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Economic Outcomes and the Decision to Vote: The Effect of Randomized School Admissions on Voter Participation

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ABSTRACT

We provide empirical evidence on the determinants of voter turnout using the random assignment of economic outcomes to potential voters generated by a school choice lottery. This is the first paper to use random assignment of real outcomes resulting from a policy experiment to understand the factors that influence voter turnout. We show that school lottery losers are significantly more likely to vote in the ensuing school board election than lottery winners. The asymmetric effect increases with income and past election participation. The results support a model of 'expressive' voting where negative economic outcomes increase the probability of voting. Such results may account for loss minimizing behavior by public officials, particularly for voters in middle and higher income neighborhoods.

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I. Introduction

What motivates citizens to vote? Understanding the factors that influence voting behavior is a central issue in political economy and public finance. Presumably, politicians and elected officials choose platforms and campaign tactics to maximize their probability of winning elections. Consequently, the way in which economic outcomes influence voter turnout and voting behavior has important implications for understanding electoral politics and equilibrium welfare in a democratic system. As a result, there is a large theoretical and empirical literature focusing on the determinants of the decision to vote.

The decision to vote is somewhat problematic for the rational-choice framework since the probability that any one voter will affect an election outcome is miniscule. It is difficult to generate voter turnout from a personal cost-benefit analysis of expected economic gains from causing the election of the preferred candidate versus the personal cost of voting (Downs (1957), Olson (1965), Palfrey and Rosenthal (1985), Feddersen (2004)). Despite this difficulty, many analysts continue to model voting behavior as a function of expected utility from future economic policy (e.g. the median voter model) since this framework provides a tractable tool for measuring and evaluating welfare in a democratic system (Nechyba (1999), (Epple, Filimon, and Romer (1984, 1993), Epple and Romer (1991), and Fernandez and Rogerson (1998)).

The 'paradox of not voting' has led many researchers to explore motivations for voting outside of the rational-choice framework. In particular, 'expressive' models of voting and 'group-based' models of voting have emerged. offering alternative explanations of voting behavior. Expressive voting implies that individuals vote not because they expect to change the election outcome, but because they derive utility from expressing their opinions through voting. In group-based voting models, voters identify themselves with groups and vote to maximize the probability that the group's preferred candidate or policy wins. Hence they vote to maximize the social welfare of their group ('sociotropic' motivation), as opposed to their personal welfare ('egotropic' motivation).[1]

[1] Feddersen (2004) provides and excellent summary of current research in voter turnout and voting behavior.

Empirical tests of voter turnout theories have followed two main approaches. First, there is a significant literature using non-experimental analyses of observational data to study the relationship between economic outcomes and voting behavior (e.g. Kramer (1971), Bloom and Price (1975), Kinder and Kiewiet (1979)). These research papers provide an empirical link between economic outcomes and voting behavior; however such papers are plagued by problems of potential endogeneity and omitted variables bias, making suspect any causal interpretation of the results. A more recent line of research has focused on identification by using field experiments to test motives for voting. For example, Gerber and Green (2000) randomized get-out-the vote efforts such as door-to-door canvassing, randomly encouraging people to vote by appealing to senses of civic duty or community responsibility. They find convincing evidence that canvassing efforts significantly increase voter turnout. However, even though canvassing experiments provide credible identification, they are not able to provide a link between policy outcomes and voter turnout.

In this paper, we present new evidence on voter turnout using 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. We use administrative data on the outcomes of a school choice lottery in Mecklenburg County, North Carolina. We match information on the outcomes of the school lottery 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 then test if losing or winning the lottery to attend one's first choice school affected the decision to vote.

In 2002, the Charlotte-Mecklenburg school district (CMS) in North Carolina implemented a district-wide school choice plan after the 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. The school district provided us with data on each student's choices, lottery numbers, and assignments, along with data on demographics for the years surrounding the implementation of the school choice plan.

We then matched the individual lottery outcomes to voting and registration records in Mecklenburg County for the school board election that followed the first year of school choice. With the school lottery and matched voter registration data in hand, we test if losing versus winning the lottery affects the probability of voting, conditional on baseline voting behavior, demographic characteristics and school-grade choice fixed effects. Since lottery outcomes were randomly assigned, they are orthogonal to other factors that may influence voting behavior, such as whether or not a person thinks smaller class sizes would better benefit community-wide education. Furthermore, the lottery allows for a valid statistical comparison between the voting behavior of those experiencing negative and positive economic outcomes without the potential for confounding differential changes in other factors that influence voting, such as the changes in the quality of candidates across elections in time series analysis of voting behavior on (Kramer (1971), Bloom and Price (1975)).

We show that lottery losers are significantly more likely to have voted 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 42% among past voters with median household income. We present evidence that this result is 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 result has important implications for the equilibrium provision of public school quality and the political viability of broad public school choice programs. It implies, for example, that efficiency or distribution results of public education provision generated by a median voter model may not hold in reality. According to our results, expressive voting resulting from a negative outcome may constitute a significant component of the decision to vote. We discuss these implications further in the conclusion.

This paper proceeds in four sections. The first section reviews the relevant literature on voter turnout. 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 fifth section contains a discussion of conclusions.

II. Literature Review

In much of the literature on voter turnout, the decision to vote is presumed to be the result of a personal cost-benefit analysis. The calculus of voting model (Downs (1957), Riker and Ordeshook (1968)) describes the decision to vote being made if the benefits of voting outweigh the costs. The benefits of voting are comprised of the probability that the vote will affect the election outcome, times the benefit the voter derives if her candidate is elected, plus an additive term that captures the benefit from voting that is separate from the expected utility gained from changing the election outcome. This model is typically represented as $pB + D > C$, where p is the probability the voter will swing election, B is the utility gain to the voter from having her preferred candidate elected with her preferred policies implemented, D is the utility derived from voting outside of the election result, and C is the personal cost in time and otherwise of going to the voting booth and casting a ballot. pB is often referred to as the 'instrumental' benefit from voting, while D is referred to as the 'expressive' benefit from voting.

Much of the literature has focused on the 'instrumental voting' term. Instrumental voting describes an expected utility motivation from voting that is driven by a utility gain from having the preferred policy enacted (or candidate elected). The instrumental motivation for voting underlies important models of public good provision, such as the median voter model, as well as models of the policy position locations of candidates in two-party elections. If people vote based on expected utility gains from policy outcomes, then candidates will position themselves at the preference of the median voter, and economists can generate concepts of efficiency and welfare under majority rule voting. However, 'instrumental' voting has difficulty explaining why rational agents vote, since the probability of any one vote being a pivotal vote is near zero even in relatively small sized elections (Palfrey and Rosenthal (1985), Coate, Conlin and Moro (2004), Feddersen (2004)). In most elections, the probability of swinging the election is so small that the fraction of the population that should vote under this model is only the fraction for whom $D > C$.

For this reason researchers have turned their focus to understanding D. There are several non-instrumental motivations for voting, including a utility of voting driven by group-identity or group-rule utilitarianism, whereby elections act to divide citizens into groups who vote following a group rule that maximizes the total benefit (net voting costs) to their group of having their candidate elected (Morton (1987, 1991) and Feddersen and Sandroni (2002)). In this case the utility derived from voting can be thought of as a collectivist utility: the benefit one derives from having one's group win and reaping the aggregated group benefits that result. Group-based models of voting find support from empirical evidence that voters vote based on how they expect society to benefit, rather than how they expect to personally benefit ('sociotropic' vs. 'egotropic') as presented in regression analysis using voter survey data (Kinder and Kiewiet, 1979). However, as Kramer (1983) points out, as long as personal and social economic outcomes or perceptions are correlated, it is not possible to disentangle sociotropic versus egotropic voting from survey responses.

Coate and Conlin (2004) estimate a structural model of group-rule utilitarian behavior using voter turnout data from Texas Liquor referenda. They find support for the group-rule utilitarian model over an alternative 'intensity model', given the structural assumptions on the distribution of cost and benefit parameters in both models. The 'intensity model' is one where voters vote if an 'intensity' parameter times their benefit from the election is greater than the cost: $aB > C$, where a is constrained to be the same for all voters in all groups - supporters or opposers. A strong benefit of this structural approach is that it uses real variation in actual election outcomes and citizen population across elections to estimate models of voting. The assumptions on the distributions of parameters of interest, however, play an important role in testing between models using non-random variation in population characteristics, election timing, election characteristics, and election outcomes.

Consequently, a second line of research has focused on field experiments to investigate reasons for voter turnout. Green and Gerber (2000) use field experiments with random assignment of door-to-door get-out-the-vote canvassing to examine what motivates voting. They find that door-to-door canvassing has a significant impact on voter turnout, and is much more effective than alternative get-out-the-vote methods such

as phone calls. In addition, the authors vary the canvassing treatment to test different voting motivations, randomly appealing to i) a sense of civic duty, ii) an importance for welfare of local community (community solidarity), and iii) a statement of a 'close election' aimed at affecting the subject's perception of the probability of swinging the election. They find the strength of estimated impact on voter turnout was 9.1%, 5.1%, and 12.1% respectively, lending suggestive evidence that an increased chance of being pivotal has the strongest impact on voting behavior, and that of the non-instrumental motivations, the appeal to civic duty was slightly more effective. While random assignment ensures a causal interpretation of the regression results, canvassing experiments cannot help understand how actual economic outcomes affect voting behavior.

CMS school choice lottery provides us with a field experiment of randomly assigned personal economic outcomes that we can use to examine motivations for voting. Since the outcomes are randomly assigned, they are orthogonal to other issues that may influence voting such as civic duty and probability of swinging the election. We will present evidence that people are significantly more likely to vote if they lost the lottery, and that this effect is particularly strong among those who participated in the prior election and those living in more affluent communities. We provide further evidence indicating that this result is most likely driven by an 'expressive' decision to vote, where a negative policy outcome results in stronger expressive motivation. The fact that the policy experiment, randomization, and voting outcomes occur in the context of public school policy, these results have important implications for economic models of public school provision and public school choice in political economy and public finance.

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. In each year following the first year of school choice, 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 discontinuous black and white neighborhoods to achieve racial balance. These zones were changed to 'neighborhood-school' zones. As a result, approximately 50 percent of parcels lost property rights to the school they were assigned to under busing for integration. Moreover, even when the designated home school did not change as a result of school choice, the composition of students often changed due to changes in assignment boundaries elsewhere. The introduction of the School Choice Plan was intended to move the district from a regime of strict school assignment to a system where students could attend a school of their choice without limitations on residential location. 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 by the school district 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.[2]

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 their 1st choice, they were guaranteed admission 100%. Many students did not list their home school for any of their three choices.[3] Our analysis will focus on students who did not choose their guaranteed home school and whose admission to their first choice school was determined by lottery number, since admission to the guaranteed home school was not subject to randomization.

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 chose their guaranteed school, and the remaining students chose a school for which they were not guaranteed admission.

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

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 school enrollment size at high-demand schools in an expressed effort to give each child one of her top three choices. Because of this, in the first year, approximately 95% of students 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 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 lexicographic order based on the following priorities:

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.[4]

Under the lottery system, students listing a given school as their first choice were sorted by priority group and a randomly assigned lottery number.[5] Slots remaining after home school students first choices were accounted for were assigned in order of priority group and random number.[6] If a school was not filled by those who had listed it as a first

[4] 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.

[5] 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.

[6] 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

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.[7]

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.[8] 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, funding allocation, and hires school officials such as the Superintendent of Schools to operate the details of the school district.

Of the three at-large board members up for re-election, two did not seek re-election. One did seek re-election, and was also the sitting chair of the school board. Table I shows the names and occupations, and describes the platforms of the candidates

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minimum of their individual lottery numbers. We dropped those who were admitted to a school because of a sibling preference.

[7] For a discussion of potential strategy in school choices and rankings on the part of parents, please see Hastings, Kane and Staiger (2005a). 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 their 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.

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

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 the school board elects which one of the three will serve as the school board chair and which one will serve as vice-chair. The third at-large member remains without title.

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 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

[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' 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.

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 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 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

In order to exploit the randomization in economic outcomes to identify a causal impact on voter turnout, we use the school lottery outcomes to create treatment and control groups for estimating the relationship between personal outcomes and the decision to vote. In order to estimate a causal relationship using randomization by lottery, 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 1st choice schools was determined solely on the basis of a random number. Following Hastings, Kane and Staiger (2005b), 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-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 attending 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 them in the Fall 2003 census we cannot match them 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, 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, amongst white voters, losing versus winning the lottery increases the odds of voting by approximately 38.7%. This is a very strong, but not unreasonably strong impact on voter turnout. For example, the identified effect of losing the lottery is approximately as large as the effect of door-to-door canvassing identified in Green and Gerber (2004). 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 spot 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, 'Median Income' is measured as the median income for households in student *i*'s block group of student *i*'s race de-meaned 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 $151,000. 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, amongst probable voters, losing the lottery increased the odds of voting by 42% 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. 'Expressive' versus 'Instrumental' explanations for the results

In the context of the calculus of voting model, these results suggest that 'expressive' voting plays an important role in voter turnout. In addition, the results show that expressive motivations for voting are asymmetric - losing the lottery caused increased turnout relative to winning the lottery - suggesting that the negative impact of losing the lottery was more motivating than the positive impact of winning the lottery. One might argue that the identified effect is not generated by expressive voting where losing motivates more than winning, but instead is a 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 were more motivated to vote than lottery winners. Although this argument still suffers from the problem that the probability that any one voter is instrumental is *a priori* extremely small given the size of the voting population, we test for an instrumental 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 1st choice school 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 an instrumental explanation for the asymmetric impact of losing the lottery on voter turnout, where parents who lost the lottery, faced with poorer-performing schools, are more likely to vote because they have a larger stake in education 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 1st choice school and the child's prior-year school. We break the effects of the lottery outcomes into the difference between the 1st choice school score and the last year's school score (the academic gain) if the family received admission to their 1st 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 final results 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 42%. 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 59%. 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.

In the context of the calculus of voting model, these results have some interesting implications for the factors that shape expressive voting - the '*D*' component in the cost-benefit analysis of voter participation. Since lottery numbers were randomly assigned, lottery losers and lottery winners should on average have the same cost of voting. Hence losing the lottery must impact *D* more than winning the lottery does. In particular, for those with *D* large enough to participate in prior elections, losing the school choice lottery outcome had a particularly strong effect on voter turnout. The result is consistent with a model where a person's personal cost of voting is drawn from a random distribution, resulting in a probability of voting given a particular utility level from expressive voting. Among those with utility of voting high enough to have positive

participation in prior elections, losing the lottery differentially increased the utility from voting enough to cause a 42% rise in the odds of voting among this population.

In addition, it is important to note that the lottery outcome is a *personal* economic outcome. It is orthogonal to other school policy results in the broad community. This fact implies that D is asymmetrically affected by negative personal ('egotropic') outcomes, as opposed to being solely affected by social or 'sociotropic' concerns. Furthermore, the significant interaction between losing the lottery and median own-race and neighborhood income levels implies that the negative egotropic outcome of losing the school choice lottery has a larger asymmetric effect on D in higher-income neighborhoods. One possible explanation is that higher-income families place higher utility on schooling, and are therefore more motivated to vote when disappointed by a negative lottery outcome. Alternatively, higher-income families may feel a stronger entitlement to receive admission to their preferred school, and are thus more angered and motivated to vote when they are denied admission. While we cannot determine between these two underlying mechanisms, we can determine that the effect of losing the school choice lottery on the probability of voting is increasing in income and in past voting participation.

VI. Conclusion

This paper provided 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, conditional on school-choice fixed effects and baseline characteristics. 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 40% 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 amongst likely voters is consistent with results from door-to-door canvassing experiments (Gerber and Green (2004)), which find that canvassing and get-out-the vote efforts have greater effects on regular voters than on infrequent voters particularly in low turn-out 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 and Public Finance in the context of public school 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 optimal political strategy may be to minimize losses to any minority of the electorate. Within public school provision, 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 in fact affluent citizens are the most motivated to vote and are significantly more likely to vote in response to a 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

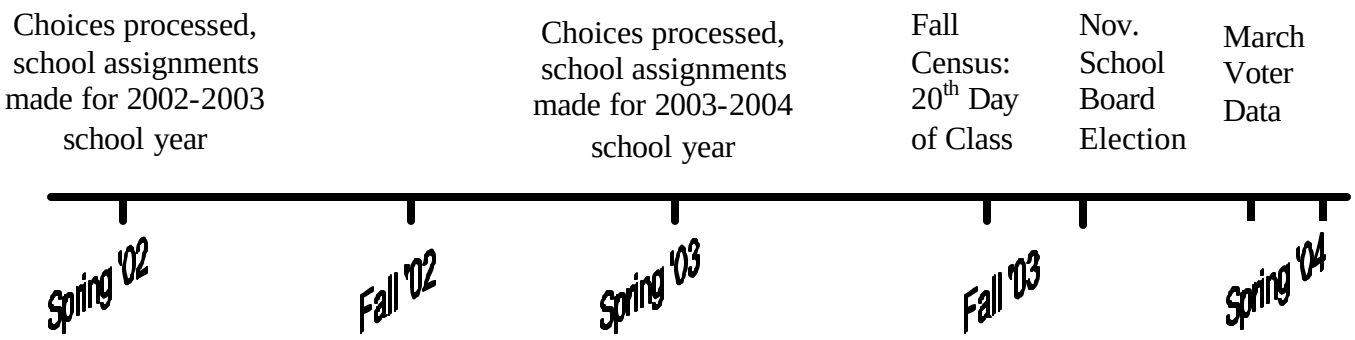

Table I: November 4, 2003 School Board Election: At-large Candidates

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' 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 400 votes.
Data Sources: Election totals are from Mecklenburg County Board of Elections. Candidate information taken from the candidate's 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	61.13%	71.12%	73.65%
Percent Female	50.83%	54.94%	55.32%
Own block-group and race median income in 2000 Census	$50,579	$61,293	$66,261
Party Affiliation			
Percent Democrat	---	42.69%	45.80%
Percent Republican	---	35.59%	39.52%
Total N	771,617	428,925	97,258

Notes: Data from Mecklenburg County Board of Elections March 2004 Voter file and the US Bureau of the Census, 2000 Decennial Census and State and County Quick Facts.

Table III: Student Characteristics

	All Students	Randomized
Student demographics		
Black	41.2%	53.7%
Female	49.6%	51.8%
Free or reduced lunch	33.1%	37.4%
Own block-group and race median income in 2000 Census	$55,670	$53,661
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 Student Body 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	0.572	0.367	0.009
			(0.008)
Female	0.494	0.439	0.014
			(0.012)
Free or reduced lunch	0.343	0.399	-0.033*
			(0.015)
Own block-group and race median income 2000 Census	$52,382	$53,479	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

Note: 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. 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	-0.021* (0.009) N=9408
2002-2003 Lottery Randomized Group: Not Present in Fall 2003 Student Census	0.159	-0.017 (0.011) N=6541
2003-2004 Lottery Randomized Group: Not Present in Fall 2003 Student Census	0.105	-0.026 (0.015) N=2957

Note: 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: white, female, free/reduced lunch, median income and voting history. 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. 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* 3lection	(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	-1004.350

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).

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***		
	(0.073)		
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

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).

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

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.

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)	(0.110)
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	-2108.761

Note: 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*
	(0.162)
Joint Signifiance: P-value	0.009
Total observations	7365
Log Pseudolikelihood	-2109.054

Note: 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.

APPENDIX TABLE:

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

Dependent Variable: Indicator if at least one member of student's household voted in *2003* 3lection	(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)	(0.028)	(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	8086	2678	5398
Adjusted R-Squared	0.412	0.351	0.406

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