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Can Public Policy Affect Private School Cream-Skimming?

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Abstract – We investigate how key school and community characteristics interact with the characteristics of individual students and families in determining the enrollment patterns in public and private schools. Using unique, nationally-representative, individual-level data, we find evidence that a number of factors plausibly influenced by public policy (e.g., school-district concentration, student-teacher ratios, and local violent crime rates) have powerful effects on the composition of public and private schools.

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"We're hemorrhaging."

– James Woods, public-school superintendent[1]

The increasing numbers of students who choose private over public schooling threaten the traditional role of public schools in the United States. Critics of public schools argue that private schools offer better education and therefore should be supported as alternatives to public schools, through either voucher or tuition-assistance plans. Moreover, critics argue, increased private-school competition will induce improvements in public schools. Champions of public schools counter that such plans drain public schools of the most able students, especially from families with above-average incomes and education; lead to even more segregated schools; leave public schools with the students most difficult to teach and with fewer opportunities to capitalize on positive peer-groups; and further erode local support for public schools.

In this paper, we ask whether local policies can improve the competitiveness of public schools in retaining students, particularly those students most likely to opt out -- white, high-achieving students from well-educated, high-income families. We ask, for example, whether or not success in lowering the violent crime rate in a community can help to retain students, and if so, whether retention varies by race, ability, family income, or parental education. Crime could spill directly into local public, or alternatively parents who reside in areas with high rates of crime may be more sensitive to safety issues and select schools based on *perceptions* of school safety, regardless of the extent to which high crime rates actually spill into local public schools. We also ask whether or not increased competition within the public sector, through a greater variety and decreased concentration of districts, or decreases in the student-teacher ratios in public

[1] As reported in *Business Week,* February 7, 2000, p. 76 [2].

schools can help retain students.

This paper is the first to examine the role of local policies and attributes, as they interact with individual student characteristics, in determining the composition of public- and private-school enrollments in particular communities. The importance of the composition of schools, and the issue of private-school "cream skimming," is highlighted by the central role given to peer groups in a number of recent studies, including Moreland and Levine [22], Nechyba [23], and Epple and Romano [6].[2]

Most prior studies use aggregate-level data, which obscure important interactions between community- and individual-level attributes. (See Clotfelter [4]; Hamilton and Macauley [13]; Sonstelie [24]; West and Palsson [25]; and Betts and Fairlie [1]). Several recent papers use individual-level data to evaluate the determinants of school-sector choice (Goldhaber [11]; Hoxby [16]; Lankford and Wyckoff [18]; Lankford, Lee and Wyckoff [20]; and Long and Toma [21]), but are only able to use information about the schools that students actually chose, without having any information about either alternative schools or important interactions between individual student characteristics and those of local schools and communities.

Recent work by Lankford and Wyckoff [19] utilizes data on student and family characteristics, community characteristics, and the attributes of public and private schools available to individual students in a particular area. Using individual-level Census data for white students in eight New York metropolitan areas, Lankford and Wyckoff investigate the effect of school choice and residential location on racial segregation of students and find substantial evidence that community racial composition plays an important role in determining the school selection of white students. Indeed, they argue that race plays the most important role.

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[2]Other studies, e.g., Evans, Oates and Schwab [7], suggest smaller peer-group effects.

The prominence of race in this new evidence raises the question of whether other school and community attributes, especially those influenced directly by public policy, interact with the characteristics of individual students and families in determining enrollment patterns. Our unique, nationally representative data permit us to address this question directly. That is, we are able to estimate the effects of local factors influenced by public policies on the composition of public and private schools, measured in terms of racial segregation, family income and education, and relative student ability. We find that local violent crime rates, school-district concentration, and student-teacher ratios in public schools, have a powerful role in determining the composition of public and private schools – especially in retaining those students most likely to opt out of public schools.[3]

1. Data and empirical model

We seek to identify the factors that determine the school-sector enrollment of individual students, and divide schools into two possible types: public and private, whether religious or non-religious. All schools in our sample are day schools, and we explicitly exclude military and boarding schools due to limitations of the data in identifying residential location, which are described later in this section. While there are important differences in many respects between religious and non-religious private schools, we abstract from those differences here in order to focus exclusively on the choice between public and private schools. Our dependent variable is the observed sector (public or private) in which the student is enrolled in the *tenth* grade. As our dependent variable is discrete, we estimate the sector-selection model using probit regression.

Our primary data come from the restricted-access version of the National Education Longitudinal

[3] While we examine the effects of individual decisions on the racial composition of schools, we do not examine whether the racial composition of the community also affects school selection, which is the primary focus of Lankford and Wyckoff's study.

Survey (NELS), conducted by the National Center for Education Statistics (NCES) of the U.S. Department of Education. The NELS is an exceptionally rich data set that tests students nationwide first in eighth grade, and then follows the student through high school (and beyond). Moreover, the NELS has a rich set of student and family characteristics. Even so, a weakness of the NELS is that it does not identify the private schools in the sample or even the communities in which they are located, even in the restricted-access version of the data set. Hence, the finest level of private-school geographic identification available is the state. (Public schools are identified in the restricted-access version.) This weakness has led researchers to either dismiss the NELS as a useful tool for evaluating private-school enrollment (as in Lankford and Wyckoff [19]) or to use the NELS but not include any information about the set of public and private schools available to the student (as in Goldhaber [11]).

We have been able to circumvent this problem. Using a matching algorithm, along with auxiliary information, we are able to identify with certainty the geographic location of almost every private school in the NELS sample.[4] More specifically, we match characteristics of private schools that are reported both by private-school administrators in the NELS survey to those also reported in detailed marketing data from a virtual census of private schools acquired from Dun and Bradstreet. While we are not permitted to describe the exact variables used to perform this algorithm, we rely principally on data on course offerings, tuition, cohort size, and gender composition to conduct this match. To confirm unique matches, in a few instances we supplement these characteristics with public information obtained from direct contact with a number of private schools. Thus, we are able to use the rich data available in the NELS, while also being able to describe the public- and private-school options available to each student in our sample.

[4]Unfortunately, confidentiality restrictions necessitate that we not publish the algorithm that we use to match the Dun and Bradstreet data to the NELS. The algorithm is available to anyone with appropriate clearance from the Department of Education.

Representativeness of the sample data

Our sample consists of 15,093 students, or 86 percent of the set of students for which a high school (in tenth grade) is identified in the NELS. We lose data for several reasons. First, we lose about five percent of public-school observations because of an inability to perfectly identify NELS public schools even in the restricted-use version of the data. Second, we lose about nine percent of private-school observations because in a few instances we could not determine with certainty the identity of the private school, and therefore could not place it geographically. Third, we lose another eight percent of private-school observations because we intentionally exclude private schools that are not exclusively day schools; since students at boarding schools may not actually live in the vicinity of that school. These omissions leave us with 16,241 potential observations. The remaining observations are lost because we are missing one or more community-level variables for some schools.

To ensure that our final sample is representative of the nation as a whole, we compare observed characteristics of omitted observations to those of the population. Fortunately, these attributes appear qualitatively identical--that is, they vary by fewer than two percentage points--along a number of lines (race, income, parental marital status, urbanicity, region of the country, parental education, family size, and religious background). However, the sampling design of the NELS also raises potential concerns regarding the selection of private schools in the survey, since their inclusion is conditional on the selection of public schools, not *purely* random.[5] Even so, the private-school students in our sample do not appear appreciably different from the private-school students in the country as a whole. While 12 percent of students our sample (in metropolitan areas) attend private school, 11 percent of similar-aged students in

[5]Specifically, while schools were selected to be representative of the public and private school populations in eighth grade, the sample is not necessarily representative for high schools. The NELS did not follow every student between the base year and subsequent follow-ups, especially in schools where only one or two students were observed in the first follow-up. Also, the set of high schools in the sample may in part be due to the original selection of middle schools, which will not necessarily yield a representative high-school population. These problems appear minor – a conclusion confirmed by some simple validity checks.

metropolitan areas in the 1990 Census one percent sample attend private schools. Nineteen percent of NELS families in the top third of the income distribution in metropolitan areas send their children to private school, as compared to 17 percent in the Census sample. Seven percent of NELS African-American and Hispanic students in metropolitan areas attend private schools, the same fraction observed in the Census.

Moreover, the geographic distribution of private-school students in the NELS also closely mirrors the distribution in the Census sample. For the western United States, 9 percent of the NELS students attend private school, as compared to 8 percent in the Census. For the Midwest, 14 percent of the NELS students attend private school, as compared to 12 percent in the Census. For the Northeast, 15 percent of NELS students attend private school, as compared to 16 percent in the Census. For the South, 10 percent of NELS students attend private school, as compared to 9 percent in the Census. Hence, the private-school students in the NELS appear representative of the national population of private-school students.

Residence and household location

We assume that each student in our sample resides in the county in which he or she attends school. That is, each student considers only the public and private schools in his or her county of residence. This assumption bounds the student's possible choice set, but it is also necessary because while we know the location of the school that each student attends, we do not know the precise location of each student's residence.

Household location decisions across *counties* may still be endogenous to sector choice, possibly inducing a feedback from school characteristics to county characteristics.[6] To gauge the degree to which this might be a problem, though, we also estimate models for which the entire metropolitan area provides the relevant choice set for urban students, as well as models for which all contiguous counties form the

[6]We thank Dennis Epple for pointing this out.

basis of the relevant choice set. In both alternatives, the results are qualitatively similar (never varying by more than two or three percentage points) to those reported below. Since all community characteristics in our reported model are already measured at the county level, the results already include within-county differences in community characteristics and endogenous household location choices. Thus, there is little evidence that endogenous residence choice confounds our estimates.

Variables in the model

We estimate the probability of student enrollment in a public or private school in the tenth grade using individual student, family and community demographic and school characteristics, with a special emphasis on the interactions between individual and local policy-related variables. These interactions are important in explaining why students and families might choose to opt out of public schools. In a naive median-voter model with homogenous local populations, no special restrictions on the supply of public schools (e.g., with no Constitutional restriction on religious education), and no asymmetric information or other "control" problems for public schools, all citizens would be supplied with exactly the quality and quantity of public schooling demanded by the (identical) median voter.

Of course, local populations are not homogenous, public schools are subject to special restrictions, and voters and their agents do face information and other control problems in operating public schools. Hence, population heterogeneity (and the degree to which an individual student and family differs from others in the local population), the prominence of religious affiliations, and other local factors should be important in explaining the selection of students out of public schools and into private schools. We should emphasize, though, that "selection" in our model is the reduced-form result of the enrollment choices of both individuals and local schools.

We adopt a standard set of family and demographic variables: variables reflecting gender, race, Hispanic ethnicity, the student's family income, parental education, parental frequency of religious attendance, variables reflecting whether a male or female parent or guardian lives in the student's home, an

indicator for parental marital status, the number of siblings, fifteen religious denomination variables, the student's eighth-grade mathematics test score, and nine Census-subregion dummies reflecting unobserved regional variations in relative probabilities of school-sector choice.

The test score is one of a four-test standardized objective battery the NELS recorded in four subject matter areas (mathematics, reading, science, and social studies.)[7] We select mathematics as a representative measure of because mathematics test scores tend to be the best predictors of future labor market success (see, e.g., Bishop [2]) and are, in our view, least likely to be affected by regional differences in curricular emphasis. In any event, the four test scores are highly correlated, so the use of mathematics test scores, rather than an alternative or composite score, should not pose substantial concerns.

What may raise concerns, however, is the potential endogeneity of test scores to sector selection. While there is disagreement as to whether sector selection affects student outcomes, it is certainly plausible to expect that private schools may appear to attract higher-ability students when actually this relationship is due to productivity differences across the sectors. We will address this endogeneity issue in two ways. First, we note that this paper focuses on *interactions* between test scores and community characteristics; therefore, even if private schools have productive advantages vis-a-vis public schools, it is less appealing (though by no means implausible) to suggest that these differences are systematically related to community attributes. Second, and more importantly, we address this endogeneity by controlling in some specifications for the student's eighth-grade school sector of attendance; the results of this exercise, reported in the last portion of Section 3, support the notion that our results are not driven in large measure by the potential endogeneity of test scores.

We include missing data flags for observations in which the variable is missing, but our results are not qualitatively changed if we include only those observations with complete data. In addition to these

[7]More information on the tests can be found in Figlio and Stone [10].

demographic variables, we explain sector selection using variables to account for Constitutional and other limitations on public schools (e.g., religious instruction), heterogeneity in the service population for the locally provided public education, as well as variables likely to magnify the importance of local heterogeneity. Some of these variables are motivated by work in industrial organization by Downes and Greenstein [5] on the entry of private schools into local markets, as well as by other recent work on public-private school choice (e.g., Lankford and Wyckoff [18]; Lankford, Lee and Wyckoff [20]).

Hence, the set of explanatory variables also includes the urbanicity of the county (variables reflecting central or suburban counties in a Metropolitan Statistical Area), a variable reflecting whether there is a private high school affiliated with the student's religion in the county of residence,[8] and variables reflecting the demographic and economic characteristics of the county and characteristics of the schools in the county. This set of characteristics includes county population, metropolitan area size, median household income, percentage of residents in poverty, percentage of residents who are nonwhite, percentage of adults with a bachelor's degree, the average house price in the county, and the proportion of public schools that are unionized.

We concentrate on three variables in particular that are arguably influenced by public policy. Specifically, we consider the role of public school competition (measured by a Herfindahl index of school district concentration),[9] public school student-teacher ratios, and the violent crime rate in the county. In addition to determining the mean relationship between these policy-related variables and the likelihood of

[8]We also estimate specifications for only those students with a private high school in their county, and obtain equivalent results.

[9]Hoxby [15] presents evidence that public schools in areas with low concentration (high competition) of public schools have better-performing students. Hoxby and others use a Herfindahl index as a measure of school competition, a convention adopted here. A concentration measure better reflects the choice set faced by a typical household in an area than, say, the number of school districts per capita. A county with 100,000 students and evenly divided into ten school districts of 10,000 students apiece, for example, offers more competition for students than a similar county with one school district with 91,000 students and nine others with 1,000 students apiece. Nevertheless, our qualitative findings do not apear sensitive to the use of alternative measures, including the number of districts per capita.

private-school enrollment, we are especially interested in determining the importance of *interactions* between these variables and several key student characteristics -- race, family income, parental education, and individual student test scores. This last set of interactions will provide evidence as to whether these local school and community characteristics appear to influence the *extent* of private-school cream skimming. Table 1 presents descriptive statistics for all variables included in the regressions.

2. Probit results

As noted above, we estimate the school selection model using probit regression. The empirical model explains just under half of the variation in sector selection, as measured by the pseudo-R^2. Despite the fact that the vast majority of students are enrolled in the public sector, the model still correctly predicts a large fraction of our private-school students. On the basis of a maximum-probability rule, the model correctly categorizes 54 to 71 percent, depending on specification, of the individual private-school students. The estimated model also correctly places almost all of the individual public-school students in the public sector, though this might be anticipated because the public sector is by far the largest.

Parameter estimates

Estimates of the probit parameters of sector selection are presented in Table 1, with the exception of the region-specific constants. Since the community characteristics do not vary across individuals within each county, we adjust the standard errors to account for the clustering of data by county. While our goal is to measure the degree to which individuals switch sectors when school or community characteristics change, the individual parameter estimates still merit brief description. In general, the estimated (reduced-form) relationships conform to our ex ante expectations. Not surprisingly, high-achieving students and students from higher income, better educated families, or families where at least one parent attends church regularly are more likely to attend a private schools. A number of local factors are strongly associated with sector selection. All else equal, for instance, students are more likely to attend a private school as the county's family income or property values increase, as the county poverty rate increases

(suggesting a greater income dispersion), if the county of residence has a private school associated with that student's religion, and as the proportion of unionized public schools rises. The addition of these five local factors alone nearly triples the explanatory power of the model.

Even so, our concern here is not simply whether private-school cream skimming occurs, but the rather the extent to which certain characteristics of the public schools and other factors in the community influenced by public policy affect sector selection. All three of our key policy-related variables appear to be important to student choices. Hoxby [15] finds that the less concentrated public schools are in an area, the higher their quality.[10] We find complementary results in our model: the more concentrated public schools are in a county, the more likely students are to select into private schools, all else equal. Hence, lower levels of school competition (or less choice, in general) tend to push more students out of the public sector. Sector selection also appears to respond to average student-teacher ratios for public schools in a county. All else equal, students are more likely to select into private schools as student-teacher ratios increase for public schools in the county. While not a school characteristic, county violent crime rates also play an important role in sector selection. As the violent crime rate in a community increases, so does the likelihood that students will enroll in the private sector, all else equal.

How large are these relationships? Since the probit model is nonlinear, one cannot immediately determine marginal effects of the variables directly from the coefficients. Therefore, Table 1 reports the marginal effects of the different variables implied by the set of probit coefficients. A one standard deviation increase in the fraction in poverty (9.31 percent) is associated with a 4.2 percentage point increase in the probability of selecting a private school, and a one standard deviation increase ($8,656) in median household income is associated with a 3.6 percentage point increase in the probability of selecting

[10]Grosskopf, Hayes, Taylor and Weber [12] also find evidence that public-school concentration affects school quality for sufficiently concentrated metropolitan areas.

a private school. A one standard deviation increase in unionization (40 percentage points) is associated with a 0.9 percentage point increase in the probability of selecting a private school.

Looking at the specific policy-related variables of immediate interest, we find that, all else equal, a one standard deviation increase in the degree of public-school concentration in the county (Herfindahl index increase of 0.351) is associated with a 2.1 percentage point increase in the probability of private-school enrollment. A one standard deviation increase in the average student-teacher ratio (3.27) is associated with a 1.5 percentage point increase in the probability of private-school enrollment, and a one standard deviation increase in the violent crime rate (0.496 points) is associated with a 3.1 percentage point increase.

3. Changes in private-school cream skimming

The preceding discussion suggests that the relative *sizes* of the public and private sectors change when community and public school characteristics change. However, these changes may or may not have any implications for potential peer-group effects in public schools, i.e., on the extent of private-school cream skimming. To gauge how changes in community characteristics might affect the peer groups of students remaining in public schools, one must look at the predicted compositional changes in the public and private sectors. Tables 2 through 4 speak directly to the question of differential private-school cream skimming associated with different community characteristics.

Policy-related variables and student characteristics

Table 2 presents the estimated coefficients for the three major policy-related variables (district concentration, student-teacher ratios, and violent crime rates), as well as the coefficients for the interactions between these three variables and four different individual-specific variables: the eighth-grade test score (a measure of ability), an indicator of whether a parent has a college degree, the family income, and an indicator of whether the student is white. The first four columns of Table 2 report specifications where each of these individual characteristics are interacted one at a time with the three community

variables, and the final column of Table 2 reports the results of a specification in which all four sets of interactions are included in the same regression.

The most directly interpretable sets of coefficient estimates are those reported in the first four columns of Table 2, because the four background characteristics (race, income, parental education, and test scores) are highly correlated. Therefore, the only coefficient estimates that we directly interpret are those from these first four columns, where each background variable is included in a separate regression.[11] The estimated effects of public-school concentration on private-school enrollment are not homogenous across different types of students. Specifically, high-income students, and those students with a high level of parental education, are more likely to enroll in the private sector as the public sector becomes more concentrated. Therefore, private-school cream skimming may be exacerbated in places with fewer public-sector options. This result provides some tentative evidence that the public-school productivity gains associated with increased competition may be in part due to differential public-school selection.

Estimates for the student-teacher ratio suggest that students with high-income or highly-educated parents are more likely to enroll in private schools as the public-sector student-teacher ratio increases, as will initially high-achieving students and white students. Therefore, increased student-teacher ratios lead differentially to students from wealthier, better-educated, and higher-achieving families leaving the public sector.

Changes in the violent crime rate also apparently induce differential responses across various types of students in private-sector enrollment. White students, as well as high-income, highly-educated, and high-achieving students of all races, are more likely to enroll in the private sector as the county-level crime rate increases (although the differential effects for white students and highly-educated families are not quite statistically significant at conventional levels). This result, therefore, suggests that communities

[11]Later in this paper, we interpret the coefficients from the last column of Table 2 jointly.

better able to control crime may also be more likely to retain students.

The final column of Table 2 presents the results of a specification in which all four sets of interactions are included at the same time. While these results are harder to interpret because of the collinearity between race, parental education, family income, and initial test scores, the results suggest that, independent of the other factors, white and high-income students are differentially likely to select out of the public sector as the violent crime rate increases (as are highly-educated families, but this result is not significantly distinct from zero), and that, high achievers are, all else equal, less likely to select out. (The interaction variables are relatively collinear, however. Recall that in the first four columns of Table 2 there is no apparent negative selection when only initial achievement is considered as an interaction.) The results also suggest that high-achieving and high-income students are more likely to select out of the public sector as the student-teacher ratio increases, and that white and high-achieving students are particularly responsive to public school concentration.[12]

Estimated magnitudes of cream-skimming effects

To assist in gauging the magnitudes of the effects of district concentration, student-teacher ratios, and violent crime rates on private-school cream skimming, Tables 3 and 4 present the fractions of students with various attributes who are predicted to enroll in the private sector under different scenarios, using the point estimates from the specification reported in Table 2 as a guide. Table 3 presents these predictions

[12]Throughout, we treat the private sector as homogeneous, rather than differentiating between religious and non-religious private schools. We report in Appendix Table 1 the results of a multinomial logit regression with three sectors: public, religious, and non-religious private schools.
Differential selection of whites, highly-educated, high-income, and high-achievement families in response to community characteristics tends to be stronger into non-religious than into religious schools, though the differential selection into religious schools is present as well. Details on this regression are available on request.

based on empirical models in which only one background characteristic is interacted with the policy variables in each regression, while Table 4 presents these predictions based on the empirical specification in which all four background characteristics of interest are interacted with the policy variables simultaneously. Note that these results are based on the probit predictions of sector selection for each student, and rely not only on the interaction terms but also on all of the other coefficients, as well. Because of this point, one cannot read directly between the probit results from Table 2 and the predictions reported in Tables 3 and 4. That is, just because one interaction term is negative, one cannot draw any inferences about what the expected sign of a Table 3 or 4 prediction should be. This is particularly true in the case of Table 4, in which each policy variable is interacted with all four student background characteristics. For example, the last column of Table 2 suggests that the estimated interaction term between concentration and parental education is negative; however, we may still predict that concentration differentially *positively* affects highly-educated families if the positive interactions between concentration and student test scores or white race (both of which are highly correlated with parental education) outweigh the negative interaction mentioned above. Indeed, in this case (and all other places where the odd negative interaction term is encountered,) the positive interactions with other correlated variables are of sufficient magnitudes to outweigh the negative "direct" interactions with the background variable of interest. (This point becomes much clearer when we observe that the predicted effects are virtually identical when comparing across specifications.)

Even in the case of specifications with a single interaction term, however, the interaction term need not be positive to predict differential positive selection into private school; if white, high-income, high-ability, or highly-educated families are more likely to be on the margin of selection into private school (as is suggested by Table 1,) then even the same "treatment" of a community characteristic may be expected to differentially push these families over the margin while not inducing a sector switch for families farther away from the selection border. Therefore, one must consider the full set of parameter

estimates when forecasting who will switch school sectors under different circumstances.

Regardless of the model specification used, the three policy-related variables are strongly associated with cream skimming, i.e., with segregation of students by race, education, income, and ability between public and private schools. When public-school concentration increases from the bottom to the top third, private-school enrollments increase by 25 or 26 percentage points (depending on specification) for students from high-income families, but by only 2 percentage points for students from low-income families. In the case of ability, private-school enrollments increase by 10 or 11 percentage points for high-ability students as the concentration rate moves from the bottom to the top third, while private-school enrollments increase by 3 or 4 percentage points for low-ability students. Private-school enrollments increase by 7 or 8 percentage points for white students, in comparison to the 2 or 3 percentage point increase for Hispanic and African-American students. Increased public-school concentration, then, appears to be related to differential private-school cream skimming, or said differently, increased public school competition appears to lower the extent of income, education, racial, and ability cross-sector segregation for public and private schools.

Similar patterns emerge in the case of student-teacher ratios. Increases in public-school student-teacher ratios appear to push students from highly-educated or high-income families and high-ability students out of the public sector. Private-school enrollments increase by 10 percentage points for students whose parents have college degrees, but only marginally for students whose parents do not; by 22 or 23 percentage points for high-income families, but only marginally for low-income families; by 10 percentage points for high-ability students, but only marginally for low-ability students. The same holds true for white families, though the effect (4 percentage points) is not as large as for education, income, or ability. It appears, then, that increases in public-school student-teacher ratios may also lead to a greater degree of segregation by income, education, ability, and race for public and private schools, regardless of whether student-teacher ratios can be directly linked to observed measures of student achievement.

For violent crime rates, only 6 or 7 percent of white students are forecast to select private schools when crime rates are in the bottom third, but 35 percent choose a private school when crime rates are in the top third; the difference is only 6 or 7 percentage points for African-American and Hispanic students. Similarly, predicted private-school enrollments of students whose parents have college degrees rise from 16 to 53 percent when crime rates go from the bottom to the top third. In contrast, private-school enrollments of students whose parents do not have a college degree only rise by 8 or 9 percentage points. A similar pattern emerges with respect to income. Private-school enrollment rates increase for all income groups as the crime rate increases, but the enrollment-rate increases are clearly more heavily concentrated at the top of the income distribution. Predicted private-school enrollment increases by 38 or 39 percentage points for families with incomes greater than $75,000, but by only 3 or 4 percentage points for those with low incomes. With respect to ability, private-school enrollments of the top third of students in terms of ability increase by 36 or 37 percentage points, while the private-school enrollments of the bottom third of students increase by only 4 or 5 percentage points. Hence, increases in the violent crime rate appear to have powerful effects on the extent of income, education, racial and ability segregation across the public and private sectors.

The strength of the effects summarized in Table 4 are encouraging, in that they suggest that some public policies have potentially powerful effects on the segregation of students by income, education, ability, and race between public and private schools. The results suggest, for example, that in some instances high-income and high-ability students more than double rates of private-school enrollment when one of the policy-related variables changes from the bottom to the top third of the observed variation. Such large, powerful magnitudes may appear implausibly so. To gauge the plausibility of these magnitudes, we also report in Table 4 the *observed* differences in the private school attendance rates as the policy-related variables change. To see how these observed differences are calculated, consider as an example the upper-left-hand calculation in Table 4. When concentration is in its bottom third, white

students are observed to be 4.2 percentage points more likely to attend private schools than are African-American or Hispanic students. When concentration is in its top third, this observed difference is 10.7 percentage points. Therefore, the reported observed difference (in Table 4) is 10.7-4.2=6.5 percentage points.

Changes predicted by our empirical model are approximately similar in magnitude to the differences observed in the raw data, only diverging to a noticeable degree in the case of the crime rate forecasts (though even there, the results are in the same ballpark as the raw data.) For instance, our model predicts that the difference between high-income and low-income student responses to an increase in public-school concentration is 26 percentage points; in the raw data, this difference is 21 percentage points. The predicted difference in response to increases in student-teacher ratios is 21 percentage points, virtually the same as seen in the raw data. The predicted difference in response to increases in the violent crime rate is 35 percentage points, more than the 28 percentage point difference observed in the raw data, but not out of line with the observation. The relevant comparisons for other student attributes tend to track the income comparisons—very small distinctions between observation and prediction in the case of concentration and student-teacher ratios, and a larger distinction (but never greater than about 50 percent) in the case of crime rates. Therefore, our results, though large in magnitude, do not appear to be out of line with the natural differences observed in the raw data.

Perhaps an even simpler way to demonstrate that the estimated results, while quite large, are plausible is to pick a single measure of background characteristics – say, income – and directly report the fraction of students selecting the private sector under different circumstances. Table 5 reports the *observed* fraction of low-income and high-income families that select into private schools under different levels of public school concentration, student-teacher ratios, and crime rates. We observe, for instance, that while high-income families are 30 percentage points more likely to select into private schools than are low-income families when public school concentration is low, this gap is 52 percentage points when

concentration is high. While high-income families are 25 percentage points more likely to select into private schools than are low-income families when public school student-teacher ratios are low, this gap is 45 percent when student-teacher ratios are high. And while high-income families are 23 percentage points more likely to select into private schools than are low-income families when crime rates are low, this gap is 51 percent when crime rates are high. This type of comparison lends additional credence to the notion that the estimated effects are real, and not artifacts of out-of-sample prediction or functional form.

Sensitivity tests

School selection is complex, and our results might be biased by the omission of some key, but otherwise uncontrolled variables. There may be unobserved factors that are correlated with both private school selection and the observed community characteristics. (Or, as mentioned above, test scores may be endogenous to sector selection.) To probe for this possibility, we present in the top panel of Table 6 the estimated interaction terms that come from models in which we control for the student's *ex ante* (in this case, eighth-grade) sector enrollment. For brevity, we focus on the violent crime rate as the community characteristic of emphasis in this table, though all other variables utilized above remain in the model but suppressed from the table. This model deals explicitly with the endogenous test score problem because we are now controlling for sector selection that is simultaneous with the lagged test scores used as controls.

Community characteristics change slowly over time, and there is substantial persistence in parental school sector choice between middle school and high school. (96 percent of students remain in the same school sector in both eighth and tenth grades; this proportion is roughly the same for both public and private sectors.) Therefore, it is remarkable that in several specifications the interaction terms between the violent crime rate and background characteristics remain positive and significant despite the fact that we are identifying treatment effects only off of the four percent of students who change sectors between eighth and tenth grades. The results suggest that, regardless of eighth grade sector selection, white students and high-ability students tend to differentially select into private schools in high school as the

county violent crime rate increases. This result provides additional evidence, therefore, that community characteristics influence school-sector selection.

Similarly, the second panel of Table 6 present the results of a model specification in which we control for the fraction of students in the community enrolled in private schools in 1970, as gleaned from Census microdata (one percent metropolitan area sample). The results of this specification are quite similar to those presented in the top panel of Table 6. Once we control for factors that may have historically influenced larger or smaller numbers of students to select into the private sector, the result remains that white students and high-achievers tend to differentially select into the private sector as the violent crime rate increases. In sum, the evidence is reasonably consistent that community characteristics yield differential school-sector selections.

Because these coefficient estimates are difficult to fully interpret directly, we present in Table 7 simulated predictions along the lines of those presented in Tables 3 and 4. The simulated effects of changing violent crime rates, student-teacher ratios, and public school concentration rates tend to be similar to those forecast using Table 2 data. As before, these differential predicted increases in private school selection come about both because of the positive interaction terms (in many instances) as well as because of the positive "direct effect" of the community characteristics. If certain background characteristics make a student more likely to be on the margin of selecting a public or private school, then one need not necessarily have a positive interaction term for a change in community attributes to push some students (generally white, high-ability, high-income, and with well-educated parents) over the margin of sector selection while not being sufficient to so influence others.

4. Discussion

Public educators have long complained that private-school "cream skimming" leaves public schools with a population of students from families with lower incomes and less education, as well as students with lower average ability (a population also arguably more expensive to educate). The

segregation by income, education, ability, and race, they argue, then further undercuts support for public education. Our data appear to confirm that cream skimming occurs: private-school students are disproportionately high-income, high-SES and high-ability, as well as disproportionately white. Given the evidence – both theoretical and empirical – that strong peer groups influence student outcomes, one could interpret some of these findings as a partial explanation for why public-school students tend to have lower outcomes than otherwise-equivalent private-school students.

Our primary question, though, is whether or not key policy-related variables at the school and community level can affect the *extent* of cream skimming, not simply whether cream skimming occurs. Because of our unique date, we are able to pursue this question directly. In our data, these characteristics play a substantial role in the school-sector selection of high-ability students and students from high-income and highly educated families (In fact, several of these characteristics apparently play a larger role than, say, Catholic religion, which has been suggested by numerous authors as a principal determinant of sector selection). Key policy-related variables at the school and community level, such as public-school concentration, student-teacher ratios in the public schools, and the local violent crime rate, appear to have powerful effects on the extent of segregation by race, income, education, and ability across public and private schools.

Several potentially important implications for public policy arise from these results. The degree of cream-skimming and peer-group differences between public and private schools may be influenced, sometimes powerfully so, by a number of public policies. For instance, fighting crime successfully and lowering the violent crime rate will likely improve the ability of public schools to retain higher socio-economic status and ability students and lessen the disparity in peer groups between the public and private sectors. Education policy may have an important role here as well. While the weight of evidence (as summarized by Hanushek [14]) suggests that student-teacher ratios have little direct effect on student outcomes, our results suggest that student-teacher ratios may have a surprisingly powerful *indirect* effect on

student achievement, since they apparently have large effects on student peer groups.

This latter finding may provide insights into the potential effects of the tax limitations and school-finance reforms that have been implemented around the country in recent years. Since tax limits tend to lead to increased student-teacher ratios (Figlio [8,9]), and "equalizing" school finance reforms lead to increased student-teacher ratios in the districts most likely to lose students to the private sector, our results suggest that the current wave of policies may lead to increased disparities between the composition of public and private schools. Downes and Greenstein [5] provide corroborative evidence of this possibility. They find evidence of substantial new private-school entry following the imposition of California's Proposition 13 tax limitation and *Serrano* court decision equalizing school spending, and that community demographics played a significant role in this phenomenon.

Our results also have implications for school-district consolidation and competition. Hoxby [15] suggests that decreased school concentration in an area benefits students. Our results indirectly corroborate, while modifying, Hoxby's argument. Here, we find substantial evidence that school concentration affects sector selection, but in other work (Figlio and Stone [10]) we find that after correction for student selection there is little relationship between concentration and student test performance. Hence, the path through which school-district concentration affects achievement may be through the increase in cream skimming that arises as public schools become less competitive and families face less choice in the public sector. We should note, however, that any such arguments are, so far, indirect.

We are not able to make any direct claims as to what is likely to occur in the event of the implementation of a private-school voucher program, since we have neither the data to measure the price responsiveness of sector selection nor a way of gauging the price responses of private schools to vouchers. In principle, however, the effect is ambiguous: a lower relative price of private education could exacerbate cream skimming, but on the other hand, it would provide additional opportunities for lower-income

students to attend private school. Increased competition from private schools may lead to more efficient public schools (as is suggested by Hoxby [17]), which could lead to a reduction in the degree of cream-skimming. In the end, as is often the case, more data than are currently available are required to address this question.

Finally, our results should provide little comfort to either critics or champions of public schools. We find evidence of pervasive, pronounced cream-skimming in response to a variety of student, school, and local factors — a phenomenon that has profound implications for the composition of public schools and the resulting disparities in education, opportunity, and potential earnings. These would seem to be comforting findings for champions of public schools seeking to counter arguments for private-school vouchers or tuition-assistance, and difficult evidence for critics to overcome. Yet, our results also indicate a prominent role for a number of factors long dismissed by champions of public schools but touted by critics, including the importance of local school-district competition.

References

[1] J. Betts and R. Fairlie, Does Immigration Induce "Native Flight" from Public Schools into Private Schools? Working paper, University of California (1998).

[2] J. Bishop, Is the test score decline responsible for the productivity decline? *American Economic Review*, 79, 178-197 (1991).

[3] *Business Week*, For profit schools, February 7, 64-76 (2000).

[4] C. Clotfelter, School desegregation, "tipping," and private school enrollment, *Journal of Human Resources*, 28-50 (1976).

[5] T. Downes and S. Greenstein, Understanding the supply decisions of nonprofits: modeling the location of private schools, *Rand Journal of Economics*, 365-390 (1996).

[6] D. Epple and R. Romano, Competition between private and public schools, vouchers and peer group effects, *American Economic Review* (1998).

[7] W. Evans, W. Oates, and R. Schwab, Measuring peer group effects: a study of teenage behavior, *Journal of Political Economy*, 966-991 (1992).

[8] D. Figlio, Did the tax revolt reduce school performance? *Journal of Public Economics*, 245-269 (1997).

[9] D. Figlio, Short-Run Effects of a 1990s-Era Property Tax Limit, *National Tax Journal*, 55-70 (1998).

[10] D. Figlio and J. Stone, Are private schools really better? *Research in Labor Economics* (1999).

[11] D. Goldhaber, Public and private high schools: is school choice an answer to the productivity problem? *Economics of Education Review*, 93-109 (1996).

[12] S. Grosskopf, K. Hayes, L. Taylor, and W. Weber, Allocative inefficiency and school competition. Working paper, SMU (1997).

[13] B. Hamilton and M. Macauley, The determinants and consequences of the private-public school choice, *Journal of Urban Economics*, 282-294 (1991).

[14] E. Hanushek, Measuring investment in education, *Journal of Economic Perspectives*, 9-30 (1986).

[15] C. Hoxby, Does competition among public schools benefit students and taxpayers? *American Economic Review* (forthcoming).

[16] C. Hoxby, The effects of private school vouchers on schools and students. In *Holding schools accountable: performance-based reform in education*, Helen Ladd, ed. Washington: Brookings Institution, 177-208 (1996).

[17] C. Hoxby, Do private schools provide competition for public schools? NBER working paper (1994).

[18] H. Lankford and J. Wyckoff, Primary and secondary school choice among public and religious alternatives, *Economics of Education Review*, 317-337 (1992).

[19] H. Lankford and J. Wyckoff, The effect of school choice and residential location on the racial segregation of K-12 students, Working paper, SUNY-Albany (1997).

[20] H. Lankford, E.S. Lee, and J. Wyckoff, An analysis of elementary and secondary school choice, *Journal of Urban Economics*, 236-251 (1995).

[21] J. Long and E. Toma, The determinants of private school attendance, 1970-1980, *Review of Economics and Statistics*, 351-356 (1988).

[22] R. Moreland and J. Levine, The composition of small groups, in *Advances in group processes*, E.J. Lawler et al, eds. Greenwich, CT: JAI Press (1992).

[23] T. Nechyba, Public school finance in a general equilibrium Tiebout world: equalization programs, peer effects, and private school vouchers, NBER working paper #5642 (1996).

[24] J. Sonstelie, Public school quality and private school enrollments, *National Tax Journal*, S343-S353 (1979).

[25] E. West and H. Palsson, Parental choice of school characteristics: estimation using statewide data, *Economic Inquiry*, 725-740 (1988).

Table 1: Descriptive statistics and estimated coefficients in baseline sector selection equations (robust standard errors in parentheses)(excluding constants and missing-data flags)

Variable	Probit coefficient (standard error)	Marginal effect	Sample mean	Standard deviation (for continuous variables)
Male	0.013 (0.064)	0.001	0.446	
Asian	0.189 (0.309)	0.016	0.051	
Hispanic	0.186 (0.316)	0.016	0.109	
African-American	0.235 (0.347)	0.021	0.094	
White	0.539 (0.320)	0.036	0.625	
Native American	0.115 (0.336)	0.009	0.031	
Male parent or guardian home	-0.097 (0.065)	-0.008	0.763	
Female parent or guardian	0.055 (0.098)	0.004	0.871	
Number of siblings	-0.031 (0.018)	-0.002	2.029	1.612
Six or more siblings	0.130 (0.118)	0.011	0.059	
Income	0.007 (0.001)	0.0005	35.057	38.932
Parent college grad	0.337 (0.052)	0.029	0.275	
Parent dropout	-0.583 (0.115)	-0.028	0.085	
Parents married	-0.097 (0.066)	-0.007	0.682	
Methodist	-0.115 (0.092)	-0.008	0.066	
Lutheran	-0.284 (0.188)	-0.017	0.049	
Presbyterian	0.190 (0.119)	0.016	0.036	
Episcopalian	0.571 (0.127)	0.069	0.017	

Variable	Probit coefficient (standard error)	Marginal effect	Sample mean	Standard deviation (for continuous variables)
Pentecostal	-0.306 (0.146)	-0.017	0.024	
Other Protestant	0.356 (0.201)	0.036	0.020	
Catholic	0.608 (0.112)	0.061	0.243	
Eastern Orthodox	1.242 (0.263)	0.242	0.003	
Mormon	-0.517 (0.336)	-0.024	0.018	
Other Christian	0.099 (0.107)	0.008	0.082	
Jewish	0.513 (0.187)	0.059	0.022	
Moslem	0.391 (0.237)	0.041	0.004	
Eastern religion	0.330 (0.255)	0.033	0.010	
No religious affiliation	0.271 (0.178)	0.025	0.089	
Omitted religion	0.418 (0.226)	0.043	0.079	
Parent attends religious services	0.233 (0.056)	0.017	0.524	
Eighth grade test score	0.013 (0.003)	0.001	32.475	16.328
County income	0.058 (0.026)	0.043	30.629	8.621
County property values	0.002 (0.003)	0.002	88.023	56.328
County fraction in poverty	0.059 (0.016)	0.004	18.144	9.302
County percent nonwhite	-0.005 (0.009)	-0.0004	28.222	20.803
County percent unionized	0.304 (0.291)	0.022	0.756	0.399
County percent with bachelor's degree	-0.002 (0.019)	-0.0002	15.746	6.252
Religious school in	0.368	0.026	0.595	

Variable	Probit coefficient (standard error)	Marginal effect	Sample mean	Standard deviation (for continuous variables)
student's religion	(0.167)			
County population /100000	-0.011 (0.006)	-0.008	9.161	18.184
Central county in MSA	0.371 (0.251)	0.026	0.566	
Suburban county in MSA	0.383 (0.254)	0.035	0.188	
MSA population /100000	-0.007 (0.002)	-0.0005	22.923	45.371
Violent crime rate	0.862 (0.331)	0.064	0.500	0.430
Public school student-teacher ratio	0.062 (0.039)	0.005	17.244	3.312
Public school concentration	0.780 (0.349)	0.058	0.431	0.346

Table 2: Probit parameter estimates for interactions between three policy-affected variables and individual characteristics (robust standard errors in parentheses)

Regression specification:	(1)	(2)	(3)	(4)	(5)
Violent crime rate in county	0.638 (0.109)	0.809 (0.093)	0.759 (0.100)	0.128 (0.156)	0.559 (0.233)
Violent crime x white	0.180 (0.144)				0.638 (0.149)
Violent crime x parent has bachelor's degree		0.097 (0.084)			0.175 (0.135)
Violent crime x family income			0.002 (0.001)		0.004 (0.001)
Violent crime x eighth grade test score				0.019 (0.003)	-0.011 (0.005)
Concentration of public schools in county	0.066 (0.017)	0.657 (0.113)	0.539 (0.127)	0.879 (0.209)	-0.008 (0.174)
Concentration x white	0.003 (0.015)				0.319 (0.106)
Concentration x parent has bachelor's degree		0.305 (0.118)			-0.070 (0.099)
Concentration x family income			0.005 (0.001)		-0.000 (0.001)
Concentration x eighth grade test score				-0.001 (0.004)	0.018 (0.003)
Student-teacher ratio in county	0.362 (0.144)	0.053 (0.011)	0.054 (0.014)	0.012 (0.021)	0.028 (0.026)
S-t ratio x white	0.657 (0.143)				-0.011 (0.016)
S-t ratio x parent has bachelor's degree		0.032 (0.013)			0.019 (0.015)
S-t ratio x family income			0.0004 (0.0002)		0.00030 (0.00016)
S-t ratio x eighth grade test score				0.0013 (0.0005)	0.0008 (0.0005)

Table 3: Fraction of students predicted to select private high schools under various conditions (derived from Table 2, specifications 1-4)

Student characteristic	*Concentration of public schools in county (thirds)*			*Public school student-teacher ratio (thirds)*			*Violent crime rate in county (thirds)*		
	Lowest concent.	Highest concent.	Difference	Lowest ratios	Highest ratios	Difference	Lowest crime	Highest crime	Difference
FROM SPECIFICATION 1:									
White students	0.154	0.233	0.079	0.129	0.168	0.039	0.066	0.350	0.284
African-American or Hispanic	0.066	0.088	0.022	0.049	0.076	0.027	0.025	0.088	0.063
Difference			0.057			0.012			0.221
FROM SPECIFICATION 2:									
Parents have college degree	0.300	0.459	0.159	0.265	0.369	0.104	0.163	0.528	0.365
Parents have hs, not college degrees	0.047	0.080	0.033	0.038	0.047	0.009	0.018	0.102	0.084
Difference			0.126			0.095			0.281
FROM SPECIFICATION 3:									
Family income over $75,000	0.453	0.722	0.269	0.416	0.647	0.231	0.346	0.726	0.380
Family income under $25,000	0.018	0.034	0.016	0.012	0.018	0.006	0.008	0.039	0.031
Difference			0.253			0.225			0.349
FROM SPECIFICATION 4:									
Top third ability	0.238	0.350	0.112	0.195	0.296	0.101	0.102	0.464	0.362
Bottom third ability	0.022	0.055	0.033	0.022	0.032	0.010	0.016	0.060	0.044
Difference			0.079			0.091			0.318

Table 4: Fraction of students predicted to select private high schools under various conditions (derived from Table 2, specification 5)

Student characteristic	*Concentration of public schools in county (thirds)*			*Public school student-teacher ratio (thirds)*			*Violent crime rate in county (thirds)*		
	Lowest concent.	Highest concent.	Difference	Lowest ratios	Highest ratios	Difference	Lowest crime	Highest crime	Difference
White students	0.155	0.228	0.073	0.126	0.168	0.042	0.062	0.350	0.288
African-American or Hispanic	0.060	0.088	0.028	0.050	0.073	0.023	0.022	0.089	0.067
Difference			0.045			0.019			0.211
Observed difference in data			0.065			0.027			0.131
Parents have college degree	0.294	0.445	0.151	0.262	0.364	0.102	0.161	0.526	0.325
Parents have hs, not college degrees	0.047	0.079	0.032	0.038	0.048	0.010	0.014	0.108	0.094
Difference			0.119			0.092			0.231
Observed difference in data			0.094			0.084			0.161
Family income over $75,000	0.448	0.725	0.277	0.411	0.629	0.218	0.339	0.724	0.385
Family income under $25,000	0.017	0.032	0.015	0.012	0.020	0.008	0.007	0.043	0.036
Difference			0.262			0.210			0.349
Observed difference in data			0.218			0.196			0.275
Top third ability	0.239	0.339	0.100	0.194	0.292	0.098	0.098	0.466	0.368
Bottom third ability	0.018	0.061	0.043	0.022	0.031	0.009	0.015	0.065	0.050
Difference			0.057			0.089			0.318
Observed difference in data			0.053			0.101			0.210

Table 5: Fraction of students selecting private schools, by income and community characteristic

	Income over $75,000	Income under $25,000	Difference	Difference-in-difference
Low public school concentration	0.341	0.044	0.297	
High public school concentration	0.548	0.033	0.515	0.218
Low student-teacher ratio	0.271	0.022	0.249	
High student-teacher ratio	0.478	0.033	0.445	0.196
Low crime rate	0.253	0.023	0.230	
High crime rate	0.545	0.039	0.506	0.275

Table 6: Sensitivity testing: Probit parameter estimates for interactions between violent crime rate and individual characteristics (all other variables from Table 2 are still included in model; robust standard errors in parentheses)

Regression specification:	(1)	(2)	(3)	(4)	(5)
MODEL 1: CONTROLLING FOR EIGHTH-GRADE SECTOR SELECTION					
Violent crime rate in county	1.321 (0.259)	1.405 (0.213)	1.366 (0.217)	1.089 (0.308)	0.911 (0.345)
Violent crime x white	0.340 (0.187)				0.365 (0.190)
Violent crime x parent has bachelor's degree		0.126 (0.143)			-0.010 (0.158)
Violent crime x family income			0.001 (0.001)		-0.000 (0.001)
Violent crime x eighth grade test score				0.009 (0.005)	0.009 (0.005)
MODEL 2: CONTROLLING FOR PERCENT IN PRIVATE SCHOOLS IN 1970					
Violent crime rate in county	0.974 (0.133)	1.223 (0.116)	1.202 (0.123)	0.791 (0.188)	0.771 (0.208)
Violent crime x white	0.478 (0.118)				0.434 (0.122)
Violent crime x parent has bachelor's degree		-0.030 (0.101)			-0.146 (0.117)
Violent crime x family income			0.000 (0.001)		-0.001 (0.001)
Violent crime x eighth grade test score				0.012 (0.004)	0.011 (0.004)

Table 7: Sensitivity testing: fraction of students predicted to change school sector under various conditions

	Model specification: controlling for sector choice in eighth grade			Model specification: controlling for fraction enrolled in private schools in 1970		
Fraction of students changing sector as:	Violent crime rate increases from bottom 1/3 to top 1/3	Concentration increases from bottom 1/3 to top 1/3	Student-teacher ratio increases from bottom 1/3 to top 1/3	Violent crime rate increases from bottom 1/3 to top 1/3	Concentration increases from bottom 1/3 to top 1/3	Student-teacher ratio increases from bottom 1/3 to top 1/3
Student characteristic:						
White students	0.223	0.007	0.028	0.219	0.320	0.060
Parent has college degree	0.289	0.083	0.095	0.285	0.350	0.107
Family income over $75,000	0.386	0.221	0.205	0.386	0.496	0.252
Family income under $25,000	0.037	-0.029	0.002	0.008	0.030	0.016
Top third ability distribution	0.299	0.053	0.086	0.273	0.360	0.081
Bottom third ability distribution	0.049	-0.020	-0.014	0.025	0.081	0.025

Appendix Table 1: Selected coefficients from multinomial logit evidence of differential selection into religious and non-religious private schools (robust standard errors in parentheses)

Equation:	Religious schools vs. public schools	Non-religious schools vs. public schools
Violent crime rate in county	0.436 (0.356)	-2.178 (0.843)
Violent crime x white	0.574 (0.216)	0.872 (0.452)
Violent crime x parent has bachelor's degree	-0.274 (0.203)	0.215 (0.443)
Violent crime x family income	-0.004 (0.002)	0.002 (0.003)
Violent crime x eighth grade test score	0.019 (0.008)	0.066 (0.014)
Concentration of public schools in county	1.581 (0.491)	1.286 (1.236)
Concentration x white	0.984 (0.313)	1.424 (0.665)
Concentration x parent has bachelor's degree	0.574 (0.283)	0.675 (0.601)
Concentration x family income	0.009 (0.003)	0.005 (0.004)
Concentration x eighth grade test score	-0.023 (0.011)	-0.026 (0.020)
Student-teacher ratio in county	0.028 (0.046)	-0.201 (0.154)
S-t ratio x white	-0.029 (0.032)	0.203 (0.103)
S-t ratio x parent has bachelor's degree	0.036 (0.029)	0.173 (0.099)
S-t ratio x family income	0.0006 (0.0004)	0.0013 (0.0007)
S-t ratio x eighth grade test score	0.0015 (0.0010)	0.004 (0.003)