

Supply and Demand in a Public School Choice Program

Randall Reback*

Barnard College and Teachers College, Columbia University

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.

JEL: I20, I28, H73

Keywords: school choice, inter-district open enrollment, public school demand, Minnesota

* rr2165@columbia.edu. Department of Economics, Barnard College, 3009 Broadway; New York, NY, 10027. Phone: 212-854-5005. Fax: 212-854-8947

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 (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 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

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.

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 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 Relative values of student test scores are slightly stronger predictors of demand

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.

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.

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 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.

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, and there are not any application 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. However, the law allows districts to reject applications due to strains on capacity. 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 only recently began collecting annual information from the districts concerning open enrollment rejections.

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 \$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.⁵

⁵ 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.

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 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 one school district but wants their child to attend public schools in a different district. This section presents a simple model of a household's location decision and the ensuing decision of whether to apply to transfer to other districts. While the theoretical framework focuses on district-level characteristics, ignoring heterogeneity across schools within the same district, some of the empirical analyses below verify that within-district school heterogeneity does not significantly influence the supply or demand for transfer spaces in Minnesota.

Define Q_j as a vector of attributes of the educational services offered by school district j . Let H_j equal a vector of all other attributes of the housing, services, and location offered by district j . For simplicity, assume that all of the housing within district j is homogenous and assume that households only have one child. Define c_{jk} as the transportation costs, in terms of both time and private expenditures,

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

associated with living in district j and sending a child to school in district k . Consider household i 's indirect utility function, $v_{irk}(Q_k, H_r, c_{rk})$, where the household resides in district r and receives educational services from district k . Households may have heterogeneous preferences, particularly with regards to the types of school district characteristics that they value.

If a household resides in district r , then they are guaranteed the option of setting $Q_k=Q_r$. The household must first choose where to live, in light of these characteristics and the equilibrium house prices and tax rates. Suppose that there are three districts: district A, district B, and district C. Without loss of generality, assign district B and district C so that $v_{iAB} > v_{iAC}$. Define $p_k \in [0,1]$ as the expected probability of being allowed to send a child to district k while living in another district. We can then define a household's expected indirect utility from living in district A, bar, $\bar{v}_{iA}$, as follows:

$$\begin{aligned}
 \bar{v}_{iA} &= v_{iAA} \text{ if } v_{iAA} > v_{iAB} > v_{iAC} \\
 (1) \quad &= p_B v_{iAB} + (1 - p_B) v_{iAA} \text{ if } v_{iAB} > v_{iAA} > v_{iAC} \\
 &= p_B v_{iAB} + p_C (1 - p_B) v_{iAB} + (1 - p_C) (1 - p_B) v_{iAA} \text{ if } v_{iAB} > v_{iAC} > v_{iAA}
 \end{aligned}$$

Assuming that a household is risk neutral, it will choose to reside in district r if:

$$(2) \quad \bar{v}_{ir} > \bar{v}_{is} \quad \forall r \neq s$$

The equilibrium supply and demand in this model is complicated, because this household location decision is influenced by the endogenously determined transfer application acceptance probabilities. The analyses in this paper will measure the transfer demand for each district after residential location decisions and these endogenous transfer acceptance probabilities have reached a long-run equilibrium. After the residential location decision, the household must decide whether to apply to transfer to other districts. The household residing in district r will apply to transfer to district j if $v_{irj} > v_{irr}$. This assumes that there are not any application costs, which is true for the program examined in this paper.

Note that there are two general cases in which $v_{irj} > v_{irr}$. First, this could be an attempt of household i to free-ride on district k 's premium services. In this case, the majority of households prefer district k

where housing thus becomes more expensive than in district j. Second, it could be true that $v_{irj} > v_{ijj}$ due to the idiosyncratic preferences of household i, which may have unique reasons for placing a high value on either housing in district j or schooling in district k (or both). Both idiosyncratic preferences and attempts at free-riding could thus explain why people apply to transfer under an open enrollment program.

With N_j households in the remainder of the state outside district j, the demand to transfer into district j in terms of the number of interested transfer students will equal:

$$(3) \quad D_j = \sum_{i=1}^{N_j} I_1(v_{irj} > v_{irr}) ,$$

where $I_1(v_{irj} > v_{irr})$ equals one if $v_{irj} > v_{irr}$ and equals zero otherwise.

Note that transfer demand is defined as the number of applicants, so that a household might demand to transfer into district j from district r but also demand to transfer into district k from district r. By using this type of transfer demand, this paper implicitly focuses on estimating which factors make district j preferred to district r, regardless of the relative merits of transferring to either district j or district k.

Equation (3) suggests that there should be high demand to transfer into district j when the characteristics of district j, Q_j , are relatively desirable compared to nearby districts, while the transportation cost of transferring to district j from a less desirable district is low.

3.2 Supply

An administrator in each district must decide how many inter-district transfer students it is willing to accept. Let T_j equal the number of transfer students enrolled in district j. There will be several potentially important factors determining the level of T_j that district j's administrator prefer.

Define $m_j(T_j)$ as the marginal cost from allowing T_j incoming transfer students while maintaining the same quality of educational services for residential students as if there were not any transfer students entering. This marginal cost will include both the direct costs associated with providing services for transfer students, as well as the net cost of any peer effects caused by these transfer students.

(Incoming transfer students could create negative peer effects which increase the marginal cost, or these transfer students could create positive peer effects which decrease the marginal cost or even lead to negative net costs.) This marginal cost will also include the costs of compensating for any loss of school district revenue due to capitalization effects. When students are able to transfer into a popular school district, the erosion of the housing premium can decrease the housing prices in that district, which in turn leads to a smaller local property tax base (Reback, 2005).

Define $h_j(T_j)$ as an index of the value of any positive reputation effects from admitting transfer students. 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.

Let $g_j(T_j)$ equal the level of residents' discontent over incoming transfer students. Holding actual school quality constant, there are several reasons why incoming transfer students could decrease residents' welfare. First, this incoming transferring could decrease local house prices. Second, the residents may perceive that the incoming transfer students lead to more negative peer effects than the actual peer effects.

Finally, define $q(T_j)$ as an index of the state's satisfaction that district j is in compliance with the state's open enrollment law. Even if the other factors imply that the district should not accept many transfer students, the district administrator may be concerned with whether it appears to be following the law's guidelines.

The function measuring the combined impact of these supply-side factors will vary across districts, as some districts' administrators will prioritize certain objectives more than others. Define S_j as the maximum level of T_j that district j 's administrator decides to allow. District j 's administrator will choose S_j to maximize some function of these factors:

$$(4) \quad f_j(S_j * \text{Subsidy} - m(S_j), g(S_j), h(S_j), q(S_j)).$$

The first term represents the net financial gain to the district, which equals the number of incoming transfers multiplied by the per student subsidy for serving these students minus the marginal cost of serving these students. As mentioned earlier, this subsidy equaled about \$4000 per student in Minnesota during this paper's sample period, varying by only a couple of hundred dollars across districts.

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 accepted transfer applicants will equal the minimum of the supply and demand for transferring. The number of accepted transfer applicants, T_j^* , will be:

$$(5) \quad T_j^* = \min[S_j, D_j]$$

This simple theoretical analysis highlights some important considerations for empirically analyzing the inter-district transferring market. First, transfer demand may come from both households seeking to enhance school quality without paying a housing premium and from households with idiosyncratic preferences. Second, most variables that may have positive effects on demand may also be associated with lower levels of supply. For example, 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, because these test scores seem to be positively correlated with valued characteristics of school quality (Q_j). 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's data allows one to estimate which observable variables are important components of inter-district demand, i.e., which variables should be included in the Q_k vector in households' indirect

utility functions. Fortunately, these data include both transfer rates and rejection rates, so that one may estimate the transfer demand to enter each school district (D_j) without worrying about the confounding effects of the supply of spaces in that district (S_j). Less fortunately, these data are also highly aggregated, which slightly limits how precisely one may estimate the parameters described above. In particular, the data are at the district-level rather than the household level, and the data do not reveal the number of students 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. By incorporating geographic information, the empirical strategy described below is to exploit information about districts' neighbors in order to characterize the likely transfer decisions that are most relevant to students.

The data combine 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).

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

⁷ The district-level test score measures used in this paper equal the average of the mean student test scores in third, fifth, and eighth grade in reading and math during the 1998-99 school year.

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 2000-2001.⁸ 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?

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 in Section 6.3 below, rejections were uncommon. Furthermore, there were not any application fees, and applying to one district did not preclude applying to others. The only costs associated with applying would be the cost of gathering information about schools, 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. Because 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 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 if they did not feel very strongly about the transfer opportunity.

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

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 districts. However, this type of transfer was probably uncommon due to the higher incomes generally found in the suburban 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 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

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.)

participate, students from low income families (eligible for federally subsidized school lunches) are slightly more likely to participate, and special education students are slightly more likely to participate. Examining entrants into lotteries for intra-district 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 smaller median household income 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

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. The following model is used to predict transfer demand:

$$(6) \quad \log(D_j) = \alpha + \beta_1 \log(\# \text{ of Households}_j) + \beta_2 \log(\text{Population Density}_j) + \beta_3 (\% \text{ of Students in Elementary Grades}_j) + \beta_4 (\% \text{ of Students in Middle School Grades}_j) + X_j \beta_5 + \bar{X}_{j,neighbors} \beta_6 + X_{j,neighbors}^{\min} \beta_7 + \epsilon_j.$$

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 first four independent variables are control variables accounting for structural differences across districts which 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 X_j 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 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 $X_{j,neighbors}^{\min}$ therefore includes the Z-score of the minimum value of these characteristics among district j 's neighbors, and Vector $\bar{X}_{j,neighbors}$ contains the Z-score of the population size-weighted mean value of these characteristics for district j 's neighbors.

In the full model, these vectors include all of the district-level variables listed in Table 1: 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.¹¹ Because net transfer rates will also

¹¹ Test scores predating the open enrollment program are also not available.

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.¹²

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 schools enrollment in the district neighbors. The results below remain 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.

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

¹² 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.

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 12), 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 fewer 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 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.

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 socioeconomic characteristics and per pupil spending. The F-test comparing these two regression models 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 some tentative 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 (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, the variables at the district-level which bests 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 (6), this variable is statistically insignificant and the models continue to explain roughly the same proportion of the variance in transfer demand.¹³ Either most transfer applicants are enticed by overall district characteristics or these characteristics seem to proxy well for the qualities of particular schools that these applicants find attractive.

¹³ For example, suppose that one re-estimates the model in column 4 in Table 4a with the mean math test scores specifically for 5th grade students in the district. If one adds an independent variable equal to the Z-score for the maximum school-level mean 5th grade student math test score found in the district, this additional variable has a coefficient of .067 with a standard error of .154. The R-squared only increases from .466 to .468 with the addition of this maximum school-level mean test score variable.

6.2.2 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 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.

Given that few districts rejected applicants, it is difficult to precisely estimate how various factors simultaneously influenced the probability that a district's supply of transfer spaces was binding. In light of this limitation, this section uses a non-parametric approach to analyze these supply-side decisions.

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 percent of the districts that rejected transfer applicants met at least one of these two conditions, while only 34 percent 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.

Although some transfer applicants may have requested specific schools, within-district heterogeneity 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 test score gaps shown in Table 7 predict rejections. This finding even holds if the analysis only includes rejections that districts claimed were due to "lack of capacity in a school building."

Aside from mean student test scores, 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. The greater importance of test scores might reflect administrators' concerns over the potential peer effects from admitting transferring students.

6.4 Effects of Student Transferring on Segregation Across School Districts

Given that peer characteristics are correlated with both the supply and demand for transfer spaces, it may be important to examine whether the actual equilibrium transfers influence the segregation of students across school districts. Estimates of the effects of incoming transfer students on various forms of segregation across districts are displayed in Table 8. 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 8 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 8 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.¹⁴

The estimates in Table 8 reveal a trivial impact of incoming transfer students on statewide segregation across districts by race, family income, or special education status. The 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

¹⁴ The dissimilarity index equals $\frac{2}{N} \sum_{i=1}^N \text{abs}(x_i - x^{\text{pop}})$ for districts $i=1,2,\dots,N$, 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.

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, and the quality of specific programs such as 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 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 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.

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,¹⁵ 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 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

¹⁵ 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.

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 administrators' control of the supply of transfer spaces so that actual transferring patterns reflect the school characteristics that parents value most.

Acknowledgements

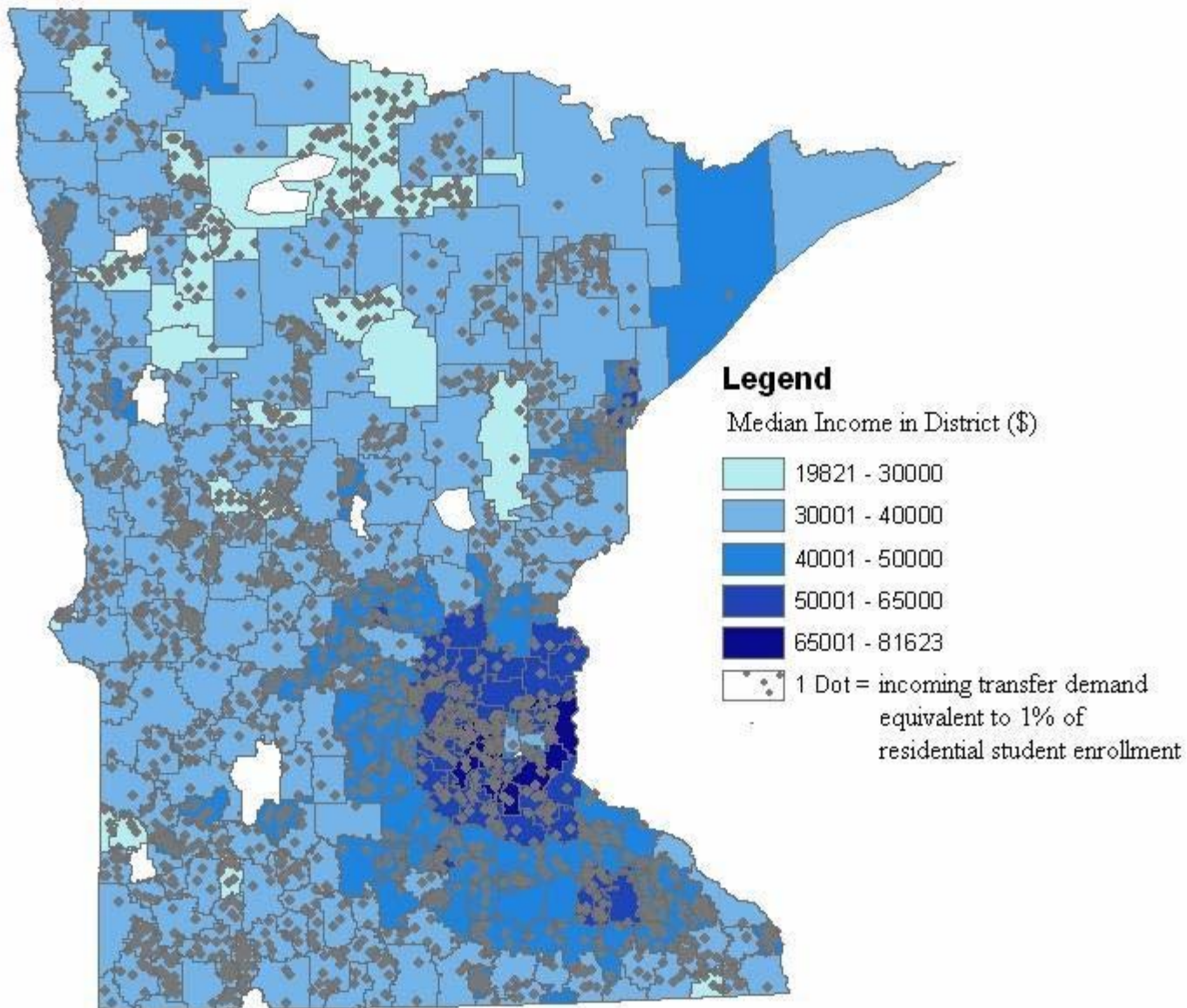
I thank the Minnesota Department of Education for providing data, and I thank Rachel Kessler and Lillian Forsyth for providing helpful research assistance. I am also grateful for comments and suggestions from Julie Cullen, Mark Long, Lalith Munasinghe, Dave Sjoquist, Miguel Urquiola, and participants in the 2004 APPAM meetings, 2005 AEFA meetings, and 2005 SOLE meetings.

References

- Armor, David J. & Peiser, Brett M. *Competition in Education: A Case Study of Inter-district Choice*. Pioneer Institute, (1997).
- Barrow, Lisa. "School Choice through Relocation: Evidence from the Washington D.C. Area," *Journal of Public Economics* 86(2), (2002), pp. 155-189.
- Bayer, Patrick, Ferreira, Fernando and McMillan, Robert. "Tiebout Sorting, Social Multipliers and the Demand for School Quality." *NBER Working Paper 10871*, (2004).
- Belfield, Clive R., Levin, Henry M., & Schwartz, Heather L. "School Choice and the Supply of Private Schooling Places: Evidence from the Milwaukee Parental Choice Program." Occasional Paper No. 84, National Center for the Study of Privatization in Education, Teachers College, Columbia University, www.ncspe.org, (2004).
- Black, Sandra E. "Do Better Schools Matter? Parental Valuation of Elementary Education." *Quarterly Journal of Economics*, (1999), pp. 577-600.
- Brown, Cynthia G. *Choosing Better Schools: A Report on Student Transfers under the No Child Left Behind Act*. Citizens' Commission on Civil Rights, Dianne M. Piché and William L. Taylor, editors. <http://www.cccr.org/ChoosingBetterSchools.pdf>, (2004).
- Cullen, Julie Berry; Jacob, Brian and Levitt, Steven. "The Impact of School Choice on Student Outcomes: An Analysis of Chicago Public Schools.", *Journal of Public Economics* 89(5-6), (2005), pp. 729-760.
- Cullen, Julie Berry; Jacob, Brian and Levitt, Steven. "The Effect of School Choice on Student Outcomes: Evidence from Randomized Lotteries," *NBER Working Paper 10113*, (2003).
- Downes, Thomas A. and Zabel, Jeffrey E. "The Impact of School Characteristics on House Prices: Chicago 1987-1991." *Journal of Urban Economics* 52(1), (2002), pp. 1-25.
- Epple, Dennis and Romano, Richard E. "Competition Between Private and Public Schools, Vouchers, and Peer Group Effects." *American Economic Review* 88, (1998), pp. 33-62.
- Figlio, David and Lucas, Maurice. "What's in a Grade? School Report Cards and House Prices." *American Economic Review* 94(3), (2004).

- Fossey, R. "Open Enrollment in Massachusetts: Why Families Choose." *Educational Evaluation and Policy Analysis* 16(3), (1994), pp. 320-334.
- Fowler, FC. "Participation in Ohio's Interdistrict Open Enrollment Option: Exploring the Supply-Side of Choice." *Educational Policy* vol. 10, issue 5, (1996), pp. 518-536.
- Nechyba, Thomas. "What Can Be (and What Has Been) Learned from General Equilibrium Simulation Models of School Finance?" *National Tax Journal* 56, (2003), pp. 387-414.
- Palmer, Elisabeth A. *This Choice is Yours After Two Years: An Evaluation*. Aspen Associates. report submitted to the Minnesota Department of Education, <http://education.state.mn.us/content/059849.pdf>, (2003).
- Reback, Randall. "House Prices and the Provision of Local Public Services: Capitalization under School Choice Programs." *Journal of Urban Economics* 57(2), (2005), pp. 275-301.
- Schneider, Mark & Buckley, Jack. "What do Parents Want from Schools? Evidence from the Internet." *Educational Evaluation and Policy Analysis* 24(2), pp. 133-144.
- School District Profiles, 1999-2000*. Minnesota Department of Families, Children, and Learning. (now called Minnesota Department of Education, 2000.
- Tiebout, Charles. "A Pure Theory of Local Expenditures." *Journal of Political Economy* 64, (1956), pp. 416-24.

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

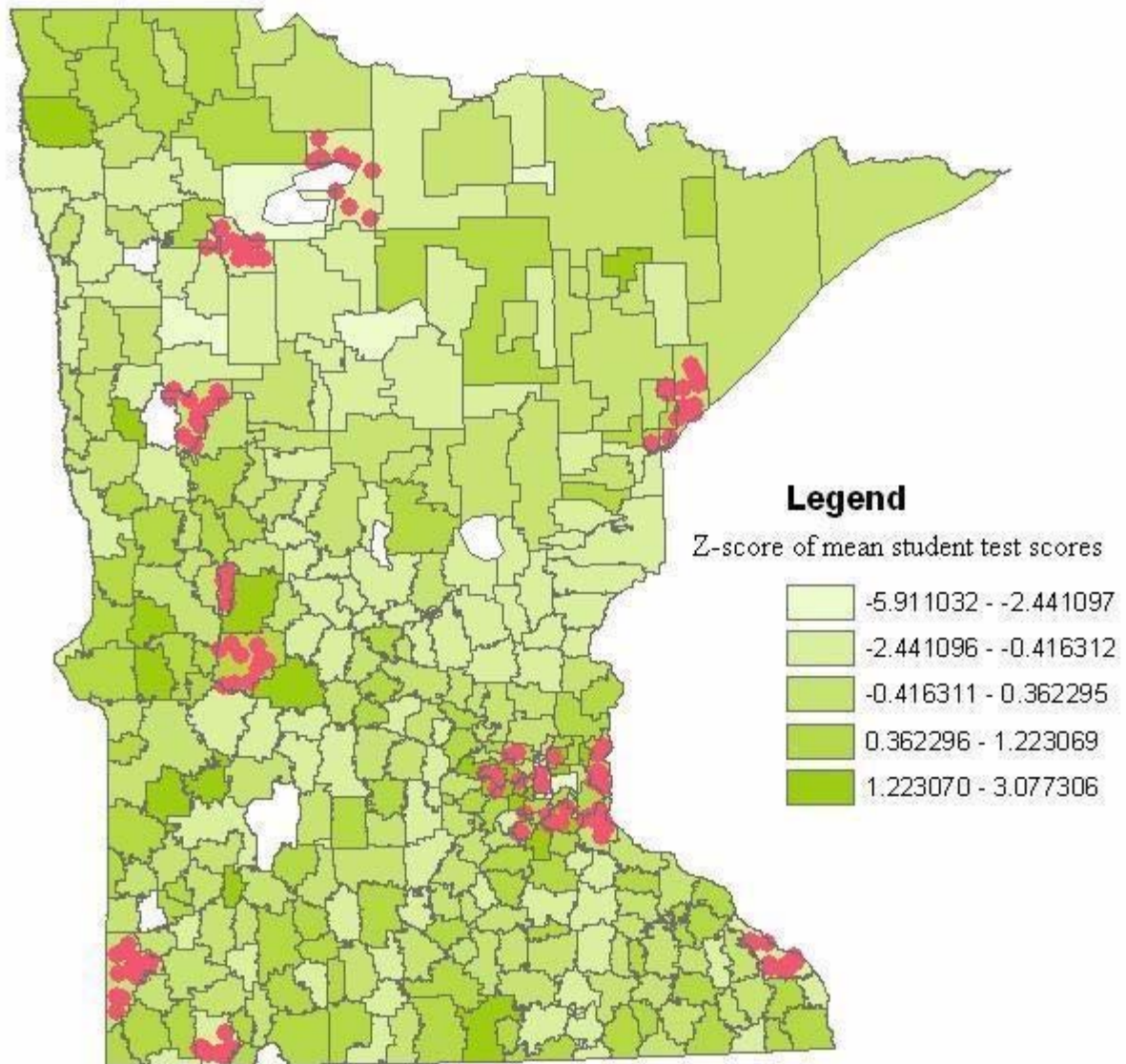


Table 1: Descriptive Statistics for Main Sample

	Mean	Median	Stand. Dev.
District characteristics			
Number of Incoming Transfer Students	95.9	62	110.6
Number of Outgoing Transfer Students	94.9	54	148.1
Demand for Incoming Transfer Spaces	97.4	62	115.0
Number of Residential Students	2524	1053	5406
Number of Households	5633	2175	13249
Population Density (people per sq. ft.)	0.000101	0.000010	0.000309
% of Students in Elementary Grades	0.433	0.428	0.087
% of Students in Middle School Grades	0.239	0.238	0.053
Z-score of Average Student Test Score	0	0.074	1
Z-score of Average Student Math Test Score	0	0.031	1
Z-score of Average Student Read. Test Score	0	0.076	1
Mean House Value	90220	83025	36777
Median Income	41307	38155	10875
% of Adults with a Bachelor's Degree	0.118	0.103	0.056
% of Adults without High School Diploma	0.171	0.174	0.052
Public School Spending per Pupil	6980	6688	1310
Local Public School Revenue per Pupil	2144	1922	946
% of Spending Spent on Vocational Ed.	0.02	0.02	0.02
% of Spending on Community Service	0.03	0.03	0.02
Indicator Variable for a Hockey Team			
Going to the State Finals Recently	0.12	0	0.32
Indicator Variable for a Football Team			
Going to the State Finals Recently	0.05	0	0.23
Household-weighted, district-level averages for neighboring districts			
Z-score of Average Student Test Score	0.054	0.076	0.426
Z-score of Average Student Math Test Score	0.052	0.067	0.431
Z-score of Average Student Read. Test Score	0.056	0.070	0.437
Mean House Value	88112	82182	28408
Median Income	41606	37532	9461
% of Adults with a Bachelor's Degree	0.130	0.114	0.049
% of Adults without High School Diploma	0.164	0.168	0.041
Public School Spending per Pupil	6829	6694	689
Local Public School Revenue per Pupil	2096	1984	585
Minimum district-level value among neighboring districts			
Z-score of Average Student Test Score	-0.608	-0.417	0.762
Z-score of Average Student Math Test Score	-0.656	-0.484	0.746
Z-score of Average Student Read. Test Score	-0.614	-0.400	0.792
Mean House Value	69447	64845	23016
Median Income	35229	33929	7749
% of Adults with a Bachelor's Degree	0.083	0.079	0.034
% of Adults without High School Diploma	0.130	0.137	0.042
Public School Spending per Pupil	6107	6105	728
Local Public School Revenue per Pupil	1415	1342	509

Notes to Table 1: Summary statistics are based on the 329 districts used for the regression analyses. As described in Section 4, 16 districts are excluded due to incomplete data. Therefore, the total number of exiting transfer students among these 329 districts is slightly different than the total number of incoming transfer students. Percents are expressed in decimal form.

**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 equal 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	
<u>Variable</u>	Mean	Median	Mean	Median	Mean	Median
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 Expenditure s	(9) Local per pupil Revenue	(10) % of Residents with B.A. or more	(11) % of Residents without High School Diploma
Within district	.290 (.106)	.229 (.089)	.163 (.053)	.180 (.053)	.135 (.053)	.017 (.059)	-.021 (.061)	.034 (.091)	-.181 (.076)
Average of district's neighbors	.046 (.121)	-.013 (.123)	.095 (.158)	.067 (.154)	.110 (.154)	.030 (.060)	.181 (.070)	.054 (.090)	.015 (.110)
Minimum of district's neighbors	-.327 (.111)	-.153 (.114)	-.245 (.086)	-.253 (.087)	-.218 (.083)	-.031 (.056)	-.234 (.068)	-.149 (.081)	-.086 (.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: All independent variables listed above have been converted to Z-scores. 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 (0.084)	0.017 (0.085)	0.012 (0.084)	0.061 (0.083)	0.034 (0.077)	0.048 (0.074)	0.037 (0.083)
Log(Population Density)	0.530 (0.077)	0.512 (0.074)	0.506 (0.076)	0.481 (0.074)	0.501 (0.074)	0.428 (0.057)	0.504 (0.078)
% of Students in Elementary Grades	-1.372 (0.642)	-1.406 (0.652)	-1.433 (0.646)	-1.403 (0.648)	-1.431 (0.648)	-1.515 (0.652)	-1.231 (0.646)
% of Students in Middle School Grades	-2.127 (1.042)	-1.966 (1.056)	-2.096 (1.048)	-2.024 (1.049)	-2.235 (1.051)	-2.186 (1.054)	-2.016 (1.052)
Average Student Test Score	0.216 (0.067)		0.204 (0.067)	0.223 (0.067)	0.213 (0.063)	0.244 (0.059)	0.182 (0.065)
Neighbors' Mean: Avg. Student Test Score	0.081 (0.219)		-0.041 (0.215)	0.038 (0.220)	0.020 (0.211)	-0.157 (0.190)	0.197 (0.210)
Neighbors' Minimum: Of Avg. Student Test Score	-0.235 (0.112)		-0.150 (0.107)	-0.256 (0.112)	-0.224 (0.112)	-0.169 (0.095)	-0.255 (0.111)
Average House Value	0.107 (0.146)	0.137 (0.147)		0.186 (0.110)	0.107 (0.147)		0.110 (0.146)
Neighbors' Mean: Average House Value	-0.310 (0.212)	-0.285 (0.209)		-0.314 (0.156)	-0.259 (0.208)		-0.126 (0.205)
Neighbors' Minimum: Average House Value	0.379 (0.163)	0.259 (0.157)		0.106 (0.136)	0.336 (0.163)		0.310 (0.162)
Median Income	0.146 (0.187)	0.211 (0.189)	0.244 (0.140)		0.103 (0.179)		0.080 (0.182)
Neighbors' Mean: Median Income	-0.085 (0.236)	0.010 (0.238)	-0.184 (0.161)		-0.046 (0.211)		-0.158 (0.234)
Neighbors' Minimum: Median Income	-0.422 (0.160)	-0.510 (0.160)	-0.206 (0.134)		-0.350 (0.157)		-0.359 (0.158)

Table 5b continues on next page

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

Note to Table 5b: All independent variables listed above have been converted to Z-scores.

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 to Table 6: All independent variables listed above have been converted to Z-scores, except for the hockey and football indicator variables. 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

	(1)	(2)	(3)	(4)
District Transfer Demand Ratio	Number of districts	% with historically high enrollment in 2000	% with test scores at least 1 S.D. larger than a neighboring district	% 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%	5	60%	100%	100%
3.14% - 4.6%	2	50%	50%	100%
4.7% - 7.53%	2	0%	100%	100%
7.54% - 12.5%	5	20%	80%	80%
12.6 % and up	3	0%	67%	67%
All ranges	26	27%	65%	69%
(B) Districts NOT rejecting any applicants in 2000				
0 - 1.79%	46	22%	20%	35%
1.8% - 3.13%	50	16%	28%	40%
3.14% - 4.6%	53	9%	26%	36%
4.7% - 7.53%	53	19%	28%	40%
7.54% - 12.5%	50	10%	16%	22%
12.6 % and up	51	14%	25%	31%
All ranges	303	15%	24%	34%
Statistical Significance of Test for whether Group A's % is Larger than Group B's %				
0 - 1.79%	-	.488	.185	.533
1.8% - 3.13%	-	.009	.001	.005
3.14% - 4.6%	-	.036	.236	.034
4.7% - 7.53%	-	.747	.016	.046
7.54% - 12.5%	-	.252	.001	.002
12.6 % and up	-	.750	.063	.108
All ranges	-	.053	.001	.001

Notes to Table 7: 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.