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Home Schooling: An Alternative School Choice

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There is a fairly large, evolving literature on school choice. This literature addresses the factors that influence the choice between schools in the public and private sectors. Overlooked by this literature, however, is the growing segment of school enrollment in home schools. This article empirically examines the decision to educate children at home. The empirical results suggest that the decision to home school depends on the expected quality of schooling the home unit can produce relative to that available from alternatives. More specifically, our results indicate that women's educational attainment helps explain home school enrollment, that greater heterogeneity of income within a public school district increases home enrollment, and that stricter regulations decrease home school enrollment.

1. Introduction

Whether it is due to the global economy, the information age, or other factors, the external constraints on public schools are changing. Parental choice regarding school enrollment is increasing for a variety of reasons. The choices outside the public system are increasing due to publicly financed vouchers, private scholarships, and increased incomes. In addition, both courts and legislatures have required school reforms. In response to these mandated reforms and to the changing environment more generally, public schools have introduced their own reforms by offering a variety of special programs in the form of magnet schools, charter schools, and increased choice among the traditional public schools.

Households are exercising another form of school choice that has been ignored almost entirely in the literature. Scholars have not examined systematically households' decisions to educate children at home, or to home school. Given that approximately 1.5 million children are estimated to be educated at home, this is a significant type of schooling. The home school issue raises many questions. Are the families who choose to home school doing so because of dissatisfaction with public schools or because of religious preferences, or are other factors driving the home school movement? The answers are important because they are related to the fundamental question of what determines a household's choice of school type and the potential impact of public policy on this choice.

In this article, we build on the existing school choice models to extend the options to include public, private, and home schools. We then test the implications of the model with two original data

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sets. First, with data from the Kentucky Department of Education, we create a panel of district-level data over five years to examine the factors that contribute to a family's choice to home school. We then test the model's hypotheses utilizing district-level data for 10 additional states.[1] Departments of Education provided data on the number of home-educated students in each district. The states represent diverse policy perspectives with respect to the degree of regulation of home schools. The empirical results suggest that the decision to home school depends on the expected quality of schooling the home unit can produce relative to that available from alternatives. More specifically, our results indicate that women's educational attainment helps explain home school enrollment, that greater heterogeneity of income within a public school district increases home enrollment, and that stricter regulations decrease home school enrollment.

2. Homes as Schools

Throughout history, families have chosen to home school their children. In the 17th and 18th centuries in the United States, some wealthier families hired private tutors to educate their children, but the majority of parents trained their children at home.[2] Famous students from these early arrangements include Albert Einstein, Amadeus Mozart, George Washington, and John Stuart Mill. In our country's early history, home education was, in part, due to the lack of available alternatives. The passage of compulsory education laws created a wealth of public schools and the choice to home educate almost entirely faded away with strict truancy laws. Today, home education is an increasingly popular educational choice among parents.

For the most part, the little that is known about those who home school is anecdotal or based on surveys by advocacy groups for home schooling. There is some evidence suggesting that the resurgence of home schools as a modern form of school delivery came about during the anti-establishment period of the 1960s. More recently, journalists have portrayed home schooling as the alternative preferred by large numbers of fundamentalist religious households. One thing that has been consistently found in all studies of home education is that the growth has been strong. In the 1970s, the government and various home school groups estimated the home school population to be between 10,000 and 20,000 students. By the late 1980s, the numbers had grown to between 120,000 and 260,000. Recent estimates put the home school population between 1.2 million and 1.6 million and growing at the rate of 10% per year. Home-educated children make up about 1.5% of total school enrollment and 15% of nonpublic enrollment. Some researchers feel the home school population will reach 3 million by the end of this decade.

Public perception of home education has also changed over the last 15 years. In 1986, a Phi Delta Kappa-Gallup poll found only 16% of Americans believed home schooling to be a "good thing" (Lines 1996). In 1994, however, a Wall Street Journal-NBC News poll found 28% of Americans would actually prefer home education to in-school education. The upper bound on the potential home school population is hard to estimate, but it could be significant. Potentially, the upper bound on the home school population equals the 6.8 million families with children (25.9% of all families with children) with a nonemployed, stay-at-home parent.[3]

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[1] States were chosen based on the availability of data.

[2] A distinction should be made between home education by a parent versus a tutor. Clearly they could be very different forms of education. The remainder of this article will assume that home education is meant to be education provided by parents. Home education surveys suggest that the parents provide more than 98% of all training.

[3] See U.S. Census Bureau (1997).

The growth in home education has led to a host of challenges to existing truancy laws and eventually resulted in new legislation. Thirty-five states have laws specifically dealing with home schooling.[4] These laws can vary significantly across states. A few states have even begun to offer hybrid forms of public–home enrollment. Idaho allows for dual enrollment, and one district in California offers a $1000 voucher to home-educated children for the purchase of district-approved textbooks.[5] The one attempt to regulate home education at the federal level was defeated in the House of Representatives 424 to 1 (Robertson 1994).

In the remainder of this article, we consider the decision to enroll children in home schools as a utility-maximizing choice made by households. After developing a conceptual model to analyze the school choice decision, we empirically investigate factors expected to influence the decision to home school.

3. A Model of School Choice

Theoretical work on the demand for alternative types of schooling began as early as the 1970s with studies by Stiglitz (1974) and Sonstelie (1979, 1982) and with recent generalizations by Lankford and Wyckoff (1992), Lankford, Lee, and Wyckoff (1995), and Downes and Schoeman (1998). In the 1980s, empirical work on the public–private school choice issue also emerged (Gemello and Osman 1984; Long and Toma 1988; West and Palsson 1988; Lankford and Wyckoff 1992; Lankford, Lee, and Wyckoff 1995). This literature has found, not surprisingly, that socioeconomic variables and religious preferences are significant factors in explaining private school enrollment.

In this section, we generalize a utility-maximizing household decision model of school choice to include home schools as a form of schooling that may be an alternative to either public or private schools. For purposes of illustration, assume public schools are represented as type 1, private schools as type 2, and home schools as type 3. We assume that each household or family, h, has a mother (m), father (f), and a single school-age child and considers a set of mutually exclusive school type options, j, $j = 1, 2, 3$.[6] Each household chooses the alternative j that provides it the greatest utility, U_{hj}. For example, a household chooses school type 3 among the three alternatives if the utility $U_{h3} > U_{hj}$ for $j \neq 3$. The household utility from any school type j depends on a vector of household attributes, X_h, representing socioeconomic characteristics and tastes for schooling relative to a composite package of consumption goods, C_h. Utility also depends on a vector of school attributes, S_j, which influences the household's perception of the school. More formally,

$$U_{hj} = U(X_h, C_h, S_j, \varepsilon_{hj}), \tag{1}$$

where ε_{hj} is a scalar composite of all relevant but unmeasured factors. The inclusion of this random disturbance term will capture both unmeasured school-specific characteristics and the perception of these characteristics by each household.[7] Each household maximizes utility by allocating its budget between schooling and all other goods and services.

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[4] See Klicka (1996).

[5] These hybrid arrangements are not very prominent and are not a factor in the data set compiled for this study.

[6] The implications of the model do not depend on the family composition we propose. Rather, the assumptions are made for purposes of simplification.

[7] See Lankford and Wyckoff (1992) and Lankford, Lee, and Wyckoff (1995) for additional examples of the inclusion of a random error term to capture both unmeasured school characteristics and unmeasured residual differences in preferences for a school alternative.

As represented above, the choice of school type depends not only on the characteristics of the school and the socioeconomic characteristics of the household but also on the consumption of other goods. Consumption of other goods enters the equation because the types of schools differ not only in attributes of the school that are observed by the household but also in cost to the household. Publicly provided schooling is tax financed by a flat tax, t, on household earnings, and all households pay for public schooling regardless of whether or not the child is enrolled in the public system. Households that choose the public school, or school type 1, may incur some additional costs besides the payment of taxes. The cost of supplemental materials, extra curricular activities, etc., may be paid by the public school household. Households that choose traditional private schooling (type 2) must pay the tuition price set by the school and other costs, such as textbooks and donations to the school, and in addition must pay the tax for the public school.[8] Finally, households that choose home schooling must pay the cost of educational materials such as books, curriculum planning guides, and extracurricular activity fees and continue to pay the tax for the public school.[9] The explicit cost may be a relatively low part of the cost to the home schooling family. The household has to forego potential labor income to enable one parent to remain at home. For purposes of simplicity, we assume the mother is the parent that home schools and therefore does not participate in the labor force.[10] The family will take these explicit and implicit costs into account as it considers the school type option.

Households choose the school alternative j only if the utility derived from that choice is greater than any other of the k alternatives. Stated alternatively, households choose type j if $U_{hj} > U_{hk}$ for all $k \neq j$. The probability that a household will choose a particular type of schooling is given by

$$P_j = \text{prob}[U_{hj} > U_{hk}] \quad \text{for all } k \neq j. \tag{2}$$

The model captures the hypotheses about the probabilities of attending private or public school that have been described by others. For example, if households perceive that public school attributes match their tastes for schooling, then the level of utility from school type 1 increases and thus increases the probability that a given household will choose the public school over the other types. Similarly, because households must pay tuition to attend private schools but do not receive remission of taxes, the probability of choosing the higher cost private schools increases as earned income increases.

For purposes of this article, emphasis is on factors that influence the probability of choosing school type 3, the home school, relative to that of types 1 and 2. Begin with a simple illustration. Increased quality of the public school, S_1, increases the utility from school type 1 and thereby increases the probability that public schools will be chosen over private or home schooling *ceteris paribus*. From this perspective, home schooling can be viewed as another alternative to public schools. On the other hand, an increase in private school tuition would lead to an increase in the probability a household chooses home schooling and public schooling as an alternative to the private school. Certain taste variables such as religious preferences may increase the attractiveness of both home and private schools relative to the public schools because of the increased freedom to explicitly include religious training in these settings. Religious preferences also can have an opposing effect. Students in religious minorities, for example, may find public schools more attractive than certain private schools when the latter explicitly include religious training in a faith other than that of the minorities.

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[8] In 1994, the average annual private elementary and secondary school tuition was $2100 and $3100, respectively.

[9] These out of pocket expenses averaged $488 per annum in 1990. See Ray (1990).

[10] We make this assumption because sample statistics show that, on average, the mother is responsible for 88% of instruction. See Ray (1990).

The mother's education influences the household decision regarding home schooling in multiple ways. The mother's level of education influences the household's school choice by affecting the marginal utility the mother receives from participating in labor market activity, her wages earned in the labor force, the labor force participation decision of the father and by influencing the quality of home schooling the mother can produce. The last factor is important, for unlike in the public and private schools, the attributes of the home school are defined almost entirely by the inputs of the household. In particular, the mother's level of education is a chief determinant of the characteristics of the home school. With higher levels of schooling, the mother can produce a given quality of home school with less effort. Stated alternatively, for a given level of effort expended, the mother can produce a higher quality product if she has attained a higher level of schooling. The choice confronting the household, however, is that higher levels of education on the part of the mother also imply higher wages and therefore an increased incentive to participate in the labor force. On net, the household must weigh the marginal income gains from the mother participating in the labor force versus the quality of the home school she can provide relative to the public and private alternatives.

The educational level of the father enters the household decision as it influences the household taste for education. His income also influences the decision. Increased earning power of the father, *ceteris paribus*, diminishes the marginal value of additional dollars to be earned by the mother and lowers her cost of dropping out of the labor force. Home schooling the child represents one alternative activity that the mother may choose in the absence of formal labor force participation.

4. Data and Empirical Model

The absence of prior work on home schooling can be explained by the paucity of readily available data. This article uses two sets of data that were constructed with input from state departments of education and matched to data from the National Center of Education Statistics. The first set is a panel of enrollment and school-finance data for the 176 school districts in the state of Kentucky over the five academic years from 1991–1992 to 1995–1996. Kentucky only began collecting home school data in 1991. Even so, this was earlier than most states, and many states continue to have no systematic mechanism for collecting home school enrollment data. Although we were unable to construct a panel of data for other states because of the lack of reporting over time, we created a second cross-sectional district-level data set with enrollment data from 10 states for the 1995–1996 academic year. These states are Colorado, Delaware, Florida, Kentucky, Nevada, New Mexico, North Carolina, Rhode Island, Washington, and Wisconsin. This latter set consists of 1395 school districts. The school enrollment data in Kentucky and across the states were matched to demographic data from the National Center of Education Statistics (1990 School District Data Book), financial data obtained from state departments of education, and data from *Churches and Church Membership in the United States* (1990) prepared by the Roper Center for Public Opinion.[11]

Consistent with the national trend, Kentucky saw significant growth in home education from 1991 to 1995, with home enrollment reaching nearly 1% of total enrollment by the 1995–1996 academic school year. In particular, as Table 1 indicates, the home school enrollment as a percentage of total enrollment almost doubled from the school year 1991–1992 to 1995–1996, with the percentage in 1995–1996 equaling 0.849. Private school enrollment over this period fluctuated

[11] The independent variables obtained from both the School District Data Book and the Church Membership Survey are not available on an annual basis, and thus these variables only utilize 1990 data.

Table 1. Total Kentucky School Enrollment by School Type

Academic Year	Public (% Total)	Private (% Total)	Home (% Total)	Total Enrollment (% Total)
1991–1992	633,772 (90.5)	63,165 (9.0)	3102 (0.4)	700,039 (100)
1992–1993	640,477 (90.7)	62,120 (8.8)	3702 (0.5)	706,299 (100)
1993–1994	629,283 (90.4)	63,005 (9.0)	3993 (0.6)	696,281 (100)
1994–1995	639,726 (90.3)	63,745 (9.0)	5254 (0.7)	708,725 (100)
1995–1996	658,775 (90.1)	66,018 (9.0)	6208 (0.8)	731,001 (100)
Total all years	3,202,033 (90.4)	318,053 (9.0)	22,259 (0.6)	3,542,345 (100)

annually, with a slight increase from 1991–1992 to 1995–1996, and public school enrollments also fluctuated but decreasing from the period 1991–1992 to 1995–1996.

Across the 10 states, 1.16% of total enrollment was in home schools in the academic year 1995–1996. Slightly over 9% of children were in private schools, and the remaining 89.7% were enrolled in public schools. As illustrated in Table 2, however, there is significant variance across the states. New Mexico has the highest mean percentage of home enrollment at 1.76%, a below-average private school enrollment (7.20%), and an above-average enrollment in public schools, at 91.04%. As an indication of the lack of a systematic relationship between home school and public school enrollment, consider the state of Wisconsin. It has the second highest enrollment in private schools (14.42%) but also the third highest enrollment in home schools (1.52%) in the sample. Of the 10 states, Wisconsin has the second lowest public school enrollment (84.06%).

Broken down in more detail, in every state except Nevada, districts with high levels of home enrollment have lower mean levels of private enrollment.[12] Likewise, in the aggregate, public enrollment percentages are lower in high home enrollment districts than in districts with low home enrollment. There is great variance across states, however, with four states having higher public enrollment in those districts with high levels of home enrollment. Understanding the relationship between public, private, and home enrollments requires more analysis.

As described above, all data in the sample are district-level data.[13] The model presented in section 3, however, was household based. An established literature discusses the advantages and disadvantages of using aggregate data to estimate household educational demand functions.[14] Generally, the use of aggregate data will tend to confound important relationships between individual families and schools. More specifically, Hanushek, Rivkin, and Taylor et al. (1996) argue that, in cases where omitted variables relate to state differences in school policy, there will be an upward bias of estimated school resource effects on educational achievement. The omitted variable bias works in a similar direction for the school choice decision. Ideally, we would estimate the models using household data matched to school-level data; however, these data are not yet available.[15] This study uses the lowest level of aggregation currently available, school district-level data. All coefficients, especially on the school resource inputs, must be interpreted with the above qualifications.

As described in section 3, households can choose among three school choice alternatives. Household utility from the alternatives was described as a function of the observed (S_j) and

[12] See Houston (1999) for these details.

[13] North Carolina data are county-based rather than district.

[14] In particular, see Downes and Schoeman (1998), Lankford and Wyckoff (1992), and Hanushek, Rivkin, and Taylor (1996).

[15] The 1994 Current Population Survey (CPS) attempted to include home education in the survey. Parents that indicated they had children of schooling age were asked if their children were enrolled in school. If the response to this question was yes, then the survey continued without asking about home schooling. This flaw led to significant underreporting of home education.

Table 2. Total School Enrollment by School Type and State

State	Public (% Total)	Private (% Total)	Home (% Total)	Total Enrollment (% Total)
Entire sample	7,253,124 (89.7)	739,064 (9.1)	93,556 (1.2)	8,085,744 (100)
Colorado	655,679 (92.1)	48,804 (6.9)	7,567 (1.1)	712,050 (100)
Delaware	103,033 (82.2)	22,022 (17.6)	281 (0.2)	125,336 (100)
Florida	2,124,254 (88.8)	245,239 (10.3)	22,285 (0.9)	2,391,778 (100)
Kentucky	658,775 (90.1)	66,018 (9.0)	6208 (0.8)	731,001 (100)
Nevada	265,041 (94.6)	11,973 (4.3)	3077 (1.1)	280,091 (100)
New Mexico	317,404 (91.0)	25,113 (7.2)	6138 (1.8)	348,655 (100)
North Carolina	1,156,885 (93.1)	71,598 (5.8)	13,801 (1.1)	1,242,284 (100)
Rhode Island	148,977 (85.4)	25,075 (14.4)	493 (0.3)	174,545 (100)
Washington	956,763 (91.2)	74,574 (7.1)	18,074 (1.7)	1,049,411 (100)
Wisconsin	866,313 (84.1)	148,648 (14.4)	15,632 (1.5)	1,030,593 (100)

unobserved attributes and perceptions (ε_{hj}). Following McFadden (1974), the probability that a household drawn randomly will choose school option j was given by

$$P_j = \text{prob}[V_{hj} + \varepsilon_{hj} > V_{hk} + \varepsilon_{hk}] \tag{3}$$

for all $k \neq j$, where V is a linear function of the explanatory factors described in the previous section. Assuming the ε_{hk} are independent and identically distributed, the probability that a student enrolls in alternative j is

$$P_j = e_j^V / (e_1^V + e_2^V + e_3^V) \tag{4}$$

and the relative odds of the choices satisfies

$$\log P_k / P_j = V_k - V_j \quad \text{for all } k \neq j. \tag{5}$$

Because households can choose home, private, or public education, the estimating technique for the household decision is a multinomial logit or probit model.[16] We use the logit specification and estimate effects by essentially separating the estimation into a series of two-alternative choices. The choices are that of public schooling or home schooling and private schooling or home schooling. The dependent variables become the log of the odds ratio of choosing public schooling over home schooling and the log of the odds ratio of choosing private schooling over home schooling.

The independent variables used in the estimated model include a vector of variables that represent socioeconomic and religious characteristics of the households in each school district and characteristics of the public schools in each school district. See Table 3 for a description of the independent variables and their means and standard deviations for the Kentucky data and the 10-states' data. The school characteristics include the per-pupil expenditures in the public schools in the district and the high school dropout rate in the district. The socioeconomic variables include the education level of females and males by categories of education completed. The categories for female education are those for whom the highest educational attainment is completion of high school but no college, some college education but no degree, and those with a bachelor's degree or higher. Because

[16] The multinomial logit model is appropriate if all other potential alternatives are independent of those included in the estimation of the odds ratio. We applied the Hausman test for independence of irrelevant alternatives. As a test of robustness, we also estimated the regressions using ordinary least squares. The dependent variables were percentage of students enrolled in home school and percentage enrolled in private schools. The results were qualitatively unchanged.

Table 3. Descriptive Statistics

Variable Name	Variable Description	KY Mean (SD)	10-States Mean (SD)
EXPEND[a]	Public school current operating expenditures per pupil	2915 (413.68)	6014 (1809.25)
DROPOUT[b]	Total number of persons age 16–19 not enrolled in school and not high school graduates/ total children age 3–19	0.0396 (0.0203)	0.0250 (0.0201)
SDINC[b]	Standard deviation of income by district	22,322 (4072)	23,775 (4749)
DENSITY[b]	Population density per square kilometer	240.58 (506.22)	140.76 (391.14)
BAFEMALE[b]	Percentage of females 16+ with highest educational attainment being a bachelor's degree or higher	0.0922 (0.0543)	0.1273 (0.0763)
SCFEMALE[b]	Percentage of females 16+ with highest educational attainment being some college education but no degree	0.1821 (0.0590)	0.256 (0.0751)
HSFEMALE[b]	Percentage of females 16+ with highest educational attainment being a high school diploma but no other education	0.3371 (0.0589)	0.364 (0.0780)
FEMALELEP[b]	Labor force participation rate of females age 16+	0.4694 (0.0885)	0.5385 (0.0940)
BAMALE[b]	Percentage of males age 16+ with highest educational attainment being a bachelor's degree or higher	0.1080 (0.0818)	0.1507 (0.0979)
MALEINC[b]	Average male income	17,248 (4878.21)	20,793 (5411.76)
MARRIED[b]	Percentage of households headed by married couples	0.6167 (0.0848)	0.6294 (0.07745)
BLACK[b]	Percentage of total population that is African American	0.04 (0.0514)	0.0346 (0.0832)
POVERTY[b]	Percentage of population living below the 1989 poverty level	0.2269 (0.0985)	0.1449 (0.0876)
BAPTIST[c]	Percentage of total religious adherents that are Baptist	0.5355 (0.2015)	0.1721 (0.2299)
CATHOLIC[c]	Percentage of total religious adherents that are Catholic	0.0722 (0.0965)	0.2289 (0.1260)
EVANGELICAL[c]	Percentage of total religious adherents that are Evangelical	0.0023 (0.0048)	0.0761 (0.0949)

[a] These data along with all enrollment data are annual data provided by each of the relevant states' department of education.
[b] Source: U.S. Department of Education. 1990. *School district data book* (CD ROMs). Washington, DC: Office of Educational Research and Improvement.
[c] Source: University of Connecticut. 1990. *Churches and church membership in the United States*. Storrs, CT: Roper Center for Public Opinion.

the theoretical model focuses largely on female education and its implications for the school choice decision, the male education distinction is restricted to those adult males who have completed a bachelor's degree. Other independent variables include the income level of the males, the labor force participation rate of females in the district, the percentage of married households in the district, the

distribution of income within a district, the population density per square kilometer in the district, the percentage of blacks in the district, and the percentage of the district's population living in poverty. The religious-taste variables are the percentage of persons in the district who claim adherence to Baptist, Catholic, or Evangelical religions. The Kentucky data also include year fixed effects as well as dummy variables control for regional fixed effects in the state that may not be accounted for in the other independent variables.[17] The 10-state data set includes state fixed effects and will be discussed in more detail later.

Panel Data

The results in Table 4, columns 1 and 2, are ordinary least squares and two-stage least squares estimates using the panel of data for the state of Kentucky, while columns 3 and 4 are estimates across states using the same two estimating procedures. The two-stage model was estimated to address the possible simultaneity of the decisions to home school and support public school spending.[18] In particular, families in a district who choose to home school may be less likely to support higher levels of expenditures for public schools. Similarly, households facing a residential decision may choose to live in a district with lower levels of expenditures for the public schools if they expect to home school. To the extent either of these possibilities present themselves in reality, the estimated coefficient on the expenditure variable in an ordinary least squares model will be biased. We present both model results as an illustration of robustness.

All estimates in Table 4 are the log odds of the probability of public school choice over home school choice. A positive sign on the estimated coefficient suggests an increased probability of choosing public schooling and a negative coefficient implies an increased probability of choosing home schooling. Consider first the variables that proxy for public school quality, per-pupil expenditures, and dropout rates.[19] The probability of choosing public schooling over home schooling would be expected to rise as the absolute quality of public schooling rises, *ceteris paribus*. The Kentucky estimates indicate that expenditures are insignificant but dropout rates are negative and significant. Dropout rates in the public schools appear to be influencing the decision to home school. In particular, higher dropout rates are negatively associated with public school enrollment rates *vis-à-vis* home schooling. Stated alternatively, higher dropout rates in public schools are related to a higher probability of choosing home schooling in Kentucky. The negative result holds with both ordinary least squares and two-stage least squares estimates.[20]

The diversity of a school district as represented by its standard deviation of income is strongly significant in the Kentucky estimates. To the extent that income proxies taste for schooling, greater income heterogeneity implies a larger variance in demand for the educational product. Voters in

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[17] Fixed effects at the district level were not feasible because demographic variables are based on census data at the district level that are time invariant. School districts in Kentucky are quite small and there are significant variations by region of the state.

[18] Per-pupil expenditures and enrollment are both considered endogenous in the two-stage least squares estimates. Expenditures are identified by the percentage of the population with school-aged children. Per the suggestion of an anonymous referee, we used alternative variables to identify the expenditure equation, including the years since court-mandated reform of school finance interacted with the district's position of locally raised revenues prior to the reform. The second-stage estimates were qualitatively unchanged by the choice of instrument.

[19] There is a large literature that examines the relationships between expenditures and school quality. We are not testing this relationship but using expenditures and dropout rate as imperfect proxies for school quality that may be subject to upward bias (See Hanushek, Rivkin, and Taylor, 1996). Better data reflecting school quality are not available.

[20] Note that public school spending was estimated with instruments but there was not a good instrument by which to endogenously estimate dropout rates.

Table 4. Estimated Multinomial Logit School Choice Model: ln(% Public Enrollment/% Home Enrollment)

Explanatory Variables	KY	KY 2SLS	Ten State	Ten-State 2SLS
ln(EXPEND)	0.923	−1.779	3.753***	5.531***
	(1.075)	(−1.008)	(10.210)	(3.205)
DROPOUT	−21.003***	−22.165***	−2.905	−1.935
	(−3.710)	(−3.866)	(−0.769)	(−0.494)
SDINC	−0.00019***	−0.00021***	−0.000069***	−0.000068***
	(−3.914)	(−4.117)	(−3.150)	(−3.083)
ln(DENSITY)	0.535***	0.484***	0.081	0.191*
	(4.339)	(3.802)	(1.505)	(1.630)
BAFEMALE	15.669***	16.466***	0.142	−1.142
	(2.756)	(2.870)	(0.064)	(−0.447)
SCFEMALE	−7.041**	−7.264**	−4.879***	−4.912***
	(−2.153)	(−2.207)	(−3.374)	(−3.367)
HSFEMALE	−4.390	−3.985	−5.442***	−5.790***
	(−1.203)	(−1.084)	(−3.568)	(−3.680)
FEMALELFP	−5.848**	−6.892**	−0.313	0.148
	(−2.146)	(−2.457)	(−0.320)	(0.137)
BAMALE	−11.775***	−9.820**	−2.977*	−3.073*
	(−2.940)	(−2.350)	(−1.648)	(−1.684)
ln(MALEINC)	5.308***	5.069***	3.232***	2.960***
	(3.346)	(3.166)	(4.381)	(3.760)
MARRIED	−5.041**	−6.078***	−0.852	0.114
	(−2.221)	(−2.577)	(−0.799)	(0.081)
BLACK	−7.128***	−5.571*	−0.377	−0.513
	(−2.639)	(−1.950)	(−0.319)	(−0.428)
POVERTY	2.459	3.487	3.488**	2.941
	(0.633)	(0.883)	(1.991)	(1.598)
BAPTIST	0.775	0.475	0.589	0.621
	(0.894)	(0.535)	(0.784)	(0.819)
CATHOLIC	2.587	2.837	−0.097	−0.477
	(1.160)	(1.263)	(−0.079)	(−0.370)
EVANGELICAL	−7.517	−6.114	−0.407	−0.370
	(−0.336)	(−0.271)	(−0.339)	(−0.306)
Observations	880	880	1395	1395
F-statistics	10.51	10.38	12.12	8.23
Adjusted R^2	0.2689	0.2603	0.1662	0.1520

The *t*-statistics are reported in parentheses. Significance reported as follows: significantly different from zero (in a two-tailed test) at the * 10% level, ** 5% level, *** 1% level. ADD, Year, and State Dummies not reported.

a school district choose a district level of public school spending through some collective decision rule. In a perfectly homogenous district, the decision rule would necessarily satisfy all voters. Greater variance in income or tastes, however, means that more households would be expected to prefer some alternative level of expenditures to that chosen by the collective and therefore would be more likely to choose alternatives to the public schools.[21] The results from columns 1 and 2 support the hypothesis that the greater disparity in income in a district is related to a smaller probability of enrolling in the public school relative to the home school.

[21] A referee also points out that the results are consistent with parental desire to limit exposure of their kids to low socioeconomic peers.

The coefficients on the population density variable are also significant and positive in columns 1 and 2. The results imply that households are more likely to choose public schools over home schools in more densely populated areas. Density *per se* is likely to imply greater numbers of schools, including public and private.[22] As a result, households facing more alternatives regarding type of school are more likely to find the school with desired attributes. In less densely populated areas, the home school becomes relatively more attractive even controlling for education, income, and poverty rates.

As discussed earlier, the relationship between educational levels and the decision to home school is of particular interest. Because the mother is assumed to be the one providing the home schooling, we evaluate the effects of education on the home school choice with three variables. Recall that we assume education increases both the wage rate and the productivity of the mother's effort in providing home schooling, thus leading to ambiguous conclusions about its expected sign. The variables BAFEMALE, SCFEMALE, and HSFEMALE measure the percentage of mothers in a district who hold a bachelor's degree, the percentage with some college education, and those with a high school degree.[23] Of great interest, the variables have different signs. More mothers with bachelor's degrees, *ceteris paribus*, imply a higher probability of public school enrollment relative to the home school choice or, alternatively, a lower probability of home school relative to public school enrollment. More mothers who have some college education (but not a degree) and more mothers with a high school degree, on the other hand, result in a smaller probability of public enrollment relative to home school, although the latter is insignificant. These results suggest that the rising productivity of effort associated with providing home schooling outweighs the increased value of labor force participation with high school and some college but reverses with a college degree.

Contrary to expectations, the percentage of women in the labor force is negatively related to the odds ratio of public to home school enrollment. Districts in which a high percentage of women are in the labor force are also the ones in which there is a lower probability of public schooling relative to home schooling. One reason for this result may be due to the fact that two-earner families are likely to move kids from public to conventional private schools and thereby reduce the numerator of the dependent variable by more than the denominator decreases.[24]

The characteristics of the males of the district are also of interest. The percentage of males with a college degree, BAMALE, is negatively related to the odds of choosing public schools over home school, controlling for the male income level (MALEINC) in the district and the percentage of households headed by married couples (MARRIED). Districts with a high percentage of college-educated males have higher proportions of home-schooled children relative to public schooling, *ceteris paribus*. Home schooling in Kentucky is also explained by the percentage of blacks in the district's population. A higher percentage of blacks in the district increases the odds of choosing home schooling. This result reinforces the earlier result on income heterogeneity. Finally, we consider whether the home school movement in Kentucky is explained by religious preferences. Three measures for religious preferences are used. They include percentage of Baptists, percentage of Catholics, and percentage of Evangelicals in the district. No measure of religious preferences proves significant in explaining the public to home schooling decision in Kentucky school districts.[25]

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[22] As an alternative to the density variable, we substituted number of private schools, and the coefficient was significant and negatively related to the proportion of home schooled students. We chose to use density because the number of private schools is expected to be influenced by the quality of public schools and thus introduces another simultaneity bias into the estimates.

[23] The omitted variable is the percentage of females with no high school degree.

[24] Thanks to an anonymous referee for this explanation.

[25] We also estimated religious preference in alternative ways with both data sets. A dummy variable was created for the majority religious preference in a district and interacted with the various religious measures to determine whether the effect of religion depended on the characteristics of the majority of the population. The religious variables were insignificant in these estimates.

Finally, although not reported, we included both time and region fixed effects as control variables.[26] These variables were included to control for unobservable attributes of the various regions of the state that may not be captured by the independent variables.

State-Level Estimates

Columns 3 and 4 present the estimates from the model when using the data from the 10 states from which home enrollment data were available. The single year for which the most data were available was the 1995–1996 academic year.[27] The sample of district-level data for these states is 1395 districts. Descriptive statistics are presented in Table 3 in the second column.

The state data are of particular interest because the states differ with respect to regulatory policy governing home schooling. In Kentucky, for example, the regulations require that parents register their children as home schooled. Beyond that, the state requires little additional information and imposes no testing requirements. This is also true for Washington and Wisconsin. For this reason, Kentucky data may not generalize across the 10 states in the sample. Seven of the states require standardized testing for all students who are home schooled. To some households, this requirement may be viewed as an added cost of home schooling and, if so, would be expected to influence the home schooling decision.[28] Because there may be additional policies or characteristics of schools across states that are unobserved, we estimate the state model using fixed effects for differences across states.[29]

The results from estimating the logs-odds ratios of home schooling relative to public schooling are presented in columns 3 and 4 of Table 4. The results from estimating the log of the probability of public enrollment over the probability of home enrollment in an ordinary least squares model are presented in column 3, and column 4 presents results from a two-stage least squares model. As with the single-state estimates, we begin with a focus on the public school policy variables, expenditures per pupil, and dropout rates. Interestingly, expenditures per pupil are highly significant and positive while dropout rates are not significant. On average, for the households in almost 1400 school districts across 10 states, higher public expenditures are related to a higher probability of choosing public schooling and a smaller probability of choosing home schooling.

As in Kentucky, the estimates across states suggest that the heterogeneity of the population of a district, as reflected in the income dispersion, is a significant factor in explaining enrollment probabilities. In both the ordinary least squares and the two-stage least squares estimates, the standard deviation of income is negative and significant. To the extent that the deviation in income proxies for variance in tastes, these results suggest that difference in tastes within a district increases the probability of home school enrollment relative to public school.

The educational attainment of the mother across districts in the 10 states is also similar to the districts of Kentucky over time. A higher percentage of mothers in the districts who have graduated

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[26] In Kentucky, there are 15 regions designated as Area Development Districts (ADDs). These areas differ significantly across the state in socioeconomic and cultural dimensions. There are 177 school districts, but because we used time-invariant demographic variables at the district level, fixed effect dummy variables were precluded.

[27] Presumably, these data will continue to be collected and a richer panel of data could be constructed at a later date.

[28] If the regulatory structure of the state is endogenous (i.e., those states where households prefer home schooling may be those with an absence of regulations), then the estimated coefficients may be biased. Ideally, we would estimate the regulatory structure as part of a system of equations. With data from only 10 states, we cannot adequately estimate the regulatory structures of the states, but as described in the text, we do estimate the models using state fixed effects.

[29] More specifically, we might expect that those states in which the households have a particular propensity to home school would be the states in which testing and other home school regulations are relatively lenient. Although explaining regulatory differences is beyond the scope of this article, we estimate the models with state dummy variables to capture these unobserved differences across states that may affect school policies and characteristics (also see previous footnote).

from high school or who have attended college for some time but not received a degree decreases the probability of enrolling in public schools and increases the probability of enrolling in home school. The attainment of a college degree by the females in the district is not significant across states.

Other variables that are significant in explaining the probability of public over home enrollment include the population density, male income, and the education level of the father. As in the Kentucky estimates, the religious adherence variables are not significant. This is in contrast with popular lay hypotheses about the explanation for the home school movement. Future research may help determine whether or not this result is a function of using aggregated data.

Finally, we controlled for unobserved differences across states with state dummy variables, and results are available on request.[30]

Private and Home Enrollment

Table 5 results represent the log odds of the ratio of private enrollment to home school enrollment.[31] We are interested in this choice because ultimately we wish to understand home school choice relative to all others. As expected, the attributes of public schools are less robust in explaining private enrollment relative to home school.[32] In particular, the expenditures on public schools do not affect the odds of attending private to home schools. The dropout rate is significant but has a positive sign for the Kentucky estimates and a negative sign across districts in the 10 states. Population density is significant and positive in the 10-state model, suggesting that increased school availability leads to increased private enrollment relative to home enrollment.

Again, as with the public/home odds estimates, of particular interest are the results on the educational attainment and income variables. While fewer educational variables are significant in the private/home estimates, the percentage of mothers with a high school degree is positive and significant in the Kentucky estimates, indicating that high school graduation increases the odds of choosing private school over home schooling. Across the districts of the 10 states, some college education for the female population increases the odds of choosing home schooling relative to private schooling. The educational attainment for the adult males is insignificant in explaining the relative odds of private to home schooling choice across Kentucky but is significant across districts in the 10 states. The female labor participation variable is positive and significant in the Kentucky and across-states estimates. Male income is positive and significant in the Kentucky equation, indicating that higher income for the male leads to a greater probability of private schooling relative to home schooling. The variable MARRIED is negative and significant in Kentucky and across the 10 states, implying that, *ceteris paribus*, households will be more likely to choose home schooling over private schooling when there are two adults in the household.

The percentage of blacks in the population is also positive and significant in explaining the private to home school enrollment in Kentucky and across the states. For both Kentucky and across states, a higher percentage of Catholics in a district increases the probability of enrolling in private schools relative to home schooling. This finding is consistent with numerous studies on private school

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[30] An additional variable, NOTEST, was included in the 10-state model. This variable serves as an indication of the degree of regulations of home schooling across the states. The NOTEST variable is a dummy variable with the value of one if the state has no standardized testing of students who are home schooled and a value of zero if there is standardized testing. We would expect that regulations on home schooling would increase the consistency with our expectation.

[31] The estimates are based on ordinary least squares estimates.

[32] Ideally, we would use characteristics of the private schools in the district such as true cost of attendance or class size, but data are unavailable.

Table 5. Multinomial Logit School Choice Model: ln(% Private Enrollment/% Home Enrollment)

Explanatory Variables	KY	Ten State
ln(EXPEND)	−0.248 (−0.227)	0.709* (1.658)
DROPOUT	18.915*** (2.617)	−8.270* (−1.754)
SDINC	−0.000010 (−0.161)	0.000018 (0.659)
ln(DENSITY)	−0.021 (−0.135)	0.701*** (11.589)
BAFEMALE	11.053 (1.523)	−2.747 (−0.980)
SCFEMALE	4.325 (1.036)	−6.178*** (−3.731)
HSFEMALE	16.313*** (3.503)	−1.049 (−0.555)
FEMALELFP	12.773*** (3.671)	2.722** (2.267)
BAMALE	−3.464 (−0.678)	4.768** (2.084)
ln(MALEINC)	3.793* (1.873)	−0.060 (−0.067)
MARRIED	−9.344*** (−3.225)	−3.654*** (−2.787)
BLACK	7.566** (2.195)	2.817** (2.166)
POVERTY	6.523 (1.316)	−0.928 (−0.438)
BAPTIST	0.280 (0.254)	−0.800 (−0.989)
CATHOLIC	20.058*** (7.047)	3.193*** (2.498)
EVANGELICAL	0.399 (0.014)	−0.031 (−0.026)
Observations	880	1395
F-statistics	16.41	33.37
Adjusted R^2	0.3735	0.2837

The t-statistics are reported in parentheses. Significance reported as follows: significantly different from zero (in a two-tailed test) at the * 10% level, ** 5% level, *** 1% level. ADD, Year, and State Dummies not reported.

enrollment. Again, interestingly, no other religious group is significant in explaining the odds of enrollment.

It is useful to place the results from Tables 4 and 5 in context. Based on the mean of the variables, the predicted enrollment in home schools in Kentucky is 0.50% of students. The coefficients from the above can be used to calculate probabilities of home enrollment that vary with public policy changes. Take the most commonly used input, expenditures per pupil. The sample mean value of expenditures across the districts during this time period was $2915 per pupil. The lowest 10th percentile of the districts had expenditures equal to $2481 or less. Decreasing the mean expenditure by the difference ($434) increases predicted enrollment in home schools from 0.50 to 0.57%.

Consider the output measure DROPOUT. The sample mean is 3.96%. Ten percent of districts had dropout rates of 6.33% or higher. An increase in the dropout rate from 3.96 to 6.33% causes home enrollment over this period to increase from the mean predicted value of 0.50 to 0.85%, *ceteris paribus*. DROPOUT also has a significant effect on private enrollment changes. The same change in DROPOUT raises predicted private enrollment from 2.21% of enrollment to 4.45%.

Because female education levels have changed over time, it is also interesting from a policy perspective to consider the predicted effects of changing women's educational attainment. The mean percentage of women with bachelor's degrees is 9.22. The mean of women with some college education (but no degree) is 18.21% across the districts, and the mean of women whose highest degree is high school is 33.71%. Suppose we assume that the vast majority of women have graduated high school or have some college education but no degree. Precisely, we lower women with a college degree to the 10th percentile, or 5.08%. At the same time, women with some college and women with a high school degree increase to the 90th percentiles, 25.04 and 40.91%, respectively. The home school enrollment rises from 0.50 to 2.13%. Education of the mother appears to matter.

We also translate the estimated beta coefficients on particular variables into expected probabilities of home or private school enrollments in the 10-state data set. Suppose the expenditures per pupil fell from the across-sample mean of $6013 to the lowest 10th percentile, $4506. Home school enrollment would increase from 1.24 to 3.18%. As in the Kentucky panel data, we also vary the women's educational levels. The mean percentage of females with bachelor's degrees across the 10 states is 12.73. The mean percentage of women with some college education (but not a degree) is 25.64, and the mean of women with a high school degree is 36.44%. If we decrease the female bachelor's degree percentage to the lowest 10th percentile in the sample (6.24%) and increase the women with some college education and women with a high school degree to the 90th percentiles (35.94 and 46.1%), the home school enrollment percentage increases from 1.24 to 3.06. The private enrollment percentage increases from 1.73 to 3.38. The results are not only statistically significant but economically significant as well.

One of the more interesting policy predictions in the state analysis relates to the regulations on testing across the states. As an alternative to the fixed effects results presented earlier, we explicitly controlled for the effect of standardized testing across the states.[33] States that have testing requirements for home school populations have fewer students in home schools than those in which there are no testing requirements. Following the same methodology as above, we determine the economic significance of the results. We begin with a base prediction of 1.17% of students enrolled in home schools. If all states in the sample dropped the standardized testing restriction and made no other changes, the percentage of home schooled children would be expected to rise to 1.39. Alternatively, if the remaining states were to add the restriction, the expected enrollment in home schools would decline to 0.71% of school enrollment.

5. Concluding Remarks

This article has explored a form of school choice that researchers have largely ignored. Households choose not only between different types of public schools and between public and private schools but, in the current environment, they also can choose to home school. The policy implications of this article are rather strong. The attributes of households and the attributes of the public school district influence the decision to educate children at home. One of the more interesting results is that income differences within a district significantly influence the home schooling decision. Assuming that higher variance implies more diverse tastes for educational output, this result is not surprising. It suggests that public schools are less likely to satisfy the body politic the more diverse the population. While this is a standard Tiebout story in public finance, its implications can now be extended to home schools.

Going beyond the specific variables of this article, the results also hold implications for school choice policies. As parents become more educated, they have more alternatives in numerous aspects of their lives, including the choice among schools and school types. Allowing parents to choose among the public schools and offering a variety of public school alternatives may be a way in which public districts can influence the decision of more educated parents to remain in the public sector. School choice, as it is more commonly known, may influence the choices of other school types—including the decision to home school. Most important, this study represents a first step in

[33] The fixed effects model and test variable cannot be estimated simultaneously because the test variable is perfectly collinear with the state fixed effects.

systematically examining home schooling. As better data become available, more precise estimates can be made.

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