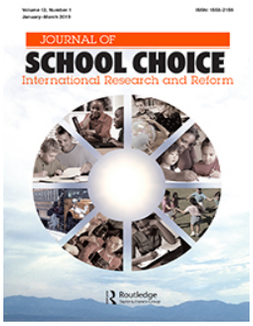

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Journal of School Choice
International Research and Reform

ISSN: 1558-2159 (Print) 1558-2167 (Online) Journal homepage: https://www.tandfonline.com/loi/wjsc20

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To cite this article: Denton Marks & David M. Welsch (2019) Homeschooling Choice and Timing: An Examination of Socioeconomic and Policy Influences in Wisconsin, Journal of School Choice, 13:1, 33-57, DOI: 10.1080/15582159.2018.1527649

To link to this article: https://doi.org/10.1080/15582159.2018.1527649

JOURNAL OF SCHOOL CHOICE
2019, VOL. 13, NO. 1, 33–57
https://doi.org/10.1080/15582159.2018.1527649

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ABSTRACT

Over the past two decades homeschooling has become increasingly popular, but this educational alternative has lacked rigorous empirical evaluation because of data limitations. Since little data are available for individual students, we examine homeschooling participation at the statewide and district level in Wisconsin. The most compelling finding is the large decrease in homeschooling at the upper levels of high school which may distort the evaluation of homeschooling as preparation for college. We also examine district and community factors associated with overall homeschooling participation and find evidence, for example, of the importance of test scores and specific religious preferences to that choice. Specifically, we find that higher district level homeschool participation is associated with lower district grade school test scores, lower expenditure per pupil, and a lower percentage of Catholic individuals living in the surrounding area.

KEYWORDS

homeschool; homeschoolers; homeschooling

JEL CLASSIFICATION CODES

I2; I21

Introduction

The most recent estimates from 2016 find that homeschooling currently enrolls approximately 1.9 million students, or about 3.5% of the K–12 population, in the United States; this was an increase from 1.8 or 2.9% and 1.1 million or 2.2% in 2007 and 2003, respectively.[1] Homeschooling has received support across the sociocultural spectrum: both evangelical Christians and "New Agers" have supported it (Cooper & Sureau, 2007). While homeschooling remains controversial, we have little rigorous empirical research to inform us on many aspects of this phenomenon. One of the central questions suggested by the spread of homeschooling asks parents' reasons for choosing it for their children; we shall call this the participation decision. In this article we analyze the determinants of homeschooling participation in school districts in Wisconsin. This article uses district-level data from Wisconsin to examine the relationship between homeschooling participation in a district and the characteristics of the population of the school district at large, the student population, and policies of the school district.

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Color versions of one or more of the figures in the article can be found online at www.tandfonline.com/wjsc.

Wisconsin is well suited for a state level and district level examination of homeschoolers. Isenberg (2002, 2007) reports that Wisconsin likely has little unreported homeschooling because the procedure for registering is simple and unobtrusive: report (a) the number of students in the household being homeschooled by grade level, (b) one's school district of residence, and (c) one's compliance with relevant state statutes. Most states use more intrusive registration, and some require examinations for homeschooled students. We expect that in these states many parents homeschool their children without registering. Wisconsin law also provides latitude for homeschooling's content, all it requires is: at least 875 hr of instruction, a "sequentially-based method of instruction" (children build upon previous knowledge), and no intent to avoid compulsory school attendance.

Among studies evaluating the participation decision of homeschoolers, Isenberg (2002), Houston and Toma (2003), and Miller (2014) use perhaps the best data and the most rigorous econometrics to examine this question.[2] Isenberg (2002) frames his research as an analysis of women's time allocation using National Household Education Survey (NHES) individuals' data and Wisconsin district data with separate models and estimations for each of these datasets. He reports a substantial difference between homeschoolers in urban areas and rural areas. For example, high-income parents in urban areas are more likely to homeschool as school quality decreases. In rural areas, homeschooling is popular among Protestants. He frames most of his results for Wisconsin as urban/rural comparisons; for most of his district analysis, he essentially treats urban and rural areas as separate samples.

Houston and Toma's (2003) main analysis examines a 5-year panel of Kentucky school districts from 1991/1992 to 1995/1996. They find that women's educational attainment, income heterogeneity, and less strict regulations are associated with greater homeschooling. Miller (2014) examines a 15-year panel of school districts in Virginia from 1998 to 2012. He reports that homeschooling growth is associated with conservative values, particularly in rural communities.

Several other studies have examined the participation decision, but they tend to analyze small samples and draw conclusions from descriptive statistics without isolating the marginal impacts of individual influences on that decision. For example, Knowles (1988) studied a small group of homeschoolers in Utah. Notwithstanding the technical simplicity of the study, he identifies three bases for homeschooling. First, parents prefer education within the family environment, seeing it as more nurturing and supportive of a strong religious orientation. Second, parents' schooling and learning experiences affect their preferences: Those with unpleasant experiences in schools are more likely to participate. Third, parents seem more likely to participate if their children have actual or perceived problems in existing

schools—for example, a lack of a rigorous learning environment or a concern about the perceived moral tone or respect for religion in schools.

Many surveys of homeschooling parents (see Brabant, Bourdon, & Jutras, 2003; Green & Hoover-Dempsey, 2007; for two examples) are essentially descriptive and lack a formal statistical model. Other studies using data from the Current Population Survey (CPS), NHES, and SAT test takers have data issues. For example, Bauman (2002) used data from the CPS and NHES to estimate a logistic regression to analyze the decision whether or not to participate. Though unable to control for many potential influences, he finds that homeschooling is more likely with a nonworking parent, a mother with postsecondary education, and the presence of other children in the household.

Other studies have made modest attempts to measure the homeschooling quality. Wartes (1987, 1988, 1989, 1990, 1991), Falle (1986), Ray (1994, 1997, 1998, 2000), and Rudner (1999) examined the academic performance of homeschoolers relative to other students but could not correct for basic sample selection issues, relying instead upon comparisons of group averages.

Performing a thorough literature review, Murphy (2012) describes the households of homeschoolers. Most are relatively large, White, two-parent families with higher education levels who tend to be middle class. Most mothers do not participate in the labor market. Homeschooling parents tend to be relatively young. From a religious perspective, homeschooling often emerges from Christian beliefs, predominantly Protestant, and fundamental religious denominations are overrepresented. The literature indicates that homeschooling is more likely in small towns and rural areas and relatively less present in the northeastern United States. Again, most, if not all, of this literature is essentially descriptive. Our article, on the other hand, employs choice models that allow us to examine and isolate the impact of many of these economic and social factors while controlling statistically for a number of other influences.

We see three contributions from our analysis. First, we find a particularly large decrease in homeschooling between grades in the last 2 years of high school. Second, we test which district characteristics are associated with a change in the number of homeschoolers in later high school and find very little is statistically significant once we control for other factors. The primary exception is that more urbanized districts experience a larger percentage decrease in homeschoolers in later high school. Third, we examine which district characteristics are associated with total homeschooling participation, holding others factors fixed; specifically, we find that participation varies inversely with the district's grade school test scores, expenditure per pupil, and share of Catholics in the population.

Several features distinguish this article from Isenberg's (2002) analysis of district data in Wisconsin. First, our district data include more districts and

years of observation. Second, these data are more recent, coming from the 2002/2003 through 2007/2008 school years. Third, because of its application to integer-valued data (number of students being homeschooled), we use negative binomial models to explore the determinants of homeschool enrollment in school districts. Fourth, Isenberg's focus is female time use so he omits some of the policy variables we include; for example, we include district policy variables such as expenditure per pupil. Fifth, we analyze more measures of community and students that provide a clearer distinction between the characteristics of local students in general and homeschoolers. Sixth, we identify a clear pattern of reduced homeschooling in the later high school years, posit some potential explanations for this, and investigate it empirically at the district level.

Theoretical discussion

We now consider the parent–student homeschooling decision. For simplicity, we assume that homeschooling is the only alternative to public school. We could extend the analysis to allow for other options such as private school and even extradistrict schools since Wisconsin has a strong interdistrict choice program (Welsch, Statz, & Skidmore, 2010).

Our assumptions about and analysis of parental choice resembles Cullen, Jacob, and Levitt (2005). Potential homeschooled students and parents differ in both observable (e.g., race, religion, income) and unobservable characteristics, such as preferences, innate ability, and motivation. Schools and school districts differ by teacher quality, peer characteristics, and other influences on students and/or parents. Students, along with parents, base homeschooling decisions on utility maximization subject to cost constraints which include foregone income (if homeschooled) and parents' available time.

The decision depends on parents' perceived net benefits, perhaps on behalf of their children. Expected benefits depend upon academic achievement, depth of curriculum (especially its ethical and religious content), disciplinary policy, peer characteristics, and extracurricular activities. Murphy, Gaither, and Gleim (2017) performs a detailed examination of parents' motivations for homeschooling and focuses on religion, academics, school environment, and family. Expected costs include property taxes and foregone income (if homeschooling).

Homeschooling and location decisions are likely interdependent: for example, a strong preference for homeschooling may increase the likelihood of settling in low-spending, low-tax districts because the household prefers not to pay for traditional schools that they will not use. This is not to say that households preferring homeschooling will not see other benefits from a strong, perhaps expensive school district (such as education levels of neighbors and cultural amenities) or will be unconcerned about conditions that might accompany low-cost, perhaps low-quality school districts, such as

truancy rates and high youth unemployment. Given the incidence of homeschooling, it seems unlikely that most households place a low value on high-quality schools. Simply, at the margin, some might prefer not to pay for schools they plan not to use.

Another consideration is that the order of the decision process could influence the decision to homeschool: for example, the family may be more inclined to use public schools if other circumstances such as employment dominate their choice and put them in a district with excellent schools.

The sequence of the location-schooling decision can affect the outcome. Possible sequences include:

- a joint location-schooling decision,
- a schooling decision followed by a location decision, and
- a location decision followed by schooling decision.

Examples of other influences include the point in the parents' life cycle (such as early career vs. mature career) and the age profile of all children in the household.

For example, consider the following family that has many district choices—so there are likely few or no employment constraints—that considers higher spending districts to be of higher quality. Suppose this family has a mild preference for homeschooling. With the second schooling-then-location sequence, they would prefer to homeschool and choose a low spending/tax district, *cet. par*. With the third sequence, that same family chooses whether to homeschool based on upon their previously chosen residence. If they settled in a low spending/tax district, they would more likely choose to homeschool; but if they located in a high-spending tax district, they would choose the public schools. With the first scenario, the joint decision would reflect the nature of the districts available and the appeal of their public schools. They could choose a low spending/tax district and homeschool if no districts in the area satisfied their educational preferences. On the other hand, if a district matches their educational preferences, they may settle in a high-spending tax district with their children in public schools. Thus, given the potentially tied decisions of location and schooling, the same family could settle in different districts with different schooling decisions, depending upon the sequence of decisions and the strength of other influences.

This also suggests two influences on the number of homeschoolers in a low spending/tax district: more homeschoolers will locate there and individuals who already live there will be more likely to homeschool. A further complication is that the strength of one's preference for or against homeschooling is likely to influence the family's sequence of decisions.

We see the potential complexity of any analysis of homeschooling. These issues are not unique to district-level data (they would still be present with individual-level data), but they will be more pronounced. A concern specific to district-level

data is that the results may be difficult to interpret. Isenberg (2002, 2007)) discusses the challenge of disentangling household characteristics from district characteristics. For example, results showing that the share of the district population self-described as evangelical Christians varies directly with the percentage of homeschooled students could mean two things: (a) evangelical Christians in the area are homeschooling, possibly implying that they prefer that form of education or (b) nonevangelical Christians in an area with a larger percentage of evangelical Christians are more likely to homeschool because they are reluctant to send their children to schools that may have a large percentage of evangelical Christians.

Our modeling can control for many important factors. Adding controls to a model greatly improves our ability to separate these effects from each other. Because we have a variety of controls that allow us to distinguish district from community characteristics, we hope to disentangle some of these influences. For example, our model can examine two (hypothetical) districts with the same median income but different numbers of free and reduced lunch students (a common proxy for students' family incomes), thus (partially) separating this district characteristic from the community characteristics.

Data and state level results

Wisconsin data

Our data are from Wisconsin which is an excellent state for examining the number of homeschoolers because, unlike some other states, it is believed to have little unreported homeschooling. The state's procedure for registering a homeschooling family is not burdensome or intrusive. They need answer only three questions: how many students in the household will be homeschooled (by grade level), the school district of the family's residence, and the family's compliance with state statutes. In many states, the procedure is much more burdensome; some states even require homeschooled students to take the state exams. In these states, parents may choose not to report to the state authorities and homeschool "underground."

We have both state and district level data. Our state data are from 1984–2010 and our district data are from school years 2002–2003 through 2007–2008. District-level data include variables on number of homeschoolers by grade, along with percentage of students eligible for free or reduced lunch, ethnic composition of the students in the district, a measure of racial diversity, total student population in a district (called "membership" in Wisconsin), percentage of students in the districts enrolled in private schools, and type of district. We also have variables on the community within the district (all individuals, not just students): total population, median income, education levels, age distribution of the district, percent urban, political affiliation of the district, and religious characteristics.

Changes in cohort size by grade (state level data)

Figure 1 presents Wisconsin homeschool enrollment as a percentage of total enrollment (public plus private plus homeschool) for 1984–2010; years refer to the fall semester. Since 1984, homeschool enrollment steadily increased to a high in 2004 of approximately 2.3% when it stabilized or perhaps declined a bit. This small decline could reflect the recession resulting from the "dot.com bubble" or the rise in public virtual schools discussed briefly as follows.

Tables 1 and 2 show Wisconsin homeschool enrollment by grade for the seven consecutive academic years 2004–2011. Table 1 shows enrollment by academic year and grade. Reading along a diagonal (e.g., shaded) indicates the progression of enrollment of a cohort, assuming that all members move to the next grade annually. This likely overstates the progression of original members since we cannot track additions (e.g., those newly joining) and subtractions (including those held back). Table 2 shows percentage changes in enrollments of the same cohort across adjoining grades. For example, starting with 1,423 in Table 1 and following it diagonally allows us to see amount changes in the same cohort across Grades 1 to 2. The percentage change between these numbers are in the first row of results in Table 2. The second to last column of Table 2 presents the overall average percentage changes, summarizing the results (the last column provides standard deviations [SD(POPU)]).

Interestingly, the largest decrease in homeschooling is between Grades 11 and 12. This is by far the most significant drop, dwarfing all other between-grade changes: the average Grade 11-to-12 change is a 23.1% decrease, and the next closest is the average Grade 10-to-11 decrease of 7.7%. Indeed, this

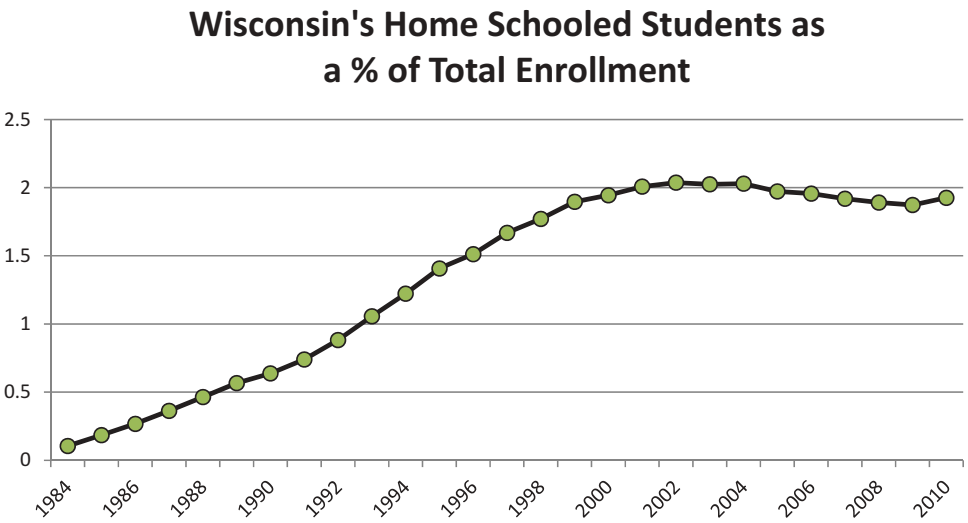

Figure 1. Wisconsin's home schooled students as a % of total enrollment.

Table 1. Homeschool enrollment by grade.

Grade	04–05	05–06	06–07	07–08	08–09	09–10	10–11	Total
Placement	Enrollment	Enrollment	Enrollment	Enrollment	Enrollment	Enrollment	Enrollment	04/05–07/08
1	1,423	1,428	1,375	1,356	1,357	1,409	1,127	9,475
2	1,415	1,368	1,352	1,317	1,317	1,335	1,164	9,268
3	1,402	1,338	1,350	1,376	1,350	1,322	1,179	9,317
4	1,476	1,369	1,389	1,349	1,385	1,365	1,098	9,431
5	1,446	1,417	1,320	1,383	1,334	1,326	1,155	9,381
6	1,360	1,430	1,447	1,332	1,412	1,343	1,189	9,513
7	1,482	1,387	1,376	1,424	1,286	1,367	1,160	9,482
8	1,475	1,427	1,393	1,314	1,390	1,232	1,149	9,380
9	1,516	1,428	1,422	1,273	1,259	1,316	1,042	9,256
10	1,446	1,507	1,538	1,375	1,300	1,183	1,144	9,493
11	1,551	1,370	1,453	1,397	1,246	1,184	1,064	9,265
12	1,233	1,212	1,036	1,134	1,076	967	891	7,549
Ungraded 1–8	2,489	2,571	2,624	2,581	2,542	2,555	4,347	19,709
Subtotals 1–8	19,714	19,252	19,075	18,611	18,254	17,904	17,709	130,519
Ungraded 9–12	1,029	1,071	1,082	1,114	1,104	1,145	1,867	8,412
Subtotals 9–12	30,453	29,838	29,623	28,799	28,171	27,486	29,213	203,583

Table 2. % change in homeschool enrollment between grades (follows same cohort).

	04/05 to 05/06	05/06 to 06/07	06/07 to 07/08	07/08 to 08/09	08/09 to 09/10	09/10 to 10/11	Average	SD (POPU)
1st to 2nd	−3.9	−5.3	−4.2	−2.9	−1.6	−17.4	−5.9	5.3
2nd to 3rd	−5.4	−1.3	1.8	2.5	0.4	−11.7	−2.3	4.9
3rd to 4th	−2.4	3.8	−0.1	0.7	1.1	−16.9	−2.3	6.8
4th to 5th	−4.0	−3.6	−0.4	−1.1	−4.3	−15.4	−4.8	5.0
5th to 6th	−1.1	2.1	0.9	2.1	0.7	−10.3	−0.9	4.3
6th to 7th	2.0	−3.8	−1.6	−3.5	−3.2	−13.6	−3.9	4.7
7th to 8th	−3.7	0.4	−4.5	−2.4	−4.2	−15.9	−5.1	5.1
8th to 9th	−3.2	−0.4	−8.6	−4.2	−5.3	−15.4	−6.2	4.8
9th to 10th	−0.6	7.7	−3.3	2.1	−6.0	−13.1	−2.2	6.5
10th to 11th	−5.3	−3.6	−9.2	−9.4	−8.9	−10.1	**−7.7**	2.4
11th to 12th	−21.9	−24.4	−22.0	−23.0	−22.4	−24.7	**−23.1**	1.1

SD (POPU) stands for the population standard deviation.

decrease between 11th and 12th grade is all the more significant considering the substantial decrease between 10th and 11th. This means that the decrease between 10th and 12th grades was approximately 31.5%, 29%, 30%, 24.8%, and 28.4% for the cohorts that began the 2004/2005, 2005/2006, 2006/2007, 2007/2008, and 2008/2009 school years in 10th grade respectively. Also, these two measures are consistent across time; they have the smallest standard deviation, despite having the largest averages. One cannot disregard such a significant decrease in the number of homeschoolers at the end of high school. We suggest several explanations for it.

First, homeschoolers may leave high school one or two years early and enter postsecondary education. Unfortunately, we have no data to test this. Second, in these grades, students who turn 18 are not required to attend, but this effect is probably small. Third, parents may feel less qualified to teach these upper grades but, given the increased availability of public virtual schools through Wisconsin's open enrollment program, may continue to keep their children away from public school peers and buildings and enroll them instead in free public virtual education with certified teachers. Again unfortunately, we have no data to perform a rigorous test to examine this.[3] Fourth, homeschoolers may move to public schools in their last year or two to aid college admission—in particular, to create a record for college applications (we discuss this in more detail as follows). Finally, related to the previous effect, colleges give extra weight to college admission exams (usually the ACT in Wisconsin) for homeschooled students. Those with low scores in early testing may try to avoid this by moving to a traditional high school to produce a school record, decreasing the weight placed on their test scores. These last two explanations can obscure analysis of the relative quality of homeschooling: if students with low test scores whose education is essentially homeschooling are identified incorrectly as traditionally schooled, then we undercount the pool of homeschooled students and overestimate the success of homeschooled students in college admissions and performance because we

have missed some number of low-testing students who, at the end of high school, moved to public schools.[4] In the subsection titled "Change in High School Homeschoolers" we attempt to model which district characteristics may be associated with this substantial drop in homeschoolers at the end of high school. However, many of these suggestions merit further investigation in future research.

District data

We now turn to a district-level analysis of homeschooling participation, using data from 425 Wisconsin districts for the years 2002–2003 to 2007–2008 (earlier data are excluded because of changes in the measurement of test scores, one of our key variables).[5]

Table 3 presents descriptive statistics for our dependent variables—district homeschooling enrollment (defined in the next section) and percentage change in homeschoolers between 11th and 12th grades. Table 3 also includes our independent variables which are a wide range of community, (potential) peer, and district policy descriptors. District characteristics include: total population, median household income, district residents' education level, percentage of the population between 0–17 years old, percentage urban, percentage Republican (percentage who voted for G. W. Bush in 2004), and variables for religious preferences.[6] Student population characteristics include: percentage eligible for a free or reduced price lunch,[7] ethnic composition (percentage Black or Hispanic; "White and other" is the reference group), the racial Herfindahl index (RHI) (a measure of racial diversity) [we use (1–RHI)*100 for ease of interpretation where a larger number implies more racial diversity],[8] total students in the district ("membership"),[9] percentage of students in private schools, and indicator variables for K–8 and Union High School (UHS) districts.[10] District policy variables include extracurricular activities per student, average experience of teachers, percentage of teachers with a Master's degree or higher, expenditure per student, and pupil-to-teacher ratio. While we lack a structural model of household choice, the numerous independent variables allow us to examine their impact upon participation.

We also include as independent variables two measures of test scores from Wisconsin's Knowledge and Concepts Examinations: the percentage of students that score in the Advanced or Proficient (top two of four) categories on the Grades 4 and 8 examinations and the percentage in these two categories in Grade 10 (students in the lower two categories are the reference group). These top two categories indicate that the student was performing at grade level or better on every question. Both measures are a weighted average in all five disciplines.[11]

Table 3 reveals several data issues. First, as noted earlier, WDPI (Wisconsin Department of Public Instruction) reports as missing any districts with only 1–5 homeschoolers (158 of the 2,549 district/year

Table 3. Descriptive statistics.

	N	Mean	ST Dev	Min	Max
Dependent variables					
Homeschooled students (coding missing as three)	2,549	48.16	68.49	0.00	957.00
Homeschooled students (missing as missing)	2,391	51.34	69.55	0.00	957.00
% change in homeschoolers between 11 and 12	1,929	−15.43	39.95	−100.00	300.00
Independent variables					
Test Scores:					
Test scores grade 4 & 8	2,477	83.92	6.01	49.46	98.59
Test scores grade 10	2,267	78.11	8.01	28.15	98.62
Community characteristics:					
Total population	2,546	13,097.03	34,070.03	450	597,040
Median income	2,546	45,346.69	12,253.38	26,193.00	144,173.00
% at least a HS degree but no 4 year[a]	2,546	44.28	5.16	16.48	54.76
% at least 4 year degree[a]	2,546	12.16	6.81	3.90	51.59
% of population ages 0–17	2,546	25.96	3.16	14.91	39.14
% Urban	2,546	33.05	37.45	0.00	100.00
% Republican	2,546	51.14	8.58	16.84	69.88
% Catholic[b]	2,546	30.86	10.56	8.46	66.18
% Evangelical Christian[b]	2,546	13.33	6.47	2.28	30.05
% Mainline Protestant[b]	2,546	17.37	7.37	0.00	42.75
School district characteristics:					
% Free and reduced lunch	2,549	24.60	14.43	0.00	87.58
% Students that are Black K–12	2,549	1.81	4.58	0.00	59.74
% Students that are Hispanic K–12	2,549	2.99	3.95	0.00	38.19
(1-Racial Herfindahl) *100	2,549	13.48	11.80	0.00	65.52
Membership	2,549	2,046.57	5,213.35	32.00	97,359.00
% Private school enroll (missing data)	1,573	16.90	20.35	0.00	233.04
UHS district[c]	2,549	0.02	0.14	0	1
K–12 district[c]	2,549	0.87	0.34	0	1
District policies:					
Total extra. activities per member	2,549	8.88	5.86	0.00	101.67
Average teacher experience	2,549	15.44	2.34	4.70	27.00
% of teachers with masters or higher	2,549	40.43	15.69	2.28	90.73
Financial variables:					
Expenditure per member	2,549	10,052.01	2,218.64	6,707.58	58,596.00
Pupil to teacher ratio	2,549	13.45	1.77	1.09	22.65

Note. UHS = Union High School.
[a]No high school degree is the reference group. [b]Other religions and nonadherents is the reference group. [c]K–8 District is reference group.

observations in this dataset). We code this at their median (3). We also lack data on the number of private school students for 976 district/year observations. One district was created during our sample period so there are no Census and thus no community data for its 3 years in the sample. The missing private school district/years data could be a concern so we estimate models with and without them to check the robustness of the results.

All variables except the religion (percentage Catholic, evangelical Christian, mainline Protestant, with "other and nonadherents" as the reference group) and Republican variables are at the district level; these two variables are only available by county so districts within a county have the

same observation for these variables. All district variables were obtained from WDPI except the religion and Republican variables. "Religion" measurements come from the Religious Congregations & Membership–2000 data in the American Religion Data Archive.[12] Our "Republican" variable is the percentage of those voting for G. W. Bush in the 2004 presidential election taken from the *Atlas of United States Presidential Elections*. Most community characteristics are from the 2000 Census and thus are constant for a given school district across the 4 years of the panel.

Models

In the subsection "Total Homeschooled Students in a District" we develop a model of the determinants of total homeschool enrollment in Wisconsin school districts. Since number of homeschooled students is a nonnegative count variable, we estimate a negative binomial model. In the subsection titled "Change in High School Homeschoolers" we estimate a two-step model that attempts to discover what characteristics are associated with the decrease in homeschoolers in later high school. Note that we do not include district fixed effects because many of the demographic variables of interest do not change much over time and/or they are only available from the U.S. Census in census years and so are constant over the period of analysis. We do, however, adjust the model for clustering within a school district (as discussed as follows), which corrects for correlation of the errors of district with itself across time.

Total homeschooled students in a district

We develop a model of the determinants of homeschool enrollment in Wisconsin school districts. Let HS_{ijt} be a count variable that takes on values 0, 1, 2, … of the number of homeschooled students in district i in county j, in year t. The density function for the negative binomial model is then given by:

$$f(HS_{ijt}|\lambda,\alpha) = \frac{\Gamma\left(HS_{ijt} + 1/\alpha\right)}{\Gamma\left(1/\alpha\right)\Gamma(HS_{ijt}+1)}\left(\frac{1/\alpha}{\lambda_{ijt}+1/\alpha}\right)^{1/\alpha}\left(\frac{\lambda_{ijt}}{\lambda_{ijt}+1/\alpha}\right)^{HS_{ijt}} \quad \alpha \geq 0 \tag{1}$$

where $\Gamma(\cdot)$ is the gamma function, $\lambda_{ijt} = \exp(x'_{ijt}\beta)$, x_{ijt} is the vector of district and community characteristics discussed earlier (mostly district data but some county-level data) expected to affect district homeschooling enrollment, and $\alpha > 0$ is the overdispersion. The first two moments are:

$$\begin{aligned} E\left[HS_{ijt}|x_{ijt}\right] &= \lambda_{ijt} \\ V\left[HS_{ijt}|x_{ijt}\right] &= \lambda_{ijt} + \alpha\left(\lambda_{ijt}\right)^2 \end{aligned} \tag{2}$$

If $\alpha = 0$, there is no overdispersion (conditional mean equals conditional variance), and this model reduces to the Poisson model. We estimate a standard Likelihood-ratio test that compares the negative binomial model to the Poisson (testing for overdispersion); the results are at the bottom of Table 4 where the null hypothesis is $\alpha = 0$ (no overdispersion). All models for all tests show strong evidence that there is overdispersion. We estimate all regressions with Huber-White standard errors since we have observations that are different sizes and, as noted previously, the standard errors are adjusted for within-group correlation of the error terms.

Change in high school homeschoolers

To test for district characteristics associated with decreased homeschoolers in later high school years, we estimate models where the dependent variable is the percentage change in the number of 12th graders as a percentage of the 11th graders in the previous year:

$$SeniorCh_{it} = \left(\frac{HS12Gr_{it}}{HS11Gr_{it-1}} - 1\right) \times 100$$

where $HS12Gr_{it}$ is the number of 12th grade home schooled children in district i in year t, and $HS11Gr_{it-1}$ is the number of homeschooled students in district i in year *t-1*. For any district that has no homeschooled students in grade 11 in *t-1* this variable will be undefined in year t.

Note that there may be district characteristics associated with a decrease or an increase in this number for districts with no homeschoolers in Grade 11. Also, districts with no homeschoolers in Grade 11 are fundamentally different from those with homeschoolers in Grade 11. To deal with this issue we employ a two-step method based on Heckman, 1976).

It is realistic to believe that districts with more than zero homeschoolers are, *cet. par.*, not randomly selected from the population so that estimations using only districts where the senior change variable is defined will have selection bias. To address this, we employ the standard selection model which allows for dependence in the two parts.

We employ the standard sample selection correction where our selection equation (participation equation) is estimated using:

$$P(s_{it-1} = 1 | x_{it-1}, HS_{t-1}) = G(x'_{it-1}\gamma + \theta HS_{t-1}) \tag{3}$$

$$\Phi(\cdot) = \int_{-\infty}^{\infty} \varphi(v)$$

where s_{it} is 1 if there are any homeschooled students in Grade 11 in year *t-1*, and x_{it-1} is a vector of district and community characteristics in *t-1*. These variables are also in equation (1), but here they are lagged one period,

Table 4. Negative binomial models, total home school participation.

	(1)		(2)		(3)		(4)		(5)		(6)	
4th & 8th grade test score	−0.010**	(0.005)	−0.021***	(0.007)					−0.011**	(0.005)	−0.019***	(0.007)
10th grade test scores					−0.002	(0.003)	−0.008*	(0.004)	−1.79E-04	(0.003)	−0.005	(0.004)
Community characteristics												
Total population	−6.72E-07	(6.01E-06)	6.98E-06	(5.91E-06)	1.74E-06	(5.96E-06)	5.80E-06	(6.37E-06)	1.11E-06	(5.99E-06)	5.81E-06	(6.54E-06)
Median income	4.62E-06	(6.12E-06)	1.67E-05**	(6.95E-06)	1.13E-05	(6.91E-06)	2.16E-05**	(9.17E-06)	1.35E-05*	(7.27E-06)	2.37E-05**	(9.25E-06)
% at least a HS degree, no 4 year[a]	−0.012	(0.010)	−0.016	(0.011)	−0.021*	(0.011)	−0.017*	(0.010)	−0.021*	(0.011)	−0.017	(0.011)
% at least 4 year degree [a]	−0.007	(0.011)	−0.022*	(0.012)	−0.010	(0.012)	−0.026**	(0.013)	−0.007	(0.013)	−0.021	(0.013)
% of population ages 0–17	−0.025*	(0.013)	−0.017	(0.015)	−0.023	(0.014)	−0.019	(0.015)	−0.024*	(0.014)	−0.02	(0.016)
% Hispanic	−0.014	(0.082)	−0.024	(0.093)	−0.01	(0.085)	0.048	(0.106)	−0.018	(0.084)	0.045	(0.106)
% Black	−0.040	(0.036)	−0.031	(0.036)	−0.025	(0.040)	−0.027	(0.039)	−0.029	(0.040)	−0.027	(0.039)
% Urban	0.005***	(0.002)	0.007***	(0.002)	0.005***	(0.002)	0.007***	(0.002)	0.005***	(0.002)	0.007***	(0.002)
% Republican	0.008*	(0.004)	0.018***	(0.006)	0.006	(0.004)	0.016**	(0.006)	0.007	(0.005)	0.016**	(0.006)
% Catholic[b]	−0.011***	(0.003)	−0.011***	(0.004)	−0.012***	(0.003)	−0.012***	(0.004)	−0.012***	(0.003)	−0.012***	(0.004)
% Evangelical Christian[b]	0.009*	(0.006)	−0.003	(0.007)	0.011*	(0.006)	−0.003	(0.007)	0.011*	(0.006)	−0.003	(0.007)
% Mainline Protestant[b]	−0.004	(0.005)	4.62E-04	(0.006)	−0.004	(0.005)	8.96E-05	(0.007)	−0.004	(0.005)	5.53E-04	(0.007)
School district characteristics												
K–8 District	−1.018***	(0.166)	−0.939***	(0.200)								
UHS District					−0.46*	(0.238)	−0.637**	(0.293)				
% Free and reduced lunch	0.010***	(0.004)	0.014***	(0.005)	0.013***	(0.004)	0.019***	(0.006)	0.013***	(0.004)	0.017***	(0.006)
% Students that are Black	−0.015	(0.013)	−0.025*	(0.015)	−0.023*	(0.013)	−0.027	(0.017)	−0.022	(0.014)	−0.032*	(0.018)
% Students that are Hispanic	−0.005	(0.009)	−0.031***	(0.011)	−0.006	(0.010)	−0.031***	(0.011)	−0.007	(0.010)	−0.032***	(0.011)
(1-Racial Herfindahl) *100	0.001	(0.008)	0.010	(0.011)	0.002	(0.008)	0.01	(0.012)	5.16E-04	(0.008)	0.009	(0.011)
Membership	1.13E-04	(8.24E-05)	3.80E-05	(7.51E-05)	9.18E-05	(8.23E-05)	4.59E-05	(8.31E-05)	9.46E-05	(8.30E-05)	4.54E-05	(8.24E-05)
% Private school enroll (missing data)			−0.006***	(0.002)			−7.97E-04	(0.003)			−7.35E-04	(0.003)
District policies												
Extracurriculars per member	−0.002	(0.003)	0.002	(0.004)	−2.34E-04	(0.003)	0.002	(0.004)	1.01E-04	(0.003)	0.002	(0.004)
Average teacher experience	0.019*	(0.011)	2.28E-05	(0.014)	0.021*	(0.012)	0.007	(0.015)	0.024**	(0.012)	0.009	(0.015)
% of teachers with masters or higher	0.007***	(0.002)	0.006***	(0.002)	0.007***	(0.002)	0.006***	(0.002)	0.007***	(0.002)	0.006***	(0.002)
Expenditure per member	−1.46E-04***	(2.83E-05)	−1.54E-04***	(3.98E-05)	−1.56E-04***	(3.15E-05)	−1.65E-04***	(4.08E-05)	−1.63E-04***	(3.40E-05)	−1.73E-04***	(4.39E-05)
Pupil to teacher ratio	0.050**	(0.020)	0.023	(0.026)	0.054***	(0.020)	0.028	(0.027)	0.043*	(0.022)	0.023	(0.027)
Overdispersion test	2.5e+ 04		1.8e+ 04		2.5e+ 04		1.8e+ 04		2.4e+ 04		1.7e+ 04	
α = 0 [p-value]	[0.00]		[0.00]		[0.00]		[0.00]		[0.00]		[0.00]	
Observations (n*t)	2,474		1,551		2,266		1,473		2,197		1,452	

Note. UHS = Union High School. The number in parenthesis is the heteroskedasticity-robust standard error clustered on school districts
[a]No high school degree is the reference group. [b]Other religions and nonadherents is the reference group.
*p < .10. **p < .05. ***p < .01.

$\gamma$is a vector of estimable coefficients, $\theta$is an estimable coefficient and $\varphi(v)$ is a standard normal density function.

The outcome equation is estimated using:

$$SeniorCh_{it} = x'_{t-1}\psi + \sigma_{12}\lambda(x'_{t-1}\hat{\gamma}) \quad (4)$$

where σ_{12} is the covariance between the error terms of the two equations, $\lambda(x'_{t-1}\hat{\gamma}) = \varphi(\cdot)/\Phi(\cdot)$ (the inverse Mills ratio), $\hat{\gamma}$ is a vector of estimated coefficients from the participation equation, and $\psi$is the vector of estimable coefficients of interest. District characteristics are lagged one period in the outcome equation as well as the selection equation since homeschoolers make their decision to enroll in year t based on district characteristics in t-1; this also provides the additional benefit that eliminates the possibility that the (new) homeschoolers' characteristics will be included in these variables. Note our "exclusion restriction" is that we have total homeschooled students (HS_{t-1}) in the first equation but not the second.[13] Our estimation procedure corrects the standard errors to allow for the estimation error of the inverse Mills ratio in the second stage.[14]

Estimation results

Total homeschoolers in a district

The main estimates of the negative binomial model where total homeschoolers in the district is the dependent variable are presented in Table 4. The only differences among the estimates in this table are the test score variables (variations shown in the top two rows) and inclusion or exclusion of the private school student enrollment variable. The first two columns of results include 4th plus 8th grade test scores, the second pair include 10th grade scores, and the last pair includes both test measures. Including 4th and 8th grade test scores excludes UHS districts from the analysis, including 10th grade test scores excludes K–8 districts, and including both eliminates both types of districts. Estimations (columns) 2, 4, and 6 add the percentage of the students in private schools. We consider several specifications since the inclusion of these different variables creates missing data issues. We discussed the missing private school enrollment data earlier.

First, we focus on the results that are always or often significant across all the estimations. Many of these results are generally consistent with our expectations. The number of homeschooled students in a district is positively related to the percentage of students eligible for free or reduced lunch (note that we control for the district's median income) and the percentage of the district urbanized and negatively related to the two "specialty districts" (K–8 and UHS).

One key result is that districts with a larger percentage of Catholic individuals (relative to "other religions and nonadherents") have fewer

homeschoolers. Specifically if the amount of Catholic individuals increases by one percentage point (and "other religions and nonadherents" decreases by one percentage point), we would expect the number of homeschoolers to be approximately 1% lower. This could be quite large if we had two districts that were otherwise identical, but one was 31% Catholic (approximately the mean) and the other was 42% Catholic (approximately one standard deviation above the mean): we would expect the more Catholic district to have approximately 10% fewer homeschoolers.[15] This is particularly striking because this remains significant even when controlling for the percentage of students in private schools because many private schools in Wisconsin are Catholic. Also, the coefficient on the Catholic variable is always significantly different from the mainline Protestant coefficient and significantly different from the evangelical Christians coefficient in all estimates that do not include private school students. In other words, we reject H_o: $\beta_{cath} = \beta_{prot}$ and H_o: $\beta_{cath} = \beta_{evan}$ where β_{cath} is the coefficient on percentage Catholic, β_{prot} is the coefficient on the mainline Protestant variable, and β_{evan} is the coefficient on percentage evangelical Christians. These results provide clear evidence that areas with larger Catholic populations have lower homeschool participation. This is of particular interest because much of the literature on homeschooling highlights only the general religiosity of individuals and its relation to homeschooling or focuses more on Protestants. Our results indicate that it is important to distinguish between Catholics and other Christians since it appears that they may have differing views on homeschooling.

Note also that districts with higher expenditure per pupil (member) have fewer homeschooled children. This could mean any or all of the following: parents who elect homeschooling do not locate in districts with high spending (perhaps because of property taxes), those in districts that spend more are more likely to use the public schools, and/or lower school funding makes homeschooling more attractive. This connection between funding levels and homeschooling could reflect the interdependence of location decisions and spending/tax consequences discussed earlier.

We also see strong evidence that higher test scores, particularly in 4th and 8th grades, vary inversely with homeschooling. Specifically, if a district has one percentage point more students scoring proficient or advanced in 4th and 8th grades, we expect approximately 1–2.1 percentage fewer homeschoolers. One standard deviation change in 4th and 8th grade test scores would be associated with approximately 6%–12.6% fewer homeschoolers. This result seems large overall but small compared to the Catholic result.

To examine this result further, we examine math and reading tests separately. Table 5 presents these results (for ease of reading, we omit the results for other regressors). The estimates for math scores only are the two top rows, and the estimates for reading scores only are the two bottom rows.

Table 5. Negative binomial models, total home school participation (Math and reading scores).

	4th and 8th Grades		10th Grade		4th and 8th and 10th grades	
Math grades 4 & 8	−0.005*	−0.012***			−0.005*	−0.01***
	(0.003)	(0.004)			(0.003)	(0.003)
Math grade 10			−0.003	−0.007*	−0.002	−0.005
			(0.003)	(0.004)	(0.002)	(0.004)
Reading grades 4 & 8	−0.004	−0.012**			−0.006	−0.011**
	(0.004)	(0.005)			(0.004)	(0.005)
Reading grade 10			−1.53E-04	−0.005	6.30E-04	−0.004
			(0.003)	(0.003)	(0.003)	(0.003)
Observations (n*t)	2,476	1,552	2,266	1,473	2,198	1,453
Private enrollment		X		X		X

Note. The number in parenthesis is the heteroskedasticity-robust standard error clustered on school districts. All models include all the control variables listed in Table 4.
*p < .10. **p < .05. ***p < .01.

These comparison indicates that math scores may have a slightly stronger (negative) association with homeschooling than reading scores.

Finally, and perhaps a bit puzzling, the relationship between the percentage of teachers with Masters or higher degrees and number of homeschoolers is always positive. This seems counterintuitive but may reflect evidence from the education literature of a limited relationship between teachers' advanced degrees and student performance.[16]

Since the coefficients on percent evangelical Christians and pupil-to-teacher ratio lose significance in the estimations which add private school enrollment, and the coefficient on percentage Hispanic become significant, they warrant special attention. Two possible explanations for these changes are, first, that allowing for private school enrollment reduces the sample size and creates some type of sample selection issue; and, second, that controlling for private school enrollment is important and alters the results. To examine this first possibility, we estimate equations like (1), (2), and (3) restricting them only to districts with data on private school enrollment (we will call these "restricted" (1), (2), and (3)). This allows us to compare (1) and (2), (3) and (4), and (5) and (6) using the same sample (results available from the authors). In restricted (1), (3), and (5) the evangelical Christians and pupil-to-teacher coefficient are not significant and the Hispanic coefficient is. Thus, these differences are more likely attributable to sample selection and not the inclusion of the private school enrollment variable.

Change in high school homeschoolers

The results of this section examine which district characteristics are associated with the decrease in homeschooled students between 11th and 12th grade; these are presented in Table 6, which has the same format as Table 4. Most estimated coefficients are consistently insignificant. The one exception is that a larger percentage urban is associated with a decrease in the number of homeschoolers

Table 6. Percentage change in homeschooled students between 11th and 12th grades (outcome equation).

	(1)		(2)		(3)		(4)		(5)		(6)	
4th & 8th grade test score	−0.005	(0.009)	−0.357	(0.351)					−0.292	(0.284)	−0.481	(0.340)
10th grade test scores					0.276	(0.182)	0.161	(0.244)	0.418**	(0.178)	0.275	(0.258)
Community characteristics												
Total population	−5.89E-5	(3.75E-5)	5.57E-5	(2.76E-4)	2.86E-04	(2.71E-04)	1.42E-4	(2.73E-4)	2.47E-04	(2.78E-04)	6.48E-5	(2.76E-4)
Median income	−1.01E-5	(8.40E-6)	−3.65E-5	(3.40E-4)	−1.95E-04	(2.58E-04)	−7.61E-5	(3.39E-4)	−2.739E-04	(2.74E-04)	−7.22E-5	(3.42E-4)
% at least a HS degree but no 4 year[a]	−0.006	(0.017)	0.367	(0.407)	0.314	(0.381)	0.351	(0.407)	0.384	(0.387)	0.408	(0.408)
% at least 4 year degree[a]	−0.019	(0.016)	0.529	(0.496)	0.421	(0.422)	0.411	(0.490)	0.528	(0.434)	0.525	(0.497)
% of population ages 0–17	−0.032	(0.022)	−0.372	(0.652)	0.974*	(0.551)	−0.142	(0.647)	0.977*	(0.561)	−0.353	(0.653)
% Hispanic	0.174	(0.109)	4.043	(4.550)	−0.381	(3.417)	3.726	(4.534)	−0.955	(3.475)	3.821	(4.559)
% Black	0.061	(0.054)	−1.609	(1.175)	−0.673	(1.102)	−1.257	(1.178)	−0.905	(1.113)	−1.456	(1.181)
% Urban	0.001	(0.002)	−0.141**	(0.058)	−0.086*	(0.048)	−0.120**	(0.057)	−0.100**	(0.049)	−0.138**	(0.058)
% Republican	0.010	(0.007)	−0.029	(0.212)	0.067	(0.173)	0.006	(0.210)	0.053	(0.177)	−0.028	(0.212)
% Catholic[b]	−0.008*	(0.004)	0.043	(0.153)	0.132	(0.126)	0.013	(0.153)	0.143	(0.127)	0.033	(0.153)
% Evangelical Christian[b]	0.013*	(0.007)	0.207	(0.252)	0.170	(0.204)	0.220	(0.251)	0.169	(0.206)	0.209	(0.252)
% Mainline Protestant[b]	−0.008	(0.006)	−0.171	(0.247)	−0.029	(0.193)	−0.211	(0.247)	−0.018	(0.195)	−0.173	(0.247)
School district characteristics												
K–8 district	−1.84***	(0.203)	−39.05	(41.59)								
UHS district					−7.395	(7.917)	1.726	(13.499)				
% Free and reduced lunch	−0.005	(0.005)	−0.156	(0.239)	−0.022	(0.159)	−0.038	(0.232)	−0.116	(0.173)	−0.148	(0.239)
% Students that are Black K–12	−0.014	(0.027)	1.103	(0.799)	0.809	(0.600)	0.711	(0.780)	1.053*	(0.621)	1.066	(0.798)
% Students that are Hispanic K–12	−0.019	(0.019)	0.313	(0.515)	0.419	(0.428)	0.434	(0.517)	0.348	(0.437)	0.380	(0.518)
(1-Racial Herfindahl) *100	−9.20E-4	(0.009)	−0.395	(0.245)	−0.240	(0.196)	−0.382	(0.243)	−0.163	(0.205)	−0.381	(0.245)
Membership	5.73E-4**	(2.47E-4)	−4.60E-4	(0.002)	−0.002	(0.002)	−7.77E-4	(0.002)	−0.002	(0.002)	−4.88E-4	(0.002)
% Private school enroll (missing data)			0.041	(0.139)			−0.076	(0.115)			0.025	(0.140)
District policies												
Extracurriculars per member	−9.07E-4	(0.007)	0.070	(0.248)	−0.008	(0.211)	0.064	(0.248)	0.009	(0.218)	0.084	(0.248)
Average teacher experience	0.029	(0.018)	0.642	(0.725)	0.062	(0.582)	0.614	(0.725)	0.094	(0.592)	0.557	(0.729)
% of teachers with masters or higher	−0.002	(0.003)	−0.017	(0.101)	−0.005	(0.086)	−0.006	(0.101)	−0.004	(0.087)	−0.016	(0.101)
Expenditure per member	4.65E-6	(4.25E-5)	3.32E-4	(0.002)	6.48E-04	(0.001)	−6.64E-4	(0.002)	0.001	(0.001)	2.52E-4	(0.002)
Pupil to teacher ratio	0.036	(0.037)	1.383	(1.287)	0.890	(0.980)	1.654	(1.261)	0.599	(1.084)	1.336	(1.288)
Inverse mills ratio	−18.932**		−16.871***		−14.155*		−12.972**		−32.040***		−18.473**	
Standard error of inverse mills ratio	(8.314)		(6.318)		(8.328)		(6.249)		(6.724)		(8.328)	
Observations (n*t)	1,294		1,596		1,224		1,393		1,832		1,210	
Number of censored observations	222		524		139		308		306		139	

Note. UHS = Union High School. The number in parenthesis is the heteroskedasticity-robust standard error clustered on school districts
[a]no high school degree is the reference group. [b]other religions and nonadherents is the reference group
*p < .10. **p < .05. ***p < .01.

between 11th and 12th grade. Also, once we control for 4th and 8th grade test scores, higher 10th grade test scores mean a smaller decrease in the number of homeschoolers. This could indicate that homeschoolers are less likely to enroll in districts where enrolled students are doing well (either through natural ability or higher quality education or both) because they will have to compete with those students when creating a school record.

Discussion

We emphasize that our estimates reveal associations rather than causality. However, our abundance of regressors gives our results a semistructural quality. At the end of the "Theoretical Discussion" section, we discussed the difficulty of disentangling the impact of community characteristics from district characteristics. However, for some variables, because we control for similar influences at the community and district levels, we can isolate effects somewhat, and these estimates may have a semistructural aspect. For example, we see that the percentage of students who are eligible for free and reduced lunch is directly related to the number of homeschoolers in the district, even controlling for median income. Median income is also directly related to the number of homeschoolers in the district in most specifications. This may indicate that both the income of the homeschool families and the socioeconomic status of the students (potential peers) in the district may influence whether parents decide to home school. These results imply that higher income families are more likely to homeschool and that potential homeschoolers are more likely to homeschool in districts with a large amount of low-income students.

Our estimates of the district characteristics associated with a change in high school homeschoolers show very little related to this decrease. Perhaps the decision to stop homeschooling relates more to the students' characteristics than to those of the district. The result that is consistently significant is the inverse relationship between the percentage urban and the amount of homeschooling. This could reflect lower transportation costs to enrolling in school in an urban area. Another possibility is that urban areas may offer more schooling options so families are more likely to find a match rather than resort to homeschooling.[17]

Lower test scores are positively associated with homeschool participation, but there is some indication that lower high school test scores are associated with a decrease in the number of homeschoolers between 11th and 12th grades. This could indicate that, when first making the homeschool decision, parents choose districts with high test scores because this indicates high education quality (or test scores are capturing the education quality of the district). However, if parents are enrolling their students at the end of high school, they would not enroll their students in a district with high test scores

where creating a precollege record that would reflect positively on their children might be more difficult with more high-achieving students in the district.

Conclusion

This analysis adds important findings to the homeschooling literature. First, the number of homeschoolers falls sharply in later high school. This is important for researchers working with college-level data: those working with this type of data should be aware that it may be easy to misclassify the educational background of homeschooled college students. If one earlier suggestion is correct—that homeschooled students with poor test scores tend to switch to high school in Grade 11 or 12—then the perceived college performance of homeschooled students may be upward biased: Homeschoolers look better than they are. This urges caution when classifying students' educational backgrounds and we encourage future researchers to define and measure homeschoolers carefully.

District-level results indicate that, controlling for other factors, homeschooling is more popular in districts with lower 4th and 8th grade test scores, that have less Catholic individuals residing inside its borders, is more urbanized, and has more students eligible for free or reduced lunch. We also find strong evidence that public school spending varies inversely with homeschooling participation. Perhaps households choose homeschooling and then make a location decision based upon lower property taxes (because of low spending); or, alternatively, households who find themselves in low spending/tax districts may opt for homeschooling out of concern for the quality of the local schools even when controlling for other measures of school quality such as pupil/teacher ratio and test scores.

Most district characteristics are not associated with the decrease in the number of homeschoolers in later high school. This indicates that it most likely has more to do with the characteristics of the homeschooled students themselves. The one result that is consistently significant is the inverse relationship between the number of homeschoolers between 11th and 12th grades and the district's degree of urbanization.

We acknowledge concerns about district level data, although our rich set of controls mitigates this to some extent. Keeping this potential limitation in mind, the results of the models provide useful insights into homeschooling participation and provide new results and pose questions that have not yet appeared in the homeschool literature. A further note is that Wisconsin, along with other states, has seen a substantial increase the number of virtual schools. This could explain the recent, admittedly small, drop-off in homeschoolers if parents are substituting virtual schools for homeschooling. This merits future research.

Notes

1. U.S. Department of Education, National Center for Education Statistics, Parent Survey of the National Household Education Surveys Program (NHES), Parent and Family Involvement in Education Survey of the NHES, 2003, 2007, and 2016.
2. For an excellent reviews on the history of homeschooling, the reasons parents choose homeschooling, and more detail on the relevant literature, see Isenberg (2007) and Murphy and colleagues (2017).
3. We do find some evidence to support our argument. We examine several recent years of virtual school enrollment data. In a cohort to cohort comparison we see an increase in enrollment between 10th to 11th grade of approximately 48% in virtual schools, however, we do see a decline of approximately 21% between 11th and 12th grade.
4. It is unclear how homeschooling is reported to colleges—either as information required with the application or simply volunteered by the applicant. Our argument may be weaker in the latter case.
5 The full dataset actually includes 2,549 observations because in 2006/2007 two districts consolidated, leaving only 424 districts, while in 2007/2008 two other districts split apart bringing the number back to 425.
6. The community characteristics describe those who live in the geographic area of the district whether or not they have children in K–12 education.
7. Some districts did not report Free and Reduced Lunch Eligible; we coded these as zero because most of these districts did not participate because they were high-income districts.
8. The Racial Herfindahl index = $\sum_{i=1}^{N} (\text{ProportionofRace}_i)^2$. The racial Herfindahl will be between zero and one. A higher Herfindahl index will imply less diversity. We can include the proportion of each of five races: Asian, Black, Hispanic, American Indian, and White.
9. The variable "membership" is similar to the total number of students except that it adjusts for part-time attendance (e.g., a 4-year old kindergarten student who attends only in the morning would be considered half a student).
10. In Wisconsin, most districts are "K–12 districts" that offer a full range of grades, but there are 47 "K–8 districts" and nine "UHS districts" ("union high school" districts). These K–8 districts offer only K–8 education and "feed into" UHS districts that are only high school districts. There were only 46 K–8 districts starting with the 2006/2007 school year because the consolidation mentioned previously involved two K–8 districts.
11. "Advanced" is the highest level a student can earn and "minimal" is the lowest level. Advanced performance level means that students were able to perform grade-level skills and use strategy and critical thinking to draw conclusions or apply knowledge. Proficient performance level means that students were able to perform grade-level skills adequately. Basic performance level means students can perform some grade-level skills and can understand below grade-level material. Minimal performance level means students can perform some below grade-level skills. According to WDPI: "The long-term goal is for all students, except students with severe disabilities, to progress to the Proficient and Advanced levels".
12. The classification of various religious bodies into "evangelical Christian," "Mainline Protestant," "Catholic," and "Other" categories was created by the staff of the American Religion Data Archive (ARDA). These definitions are adapted from Steensland and colleagues (2000).

13. Note, if we include total homeschooled students in the second equation as well, we get similar results; but then we are relying on the functional form of the Probit in the first stage for identification.
14. We do not discuss the results of the selection equation in the results section, but we do include a table of these results in the Appendix as Table A1. Of particular note is the statistical significance of the estimated coefficient on lagged homeschoolers, our variable excluded from the outcome equation.
15. Negative binomial specifications measure approximately what the proportionate change (or percentage change if the coefficient is multiplied by 100) in the dependent variable will be given a one-unit change in the independent variable (if the independent variable is in level and not log form). Technically, it measures how much the difference in logs of the expected counts changes (or the log of the ratio of counts) for a one-unit change in the independent variable: this is approximately the proportion if the proportion is small.
16. We note that this most likely does not reflect the parents' education level and preference for homeschooling, since our community characteristics already control for the education level of the citizens in the area.
17. However, a counterargument to this explanation is that our model controls for number of students (membership) which will be somewhat correlated with number of schools.

Acknowledgments

The authors wish to thank the University of Wisconsin–Whitewater Fiscal and Economic Research Center, the University of Wisconsin Extension, and the University of Wisconsin–Whitewater College of Business and Economics for financial support for data collection. We would also like to thank Quinton Baker, Matthew Le Donne, and Justin Kasper for research assistance in collecting this data and other related activities.

Disclosure statement

No potential conflict of interest was reported by the authors.

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Appendix

Table A1. Heckman first stage equation (selection equation).

	(1)		(2)		(3)		(4)		(5)		(6)	
Homeschool	0.028***	(0.003)	0.032***	(0.004)	0.032***	(0.003)	0.032***	(0.004)	0.031***	(0.003)	0.032***	(0.004)
4th & 8th grade test scores	−0.005	(0.009)	−0.014	(0.011)					−0.010	(0.010)	−0.017	(0.012)
10th grade test scores					−0.002	(0.006)	0.004	(0.007)	2.54E-4	(0.006)	0.006	(0.008)
Community characteristics												
Total population	−5.89E-5	(3.75E-5)	1.09E-4*	(6.03E-5)	9.23E-6	(4.29E-5)	1.41E-4**	(5.64E-5)	−1.28E-5	(4.5E-5)	1.12E-4*	(6.12E-5)
Median income	−1.01E-5	(8.40E-6)	−2.55E-5**	(1.23E-5)	−8.89E-6	(9.84E-6)	−2.4E-5*	(1.23E-5)	−7.26E-6	(1.02E-5)	−2.39E-5*	(1.24E-5)
% at least a HS degree but no 4 year[a]	−0.006	(0.017)	−0.019	(0.022)	0.006	(0.019)	−0.017	(0.022)	0.002	(0.019)	−0.019	(0.022)
% at least 4 year degree[a]	−0.019	(0.016)	−0.007	(0.022)	−0.019	(0.018)	−0.016	(0.022)	−0.020	(0.018)	−0.011	(0.022)
% of population ages 0–17	−0.032	(0.022)	−0.025	(0.030)	−0.025	(0.024)	−0.019	(0.029)	−0.034	(0.025)	−0.025	(0.030)
% Hispanic	0.174	(0.109)	0.144	(0.151)	0.209*	(0.123)	0.178	(0.151)	0.215*	(0.124)	0.162	(0.151)
% Black	0.061	(0.054)	−0.005	(0.092)	0.119	(0.097)	7.32E-4	(0.094)	0.133	(0.099)	2.99E-4	(0.093)
% Urban	0.001	(0.002)	0.003	(0.003)	0.002	(0.002)	0.003	(0.003)	0.002	(0.002)	0.003	(0.003)
% Republican	0.010	(0.007)	0.013	(0.010)	0.006	(0.008)	0.010	(0.010)	0.006	(0.008)	0.011	(0.010)
% Catholic[b]	−0.008*	(0.004)	0.008	(0.006)	−0.004	(0.004)	0.008	(0.006)	−0.004	(0.004)	0.008	(0.006)
% Evangelical Christian[b]	0.013*	(0.007)	0.024**	(0.010)	0.010	(0.008)	0.023**	(0.010)	0.010	(0.008)	0.025**	(0.010)
% Mainline Protestant[b]	−0.008	(0.006)	−0.005	(0.008)	−0.007	(0.006)	−0.005	(0.008)	−0.007	(0.006)	−0.005	(0.008)
School district characteristics												
K–8 District	−1.84***	(0.203)	−3.42***	(0.591)								
UHS District					1.57**	(0.695)	0.370	(0.961)				
% Free and reduced lunch	−0.005	(0.005)	−0.004	(0.007)	−0.001	(0.005)	−0.002	(0.007)	−9.83E-4	(0.006)	−0.004	(0.007)
% Students that are Black K–12	−0.014	(0.027)	−0.024	(0.053)	−0.014	(0.040)	−0.015	(0.051)	−0.025	(0.040)	−0.023	(0.053)
% Students that are Hispanic K–12	−0.019	(0.019)	−0.009	(0.027)	−0.025	(0.021)	−0.020	(0.027)	−0.021	(0.021)	−0.019	(0.027)
(1- Racial Herfindahl) *100	−9.20E-4	(0.009)	−0.005	(0.012)	0.002	(0.009)	−0.004	(0.012)	4.54E-4	(0.009)	−0.004	(0.012)
Membership	5.73E-4**	(2.47E-4)	−1.85E-4	(3.40E-4)	1.44E-4	(2.58E-4)	−3.66E-4	(3.13E-4)	2.68E-4	(2.78E-4)	−2.11E-4	(3.43E-4)
District policies												
Extracurriculars per member	−9.07E-4	(0.007)	0.006	(0.008)	6.93E-4	(0.007)	0.004	(0.008)	0.001	(0.007)	0.005	(0.008)
Average teacher experience	0.029	(0.018)	0.044*	(0.025)	0.052**	(0.020)	0.045*	(0.025)	0.049**	(0.020)	0.047*	(0.026)
% of teachers with masters or higher	−0.002	(0.003)	−0.0039	(0.004)	−0.004	(0.004)	−0.004	(0.004)	−0.004	(0.004)	−0.004	(0.004)
Expenditure per member	4.65E-6	(4.25E-5)	−1.58E-4**	(6.26E-5)	−3.58E-5	(4.61E-5)	−1.31E-4**	(5.96E-5)	−3.82E-5	(4.81E-5)	−1.53E-4**	(6.29E-5)
Pupil to teacher ratio	0.036	(0.037)	0.099**	(0.048)	0.068*	(0.039)	0.118**	(0.046)	0.072*	(0.040)	0.101**	(0.048)

Note. UHS = Union High School. The number in parenthesis is the heteroskedasticity-robust standard error clustered on school districts
[a]No high school degree is the reference group. [b]Other religions and nonadherents is the reference group.
*p < .10. **p < .05. ***p < .01.