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The effect of education on homeownership: Evidence from 20th century school attendance laws in the United States

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Abstract

This article examines the causal impact of schooling on the probability of homeownership using decennial US Census data between 1960 and 2000. This is done by employing an instrumental variable approach that exploits historical changes in state mandatory schooling and child labour laws which affected the educational attainment of individuals with relatively low levels of schooling. Aggregate results suggest that policy-induced increases in schooling at the bottom of the educational distribution have a positive impact on homeownership rates of 1.9 percentage points. Disaggregated results reveal that the impact of education is highest among individuals who are located in the middle and top terciles of the income distribution with no effect of additional education in the lowest tercile. These results add to the growing body of literature which suggests that education may lead to positive outcomes beyond labour market earnings.

KEYWORDS
education, housing wealth, identification

JEL CLASSIFICATION
I21, I24, R31

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1 | INTRODUCTION

This research is the first to examine the causal effect of education on homeownership. There are several reasons to be interested in the impact of education on housing. Economically, homes are the single largest asset on household balance sheets and one of the most important ways in which many American households accumulate retirement wealth (Bertaut & Starr-McCluer, 2002; Tracy & Schneider, 2001). Homeownership generally results in greater wealth accumulation than renting even among low- and moderate-income households (Di et al., 2007; Dietz & Haurin, 2003; Turner & Luea, 2009). As the policy relevance of education depends at least partly on the wealth differential associated with it, the question of the impact of education on homeownership is important.

Furthermore, housing choices play a key role in deepening inequalities in society, especially those that are handed on from one generation to the next. A substantial body of research suggests that homeownership conveys positive effects on the economic success of children including educational attainment and future earnings prospects (e.g., Barker & Miller, 2009; Chetty & Hendren, 2018; Green & White, 1997; Harkness & Newman, 2003; Haurin et al., 2002; Holupka & Newman, 2012). Given the widespread concerns about intergenerational mobility, it is important to consider the relationship between education and homeownership decisions as housing is an important mediating mechanism through which parents can improve their children's well-being and productivity later in life.

Beyond the private benefits received by households, homeownership has been shown to generate positive externalities to society through its effect on neighbourhood capital and citizenship. For example, homeowners invest more in their communities and tend to be more active in community affairs than renters (Blum & Kingston, 1984; DiPasquale & Glaeser, 1999; Green & White, 1997; Rossi & Weber, 1996). It is therefore important to understand the effects of education on homeownership if the gains from homeownership contribute to other members of society through making households equity holders in their communities.

Figure 1, drawn from the US decennial Censuses and the American Community Surveys, visually represents the long-term trends in homeownership rates traced out by education between 1960 and 2020. A number of important facts are discernible. First, the percentage of Americans aged 30 or above who own their home has risen substantially from 69% in 1960 to 79% by 2020. Second, the largest increases in homeownership over time have been for college graduates. The homeownership rate among college graduates rose by 10% points from 74% to 84% between 1960 and 2020. Over the same period individuals with some college education saw a 5% point increase in homeownership while among high-school graduates a 4% point increase was observed. Third, the homeownership rate among high-school dropouts rose from 67% to 71% between 1960 and 1990. It then decreased in every decade for the past 30 years falling by 7% points to 64% in 2020. In recent decades part of the slowdown in the aggregate homeownership rate appears to be due to the declining rates of homeownership among high-school dropouts.

In addition, the compressed profile of homeownership by education in the first three Censuses and the spreading out of homeownership rates since 1980 likely reflects over-time trends in the earnings of workers with different educational attainments.[1] Earnings returns to education traced back to the beginning of my data were substantial among those at the lower end of the educational distribution in the 1960, 1970 and 1980 s (Card & Lemieux, 2000; Goldin & Katz, 2007; Psacharopoulos, 1989). Since the late 1980 s, the earnings of those at the upper end of the educational distribution grew

[1]In addition, high homeownership rates for all education groups in the early part of my data was also likely due to relaxed credit standards and new mortgage products that expanded the borrower base particularly post-World War II (Chevan, 1989; Jackson, 1987; Schwartz, 2021).

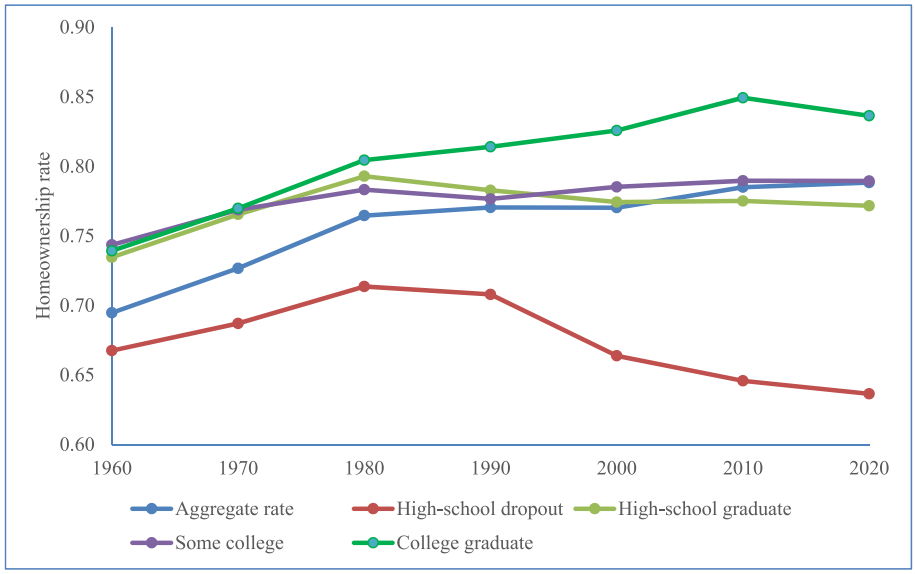

FIGURE 1 Homeownership rates, 1960–2020. Data are drawn from the US decennial Censuses and American Community Surveys. The sample contains 27, 360, 420 individuals aged 30 and above and includes both men and women. High school dropouts are individuals with less than 12 years of completed education while individuals who have completed high school possess exactly 12 years of schooling. Individuals with some college attendance have between 13 and 15 years of education, while college graduates have 16 or more years of education.

continuously relative to those without a postsecondary education (Bound & Johnson, 1992; Card & Lemieux, 2000; Goldin & Katz, 2007). Over-time evidence on expanding wage differentials between more and less educated workers fits into the long-term changes in homeownership rates observed over the course of my data.

This broad overview of change in the education profile of homeownership, especially the sharp decline in homeownership for individuals who dropped out of high school, suggests a potential role for targeted public policy in education to improve homeownership rates particularly among those with low levels of education. Credible estimates of the effects of education are difficult to establish, however. The most common empirical approach is to investigate the impact of educational attainment on homeownership together with a wide range of controls for observable factors that take account of key demographic characteristics and household income (Fisher & Gervais, 2011; Goodman & Mayer, 2018; Gyourko & Linneman, 1996, 1997; Yao, 2019). These studies generally report a strong correlation between schooling and homeownership.

Several explanations can be advanced for the observed correlation between education and homeownership. To begin with education delivers a higher income, which increases the affordability of homeownership. Better educated individuals are also more likely to maintain a certain level of permanent income, making it easier to save for a down payment and secure a loan or mortgage. Education could also influence decisions about homeownership by altering an individual's expectations about future streams of income. Moreover, education has been shown to significantly increase investment income and support individuals in building a solid credit history, which may further improve the ability of households to borrow and devote more financial resources to homeownership (Campbell, 2006; Cole et al., 2014).

In addition, the knowledge and traits acquired through schooling, even after controlling for income, could influence decisions about homeownership. The better educated may be more able to acquire

more and better information about the housing and mortgage markets. To the extent that education favours information acquisition it will reduce the cost associated with homeownership. In addition, better educated individuals may be more efficiently able to process information relating to homeownership. To the extent that the better educated use information more efficiently than the less-educated means that they may have greater financial acumen out of any given amount of time and effort they invest.

Another explanation asserts that education provides a pathway to homeownership through assortative mating if educated individuals are more likely to marry each other. The argument posits that more education may render an individual more attractive on the marriage market and due to assortative mating will partner with a spouse with similar levels of education and earnings (Behrman & Rosenzweig, 2002; Currie & Moretti, 2003; Eika et al., 2019; Lefgren & McIntyre, 2006). These gains in education and income from the marriage market may further translate into improvements in the probability of homeownership.

A final explanation is that the observed association between homeownership and education might be due to unobservable characteristics that causes the same individuals to study longer and to partake in homeownership. If unobservable factors are the primary reason for the amount of schooling individuals select, and these factors in turn partly explain the observed correlation between schooling and homeownership, estimates of the effect of additional schooling on the likelihood of homeownership are overstated. Education endogeneity may arise possibly due to differences in ability, family background, taste preferences such as the rate of time preference, or other unobserved characteristics. In this paper, I do not attempt to distinguish between the many channels through which education may affect homeownership decisions. Instead, I explore the causal relationship between education and homeownership.

The remainder of this paper uses data for native White Americans born between 1905 and 1954 from the 1960–2000 U.S. Censuses and adopts a Two Stage Least Squares (2SLS) strategy to address biases that are encountered when estimating by Ordinary Least Squares (OLS). Changes in mandatory schooling and child labour laws across different states at different times are used as an instrument for schooling. In doing so, this work builds on a large literature that has employed these laws as powerful instruments to identify the effects of education on a range of other outcomes including, but not limited to, earnings (Stephens & Yang, 2014), investment income (Cole et al., 2014), criminal activity (Bell et al., 2016; Cano-Urbina & Lochner, 2019), mortality and health (Lleras-Muney, 2005), teenage childbearing (Black et al., 2008) and the educational attainment of offspring (Oreopoulos et al., 2006). The current study makes a unique contribution to the literature by providing the only available evidence on the causal relationship between education and homeownership—possibly one of the most important long-term outcomes of education.

My results point to the importance of a direct effect of schooling in explaining the observed schooling-homeownership correlation. For the aggregate sample, an additional year of schooling raises the probability of homeownership by 1.9% points. Using subsamples of data for individuals in different terciles of the income distribution, I find a significant relationship between education and homeownership of 3.5–3.9% points for middle- and high-income families. By contrast, there is no evidence that additional education leads to homeownership at the bottom tercile of the income distribution. Overall, these results provide the first evidence that policy-induced increases in schooling improve homeownership rates, at least for middle- and high-income families.

The main contribution of this paper is estimating a causal relationship from education to homeownership. Therefore, it is important to be clear about what the identification strategy implies from a policy perspective. I measure a "Local Average Treatment Effect (LATE), that is, the effect of an additional year of education for the compliers' sub-population who were induced to go to school for longer

by changes in compulsory schooling and child labour legislation. Students on the margin of dropping out of high school are of the utmost importance from a policy perspective because they represent the group who have experienced the greatest fall in owner-occupancy rates over the last 30 years. My findings suggest that policymakers interested in raising homeownership rates should consider addressing educational outcomes particularly at the lower end of the educational distribution.

This paper is organised as follows. Sections 2 and 3 present the data set used and the estimation strategy, respectively. Section 4 presents and discusses the estimation results. Section 5 concludes with a few notes of caution on how to interpret my results for public policy purposes.

2 | DATA

In this paper I use decennial Census data from 1960 to 2000 from the Integrated Public Use Micro Sample (IPUMS). The particular samples I use are the 1% 1960 sample, the two 1% 1970 state samples, and the 5% sample from the 1980, 1990 and 2000 Censuses. Across the five Censuses my sample extract is limited to native-born Whites aged between 30 and 70 who are members of the 1905–1954 cohorts. The cohort range is between 1905 and 1954 because previous studies demonstrated that the compulsory schooling laws were far more effective as instruments for these cohorts than for more recent birth cohorts (Bell et al., 2016; Goldin & Katz, 2008; Lleras-Muney, 2002). My analysis focuses on Whites since I find no evidence that compulsory schooling laws impacted the educational attainment of Blacks in my data. I extract a sample of 11, 253, 988 individuals for whom there is complete information on all relevant variables used in this study. The size of the dataset is an enormous advantage which enables the generation of precise estimates using the instrumental variables strategy.

The main objective of this paper is to examine the causal effect of education on home ownership. All five Censuses report the highest level of completed education for each individual, which I convert to years of schooling based on the normal time required. Therefore, the schooling variable takes values from 0 to 17, as 17 years of schooling is a uniform top-code across Census years. For homeownership status, I create a dummy variable equal to 1 if the respondent owned his/her own home either outright or with a mortgage at the time of the survey.

Summary statistics are presented in Table 1. For cohorts born between 1905 and 1954, homeownership rates have substantially increased over time from 72% in 1960% to 87% in 2000. The trend data reveals that average years of schooling has increased steadily from approximately 11 in 1960 to 13 in 2000 while the fraction of high school graduates rose from 54% in 1960% to 89% in 2000. These improvements in education are expected to have contributed to the increase in the homeownership rate over time. Several demographic patterns in the table were also likely to have implications for homeownership. The average family income, adjusted for inflation, generally grew over time. Apart from becoming better educated and wealthier, the 1905–1954 cohort has also become older with the average age increasing from 42 in 1960 to 56 in 2000. The tendency for homeownership rates to rise with age implies that aggregate homeownership rates would have increased as cohorts grow older over the course of my data, even if nothing else changed (Haurin & Rosenthal, 2007).

Table 2 analyses differences in the average probability of homeownership by educational attainment. For comparison purposes, this table provides differences in sample means between differently educated individuals. Over the 5 decades under study the average homeownership rate for individuals with fewer than 12 years of schooling is about 77% while it is approximately 84% for those who have completed high school. Homeownership rates are just 2% points higher for college graduates than high school graduates, while there is essentially no difference in homeownership rates between those with some college education and a high school diploma.

TABLE 1 Summary statistics: Mean (standard deviation) by year

	1960–2000	1960	1970	1980	1990	2000
Homeownership	0.807 (0.394)	0.724 (0.447)	0.776 (0.417)	0.815 (0.388)	0.836 (0.370)	0.868 (0.339)
Years of schooling	12.264 (2.618)	11.165 (2.606)	11.656 (2.614)	12.371 (2.614)	12.807 (2.385)	13.092 (2.323)
High school or higher	0.728 (0.445)	0.535 (0.499)	0.623 (0.485)	0.740 (0.439)	0.841 (0.366)	0.893 (0.309)
Required schooling ≤ 6	0.065 (0.246)	0.140 (0.347)	0.099 (0.298)	0.056 (0.230)	0.019 (0.136)	0.017 (0.130)
Required schooling = 7	0.199 (0.399)	0.262 (0.440)	0.230 (0.421)	0.196 (0.397)	0.167 (0.373)	0.141 (0.348)
Required schooling = 8	0.343 (0.475)	0.437 (0.496)	0.388 (0.487)	0.334 (0.472)	0.311 (0.463)	0.242 (0.428)
Required school = 9–11	0.394 (0.489)	0.161 (0.367)	0.284 (0.451)	0.414 (0.493)	0.503 (0.500)	0.599 (0.490)
Male	0.483 (0.500)	0.483 (0.500)	0.485 (0.500)	0.482 (0.500)	0.482 (0.500)	0.487 (0.500)
Age	48.792 (10.694)	41.539 (7.061)	46.373 (9.726)	48.036 (11.837)	50.978 (10.272)	56.245 (7.125)
Family income (1999$)	57,402 (46,510)	40,958 (24,983)	54,664 (35,546)	54,884 (35,077)	64,598 (53,193)	72,831 (71,683)
Observations	11,253,988	427,230	1,132,150	3,707,986	3,485,421	2,501,201

Note: Data are drawn from the US decennial Censuses between 1960 and 2000. The sample contains individuals 30–70 years old and includes both men and women. The sample is restricted to White Americans who were born in the U.S.

TABLE 2 Homeownership rates by education 1960–2000

	1960–2000	1960	1970	1980	1990	2000
High school dropout (1)	0.772 (0.420)	0.683 (0.465)	0.740 (0.438)	0.779 (0.415)	0.801 (0.399)	0.799 (0.401)
High school graduate (2)	0.844 (0.363)	0.761 (0.427)	0.802 (0.398)	0.832 (0.374)	0.854 (0.354)	0.875 (0.331)
Diff (2)–(1)	0.072 (0.000)	0.078 (0.002)	0.062 (0.001)	0.053 (0.001)	0.052 (0.001)	0.076 (0.001)
Some college (3)	0.838 (0.368)	0.767 (0.423)	0.798 (0.401)	0.819 (0.385)	0.841 (0.366)	0.872 (0.334)
Diff (3)–(2)	−0.006 (0.000)	0.006 (0.002)	−0.004 (0.001)	−0.013 (0.001)	−0.013 (0.001)	−0.003 (0.001)
College graduate (4)	0.863 (0.344)	0.761 (0.427)	0.797 (0.402)	0.833 (0.373)	0.871 (0.335)	0.902 (0.297)
Diff (4)–(3)	0.025 (0.000)	−0.006 (0.003)	−0.001 (0.002)	0.014 (0.001)	0.030 (0.001)	0.030 (0.001)
No. of observations	11,253,988	427,230	1,132,150	3,707,986	3,485,421	2,501,201

Note: See Table 1 for data sources. Additionally, diff (2)–(1) shows the difference in homeownership rates between high school graduates and high school dropouts, diff (3)—(2) shows the difference in homeownership rates between those with some college and high school graduates, and diff (4)—(3) shows the difference in homeownership rates between college graduates and those with some college education. The numbers in parenthesis underneath means are standard deviations, except where standard errors are reported underneath mean differences.

Table 2 also breaks down the distribution of homeownership among education categories by Census year which reveals some complex patterns. Homeownership rates rose for all education groups in every decade except for high-school dropouts which show stagnation after 1990. The fact that the homeownership rate among high school dropouts did not decline is most likely due to the fact that every cohort sees its homeownership rate rise over time as the cohort ages. Interestingly, in the first 3 decades, the mean level of homeownership among those who had attended post-secondary education is approximately identical to that for high school graduates. In succeeding decades, homeownership rates among those with some college education continue to remain virtually identical to or slightly lower than those with a high school education. However, college graduates made significant gains in homeownership having about a 3-percentage point higher rate than those with a high school diploma and a 10-percentage point lead over high school dropouts in the last Census. By the end of my data, college graduates achieved the highest level of homeownership with an ending rate of 90%. This pattern indicates that it was the better-educated households whose relative incomes substantially increased with time that were able to take advantage of the extremely favourable economic conditions and housing policies in the U.S. during the 1990 and 2000 s.

While the patterns presented in Table 2 hint at a possible causal relationship between schooling and homeownership especially at the lower end of the educational distribution, more sophisticated analysis is needed to appropriately identify the impact of education on homeownership. By using two-stage least squares, I move beyond descriptive techniques and estimate the causal estimate effect of education.

The instrumental variable for education is the number of required mandatory schooling years given by compulsory schooling and child labour laws. Data on the schooling requirement variables have been previously compiled by Stephens and Yang (2014) who gathered and coded information on law changes each year over the period from 1914 to 1978. They constructed a required schooling measure using multiple aspects of state compulsory schooling laws and child labour laws to determine the minimum years of schooling that an child is required to attend. Compulsory schooling laws typically specify an entry age by which the child is required to be in school and a drop out age at which the child can choose to leave school. Frequently written into schooling laws are two types of exceptions that allow children to stop attending before the drop out age. The first type allows children to stop attending if they have completed a specified amount of schooling. The second type of exception permits children to drop out early if they have secured employment and have also reached a minimum age and number of years of schooling. Child labour laws specify the age and/or the completed schooling requirement needed to be reached before entering the labour force. Stephens and Yang (2014) construct a required schooling measure that accounts for any changes to the compulsory schooling and child labour laws that may have occurred for children through age six to 17 to determine whether they are required to attend school at that age based on the law that is in place that same year. For each age between 6 and 17, if the child either has not reached his/her dropout age or is not eligible for an exception, the number of required years of schooling is increased by 1. Once the child either reaches the dropout age or meets the minimum age and/or years of schooling for an exception, the required years of schooling is not increased unless there is a subsequent change in the schooling statutes. This calculation gives the cumulative number of years each child was obliged to be in school.

The fact that state of residence at each age is not solicited in the censuses means the assignment of school leaving laws must assume that individuals continued to attend school in their state of birth throughout childhood. To the degree that individuals migrate across states between birth and age 17, the precision of the instrument is diminished. However, the 2SLS estimates should still be consistent since it is unlikely that the mismatches are correlated with the attendance laws as these are unlikely to be a motivating factor behind migration. The identifying assumption is that conditional on the set of

control variables used in estimation, the timing of the changes in the attendance laws within each state is orthogonal to characteristics of individuals that affect homeownership.

In my analysis I incorporate state-level school quality data as education quality may have changed at the same time compulsory schooling laws were being changed (Sansai, 2015). The school quality measures are originally from Card and Krueger (1992) and were later extended by Stephens and Yang (2014). These data were compiled from seminannual issues of the Biennial Survey of Education from 1911 to 1958 and annually since 1960 from the Digest of Education Statistics. These reports provide a rich source of information on the average characteristics of public schools in different states at different points in time. From the wealth of school quality information available, Card and Krueger (1992) focused on the following three: (i) pupil/teacher ratios, (ii) school term lengths, and (iii) average relative teacher salaries. For each of these quality indicators, Card and Krueger (1992) created a single measure for each state of birth/year of birth cohort by averaging the measures during the years in which that cohort was six to 17 years of age. By considering the impact of school quality, I address important concerns raised by Stephens and Yang (2014) that increases in compulsory schooling laws are correlated with improvements in school quality in the U.S.

3 | EMPIRICAL METHODOLOGY

I start by exploring the effects of education on homeownership within the following econometric framework:

$$h_{ist} = \alpha_1 + \alpha_2 S_{ist} + \delta_t + \delta_s + \delta_y + \boldsymbol{X}_{ist}\Gamma + \varepsilon_{ist} \tag{1}$$

Here h_{ist} represents the dummy dependent variable for homeownership for individual i born in state s in year t, S_{ist} is the number of years of completed schooling, δ_t, δ_s, and δ_y represent fixed effects for year of birth, state of birth and Census year respectively, and ε_{tsy} denotes the statistical residual. The vector $\boldsymbol{X}_{tsy}$ contains the following covariates: region-specific state of birth effects, school quality measures, mean house prices, a quartic polynomial in age (for each birth cohort in different survey years), the presence of children and marital status. When the sample composition includes both males and females, an indicator for gender is added to this model. Mean house prices in the current state of residence are included to account for differences in housing market conditions across states that might affect the affordability of homeownership. In addition, adding house prices to the model partially alleviates the concern that the general equilibrium effect may lead to biased shifting to the right, leading to a larger housing demand and therefore an increase in house prices. Married households with children have the highest rate of homeownership and for this reason these variables are controlled for in estimation. Stephens and Yang (2014), using the same schooling requirement laws that are used here, demonstrated that when estimating the impact of schooling on a number of outcomes, year of birth dummies that differ across the four US Census regions are necessary for the instrument to be valid. Their recommendation for controlling for regional differences in the year of birth effects is based on the premise that standard estimates of the effects of increased schooling may be driven by a variety of factors, including school quality, that have disproportionate effects across the regions of the U.S. rather than by variation within states over time that is typically used to identify these models. For that reason, the Card and Krueger (1992) school quality measures are included in $\boldsymbol{X}_{tsy}$. The coefficient α_2 represents the net effect of an additional year of schooling on the dependent variable. It is anticipated that $\alpha_2 > 0$ since higher educational attainment is expected to increase the probability of homeownership.

In estimating Equation (1) it is unlikely that schooling is exogenous since many of the same factors that affect decisions about homeownership and schooling are unobserved. For example, individuals with high levels of ability will engage in more education, since more able individuals are more efficient learners. At the same time, more able individuals may be more likely to become homeowners if they earn more money in the labour market or are better able to gather and process information about mortgages and other aspects of homeownership. Schooling and homeownership may be positively correlated, even if schooling has no causal effect on homeownership. To address the potential endogeneity of schooling and generate an estimate of α_2 that yields a causal effect of schooling on homeownership, I require an instrument that satisfies the usual conditions.

In this paper, I exploit variation in state required schooling as an instrumental variable for education. States changed their schooling and child labour laws at different times, generating variation across cohorts and jurisdictions in exposure to compulsory schooling laws. Underpinning the 2SLS estimation strategy of Equation (1) that utilises these laws is a first stage equation that takes the following form:

$$S_{ist} = \beta_1 + \beta_2 RS7_{st} + \beta_3 RS8_{st} + \beta_4 RS9_{st} + \phi_t + \phi_s + \phi_y + \boldsymbol{X}_{ist}\Lambda + \upsilon_{ist} \tag{2}$$

where ϕ_t, ϕ_s and ϕ_y are fixed effects for year of birth, state of birth and survey year, respectively. Here RS_{st} represents the schooling law instrument variables which are based on the required schooling measures as given in the data section and are specified as three indicator variables, $RS7$, $RS8$ and $RS9$ corresponding to the required number of years of schooling of 7 years, 8 years, or 9 or more years respectively that individual i was exposed to during childhood. The omitted category is laws that required six or fewer years of schooling.[2] Since the first-stage equation includes both state of birth and year of birth fixed effects, the coefficients on the RS_{st} are identified by both variation in laws across states for each birth cohort as well as variation within states across birth cohorts. The vector $\boldsymbol{X}_{ist}$ represents additional controls as mentioned above. The error term is denoted by υ_{ist}. Estimation is done via standard linear 2SLS. Standard errors in each stage are estimated using Huber-White standard errors and clustered by state of birth/year of birth cell.

4 | RESULTS

The main results of the paper are in Table 3 which display the coefficients on years of schooling from OLS and 2SLS along with the corresponding first-stage regressions.[3] Column one presents the estimates for the entire sample, whereas columns two and three show the results separately for men and women. The first stage estimates are quite similar across samples and demonstrate that changes in schooling requirements did translate into an increase in educational attainment. The standard F-statistics range between 40.93 and 53.84, which is well above the conventional value of 10 for weak instruments (Staiger & Stock, 1997). Furthermore, the "effective" F statistics are large by any benchmark as a comparison with the Montiel-Pflueger critical values shows. These tests suggest that the instrument is sufficiently strong in all samples. The strength of the instrument is important as the use of a weak instrument tends to bias 2SLS estimates towards OLS estimates.

[2]Required years of schooling is concentrated in the 6–9 range, with fewer than 1% of observations requiring 11 years of schooling.

[3]In analysis not reported, I also estimated the schooling effects using Probit and IV-Probit models. These results, available upon request, are qualitatively similar to those reported here.

TABLE 3 The effects of years of schooling on homeownership

	Entire sample (1)	Male (2)	Female (3)
Years of schooling (OLS)	0.018*** 0.000	0.015*** 0.000	0.021*** 0.000
Years of schooling (2SLS)	0.019** (0.009)	0.018 (0.012)	0.020** (0.009)
2SLS confidence interval			
Hausman test [*p*-value]	0.011 [0.916]	0.074 [0.785]	0.016 [0.899]
First-stage:			
Required years of schooling = 7	0.003 (0.014)	0.013 (0.016)	−0.007 (0.015)
Required years of schooling = 8	0.092*** (0.013)	0.088*** (0.015)	0.093*** (0.014)
Required years of schooling = 9–11	0.168*** (0.015)	0.152*** (0.018)	0.179*** (0.017)
Standard F-statistic	59.231	34.018	64.009
M-F effective F statistic 5%	62.496	34.674	67.538
M–P weak IV critical values:			
tau = 5%	17.040	15.520	17.653
tau = 10%	10.701	9.819	11.082
tau = 20%	7.175	6.652	7.418
tau = 30%	5.870	5.481	6.057
Number of observations	11,253,988	5,443,374	5,810,614

Note: See Table 1 for data sources. All specifications control for state of birth, cohort of birth, region by year of birth, school quality indicators, survey year, mean house prices, a fourth-degree polynomial in age, and dummy variables for the presence of children and marital status. When the sample includes both males and females, a dummy variable for gender is also included. Regional effects include four dummies for the four US Census regions of birth. State of birth fixed effects are 49 dummies for state of birth (excluding Alaska and Hawaii). Cohort of birth effects are 50 dummies for year of birth between 1905 and 1954. Mean house prices are calculated at the state of residence and survey year level. The standard errors, which are reported in parentheses, are corrected for year of birth/state of birth clustering. Single, double and triple asterisks denote statistical significance at the 10%, 5%, and 1% levels, respectively.

Before proceeding to the 2SLS estimates, I first discuss the OLS estimates of the effects of education, which may be subject to omitted variable bias. The OLS estimates yield the expected positive correlation between education and homeownership. For the full sample, the estimates suggest that a 1 year increase in schooling increases the probability of homeownership by 1.8% points. To put the magnitude of this effect in perspective, since 80.7% of individuals in the full sample own their own home, this estimate implies that an additional year of education increases the homeownership rate by 2.2%. Examining results separately by gender, the estimates are positive and highly significant for both men and women with magnitudes of 0.015 and 0.021 respectively. OLS estimates, however, might yield biased estimates and lead to misleading conclusions about the role of education in promoting homeownership if education and homeownership are correlated with variables omitted from Equation (1). For this reason, I turn to 2SLS estimates to examine the results when the endogeneity of schooling is considered.

For the aggregate sample, the 2SLS estimate is very similar to OLS, suggesting that increasing education by a year increases the probability of homeownership by 1.9% points. The estimate for women is slightly larger than that for men with coefficient magnitudes of 0.018 for men and 0.020 for women. For both men and women, the standard and "effective" *F*-statistics are much higher than the minimum recommended levels. The Hausman tests for endogeneity confirm that I cannot reject the null hypothesis that the OLS and 2SLS estimates are the same for any of the samples.

TABLE 4 The effects of years of schooling on homeownership by family income

	Lowest income tercile (1)	Middle income tercile (2)	Highest income tercile (3)
Years of schooling (OLS)	0.012*** (0.000)	0.003*** (0.000)	0.005*** (0.000)
Years of schooling (2SLS)	−0.014 (0.013)	0.037*** (0.011)	0.035*** (0.010)
2SLS confidence interval			
Hausman test [*p*-value]	3.851 [0.049]	8.663 [0.003]	8.796 [0.003]
First-stage:			
Required years of schooling = 7	−0.005 (0.016)	0.001 (0.016)	−0.029 (0.019)
Required years of schooling = 8	0.074*** (0.014)	0.089*** (0.014)	0.063*** (0.015)
Required years of schooling = 9–11	0.154*** (0.018)	0.176*** (0.017)	0.131*** (0.018)
Standard F-statistic	41.761	53.838	40.934
Montiel–Pflueger "effective" F statistic (5%)	41.066	58.177	40.339
Montiel–Pflueger weak IV critical values:			
tau = 5%	16.195	19.303	19.401
tau = 10%	10.221	12.062	12.147
tau = 20%	6.896	8.018	8.087
tau = 30%	5.665	6.512	6.572
Number of observations	3,698,870	3,649,980	3,905,138

Note: See Table 3.

Education may have different effects on homeownership associated with different levels of family income. To explore whether my aggregated analysis obscures effects by income level, I consider the probability of homeownership at the bottom, middle and top terciles of the income distribution. Table 4 shows the OLS, first stage and 2SLS estimates of the effect of education on these three subsamples. The OLS estimates are universally smaller in these split samples than for the pooled sample but still statistically significant and consistent with education improving homeownership. The results imply that increasing education by 1 year increases the probability of homeownership by 1.2% points for low-income families, by 0.3% points for middle-income families and 0.5% points for high-income families.

The 2SLS estimates reflect the marginal effect of education for the group affected by the instrument within the three different subsamples. In these three subsamples, the first-stage standard *F*-statistic far exceeds the conventional criteria for strong instruments while the "effective" *F*-statistics exceed all the weak IV critical values. Among low-income families, the 2SLS estimates provide no evidence of a positive effect of education on homeownership. Indeed, the point estimate is negative, albeit statistically insignificant. The difference between the OLS and 2SLS estimates likely arises because the OLS estimates suffer from omitted variable bias due to correlations between education and other factors (such as ability) that influence homeownership. By contrast, for the second and third subsamples, middle- and high-income families, the 2SLS estimates suggest that the effect of education is causal with one additional year of education leading to higher homeownership rates of 3.7% points and 3.5% points, respectively. These estimates are much larger than their OLS counterparts using a standard Hausman test. From Table 1, the homeownership rate over middle- and high-income families is 82.9 and 91.2%, respectively. Thus, the 2SLS estimated 3.7 and 3.5% point increases would lead

to a rise in the homeownership rate of 4.46% for middle-income families and 3.84% for high-income families. Overall, the finding that the impact of education is about 4% higher in the two top terciles of the income distribution points to a complementarity between education and income.

Given that the summary statistics displayed in Table 2 reveal particularly large gains associated with high-school completion, I re-estimate the model replacing years of completed schooling with an indicator for high-school completion. For this analysis I restrict the sample to those who have at most 12 years of completed schooling. The results from this exercise are reported in Table 1A in the Appendix.[4]

Table 2A Consistent with the evidence presented earlier, the first stage results find that the reforms lead to an increase in the fraction of individuals who completed high school with the standard and "effective" *F* statistics indicating good predictive power across all samples. For the whole sample, the OLS estimate implies that the difference in the probability of homeownership between high school graduates and individuals with fewer than 12 years of schooling is 8.1% points. The analogous 2SLS estimate indicates an improvement of 6.0% points which is marginal in terms of statistical significance. Breaking the data down into men and women, the OLS estimates indicate an increase in the probability of homeownership by 7.3% points for men and gains of 8.8% points for women. However, the 2SLS estimate indicates that for men high school completion increases homeownership by 9.1% points which is marginally significant while the corresponding estimate for women is much smaller and statistically insignificant. Although theory provides little guidance on this, it is likely that the completion of high school for men matters more than for women with respect to homeownership decisions. This is plausible given that the previous literature has revealed that men earn substantially more over a lifetime than women at all educational levels but particularly at lower education sub-groups (see, for a review of the literature, Tamborini et al., 2015).

Looking at the results across the terciles of the income distribution, the OLS estimates range from 3.1 to 6.8% points and are highly statistically significant in each subsample. The corresponding 2SLS indicate that there appears to be a substantial positive causal effect of high-school completion in the middle and highest income terciles of 9.3% points and 14.0% points, respectively. A comparison of OLS and 2SLS results show that the 2SLS estimates are always larger in magnitude. Thus, the OLS estimates appear to be downward biased in these two subsamples. Among individuals in the lowest income tercile, the 2SLS results do not reveal any statistically significant effect on the probability of homeownership, despite a substantial and significant OLS relationship. This pattern of results is essentially consistent with those produced earlier where the dependent variable was defined as years of schooling.

The a priori expectation was the OLS estimates would be too large. I expected that the OLS estimate of the average treatment effect (ATE) would be biased upwards because education choice is thought to be positively correlated with unobserved ability. In this case, I expected to find the 2SLS estimates, which correct for the bias, to be lower than the corresponding OLS estimates. Indeed, this is the case for the group of individuals affected by the instrument in the lowest segment of the income distribution. By contrast, in the higher terciles of the income distribution, the 2SLS estimates of the effect of education is found to be much larger than the corresponding OLS estimates. The estimated effects of education on homeownership obtained in the 2SLS framework are fundamentally Local Average Treatment Effects (LATE) for the compliers' sub-population who were induced to go to school for longer by the change in the instrument. The most plausible explanation for the divergence between the 2SLS and the OLS estimates in different terciles of the income distribution is related

[4]I also estimated the effects of high-school completion using Probit and Bivariate Probit models. These results, available upon request, are qualitatively similar to those reported here.

to the composition of the complier group. The bulk of compliers in the lowest tercile of the income distribution might be individuals from the lower end of the ability and wealth distributions whereas compliers located in the higher terciles of the income distribution might generally be better endowed and stand more to gain from additional education (Brunello et al., 2009).

In relation to the existing literature, although Stephens and Yang (2014) found no causal effect of education for the group affected by historical changes in schooling requirements on a number of labour market outcomes and divorce when allowing year of birth effects to vary across region, research focusing on other outcomes uncovered important benefits of schooling. For example, Lleras-Muney (2005) examining the health impact of increased schooling found positive causal effects on mortality even accounting for region by year of birth effects in her analysis. More recently, Cano-Urbina and Lochner (2019) also using compulsory schooling laws as instruments estimated significant effects of schooling on criminal activity using Census data from 1960 to 1980 and controlling for region-specific cohort trends.

5 | CONCLUSION

Homeownership rates in the U.S. have long been a matter of policy concern. Although the literature has explored different factors that might impact owner-occupancy rates, the causal effect of education on homeownership has not yet been documented. I address this gap in the literature by providing the first evidence on the causal effect of schooling on homeownership for White Americans. Exogenous variation in education is generated from state-level variation in minimum school requirements. The results suggest that education has a positive causal effect on homeownership. Specifically, my aggregate findings indicate that one more year of schooling increases the probability of homeownership by 1.9% points, with no important differences observed between men and women. Additional analysis highlights the importance of sample restriction according to income in understanding the impact of education for homeownership. The results stratified by family income reveal that individuals in the lowest tercile of the distribution do not gain from an extra year of education. The impact of schooling on homeownership is concentrated in the upper two terciles of the income distribution where an extra year of education increases the probability of homeownership by 3.5–3.9% points. In view of the large magnitude of the effect of education on homeownership among middle and high-income families, it is clear that homeownership is determined in substantial part by educational policy.

There are at least two important caveats which should be kept in mind when interpreting my results. First, the 2SLS estimates are fundamentally Local Average Treatment Effects (LATE) for a subsample of the general population who were compelled to take an extra year of schooling by changes in compulsory schooling and child labour laws. Therefore, the compliers in this study are most likely coming from the lower end of the education distribution. If the marginal effect of an additional year of schooling is different among those with low levels of education, then 2SLS estimates will reflect the marginal return for this group and will not be informative about the average effect of schooling in the population.

Second, the results presented in this study are based on examining effects from raising the minimum schooling requirements that affected cohorts many decades ago. The compliers of more recent changes in schooling requirements might certainly differ today as the proportion of young people failing to finish high school has decreased substantially over time (Heckman & LaFontaine, 2010). The early schooling and child labour laws used in this study affected a larger segment of the population when educational attainment was much lower than more recent reforms. As a result, it was likely that among those affected in my study there were many individuals of great ability who had left school at

the earliest opportunity. This would be less likely in more recent decades, and presumably the more recent the reforms, the more selection in terms of those who leave school early. If the causal effect of education on homeownership is mediated by skill or ability, one would observe a different effect for these marginal students impacted by more recent reforms. Thus, it is not clear whether policy interventions aimed at improving education at the lower tail of the distribution would generate similar effects on subsequent homeownership today as those found in the present study. In addition, further research is required to assess whether results generalise to contemporary levels of education in the U.S. It is possible that other policy levers which generate variation at higher levels of education might yield different effects of additional schooling on homeownership.

Despite these limitations, the conclusion that education affects homeownership has significance policy relevance. Specifically, considering only the increases in labour market earnings when evaluating education would mean underestimating the returns to human capital investment. The benefits of policies aimed at increasing schooling, especially at the lower end of the education distribution, may extend beyond the expected labour market payoffs and policymakers should incorporate considerations of homeownership in deciding schooling investment.

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CONFLICT OF INTEREST

The author declares that there is no conflict of interest that could be perceived as prejudicing the impartiality of the research reported.

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APPENDIX

TABLE 1A The effects of high-school completion on homeownership

	Entire sample	Male	Female	Lowest income tercile	Middle income tercile	Highest income tercile
	(1)	(2)	(3)	(4)	(5)	(6)
High school (OLS)	0.081*** (0.001)	0.073*** (0.001)	0.088*** (0.001)	0.068*** (0.001)	0.040*** (0.001)	0.031*** (0.001)
High school (2SLS)	0.060 (0.041)	0.091 (0.056)	0.036 (0.043)	−0.037 (0.081)	0.093** (0.046)	0.140*** (0.036)
Hausman test [*p*-value]	0.253 [0.615]	0.109 [0.742]	1.507 [0.219]	7.125 [0.008]	1.285 [0.257]	9.065 [0.003]
First-stage:						
Required years of schooling = 7	0.001 (0.003)	0.001 (0.004)	0.001 (0.004)	0.000 (0.004)	0.000 (0.004)	0.000 (0.005)
Required years of schooling = 8	0.024*** (0.003)	0.020*** (0.003)	0.027*** (0.004)	0.015*** (0.003)	0.028*** (0.004)	0.029*** (0.005)
Required schooling = 9–11	0.043*** (0.004)	0.036*** (0.004)	0.049*** (0.004)	0.029*** (0.004)	0.051*** (0.005)	0.056*** (0.006)
Standard F-statistic	71.469	44.433	72.991	32.007	63.485	60.495
M–P effective F statistic 5%	72.890	40.699	77.959	28.979	74.526	75.896

TABLE 1A (Continued)

	Entire sample (1)	Male (2)	Female (3)	Lowest income tercile (4)	Middle income tercile (5)	Highest income tercile (6)
M–P weak IV critical values:						
tau = 5%	14.906	15.302	15.308	15.590	17.577	17.800
tau = 10%	9.474	9.703	9.725	9.891	11.027	11.152
tau = 20%	6.453	6.589	6.613	6.712	7.379	7.451
tau = 30%	5.337	5.437	5.459	5.533	6.025	6.078
Number of cells	6,892,723	3,100,297	3,792,426	2,869,192	2,353,708	1,657,657

Note: See Table 3.

TABLE 2A Summary statistics: Mean (standard deviation) by family income

	Lowest income tercile (1)	Middle income tercile (2)	Highest income tercile (3)
Homeownership	0.686 (0.464)	0.829 (0.376)	0.912 (0.283)
Years of schooling	11.082 (2.454)	12.153 (2.406)	13.516 (2.469)
High school graduate	0.557 (0.497)	0.735 (0.441)	0.880 (0.325)
Required schooling ≤ 6	0.102 (0.302)	0.063 (0.242)	0.042 (0.200)
Required schooling = 7	0.220 (0.414)	0.202 (0.402)	0.193 (0.395)
Required schooling = 8	0.370 (0.483)	0.359 (0.480)	0.323 (0.468)
Required school = 9–11	0.309 (0.462)	0.376 (0.484)	0.442 (0.497)
Male	1.568 (0.495)	1.493 (0.500)	1.483 (0.500)
Age	50.621 (11.759)	47.180 (10.626)	48.564 (9.198)
Family income (1999$)	22,044 (9907)	49,826 (7925)	106,946 (55,898)
Observations	3,698,870	3,649,980	3,905,138

Note: See Table 1.