, Shughart and Williams (1993) test reduced-form relationships between the prevalence of private schools and public school academic outcomes. Some studies find evidence consistent with increased public school quality in areas with higher measures of school competition. More recently Hastings, Kane and Staiger (2005) study parental choices under a public school choice plan to estimate a structural model of school demand. They find that heterogeneous preferences for school quality imply that some schools will face demand-side pressure to improve, while others will not. Their results imply that demand-side pressure may lead to vertical separation of education quality provision in public school choice.

Another set of recent papers have used randomized lottery outcomes to examine the marginal impact of school choice – whether students who gain admission to their first-choice schools experience gains in academic outcomes as a result (Hastings, Kane and Staiger (2006a), Cullen, Jacob and Levitt (2003), Mayer, et al. (2002), Krueger and

Zhu (2004) and Rouse (1998)). Overall, these studies of the marginal impacts of school choice find on average no affect of attending a first-choice school on academic outcomes. Hastings, Kane and Staiger (2006b) find evidence of heterogeneous treatment effects, where students who placed a high weight on academics when choosing schools show significant gains on test scores when randomized into their first-choice schools. These heterogeneous treatment effects are driven by heterogeneous preferences, again pointing to demand-side outcomes that may benefit some students but not others in public school choice.

Our approach is similar to the studies above in that we use randomized outcomes generated by a school choice lottery to identify the treatment effect of interest. However, instead of focusing on student outcomes, this paper focuses on the supply side incentives of school boards through the impact of lottery outcomes on voter participation and behavior. There are several components in public school organization that may affect the incentives for public school choice and school quality provision in choice settings, including labor market structure (Hoxby (1994), Hoxby (1996) and Hoxby (2002)) and public governance. These institutions may affect the ability of demand-side market forces, even if present, to produce improved school quality in a public school choice system. Furthermore, the incentives implicit in these institutions may prevent school choice program adoption, or prevent its long-term viability once adopted even if it is more socially efficient or productive. The link between political motivations and school choice has become increasingly important recently with decisions in Florida and Wisconsin concerning their limited school voucher programs, and outcomes in California for school voucher ballot initiatives (Brunner, Sonstelie and Thayer (2001) and Brunner and Sonstelie (2003)).

Therefore, voter behavior and response is an important factor in understanding the incentives for public school choice adoption, the viability of public school choice, and the provision of school quality under public school choice. There is a recent empirical literature examining the factors that determine voter participation in general. In particular, researchers have turned to examining motivations for voting outside of classical instrumental voting decision in large part because the probability that any one voter is pivotal in an election is too small to justify voting with positive voting costs.

These motivations include group-decision rules (Coate and Conlin (2004)), civic duty, and expressive voting (Riker and Ordeshook (1968), Gerber and Green (2000) Green and Gerber (2004)). Much of the evidence has come from randomized field experiments of 'get out the vote' campaigns, which test alternative underlying motivations for voting by randomizing 'get out the vote' campaigns. However, even though canvassing experiments provide credible identification of the non-classical drivers of voter participation, they are not able to provide a link between actual policy outcomes and voter turnout.

This paper uses a unique policy experiment that randomized economic outcomes across potential voters. As far as we know, this is the first analysis of the causal effect of randomly assigned economic outcomes on subsequent voting behavior. This approach allows us not only to better understand the underlying mechanisms that influence voter behavior, but also the potential consequences for the incentives for public school choice adoption, viability, and school choice mechanism design in districts governed by elected officials.

III. The CMS School Choice Plan

A. School Choices

For three decades before the introduction of a school choice plan in the fall of 2002, the Charlotte-Mecklenburg public school district (CMS) bused students to assigned schools to achieve racial integration. In September 2001, the U.S. Fourth Circuit Court of Appeals declared the school district "unitary" and ordered the district to dismantle the race-based student assignment plan by the beginning of the next school year. As a consequence the school district moved to implement a new district-wide public school choice plan to replace the system of bussing for racial integration.

In the spring of 2002, parents were asked to submit their top three choices of school programs for each child. Each student was assigned a "home school" in her neighborhood, typically her closest school, and was guaranteed admission to this school if she was not admitted to any of her top three choices. Students were similarly guaranteed admission to continue in magnet programs in which they were enrolled in

Spring 2002. Admission to non-guaranteed schools was determined by a lottery system described further in the next section. After the first year of the choice plan, parents with children in rising grades, parents entering CMS and any parents who wished to change their child's school were required to submit choice forms in a similar manner. Again admission to oversubscribed schools was assigned by lottery. Students who were in non-rising grades and had already sorted to one of their preferred schools in the first year of school choice did not have to submit a choice form if they wished to stay where they were.

The implementation of the school choice program resulted in a large redistricting of home school assignments. Prior to choice, school assignment zones were drawn to capture non-contiguous black and white neighborhoods to achieve racial balance. With the introduction of the choice plan, families were assigned to a default school in their neighborhood. As a result, approximately 50 percent of parcels lost property rights to the school they were assigned to under the busing plan. Moreover, even when the default school under the choice plan was the same as the school assigned under the busing plan, the composition of students in that school often changed due to changes in assignment boundaries elsewhere. The introduction of the school choice plan was intended to provide more educational options to parents. The initial school choice plan was to stay in effect for 3 years (through 2005-2006 school year), at which time there would be an extensive review of the choice system allowing for public comment and discussion.

We were given secure access to administrative data including the choice response forms for the first two years of school choice. For each school year, the school choice response forms were submitted in the spring of the prior school year. For example, choices for the 2002-2003 school year were submitted in Spring 2002, and choices for the 2003-2004 school year were submitted in Spring 2003. For each of these school lotteries, we have the choice response forms and demographic information including geographic location for approximately 95% of the students who were required to submit choice forms.[1]

[1] The remaining 5% of students did not submit choice forms even though they were required to. CMS officials then assigned them to their guaranteed neighborhood school.

B. Lottery Assignments

In the first school choice lottery, every student was required to submit a choice form to CMS. As described earlier, each student was assigned a new neighborhood school, at which they were given a guaranteed seat. If a student chose this new 'home school' as her first choice, she was guaranteed admission 100%. Many students did not list their home school for any of their three choices.[2] Our analysis will focus on students who did not choose their guaranteed home school, whose admission to their first-choice school was determined by lottery number.

In the second school choice lottery, only students who were in rising grades, new to CMS, or affected by changes in home school boundaries resulting from the opening of new schools were required to submit choice forms. If a non-rising grade student wished to continue at her current school (the school she was admitted to after the first year of school choice assignments), she was not required to submit a choice form. Hence from the second year of lottery assignments, we will again only use those students who chose a non-guaranteed school as their first choice, and hence had an admission status determined by the school choice lottery. Across the two years of lottery choices, slightly over half of the students submitting choice forms chose their guaranteed school, and the remaining students chose a school for which they were not guaranteed admission.

Admission of students to non-home choices was limited by grade-specific capacities set by the district. In the first year of school choice, the district allowed significant increases in enrollment at high-demand schools in an effort to give each child one of her top three choices. As a result, approximately 95% of students in the first year of choice received admission to one of their top three choices. School capacities were not expanded in the second year of school choice (however, parents were not informed of this policy change prior to submitting choices).

Approximately one third of the schools in the district were oversubscribed in the first year, and approximately two thirds of schools were oversubscribed in the second year. The district implemented a lottery system for determining enrollments in those

[2] Please see Hastings, Kane and Staiger (2005) for a detailed description of the choices and how they varied in the student population.

oversubscribed schools. Under the lottery system, students choosing non-home schools were first assigned to priority groups and student admission was then determined by a lottery number. The priority groups for district schools were arranged in the following lexicographic order:

Priority 1: Student who had attended the school in the prior year. (Students were subdivided into 3 priority groups depending upon their grade level, with students in terminal grades—grades 5, 8 and 12—given highest priority.)

Priority 2: Free-lunch eligible student applying to school where less than half the students were free-lunch eligible.

Priority 3: Student applying to a school within her geographic Choice Zone.[3]

Under the lottery system, students listing a given school as their first choice were sorted by priority group and a randomly assigned lottery number.[4] Slots remaining after home school students' first choices were accounted for were assigned in order of priority group and random number.[5] If a school was not filled by those who had listed it as a first choice, the lottery would repeat the process with those listing the school as a second choice, using the same priority groups as above. However, for many oversubscribed schools, the schools were filled up by the time the second choice priority groups came up.[6]

[3] The county was split into four geographic Choice Zones. A student could chose any school in any Choice Zone, however bussing would only be provided by the district to schools within the student's Choice Zone.

[4] The random number was assigned by a computer using an algorithm that we verified with CMS computer programmers. Parents do not know their lottery numbers. They submit their choice forms to CMS, who assigns a random number to each submission and then communicates outcomes to parents once the lottery assignment algorithm is run.

[5] Once any sibling was admitted to a school, other siblings could choose to attend the school. In other words, if two siblings list the same school as their first choice, their lottery number is effectively set to the minimum of their individual lottery numbers. We dropped those who were admitted to a school because of a sibling preference.

[6] For a discussion of potential strategy in school choices and rankings on the part of parents, please see Hastings, Kane and Staiger (2005). In that paper we estimate preferences for school characteristics in a discrete choice demand model using the administrative data and choice forms for the first year of school choice. We test for potential strategic hedging on the quality of school listed given the quality of the guaranteed school and do not find evidence supporting strategic behavior. The lack of strategic behavior may be due to i) the expressed effort by the school district to give every student one of her choices, and ii) the priority group increase in the probability of admission for free- and reduced-lunch recipients trying to apply to schools with wealthier student populations.

Students who were not assigned one of their top choices were placed on a waiting list. About 19% of students winning the lottery to attend their first-choice schools subsequently attended a different school, with 13% choosing to attend their home school instead and another 6% choosing to attend a different school entirely, with most of these students changing address. When slots became available, students were taken off the wait list based on their lottery number alone, without regard for their priority group.

IV. The Election and Voter Registration Data

A. The November 2003 School Board Election

On November 4, 2003, Mecklenburg County voters went to the polls to vote in elections for local officials including the three at-large school board members.[7] The CMS school board is composed of nine members: three at-large members and one member for each of six sub-districts. All board members are elected to four-year terms with at-large members and district members elected in an alternating cycle every two years. The school board decides on goals and policies for CMS including funding initiatives and bond measures, new school sites and funding allocation. The school board also appoints the superintendent to run the daily operation of the school district and to execute board policy.

Of the three at-large board members up for re-election, two did not seek re-election. The one member who did seek re-election was also the sitting chair of the school board. Table I shows the names and occupations, and describes the platforms of the candidates for the three at-large seats, as well as the total votes cast for each candidate. The three candidates with the most votes are elected as at-large members, and typically serve as the school board chair and vice chairs.[8]

Two items in Table I are important to note. First, the sitting chair was not re-elected, losing by a small margin. Second, based on the official platforms of the candidates, changing the school choice system was not one of the foremost campaign issues. Instead, the winning candidates focused on traditional issues such as budget

[7] Other offices up for election included mayor and city council.

[8] (Source: Charlotte Advocates for Education voting guide), the Chair and Vice-Chair serve one-year terms and are not necessarily at-large members.

streamlining and funding increases, improving quality and retention of teachers, and improving student achievement in general.[9] One reason for this may have been that the old regime of busing for integration was outlawed by the courts, and the district had made a three-year commitment to the school choice plan, before conducting a review process and discussing potential changes. In addition, since most residents received their first-choice school in the first year of choice, many constituents may have been satisfied with the choice system, and more concerned with other issues such as funding, growth, and education improvement.

B. Mecklenburg County Voter Registration Data

The November 2003 elections followed directly after the first school year under school choice, and after the first two school choice lotteries and assignments had been made. Figure 1 presents a timeline of events. The Mecklenburg County Board of Elections keeps voter registration data with demographic information and past voting history for up to 20 elections for every registered voter in Mecklenburg County. The data are updated continuously as new voters register, and as current voters change addresses within county. We were able to obtain an older version of the voter registration file that was inadvertently preserved from March 2004. This data set includes the full name, address, ethnicity, gender, party affiliation, date of last address change, and voting history for every registered voter in Mecklenburg County as of March 2004. The addresses from this file were geocoded by the Board of Elections, giving us precise longitude and latitude coordinates for each registered resident. Since most moving occurs during the spring-fall months, the March 2004 geocoded data provide fairly accurate information on voters and their locations in November of 2003 at the time of the election.

Table II describes the demographics of registered voters and those who cast ballots in the November 2003 election. Based on demographic information for the county

[9] The one candidate to mention issues related to the school choice plan was Mr. Mike Kasper who stated one primary objective was to establish 'Neighborhood Schools Zones' that are permanent. This platform was directed at the high-growth and wealthy southern districts within CMS who had experienced several home school boundary changes with the opening of new schools over the past 10 years: both before and after the school choice plan was implemented. Some parents in those communities wanted to have more stability in their designated neighborhood school as new schools were opened. This area is largely affluent and white – the group of citizens who are traditionally most likely to vote.

as a whole, whites are more likely to be registered, and also more likely to have voted given registration in the election of interest. Moreover, registered voters have on average significantly higher incomes than the county-wide population average, where income is measured by the median household income for residents of the voter's own race living in the voter's own block group as reported by the 2000 Decennial Census. Of registered voters, those actually casting ballots in the 2003 election were again wealthier than the average registered voter. In addition, voters registered as Independent or Libertarian (not Republican or Democrat) were less likely to cast ballots in the election than those who were registered as Republican or Democrat.

V. Estimating the Impact of Lottery Outcomes on the Decision to Vote

A. Defining the Randomized Sample of Lottery Participants

We use the school lottery outcomes to create treatment and control groups. We focus on the subset of students choosing schools that were over-subscribed. We then limit our sample to the marginal priority groups within those schools for whom lottery number alone determined enrollment. Recall from Section III.B that admissions to oversubscribed schools were determined by the concatenation of a priority number, which depended on student and school specific factors such as free and reduced lunch status, followed by a randomly generated lottery number. Throughout most of the analysis, we will ignore members of priority groups in which all students were either admitted or denied admission—since the assignment of lottery numbers had no impact on their options. Hence, for all students in the analysis, the randomly generated lottery number solely determined admission to the first-choice school within each school choice and grade combination. In some schools, the marginal priority group will consist of those who attended the school the year before, or free-lunch eligible students, or students from the choice zone. The marginal priority group may also be different for different grade levels in a school.

We began with the choice forms submitted by 105,706 students in the first year, and 33,530 students in the second year. After dropping students who had special

disabilities needs and students who were admitted because of siblings, we were left with a sample 92,789 in the first year and 29,104 in the second year of data. Of these, approximately 60% in the first year and 51% in the second year listed their guaranteed school as their first choice and were therefore not subject to randomization. We then further excluded students within priority groups that were sufficiently high or low so that all members of the priority group were admitted or excluded from admission to their first-choice school and grade combination. This left us with 10,174 students in marginal priority groups: 6,931 students from the first lottery year and 3,243 students from the second, where marginal priority groups are those priority groups for which admission to the first-choice schools was determined solely on the basis of a random number. Following Hastings, Kane and Staiger (2006b), we further exclude inactive students from the randomized group. Inactive students are students who reside in Mecklenburg County, but do not receive schooling through CMS. These include current private school or home school students who participate in the lottery in order to potentially gain admission to a public school they would prefer to their current alternative. There are 352 of these students, leaving us with 9,692 active students in the randomized group.

Table III shows the characteristics of the students in the randomized group versus the characteristics of all students in CMS. Students in the randomized group are slightly more likely to be African American and slightly more likely to be recipients of federal lunch subsidies. In addition, they come from guaranteed school assignment zones with significantly lower than average test score outcomes. However, they chose schools with higher than average standardized test score results. We measure school test scores as the school and program level average of standardized student-level test score results.

In order to verify the validity of the randomization of lottery numbers, we examine the baseline characteristics of lottery winners and losers within the randomized group. Table IV reports these baseline characteristics. The table reports means for each group, as well as regression adjusted differences from an OLS regression including fixed effects for the school program and grade for which the lottery is being conducted. Before adjusting for lottery block fixed effects, there are a few differences in baseline characteristics between lottery winners and losers. However, these differences were largely due to a correlation between the characteristics of lottery participants and the

lottery odds. After including a fixed effect for each school program and grade, all such differences were smaller and were generally not significantly different from zero. The only characteristic for which there remained a statistically significant difference after including the lottery block fixed effects was free- and reduced-lunch recipient status. Since admission priorities depended in part on a student's lunch status, there were very few lotteries that had any variation in this variable, making this estimated difference somewhat suspect.

B. Matching student data to voter registration data

Within the marginal priority groups, we would like to estimate the impact of winning the lottery to attend a first-choice school on the decision to vote. Therefore, we must first match the voter registration data to the lottery outcome data. We have geocoded locations for students and voters, as well as street address and full name for students and street addresses and full names for registered voters from the voter data. We use the student locations provided to us in the Fall 2003 student census taken by the school district to create official enrollment lists for federal and state funding. The census is taken on the 20th day of the school year - approximately at the end of September 2003. This gives us address information as close as possible to the actual election date. We use these geocoded residential locations to create matches between students and registered voters in the voting file.

Student locations were geocoded by the district at the center of the housing parcel, while the voter registration data were geocoded to the middle of the street in front of the residence. Hence the geocodes did not perfectly overlap across the two data files. In order to match voters to students, we created small geographic circles around each student, and pulled off all voters that fell within that geographic radius. Within geographic radius, we then matched voters to students by matching on exact street address and exact last name. This resulted in approximately 90% of our overall matches. We then examined the remaining students, creating matches for those with hyphenated last names and those with slight name misspellings (e.g. McDowell vs. MacDowell), still requiring a match on

geography and street address. Those students with no match are then counted as having no registered voters in their household.

C. Attrition

Since our lottery outcomes are from Spring 2002 and Spring 2003, and our residential location and voter data are from the Fall of 2003, not all students in our randomized group are present and active in CMS in Fall 2003. Table V presents results for attrition across lottery winners and lottery losers from the two randomized groups. On average there is approximately a 14% attrition rate out of the randomized group of students. Across the two lottery years, there was a negative and significant differential attrition implying that lottery losers were more likely to attrit than lottery winners. This differential attrition was quite small in magnitude and insignificant in either lottery year individually, but was significant in the pooled randomized sample. Recall that any student in the randomized group and not present in the Fall 2003 census will not be counted as being in the potential voting population or as a registered voter, since if we do not have an address for her in the Fall 2003 census we cannot match her by address to the voter registration data. Hence, differential attrition would act, if anything, to understate a positive asymmetric effect of losing the lottery on voter turnout.

D. Regression Results

Table VI reports the estimates of the effects of *losing* the lottery on voter turnout, based on a conditional logit estimation (Chamberlain (1980)) of the effects of losing the school choice lottery on the probability of voting, conditional on baseline demographic characteristics and choice-grade (lottery block) fixed effects. We also allow for clustered standard errors at the choice-grade level. The dependent variable – the probability of voting – is an indicator variable if any person in the student's household voted. An alternative specification using the total number of people in the student's household who voted in an OLS regression analysis yielded very similar results, and is presented in Appendix Table AI. There were a total of 8,065 students with addresses in the Fall 2003

census who were in the randomized group. For some of the smaller lottery blocks, there is no variation in the dependent variable across students. These observations are dropped from the conditional logit estimation since they add no information to the likelihood function. This reduces the number of observations in the final analysis to 7,365.

The results presented in Column 1 of Table VI show that overall, there was no significant differential impact of losing versus winning the lottery on voter turnout. However, Column 2 shows that among white students, those whose families are most likely to vote in any election, there is a strong and significant differential impact of losing the lottery on voter turnout. In particular, among white voters, losing versus winning the lottery increases the odds of voting by approximately 38.7% (exponentiating the logit coefficient). This is a very strong, but not unreasonably strong impact on voter turnout. For example, the estimated impact is approximately as large as the effect of door-to-door canvassing identified in Green and Gerber (2004). In contrast, there is no significant effect of lottery outcomes on voting in the non-white population. Baseline characteristics are included to improve precision of the estimates, but do not affect the point estimates of the impact of randomly assigned lottery outcomes on voter turnout. The baseline coefficients validate correlations in the overall voting population: voter turnout is significantly higher among whites, higher-income populations, and among citizens who voted in the prior school board election (November 2001). To further validate the random assignment of lottery outcomes across potential voters, Table VII presents the results from the regression in Table VI using voter turnout in the *2001* election as the dependent variable instead of voter turnout in the 2003 election. The 2001 election was also a school board election, and occurred before the implementation of the school choice plan. These regression results verify the validity of the randomization, since lottery outcomes do not cause voter turnout in the baseline school board election.

Since race, income and voting history are correlated, we present interactions with losing the lottery and each of these baseline characteristics in Table VIII. Column 1 shows that the asymmetric effect of losing the lottery on voter turnout is increasing in income, and that the interaction with race becomes insignificant once this interaction is included. Throughout our analysis, income is measured as the median income for households in student *i*'s block group of student *i*'s race demeaned by the county-wide

median income of $51,000 and divided by 1,000. Hence a value of 'Median Income' equal to zero implies a median income of $51,000, and a value of 50 implies a median income of $101,000. Column 2 further adds an interaction between past voting history and lottery outcomes. The coefficient on the interaction between voting history and losing the lottery is very large and significant indicating that, among probable voters, losing the lottery increased the odds of voting by 41% relative to winning the lottery. The coefficient on income interacted with lottery outcomes remains unchanged. Hence, the asymmetric effect of losing the lottery on voter turnout is more likely a function of income and past voting history than it is of race.

E. Further Analysis

These results show that losing the lottery motivates voting more than winning the lottery does. One explanation is that people get angry or disappointed and this motivates them to vote. This is consistent with 'expressive' voting -- people derive a utility from voting (for example, see Brennan and Lomasky (1993)). This might then imply that the increase in voter turnout would lead to votes solely against the incumbent. Alternatively, the increase in turnout among lottery losers could be the result of the fact that lottery losers have more at stake in improving education at their schooling outcome than lottery winners, since they were assigned to a non-preferred school. Hence, it could be the case that lottery losers faced a greater instrumental benefit from voting, and hence are more motivated to vote than lottery winners. In this case it is not clear that lottery losers would be more or less likely to vote against the incumbent. Although this argument still suffers from the problem that the probability that any one voter is pivotal is *a priori* extremely small given the size of the voting population, we test for this explanation of the results in Table IX.

Table IX presents the effect of losing the lottery on voter turnout as a function of the difference in the quality of the child's first-choice school and the child's neighborhood school, where quality is measured by the average standardized test score for students in the school. Because the lottery was run as a first-choice maximizer, the majority of students who did not win admission to their first-choice school were admitted

to their neighborhood school. If lottery losers, being randomized into their less-desired and on average lower-scoring neighborhood school, realized that they had more at stake than lottery winners who were randomized into better schools and more-desired schools, then we might expect them to be more likely to vote than lottery winners conditional on school choice and grade fixed effects. Furthermore, we would expect this effect to be stronger the larger the standardized test score difference between the first-choice school and the neighborhood school, conditional on choice-grade fixed effects. Column 1 of Table IX shows an insignificant coefficient on the interaction between losing the lottery and score gap between the first-choice and home school. Hence the regression analysis does not lend support for the hypothesis that the asymmetric effect of losing the lottery is generated by a desire to influence future school quality improvement.

Column 2 of Table IX creates a second measure of score gains and losses to further test if those who experienced losses in academics were more likely to vote. In this column we create the difference in test scores between the first-choice school and the child's prior-year school. We break the effects of the lottery outcomes into the difference between the first-choice school score and the last year's school score (the academic gain) if the family received admission to their first-choice school, and the difference between the home school score and the last-year's school score in the event that the family lost the lottery (the academic loss). This alternative measure of the relative importance of improving education for lottery losers and lottery winners does not yield significant results either.

F. Quantifying the Effect of Losing the School Choice Lottery

Tables VIII and IX imply that expressive voting model may better explain the observed empirical result that losing the school choice lottery caused a substantial increase in the probability of voting in the school board election. Table X presents estimates from a simplified specification that can be used to quantify the impact of lottery outcomes on voting behavior. The coefficients on losing the lottery and its interactions with income and past voting history are jointly significant with a p-value of 0.009. Together, they imply that for likely voters with an income level equal to the median in

the county, losing the lottery increased the odds of voting by 34%. For a family who voted in the 2001 election and has an income value of $75,000, losing the lottery increased the propensity to vote by 58%. In particular, an increase in measured household income of about $50,000 increases the asymmetric effect of losing the lottery on voter turnout as much as past voter participation does. Note that, because income enters linearly relative to the median, the coefficients imply that a person who did not participate in the prior election and with an income below the 1st percentile in our sample (12,000) would have a decrease in the probability of voting in response to losing the lottery that would be significant at the six percent level. However, this is an artifact of the linearity of the model. If we introduce a spline in the interaction effect of income and losing the lottery at the 25th percentile of income (32,000), we find a flat and insignificant interaction effect for low income households and a slightly steeper effect (0.008) for households with neighborhood income above the 25th percentile.

Using individual level voter turnout data and individual level administrative data allows us to credibly identify the differential effect of losing the school choice lottery on the decision to vote. The results suggest that the asymmetric effect of losing the lottery on voter turnout is consistent with expressive voting – where disappointment or anger from losing the lottery motivates voters more than winning the lottery does. If this is the case, we might expect the increase in voter turnout from losing the lottery to turn out against the incumbent school board chair. We do know from the overall voting results that she lost her bid for re-election. Unfortunately, with individual level data, we cannot say anything about *how* people voted, only whether or not they voted. Nevertheless, we can use our identified effect of losing the lottery to test if precinct-level election results are consistent with an increase in the number of votes against the incumbent as a result of losing the school choice lottery.

Our approach is as follows. Mecklenburg County had 190 precincts at the time of the 2003 election. Using GIS software, we determine the precinct that each student lives in and link each student with registered parents to their voter records. Using the school assignment outcomes, we categorize students as losing the lottery if they did not gain admission to their first-choice school. We then predict the increased probability that someone from each household who lost the lottery voted against the incumbent given

their demographic information and the coefficients presented in Table X. We then aggregate the predicted increase in votes against the incumbent up to the precinct level, and see if it is a significant determinant of the actual election outcome, controlling for other baseline covariates. The results from this regression are presented in Table XI. While this approach does not carry the force of randomized assignment, it is helpful to see if election results by precinct are consistent with our identified effect of losing the lottery on voter turnout.

Table XI Column 1 shows that the predicted increase in turnout from lottery losers is a significant determinant of the number of votes against the incumbent school board chair. We control for precinct level voter turnout in the prior school board election (2001) as well as demographic characteristics of families in the district. All of the coefficients have the expected signs and magnitudes. The number of voters in the prior election is positive and significant with a coefficient of 0.556. Given past election turnout levels and the total number of families in each precinct, the number of African American families in a precinct is strongly negatively correlated with votes against the incumbent (the incumbent was African American and a democrat). We also include the precinct number of votes for the incumbent school board chair in her prior election bid (1999).[10] As expected, this affects the number of votes against her in a negative and significant way. The coefficient on the predicted increase in turnout from lottery losers is positive and significant, implying that the number of lottery losers in a precinct is positively and significantly correlated with the number of votes against the incumbent school board chair. The point estimate is larger than one, however the standard errors are large implying that one is contained within the 95% confidence interval. Recall that the results in Table XI give the increase in odds that *at least one person* from student *i*'s household votes as a result of losing the lottery. It also does not include the increases in votes against the incumbent chair that are generated by citizens who would have voted for her, but now vote against her. Thus we may expect this coefficient to be greater than 1 if losing the lottery caused multiple votes against the incumbent, either through the effect on multiple adults within the household, potential neighborhood effects, or through the

[10] There were four new precincts added between 1999 and 2003 in the outskirts of the county where the highest growth has occurred during that time period. This gives us 186 as the total number of precincts for our regression.

effect on voters who would have voted for the incumbent and now decide to vote against her. If we take this point estimate and multiply it by the sum of the increased probability of voting from lottery losers, it implies an increase of 2,091 votes cast against the incumbent school board chair. She lost the election by a margin of 402 votes (Table I).

Column 2 presents results for the same regression with votes against the incumbent Mayor of Charlotte, Mayor McCrory, as the dependent variable. Because only precincts in Charlotte proper could vote in this election, the total number of precincts falls to 158. We find no significant effect on the number of votes cast against the mayor votes for the incumbent as the dependent variable. Column 3 presents results from the same regression model as Column1, except the number of votes *for* the incumbent school board chair instead is the dependent variable in this regression. In particular, these show that the incumbent had higher support in both African American neighborhoods and in precincts that voted for her in the 1999 election. The results also show that the predicted increase in turnout from lottery losers is not a significant determinant of votes for the incumbent school board chair. Taken together, these results provide suggestive evidence that lottery losers were more likely to vote in the election than lottery winners, and when they did vote, they turned out against the incumbent school board chair.

VI. Conclusion

This paper provides empirical evidence on the factors that influence the decision to vote by using a unique policy experiment that randomized economic outcomes across potential voters. The results indicate that randomly losing a school choice lottery significantly increased the probability of voting in the ensuing school board election relative to winning the lottery. The asymmetric effect of losing the lottery is increasing in past election participation as well as in neighborhood income levels. The effect is large in magnitude: losing the lottery increases the odds of voting by over 30% among past voters, with the effect increasing further with income. Further empirical evidence indicates that this result is most consistent with a model of ‘expressive’ voting where individuals have a stronger desire to express themselves through voting when they experience a negative policy outcome such as losing the school lottery.

The significant impact of losing the lottery among likely voters is consistent with results from door-to-door canvassing experiments (Green and Gerber (2004)), which find that canvassing and get-out-the vote efforts have greater effects on regular voters than on infrequent voters particularly in low turnout elections such as municipal elections. However, this paper adds further evidence on the motivation to vote by examining the impact of actual economic outcomes exploiting randomization generated by policy makers. We are further able to distinguish the differential impact of losing versus winning the school choice lottery, and establish that the negative outcome of losing the lottery provides stronger motivation for voter turnout.

This result has important implications for the political economy of public schooling and the provision of public goods more broadly. The results imply that personal disappointment or negative outcomes provide a strong motivation to vote. This suggests that the optimal political strategy for those seeking re-election may be to minimize losses, particularly to higher income voters and those with regular voting records. The results also bring into question predictions of public good provision based on a median voter model, or any rational choice model of voter behavior. Concepts of efficient sorting, equilibrium quality provision, optimal allocation and mechanism design in a public school choice program need to consider the political viability of public school programs designed to increase competition and school quality under public school choice. If affluent citizens are the most motivated to vote and are significantly more likely to vote in response to negative personal outcomes resulting from policy, school district policies that seek to increase school quality provision or choice options to less advantaged communities at a cost to a minority of affluent constituents may not be politically feasible.

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Figure I: Timeline of Events

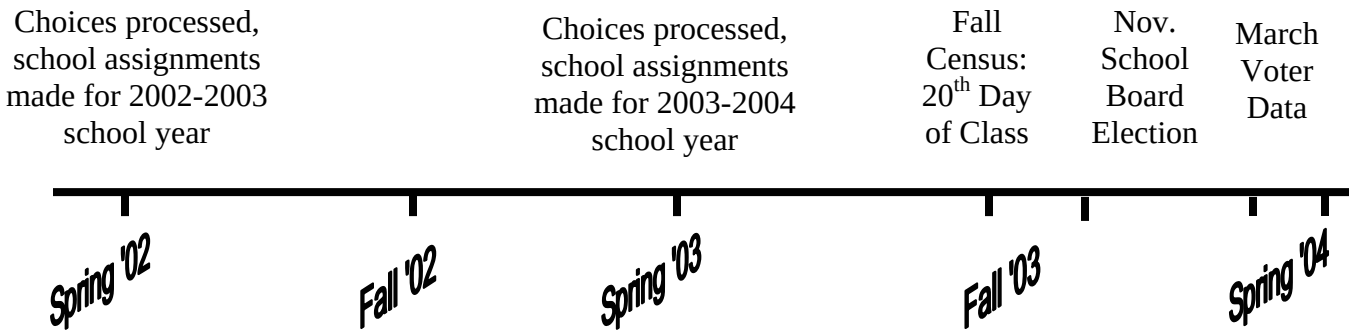

Table I: November 4, 2003 School Board Election: At-large Candidates

Candidate Name	Occupation	Important Issues	Votes Received
Kaye McGarry	Business Owner/ Author/ Speaker	Reprioritize budget so that more is spent on teachers and less on bureaucracy, increase qualified teacher retention	37,164
Joe (Coach) White	Retired Football Coach	Increase funding, increase community involvement and improve relationship with School Board	31,360
Kit Cramer	Group Vice President for Education, Charlotte Chamber	Student achievement, reduced teacher turnover	31,004
Wilhelmenia Rembert***	University Administrator and Tenured Professor, Current School Board Chair	Enhance teacher quality and compensation, improve student achievement for all groups of students	30,602
Mike Kasper	Controller	Simplified and transparent budget, establishment of 'Neighborhood Schools Zones' that are permanent	24,863
George Dunlap	Police Officer	Student achievement, fiscal responsibility	22,651
Larry Bumgarner	Information Not Available	Information Not Available	14,886
Rachel B. Hall	Information Not Available	Information Not Available	9,529
Queen Norwood Thompson	Social worker/ Drop-out counselor	Accountability system that assesses quality of education for each child not just based on test scores, empower inner-city schools through specialized programs	5,868
Fred Marsh	Retired Small Businessman	Higher test scores, lower drop out rates	5,054
Nick Holley	Campaign Manager for Kim Holley for US Congress	Reducing mobile classroom units, increasing CMS student achievement standards	4,544

Notes: Top three candidates won the election. ***Wilhelmenia Rembert was incumbent chair who lost the election by 402 votes.
Data Sources: Election totals are from Mecklenburg County Board of Elections. Candidate information taken from the candidates' written information about themselves and their positions as printed in the Charlotte Advocates for Education voting guide for the November 4, 2003 election.

Table II: Summary Statistics from Voting Data

	Mecklenburg County	Registered Voters	Voters in 2003 Election
Demographics			
Percent White	58.04%	71.12%	73.65%
Percent Female	51.14%	54.94%	55.32%
Own block-group and race median income in 2000 Census	$50,579	$61,294	$66,261
Party Affiliation			
Percent Democrat	---	42.69%	45.80%
Percent Republican	---	35.59%	39.52%
Total N	736,815	427,133	97,258

Notes: Data from Mecklenburg County Board of Elections March 2004 Voter file and North Carolina State Board of Elections, and the US Bureau of the Census, 2000 Decennial Census, State and County Quick Facts and 2003 American Community Survey

Table III: Student Characteristics

	All Students	Randomized
Student demographics		
Black	41.2%	53.7%
Female	49.6%	51.1%
Free or reduced lunch	33.1%	37.4%
Own block-group and race median income in 2000 Census	$55,670	$53,012
Choice school characteristics		
Average combined scores	0.051	0.083
Percent free or reduced lunch	36.3%	36.1%
Home school characteristics		
Average combined scores	-0.074	-0.205
Percent free or reduced lunch	41.0%	47.0%
Number of students	92,789	9,692

Notes: Data from Charlotte-Mecklenberg Schools. Statistics on All Students taken from the 2002-2003 school year. Randomized group included students in 2002-2003 and 2003-2004 school lotteries for who lottery number alone determined assignment.

Table IV: Characteristics of the Randomized Group

Variable	Won Lottery	Lost Lottery	Regression Adjusted Difference
Student demographics			
White	0.344	0.367	0.009
			(0.008)
Female	0.509	0.512	0.001
			(0.013)
Free or reduced lunch	0.340	0.399	-0.033*
			(0.015)
Own block-group and race median income 2000 Census	$52,383	$53,480	469.98
			(514.66)
Home school characteristics			
Average combined score	-0.214	-0.198	0.010
			(0.008)
Percent free or reduced lunch	0.481	0.462	-0.010
			(0.006)
Percent black	0.599	0.585	-0.013
			(0.007)
N	4129	5563	9,692

Notes: Adjusted difference reports the coefficient on whether the student was assigned to her first-choice school from separate regressions with each variable in the first column as the dependent variable, controlling for lottery fixed effects. Standard errors adjust for clustering at the level of the first-choice school and grade. Asterisks indicate significance (*=.05, **=.01, ***=.001).

Table V: The Impact of Random Assignment to 1st Choice School on Attrition

Variable	Mean	Regression Adjusted Difference: Lottery Winners vs. Lottery Losers
Both Randomized Groups: Not Present in Fall 2003 Student Census	0.142	-0.024** (0.009) N=9408
2002-2003 Lottery Randomized Group: Not Present in Fall 2003 Student Census	0.159	-0.020 (0.011) N=6541
2003-2004 Lottery Randomized Group: Not Present in Fall 2003 Student Census	0.105	-0.028 (0.015) N=2957

Notes: Each entry in the table is from a separate regression of an indicator of attrition on whether the student was assigned to her first-choice school, controlling for lottery fixed effects and the following baseline covariates: black, female, free/reduced lunch, median income. Twelfth grade students in the randomized group for the 2002-2003 school year are not included in the attrition regression, since graduation implies they would not be in the Fall 2003 student census. Standard errors adjust for clustering at the level of the first-choice school and grade. Asterisks indicate significance (*=.05, **=.01, ***=.001).

Table VI: The Impact of Winning or Losing the Lottery on Voting in *2003* Election

Dependent Variable: Indicator if at least one member of student's household voted in *2003* election	(1) All Students	(2) White	(3) Non-White
Randomized Outcome:			
Lost Lottery	0.131	0.327*	-0.036
	(0.095)	(0.139)	(0.135)
Student Baseline Characteristics:			
White	0.239*	--	--
	(0.096)	--	--
Female	-0.016	0.010	0.002
	(0.082)	(0.120)	(0.008)
Free or Reduced Lunch	-1.016***	-11.975***	-0.070***
	(0.260)	(0.758)	(0.015)
Median Income (demeaned)	0.007***	0.011***	0.0005
	(0.002)	(0.003)	(0.0003)
Household Voted in 2001	3.086***	2.624***	3.471***
	(0.087)	(0.112)	(0.126)
Total observations	7365	2438	4602
Log Pseudolikelihood	-2114.496	-930.437	-1004.351

Notes: Conditional (fixed-effects) logit estimation with lottery-block fixed effects; standard errors adjust for clustering at the lottery-block level. Asterisks indicate significance (*=.05, **=.01, ***=.001).

Table VII: Testing the Validity of Random Assignment by Examining the Impact of Winning or Losing the Lottery on Voting on *2001* Election

Dependent Variable: Indicator if at least one member of student's household voted in *2001* election	(1) All Students	(2) White	(3) Non-White
Randomized Outcome:			
Lost Lottery	-0.034	-0.006	-0.030
	(0.076)	(0.118)	(0.097)
Student Baseline Characteristics:			
White	0.498***		
	(0.074)		
Female	-0.056	-0.142	-0.001
	(0.060)	(0.090)	(0.075)
Free or Reduced Lunch	-0.868***	-13.242***	-0.898***
	(0.170)	(0.837)	(0.187)
Median Income (demeaned)	0.004***	0.006***	0.002
	(0.001)	(0.002)	(0.002)
Total observations	7532	2486	4700
Log Pseudolikelihood	-3133.550	-1322.192	-1610.218

Notes: Conditional (fixed-effects) logit estimation with lottery-block fixed effects; standard errors adjust for clustering at the lottery-block level. Asterisks indicate significance (*=.05, **=.01, ***=.001).

Table VIII: The Impact of Losing the Lottery on Voting: Interactions of Lottery Outcomes with Race, Income and Prior Voting History

Dependent Variable: Indicator if at least one member of student's household voted in *2003* election	(1)	(2)
Randomized Outcome:		
Lost Lottery	0.120	-0.0183
	(0.126)	(0.138)
Lost Lottery*White	-0.022	-0.045
	(0.172)	(0.168)
Lost Lottery*Median Income	0.010*	0.010*
	(0.004)	(0.004)
Lost Lottery*Median Income Squared	-0.00007	-0.00006
	(0.00006)	(0.00006)
Lost Lottery*Voted in 2001	--	0.347*
	--	(0.164)
Total observations	7365	7365
Log Pseudolikelihood	-2111.204	-2108.712

Notes: Conditional (fixed-effects) logit estimation with lottery-block fixed effects; standard errors adjust for clustering at the lottery-block level. Asterisks indicate significance (*=.05, **=.01, ***=.001). Regressions include baseline controls: race, gender, median income, median income squared, voting history, free and reduced lunch status.

Table IX: The Impact of Losing the Lottery on Voting: Interactions of Lottery Outcomes with School Level Academics

Dependent Variable: Indicator if at least one member of student's household voted in *2003* election	(1)	(2)
Randomized Outcome:		
Lost Lottery	0.154	0.140
	(0.110)	(0.108)
Lost Lottery*(Score 1st choice – Score Home School)	-0.003	--
	(0.006)	--
Won Lottery*(Score 1st choice – Score Last Year's School)	--	0.034
	--	(0.184)
Lost Lottery*(Score Home School – Score Last Year's School)	--	0.131
	--	(0.262)
Total observations	7365	7365
Log Pseudolikelihood	-2113.944	-2113.761

Notes: Note: Conditional (fixed-effects) logit estimation with lottery-block fixed effects; standard errors adjust for clustering at the lottery-block level. Asterisks indicate significance (*=.05, **=.01, ***=.001). Regressions include baseline controls: race, gender, median income, median income squared, voting history, free and reduced lunch status, and all variables that are interacted with winning or losing the school choice lottery.

Table X: The Differential Impact of Losing the Lottery on Voting

Dependent Variable: Indicator if at least one member of student's household voted in *2003* election		
Randomized Outcome:		
Lost Lottery	-0.064	
	(0.113)	
Lost Lottery*Median Income	0.007*	
	(0.003)	
Lost Lottery*Voted in 2001	0.355*	
	(0.163)	
Joint Significance: P-value	0.009	
Total observations		7365
Log Pseudolikelihood		-2109.174

Notes: Conditional (fixed-effects) logit estimation with lottery-block fixed effects; standard errors adjust for clustering at the lottery-block level. Asterisks indicate significance (*=.05, **=.01, ***=.001). Regressions include baseline controls: race, gender, median income, median income squared, voting history, free and reduced lunch status.

Table XI: Relationship Between Precinct Level Election Results and Predicted Turnout Against the Incumbent from Lottery Losses

	Dependent Variable		
	(1)	**(2)**	**(3)**
	Precinct Number of Votes Against Incumbent	**Precinct Number of Votes Against Mayor**	**Precinct Number of Votes For Incumbent**
Constant	45.496*	-9.887	-24.4248**
	(19.550)	(12.581)	(9.398)
Precinct Voter turnout in 2001	0.5564***	0.6065***	0.0752***
	(0.039)	(0.041)	(0.019)
Precinct Number of Public School Parents who Voted 2001	-0.2194*	0.0493	0.0370
	(0.109)	(0.0815)	(0.052)
Percent voted for Incumbent in prior election (mayor for column 2)	-0.3381***	-0.4099***	0.4987***
	(0.634)	(0.042)	(0.030)
Precinct Number African American	-0.3279***	0.0188	0.0742*
	(0.0607)	(0.651)	(0.0292)
Precinct Number of Public School Students	0.2029***	-0.0105	-0.0114
	(0.042)	(0.0267)	(0.020)
Precinct Average Median Income	0.2236	-1.2230***	0.3572
	(0.512)	(0.3270)	(0.246)
Precinct Average Median Income Squared	0.0253*	-0.0060	-0.0157**
	(0.012)	(0.008)	(0.006)
Precinct Average Median Income Cubed	-0.0002	0.0001	0.0001*
	(0.0001)	(0.00006)	(0.00005)
Precinct Predicted Increased Turnout from Lottery Losses	15.9089*	6.9691	3.6264
	(7.959)	(6.615)	(3.826)
Adj. R-Squared	0.8414	0.8362	0.8745
N	186	158	186

Note: Asterisks indicate significance (*=.05, **=.01, ***=.001).

APPENDIX TABLE:

Table AI: Impact of Losing the Lottery on Total Number of Voters in Student's Household

Dependent Variable: Number of members of student's household who voted in *2003* election	(1) All Students	(2) White	(3) Non-White
Randomized Outcome:			
Lost Lottery	0.021	0.093**	-0.011
	(0.014)	(0.032)	(0.014)
Student Baseline Characteristics:			
White	0.061***	--	--
	(0.016)	--	--
Female	-0.005	-0.008	0.0004
	(0.012)	(0.029)	(0.011)
Free or Reduced Lunch	-0.082***	-0.124***	-0.090***
	(0.019)	(0.019)	(0.019)
Median Income (demeaned)	0.001**	0.003**	0.0004
	(0.0004)	(0.001)	(0.0003)
Household Voted in 2001	0.873***	0.893***	0.847***
	(0.022)	(0.033)	(0.032)
Total observations	8085	2677	5398
Adjusted R-Squared	0.412	0.351	0.406

Notes: Regression estimation with lottery-block fixed effects; standard errors adjust for clustering at the lottery-block level. Asterisks indicate significance (*=.05, **=.01, ***=.001).