The Impact of Early Investments in Urban School Systems in the United States

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Abstract

Urban school systems in the United States increased their per pupil expenditures by nearly two-thirds over the 1920s, an investment in public education that was unprecedented in American history at the time. We compile a novel dataset of city-level school expenditure data from the early twentieth century and follow students forward in time using complete count censuses to assess the impact of these inputs on the educational attainment and wages of workers in their prime earning years. To address the potential endogeneity of schooling inputs, we instrument expenditures using anti-German hysteria around World War I. Increasing per pupil spending by 10 percent increased wages by about 5 percent. However, exogenous investments in education appear to have primarily benefited the children of skilled workers and professionals.

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1. Introduction

Public education has long been viewed as a tool for improving the labor market outcomes of children from poor families and assimilating young immigrants into American society. The question of how to allocate resources to educate these students has received a great deal of attention in economics, particularly as transfers from state and federal governments have expanded as a means of providing additional money to the most disadvantaged.[1] However, for most of American history, local governments assumed most of the responsibility for raising funds and making investments in public education. This paper asks who benefited from improvements in urban school systems in the United States in the early twentieth century, when cities made historically unprecedented investments in education. For instance, in the 1920s alone, expenditures per pupil grew by nearly two-thirds in American cities (see Figure 1).

This expansion of school resources occurred for several reasons. The rise of new skilled occupations and the spread of technologies such as electrification and small motors increased the return to education for the bulk of the labor force in the early twentieth century (Goldin 2001). Urban voters, recognizing the need to prepare youth for this "new" economy, largely supported investments in education. City governments responded by issuing bonds for school construction, with the period after 1910 particularly focused on new high schools. The share of 18-year-olds with a high school diploma increased from 9 percent in 1910 to more than 50 percent by 1940 (Goldin and Katz 2008). Expenditures were also used to improve the quality of education, and city systems made significant changes such as introducing middle schools during the early twentieth century.

[1] For instance, the state share of public elementary and secondary school revenues nationally grew from 30 percent to over 50 percent between 1940 and 1990 ("Revenues and Expenditures for Public Elementary and Secondary School Districts" (Fiscal Year 2010), National Center for Education Statistics: https://nces.ed.gov/pubs2013/2013307.pdf).

Second, high levels of immigration prior to World War I, particularly from eventual enemy nations such as Germany, had also left native-born citizens anxious about the assimilation of foreign-born children. Reformers hoped that improved schools would help all youth "…acquire a common fund of ideas, ideals, and habits of thought and action in order that there may be social and national solidarity" and provide a bulwark against labor unrest.[2] Curricula changed to emphasize matters of health and citizenship in addition to providing vocational education. There is thus reason to believe that children from both wealthy and disadvantaged backgrounds could have benefited from early twentieth century educational investments.

While the economic consequences of urban school spending have been largely unexplored for the early twentieth century, a large literature has investigated the impacts of educational investments made in the ensuing decades. A significant number of papers, particularly those using test scores as outcomes and a difference-in-difference approach, echo the findings of the Coleman Report (1966) and find little evidence of a relationship between school inputs and student outcomes.[3] On the other hand, a literature using state-level aggregated education metrics has largely found positive returns to mid-twentieth century school expenditures (Morgan and Sirageldin 1968, Akin and Garfinkel 1977, Card and Krueger 1992). The most relevant paper to ours is the recent study of county-level school resources in the Jim Crow South by Carruthers and Wanamaker (2017) which finds significant wage returns to educational expenditures for young southern men over the 1920s and 1930s.

Our empirical strategy combines insights from the existing literature with a newly assembled dataset to estimate the impacts of the growth in educational expenditures in early

[2] Annual Report of the Detroit Public Schools, 1920 as quoted in Amsterdam (2016) p. 60.
[3] See Card and Krueger (1996), Hanushek (1996), Hanushek (1997), Hanushek (1998), and Krueger (2003) for reviews and overviews of the contemporary literature. Recent work by Jackson et al. (2016) finds that *exogenous* increases in educational expenditures generate long-term economic benefits for disadvantaged children later in the twentieth century.

twentieth century urban areas. To measure municipal inputs, we digitized Bienniel Surveys of Education for 1900, 1910, 1920, and 1930 at the city level, the smallest unit of geography available for this period. To obtain outcomes for students educated in urban schools during these decades, we match individuals from the 1920 and 1930 censuses to the 1940 complete count census. The advantages of this linking are twofold. First, because the census only asked state of birth, linking individuals is essential for matching working adults to the local level of schooling resources they experienced as children. This step also reduces aggregation bias relative to using state-level educational resources.[4] Second, observing individuals as both children and adults allows us to control for family background in our empirical work. The omission of these characteristics has been cited as a potential source of positive bias in previous work (Betts 1996). Furthermore, we can also investigate the potentially heterogeneous returns to educational resources during this period.

The existing literature has largely treated changes in educational inputs as exogenous. Our final empirical contribution uses history as a guide to develop a novel instrument for local levels of schooling expenditures related to anti-German hysteria in the aftermath of World War I. In particular, we argue that the German population share in a county prior to outbreak of the conflict was associated with significant increases in educational investments but unrelated to expenditures on other public goods. Furthermore, this pattern is unique to the German population and does not hold for other immigrant groups. Our empirical approach thus combines the mobility-based estimation strategy proposed by Card and Krueger (1992) and extended by Heckman et al. (1996) with more recent innovations in the literature that leverage exogenous

[4] Hanushek et al. (1996) and Betts (2010) both suggest that estimated returns to school resources rise with the level of aggregation.

changes in school inputs (e.g. Johnson 2011, Lavy 2015, Jackson et al. 2016, Lafortune et al. 2016).

We find that early twentieth century investments in education improved the earnings of workers after they entered the labor force. In particular, a 10 percent increase in expenditures per pupil increased the return to education by 0.4 to 0.5 percent, where the average return to education was 7 percent. However, the gains associated with increased investments accrued entirely to the children of professionals and members of other skilled occupations. We find little evidence of a return for the children of unskilled workers. Furthermore, while children of low-skilled parents had higher educational attainment in cities that spent more on education, there was no causal impact of expenditures on years of schooling for any group. We argue that exogenous increases in school spending appear to have been used to improve the quality of instruction rather than to build new schools, possibly blunting the relationship between inputs and educational attainment and limiting the potential benefit for children who were less likely to attend high school.

Our findings shed new light on the history of education financing in the United States, in particular the long-standing tradition of elite capture of schooling resources. The tendency of black schools to be underfunded relative to white schools in the South has been previously explored by economists (e.g. Cascio and Washington 2013; Carruthers and Wanamaker 2016). Our results demonstrate that urban schooling resources, which were increased in part due to concerns about poor immigrant children, were deployed in ways that appear to have primarily benefited children of the most advantaged families. Urban investments in public education in the early twentieth century could thus have potentially exacerbated inequality were it not for the

many forces acting to compress earnings between 1930 and 1950 (Goldin and Margo 1992; Collins and Callaway 2017).

Our results also underscore the importance of institutions such as court-ordered school financing reforms, which typically obligate states to disburse funds to poor districts in a transparent manner, for ensuring that the most disadvantaged children benefited from public schooling resources later in the twentieth century. Furthermore, our causal estimates of the returns to schooling resources for the children of educated parents in the early twentieth century are similar in magnitude to recently published estimates for the contemporary period (for instance, see Jackson et al 2016). The findings of our paper are thus inconsistent with the notion that causal returns to schooling resources were vastly different over the course of the twentieth century.[5]

The remainder of the paper is organized as follows. In Section 2 we present the historical background on schooling expansion during the early twentieth century and the attitude toward German immigrants that developed during World War I. In Section 3 we discuss the creation of our new dataset, which contains city-level school resources linked to student outcomes. Section 4 presents the empirical strategy and introduces the German share instrument. Section 5 provides the baseline empirical results showing how school resources effecting educational attainment and the return to education during the early twentieth century. Section 6 examines how results very by socioeconomic status and explores the mechanism behind our results. Finally, Section 7 concludes.

[5] Hanushek (1998) comments that there may be little observable relationship between school resources and student outcomes since, if added resources have diminishing effects on student achievement, "current school operations may be largely 'on the flat' of the production function…it is quite possible that the enormous changes in educational resources did have an effect on outcomes in the first half of this century, but that more recent studies are also correct in finding 'no effect' for the sorts of resource changes discussed in current schools" (Hanushek 1998, pg. 19-20).

2. Historical Context

Economists have long been interested in the dramatic expansion of public education in the early twentieth century. While municipal financing of education has received little quantitative attention to date, the existing literature has identified several interrelated mechanisms behind the growth in educational attainment in the United States over these decades. First, economic historians have pointed the response of individuals to the increased demand for white collar workers, which ushered in an era of rapidly growing high school attendance and graduation rates (Goldin 1998). Second, changes in the supply of education improved access to graded primary schools as well as high schools: Goldin and Katz (2008) find that areas with high taxable wealth and greater homogeneity in economic and social conditions led the way in providing secondary education.

Finally, the early twentieth century saw the establishment and expansion of many state-level compulsory schooling laws (CSLs). Studies investigating the extent to which legislation was responsible for observed increases in educational attainment have found mixed results. Landes and Solmon (1972) find no effect of CSLs while Eisenberg (1988) finds modest effects of (a 1 to 2 percent increase) in school attendance. Margo and Finegan (1996) find that CSLs significantly increased attendance in states that coupled a CSL with comprehensive child labor laws. Clay et al. (2012) find that CSLs passed after 1880 increased educational attainment and the wages of men who were born in the early twentieth century. Finally, Lleras-Muney (2002) finds that legally requiring children to attend one more year of school increased educational attainment by 5 percent.

To our knowledge there is little direct evidence on the impact of anti-immigrant sentiment on public education during this period besides a recent study on the impact of the

Americanization movement on immigrants themselves (Lleras-Muney and Shertzer 2015). The outbreak of World War I was accompanied by a great deal of immigrant scrutiny. After President Wilson's inflammatory declaration of war, antagonism toward enemy aliens was further heightened with the release of James W. Gerard's well-known book *My Four Years In Germany* in 1917. Gerard served as the United States Ambassador to Germany from 1913-1917 and his book stressed the hostility of German officials towards the United States. Gerard writes that Arthur Zimmermann, the State Secretary of Foreign Affairs of the German Empire, once warned him "The United States does not dare to do anything against Germany because we have five hundred thousand German reservists in America who will rise in arms against your government if your government should dare to take any action against Germany" (Gerard 1917, pg. 237). *My Four Years in Germany* was so popular that Warner Brothers released a film adaptation of the book in 1918.

Anti-German sentiment reached its peak in April of 1918 when Robert Prager, a German immigrant, was hanged by a mob in Collinsville, Illinois.[6] Although extreme, this was far from the only instance of mob violence toward German immigrants during World War I. There were numerous other instances of mob violence in Kansas and Illinois and a plaque in Cincinnati still commemorates the "Anti-German Hysteria" that swept the city in 1917 and 1918 (Juhnke 1977).[7]

At the same time that there was mass anxiety about the potential threat enemy aliens posed, there were also concerns about training an army of immigrants. Eighteen percent or over half a million soldiers in the AEF were immigrants, hailing from 46 different countries (Ford

[6] See Hickey (1969) for a detailed historical explanation of this event.
[7] For a more complete history of this topic see Frederick C. Luebke's *Bonds of Loyalty: German-Americans and World War I* (1974) or Clifton J. Child's *The German-Americans in Politics* (1939). Another source is Captain Henry Landau's *The Enemy Within: The Inside Story of German Sabotage in America* (1937).

2001). Many of these immigrant soldiers could not speak or understand English, which created problems when they needed to carry out orders.[8] Some immigrant soldiers were given a crash course in English, United States history and civics, but elected officials placed their hope in the education system to serve as a more permanent solution (Laskin 2014). Russell Kazal, in his history of German-Americans, writes that Americanization "lacked mass support until the war, when fear of divided immigrant loyalties brought it into the public spotlight" (Kazal 2004, pg. 166). Thus, the historical narrative paints the following picture: anti-German sentiment during World War I fostered the need to Americanize immigrants and led cities with high German shares of the population to increase spending on schools.

3. Data

3.a. City school resource data

We construct a new city level dataset on public school resources for the years 1900, 1910, 1920, and 1930. These data come from the Report of the Commissioner of Education Volume II (1900 and 1910) and the Biennial Survey of Education (1920 and 1930). Contained within these reports is information on current expenditures on day schools, expenditures on teachers and supervisors, average daily attendance at public schools, and the number of public school teachers. These data allow us to compute three measures of school resources: current expenditures per pupil, expenditures per teacher, and pupil-teacher ratios. Much of our analysis is focused on cohorts educated in 1920 and 1930 and, therefore, we form a balanced panel of cities for which we have

[8] The Commissioner of Education Philander P. Claxton wrote in his annual report: "Rumors then began to reach us of large numbers of the drafted men who were unable to understand the orders given by their officers, who had no knowledge of the reason or purpose of the war, and whom it was impossible to train with the other soldiers. We learned that in one camp alone it was necessary to converse with the men through interpreters in 40 different languages…All of these factors brought the need for Americanization urgently before the American people, and organizations and communities everywhere began to study the problem" (Claxton 1919; Report of the Commissioner of Education for 1919, pg. 43-44).

all three measures of school resources in the years 1920 and 1930.[9] This balanced panel provides us with school resource data for 446 U.S. cities. We then map each city to the county it was located in during the 1910 census for use in our linked sample of individuals (see Section 3.b).[10] Our 446 cities map to 323 separate counties because many counties contain several cities. For instance, Hartford County, Connecticut contains the cities of Bristol, Hartford, Manchester, and New Britain. To obtain consistent county-level measures, we aggregate the school data for all cities in a county before computing our measures of school resources. Summary statistics of school resources in these counties in 1920 and 1930 are displayed in Table 1 Panel A.

To provide a more complete picture of the evolution of these school resources in the early twentieth century we graph time series of all three variables in Figure 1. Panel A of Figure 1 shows nominal expenditures per pupil, which were increasing steadily during the early twentieth century. However, Panel B displays real expenditures per pupil which were fairly flat from 1900 to 1920. It is only after 1920 that large real increases are evident. Real expenditures per pupil increased $85 in 1920 to $160 by 1930. Panel C graphs the pupil-teacher ratio, which decreased steadily from 1900 to 1920 and then leveled off. Finally, Panel D shows real expenditures per teacher. Real expenditures per teacher actually decreased until 1920, then grew from $1,400 in 1920 to over $2,300 in 1930. These figures underscore the importance of changes in school resources in the 1920s.

3.b. A linked sample

[9] Balancing the panel to include cities for which we have all three measures in 1900, 1910, 1920, and 1930 reduces the sample size by 71 cities (to 375) and balancing the panel to include cities for which we have all three measures in 1910, 1920, and 1930 reduces the sample size by 56 cities.

[10] We sum current expenditures on day schools, expenditures on teachers and supervisors, average daily attendance, and number of teachers across cities that are located in the same county and then compute our measures of school resources. We map to the 1910 census since that is the census we will use to determine the German-share of a county's population.

To measure the extent that school resources impact student outcomes we construct a dataset of individuals linked from the 1920 and 1930 IPUMS 1% samples (Ruggles et al. 2015) to the 1940 complete count census. The goal of our linking algorithm is to match individuals who were educated in one of our 446 cities in 1920 or 1930 to their corresponding census record in 1940. However, the 1920 and 1930 IPUMS samples only report city of residence for a select number of cities, but county or residence in reported for all individuals. We therefore geocode the location of each city for which we have school resource data and find the county the city was located in during the 1910 census.

Before performing our iterative linking procedure we make several sample restrictions. We restrict to white men who were living in one of the 323 counties for which we have corresponding county-level school resource data in 1920 and 1930. When linking the 1920 IPUMS sample we restrict our attention to men born in the United States between 1905 and 1914 (aged 6 to 15 in 1920 when we measure school resources), and when linking the 1930 IPUMS sample we restrict to men born in the United States between 1915 and 1924 (aged 6 to 15 in 1930). The youngest individuals in the 1930 sample were 16 and 17 years old in 1940 and, therefore, very few of them were in the labor force in the 1940 census. These individuals, of course, cannot be used to study the relationship between school resources and labor market outcomes.

We employ an iterative linking procedure that is commonly used in economics and has been previously used by Abramitzky et al. (2012) and Long and Ferrie (2013). First, we standardize given names and surnames according to the NYSIIS Phonetic Code and drop all duplicates (in both the IPUMS samples and the 1940 complete census) in terms of first name, surname, birthplace, and age. Next, we link records from the IPUMS samples to records in the

1940 complete count census if they match exactly on first name, surname, birthplace, and age. Linked individuals are set aside, and we attempt to link the remaining individuals based on first name, surname, birthplace, and now allow their age to be within one year (plus or minus) of the age reported in the IPUMS record. After setting aside these individuals, we perform the same procedure, but we now allow an individual's age to be within two years (plus or minus) of the age reported in the IPUMS record.

The results from this linking procedure are displayed in Table 2. For the 1920 IPUMS sample we searched for 41,776 individuals in the 1940 census and were able to link 14,178 of them (a 34% link rate). For the 1930 IPUMS sample we searched for 50,531 individuals in the 1940 census and we were able to link 19,218 of them (a 38% link rate). The link rates are a bit higher than those found in Abramitzky et al. (2012) and Long and Ferrie (2013), which is likely explained by the fact that both of those papers are matching over a longer period (1865 to 1900 in Abramitzky et al. (2012) and 1850-1880 in Long and Ferrie (2013)). Our linked sample for both the 1920 and 1930 IPUMS samples appear to be representative of the entire IPUMS sample that we attempted to link. Where significant differences exist, such as literacy and school attendance in 1920 and living in an urban area in 1930, they are small in magnitude and, therefore, unlikely to contribute to a biased interpretation of our results. [11]

4. Empirical strategy

4.a. Estimating the effect of school resources on educational attainment

The objective of our empirical analysis is to examine the effect of school resources on outcomes in adulthood. Increased expenditures could impact students either by encouraging greater

[11] Abramitzky et al. (2012) and others find that urban individuals are over-represented in their linked samples. Mill (2013) attributes this to "the more concentrated distribution of first names in rural areas" (Mill 2013, pg. 86).

educational attainment or by increasing the returns associated with the same educational attainment. We first focus on the impact of school resources on attainment. Since school resources are measured at the county-level, but educational attainment is measured at the individual-level, we adopt a two-step estimation procedure. First we regress an individual's educational attainment on individual-level characteristics and county-of-education fixed effects:

$$[attainment]_{iec} = \boldsymbol{X'_{iec}}\boldsymbol{\delta_c} + \gamma_{ec} + \tau_{iec} \quad (1)$$

In the above equation, *i* indexes individuals, *e* indexes county-of-education, and *c* indexes cohort (there are two cohorts; 1920 and 1930). $[attainment]_{iec}$ is the educational attainment of individual *i*. In equation (1) $[attainment]_{iec}$ is assumed to be linearly related to the independent variables. However, as shown in Appendix A Figures 1 and 2, this is not the case for individuals who attain very low and very high levels of education. Appendix A Figure 1 shows the earnings-education profile for the 1920 cohort and Appendix A Figure 2 shows the earnings-education profile for the 1930 cohort. Both appear to be fairly linear for individuals who have between 5 and 16 years of education. As such we do not include individuals who attained fewer than 5 or more than 16 years of education in our sample. The restricted earnings-education profiles are shown in Appendix A Figures 3 and 4. [12]

The vector $\boldsymbol{X'_{iec}}$ contains individual-level characteristics whose effects are allowed to vary by cohort. These characteristics include: mother's literacy (three dummy variables: mother literate, mother illiterate, and mother not present), father's literacy (three dummy variables: father literate, father illiterate, and father not present), mother's occupation, and father's

[12] Very few individuals report education levels above and below our cutoffs. In the 1920 cohort, 2.13% of the sample has less than 5 years of education and 2.43% has more than 16 years of education. In the 1930 cohort, 1.78% of the sample has less than 5 years of education and 0.63% of the sample has more than 16 years of education. We could follow Card and Krueger (1992) in defining educational attainment as: $E_{ielc} = max\{e_{ielc} - T_{ec}, 0\}$, where e_{ielc} is the actual number of years of education attained by individual *i* and T_{ec} is the years of education attained by the second percentile of the education distribution in county *e* for cohort *c*. However, we find that the education-earnings profile is still non-linear when defining education this way.

occupation. γ_{ec} is a county-of-education fixed effect and τ_{iec} is a stochastic error term. After estimating equation (1) for each cohort, we regress the conditional average education in each county-cohort group on the school resources that individual's in that group were exposed to:

$$\gamma_{ec} = \gamma_c + \gamma_e + \varphi[school\ resources]_{ec} \tag{2}$$

where $[school\ resources]_{ec}$ is one of the three measures of school resources, described in Section 3.a. γ_c and γ_e are cohort and county-of-education specific constants. We cluster standard errors at the county-of-education level.

4.b. Estimating the effect of school resources on the rate of return to education

We also wish to estimate the effect of school resources on the rate of return to education (the slope of the line in Appendix A Figures 3 and 4). To estimate this relationship we use a method developed by Card and Krueger (1992) and extended by Heckman et al. (1996). The model is given by:

$$ln[earnings]_{ielc} = \theta_{ec} + \theta_{lc} + \boldsymbol{X'_{ielc}\beta_c} + [attainment]_{ielc}(\alpha_{ec} + \alpha_{lc}) + \varepsilon_{ielc} \tag{3}$$

where *i* indexes individuals, *e* indexes county-of-education, *l* indexes county-of-residence, and *c* indexes cohort. $ln[earnings]_{ielc}$ are the weekly earnings of individual *i*, which are defined as the amount of money wages or salary an individual earned as an employee in 1939 divided by the number of weeks the individual worked in 1939 provided they worked at least 40 weeks.[13] We remove the top and bottom 1 percent of weekly wage earners.

[13] Census enumerators were instructed to not include "the earning of businessmen, farmers, or professional persons derived from business profits, sale of crops, or fees" (Ruggles et al. 2015; 1940 enumerator instructions). This means that small business owners and farmers are not in our sample, a common restriction in the literature using the 1940 census for income.

θ_{ec} is a cohort-specific fixed effect for individuals educated in county *e*, θ_{lc} is a cohort-specific fixed effect for individuals living in county *l,* and $\boldsymbol{X'_{ielc}}$ is a vector of control variables for individual *i* that include: potential work experience and its square, an indicator if individual *i* resides in an SMSA, mother's literacy (if present), father's literacy (if present), mother's occupation, and father's occupation.[14] $[attainment]_{ielc}$ is the educational attainment of individual *i* and is defined as in Section 4.a. We allow the rate of return to education to consist of two components: a cohort-specific return to the county-of-education, α_{ec}, and a cohort-specific return for the county-of-residence, α_{lc}. Note that when education is interacted with both county-of-education and county-of-residence fixed effects, the county-of-education component of the return to education, α_{ec}, is identified by individuals who were educated in one county and then move to another county.[15] Finally, ε_{ielc} is a stochastic error term.

We assume that the cohort specific county-of-education return to education, α_{ec}, is related to school resources in the following way:

$$\alpha_{ec} = \alpha_c + \alpha_e + \sigma[school\ resources]_{ec} \qquad (4)$$

where $[school\ resources]_{ec}$ is one of the three measures of school resources, described in Section 3.a, and α_c and α_e are cohort and county-of-education specific constants. Following Card and Krueger (1992) and Heckman et al. (1996) we estimate the effect of school resources on the rate of return to education using a two-step procedure where we first estimate equation (3) for each cohort (1920 and 1930) and then regress estimates of the rate of return to education on school resource measures (equation (4)). The second stage regressions are OLS regressions

[14] We define potential experience as: age - years of education - 6.

[15] It would be possible to allow the return to education to have a state-of-residence or region-of-residence specific component, instead of a county-of-residence component. However, the county-of-education component of the return to education would then be identified by individuals who are educated in one county, and then move out of the state or region they were educated in. Few individuals in our linked sample move out the state or region they were educated in.

weighted by the inverse sampling variance of the observation (i.e. weighted by the number of observations used to estimate the return to education in each county-cohort cell in the first stage). Standard errors are again clustered at the county-of-education level. Finally, Panel B of Table 1 displays summary statistics for the individuals that are used to estimate equation (3) after all of our sample restrictions have been made. We use 8,097 individuals to estimate equation (3) for the 1920 cohort and we use 5,292 individuals to estimate equation (3) for the 1930 cohort. The average weekly wage of an individual in the 1920 cohort is $28.24, while the average weekly wage of an individual in the 1930 cohort is $19.20. Both cohorts have an average educational attainment of around 10.5 years. Finally, the average age of the 1920 cohort in 1940 is 30 and the average age of the 1930 is 22.[16]

The two-step procedure described above provides several advantages over estimating a standard Mincer earnings equation. First, we identify the return to education using individuals who were educated in one county and then moved to another. This approach allows us to eliminate any unobserved county-of-education and county-of-residence fixed characteristics that might affect the rate of return to education. Second, by assuming the return to education is directly impacted by school quality, we can exploit plausibly exogenous changes in school quality to determine how they affect the return to education. Instrumenting for school resources addresses endogeneity concerns that accompany a naïve regression of wages on school quality. Our approach thus combines elements of the mobility-based identification strategy with the empirical idea behind recent papers that instrument for school quality using exogenous school finance reforms.

[16] Chetty et al. (2014) find that income ranks are stable between the ages of 30 and 60. A limitation of our approach is that we observe individuals in the 1915-1924 cohort when they are younger than 30 on average. We note that this limitation is likely to bias us against finding returns to school resources.

4.c. German share of population instrument

To address the potential endogeneity of school resources, we attempt to establish exogenous variation in expenditure variables using the German share of a county's population in 1910. The logic for this instrument can be stated as follows: a high-German share of the population prior to World War I resulted in more anti-German hysteria during World War I and a larger push to Americanize immigrants, especially enemy aliens, during the 1920s and 1930s. This push to Americanize immigrants was accompanied by increases in school resources, which might have had spillover effects on the native population. Our exclusion restriction is, therefore, that the German share of a county population in 1910 effects the outcomes of students educated in that county only through the increase in school resources that occurred as a result of Americanization efforts after World War I. To construct this instrument we use the 1910 complete count census to count the number of German-born immigrants living in a county prior to the outbreak of World War I. From these counts we calculate the percent of each county's population that was German-born.

We perform a variety of exercises to establish the relevance and validity of our instrument. We begin by demonstrating that the German share of a county population in 1910 is, indeed, a strong predictor of school resources in 1920 and 1930. The empirical model takes the following form:

$$[school\ quality]_{et} = \delta_e + \delta_t + \beta ln[German\ share\ 1910]_e * [post\ wwi]_t + \varepsilon_{et} \quad (5)$$

where *e* indexes counties and *t* indexes years (1900, 1910, 1920, and 1930). $[school\ quality]_{et}$ is one of our three measures of school quality and $ln[German\ share\ 1910]_e$ is the log of the

German share of the county population in 1910.[17] $[post\ wwi]_t$ is an indicator variable for years after World War I (1920 and 1930) and we include county fixed effects, δ_e, and year fixed effects, δ_t.

Results from estimating equation (5) are displayed in Table 3. In column (1), a 10% increase in the German share of the county population prior to World War I was associated with a 0.35% increase in expenditures per pupil after World War I. In column (4), a 10 percent increase in the German share of the county population is associated with a 0.25 percent increase in expenditures per teacher after World War I, and in column (7) a 10 percent increase in the German share of the county population is associated with a 0.2 percent decrease in the pupil-teacher ratio, although the relationship between the German share and pupil-teacher ratios is not very strong.

We also provide visual evidence that, after World War I, expenditures per pupil increased in counties with above median ("high") German shares of the population relative to counties with below median ("low") German shares of the population. Time series of expenditures per pupil, in real terms, for counties with high and low German shares of the population are displayed in Figure 2. From 1900 to 1910 counties with high and low German populations followed a similar trend with about $13 separating the two sets of counties in 1910 (high German was $90.80 and low German was $77.75). After the conclusion of World War I, the gap between high-German and low-German counties widens considerably. In 1920, the gap was almost $16 ($89.09 for high-Germans and $73.27 for low-Germans) and in 1930 the gap was over $46 ($172.71 for high-Germans and $126.31 for low-Germans), an increase of over 250 percent. Figure 2, therefore, provides visual evidence that expenditures per pupil increased in counties with a high

[17] The lowest German-born share is 0.05% in Spartanburg County, SC and the highest German-born share of over 17% of the population is Milwaukee County, WI.

German share of the population more rapidly than they increased in counties with a low German share of the population after World War I.

We next turn to examining the validity of our instrument. For our instrument to be valid, the German share of the population in 1910 must affect student outcomes only through school resources. A potential concern with this exclusion restriction is that the German share of the population is correlated with the overall immigrant share of the population, and immigrants, in general, might settle in locations that spend more on schooling. Columns (2) and (8) of Table 3 demonstrate that the Italian-share of the population is not associated with increased school resources and columns (3), (6), and (9) show that the Irish share of the population is, also, not associated with increased school resources. In column (5) it does appear that the Italian share of a county population is significantly associated with expenditures per teacher, but we note that this result is not robust to dropping counties around New York City (including nearby counties in New Jersey and Connecticut). Therefore, it appears that only the German share of the population predicts school resources after World War I, consistent with the history of increasing school resources to assimilate enemy aliens.

Another concern regarding the validity of the instrument is that Germans settled in places that spent more on public goods. Cities that opt to spend more on public goods may have had more homogenous and wealthy populations, which would affect labor market outcomes regardless of the German share. Table 4 refutes this argument. While the German share of the population was positively associated with increased school expenditures per pupil after World War I, the presence of Germans was actually negatively related to spending on other public goods such as sewers and fire departments.[18] Finally, while the coefficient on the interaction of German share with the post-World War I indicator is positive for spending on police departments,

[18] The data on city expenditures was provided by Paul Rhode.

the magnitude is small and insignificant. We thus believe that our German share of the population instrument is both relevant and valid.

5. Baseline empirical results

5.a. School resources and educational attainment

The affect of school resources on educational attainment, obtained from first estimating equation (1) and then estimating equation (2) are displayed in Table 5. Columns (1)-(3) display OLS estimates without county fixed effects in the second-stage. Columns (4)-(6) display OLS estimates with county fixed effects in the second-stage. Finally, columns (7) and (8) display two-stage least squares estimates that correspond to columns (1) and (2).[19] In column (1) a 10 percent increase in current expenditures per pupil results in an increase in educational attainment by 0.053 school years. This relationship, without the county and year fixed effects, is graphed in Figure 3. Each circle represents one of our counties and the size of the circle represents the number of observations used to estimate the conditional educational attainment in that county. The red line regression line is weighted by the size of each point. In column (2) a 10 percent increase in expenditures per teacher results in a 0.042 school years increase in attainment. In column (3) a 10 percent decrease in the pupil-teacher ratio results in a 0.044 school year increase in attainment. The estimates in columns (4)-(6) are similar in magnitude, although the statistical significance is reduced because we only have two observations for each county.

Turning to the two-stage least square estimates, we find that a 10 percent increase in current expenditures per student or expenditures per teacher is associated with an increase in attainment by about 0.015 school years. The two-stage least squares results are small in

[19] Note that it is not possible to perform the two-stage least squares analysis with county fixed effects because our instrument only varies out the county level not the county-cohort level.

magnitude, about one-third the size of the OLS results, and lose all statistical significance. To provide some interpretation, the average term length is approximately 181 days and therefore a 10 percent increase in school resources is associated with a three-day increase in educational attainment. We conclude that exogenous changes in school resources did not have large impacts, if any, on educational attainment in the early twentieth century. Note that we do not instrument for the pupil-teacher ratio because, in this case, our instrument is not strong, as demonstrated in Table 3 column (7).

5.b. School resources and the return to education

We next turn to the effect of school resources on the rate of return to education. The results from the second step of the two-step procedure are displayed in Table 6, which is set-up analogously to Table 5. Note that the average rate of return for an additional year of education, which is estimated in the first step, is 7.6 percent. In column (1), a 10 percent increase in current expenditures per pupil increases the rate of return to a year of education by 0.64 percentage points. This relationship, without the county and year fixed effects, is graphed in Figure 4, which is analogous to Figure 3. In column (2) a 10 percent increase in expenditures per teacher increases the rate of return to education by 0.53 percentage points and in column (3) a 10 percent decrease in the pupil-teacher ratio increases the rate of return to a year of education by 0.2 percentage points. In column (4), when county fixed effects are included, a 10 percent increase in current expenditures per pupil increases the rate of return to a year of education by 0.8 percentage point, although the coefficient is no longer statistically significant. In column (5), a 10 percent increase in expenditures per teacher increases the rate of return to education by 0.11 percentage points and in column (3) a 10 percent decrease in the pupil-teacher ratio increases the

rate of return to a year of education by 0.83 percentage points. Thus, when county fixed effects are added to the model the coefficient generally remain similar, especially in column (4), but they lose significance due to the limits of our sample for within-county analysis.

We now instrument for school resources in 1920 and 1930 using the German share instrument. In column (7), a 10 percent increase in current expenditures per pupil increases the rate of return to a year of education by 0.79 percentage points and in column (8) a 10 percent increase in expenditures per teacher increases the rate of return to education by 0.82 percentage points. These coefficients are fairly similar to the comparable coefficients in columns (1) and (2) of the table. We, therefore, conclude that during the early twentieth century exogenous changes in school resources had large and significant effects on the intensive quality of education, i.e. students saw a larger return for each additional year of education. However, school resources did not keep students in school longer.

6. Results by socioeconomic status and mechanisms

6.a. Socioeconomic status

We next ask if our findings vary by the socioeconomic status of the household experienced by the men in our sample when they were children. This line of inquiry is particularly interesting due to changes in public school financing during the twentieth century. Starting in the early 1970s school finance reforms targeted low-income school districts in an attempt to equalize school resources across districts. Jackson et al. (2016) find that these reforms primarily benefited low-socioeconomic status students. However, during the first half of the twentieth century attempts to disburse funds across districts were limited to small per-pupil transfers from the state government, if such transfers existed at all. Thus, when per pupil resources increased during the

first half of the twentieth century, there is no reason to believe that they should have had greater impact on low-socioeconomic-status students.

To determine the effect of school resources on the rate of return to education by socioeconomic status we divide students by whether the head of their household was high socioeconomic status (professionals, managers, proprietors, and clerks) or low socioeconomic status (salesmen, craftsmen, operators, service workers, and laborers).[20] We then re-estimate equations (3) and (4) separately for high and low socioeconomic status children. The results for high socioeconomic status children are displayed in Table 7. Columns (1)-(3) of Table 7 display results for educational attainment and columns (4)-(6) of Table 7 display results for the return to education. Panel A shows the OLS results and Panel B shows the 2SLS results. In both Panel A and Panel B we find that increases in school resources do not have large or significant impacts on the educational attainment of high socioeconomic status children. However, we do find that increases in school resources have large effects on the return to education for high socioeconomic status children. In column (4) Panel A a 10 percent increase in current expenditures per pupil results in 5.7 percentage point increase in the return to a year of education and in Panel B a 10 percent increase in current expenditures per pupil results in an 8.4 percentage point increase in rate of return to education. These are extremely large effects, but it should also be noted that the average rate of return we estimate for students of high socioeconomic status households in the first step is 73.6 percent.

Table 8 displays the results for children of low socioeconomic status households and is set-up analogously to Table 7. In column (1) Panel A a 10% increase in current expenditures per pupil increases educational attainment by 0.057 school years. However, this result is greatly

[20] Due to the difficulty in assigning farmers a socioeconomic status the children living in households where the head is a farmer are excluded from the analysis.

reduced in magnitude and loses significance when estimated by 2SLS in Panel B. Similarly, in column (2) Panel A a 10 percent increase in expenditures per teacher increases educational attainment by 0.048 school years, but again is loses significance in Panel B. Columns (4)-(5) show that there does not appear to be any significant effects of school resources on the return to education for low socioeconomic status students. In conclusion, increases in school expenditures during the early twentieth century, while motivated in part by a desire to assimilate immigrants and prepare students for the new economy, appear to have largely benefited students from high socioeconomic households.

6.b. Exploring the mechanisms

We conclude our empirical analysis by investigating the potential mechanisms behind our results. Is the increase in the return to education that we find due to more intensive and better-funded instruction? Is it the result of new schools and facilities? Or is it due to of the expansion of other services, such as guidance counseling? We shed light on these questions in Table 9, where we regress various measures of school expenditures on total expenditures per pupil. In column (1) the dependent variable is instructional expenditures per pupil, which consists of spending on principals, supervisors, teachers, and textbooks. Column (2) is capital outlay and debt expenditures per pupil, which were used to construct new schools and expand and improve existing schools. Column (3) includes all other expenditures per pupil, which include, but are not limited to, spending on administration, operation expenses (fuel, lights, janitor supplies, etc.), and maintenance costs. These three categories are mutually exclusive and combine to give total expenditures per pupil. Thus, the coefficients in columns (1)-(3) can be interpreted as the dollar increase in each expenditure category when total expenditures increase by $100.

Panel A provides OLS estimates with county fixed effects. For a $100 increase in total expenditures per pupil $35 went to instruction, $63 to capital and debt expenses, and $2 to other expenditures. Breaking instructional spending down into instructional spending in elementary and high school (columns (4) and (5)), we see that if total expenditures per pupil increased by $100, $11 went to instruction in elementary school and $5 to instruction in high school. Since total instructional expenditures increased by $35, the remaining $19 must have gone to instruction in junior high, although this is not consistently reported.

Panel B repeats the specifications in Panel A, but no longer includes county fixed effects. The results are largely similar although expenditures were split more evenly between instruction and capital outlays. Finally, Panel C presents 2SLS estimates that can be compared to Panel B. When there was a $100 exogenous increase in expenditures per pupil, $64 went to instruction, $48 to other expenditures, and capital and debt spending actually decreased by $12. Within instructional expenditures, expenditures on elementary instruction increased by $28 and expenditures on high school instruction increased by $10, leaving a $26 increase for instruction in junior high school. Exogenous increases in schooling resources associated with anti-German sentiment, therefore, seem to have been earmarked for instruction expenses and other services rather than for the construction of new buildings. Our main results suggest that these instructional expenses, which were primarily allocated to the elementary and junior high school level, mainly benefited the children of advantaged families.

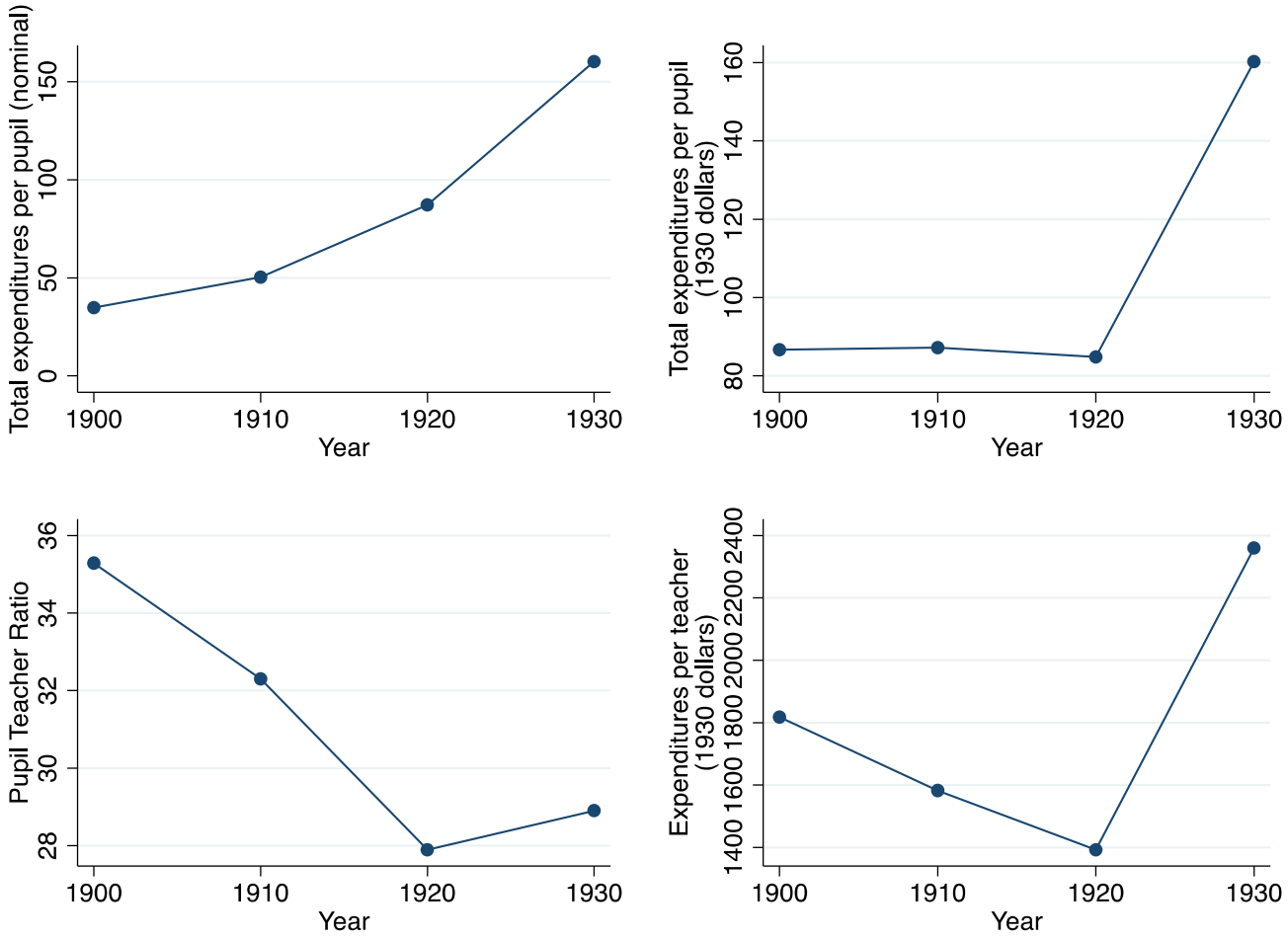
7. Conclusion

This paper examines the relationship between urban school resources and outcomes in early twentieth century cities. Our identification strategy exploits anti-German sentiment after World

War I to identify exogenous educational investments intended to Americanize immigrants from enemy sending nations. We find that early twentieth century investments in education improved the earnings of men once they entered the labor force. In particular, a 10 percent increase in expenditures per pupil increased the return to education by 0.4 to 0.5 percent, where the average return to education was 7 percent. These results are in line with recently published estimates for the contemporary period (e.g. Jackson et al 2016). However, we find no evidence of a causal impact of schooling resources on attainment, and the wage returns are evident only for the children of professionals and other skilled workers. While children of low-skilled parents had higher educational attainment in cities that spent more on education, we do not find any evidence of a return to schooling inputs for these less privileged students once they reached adulthood.

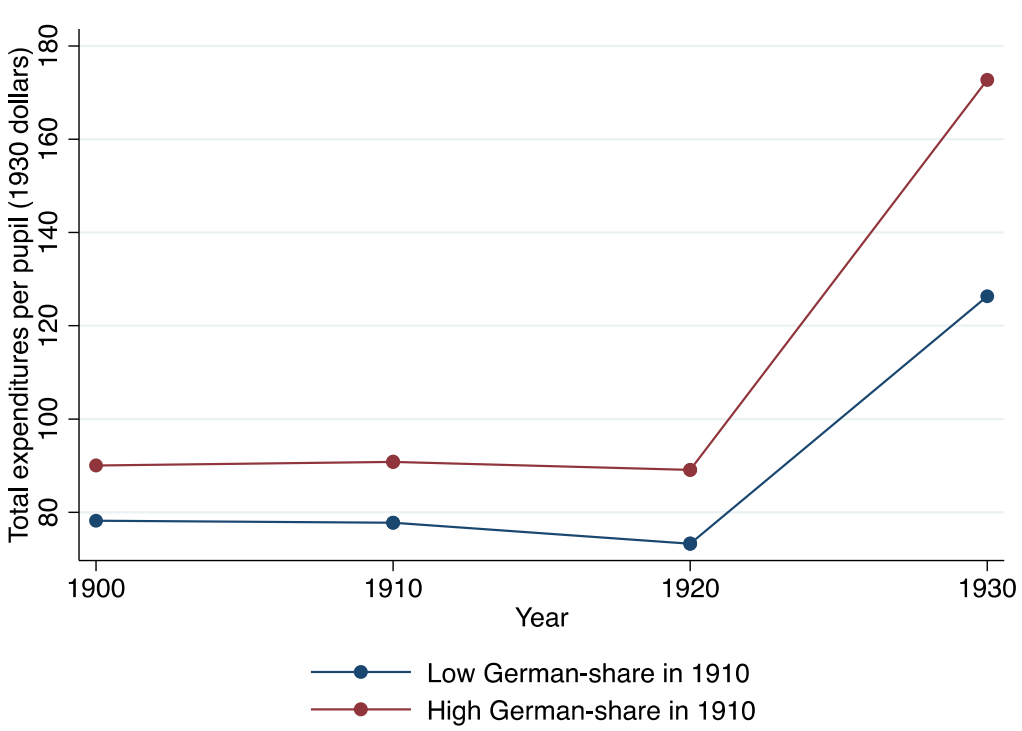
Our finding that schooling resources that were aimed at least partly at the children of recent immigrants ended up primarily benefiting the most advantaged urban residents may is at first surprising. However, our analysis of how these resources were allocated suggests that exogenous increases in school spending appear to have been used to improve the quality of instruction rather than to build new schools. These types of schooling inputs may be more easily directed to privileged students rather than second-generation immigrants or the children of unskilled laborers. Nonetheless, our results underscore the importance of transparent allocation rules such as court-ordered school financing reforms for ensuring that the most disadvantaged children benefit from public investments in education.

Figure 1: School resources during the early twentieth century



Notes: Panel A (upper left) graphs nominal expenditures per pupil, Panel B (upper right) graphs real expenditures per pupil using 1930 dollars, Panel C (lower left) graphs the pupil teacher ratio and panel D (lower right) graphs real expenditures per teacher using 1930 dollars. All variables are computed across the 272 counties for which we have complete data on all three measures of school resources in each year. That is, the graphs do not display the averages across the 272 counties, but rather, are computed across the 272 counties (a graph of the average across the 272 counties looks quite similar).

Figure 2: Expenditures per pupil by German share



Notes: This figure graphs real total expenditures per pupil for counties with high and low German shares of the population in 1910. High and low German shares are defined by splitting the sample of 272 counties at the median of German share, which is around 2% of the population that is German. Total expenditures and average daily attendance in public schools are aggregated for the low- and high-German-share counties and then total expenditures per pupil is calculated. A graph of the average across the low- and high-German-share counties looks quite similar.

Figure 3: Current expenditures per pupil and educational attainment

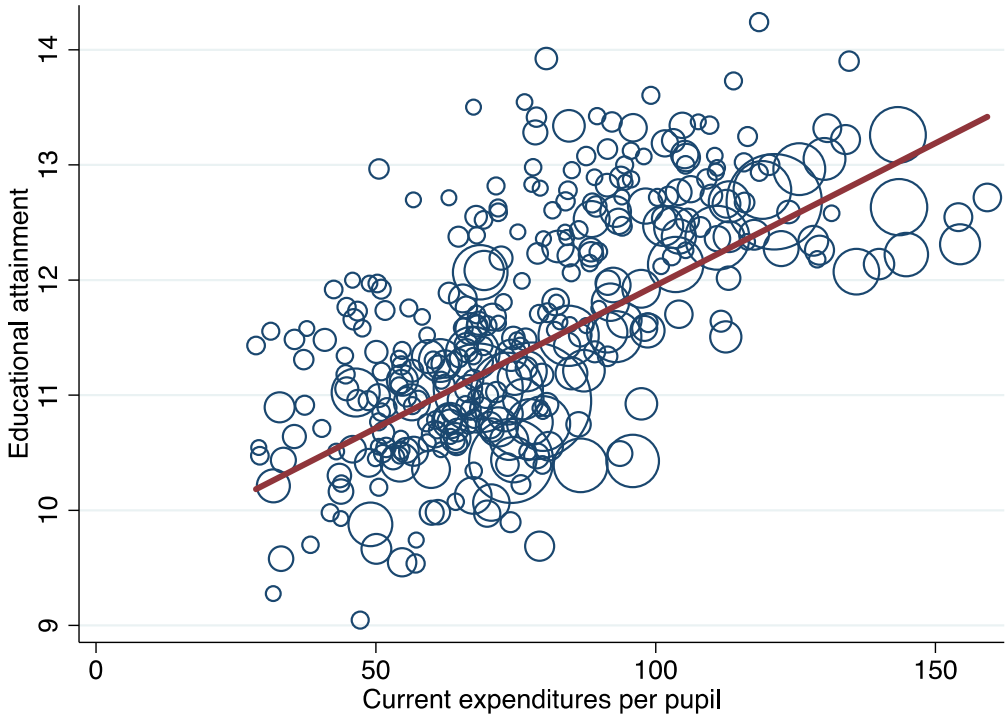


Figure 4: Current expenditures per pupil and the return to education

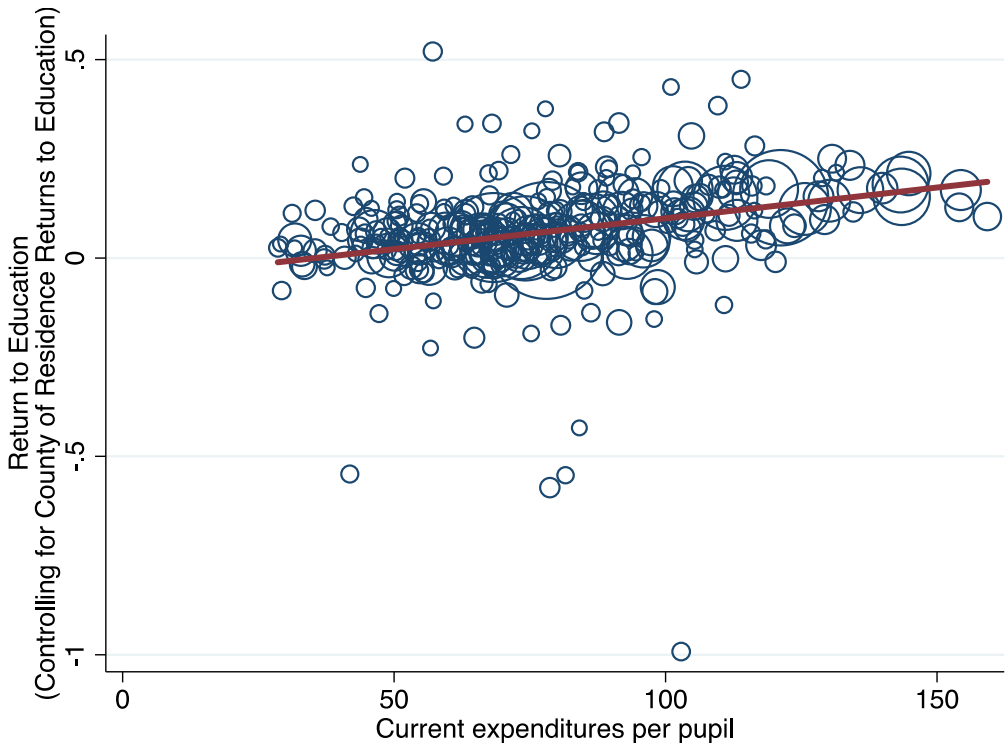


Table 1: Summary statistics

	1920		1930	
	Mean	Standard deviation	Mean	Standard deviation
Panel A: County-level summary statistics				
Total expenditures per pupil	80.49	32.61	130.46	47.18
Instructional expenditures per pupil	45.65	18.44	92.28	28.56
Capital and debt expenditures per pupil	18.64	19.76	31.98	56.14
All other expenditures per pupil	16.2	6.19	6.2	47.91
Elementary instructional expenditures per pupil	30.31	10.42	37.62	10.5
High school instructional expenditures per pupil	11.83	5.29	18.76	6.58
Current expenditures per pupil	60.32	17.77	102.11	35.64
Expenditures per teacher	1170	428	1822	389
Pupil-teacher ratio (using average daily attendance)	28.02	5.37	28.35	4.55
German share (1910)	0.03	0.0294	0.03	0.0294
Observations	323	323	323	323
Panel B: Individual-level summary statistics				
Weekly wage	28.24	12.29	19.2	8.87
Educational attainment	10.39	2.65	10.64	2.15
Age	30.39	2.93	22.31	2.21
Mother present?	92.9	25.69	93.03	25.47
Mother literate if present?	92.75	25.93	92.89	25.7
Father present?	88.81	31.53	87.03	33.59
Father literate if present?	94.65	22.51	94.25	23.29
High SES HH	17.64	38.12	19.2	39.39
Observations	8097	8097	5292	5292

Notes: Current expenditures per pupil do not include expenditures on evening schools.

Table 2: Comparison of linked children to the IPUMS sample; 1920 and 1930 IPUMS linked to 1940 full count census

Census Year:	1920			1930		
	Linked Sample	IPUMS Sample	p-value of difference	Linked Sample	IPUMS Sample	p-value of difference
Distribution state of residence						
Alabama	0.58	0.78	0.02	0.72	0.88	0.04
Arkansas	0.29	0.33	0.47	0.25	0.24	0.81
California	3.57	4.01	0.02	5.11	5.75	0
Colorado	0.53	0.67	0.07	0.43	0.6	0.01
Connecticut	2.26	2.54	0.06	2.78	2.89	0.44
Delaware	0.19	0.25	0.2	0.22	0.28	0.17
District of Columbia	0.29	0.42	0.03	0.32	0.46	0.01
Florida	0.23	0.31	0.13	0.3	0.37	0.16
Georgia	0.64	0.76	0.15	0.5	0.61	0.09
Illinois	10.87	9.37	0	10.12	9.19	0
Indiana	2.72	2.67	0.75	2.91	2.85	0.67
Iowa	1.5	1.51	0.93	1.27	1.4	0.19
Kansas	0.97	1.06	0.36	0.8	0.83	0.7
Kentucky	0.63	0.7	0.38	0.7	0.68	0.13
Louisiana	0.56	0.68	0.12	0.65	0.7	0.47
Maine	0.52	0.59	0.34	0.55	0.65	0.13
Maryland	1.11	1.45	0	1.22	1.45	0.02
Massachusetts	7.77	7.57	0.44	7.32	7.29	0.89
Michigan	4.06	4.54	0.02	5.66	6.04	0.06
Minnesota	2	2.01	0.94	1.95	1.92	80
Missouri	2.46	2.57	0.47	2.02	2.12	0.41
Montana	0.07	0.13	0.07	0.06	0.09	0.22
Nebraska	0.3	0.35	0.38	0.31	0.33	0.68
New Hampshire	0.47	0.65	0.02	0.53	0.64	0.1
New Jersey	5.57	6.03	0.04	6.32	5.96	0.08
New York	12.43	11.77	0.04	10.07	9.57	0.05
North Carolina	0.7	0.72	0.81	0.61	0.69	0.25

Table 2 (continued)

North Dakota	0.06	0.1	0.17	0.14	0.1	0.16
Ohio	8.84	8.13	0.01	8.77	8.55	0.35
Oklahoma	0.26	0.24	0.68	0.26	0.33	0.14
Oregon	0.39	0.49	0.13	0.44	0.49	0.39
Pennsylvania	17.1	15.06	0	15.93	14.37	0
Rhode Island	0.85	1.14	0	1.09	1.23	0.13
South Carolina	0.2	0.28	0.11	0.25	0.31	0.19
South Dakota	0.13	0.1	0.35	0.04	0.08	0.07
Tennessee	0.97	1.11	0.16	0.98	1.22	0.01
Texas	2.18	2.53	0.02	2.6	2.78	0.19
Utah	0.35	0.5	0.02	0.43	0.53	0.1
Vermont	0.07	0.15	0.02	0.03	0.04	0.54
Virginia	0.47	0.61	0.06	0.4	0.5	0.09
Washington	1.18	1.37	0.09	1	1.26	0
West Virginia	0.56	0.61	0.5	0.5	0.6	0.12
Wisconsin	3.1	3.16	0.72	3.44	3.11	0.03
Personal characteristics						
Mean age	10.3	10.33	0.28	10.37	10.44	0
Median age	10	10		10	10	
Literate	99.65	99.34	0	99.4	99.43	0.72
In school	94.71	94.26	0.04	93.12	93.06	0.78
In urban area	74.47	74.2	0.53	79.56	78.48	0
In owner occupied housing	46	45.76	0.62	51.79	51.49	0.48
Observations	14178	41776		19218	50531	

Notes: This table reports differences in means between individuals who were linked to the 1940 census, as described in the text, and the entire IPUMS sample that we attempted to link. The census question on literacy only applied to persons 10+ years of age in 1920 and 1930. Therefore, the sample size used to construct the means is smaller than the observations listed (8,212 linked and 24,217 in the IPUMS sample for 1920; 11,130 linked and 29,766 in the IPUMS sample for 1930). To construct the means for the census question about whether the individual lived in housing that was rented or owned by the occupants we dropped individuals who reported "N/A" (13,947 linked and 40,983 in the IPUMS sample for 1920; 18,953 linked and 49,810 in the IPUMS sample unlinked for 1930).

Table 3: Effect of immigrant population shares on school resources

	Log current expenditures per pupil			Log expenditures per teacher			Log pupil-teacher ratio (using average daily attendance)		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Log German share (1910) * Post WWI	0.0352***			0.0250**			-0.0182*		
	(0.0135)			(0.0116)			(0.00988)		
Log Italian share (1910) * Post WWI		0.00657			0.0176**			0.00388	
		(0.00863)			(0.00724)			(0.00588)	
Log Irish share (1910) * Post WWI			0.0191			0.0123			-0.00733
			(0.0130)			(0.0123)			(0.00960)
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
County FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1084	1084	1084	1084	1084	1084	1084	1084	1084
Counties	271	271	271	271	271	271	271	271	271

Notes: This table reports OLS estimates from equation (5) in the text. Standard errors, reported in parentheses, are clustered at the county level. See Section 3.a. of the text for details on the independent variables and see section 4.c. for details on the immigrant share variables. Post WWI is an indicator variable for the years after World War I (1920 and 1930).

* p<0.1, ** p<0.05, *** p<0.01

Table 4: Effect of German population shares on non-education expenditures

	Log current expenditures per pupil	Log expenditures per capita on sewers	Log expenditures per capita on police	Log expenditures per capita on fire
	(1)	(2)	(3)	(4)
Log German share (1910) * Post WWI	0.0601**	-0.0756	0.00380	-0.0282
	(0.0258)	(0.114)	(0.0439)	(0.0358)
Year FE	Yes	Yes	Yes	Yes
County FE	Yes	Yes	Yes	Yes
Observations	388	388	388	388
Counties	97	97	97	97

Notes: This table reports OLS estimates from equation (5) in the text. Standard errors, reported in parentheses, are clustered at the county level. See section 4.c. for details on the dependent and independent variables. Post WWI is an indicator variable for the years after World War I (1920 and 1930).

* p<0.1, ** p<0.05, *** p<0.01

Table 5: Effect of school resources on educational attainment, 1940 Census

	Educational attainment							
	OLS without county FE			OLS with county FE			2SLS without county FE	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Log current expenditures per pupil	0.531***			0.534*			0.152	
	(0.137)			(0.299)			(0.289)	
Log expenditures per teacher		0.415***			0.640*			0.157
		(0.154)			(0.349)			(0.300)
Log pupil-teacher ratio (using average daily attendance)			-0.438			-0.342		
			(0.267)			(0.476)		
First stage F-statistic							88	42
Cohort FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
County FE	No	No	No	Yes	Yes	Yes	No	No
Observations	645	645	645	645	645	645	645	645
Counties	323	323	323	323	323	323	324	325

Notes: This table reports OLS estimates from equation (2) in the text. The unit of observation is a county-cohort cell. Standard errors, reported in parentheses, are clustered at the county-of-education level. Estimates are weighted by the inverse sampling variance of the dependent variable. See Section 3.a. of the text for details on the independent variables. The dependent variable is the conditional average educational attainment in a county-cohort cell, which is estimated in a first-stage regression described in Section 4.a. of the text.

* p<0.1, ** p<0.05, *** p<0.01

Table 6: Effect of school resources on the rate of return to education, 1940 Census

	Percentage return to educational attainment							
	OLS without county FE			OLS with county FE			2SLS without county FE	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Log current expenditures per pupil	0.0643***			0.0801			0.0792**	
	(0.0171)			(0.0805)			(0.0312)	
Log expenditures per teacher		0.0530***			0.0118			0.0822**
		(0.0154)			(0.0869)			(0.0335)
Log pupil-teacher ratio (using average daily attendance)			-0.0201			-0.0830		
			(0.0270)			(0.103)		
First stage F-statistic							74	42
Cohort FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
County FE	No	No	No	Yes	Yes	Yes	No	No
Observations	645	645	645	645	645	645	645	645
Counties	323	323	323	323	323	323	324	325

Notes: This table reports OLS estimates from equation (4) in the text. The unit of observation is a county-cohort cell. Standard errors, reported in parentheses, are clustered at the county-of-education level. Estimates are weighted by the inverse sampling variance of the dependent variable. See Section 3.a. of the text for details on the independent variables. The dependent variable is the percentage return to educational attainment in a county-cohort cell, which is estimated in a first-stage regression described in Section 4.b. of the text.

* p<0.1, ** p<0.05, *** p<0.01

Table 7: Effect of school resources on educational attainment for high SES students, 1940 Census

	Educational attainment			Percentage return to educational attainment		
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A: OLS estimates						
Log current expenditures per pupil	0.198			0.571***		
	(0.219)			(0.122)		
Log expenditures per teacher		-0.265			0.854***	
		(0.257)			(0.102)	
Log pupil-teacher ratio (using average daily attendance)			-0.538			0.483**
			(0.387)			(0.240)
Cohort FE	Yes	Yes	Yes	Yes	Yes	Yes
Panel B: 2SLS estimates						
Log current expenditures per pupil	-0.0659			0.843***		
	(0.450)			(0.197)		
Log expenditures per teacher		-0.0706			0.903***	
		(0.479)			(0.161)	
Log pupil-teacher ratio (using average daily attendance)						
First stage F-statistic	68	36		68	36	
Cohort FE	Yes	Yes		Yes	Yes	
Observations	477	477	477	477	477	477
Counties	288	288	288	288	288	288

Notes: This table reports OLS estimates from equation (2) in the text in columns (1)-(3), and equation (4) in the text in columns (4)-(6). The unit of observation is a county-cohort cell. Standard errors, reported in parentheses, are clustered at the county-of-education level. Estimates are weighted by the inverse sampling variance of the dependent variable. See Section 3.a. of the text for details on the independent variables. The dependent variable in columns (1)-(3) is the conditional average educational attainment in a county-cohort cell, which is estimated in a first-stage regression described in Section 4.a. of the text. The dependent variable in columns (4)-(6) is the percentage return to educational attainment in a county-cohort cell, which is estimated in a first-stage regression described in Section 4.b. of the text. High SES students are students who live in a household were the head is one of the following: a professional, a manager, a proprietor, or a clerk.

* p<0.1, ** p<0.05, *** p<0.01

Table 8: Effect of school resources on educational attainment for low SES students, 1940 Census

	Educational attainment			Percentage return to educational attainment		
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A: OLS estimates						
Log current expenditures per pupil	0.571***			0.0249		
	(0.163)			(0.0235)		
Log expenditures per teacher		0.477***			-0.000684	
		(0.171)			(0.0209)	
Log pupil-teacher ratio (using average daily attendance)			-0.492			-0.0710*
			(0.305)			(0.0375)
Cohort FE	Yes	Yes	Yes	Yes	Yes	Yes
Panel B: 2SLS estimates						
Log current expenditures per pupil	0.368			-0.0773		
	(0.373)			(0.0854)		
Log expenditures per teacher		0.352			-0.0740	
		(0.359)			(0.0820)	
Log pupil-teacher ratio (using average daily attendance)						
First stage F-statistic	72	39		72	39	
Cohort FE	Yes	Yes		Yes	Yes	
Observations	614	614	614	614	614	614
Counties	320	320	320	320	320	320

Notes: This table reports OLS estimates from equation (2) in the text in columns (1)-(3), and equation (4) in the text in columns (4)-(6). The unit of observation is a county-cohort cell. Standard errors, reported in parentheses, are clustered at the county-of-education level. Estimates are weighted by the inverse sampling variance of the dependent variable. See Section 3.a. of the text for details on the independent variables. The dependent variable in columns (1)-(3) is the conditional average educational attainment in a county-cohort cell, which is estimated in a first-stage regression described in Section 4.a. of the text. The dependent variable in columns (4)-(6) is the percentage return to educational attainment in a county-cohort cell, which is estimated in a first-stage regression described in Section 4.b. of the text. Low SES students are students who live in a household were the head is one of the following: a salesmen, a craftsmen, and operator, a service worker, or a laborer.

* p<0.1, ** p<0.05, *** p<0.01

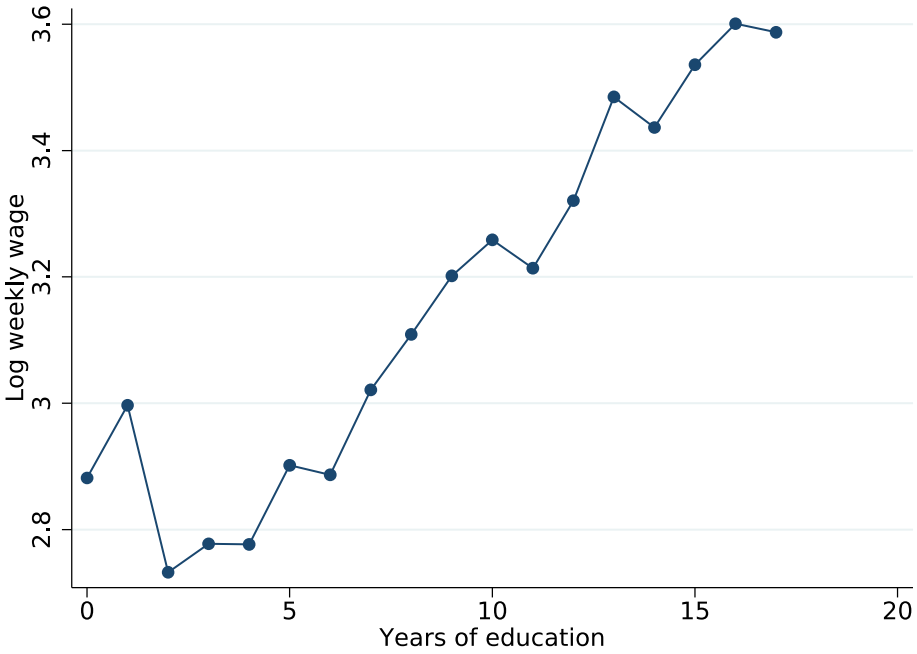
Table 9: Decomposition of expenditures

	Instructional expenditures per pupil	Capital and debt expenditures per pupil	All other expenditures per pupil	Elementary instructional expenditures per pupil	High school instructional expenditures per pupil
	(1)	(2)	(3)	(4)	(5)
Panel A: OLS estimates with county fixed effects					
Total expenditures per pupil	0.351***	0.633***	0.0158	0.108***	0.0490***
	(0.0291)	(0.0828)	(0.0810)	(0.0136)	(0.00805)
Year FE	Yes	Yes	Yes	Yes	Yes
County FE	Yes	Yes	Yes	Yes	Yes
Panel B: OLS estimates without county fixed effects					
Total expenditures per pupil	0.419***	0.484***	0.0966**	0.166***	0.0661***
	(0.0178)	(0.0472)	(0.0443)	(0.00961)	(0.00621)
Year FE	Yes	Yes	Yes	Yes	Yes
County FE	No	No	No	No	No
Panel C: 2SLS Estimates					
Total expenditures per pupil	0.642***	-0.122	0.480***	0.278***	0.104***
	(0.0518)	(0.138)	(0.121)	(0.0276)	(0.0165)
Year FE	Yes	Yes	Yes	Yes	Yes
County FE	No	No	No	No	No
First stage F-statistic	96	96	96	96	96
Observations	544	544	544	544	544
Counties	272	272	272	272	272

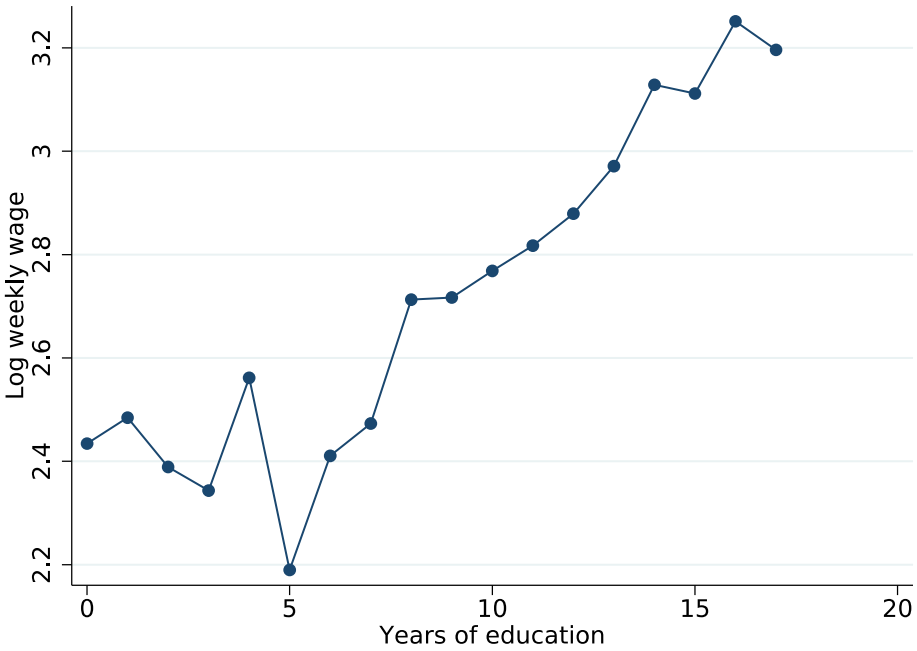
Notes: This table reports OLS estimates described in Section 6.b. of the text.
* p<0.1, ** p<0.05, *** p<0.01

Appendix A: Additional Figures

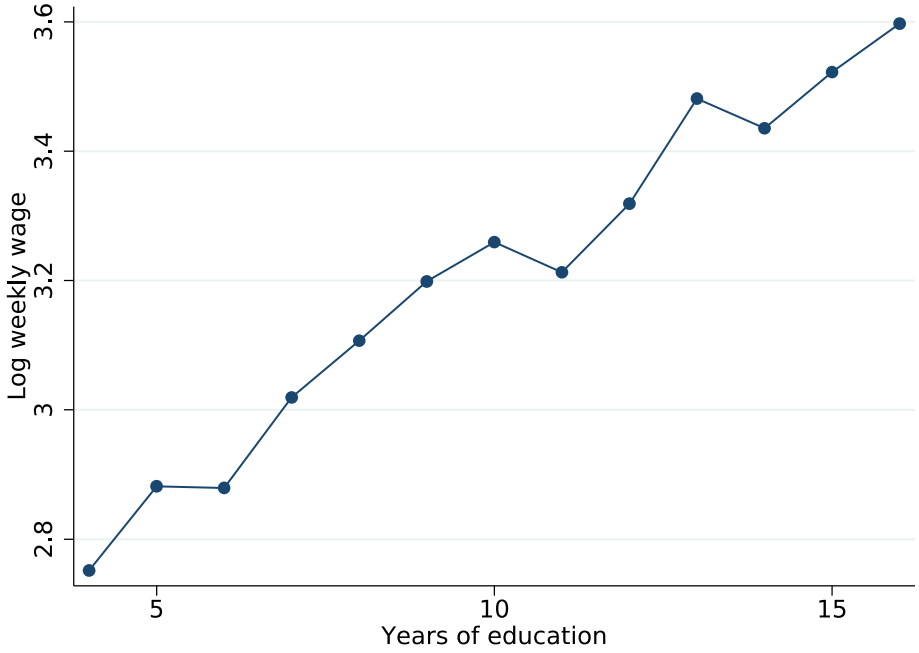
Appendix A Figure 1: Earning-education profile, 1920 cohort



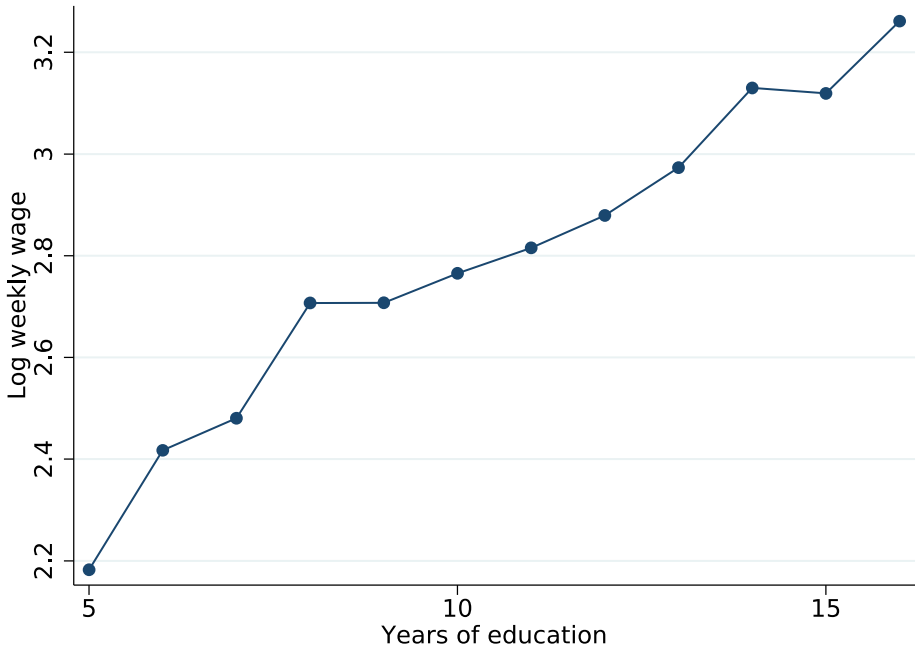
Appendix A Figure 2: Earning-education profile, 1930 cohort



Appendix A Figure 3: Restricted earning-education profile, 1920 cohort



Appendix A Figure 4: Restricted earning-education profile, 1930 cohort



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