Demand (and Supply) in an Inter-District Public School Choice Program

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Abstract: This study examines parents' demand for sending their children to a public school located outside their residential school district. Using a unique data set that contains information concerning both inter-district transfers and rejections of transfer applications, I am able to identify which school district characteristics attract the greatest demand for incoming transfers. The analyses reveal that mean student test scores are stronger predictors of transfer demand than both students' socio-economic characteristics and school district spending, suggesting that parents care more about outcomes than inputs. In addition, while districts are only supposed to reject transfer students due to capacity concerns, districts' supply decisions are also correlated with differences in student performance across neighboring districts.
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1. INTRODUCTION

While school choice debates often focus on charter schools and private school voucher programs, intra- and inter-district transferring are currently the most frequently used school choice programs. Many cities have formal intra-district open enrollment programs or magnet school programs that allow students to attend a public school that is not in their local catchment area. The *No Child Left Behind Act* has expanded intra-district public school choice throughout the country, because districts are supposed to allow students to transfer out of Title I schools failing to meet state standards for student achievement. In addition, 40 states have policies that allow students to apply to transfer to a public school outside of their residential district (Education Commission of the States, 2005). In 1993-94, about 1.8% of all K-12 students attended a traditional public school located outside of their residential school district, and the current percentage is probably greater.[1] Inter-district transfer rates are much higher in states possessing formal inter-district open enrollment programs, which require all districts to consider transfer applications from non-residential students. This paper examines determinants of the demand for transfer spaces in this type of statewide inter-district open enrollment program.

The previous literature explicitly examining participation in inter-district open enrollment has not been able to separate supply side and demand side factors.[2] Since transfer rates reflect the minimum of (1) the supply of transfer spaces and (2) the number of students who would like to transfer, there is a serious identification problem if one regresses transfer rates on explanatory

[1] This estimate is based on survey responses from a nationally representative sample of school districts in the *Schools and Staffing Survey* (1994). Several states have inter-district choice programs that were fairly new in 1994.

[2] Some studies have used survey approaches to try to separately explain the demand for transferring (Armor & Peiser, 1997) or the supply of transfer spaces (Fowler, 1996). Examining inter-district choice in Massachusetts, Armor & Peiser (1997) find that families with participating children most commonly cited curriculum and academic standards as their reasons for transferring. However, Schneider & Buckley (2002) find that parents' actual concerns, as measured by internet search patterns, may differ from these reported concerns. They found that parents in the Washington D.C. area, especially parents with college degrees, tend to be more interested in the demographics of the student body at the school than in school facilities, staff, programs, or even student test performance. While Fowler (1996) finds that the majority of districts in Ohio that did not allow incoming transfer students cited capacity concerns, the analyses below reveal that districts often cite capacity concerns when other factors appear more important in their decision.

variables. Demand to transfer under inter-district open enrollment may be driven by idiosyncratic household preferences and by attempts at free-riding (i.e., living in a less expensive district but transferring the child into a district with premium services). There should be high demand to transfer into an adjacent district when the characteristics of that district are relatively desirable compared to nearby districts, provided that the transportation cost of transferring to that district from a less desirable district is low. Meanwhile, administrators set the supply of transfer spaces in their districts by comparing the marginal benefits with the marginal costs of accepting additional transfer students. Marginal costs are due to the direct cost of services, negative peer effects (actual or perceived) caused by the incoming transfer students, and reductions in house prices due to the partial erosion of the housing premium linked to the district's popular schools.[3] Marginal benefits include gains in per-pupil state aid, as well as the appearance of compliance with their state's law and any positive reputation effects associated with incoming transfers.[4]

Many variables may affect both the supply of and demand for transfer spaces. For example, parents might prefer to send their children to schools where students earn high test scores, but those types of schools might be relatively likely to restrict the supply of incoming transfer students due to concerns over potential negative peer effects caused by incoming students with relatively low test scores. Thus, the reduced-form relationship between transfer rates and mean test scores will reflect some combination of a positive effect of test scores on demand and a negative effect of test scores on supply.[5]

[3] Reback (2005) finds evidence of one-time capitalization effects due to the adoption of inter-district open enrollment in Minnesota. Exit transfer opportunities cause house prices to increase, while incoming transfers cause house prices to decrease, because households do not necessarily have to pay a large house price premium to send their children to a popular school district.

[4] An earlier version of this paper provides a slightly more formal discussion of these theoretical sources of supply and demand (Reback, 2006).

[5] Analyzing inter-district open enrollment in Massachusetts, Fossey (1994) finds that, compared to the districts receiving their students, districts that lost at least twenty residential students tended to have lower median family incomes and lower test scores in math and science than the receiving districts. Based on previous evidence, it is unclear whether these effects would be even larger if not for the supply-side decisions of school districts.

Using district-level data describing both student transfers and transfer application rejections, I examine the demand for transfer spaces in the nation's oldest statewide inter-district choice program—Minnesota's open enrollment program. Estimated transfer demand may understate actual demand in some cases, because fewer individuals tend to apply if they anticipate rejection. However, as discussed further below, it appears that this did not hold for the most individuals in this particular program.

In the capitalization literature, there is evidence that higher test scores in local public schools lead to higher house values (Black ,1999; Downes & Zabel, 2002; Bayer, Ferreira, & McMillan, 2004) through greater local housing demand from families with school-aged children (Barrow, 2002).[6] Recent studies of parents' preferred school within a district (Hastings, Kane, & Staiger, 2005) or their preferred teacher within a school (Jacob & Lefgren, 2005) suggest that many parents place strong weight on academic achievement.[7]

The results below suggest that inter-district transfer demand in Minnesota is greatest when the mean student score on standardized tests in a district is much greater than in a neighboring district.[8] Relative values of student test scores are slightly stronger predictors of demand than relative values of socio-economic variables. Test scores have statistically significant effects on demand even if one controls for socio-economic measures and school spending per pupil. While reliable estimates of school productivity would incorporate value-added measures of student progress, this finding is consistent with parents caring about whether

[6] Figlio and Lucas (2004) also find that house values rise as a result of schools receiving higher ratings from accountability systems.

[7] Jacob & Lefgren (2005) find that there is a positive correlation between parents' classroom assignment requests and teachers' value-added effectiveness, especially within schools serving low income populations. In the intra-district choice setting, Hastings, Kane, & Staiger (2005) find that the students most sensitive to schools' mean test scores are those students in high income families. Other studies of school choice have suggested that parents may not be choosing schools that produce greater value-added achievement (Cullen, Jacob, & Levitt, 2003, 2005) and that the racial composition of students may influence their preferences (Henig, 1990; Lankford & Wyckoff, 2001; Schneider & Buckley, 2002).

[8] Throughout this article, district X is considered a "neighboring district" to district Y if they are contiguous, sharing a geographic border at any location.

a school district produces higher than expected mean student test scores due to productive schools and/or positive peer effects.

Yet the effects of test scores on transfer demand do not tell the entire story; students' academic performance is also correlated with supply-side decision making. While Minnesota's districts are not permitted to selectively admit transfer applicants, they are allowed to reject one or more applicants due to capacity concerns. Analyses of rejection patterns confirm that, controlling for transfer demand levels, districts are slightly more likely to reject applicants when the districts are at historically high levels of enrollment. Regardless of whether a district has historically high enrollments, it is much more likely to reject transfer applicants if its mean student test scores or household socio-economic characteristics are substantially greater than those of a neighboring district.

The next section describes Minnesota's open enrollment program in more detail, followed by a section discussing which factors might influence the demand and supply of transfer spaces. After describing the data, I discuss the potential endogeneity of transfer applications and then describe the empirical model and results. I conclude with a discussion of the implications of these findings for the design of school choice programs.

2. BACKGROUND ON INTER-DISTRICT OPEN ENROLLMENT

Various types of inter-district transferring have existed for decades. The first inter-district transferring began in the South in the 1960's, as an effort to promote desegregated schooling. "Freedom of choice" plans resulted in small percentages of African American students transferring to new schools, while very few white students changed schools (Wells, 1993). Although court orders tended to replace these "freedom of choice plans" with mandatory busing, some current programs continue to allow students residing in the suburbs to transfer to

urban schools or vice versa. Less formal arrangements of inter-district transferring have existed for years, as districts make agreements with one another. In a more subtle form of inter-district transferring, some parents falsify residential information so that their children may attend school in a different district. During the early 1990's, 13 states adopted formal, statewide inter-district open enrollment programs that have significantly increased rates of inter-district transferring.[9] Minnesota was the first state to establish this type of program.

Minnesota's inter-district open enrollment program became statewide in 1991, and participation rates rose steadily throughout the early 90's. In 1991, the average district lost about two percent of its residential students to open enrollment, by 1997 this average climbed to seven percent, and in 2000 the average was six percent. Under the program, all students are entitled to attend their residential school district, but they may also elect to apply simultaneously to other school districts without any admission fees. Once a student transfers into a district, the student is entitled to remain in that district through high school graduation.

Districts may not selectively accept transfer applications. If there is more than one school at the appropriate grade level, transfer applicants may rank their choices of specific schools on their transfer application and it is then up to district administrators to decide the highest ranked school in the district that has sufficient capacity to serve the student. The district administrators may reject the application entirely if they feel that there is not sufficient capacity in any of the listed buildings or in the district overall. If the district feels that it has room for some but not all of the transfer applicants during a particular year, then it is supposed to randomly choose applicants to fill the available spaces. State oversight of these rejections is fairly loose; districts do not have to provide any evidence of capacity constraints, and the state

[9] The 13 states are: Arkansas, California, Colorado, Idaho, Iowa, Massachusetts, Minnesota, Nebraska, Ohio, Oklahoma, Washington, Tennessee, and Utah (Bierlein et. al., 1993).

only recently began collecting annual information from the districts concerning open enrollment rejections.

When a student transfers to a non-residential district, the sending residential district experiences a financial loss equal to the non-compensatory aid per pupil that it receives from the state, and the receiving district gains the non-compensatory aid per pupil that it receives from the state. In 1999-2000, the year of this paper's analyses, average non-compensatory aid per student equaled about $4,000, varying across districts by only a couple of hundred dollars. While the financial award was far less than the average district's per pupil spending in Minnesota (about $7,000), this financial award usually exceeds the marginal cost of serving these additional students due to economies of scale.[10]

In addition to the inter-district open enrollment program, Minnesota offers a variety of other types of school choice programs. The two primary alternative choice programs are charter and magnet schools, but, since these are extensive in only the Minneapolis and St. Paul school districts, the presence of these programs likely has only a minor effect on this paper's district-level analyses.[11] To ensure that the availability of outside choice options does not bias the results, additional analyses of this paper's models add control variables based on the local presence of charter schools and private schools.

3. DATA

This paper's data allows one to estimate which observable variables are important components of inter-district demand. Fortunately, these data include both transfer rates and

[10] Even when special education students transfer, the residential district must compensate the receiving district for special needs such as transportation, so that the net marginal cost of receiving a special education student may not be much larger than for another student.

[11] All of the results in this paper are robust to removing these two districts, Minneapolis and South St. Paul, from the sample.

rejection rates, so that one may estimate the transfer demand to enter each school district without worrying about the confounding effects of the supply of spaces in that district. Less fortunately, these data are aggregated at the district- rather than household-level, simply revealing the total number of exiting and incoming students in each district rather than transfers out of a particular district and into another particular district. By incorporating geographic information, the empirical strategy described below exploits information about districts' neighbors in order to characterize the likely transfer decisions most relevant to students.

The data combine several school-district level data sets provided by the Minnesota Department of Education. To capture the long-run transfer equilibrium, I focus on inter-district choice during the 1999-2000 school year, nine years after the beginning of statewide open enrollment. Explanatory variables come from Minnesota's *School District Profiles* (2000), as well as district-level data from the Minnesota Department of Education's website describing mean student test scores on standardized, statewide exams for students in third, fifth, and eighth grade.[12] The two data sets of particular importance are the open enrollment transfer rate data and the open enrollment application rejections rate data. District-level open enrollment transfer flow data are available for the 1999-2000 school year, provided directly from the Minnesota Department of Education. These flows reveal the number of students residing in each school district that attend a different school district (i.e., outgoing transfer students), as well as the number of students attending the school district that do not reside in the school district (i.e., incoming transfer students).[13]

[12] The district-level test score measures used in this paper equal the average of the mean student test scores in third, fifth, and eight grade in reading and math during the 1998-99 school year.

[13] Incoming transfer flows, but not outgoing flows, are also available broken down by race and by two other categories: whether the student has been designated for special education services and whether the student is eligible for free or reduced priced lunches due to membership in a low-income family. The transfer flows do not include breakdowns by grade.

District-level open enrollment rejection data are available for the 1998-99, 1999-2000, and 2000-2001 school years. These data are the results of district responses to an annual survey given by the Minnesota Department of Education in which districts list the number of rejected open enrollment transfer applications by grade and by the reason for the rejection. The response rate to this survey was 338 out of 345 in 1999-2000, and was fairly similar for 1998-99 and 2000-2001.[14] The vast majority of school districts do not reject any transfer applications in a particular year. In the three school years mentioned above, only 8-10% of responding districts rejected *any* new applications, and some of these might have accepted some new applicants while rejecting others. The data do not provide any information about characteristics of the students applying to transfer.

The open enrollment transfer and rejection data are combined with district-level data concerning characteristics of residents, school expenditures, student test scores, total enrollments by grade, and total enrollments by race. The analyses also utilize geographic data concerning which districts are contiguous (i.e., sharing a border at some geographic location). One can thus analyze the supply and demand for schooling based on both a district's own characteristics and the characteristics of neighboring districts. This is particularly helpful, since anecdotal evidence suggests that most transferring students attend a school in a neighboring district. Out of the 345 districts in operation during the 1999-2000 school year, two newly formed districts are omitted from the regression analyses of transfer demand due to missing values for several variables, five districts are omitted due to missing financial data or test score data, and seven additional districts are omitted because they did not respond to the transfer applicant rejections survey.[15]

[14] The exact response rate and information concerning which districts did not respond is only available for 1999-2000.

[15] The regression results remain nearly identical when one includes this latter group of non-responding districts and assumes that they did not reject any applicants. This assumption seems close to reality, because none of these districts reported rejecting any students during the previous or latter year. In addition, these districts possess similar observed characteristics as districts that did not reject any applicants.

Among the 331 districts included in this analysis, the median demand for incoming transfer spaces was 62, while the mean was 97, with a standard deviation of 62. Given the low rate of rejections, the number of actual incoming transfers was almost as large, with a median of 61 and a mean of 95. The median number of residential students was 1058 and the mean was 2494. More detailed summary statistics are available in an earlier draft (Reback, 2006)

4. HOW ENDOGENOUS WERE APPLICATIONS?

Applications may be endogenous because people's perceived probability of acceptance influences their application decision. If potential applicants are deterred from applying because they anticipate rejection, then the sum of transfer students and rejected applicants may understate true demand. However, in the case of inter-district transferring in Minnesota, few people likely withheld applications because they anticipated rejection. As described above, rejections were uncommon. Furthermore, there were not any application fees, and applying to one district did not preclude applying to others. Therefore the only costs associated with applying would be the cost of gathering information about schools, the time to obtain and submit an application, and the potential emotional disappointment associated with a rejection. Given these low costs and the high probability of success, most parents likely would apply to transfer their child even if they were uncertain about whether their child should transfer or not.

Examining a subset of districts that bordered Minneapolis provides further evidence that those who were interested actually applied to the inter-district choice program. One year after this paper's sample period, there was an out-of-court settlement of an adequacy lawsuit that allowed low-income Minneapolis public school students guaranteed access to a minimum number of transfer spaces in nearby, suburban districts. Theoretically, some participants might have been induced to participate in this Minneapolis transfer who would not have participated in

the regular open enrollment program because they would have anticipated rejection. It does not appear, however, that this occurred. To investigate this possibility, I compared the number of subsidized lunch transfer students during 1999-2000 (this paper's main sample period) to the number of subsidized lunch transfer students into the participating suburban districts in 2001-02 and 2002-03 when the Minneapolis program first took effect, using data presented by Palmer (2003).[16] While the suburban districts had recruitment targets that may have induced students to temporarily participate, the number of students who used the Minneapolis program for consecutive years was generally similar to the number of these types of students using open enrollment before this program began. Only two out of the eight neighboring suburban districts experienced a non-trivial increase in incoming transfer students from low-income families, and one of these two districts had a high enough rejection rate in 1999-2000 to explain this increase.

Data concerning rejections from the years immediately before and after this paper's main sample period (1999-2000) provide further evidence that the estimates are not strongly influenced by the potential endogeneity of applications. People might not continue to apply each year if they had been previously rejected, so that it is important to check whether the results would be influenced by year-to-year deferment of applications. Twelve out of 27 districts that rejected applicants in 1998-1999 also rejected applicants in 1999-2000, while 16 out of 26 districts that rejected applicants in 1999-2000 also rejected applicants in 2000-2001. Fortunately, all of the results below concerning transfer demand in 1999-2000 remain qualitatively similar when one controls for rejections made during the previous year and rejections made during the following year. This confirms that the results are not biased from a transitory component of endogenous applications.

[16] The number of subsidized lunch transfer students in 1999-2000 may slightly overstate the number of subsidized lunch transfer students who resided in the Minneapolis district, because incoming subsidized lunch transfer students in the suburbs may have come from other suburban districts. However, this type of transfer was probably uncommon due to the higher incomes generally found in the suburban districts.

5. **EMPIRICAL ANALYSES**

The first subsection below describes rates of participation in open enrollment. The next subsection analyzes the demand for transferring into districts, and the third subsection analyzes cases in which supply is binding so that the district rejects some transfer applicants.

5.1 Participation Rates

Students from low-income families (eligible for federally-subsidized school lunches) and students receiving special education services are slightly more likely than other students to participate in open enrollment. Statewide, 25.9% of public school students come from low-income families and 11.1% of public school students are placed in special education, while these groups respectively composed 26.9% and 12.5% of transferring students. Non-white students are slightly less likely to participate in open enrollment, composing 15.7% of all public school students but only 11.8% of transferring students.[17]

5.2 Demand for Public School Transfer Spaces

I estimate the demand to transfer into district *j*, D_j, by finding the sum of incoming transfer students and the number of rejected applicants.[18] In the empirical model below, the term neighbors refers to all districts contiguous to district *j*. The following model is used to predict transfer demand:

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[17] Note that these participation trends differ from those observed for other types of school choice programs. Examining entrants into lotteries for intra-district transferring in Chicago, Cullen, Jacob, & Levitt (2003) also observe lower participation rates among non-white students, but they found lower participation among students from low-income families as well. Examining participation in a national, privately-funded voucher program that targeted low-income families, Campbell, West, & Peterson (2005) find that African-American children eligible for the program were actually more likely to apply than other eligible children, although they were less likely to participate conditional on acceptance.

[18] This measure estimates students' demand to transfer to district *j* rather than attending any other school district. In order to include districts receiving zero demand, I add one to the sum of incoming students plus rejections before taking the log. Demand in this context means that one would actually transfer if the application is accepted. This measure will overstate demand in the (relatively rare) case that a student is rejected from a district that the student would not have attended anyway. Anecdotal evidence suggests that students seldom apply to more than one district during the same year.

(1) $\log(D_j) = \alpha + \beta_1 \log(\#\text{ of households}_j) + \beta_2 \log(\text{population density}_j) + \beta_3(\%\text{ of students in elementary grades}_j) + \beta_4(\%\text{ of students in middle school grades}_j) + \beta_5 \log(\text{neighbors' \# of households}_j) + \beta_6 \log(\text{neighbors' population density}_j) + \beta_7(\text{neighbors' \% of students in elementary grades}_j) + \beta_8(\text{neighbors' \% of students in middle school grades}_j) + X_j \beta_9 + \overline{X}_{j,neighbors} \beta_{10} + X^{\min}_{j,neighbors} \beta_{11} + \varepsilon_j.$

The dependent variable equals the natural logarithm of the sum of incoming transfer students and the number of rejected applicants in district *j* during 1999-2000. One may thus interpret the coefficients in terms of percent changes in the number of students who would like to transfer into the district. The results remain nearly identical if one replaces this dependent variable with one that divides the level of demand by some measure of school district size, such as total residential enrollment.

The first four independent variables control for structural differences across districts that may be related to the number of students seeking to transfer into the district. These control variables are the number of households in the district, the population density in the district, the fraction of public school students enrolled in elementary grades (kindergarten through grade 5), and the fraction enrolled in middle school grades (grades 6 through 8). The next four independent variables control for these structural characteristics with aggregate values among the neighboring school districts.

The X_j vector contains various combinations of independent variables that might predict demand; the purpose of this analysis is to determine the relative importance of these variables. To facilitate the comparisons of these variables and their predictive validity, they are all converted into standard normal values across the sample (i.e., Z-scores). The demand for transferring into a district is likely based on both the characteristics of district *j* and

characteristics of neighboring districts. There might be greater demand to transfer into district *j* if a nearby district is significantly worse along some quality measure or if many nearby districts are worse along this quality measure. Vector $X^{\min}_{j,neighbors}$ therefore includes the Z-score of the minimum value of these characteristics among district *j*'s neighbors, and vector $\overline{X}_{j,neighbors}$ contains the Z-score of the population size-weighted mean value of these characteristics for all district *j*'s neighbors.

In the full model, these vectors include: median income of residents, mean house value of residents, education levels of residents, per pupil expenditures, local revenues per pupil, and mean student scores on standardized tests. The model does not include variables for racial composition, because there is little variation in racial composition outside of the two urban districts of Minneapolis and South St. Paul.[19] One should note that the mean test scores may be slightly influenced by the performance of incoming transfer students, because separate test score data for residential and transfer students are not available.[20] Because net transfer rates will also affect per pupil expenditures and revenues, I do not use the actual values of these variables, but instead estimate their hypothetical values if no students transferred.[21]

Additional regression models, not shown here, add four control variables for alternative school choice mechanisms: the log of private school enrollment in the district, the log of private school enrollment among the district's neighbors, the log of charter school enrollment in the district, and the log of charter school enrollment in all of district *j*'s neighbors. The models would ideally include separate controls for the supply of and the latent demand for charter and private school alternatives, but latent demand is difficult to measure. The results below remain

[19] Omitting these two urban districts from the analyses does not substantively affect any of the results in this paper.
[20] Test scores predating the open enrollment program are also not available.
[21] I estimate hypothetical total expenditures by subtracting the net amount of state aid gained by the district due to incoming and outgoing transfers, and then dividing this total expenditure measure by the number of public school students who reside in the district regardless of whether they actually remain in the local public schools.

nearly identical after the inclusion of these control variables, and the coefficients of these four control variables are very small. Of the four, only private school enrollment in the district is ever statistically significant, as it is mildly, negatively related to transfer demand.

5.2.1 Demand Related to Free-Riding.

The focus of Table 1 is on variables that might be related to the free-riding type of transfer demand, whereby students are transferring to a district that is considered to be of higher quality than their residential district. Aside from the inclusion of the structural control variables, Table 1 reveals the "raw validity" of various factors—the predictive power when one factor is included on the right-hand side of the model and other factors are omitted. The structural control variables alone actually explain 44.6% of the variation in demand, so the final column of Table 1 reports how much of the remaining variation is explained by a particular factor. The direction and statistical significance of the coefficients are similar for test scores, household income, and house values: demand is greater when a district has higher levels of these seemingly desirable characteristics and demand is greater when at least one of the district's neighbors has relatively low levels of these characteristics. For income and test scores, average characteristics of a district's neighbors are far less important predictors of transfer demand than the minimum value among neighbors, both in terms of magnitude and statistical significance. Excluding the average neighbor characteristics from these regressions has little impact on the other coefficients or on the relative predictive validity of the various types of variables. The amount of explained variation in the demand for transfer spaces is fairly similar for each type of district characteristic, with R^2's equal to .47, .46, or .48, respectively when mean household income, median house value, or mean student test score are used as independent variables. Average math test scores predict demand better than average reading test scores.

Rows 6 and 7 of Table 1 reveal the effects of parental education levels on transfer demand. Transfer demand is greater when a district has fewer high school dropouts or when a district's least educated neighbor has fewer residents with college degrees. These findings are consistent with the idea that parents want to transfer their children into districts with better-educated parents. The raw validity of these variables is fairly low, so much of this finding may simply be due to a positive correlation between parental education and another valued trait such as student test scores or parental wealth.

Row 8 of Table 1 reveals that the total spending per pupil variables, which adjust for transferring patterns (see footnote 21), do not have statistically significant effects on transfer demand. This is not very surprising, because expenditures per pupil will reflect a combination of local funding, state, and federal funding. While local funding is likely associated with desirable characteristics such as property wealth and parental interest in schooling, other funding may be linked to undesirable characteristics such as high poverty rates and low property wealth. Overall, spending per pupil across Minnesota school districts is negatively correlated with potentially valued characteristics such as median income, so the popularity of districts with higher socio-economic characteristics may cancel out the popularity of districts that spend greater amounts per pupil.

In order to isolate spending that should not be linked to any negative traits, row 9 of Table 1 focuses on local revenue per residential pupil. Presumably parents would be happy to send their child to a district where other parents make sizable financial contributions to school expenditures. In fact, demand to transfer is greater for districts where the average local expenditures of neighboring districts is relatively large and for districts where the minimum local expenditure level among the neighboring districts is relatively low. The latter finding is intuitive: parents from the low spending district may want to upgrade to a higher spending

district. One possible explanation for the former finding is that parents residing in districts with high local tax rates and large local property tax bases care a lot about their children's schooling and are not always satisfied with the local schools, so they are more likely to send their children to a neighboring district even if this district has lower per pupil expenditures.

There are differences in the relative predictive power of the variables in Table 1 if one examines demand among different types of districts, such as rural versus non-rural districts. If one splits the sample based on districts' population density, all of the coefficients retain their sign, but there are small differences in the relative ranking of how well the various explanatory variables predict demand. Test scores remain the strongest predictors for districts with low population density, but the test score, income, and house value variables predict a similar amount of transfer demand for districts with high population density. One potential explanation for this difference is that there appears to be a greater amount of Tiebout sorting across districts in relatively densely populated regions, which reduces idiosyncratic variation in test scores across districts. Household wealth and test scores are very highly correlated across densely populated districts, but they are not significantly correlated across other districts.

In addition to raw validity, it is important to determine the incremental validity of various predictors of the demand for choice. In particular, how does the amount of explained variance in demand decrease when only one type of variable is omitted? Table 2 displays the regression results when all types of independent variables are included. The coefficients generally retain their sign from Table 1. The R-squared when all variables are included equals .53, a moderate increase from the models that only included one type of predictor.

The R-squared does not decrease much when any one type of variable is omitted from the full regression model, partly because these variables are positively correlated. There is a .43 correlation between mean test score and median income, a .37 correlation between mean test

score and mean house value, and a .88 correlation between median income and mean house value. The inclusion of the mean test score variables in Table 2 allows one to explain an additional two percent of the variance in demand. The F-test comparing the full regression model with a model omitting the test score variables confirms that, at the .01 level of significance, one can reject the null hypothesis that the test score variables' coefficients equal zero.

This suggests that transfers flow towards schools with higher outputs, even controlling for schools' inputs. This provides tentative evidence that public school choice could lead students to move to more productive districts, where students earn higher test scores than one would predict from district-level socio-economic and spending variables. There are several reasons why one should interpret this result very cautiously. First, as previously stated, the test score variable measures the performance of the actual students served, so that the average test score is slightly influenced by whether student inflows and outflows improve the mean student ability level. Second, it is possible that the schools with higher than predicted test scores are not truly more productive, but simply have students with high academic abilities related to unobserved, non-school factors or students who enjoy positive peer interactions. Third, the students who use the choice program may not necessarily improve their own performance as a result (Cullen, Jacob, & Levitt, 2003, 2005). Fourth, while this analysis focuses on student sorting, a school choice program could also directly affect schools' productivity through competition or changes in funding.

Given that parents are able to express a preference for their child to transfer to particular schools within a non-residential district, an important robustness check is to determine whether within district school heterogeneity influences transfer demand. While school-level data are not available for all of the descriptive characteristics, they are available for student test scores, which

are the district-level variables that best predict transfer demand. When one adds either the standard deviation in school-level mean test scores or the maximum school-level mean test score in a particular grade as an additional control variable in the models from Equation 1, this variable is statistically insignificant and the models continue to explain roughly the same proportion of the variance in transfer demand. Either most transfer applicants are enticed by district-level characteristics or district-level characteristics proxy well for popular school-level qualities..

5.2.2 Demand Related to Tastes for Differentiated Products.

Another important robustness check for these analyses is to determine whether the previous estimates might be biased in either direction by transfer demand related to districts specializing in specific areas. While it is generally difficult to measure idiosyncratic preferences, there are certain measurable characteristics of districts that might differentiate them from one another and thus influence transfer demand. I add a few of these measures that are likely to be exogenous, i.e., not influenced by the actual transfer students who enter the schools. These variables include the fraction of spending that is dedicated to vocational education, the fraction of spending that is used for community service purposes, and the average and minimum neighboring districts' values for these vocational and community service variables. As with the earlier variables, each of these variables is included in the form of a Z-score. In addition, I explore whether transfer demand is related to indicators for whether the district has a highly successful hockey team or football team, a team that has gone to the state finals in its division during either of the two years prior to the sample period. These sports are very popular in Minnesota and there is anecdotal evidence of students being recruited for athletic purposes.

The inclusion of these additional variables does little to change the results. For example, the estimated coefficient on the test variable in this expanded model equals .22 with a .07 standard error, as opposed to .23 with a .07 standard error in Table 2. The R-squared only

increases from .53 to .54 when these eight additional variables are included, and none of the additional variables are statistically significant at the .10 level. There is slightly greater transfer demand when districts spend a greater proportion of their budgets on vocational programs than neighboring districts. This is probably due to a few students who prefer a school district offering these specialized services. Successful hockey or football teams do not increase transfer demand; in fact, districts with successful football teams receive less transfer demand than other districts. It is possible that a few students are recruited to transfer in order to play for the best teams, and it is also possible that an even greater number of students are dissuaded from transferring into a district where it may be more difficult for them to play on the teams. The results remain similar if one replaces these indicator variables with the number of successful teams per residential student served.

6. THE SUPPLY OF TRANSFER SPACES

Unlike demand, one cannot precisely estimate the supply of transfer spaces; one only observe supply in the few cases that it is binding because a district rejects an applicant. The data allow one to characterize reported reasons for these rejections and to compare districts receiving similar levels of demand but making different decisions concerning rejecting applicants. Only 26 districts (about 8% of respondents) rejected any applications for 1999-2000. Responding to a close-ended survey, districts gave reasons for these rejections that included lack of capacity in a program (31% of rejections), lack of capacity in a class (23% of rejections), lack of capacity in a school building (28% of rejections), and other reasons (18% of rejections). Districts with court-ordered desegregation plans were also permitted to cite racial balance concerns as a reason for rejections, but none did so. Districts using certain explanations for rejections possess fairly similar characteristics as districts using other explanations, though the small number of rejecting

districts weakens one's ability to formally test for differences within the group of rejecting districts.

It is possible that the low rates of rejections in Minnesota are related to school districts' ability to expand capital resources, such as the number of classrooms, over time. Examining Milwaukee's private school voucher program, Belfield, Levin, & Schwartz (2004) find that nearly half of the participating private schools in 2002 were founded after the program began. The long-run supply of transfer spaces under inter-district enrollment may also be somewhat elastic, especially given that about 5% of Minnesota's districts experienced net gains of transfer students equal to at least 20% of the size of their residential student population.

To provide rough evidence of supply-side decision making, I control for transfer demand and examine how various factors influence the relative likelihood that a district rejected any transfer applicants. The dependent variable is an indicator variable equal to one if the district rejected any transfer applicants for the 1999-2000 school year. Given the low rate of rejections, one cannot simultaneously identify the coefficients of more than a few explanatory variables, so these results should be interpreted cautiously. The first control variable is a measure of transfer demand, the total demand for transfer spaces divided by the size of the residential student population. Rejections are supposed to be based on capacity constraints, so an additional independent variable is an indicator for whether districts are at a historically high student enrollment level compared to the previous five years. The final control variable equals the number of households in the district, as larger districts may tend to receive more applications. Rejections occur in both rural and metropolitan areas, and population size appears to be a more important control variable than population density.

Table 3 displays estimates based on probit models which include these three independent variables, as well as one additional independent variable measuring the difference between a

district's characteristics and the minimum value of this characteristic among a district's neighbors. The sample for these models includes 327 districts that received at least one transfer student or application. The estimates displayed in Table 3 are the mean marginal effects, and each column displays results using a different type of descriptive variable for the difference between a district's own Z-score with the lowest Z-score of its neighbors. These models provide rough evidence concerning whether districts' supply decisions are influenced by the gap between their characteristics and those of their neighbors. The results of similar models using mean neighbor values rather than minimum values are not shown here, as minimum values appears to be more closely related to supply decisions, which is not surprising given that districts could not selectively admit applicants.

The mean estimated marginal effects displayed in Table 3 suggest that districts appear to be very sensitive to the relative characteristics of their neighboring districts. While districts are claiming to make rejections based on capacity, it appears that test score gaps and socio-economic differences are also correlated with these decisions. Column 1 suggests that the probability that the district rejects any applicants increases by 1.9 percentage points given a one point increase between a district's mean student test score (Z-score) and the lowest neighboring district's mean student test score (Z-score). A one standard deviation increase in this test score difference variable equals 1.23 points, which implies a 2.3 percentage point increase in the probability that the district rejected any applicants. This is a substantial change, considering that the overall fraction of districts rejecting any applicants was only 8%. Districts are also more likely to reject any applicants if the district has greater transfer demand, the district is at a historically high level of enrollment, or the district contains a large number of households, though only the last two of these variables is associated with a mean marginal effect that is statistically significant at the .10 level. Columns 2, 3, and 4 respectively suggest that differences in house values, median income,

and the percent of adults with college degrees are all associated with substantial changes in districts' supply behavior. For house values and the percent of adults with college degrees, there is at least a six percentage point change in the probability of the district rejecting students when the difference between the district's Z-score and that of its lowest neighbor changes by one point. Given that the standard deviation in these differences in Z-scores equals .63 for house values and .72 for the percent of adults with Bachelor's degrees, one standard deviation changes in these differences are respectively associated with 3.8 and 4.5 percentage point increases in the probability that a district rejected an applicant. The importance of house prices and parental education levels might reflect administrators' concerns over negative peer effects or negative capitalization effects from admitting additional transfer students. These results should be interpreted with caution, however, due to the possible correlation of socioeconomic gaps and omitted variables.

Although some transfer applicants may have requested specific schools, within-district heterogeneity in Minnesota does not appear to influence supply decisions. The difference between the highest school-level mean test score in the district and the minimum district-level mean test score among neighboring districts does not predict rejections as well as the district-level gaps. This finding even holds if the analysis only includes rejections that districts claimed were due to "lack of capacity in a school building" rather than district-level capacity constraints.

7. CONCLUSIONS

Using data on transfer rates and transfer application rejections, one finds that the demand for inter-district transferring in Minnesota is related to students moving into districts with higher average test scores and socio-economic characteristics than their residential district. These variables, along with structural variables like population density and the fraction of students in

high school, are statistically significant predictors of transfer demands. About half of the district-level variation in the demand for incoming transfer spaces is not explained by these variables, and may be due to idiosyncratic factors such as subjective views of school quality, the convenience of school locations, and the quality of specific programs such as in science or art.

There is positive demand for districts with higher mean student test scores than a neighboring district, and this remains true if one controls for socio-economic variables and school expenditures. This suggests that parents are concerned with outcomes, and this is also consistent with the possibility that parents tend to prefer to transfer their children to more productive schools.

Yet, there is evidence that schools' supply-side decisions occasionally constrain parental demand for districts with relatively high test scores. Given similar levels of demand, districts with substantially greater test scores and socio-economic characteristics than a neighboring district are much more likely to reject transfer applicants. This pattern remains true controlling for whether districts are at capacity in terms of their recent historical high level of enrollments. While districts claim that they are making rejections for capacity reasons, concern over negative peer effects or negative capitalization effects might influence their marginal decision making. The rejection rates in Minnesota are sufficiently low so that, on average, transfer students enter districts with higher mean student test scores than their residential districts. However, rejections might occur more frequently in states with greater spatial heterogeneity, where neighboring districts differ substantially in their demographics. For other choice programs and other geographic areas, one could imagine the supply-side forces being sufficiently strong that the vast majority of successful transfers do not allow students to enter schools with higher socio-economic characteristics or higher productivity than the schools in their residential district.

Given that this paper's data do not allow for a rigorous analysis of these supply-side issues, further research is needed in this area. The topic is important in light of current U.S. education policies; the *No Child Left Behind Act* may soon dramatically increase the frequency of public school transfer applications in large districts throughout the United States.[22] If school principals in large districts behave like Minnesota's superintendents, then these principals may try to turn away transfer applicants by claiming the schools are at full capacity.

Although it is difficult to obtain detailed data concerning *No Child Left Behind* transfer rates and transfer applications because of the policy's decentralized administration and its relatively brief tenure, it appears that many non-failing schools are not eager to admit transfer students, and most urban areas have resisted compliance with the law because they would otherwise face tremendous overcrowding problems. In a study by the Citizen's Commission on Civil Rights which received survey responses from 10 states and 53 districts in other states, the authors report that 5.6% of eligible students requested transfers out of failing schools during 2003-2004 but only 1.7% of eligible students actually transferred schools (Brown, 2004, p. 109).

Capacity concerns may often be valid, especially given pre-existing concerns with overcrowding in urban public schools due to enrollment growth and budget cuts. However, cases in which transfer applicants are rejected may more closely reflect the principal's or superintendent's concerns over peer effects than concerns over actual capacity constraints. One policy alternative would be to further increase the financial compensation for schools serving certain types of transfer students whose education is associated with a relatively high marginal cost. Another alternative would be to adopt a strict, centrally-determined formula for capacity.

[22] Under the *No Child Left Behind*, parents may transfer their children out of a public school that has been deemed failing for two consecutive years. These students have the right to transfer to some other public school within the district that has not been deemed failing.

An example of this policy is found in Britain.[23] Whether choice programs in the U.S. should adopt a similar policy depends on the desired level of participation in the particular choice program, as well as the perceived trade-off between increased participation and local administrators' flexibility.

[23] The British government amended a 1980 open enrollment policy eight years later to require schools to accept transfer students as long as total student enrollment remains less than it had been during 1979. The amendment arose due to concerns that local educational agencies were setting low capacity levels in some schools to prevent enrollment declines in other schools (Clark, 2005).

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Table 1: The Demand for Transfer Spaces: Regressions Revealing the Predictive Power of Individual Types of Explanatory Variables

	Coefficients			R^2	% of Variation in Demand Not Explained by Structural Control Variables That Is Explained by Each Model
	Within District	Average of district's neighbors	Minimum of district's neighbors		
1. Median income	.330	-.010	-.447	.469	4.3%
	(.107)	(.139)	(.157)		
2. Median house value	.267	-.144	-.150	.460	2.6%
	(.092)	(.149)	(.177)		
3. Average test score	.199	-.008	-.144	.479	6.0%
	(.054)	(.101)	(.060)		
4. Avg. Math test score	.214	.002	-.172	.485	7.0%
	(.054)	(.104)	(.063)		
5. Avg. Reading test score	.168	-.006	-.121	.471	4.5%
	(.053)	(.100)	(.058)		
6. % of Residents with B.A. or more	.085	-.071	-.200	.451	1.0%
	(.092)	(.125)	(.141)		
7. % of Residents w/o High School Diploma	-.207	.208	-.120	.460	2.6%
	(.075)	(.138)	(.141)		
8. Per pupil Expenditures	-.002	.037	-.107	.447	0.2%
	(.063)	(.147)	(.160)		
9. Local per pupil Revenue	-.004	.177	-.377	.462	2.9%
	(.058)	(.117)	(.126)		

Notes to Table 1: Each row represents a separate regression, with the same 331 districts in the sample. Robust (Huber-White) standard errors are in parentheses below each estimated coefficient. All independent variables listed above have been converted to Z-scores. Independent variables also include the structural control variables in Equation 1 for a district and its neighbors: the natural log of the number of households, the natural log of the population density, the percent of public school students enrolled in elementary grades, and the percent of public school students enrolled in middle school grades.

Table 2: The Demand for Transfer Spaces: Full Regression Model

Independent Variable	Coefficient	Robust Standard Error
Log(# of Households)	0.039	0.092
Log(Population Density)	0.612	0.108
% of Students in Elementary Grades	-1.142	0.667
% of Students in Middle School Grades	-1.652	1.098
Log(# of Households in Neighboring Districts)	0.149	0.124
Log(Population Density in Neighboring Districts)	-0.187	0.131
% of Students in Elementary Grades in Neighboring Districts	0.287	1.233
% of Students in Middle School Grades in Neighboring Districts	-0.008	0.965
Average Student Test Score	0.233	0.068
Neighbors' Mean: Avg. Student Test Score	-0.001	0.143
Neighbors' Minimum: Avg. Student Test Score	-0.086	0.073
Average House Value	0.215	0.146
Neighbors' Mean: Average House Value	-0.397	0.251
Neighbors' Minimum: Average House Value	0.490	0.245
Median Income	0.108	0.183
Neighbors' Mean: Median Income	-0.028	0.262
Neighbors' Minimum: Median Income	-0.530	0.218
% of Adults who are high school dropouts	-0.142	0.098
Neighbors' Mean: % of adults who are high school dropouts	-0.043	0.181
Neighbors' Minimum: % of adults who are high school dropouts	-0.151	0.146
% of Adults with Bachelor's Degree	-0.259	0.129
Neighbors' Mean: % of Adults with Bachelor's Degree	-0.115	0.174
Neighbors' Minimum: % of Adults with Bachelor's Degree	0.072	0.167
Public School Operating Expenditures per Pupil	0.162	0.074
Neighbors' Mean: Public School Operating Expenditures per Pupil	-0.270	0.190
Neighbors' Minimum: Public School Expenditures per Pupil	0.124	0.165
Locally-funded Public School Expenditures per Pupil	-0.124	0.072
Neighbors' Mean: Locally- funded Public School Expenditures per Pupil	0.299	0.170
Neighbors' Minimum: Locally-funded Public School Expenditures per Pupil	-0.326	0.157
Constant Term	7.779	2.986

Notes to Table 2: Estimates are based on a district-level regression containing 331 observations. The R-squared of the regression equals .534

Table 3: Mean Marginal Effects from Probit Models Predicting whether Districts Rejected any Transfer Applicants

Difference between District's Own Z-score for that characteristic and the minimum Z-score among the district's neighbors	(1)	(2)	(3)	(4)
Average Student Test Score	.019			
	(.010)			
Average House Value		.060		
		(.019)		
Median Income			.045	
			(.022)	
% of Adults with Bachelor's Degree				.062
				(.019)
Other Independent Variables				
Log(Number of Households)	.054	.052	.052	.035
	(.013)	(.013)	(.014)	(.014)
Historically High Enrollment	.046	.009	.027	.010
	(.034)	(.032)	(.034)	(.032)
Transfer Demand divided by Number of Residential Students	.047	.113	.129	.088
	(.216)	(.194)	(.188)	(.186)

Notes to Table 3: Each column displays mean marginal effects based on estimation of a probit model using 327 district-level observations. The corresponding standard errors for these mean estimated marginal effects are calculated using the delta method and displayed below in parentheses. The marginal effects for the Historically High Enrollment indicator variable are based on moving from a value of zero to a value of one. The Historically High Enrollment indicator variable equals one if the school district's student enrollment was at a five-year high.