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# Supply and Demand in a 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, I find evidence that districts also constrain the supply of transfer spaces due to concerns about potential negative peer effects. These findings contribute to the literature concerning the parental demand for schooling and provide information concerning the possible effects of the No Child Left Behind Act's school choice provisions on the redistribution of student enrollments.

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## 1. Introduction

Many parents consider the local public schools when choosing their residence, and this behavior is often referred to as traditional or Tiebout (1956) choice. Parents may also consider the availability and affordability of private schools. The debate over school choice should thus not be framed as whether parents and their children should have any school choice, but rather to what extent schooling options should be formally expanded. While school choice debates often focus on voucher programs and charter schools, intra- and inter-district transferring remain the most frequently used type of 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 any school designated as not meeting state standards for student achievement. In addition, thirty-two states have formal inter-district open enrollment programs that allow students to transfer to a public school outside of their residential district (Education Commission of the States, 2003). This paper examines determinants of the demand and supply of transfer spaces in this type of inter-district public school choice program.

The previous literature explicitly examining participation in public school choice has not been able to separate supply side and demand side factors.[1] Since transfer rates reflect the minimum of the supply of transfer spaces and the number of students who would like to transfer,

[1] While 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), the accuracy of the survey responses is questionable. 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, often differ from their reported concerns. They found that parents in the Washington D.C. area, especially parent's 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 analysis in Section 6.3 of this paper reveals that districts often cite capacity concerns even when other factors appear more important in their decision.

there is a serious identification problem if one regresses transfer rates on explanatory variables. Many of these variables may affect both the supply 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.[2] The reduced-form relationship between transfer rates and mean test scores will thus reflect some combination of a positive effect of test scores on demand and a negative effect of test scores on supply.

Using district-level data describing both student transfers and transfer application rejections, this paper separately estimates the demand and supply of transfer spaces in an inter-district choice program. I examine the demand and supply for transfer spaces in the nation's oldest statewide inter-district choice program, Minnesota's open enrollment program. I measure transfer demand for each district by finding the sum of incoming transfer students and rejected transfer applications. This may understate actual demand in some cases, because any type of application process is potentially subject to endogeneity whereby individuals are less likely to apply if they anticipate rejection. However, as discussed further below, it appears that few interested individuals were dissuaded from applying to participate in this particular program.

The results concerning the demand to participate in a choice program are somewhat similar to the findings of the house price capitalization literature. In this 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

[2] 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.

demand from families with school-aged children (Barrow, 2002).[3] The results below suggest that similar factors influence families' demand to reside in one district but transfer their child to a non-residential school district. Transfer demand is greatest when the mean student score on standardized tests in a district is much greater than in a neighboring district.[4] Student test scores are slightly stronger predictors of demand than are 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 a much rougher measure of productive schools: whether a school produces higher than expected mean student test scores.

Yet the effects of test scores on transfer demand do not tell the entire story; students' academic performance also influences 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 suggest that some districts cap the inflow of transfer students due to reasons other than strains on capacity. Large differences in student test scores between the district and one of its neighbors appear to be the most likely explanation for this behavior. Controlling for the level of transfer demand, a district with substantially greater mean student test scores than a neighboring district is significantly more likely to reject transfer applicants. While the rejection rates are low in Minnesota, rejections could occur more frequently in states with greater spatial heterogeneity, where neighboring districts differ substantially in their demographics.

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

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

The next section describes Minnesota's open enrollment program in more detail, Section 3 discusses possible influences on the demand and supply of transfer spaces, Section 4 describes this paper's data, Section 5 discusses the potential endogeneity of transfer applications, and Section 6 describes the empirical methods and results. Finally, Section 7 discusses the implications of these findings for the design of school choice programs. Unless choice programs require that transfer applications are only rejected based on specific capacity formulas rather than based on the discretion of local school administrators, participation in inter-district open enrollment and intra-district programs such as those from *No Child Left Behind* may be low in magnitude and rarely characterized by students transferring to more productive schools.

## 2. Minnesota's Open Enrollment Program

Minnesota's inter-district open enrollment program allows children to attend public schools located outside their residential district. The program became statewide in 1991, and participation rates rose steadily throughout the early 90's. In 1991, the average district lost about 2% of its residential students to open enrollment, by 1997 this average climbed to 7%, and in 2000 the average was 6%. Under the program, all students are entitled to attend their residential school district, but they may also apply directly to other school districts if they would like to transfer. Students are free to simultaneously apply to several non-residential school districts.

Districts with net inflows of transfer students likely enjoy small financial gains, while districts with net outflows of transfer students likely suffer small financial losses. When a student transfers to a non-residential district, the residential district experiences a financial loss equal to the non-compensatory aid per pupil that it receives from the state. The receiving district gains an amount equal to the non-compensatory state aid per pupil that it receives from the state.

In 1999-2000, the year of this paper's analyses, non-compensatory aid per student equaled about $3600,[5] varying across districts by only a couple of hundred dollars. This financial award was far less than the average district's per pupil spending in Minnesota (about $7,000), so that districts with net inflows of transfer students experience a decline in their revenues per pupil served. However, due to economies of scale, this financial award often exceeds the average marginal cost of serving these additional students. This may explain why, as described in Section 6.3, districts rarely reject transfer applicants.

Districts may not selectively accept transfer applications. However, the law allows districts to reject applications due to strains on capacity. If the district feels that it has room for some but not all of the transfer applicants, 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 only recently began collecting annual information from the districts concerning open enrollment rejections.

In addition to the inter-district open enrollment program, Minnesota offers a variety of other types of school choice programs. Minnesota offers charter schools which are legally independent from public school districts, receive state funding but no local funding, and may be started by one or more licensed teachers.[6] The majority of the charter schools existing during 2000 were located in the two school districts that serve the twin cities of Minneapolis and St. Paul. These two districts also offer a wide array of intra-district school choice, such as magnet schools that are attended by students from various neighborhoods within each city. Since these

[5] Non-compensatory state aid for high school students was slightly greater than for elementary students. When special education students transfer, the residential district may have to 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 regular students.

[6] Charter school policy information provided by the Education Commission of the States at http://mb2.ecs.org/reports/Report.aspx?id=65.

extensive charter school and magnet school programs are mostly limited to two school districts, the presence of these programs likely has only a minor effect on this paper's district-level analyses. In order to further 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. Theoretical Sources of the Demand and Supply of Transfer Spaces

### *3.1 Demand*

Demand for inter-district choice occurs when a family chooses to reside in District A but wishes to send their child to District B. This would occur either due to attempts to free-ride or due to idiosyncratic preferences. Free-riding is related to vertical competition between school districts, with some districts offering a better product. Idiosyncratic preferences are related to horizontal competition, with districts offering differentiated products. Under the free-riding case, District B's public schools are generally considered better, so there is a house price premium associated with the right to attend the more popular public schools. Although an inter-district transferring program decreases this type of house price premium (Reback, forthcoming), it will probably not eliminate it. While some non-resident students may be able to transfer into District B, local residents are guaranteed the right to use District B's schools whereas non-residents must apply to transfer and hope that they are accepted. Rather than pay this premium, the family chooses to reside in District A and take their chances on being able to free-ride from District B.

Another possibility is that there are idiosyncratic preferences for schools and for housing. Even if the schools located in District B are not generally considered better than the schools

located in District A, this family might feel that District B would serve their child better than District A. Perhaps they chose to live in District A for other reasons than avoiding a housing premium related to school quality; reasons such as proximity to jobs or their schooling preferences for the child's siblings. This idea deviates from a pure Tiebout model (1956), in which there are enough communities to allow people to sort into neighborhoods in which residents have homogenous preferences. However, idiosyncratic preferences are probably very relevant to actual behavior.

When examining which district-level factors may increase the demand to transfer into a district, one should thus consider factors possibly related to a district's schools generally being considered higher quality than those in a nearby district *and* factors that could be related to idiosyncratic preferences. For the former category, factors such as student test scores, student race, the socio-economic status of students' families, and per pupil spending could influence demand by affecting families' ratings of schools. Test scores have been found to influence housing premiums, so they are also a likely candidate to influence the transferring that occurs as households try to avoid these premiums. Specialized programs or unique features of a school district, such as the presence of vocational programs or successful sports programs, may be related to idiosyncratic preferences causing demand to transfer into the district. Idiosyncratic preferences may also be due to subjective differences in opinion concerning overall school quality, a phenomenon that a researcher would probably not be able to predict.

*3.2 Supply*

One factor influencing the supply of district transfer spaces is the net financial benefit from receiving transfer students. School district administrators may anticipate the average marginal cost of serving additional students and assess whether the average short-run marginal

cost of serving these students is greater than the financial award of about $3,600 per student. While there is limited concrete evidence concerning the marginal cost of serving additional students, the cost of additional textbooks and a slightly greater student-teacher ratio would probably be less than $3,600 in most cases. However, the short run marginal cost may in fact exceed $3,600 if student enrollments are already approaching historical highs for the district. In the short run, when factors of production such as the number of classrooms cannot be easily adjusted, it may be very costly to increase total enrollment beyond traditional levels.

Another factor possibly influencing the supply of transfer spaces is indirect costs associated with peer effects, the effects of incoming transfer students on the educational performance of other students. Even if peer effects do not actually occur, the mere anticipation of peer effects by a school district administrator (or by local parents who influence the administrator) is enough to influence that administrator's decision concerning the preferred supply of transfer spaces. Although an administrator is not allowed to selectively admit transfer students, the administrator may receive a certain pool of applications and decide that the types of students who would likely transfer are students associated with negative or positive peer effects. One might thus observe a smaller supply of transfer spaces in cases when a district is much 'better' than a neighboring district in terms of things like test scores or parents' socio-economic status.

An additional factor which may influence the supply of transfer spaces in a district is compliance with the state's open enrollment law. According to the law, the district is only supposed to limit transfer spaces due to capacity concerns. Despite limited regulation from the state, a district administrator may feel that she or he should leave some minimum number of transfer spaces available so that the district is in compliance.

The supply of transfer spaces may also be influenced by concerns over local housing values. When students are able to transfer to a more popular school district, the erosion of the housing premium can decrease the housing prices in that district (Reback, forthcoming). There are two negative implications for the district administrator, a smaller local property tax base and the possibility of angry homeowners who blame the administrator for a decrease in their assets.

Finally, concerns over school reputation may influence the supply of transfer spaces. Incoming transfer students may create a positive advertising effect. If there is asymmetric information, transferring may increase the overall popularity of the school district by sending a message to other parents that some parents think that this is a superior school district. This increased popularity may mitigate some of the negative effects on property values described above.

*3.3 Equilibrium*

Unlike most other markets, there is no price mechanism to guarantee that the market for inter-district transfers clears. The actual number of transfer students entering a district will equal the minimum of the supply and demand for transferring. Based on the house price capitalization literature, a district with greater student test scores than a neighboring district would be likely to receive a high level of demand due to people attempting to free-ride. On the other hand, concerns over negative peer effects or negative capitalization effects may cause these same districts to provide a relatively low supply of transfer spaces. The theoretical equilibrium relationship between transferring and factors such as student test scores is thus ambiguous, and explaining the observed equilibrium requires a separate analysis of demand and supply.

## 4. Data

This paper combines several, school-district level data sets provided by the Minnesota Department of Education. In order to capture the long-run transfer equilibrium, after general equilibrium effects related to families' location decisions have occurred, 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.[7] 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). The data do not reveal the number of districts that transfer out of a particular district and into another particular district, but simply reveal the total number of exiting and incoming students in each district. 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

[7] 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.

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 200-2001.[8] The vast majority of school districts do not reject any transfer applications in a particular year. Only 8%, 8%, and 10% of responding districts reject *any* new applications in 1998-99, 1999-2000, and 2000-2001 respectively, and some of these might have accepted some new applicants at the same time that they rejected others. Only five districts did not receive any transfer students during 1999-2000. The data do not provide any information about characteristics of the students applying to transfer. The presence of rejections data from the years immediately surrounding 1999-2000 is useful for conducting the analysis below given the potentially endogenous nature of any type of application.

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, (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. Table 1 displays descriptive statistics for variables used in the regression analyses. Out of the 345 districts in operation during the 1999-2000 school year, 2 newly formed districts are omitted from the regression analyses of transfer demand due to missing values for several variables, 7

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

other districts are omitted due to missing financial data or test score data, and 7 others are omitted because they did not respond to the transfer applicant rejections survey.

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. These non-responding districts may have mistakenly believed that they need not return the survey form unless they had rejected any applicants.

**5. How Endogenous were Applications?**

In general, costly 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.

The cost of applying to transfer to another district was fairly low. There were not any application fees, and applying to one district did not preclude applying to others. Thus, the only costs associated with applying would be the cost of time to obtain and submit an application, possibly the cost of a stamp to mail the application, and the potential emotional disappointment associated with a rejection. Since rejections were not made based on personal student characteristics, the emotional disappointment of a rejection may not have been high for most parents compared to the perceived benefits from a successful transfer application. Given these

fairly low costs, most parents likely would apply to transfer their child even if they were uncertain about whether their child should transfer or if they did not feel very strongly about the transfer opportunity. This may be particularly true since, as described below, that the vast majority of districts did not reject any transfer applicants.

Examining a subset of districts, those neighboring Minneapolis, there is some empirical evidence which supports the idea that interested applicants did apply during the sample period. One year after this paper's sample period, there was an out-of-court settlement of an adequacy lawsuit brought by the Minneapolis branch of the NAACP against the state of Minnesota. As a result of this settlement, students from low income families residing in the Minneapolis urban school district were guaranteed access to a minimum number of transfer spaces in nearby, suburban districts. In particular, students were eligible to transfer to the suburban districts if their family's income was sufficiently low that the student qualified for federally subsidized lunches. Participants in this new program may or may not have transferred across districts through regular open enrollment if this new program did not exist. Some participants in this new program may have been induced to participate due to the new advertising or larger overall participation rates created by the program. Other participants in this new program would have applied and been rejected through regular open enrollment applications. Finally, some participants in this new program would not have bothered to apply through regular open enrollment because they would have anticipated rejection.

This latter category is the potential cause for concern in this paper's analyses of open enrollment demand, and it does not appear that many students fit into this category. Table 2 compares 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 new program was first in effect.[9] While the suburban districts had recruitment targets that may have induced students to temporarily participate, Table 2 reveals that the number of these students who used the 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 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.[10] While this analysis only covers a few suburban districts, it is noteworthy that summing the number of incoming transfers and the number of rejected applicants does not appear to cause one to systematically underestimate district-level demand.

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 twenty-seven districts that rejected applicants in 1998-1999 also rejected applicants in 1999-2000, while sixteen out of twenty-six districts that rejected applicants in 1999-2000 also rejected applicants in 2000-2001. Fortunately, all of the qualitative results below concerning transfer demand in 1999-2000 remain similar when one controls for rejections made during the previous year and

[9] The number of Title I transfer students in 1999-2000 may slightly overstate the number of Title I transfer students who resided in the Minneapolis district, because incoming Title I transfer students in the suburbs may have come from other suburban district, though probably not very many due to the higher incomes generally found in the suburban districts.

[10] The total number of rejections for one of these two districts was approximately as large as the increase in incoming transfers reported in Table 2. (As a condition of receiving the raw, district-level rejections data, I agreed not to report the number of rejections by district.)

rejections made during the following year. This confirms that the results are not biased from a transitory component of endogenous applications.

## 6. Empirical Analyses

The first subsection below describes rates of participation in open enrollment and describes the districts that experienced relatively large inflows or outflows of transfer students. 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. The final subsection describes the effect of transferring on the distribution of students across districts, including the impact on racial segregation across school districts.

### *6.1 Descriptive Statistics*

Transfer rates for various types of student populations are displayed in Table 3, along with the populations' overall representation in Minnesota public schools. Non-white students are less likely to participate, students from low income families (eligible for federally subsidized school lunches) are slightly more likely to participate, and special education students are slightly less likely to participate. Examining entrants into lotteries for intra-district high school transferring in Chicago, Cullen, Jacob, & Levitt (2003) also observe lower participation rates among non-white students, but found lower participation among students from low-income families as well.

Table 4 shows characteristics of districts that were strongly affected by open enrollment transferring. All types of high impact districts, both those gaining and losing students, tend to have less wealthy residents than the median district in the state (displayed in Table 1). This may be due to wealthier families having an easier time satisfying their schooling preferences through traditional Tiebout choice and private schooling options. The forty-four districts with net gains

in transfer students equal to at least ten percent of their residential enrollments tend to have higher test scores and per pupil spending than the median district in the state, but are fairly similar along other dimensions. Regression analyses are necessary to parse out which of these variables are actually influencing transfer demand. Many of these variables are highly correlated and transfer demand may be strongly influenced by districts' characteristics relative to neighboring characteristics.

### *6.2 Demand for Public School Transfer Spaces*

The unique feature of this data set is that one can observe both transfer patterns and rejection rates. I estimate the demand for transfer spaces in a district as the sum of incoming transfer students and the number of rejected applicants for that year. As discussed in Section 5, the sum of actual transfers plus rejected applicants is likely close to the actual demand because few interested people would have refrained from applying. For the analyses of transfer demand, several control variables account for structural differences across districts likely related to the number of students seeking to transfer into the district: the number of households in the district, the population density in the district, and the fraction of public school students enrolled in elementary grades (Kindergarten through grade 5) or middle school grades (grades 6 through 8). The model used for analyzing transfer demand into district j for the 1999-2000 school year is thus:

$$(1)\ \log(\text{Demand}_j) = \alpha + \beta_1 \log(\#\text{ of Households}_j) + \beta_2 \log(\text{Population Density}_j) + \beta_3(\%\text{ of Students in Elementary Grades}_j) + \beta_4(\%\text{ of Students in Middle School Grades}_j) + X\Omega_j + \varepsilon_j.$$

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 qualitative 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 X vector contains various combinations of independent variables that might predict demand, and the purpose of this analysis is to determine the relative importance of these variables. In order 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 characteristics of that district and characteristics of neighboring districts. Vector X therefore includes not only values for district j, but also Z-score of the minimum value among district j's neighbors and Z-score of the population size-weighted mean value for district j's neighbors. In the full model, Vector X includes all of the district-level variables listed in Table 1, including 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. 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. Since 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.[11]

Additional regression models, available in an appendix upon request, add control variables for enrollments in private schools and charter schools located in the district or in one of

[11] 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 I divided 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.

the district's neighbors. Controlling for the availability of these alternative school choice mechanisms does not alter any of the qualitative results below.

*6.2.1 Demand Related to Free-Riding*

Table 5a reveals the explanatory power of various types of variables when they are included alone. The focus of Table 5a is on variables that might be related to the free-riding type of transfer demand discussed in Section 3.1, 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 5a 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 43.4% of the variation in demand, so the bottom row of Table 5a 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 home 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. 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 .456, .447, .or 464, 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.

Figure 1 illustrates how the demand for transferring varies based on the mean household income in districts. In order to adjust for differences in population density, Figure 1 defines district demand as the number of incoming transfers divided by the number of residential students. One can see in Figure 1 that districts tend to experience high demand when median household incomes is in a higher range than in one of the neighboring districts. Figure 1 also shows that districts tend to be clustered around other districts with similar median household incomes, so that the demand for transferring could be even greater for public school choice programs in geographic areas more spatially heterogeneous than Minnesota.

Column 8 of Table 5a reveals that the total spending per pupil variables, which adjust for transferring patterns (see footnote 11), do not have statistically significant effects on transfer demand. This is not very surprising, since 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, column 9 of Table 5a focuses on local revenue per residential pupil. Presumably parents would be thrilled 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.

The final two columns of Table 5a 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 a greater number of residents with Bachelor's 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 are 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.

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? The first column of Table 5b displays the regression results when all of the independent variables are included, and the other columns display results when certain variables are omitted. The coefficients generally retain their sign from Table 5a. The R-squared when all variables are included equals .54, a moderate increase from the models of Table 5a that only included one type of predictor. The R-squared does not decrease much when any one type of variable is omitted, partly because these variables are positively correlated. There is a .43 correlation between a district's test scores and its median

income, a .37 correlation between test scores and mean house value, and a .88 correlation between median income and mean house value.

Columns 1 and 2 of Table 5b reveal that the inclusion of the mean test score variables allows one to explain an additional 2% of the variance in demand, even when the model already controls for socio-economic characteristics and per pupil spending. The F-test comparing these two regression models confirms that one can reject the model in column 2 in favor of the model in column 1 at the .01 level of significance. This suggests that transfers flow towards schools with higher outputs, even controlling for schools' inputs. This provides very loose evidence that public school choice could lead students to move to more productive districts, in which students earn higher test scores than one would predict from the included 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. Fourth, while this analysis focuses on student sorting, a school choice program could also directly affect schools' productivity through competition or changes in funding.

*6.2.2 Demand Related to Tastes for Differentiated Products*

It is also worth noting that the incremental validity of the test score measure is not very large, and almost half of the variation in transfer demand remains due to idiosyncratic parental

preferences that are not captured in the data. An important robustness check for these analyses is to determine whether the previous estimates might be biased in either direction by transfer demand related to horizontal competition between districts. 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 from Table 5b. For example, the estimated coefficient on the test variable in this expanded model equals .225 with a .069 standard error, as opposed to .216 with a .067 standard error in the first column of Table 5b. The estimated coefficients of these additional variables when they are added to the full model (column 1 of Table 5b) are displayed in Table 6. 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. When neighboring districts spend a relatively large fraction of their

budgets on community service programs, there is less demand to transfer into a district. This may be due to increased loyalty to the local, residential schools in districts that have greater interactions with their communities. 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 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.

### *6.3 The Supply of Transfer Spaces*

Unlike demand, one cannot precisely estimate the supply of transfer spaces; one only observes 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 closed-ended survey, districts gave reasons for these rejections which 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 (2003) 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.

Table 7 describes characteristics that influence whether a district is more likely to reject any transfer applicants, sorted by the magnitude of demand for transfer spaces in the district. Table 7 focuses on two characteristics that are important determinants of whether the supply of spaces is binding: (1) whether the district was at maximum capacity in terms of enrollment history from the previous five years, and (2) whether the district's mean test scores are at least one standard deviation greater than one of its neighboring districts. Districts that reject applicants are significantly more likely to be at a historically high enrollment level or to have much higher test scores than a neighboring district. In fact, 69% of the districts that rejected transfer applicants met at least one of these two conditions, while only 33% of the districts that did not reject any applicants met one of these two conditions. As shown in column 4 of the bottom panel of Table 7, these differences usually remain statistically significant when one compares districts with similar levels of transfer demand. Figure 2 illustrates the relationship between mean student test scores in each district and whether the district rejected any transfer applicants. One can observe that many of the districts that rejected transfer applicants had much greater test scores than at least one nearby district. Along other dimensions, districts that rejected or did not reject applicants were not significantly different from each other. Large gaps

in average house values or in median household income between a district and one of its neighbors were only slightly more common among districts that rejected transfer students.

### *6.4 Effects of Student Transferring on Segregation Across School Districts*

Estimates of the effects of incoming transfer students on various forms of segregation across districts are displayed in Table 4. Due to the lack of data concerning exit patterns, these estimates only capture the impact of destination school district characteristics on segregation, as if any student who exits under the open enrollment program would not have attended any Minnesota public school in the absence of the program. Another important caveat is that this analysis does not consider the effects of the school choice policy on residential sorting, which may in turn influence the distribution of residential students across public school districts (Nechyba, 2003). The first column of Table 4 reveals that, of the three student subgroup categories, only non-white students were substantially more likely to choose a school district with higher representation of that group than the median district. The next two columns of Table 4 show indexes of dissimilarity based on net-of-transfer enrollments (i.e., observed enrollments in light of the policy) and based on residential enrollments (i.e., students who reside in the district and remain in the district's public schools). Dissimilarity indexes may be interpreted as the minimum fraction of students that one could reassign in order for the fraction of students in the subgroup in each district to equal the fraction of students in this subgroup in the entire Minnesota public school system.[12]

The estimates in Table 4 reveal a trivial impact of incoming transfer students on statewide segregation across districts by race, family income, or special education status. The

[12] The dissimilarity index equals $\frac{2}{N}\sum_{i=1}^{N} abs\left(x_i - x^{pop}\right)$ for districts i=1,2,...,N, where $x_i$ equals the fraction of students in the minority category among students in district i and $x^{pop}$ equals the fraction of students in the minority category among all students in the statewide population.

changes in the segregation indexes by race and by special education are each less than 2% of the size of the rate of participation in open enrollment. In other words, one would have to re-assign less than 2% of all transferring students in order to achieve similar segregation patterns as if these students did not choose any Minnesota public school district. For family income, defined based on whether the student is eligible for federally subsidized school lunches, this value is less than 4%.

## 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, the quality of specific programs such as science or art, and the popularity of athletic programs.

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 schools' supply-side decisions could easily undo parental demand for districts with high test scores. Given similar levels of demand, districts with substantially greater test scores than a neighboring district are more likely to reject transfer applicants. Though these districts claim that they are making rejections for capacity reasons, concern over negative peer effects appears to influence their marginal decision making. The rejection rates in Minnesota are sufficiently low so that, on average, transfer student enter districts with a higher mean student test scores their residential districts. However, for other choice programs and in other geographic areas, one could imagine the supply-side forces being sufficiently strong that the vast majority of transfers that actually occur do not allow students to enter schools with higher socio-economic characteristics or higher productivity than the schools in their residential district.

This research topic is particularly timely, because the No Child Left Behind may soon dramatically increase the frequency of public school transfer applications. Under the No Child Left Behind Act, 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. 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. 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 brief tenure. Due to the broad and arguably misconceived definition of a failing public school,[13] many schools have faced this designation and thus have been subject to the loss of their students. However, many non-failing schools are not eager to

[13] Under the No Child Left Behind accountability systems, student test scores only contribute to school ratings in the form of pass rates. The ratings therefore do not reflect value-added concepts of school quality, based on the educational progress of students at the school. Furthermore, more diverse schools must meet more requirements than less diverse schools, since multiple subgroups of the student population (e.g., Hispanic, White, special education students) must have a pass rate that exceeds the thresholds.

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 their concerns over actual capacity constraints. It may be dangerous to give principals, or even superintendents, discretion concerning which "non-failing" schools are able to receive transfer students; the allocation of students across schools may be largely determined by the political power and philosophies of various principals within the district. This may undermine the logic behind the choice provision, which is presumably intended to allow students to transfer to 'more productive' schools to the extent that the schools receiving transfer students are not overwhelmed by their presence. A strict, centrally-determined formula to determine transfer spaces would be imperfect and less flexible, but it would likely be a much better way to accomplish this goal. While it is questionable whether parental preferences or No Child Left Behind labels are even positively correlated with value-added measures of school productivity, public school choice programs may need to curb local control of the supply of transfer spaces so that actual transferring patterns reflect the school characteristics that parents value most.

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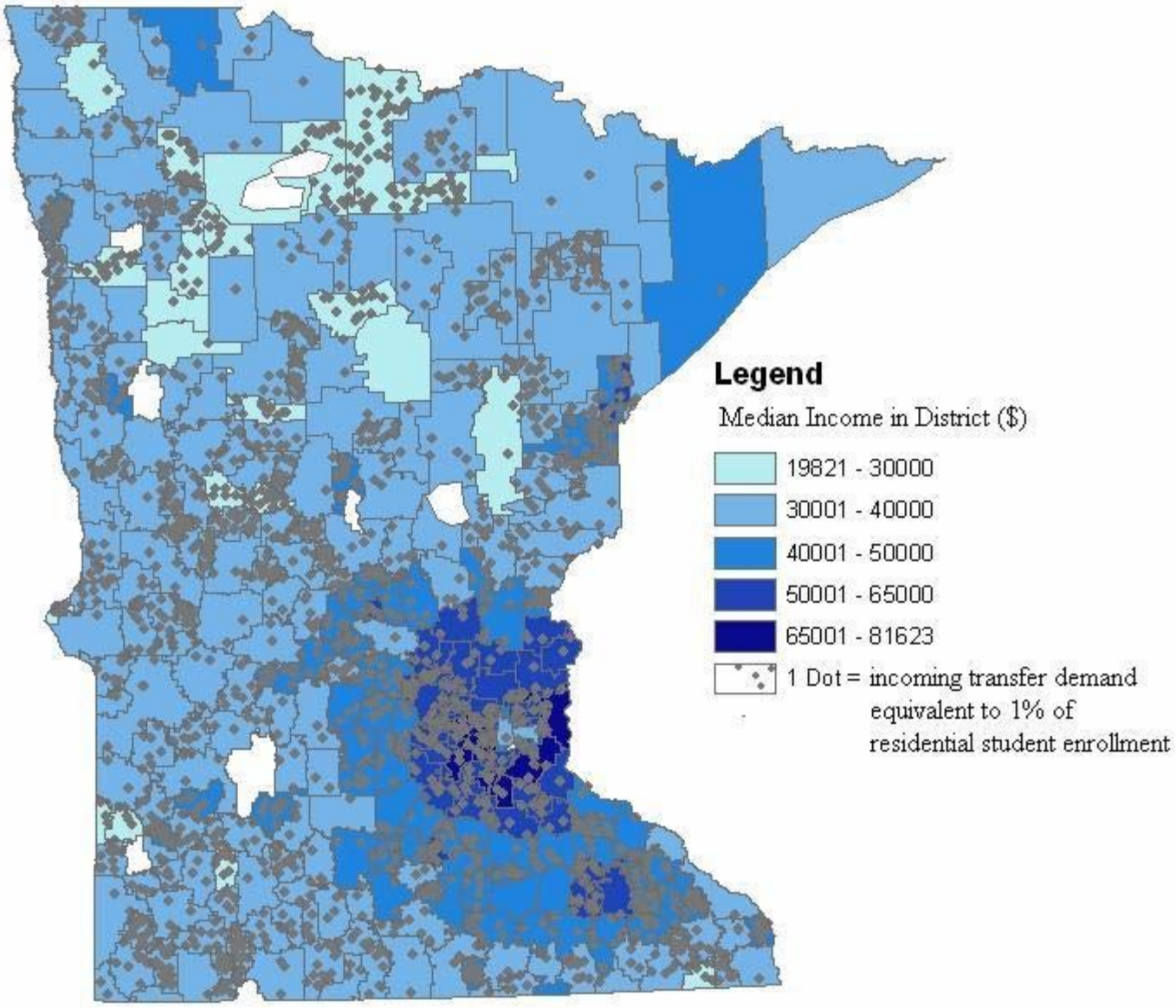
Figure 1: Median Income of School District Residents and the Demand to Transfer into the District




Note to Figure 1: Non-shaded districts are not included in the analysis due to missing values for transfer rejections.

Figure 2: Mean Student Test Scores and District Rejections of Transfer Applicants

Districts with Red Dots Rejected at Least One Transfer Applicant

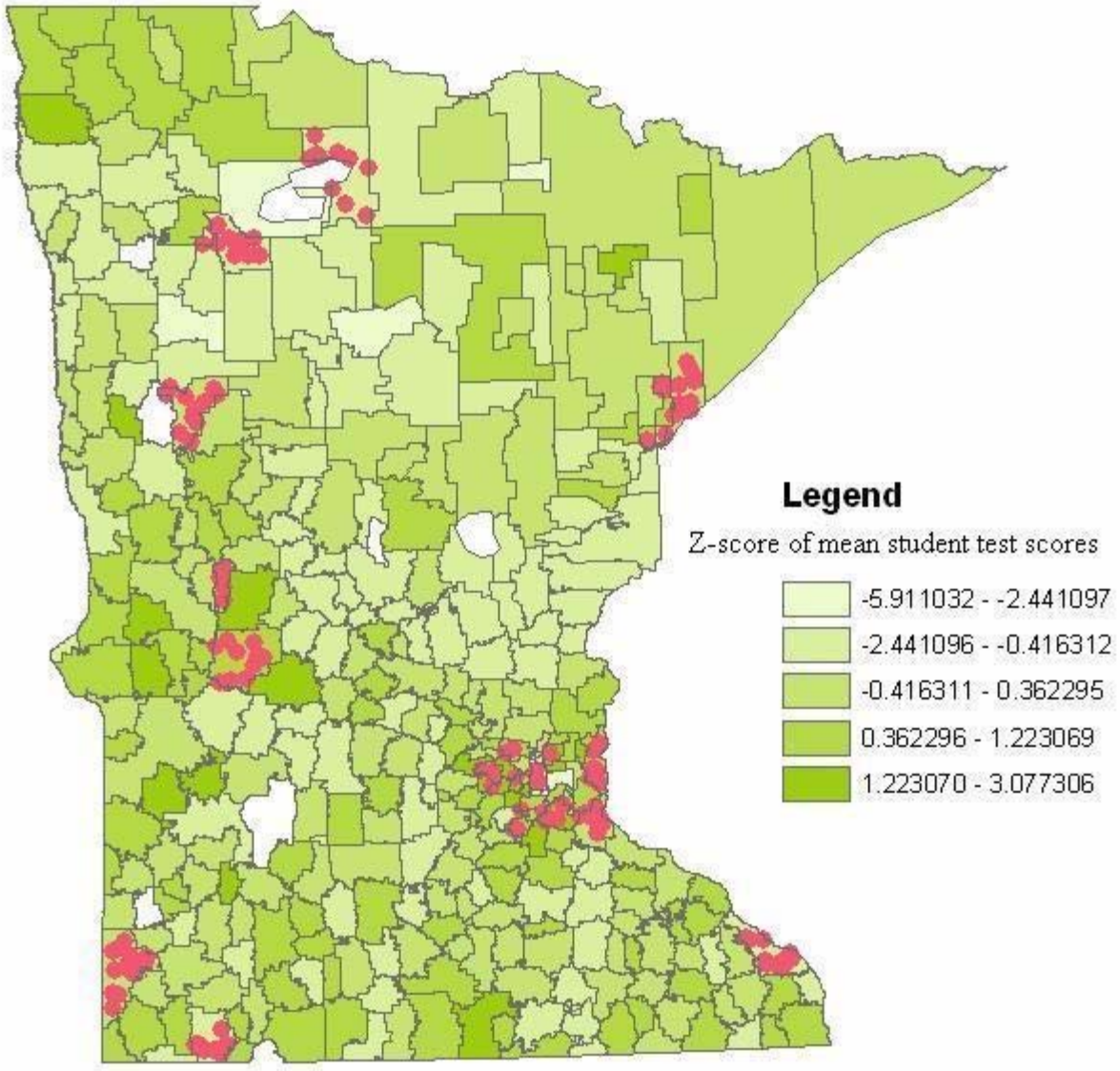


Table 1: Descriptive Statistics for Total Sample

| | Mean | Median | Stand. Dev. |
|---|---|---|---|
| **District characteristics** | | | |
| Number of Incoming Transfer Students | 95.2929 | 60.5 | 110.2781 |
| Number of Outgoing Transfer Students | 94.97633 | 54.5 | 146.7484 |
| Demand for Incoming Transfer Spaces | 96.72781 | 61 | 114.5742 |
| Number of Residential Students | 2494.547 | 1071 | 5279.731 |
| Number of Households | 5590.192 | 2182.5 | 13097.26 |
| Population Density (people per sq. ft.) | .0001008 | .0000096 | .0003062 |
| % of Students in Elementary Grades | .432704 | .4284715 | .0862175 |
| % of Students in Middle School Grades | .2391431 | .2380984 | .0522598 |
| Z-score of Average Student Test Score | .0014751 | .082897 | 1.001113 |
| Z-score of Average Student Math Test Score | .0013252 | 0396918 | 1.001184 |
| Z-score of Average Student Read. Test Score | .0015399 | .0747998 | 1.00108 |
| Mean House Value | 90144.34 | 82989.16 | 36669.42 |
| Median Income | 41296.12 | 38152.5 | 10841.7 |
| % of Adults with a Bachelor's Degree | .1186143 | .1031131 | .0556751 |
| % of Adults without High School Diploma | .1712417 | .1743508 | .0516438 |
| Public School Spending per Pupil | 6565.707 | 6407 | 950.0135 |
| Local Public School Revenue per Pupil | 2240.553 | 2038.05 | 962.6901 |
| % of Spending Spent on Vocational Ed. | .0212 | .0188 | .0156 |
| % of Spending on Community Service | .0342 | .0297 | .0185 |
| Indicator Variable for a Hockey Team Going to the State Finals Recently | .115 | 0 | .320 |
| Indicator Variable for a Football Team Going to the State Finals Recently | .055 | 0 | .227 |
| **Household-weighted, district-level averages for neighboring districts** | | | |
| Z-score of Average Student Test Score | .0513066 | .0794683 | .4364348 |
| Z-score of Average Student Math Test Score | .0481011 | .0712776 | .4445744 |
| Z-score of Average Student Read. Test Score | .0545121 | .0790842 | .4443659 |
| Mean House Value | 41626.22 | 37704.32 | 9650.818 |
| Median Income | 88597.03 | 82268.16 | 29231.52 |
| % of Adults with a Bachelor's Degree | .1296416 | .1135631 | .0499127 |
| % of Adults without High School Diploma | .1646756 | .171966 | .0416851 |
| Public School Spending per Pupil | 6544.669 | 6419.316 | 566.6304 |
| Local Public School Revenue per Pupil | 2262.957 | 2145.637 | 623.3891 |
| **Minimum district-level value among neighboring districts** | | | |
| Z-score of Average Student Test Score | -.5897366 | -.3981501 | .7546475 |
| Z-score of Average Student Math Test Score | -.6421816 | -.4827743 | .7422908 |
| Z-score of Average Student Read. Test Score | -.5942655 | -.3951343 | .7838065 |
| Mean House Value | 35460.94 | 34044 | 7769.547 |
| Median Income | 70027.19 | 65310.77 | 22718.14 |
| % of Adults with a Bachelor's Degree | .0843064 | .0795503 | .0328607 |
| % of Adults without High School Diploma | .1324135 | .1384348 | .0424339 |
| Public School Spending per Pupil | 5864.251 | 5824 | 467.5225 |
| Local Public School Revenue per Pupil | 1530.605 | 1486.95 | 538.1596 |

**Table 2: Transfers of Low Income Students to Districts in Suburbs of Minneapolis, Before and after these Districts were Forced to Admit These Students**

| Name | (1) Incoming low-income students in 1999-2000 (main sample period, before districts were forced to admit them) | (2) Incoming low-income students from Minneapolis who attend in both 2001-02 and 2002-03 |
|---|---|---|
| Richfield | 46 | 23 |
| Edina | 28 | 49 |
| St. Louis Park | 23 | 24 |
| Hopkins | 35 | 22 |
| Robbinsdale | 150 | 104 |
| Wayzata | 17 | 31 |
| Columbia Heights | 31 | 32 |
| St. Anthony | 25 | 16 |

Sources: Column (1) is based on open enrollment transfer data provided by the Minnesota Department of Children, Families & Learning and Column (2) is based on data presented by Palmer (2003).

**Table 3: Composition of Open Enrollment Participants**

| | Fraction in Public School Student Population | Fraction in Open Enrollment Transfer Student Population |
|---|---|---|
| Minority (non-white) students | 15.7% | 11.8% |
| Low-income Family students (eligible for subsidized lunch) | 25.9% | 26.9% |
| Special Education students | 11.1% | 12.5% |

Source: Based on data sets provided by the Minnesota Department of Children, Families & Learning.

**Table 4: Characteristics of High Impact School Districts**

| | Districts with at least 10% of their residential students exiting | | Districts with entering students equals to at least 10% of their residential student enrollments | | Districts with net gains of transfer students equal to at least 10% of their residential enrollments | |
|---|---|---|---|---|---|---|
| Number of Districts | 66 | | 77 | | 42 | |
| | Mean | Median | Mean | Median | Mean | Median |
| Variable | | | | | | |
| Number of Incoming Transfer Students | 44.85 | 31.50 | 118.22 | 92.00 | 149.1 | 108.5 |
| Number of Outgoing Transfer Students | 101.17 | 73.50 | 41.27 | 28.00 | 30.12 | 22.50 |
| Number of Residential Students | 741.95 | 522.50 | 648.79 | 457.00 | 653.74 | 373.00 |
| Number of Households | 1660.00 | 1142.50 | 1422.60 | 925.00 | 1570.71 | 882.50 |
| Population Density (people per sq. ft.) | 0.0000359 | 0.0000067 | 0.0000723 | 0.0000064 | 0.000125 | $6.43*10^{-6}$ |
| % of Students in Elementary Grades | 0.43 | 0.42 | 0.43 | 0.42 | 0.44 | 0.42 |
| % of Students in Middle School Grades | 0.24 | 0.24 | 0.24 | 0.24 | 0.24 | 0.24 |
| Z-score of Avg. Student Test Score | -0.18 | -0.17 | -0.09 | 0.02 | -0.02 | 0.08 |
| Z-score of Avg. Student Math Score | -0.20 | -0.23 | -0.06 | 0.01 | 0.04 | 0.08 |
| Z-score of Avg. Student Reading Score | -0.14 | -0.11 | -0.11 | -0.09 | -0.08 | -0.06 |
| Mean House Value | 82480.70 | 75432.34 | 83698.79 | 73421.05 | 83832.66 | 74112.04 |
| Median Income | 37548.41 | 35670.00 | 37871.13 | 36250.00 | 37540 | 35480 |
| % of Adults with a Bachelor's Degree | 0.09 | 0.08 | 0.10 | 0.09 | 0.11 | 0.10 |
| % of Adults without High School Diploma | 0.19 | 0.19 | 0.18 | 0.18 | 0.18 | 0.18 |
| Public School Spending per Pupil | 7265.88 | 6920.06 | 7475.51 | 7070.17 | 7920.81 | 7412.90 |
| Local Public School Revenue per Pupil | 2154.65 | 2106.91 | 2288.36 | 2166.20 | 2514.76 | 2403.81 |
| % of Spending Spent on Vocational Ed. | 0.019 | 0.017 | 0.022 | 0.019 | 0.024 | 0.022 |
| % of Spending on Community Service | 0.029 | 0.025 | 0.032 | 0.025 | 0.036 | 0.025 |
| Indicator Variable for a Hockey Team Going to the State Finals Recently | 0 | 0 | 0 | 0 | 0 | 0 |
| Indicator Variable for a Football Team Going to the State Finals Recently | 0.015 | 0 | 0.026 | 0 | 0.024 | 0 |

Table 5a:
The Demand for Transfer Spaces: Predictive Validity of Various Normalized Factors

| | (1) Median income | (2) Median House Value | (3) Average test score | (4) Average Math test score | (5) Average Reading test score | (8) Per pupil Expenditures | (9) Local per pupil Revenue | (10) % of Residents with B.A. or more | (11) % of Residents without High School Diploma |
|---|---|---|---|---|---|---|---|---|---|
| Within district | .290 | .229 | .163 | .180 | .135 | .017 | -.021 | .034 | -.181 |
| | (.106) | (.089) | (.053) | (.053) | (.053) | (.059) | (.061) | (.091) | (.076) |
| Average of district's neighbors | .046 | -.013 | .095 | .067 | .110 | .030 | .181 | .054 | .015 |
| | (.121) | (.123) | (.158) | (.154) | (.154) | (.060) | (.070) | (.090) | (.110) |
| Minimum of district's neighbors | -.327 | -.153 | -.245 | -.253 | -.218 | -.031 | -.234 | -.149 | -.086 |
| | (.111) | (.114) | (.086) | (.087) | (.083) | (.056) | (.068) | (.081) | (.115) |
| # of Observations | 329 | 329 | 329 | 329 | 329 | 329 | 329 | 329 | 329 |
| R-squared | .456 | .447 | .464 | .467 | .457 | .435 | .457 | .440 | .449 |
| % of Variation in Demand Not Explained by Structural Control Variables That Is Explained by Each Model | 3.9% | 2.3% | 5.3% | 5.8% | 4.1% | 0.2% | 4.1% | 1.1% | 2.7% |

Notes to Table 5a: Independent variables also include the district-level structural control variables in equation (1): 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 5b: The Demand for Transfer Spaces: Incremental Validity of Various Normalized Factors

| | (1) | (2) | (3) | (4) | (5) | (6) | (7) |
|---|---|---|---|---|---|---|---|
| Omitted Variables: | None | Test Scores | Mean House Value | Median Income | Adult Resident Education Levels | Mean House Value and Median Income | Per pupil expenditures and local revenue |
| Log(# of Households) | 0.021 | 0.017 | 0.012 | 0.061 | 0.034 | 0.048 | 0.037 |
| | (0.084) | (0.085) | (0.084) | (0.083) | (0.077) | (0.074) | (0.083) |
| Log(Population Density) | 0.530 | 0.512 | 0.506 | 0.481 | 0.501 | 0.428 | 0.504 |
| | (0.077) | (0.074) | (0.076) | (0.074) | (0.074) | (0.057) | (0.078) |
| % of Students in Elementary | -1.372 | -1.406 | -1.433 | -1.403 | -1.431 | -1.515 | -1.231 |
| Grades | (0.642) | (0.652) | (0.646) | (0.648) | (0.648) | (0.652) | (0.646) |
| % of Students in Middle | -2.127 | -1.966 | -2.096 | -2.024 | -2.235 | -2.186 | -2.016 |
| School Grades | (1.042) | (1.056) | (1.048) | (1.049) | (1.051) | (1.054) | (1.052) |
| Z-score of Average Student | 0.216 | | 0.204 | 0.223 | 0.213 | 0.244 | 0.182 |
| Test Score | (0.067) | | (0.067) | (0.067) | (0.063) | (0.059) | (0.065) |
| Neighbors' Mean: Z-score of | 0.081 | | -0.041 | 0.038 | 0.020 | -0.157 | 0.197 |
| Avg. Student Test Score | (0.219) | | (0.215) | (0.220) | (0.211) | (0.190) | (0.210) |
| Neighbors' Minimum: Z-score | -0.235 | | -0.150 | -0.256 | -0.224 | -0.169 | -0.255 |
| Of Avg. Student Test Score | (0.112) | | (0.107) | (0.112) | (0.112) | (0.095) | (0.111) |
| Average House Value | 0.107 | 0.137 | | 0.186 | 0.107 | | 0.110 |
| | (0.146) | (0.147) | | (0.110) | (0.147) | | (0.146) |
| Neighbors' Mean: | -0.310 | -0.285 | | -0.314 | -0.259 | | -0.126 |
| Average House Value | (0.212) | (0.209) | | (0.156) | (0.208) | | (0.205) |
| Neighbors' Minimum: | 0.379 | 0.259 | | 0.106 | 0.336 | | 0.310 |
| Average House Value | (0.163) | (0.157) | | (0.136) | (0.163) | | (0.162) |
| Median Income | 0.146 | 0.211 | 0.244 | | 0.103 | | 0.080 |
| | (0.187) | (0.189) | (0.140) | | (0.179) | | (0.182) |
| Neighbors' Mean: Median | -0.085 | 0.010 | -0.184 | | -0.046 | | -0.158 |
| Income | (0.236) | (0.238) | (0.161) | | (0.211) | | (0.234) |
| Neighbors' Minimum: Median | -0.422 | -0.510 | -0.206 | | -0.350 | | -0.359 |
| Income | (0.160) | (0.160) | (0.134) | | (0.157) | | (0.158) |

Table 5b continues on next page

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| % of Adults who are high school dropouts | -0.168 | -0.270 | -0.179 | -0.154 | | | -0.139 |
| | (0.096) | (0.093) | (0.097) | (0.096) | | | (0.097) |
| Neighbors' Mean: % of adults who are high school dropouts | -0.072 | 0.077 | -0.077 | -0.065 | | | -0.180 |
| | (0.143) | (0.131) | (0.143) | (0.142) | | | (0.139) |
| Neigbors' Minimum: % of adults who are high school dropouts | -0.158 | -0.211 | -0.121 | -0.094 | | | -0.079 |
| | (0.122) | (0.120) | (0.121) | (0.121) | | | (0.121) |
| % of Adults with Bachelor's Degree | -0.227 | -0.211 | -0.235 | -0.224 | | | -0.227 |
| | (0.122) | (0.120) | (0.122) | (0.118) | | | (0.116) |
| Neighbors' Mean: % of Adults with Bachelor's Degree | -0.180 | -0.146 | -0.168 | -0.201 | | | -0.084 |
| | (0.135) | (0.136) | (0.132) | (0.126) | | | (0.130) |
| Neighbors' Minimum: % of Adults with Bachelor's Degree | 0.026 | 0.032 | 0.030 | 0.007 | | | -0.065 |
| | (0.092) | (0.092) | (0.091) | (0.091) | | | (0.084) |
| Public School Operating Expenditures per Pupil | 0.150 | 0.098 | 0.134 | 0.138 | 0.128 | 0.103 | |
| | (0.068) | (0.065) | (0.068) | (0.068) | (0.068) | (0.067) | |
| Neighbors' Mean: Public School Operating Expenditures per Pupil | -0.166 | -0.159 | -0.157 | -0.111 | -0.156 | -0.107 | |
| | (0.089) | (0.080) | (0.087) | (0.088) | (0.087) | (0.082) | |
| Neighbors' Minimum: Public School Expenditures per Pupil | 0.002 | 0.010 | 0.020 | 0.018 | -0.003 | 0.024 | |
| | (0.057) | (0.058) | (0.057) | (0.058) | (0.057) | (0.057) | |
| Locally-funded Public School Expenditures per Pupil | -0.142 | -0.093 | -0.127 | -0.133 | -0.168 | -0.136 | |
| | (0.073) | (0.073) | (0.073) | (0.074) | (0.072) | (0.071) | |
| Neighbors' Mean: Locally-funded Public School Expenditures per Pupil | 0.301 | 0.331 | 0.301 | 0.302 | 0.245 | 0.216 | |
| | (0.104) | (0.100) | (0.098) | (0.102) | (0.100) | (0.093) | |
| Neighbors' Minimum: Locally-funded Public School Expenditures per Pupil | -0.192 | -0.233 | -0.219 | -0.227 | -0.194 | -0.220 | |
| | (0.088) | (0.089) | (0.083) | (0.087) | (0.082) | (0.076) | |
| Constant | 10.703 | 10.657 | 10.582 | 9.820 | 10.345 | 9.489 | 10.192 |
| | (1.479) | (1.489) | (1.487) | (1.442) | (1.432) | (1.289) | (1.492) |
| Observations | 329 | 329 | 329 | 329 | 329 | 329 | 329 |
| R-squared | 0.538 | 0.517 | 0.527 | 0.523 | 0.512 | 0.493 | 0.512 |

Table 6: Estimated Coefficients of Additional Variables Measuring Districts' Differentiated Services

| | Coefficient | Standard Error |
|---|---|---|
| % of Spending Spent on Vocational Ed. | | |
| District's Own | 0.107 | 0.051 |
| Minimum Neighbor's | -0.039 | 0.057 |
| Average Neighbors' | -0.005 | 0.056 |
| % of Spending on Community Service | | |
| District's Own | 0.020 | 0.066 |
| Minimum Neighbor's | 0.078 | 0.075 |
| Average Neighbors' | -0.176 | 0.088 |
| Indicator Variable for a Hockey Team Going to the State Finals Recently | -0.083 | 0.168 |
| Indicator Variable for a Football Team Going to the State Finals Recently | -0.179 | 0.210 |

Notes: Regression also contains all of the independent variables included in other models (those included in column 1 of Table 5b). The R-squared of this regression equals .554.

Table 7: The Effects of Capacity and Anticipated Peer Effects on the Supply of Transfer Spaces, Sorted by the Magnitude of Demand for the Spaces

| District Transfer Demand Ratio | (1) Number of districts | (2) % with historically high enrollment in 2000 | (3) % with test scores at least 1 S.D. larger than a neighboring district | (4) % with historically high enrollments OR test scores at least 1 S.D. larger than a neighboring district (or both) |
|---|---|---|---|---|
| (A) Districts rejecting any applicants in 2000 | | | | |
| 0 - 1.79% | 9 | 22% | 33% | 33% |
| 1.8% - 3.13% | 4 | 50% | 75% | 75% |
| 3.14% - 4.6% | 3 | 67% | 67% | 100% |
| 4.7% - 7.53% | 2 | 0% | 100% | 100% |
| 7.54% - 12.5% | 4 | 25% | 75% | 75% |
| 12.6 % and up | 4 | 0% | 75% | 75% |
| All ranges | 26 | 27% | 62% | 69% |
| (B) Districts NOT rejecting any applicants in 2000 | | | | |
| 0 - 1.79% | 48 | 21% | 15% | 33% |
| 1.8% - 3.13% | 52 | 13% | 25% | 35% |
| 3.14% - 4.6% | 53 | 11% | 25% | 36% |
| 4.7% - 7.53% | 55 | 20% | 35% | 44% |
| 7.54% - 12.5% | 52 | 12% | 13% | 23% |
| 12.6 % and up | 52 | 13% | 23% | 29% |
| All ranges | 312 | 15% | 23% | 33% |
| Statistical Significance of Test for whether Group A's % is Larger than Group B's % | | | | |
| 0 - 1.79% | - | .46 | .09 | .50 |
| 1.8% - 3.13% | - | .03 | .02 | .005 |
| 3.14% - 4.6% | - | .004 | .06 | .01 |
| 4.7% - 7.53% | - | .75 | .03 | .06 |
| 7.54% - 12.5% | - | .22 | .0008 | .01 |
| 12.6 % and up | - | .78 | .01 | .03 |
| All ranges | - | .06 | .0001 | .0001 |

Notes to Table 6: The district Transfer Demand Ratio equals the number of incoming transfer students plus the number of rejected transfer applicants, divided by the number of residential students in the district.

**Table 8: Effects of Open Enrollment on Segregation across School Districts**

| "Minority" category | % of Transfer Students Who Enter a District with Above Median Representation of the Minority Category | Actual Dissimilarity Index | Dissimilarity Index Removing Incoming Transfer Students | Fraction of all Transferring Students that could be re-assigned to avoid any effect on segregation |
|---|---|---|---|---|
| Non-white students | 93.0% | .2378 | .2383 | 1.3% |
| Low-income Family students | 49.5% | .2223 | .2209 | 3.6% |
| Special Education students | 43.5% | .0417 | .0424 | 1.7% |

Source: Based on data sets provided by the Minnesota Department of Children, Families & Learning.