Education (for the *Oxford Handbook of American Economic History*)

John Parman*

October 15, 2013

1 Introduction

The American economy has been profoundly influenced by the evolution of educational institutions and the American human capital stock. From colonial times to the present, the schooling of Americans has both helped shape the trajectory of the economy and been shaped by that trajectory in what Goldin & Katz (2009) describe as a race between education and technology. The unique public, decentralized nature of school provision in the United States has set the country apart from other Western nations, allowing the country to be a leader in terms of education for much of its history while leading to issues of inequality in schooling resources in recent decades. The history of school provision and attendance has taught us much about the sources of regional and racial gaps in socioeconomic outcomes and highlighted the critical role educational institutions play in either maintaining or eliminating those gaps. It has also offered evidence of the evolving nature of the household, the complex relationships between childhood health and adult outcomes and even the nature of the American political process.

While economic historians have exploited the rich educational history of the United States to yield unique insights related to the nature of technological change, political processes, discrimination,

*Department of Economics, College of William and Mary and NBER, 130 Morton Hall, Williamsburg, VA 23187 e-mail: jmparman@wm.edu

household resource allocation and a variety of other topics, there remain many unanswered questions. New questions are generated from the results of each new study and new data sources are consistently being unearthed and digitized, allowing economic historians to empirically study both questions about the evolution of the American economy and issues in the modern education, labor and growth literatures that were previously deemed untestable. This chapter outlines the key studies of economic historians related to the development of the human capital stock, the provision of schooling, and the role of human capital in the economy while also identifying remaining open questions and the potentially relevant untapped data sources.

2 The Evolution of the Human Capital Stock

A considerable amount of effort has been expended by economic historians to piece together evidence of the growth in the American human capital stock. The task of measuring how the educational attainments and the resulting human capital of Americans has changed over time is aided by the availability of a wide variety of detailed school records dating back to the 1700s, offering a wealth of detailed data relative to other countries. However, these efforts have been hindered by the fragmentary nature of those data. This is an unfortunate side effect of one of the virtues of the American educational system, its decentralization. With schooling decisions decided at a local level, data collection was also typically done at a local or state level, making it difficult to piece together nationally representative education statistics with a consistent interpretation across states.

To get national statistics, researchers have typically focused on the information reported in the federal census and statistics gathered by the Bureau of Education, what would ultimately become today's Department of Education. Questions on literacy and school attendance were first included in the population schedule of the federal census beginning in 1850, offering the first glimpse at the educational levels of the country as a whole. The literacy question would be replaced with an educational attainment question in the 1940 census, marking the first opportunity to consistently measure years of education for the entire Unites States population. The data series from the Bureau of Education date back to 1870 and offer a variety of detailed statistics on the types of schools, enrollment rates

and school quality across the country.

It is important to note that while much of the education literature focuses on these national data sources and is therefore restricted to their limited time span and sets of variables, there are a variety of state-level data sources covering additional years and variables. Given that the schooling system in the United States has been highly decentralized, a substantial amount of data was collected at the county and state level that was never compiled into national datasets. Several economic historians have had success exploiting these additional data sources to expand both the time periods and the detail of schooling and attendance characteristics studied. A prime example is the insights into black-white gaps in schooling gained by looking at district and county level schooling data in the work of Fishback (1989), Margo (1991), Fishback & Baskin (1991), Donohue et al. (2002) and Moehling (2004).

These additional sources, typically in the form of annual reports of states' offices of education, offer largely untapped opportunities to produce a much more detailed account of changes in educational institutions and school attendance over time. Many of them have not been explored not because they are poor data sources but simply because they have not been digitized and are restricted to the state level. As more reports are scanned by various projects digitizing the collections of libraries and the costs of transcribing digital documents fall, these data will open up new possibilities for addressing open questions in the education literature.

With the potential of alternate data source at the state and local level acknowledged, the remainder of this section will focus on national statistics to provide a sense of the overall evolution of the American human capital stock. The available measures of human capital will vary with the time period of focus. In the nineteenth century, the primary measures are actual direct measures of stocks of human capital, namely literacy and numeracy. In the late nineteenth and early twentieth century, data on human capital flows in the form of school attendance become increasing available, allowing for imputations of average educational attainment. From 1940 on, we have the ability to directly measure years of educational attainment. Data on test scores and other measures of cognitive ability begin to appear in the second half of the twentieth century, offering a means to relate the educational attainment of Americans to the level of productive human capital that educational

attainment generated.

2.1 Direct Measures of Human Capital: Literacy and Numeracy

Literacy rates from the 1850 census provide one of the earliest glimpses of America's exceptionalism in terms of educational attainment. This is the first federal census in which enumerators asked whether each adult could both read and write. Under this rather strict definition of literacy, America had already achieved widespread literacy among the white population by 1850, with overall literacy rates among the white population of 90 percent placing the United States among the most literate nations in the world. Evidence based on the ability to sign documents suggests that America had high literacy rates relative to the rest of the world in the late eighteenth and early nineteenth centuries as well (see Graff (1991) for international comparisons of literacy in the 1700 and 1800s). Table 1 shows the trends in literacy from 1850 through 1930, the last year in which literacy was recorded in the federal census. The trends show a steady rise in literacy over this time period for the country as a whole but also reveal stark variation in human capital across regions and groups within the United States.

The most dramatic difference is the gap in white and black literacy rates over this period. Note that the 1850 and 1860 censuses only recorded literacy for free blacks, accounting for the substantial decline in literacy rates when the calculations include former slaves starting in 1870. While the United States was on average a highly educated society, that did not extend to the black population which had literacy rates of under 20 percent following the Civil War. A substantial body of literature discussed later in this chapter addresses this black-white gap in literacy rates in the nineteenth century and the reasons that it has diminished but not disappeared over time.

While the black-white gap in literacy rates over time is certainly the most striking, it is not the only gap of note. In particular, there were large differences in literacy across regions that persisted over the nineteenth century into the twentieth century. Most notably, the North had significantly higher literacy rates than the South. The full 10 percentage point gap in 1870 would take several decades to close. As Collins discusses in Hatton et al. (2007), the closing of this gap was a product of intraregional migration raising levels of human capital in the South and increases in local investments improving the education of native-born Southerners.

Table 1: Trends in literacy and numeracy, 1850-1930.

	Literacy Rate						Numeracy Rate					
			Northern	Southern	Native Born	Foreign			Northern	Southern	Native Born	Foreign
Year	White	Black	White	White	White	Born	White	Black	White	White	White	Born
1850	89.92	57.41	93.35	81.57	90.35	87.98	87.38	70.47	87.95	86.21	89.37	78.28
1860	91.91	63.84	94.05	85.82	92.69	89.62	87.32	68.54	87.68	86.33	90.03	79.37
1870	91.47	17.33	93.96	83.23	92.71	88.20	88.32	65.41	88.80	87.04	90.95	81.42
1880	93.02	28.23	95.24	85.91	93.88	90.44	90.82	70.42	91.20	90.09	92.71	85.21
1900	94.48	52.03	95.74	89.92	96.03	89.50	95.36	83.21	95.47	95.11	96.01	93.27
1910	94.89	66.56	95.47	92.46	97.17	87.80	94.85	86.53	94.87	95.04	95.55	92.70
1920	95.53	74.58	95.89	93.86	97.91	87.04	96.17	88.84	96.09	96.20	96.66	94.44
1930	96.78	82.93	97.22	95.17	98.30	90.38	96.17	87.68	96.26	95.86	96.42	95.12
1940							97.08	91.52	97.20	96.63	97.15	96.68
1950							97.74	94.22	97.67	97.73	97.77	97.48
1960							99.33	98.51	99.55	99.03	99.22	100.00

Notes: Data are from the 1850 through 1960 IPUMS 1 percent samples of the federal census. Samples are restricted to individuals over the age of 19. The numeracy values given are calculated using the modified Whipple index presented in Ahearn et al..

A small body of evidence has been uncovered to relate these measures of literacy to enrollment rates, offering some guidance for how to map the literacy rates into educational attainment. From a survey of North Carolina manufacturing workers in the early twentieth century and a survey of adults conducted in 1948 by the Census Bureau, it seems that literacy generally implied an individual had obtained three or more years of schooling (Goldin, 2000; Collins & Margo, 2006).

Literacy rates are not the only means of assessing the level of human capital prior to detailed records on educational attainment. Economic historians have recently begun to turn to other measures that can shed light on slightly different dimensions of human capital. In particular, age heaping has begun to gain traction as a means of measuring human capital when data on literacy or educational attainment are either unavailable, unreliable or incapable of capturing important components of human capital. A'Hearn et al. (2009) demonstrate the usefulness of this approach, using a measure of age heaping based on the proportion of people that report ages ending in a zero or five (excessive zeros and fives indicate rounding and a lack of numeracy) and showing that this proxy for numeracy is highly correlated with literacy in census data.

These types of numeracy measures have the potential to expand our understanding of the historical evolution of human capital. First and foremost, they require only data on age (or another numerical value where a less numerate individual may tend to round), greatly expanding the number of datasets from which measures of human capital can be derived. Studies that consider earlier time periods or that use documents such as death certificates that contain far more information on individuals than typical census records but lack a measure of educational attainment can potentially incorporate these types of numeracy measures. A second motivation for incorporating numeracy measures into our standard measures of human capital is that even if a data source contains a measure of literacy or school attendance, numeracy may capture elements of human capital relevant to productivity that literacy is not strongly correlated with, namely quantitative cognitive ability.

As a simple demonstration of how looking at numeracy in addition to literacy can affect our interpretation of history, consider the literacy and numeracy trends for foreign born individuals and native-born whites in Table 1. Based on literacy alone, it appears that the human capital of immigrants stayed relatively constant over time while the human capital of native-born whites increased.

However, if we instead measure human capital with numeracy, we arrive at a very different conclusion: the human capital of immigrants was rising steadily from 1850 to 1930 and completely converged to the native-born levels. If it is the quantitative skills of these individuals that matter for productivity, relying on literacy may severely underestimate the contribution of immigration to the American economy over the late nineteenth and early twentieth century. Incorporating measures of numeracy, either by looking at age heaping by group within cross-sectional data or even at the individual level by looking at consistency of age reports across time in longitudinal data can provide us with a much more complete understanding of the variation in human capital across groups and over time in the decades before we have more detailed educational attainment records.[1]

2.2 Measures of Schooling Over Time

The first national data available to directly quantify levels of schooling come from school enrollment data from the mid-nineteenth century. By 1850, enrollment rates for white children between the ages of 5 and 19 were already over 50 percent and climbed to roughly 80 percent over the next century. As with the literacy and numeracy figures discussed above, the statistics for nonwhite children were far different, with enrollment rates at essentially zero in 1850 but converging to white enrollment rates over time. Most of the gap disappeared by the middle of the twentieth century. The average educational attainment of cohorts can be estimated from these enrollment rates, as in Margo (1986), but the resulting numbers are difficult to interpret. School attendance or enrollment tells us very little about how much school was attended in a particular year, how students progressed through grades or how often students had gaps in their educational careers. Furthermore, this approach of constructing an average stock of education from these flow data does not allow researchers to explore the relationship between individual characteristics, educational attainment and socioeconomic outcomes, limiting the usefulness of enrollment- or attendance-based measures.

More direct measures of educational attainment are first available in the 1940 federal census in which respondents were asked for the highest grade completed, offering a measure of educational

[1]This approach of measuring numeracy by comparing consistency in reported age across time in longitudinal data has been used by Long (2006) for nineteenth-century Britain and for Southern households at the time of emancipation by Wanamaker (2009).

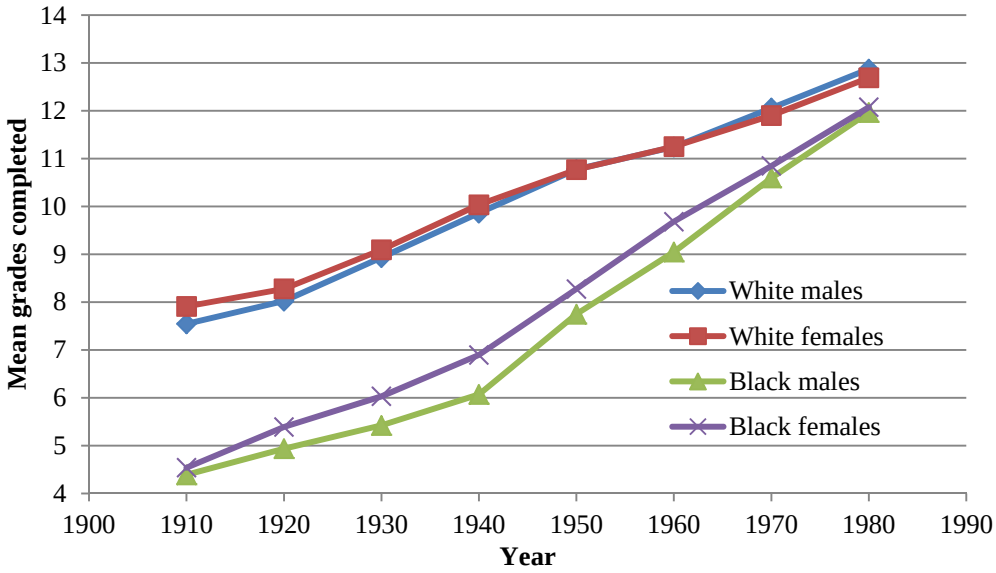

Figure 1: Educational attainment by race and gender for 25-34 year olds, 1910-1990. Source: Tabulations from IPUMS 1940, 1950, 1960, 1970 and 1980 federal census samples. The 1910, 1920 and 1930 cohort estimates were obtained using the 1940 census.

attainment comparable to modern schooling variables.[2] Figure 1 shows the evolution of years of schooling by race and gender over the twentieth century. The steady gains in literacy and numeracy over the nineteenth century have a clear counterpart in the rapid increase in educational attainment over the twentieth century, with the average educational attainment of white individuals rising roughly three quarters of a year every decade and the average educational attainment of black individuals rising by a full year per decade. The trends in educational attainment echo some of the disparities demonstrated by the literacy and numeracy data. A substantial black-white gap in educational attainment existed at the beginning of the twentieth century and while that gap has narrowed over time, it has yet to disappear. Also noteworthy is the male-female gap in education, or rather the absence of a gap. Throughout the twentieth century, the educational attainment of females not only kept pace with that of males but actually exceeded it. The high educational attainment of females

[2]Some caution is needed when interpreting highest grade completed as equivalent to years of educational attainment. As Collins & Margo (2006) note, individuals educated in the nineteenth and early twentieth centuries were often educated in ungraded schools, particularly in the South. This forced census enumerators to estimate a highest grade completed for individuals that attended ungraded school. Margo and Collins note that this may have overstated educational attainment. This creates some issues in interpreting trends over time as ungraded schools were replaced by graded schools earlier in the North than in the South, causing both regional and racial gaps in schooling to be mismeasured. Goldin (1998) also notes that the 1940 census data likely overstate the number of high school graduates.

relative to males is even more pronounced for the black population.

2.3 Measuring Cognitive Ability

As the published data on education have improved over time, economic historians have been able to switch from the crude measures of literacy and numeracy to more detailed measures of school attendance and educational attainment. While in most respects this represents a vast improvement in data quality, the switch from direct measures of human capital to a focus on years of education has certain drawbacks. In particular, years of schooling do not perfectly capture an individual's productive human capital, particularly given the variation in quality across schools and over time. Studies focused on recent periods can exploit test scores and direct measures of cognitive ability. Comparable studies are rare historically but do exist.

Fragmentary evidence exists showing a rise in general intellectual achievement (GIA) controlling for level of schooling over the first half of the twentieth century. These data consist of achievement and IQ tests given to specific grades at a handful of selected schools and show a general rise not only in the overall cognitive abilities of Americans over this period but also an increase in cognitive ability conditional on years of schooling (Rundquist, 1936; Wheeler, 1942; Finch, 1946; Flynn, 1984). In a survey of these studies, Bishop (1989) finds that the cognitive ability of high school students was rising by 1.69 IQ points per decade, impressive in its own right but even more remarkable given the increasing high school enrollments at the time. If high schools first drew from the upper tail of the ability distribution, one would predict that growing enrollments would have been decreasing the average ability of high schoolers. The observed increase of IQ among high schoolers may therefore actually substantially underestimate the growing cognitive abilities of Americans during the high school movement.

Better evidence exists for the decades following World War II thanks to the Iowa Test of Educational Development (ITED), developed in the 1920s and implemented statewide by the 1940s. The ITED tested 95 percent of both public and private schools in Iowa, providing representative data on cognitive ability for high schoolers from 1942 to the present. These data from Iowa and several other similar data sources for Indiana and Minnesota show that the rising cognitive abilities of students con-

tinued until the late 1960s, at which point scores began declining and continued to decline throughout the 1970s (Bishop, 1989). These patterns in test scores add a new dimension to the narrative of ever growing human capital stocks in the United States. The rise in educational attainment over the first decades of the twentieth century may actually understate the rise in productive human capital as cognitive ability conditional on years of schooling was increasing as well. However, the declining test scores later in the twentieth century suggest that more recent advances in educational attainment may have more muted effects on the economy as the cognitive ability associated with particular levels of schooling actually fell. As more data sources become available, it would be worthwhile for economic historians to explore ways to incorporate more nuanced measures of human capital into their work that can more carefully delineate the relationship between years of education and the cognitive abilities relevant to the workplace.

2.4 The Contribution of Human Capital Growth to Economic Growth

These distinctions between schooling, cognitive ability, and productive human capital become particularly important when assessing the contribution of the tremendous growth of the American human capital stock to overall economic growth over the past two centuries. The ability of schooling to explain differences in economic growth between the United States and other countries as well as over time within the United States is still a disputed matter. Some economists have estimated extraordinarily high contributions of education to economic growth; Denison (1962) finds that increases in education accounted for 42 percent of the growth in national income per person employed between 1929 and 1957 and roughly half that from 1909 to 1929. Goldin and Katz suggest more modest but still large contributions, estimating that the growth in education accounts for 14 percent of the annual increase in labor productivity and 15 percent of the annual growth in real GDP per capita from 1915 to 2005. Care needs to be taken, however, to recognize that it is likely cognitive ability, not simply years of schooling, that is relevant to improved economic performance. Hanushek & Woessmann (2008) demonstrate that for cross-country comparisons of growth rates, models based on test scores directly measuring cognitive ability explain three times the variation in economic growth rates that models based on schooling do. Accurately assessing the historical contribution of human capital to American

economic growth requires understanding how the relationship between schooling and cognitive ability has changed over time.

As an example of the importance of distinguishing between these two different variables, Hanushek & Woessmann note that the United States has maintained favorable growth rates relative to other countries despite its relatively poor performance on achievement tests because of its massive expansion of high school and later college opportunities to a large proportion of its citizens. The United States effectively achieved high growth rates by making up for lower levels of learning per school year with the sheer volume of aggregate school years among its population. Better understanding the historical roles of school quality versus school quantity in accounting for America's growth would offer insights into whether resources are best targeted at increasing years of educational attainment or the quality of those years.

These estimates of the contribution of education to economic growth, whether based on measures of the stock of schooling or cognitive abilities of the American workforce, pertain to the direct effect of education on productivity, essentially the effect of increasing the level of effective units of labor in a standard production function. However, a potentially more important channel for the effect of education on productivity is its relationship to technology. A more educated workforce can potentially lead to more technological advances and allow for quicker, more successful adoption of new technology. Several growth models have incorporated this notion that educational investments serve to increase the rate of technological change (see for example Nelson & Phelps (1966), Romer (1990) and Jones (1995)). The possibility that this is the main channel through which schooling influences national economic growth is supported by the finding of Benhabib & Spiegel (1994) that the level of educational attainment rather than the growth rate of education explains differences in growth rates across countries. While the direct contributions of a growing human capital stock to America's rising income per capita cited above may be modest, the indirect effects through the education's contribution to technological change are likely a critical component of America's success over the past century and an ongoing topic of interest for economic historians.[3]

[3]A second channel for indirect effects of education on growth should be mentioned. Schultz (2002) notes that the education of females is associated relatively larger benefits for society due to the link between female education and the education, nutrition and health outcomes of children. The unique gender equality in the historical provision of American education may have led to larger impacts of education on economic growth for the United States relative to

3 The Development of Educational Institutions

3.1 From Common Schools to Colleges

The extraordinary growth of American educational attainments across all segments of society suggests the development of a massive educational system up to the task of providing that schooling. Just as the United States stood out from most of its peers in the nineteenth and early-twentieth centuries for the high levels of education across nearly all socioeconomic groups, it also stood out for the way in which that education was provided. The United States developed a system of education that was unique for a variety of reasons: it was largely publicly provided, it catered to the masses, it was highly decentralized, and it developed a focus on practical education that would translate into more productive workers across a wide range of occupations. The American education system was not designed to prepare the children of the elite for college, it was built to provide opportunity to children of all backgrounds and generate a skilled workforce.[4]

Following the structure described by Goldin & Katz (2009), the history of America's educational institutions can be divided into three major transformations: the rise of common schools and universal elementary education, the high school movement and rise of high school graduates, and finally the rise of mass higher education. The rise in universal elementary schooling was a long process taking place over the nineteenth century and led by the Northern states. By the middle of the nineteenth century common schools spread throughout the nation. Legislation was passed for tax-supported elementary schools, state school officers were appointed, and rate bills for parents were phased out (see Kaestle (1983) for a history of the development of common schools). The public provision of elementary education was even built into the geographic expansion of the United States at this time, with the Land Ordinance of 1785 reserving a section of each congressional township in the Western Territory for the support of public schools and an amendment in 1850 doubling this allotment. Local governments throughout the country in both urban and rural areas embraced the notion, somewhat radical at the time, that all children should receive a common education.

other countries.

[4]By 1933, 17 percent of public school students in grades nine through twelve took typewriting, 21 percent took classes in industrial subjects and 10 percent took bookkeeping (Historical Statistics of the United States, Table Bc115-145.)

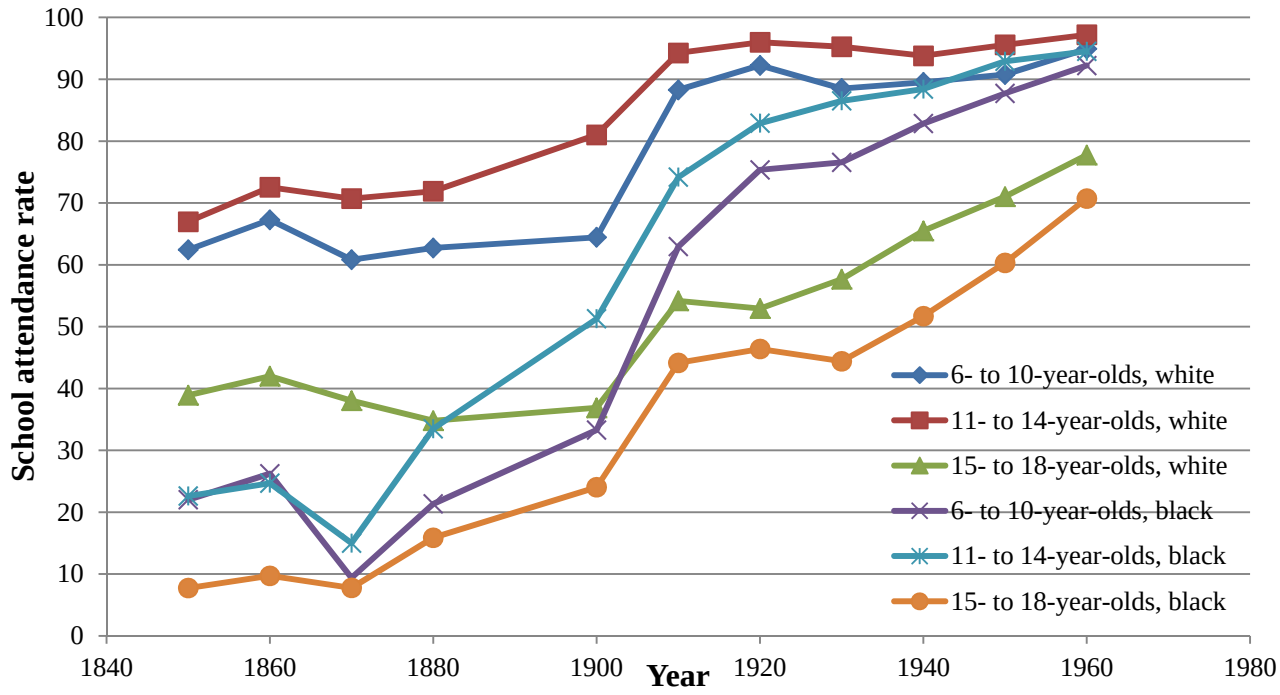

Figure 2: School attendance rates by race and age, 1850-1960. Source: Tabulations from IPUMS federal census samples for 1850 through 1960. The 1910, 1920 and 1930 cohort estimates were obtained using the 1940 census.

The next major transformation was the high school movement occurring during the first half of the twentieth century. As with the expansion of publicly funded common schools, this movement began in the North, with the West North Central region being particularly progressive, and diffused throughout the country. Relative to the rise of common schools, the high school movement was rapid. Figure 2 gives a sense of just how rapid the transformation was. The school attendance rates across all age groups demonstrate that the common school transformation was largely complete by 1850, with attendance rates relatively stable from 1850 to 1900 for the white population. The high school movement then led to a rapid increase in attendance rates between 1900 and 1920, with school attendance becoming near universal for white children between the ages of six and fourteen and attendance rates for students of high school age beginning a steady rise. These new high schools maintained the same principles of accessible education for the masses associated with the common schools. Evidence of this can be found in the passage of free tuition laws that enabled students in a district without a high school to attend high school in another district at the expense of the home

district rather than the parents. A far more complete history of the high school movement can be found in Goldin (1998).

The third transformation is the rise of higher education. Unlike the expansion of primary and secondary education, the expansion of post-secondary education has always had a large private component. Numerous private colleges and universities, many with a religious affiliation, existed since the earliest decades of the country's history. These private institutions competed for students long before the high school movement created a sizeable population of high school graduates ready for college. States began creating public institutions in the early 1800s. The Morrill Act of 1862 further promoted public higher education by establishing federal land grant universities. By the time the high school movement began, a large system of public and private post-secondary institutions was in place and ready to serve the increasing number of high school graduates. This large number of post-secondary institutions and the mix between private and public control set the United States apart from its peers both historically and to this day.

Mass enrollment in these colleges and universities was triggered by the large number of high school graduates resulting from the high school movement, technological advance increasing the demand for skills (see Goldin & Katz (1998) and Goldin & Katz (1996) on skill-biased technological change and the demand for skilled workers in the first half of the twentieth century), and a massive but understudied effort of the federal government to support higher education among veterans with the GI Bills. While the American population was on a trajectory of rising college attendance leading up to World War II, the World War II GI bill and later the Korean War GI Bill would fundamentally alter the accessibility of higher education for millions of Americans. Stanley (2003) notes that nearly 70 percent of all men who turned 21 between 1940 and 1955 were guaranteed free college under the GI Bills. Stanley estimates that the GI bills increased the postsecondary attainment of men born between 1921 and 1933 by 15 to 20 percent. Bound & Turner (2002) find comparable results focusing on the Korean GI bill. For such a potentially massive shock to the American human capital stock, these two studies represent the main attempts at estimating quantitative impacts of the GI bills on postsecondary education. There remains a large set of open questions related to exactly who took advantage of the GI bills, how the GI bills affected non-veteran students, and how the promise of

federal money to support tuition altered the mix of postsecondary institutions and the way they operated.

3.2 Explaining the Public Provision of American Education

As the previous section notes, one of the defining features of the American primary and secondary educational system was the public, decentralized nature of the system. The development of schools was not something driven by a central political authority but was rather a product of local, grassroots efforts to improve education. Explaining why American communities decided to tax themselves in order to publicly provide education is an ongoing endeavor of economic historians. The debate over the origins of public provision of education in the United States ties into a larger debate about the factors leading to the emergence of publicly funded mass education throughout the world and its relationship to the Great Divergence.

Lindert (2009) provides a series of qualitative international comparisons that highlight that cases of historical underinvestment in education by nations (there are no clear cases of overinvestment) are primarily driven by political decision making. The United States is somewhat unique in its political will when it came to financing schools. Galor et al. (2009) model the potential sources of this political will, arguing that inequality in land ownership was a barrier to passing redistributive policies and creating public schools during the transition from an agricultural to an industrial economy. They cite evidence from the early-twentieth century United States in support of their model. However, these types of models emphasizing the transition from agriculture to manufacturing fail to fully address several of the important features of American school provision. Public support for common schools arose well before this transition in the United States. Additionally, even when restricting attention to the twentieth century these types of models emphasizing education's importance to manufacturing fail to capture the US experience of largely agricultural communities leading the high school movement. We are still in search of a formal model of school provision that can fully capture the evolution of American public primary and secondary schools.

Economic historians have begun to use variation in public school funding within the United States to empirically identify the community characteristics correlated with higher levels of support for

education and provide an empirical underpinning for refining models of school provision. Go & Lindert (2010) explain the high levels of support for schooling in the rural North before the Civil War as the product of more affordable schooling (partly due to the low cost of female teachers), more localized voting mechanisms for providing school funding relative to the South, and greater political voice throughout the income distribution. Evidence from the high school movement suggests that in the twentieth century, communities with higher levels of wealth, more evenly distributed wealth, and less manufacturing activity relative to other communities were more likely to invest in public schools (Goldin, 1998; Goldin & Katz, 2009).

Stoddard (2009) uses these types of stylized facts regarding the provision of public schooling to refine the class of theoretical models of school provision that are consistent with the American experience. Noting that states in which the mean and median wealth were closer together had higher fractions of education revenue from public sources, Stoddard argues that models emphasizing the external benefits of education best explain the United States' public provision of education. This is further supported by evidence that greater public funding of schooling increased attendance of poor children rather than simply subsidizing the attendance of children from wealthier families. The patterns of school development suggest that increased public spending on schools was not driven by strictly redistributive voter motivations but rather by the decisive voters realizing benefits from the education of others.

This notion that schools generated positive externalities is a potentially critical element in explaining the causes and consequences of public school expansion that warrants more attention from economic historians. Labor economists have recently begun identifying positive externalities from schooling in modern economies, including improved health of children (Currie & Moretti, 2003), greater civic participation (Dee, 2004; Milligan et al., 2004), and reductions in crime (Lochner & Moretti, 2004) (an overview of this literature on modern externalities can be found in Moretti (2004)). An open question is the extent to which these or other externalities existed in nineteenth and early twentieth century and were taken into consideration by voters or political officials. The notion of education improving the quality of civic participation is certainly referenced in debates about school funding during the expansion of public education as are arguments that having more educated, pro-

ductive workers is beneficial to the community.

Direct evidence of positive externalities from the public school system can be found in Iowa as it led the expansion of public high schools. Parman (2012) finds that farmers in Iowa not only benefited from additional years of their own schooling in the form of higher annual earnings, they also earned higher incomes if their neighbors received more schooling. The return to an additional year of schooling was similar in magnitude whether it was the farmer's own schooling or that of his neighbor. These results provide empirical support to the rhetoric surrounding the social benefits of public school expansion, particularly in agriculture where farmers can learn from the successes and failures of their neighbors. As individual-level data sources improve, it may be possible to identify similar spillovers in other sectors. These types of spillovers would suggest that the social returns to education were significantly greater than the private returns and that the public investment in education would have led to more socially efficient levels of schooling. Additional work to quantify the various sources of externalities and their association with communities' decisions to increase public funding of schools is still needed.

While there is mounting evidence that the decentralized nature of school provision enabled the United States to be nimble with regard to rising demands for educated workers and led to an egalitarian public school system through the middle of the twentieth century, it is worth noting that those very same features have led to dramatic inequalities in the provision of public education in recent decades, as wealthy school districts have the tax base to support excellent public schools while students from poor districts have access to far fewer school resources. Further exploration of the evolution of the American school system should consider this transition from local school provision promoting equality of opportunity to increasing the rigidity of the income distribution from one generation to the next. This will become increasingly possible with the availability of new data sources such as the full 1940 federal census manuscripts. With these data, it is possible to link adults and their educational and socioeconomic outcomes to their childhood school districts as done for Iowa in Parman (2011), demonstrating that public school improvements during the high school movement actually initially reduced levels of intergenerational income mobility. Closer examination of variation in and the consequences of school expansion across space and over time in the United States will reveal more

about not only why communities chose to increase spending on schools but also under what conditions that local decision-making led to more or less egalitarian outcomes.

3.3 Separate and Unequal

This discussion of the virtues of the egalitarian nature of the American public schools comes with one enormous caveat; black individuals were largely left out of the educational system for much of the history of the country. As noted in the section on the rise in educational attainments, school attendance rates and years of schooling for blacks were substantially lower than those for whites throughout the nineteenth century and well into the twentieth century. This was not simply the product of the political mechanisms described above yielding lower levels of school provision in the regions with large black populations; it was largely due to the deliberate denial of schooling resources to blacks by local governments.

The exclusion of blacks from the educational system extends back to the days of slavery. Prior to the Civil War, slave owners were concerned that educated slaves would be more likely to rebel and more capable of forging passes enabling them to escape the South. To a slave owner, these potential costs reduced the desire to educate slaves even if an educated slave would be a more productive worker. Further restricting the ability of Southern blacks to receive an education were state laws passed in the 1830s prohibiting teaching slaves to read (see Genovese (1976) for discussion of these constraints on slave literacy). Any education of slaves was certainly not being provided by a progressive public education system. The abolition of slavery did not immediately open up the educational opportunities of whites to Southern blacks. Segregated school systems meant that black children received substantially fewer resources than white children through the first decades of the 1900s as evidenced by differences in spending per student, average class size and length of the academic year (Margo, 1991; Fishback & Baskin, 1991). This highlights one of the chief problems of local control: financing of schools for black students was subject to the local attitudes of voters on race, particularly problematic when blacks were largely disenfranchised.

Improving the quality of schooling for Southern blacks required a solution outside of the localized political process that shaped most of the history of American schools. Donohue et al. (2002) identify

two key factors, private philanthropy from Northern foundations and litigation by the NAACP.[5] The Jeanes Fund, Slater Fund, and, most significantly, the Rosenwald Fund all helped develop and raise the quality of black schools in the South from the late 1800s to the early 1930s.[6] Complementing the efforts of these foundations was civil litigation over teacher salaries by the NAACP that directly led to improvements in school quality inputs.

These litigation efforts ultimately led to *Brown v. Board of Education* and the desegregation of schools. However, even in this victory we can see further evidence of the difficulties presented by the local, adaptable nature of the educational system. The potential positive impacts of desegregation on black schooling outcomes were muted by the geographic mobility of white families in response to desegregation and the availability of private schooling options for these families (Reber, 2005; Clotfelter, 2011; Platt Boustan, 2012). One promising area of future study, highlighted in the conclusions of Collins & Margo (2006), is comparative work relating the narrowing of the racial gaps in schooling for American blacks to the experiences of other historically disadvantaged groups including former slave populations in other countries and the Native American population within the United States. The evolution of gaps in educational access and achievement under varying political structures and school systems would offer insights into exactly which forces promote or hinder convergence.

4 Investing in Education

While American political structures and potential for large social returns to education can explain much of the rise in American educational institutions, they do little to explain why individuals chose to increase their levels of educational attainment throughout history. Past research has focused on two main reasons that are obvious but whose effects are remarkably difficult to pin down empirically: laws making attendance compulsory and increased demand for highly skilled workers leading to high returns to education. Recent research has begun to uncover a host of other variables that have influenced

[5]One alternative solution is the presence of group with political power and a vested interest in improving black educational outcomes. Fishback (1989) shows that coal companies in West Virginia successfully pushed for greater school equality out of a desire to attract black workers in a tight labor market.

[6]Recent work by Carruthers & Wanamaker (2013) reveals that the Rosenwald gifts increased contemporaneous spending on schools but did not lead to long run declines in the black-white school quality gap due to funds being diverted or implicitly matched to benefit white schools. However, the funds did help close racial gaps in human capital because of higher marginal returns to schooling expenditures for black students.

the decisions to attend school including childhood health conditions and the changing structure of the household. Thanks to steady growth in the data available to researchers, our understanding of individual educational investment decisions is growing ever more nuanced.

4.1 The Returns to Education

The most straightforward explanation of increasing investments in education is that there has been a substantial private return to education throughout much of American history. The returns to literacy in the seventeenth and eighteenth centuries are confirmed by a variety of sources. Significantly shorter indenture contracts for literate indentured servants in colonial America offers some of the first evidence of the returns to education in America (Galenson, 1981). The data on returns to education from independence up to the high school movement are quite sparse. With no representative samples of individuals containing both income and education (even as proxied by literacy) we lack precise estimates of the value of an additional year of schooling. The best available evidence is in the form of wages of skilled workers relative to unskilled workers representing the premium to skill presumably obtained through education. This ratio was 1.93 in 1826-1830, 1.99 for 1856 to 1860, and 2.5 for 1895 suggesting a fairly high return to skill throughout the nineteenth century (calculations from Goldin & Katz (2009), p. 182, based on wage series from Margo (2000)).

The returns to schooling during the high school movement have been estimated using the 1915 Iowa state census, a unique source of individual level earnings and years of schooling data prior to the 1940 federal census. Goldin & Katz (2000) find returns to a year of high school of over 10 percent for employed men between the ages of 18 and 65. Returns were high for both blue-collar and white-collar occupations. These high returns help explain the eagerness with which Americans attended the newly created high schools. Beginning with the 1940 federal census, we have the educational attainment and income data to estimate standard Mincer regressions and obtain returns to schooling from 1940 to the present. These returns have been consistently high with the exception of the late 1910s and the 1940s which saw reductions in the premium for skilled labor and the return to education driven in part by expansions in education, the rise in high school education and the rise in college attendance, respectively (Goldin & Katz, 2009; Goldin & Margo, 1992). Even with these periods of

wage compression, education has generally always provided a healthy return to individuals.

One needs to be cautious, however, when comparing these historical returns to education to modern estimates. Endogeneity of schooling decisions has been a major concern in the labor and education literatures and economists have long recognized that conventional returns to education estimates may be biased upward due to selection and other issues of omitted variable bias. Economic historians have rarely had the data required to estimate a standard Mincer regression, let alone tackle these endogeneity issues. When assessing the historical returns to schooling, it is important to note that these endogeneity issues exist and that the resulting biases likely differ over time, as the set of people attending school expanded and the purposes of school in terms of generating productive human capital versus signaling ability changed in relative importance. As more detailed individual level data become available with the release of more census data and the digitization of more administrative records, economic historians will be able to better address these endogeneity issues for a more accurate assessment of the returns to schooling over time and how those returns varied across groups.

4.2 Compulsory Education

While the private returns to education were high enough to induce people to attend, states also passed compulsory schooling laws beginning in the mid-nineteenth century to compel students to attend. These laws became more stringent over time. The evidence is mixed as to whether these compulsory schooling laws were truly binding. Historians of the American educational system have asserted that compulsory schooling laws were increasingly effective at raising school attendance during the high school movement (Tyack, 1974; Troen, 1975). However, economic historians have estimated far more modest contributions of the compulsory schooling and child labor laws to increases in educational attainment during this period, with Goldin & Katz (2009) finding that they can account for just five percent of the overall increase in high school attainment from 1910 to 1938. For roughly the same period, Lleras-Muney (2002) finds that requiring children to attend one additional year of school only increased educational attainment by an average of 18 days. Recent work by Clay et al. (2012) finds that for the period of 1890 through 1927, laws increased years of schooling by 0.1 years, a modest gain relative to the large overall changes in average educational attainment occurring over that period.

While the average effect of these compulsory schooling laws may have been relatively small, Lleras-Muney and Clay et al. suggest that the effects were not uniform across all children. Lleras-Muney finds that the compulsory schooling laws were most binding in the lower percentiles of the education distribution consistent with Clay et al. finding's that much of the impact of the laws could be seen in sixth grade completion rates. These results suggest that a potentially useful focus of further research into the motivations behind and effects of compulsory schooling laws is on the differential impact of these laws across different groups and what this did for promoting or hindering equality and intergenerational mobility.[7]

4.3 The Role of the Family and Environment

Given that much of the variation in levels of schooling was driven by families deciding to increase educational investments rather than through changes in compulsory schooling laws, a natural question to ask is which families decided to invest. Identifying how individual families responded to changes in access to schools, the returns to schooling and the occupational opportunities for both children and adults offers an opportunity to provide empirical support to the models of the family and investment in children pioneered by Becker (1991). The available data to undertake such studies is rapidly expanding, particularly with the collection of more administrative data on enrollments and school characteristics and with the release of the complete 1940 federal census and its years of schooling data. The expanding set of administrative data is enabling researchers to better understand how local school, health and environmental conditions affected the decision to send children to school. The 1940 census data allows for using linking strategies to match adults in 1940 to their childhood households and school districts, providing an opportunity to view the effects of family structure, parental occupations, and school district characteristics on both educational and labor market outcomes across the country and over time.

Evidence based on cross-sectional data of school attendance and retrospective census data has begun to reveal the factors that guide families' decisions to invest in their children. Moehling (2004) considers racial differences in school attendance in the South in 1900 and 1910 and finds that the black-

[7]Note that the politics behind some of the laws suggests that they may have been passed with specific groups in mind such as the children of immigrants. See Eisenberg (1988) for discussion of the politics of compulsory schooling.

white attendance gap was a function of racial differences in parental literacy, household resources, and local school characteristics. Moehling also finds that the larger number of single parent households among the black population helps explain the schooling gap; with only a single parent to support the household, children from single parent households were far more likely to enter the labor market at a younger age. This tension between investing in a child's education and having the child work gets at the heart of debates over quantity-quality tradeoffs with children, household time and resource allocation, and the roots of the demographic transition. Bleakley & Lange (2009) offer a demonstration of the power of American educational history to shed light on these issues, showing that eradication of hookworm in the South lowered the effective costs of schooling and led to a significant decline in fertility consistent with a quantity-quality framework of fertility.

The work of Bleakley & Lange touches on a rapidly growing literature relating health to educational outcomes. While this topic receives considerable attention in modern labor studies, American economic history has a particularly valuable perspective to add. The American past has instances of enormous shocks to health and a sufficient timespan of data to see both the short- and long-term impacts of those shocks on education and labor market outcomes. Examples include not only the eradication of hookworm studied by Bleakley & Lange, but also the eradication of malaria in the South, the influenza pandemic of 1918, the improvement of urban sanitation facilities, and general improvements in medical care. In the case of hookworm and malaria, improved health conditions in the South led to increased school attendance, literacy and adult earnings (Bleakley, 2007, 2003). *In utero* exposure to influenza during the 1918 pandemic led to lower educational attainments and socioeconomic status in adulthood (Almond, 2006). These studies suggest a correlation between childhood health and education that is as strong if not stronger than the modern day correlations concerning economists and policy makers. We still have much to learn about how health impacted human capital, both directly through reduced cognitive abilities and indirectly through the alteration of family resource allocation decisions. Given that the high school movement overlapped with some of the largest changes to the health of the American public, these relationships are central to understanding the development of the American economy and the extent to which improvements in childhood health were a necessary condition for increasing educational attainments and worker productivity.

5 The Black Box of Education and the Direction of Future Research

The rise of mass education is certainly a crucial element of the history of the American economy. Extensive work by economic historians has demonstrated critical links between education and technological advance, the role of education in creating or limiting mobility and equality, and the relationships between educational outcomes and household characteristics, school district quality, labor market conditions, and local health and environmental conditions. As highlighted in this chapter, there is still interesting and important work to be done in all of these areas and an expanding set of data sources to accomplish that work.

However, there is also value in economic historians pursuing a new direction by beginning the herculean task of quantifying how education translates into productive human capital. Exploring the relationship between the actual content of education and the productivity of workers and how that relationship has changed over time would help illuminate the mechanisms underlying all of the various relationships discussed in this chapter. We have a variety of data sources at our disposal to begin this task, including the test scores discussed earlier, military test scores for cognitive ability beginning with the Army General Classification Test in World War II, the skill demands of various occupations, detailed records on curricular content and its change over time from state school reports, the subjects taught to teachers at normal schools, and, in many cases, the ability to match individuals and their outcomes to these detailed schooling data. We have a rich history of a school system and occupational distributions with substantial heterogeneity across space and time that can help economic historians open the black box of education and better understand how schooling shaped our economy in the past and how policy reforms will shape our economy in the future.

References

A'Hearn, B., Baten, J., & Crayen, D. (2009). Quantifying quantitative literacy: Age heaping and the history of human capital. *The Journal of Economic History*, *69*(03), 783–808.

Almond, D. (2006). Is the 1918 influenza pandemic over? Long-term effects of in utero influenza exposure in the post-1940 US population. *Journal of Political Economy*, *114*(4), 672–712.

Becker, G. S. (1991). *A Treatise on the Family*. Harvard University Press, 2nd ed.

Benhabib, J., & Spiegel, M. M. (1994). The role of human capital in economic development evidence from aggregate cross-country data. *Journal of Monetary economics*, *34*(2), 143–173.

Bishop, J. H. (1989). Is the test score decline responsible for the productivity growth decline? *The American Economic Review*, (pp. 178–197).

Bleakley, H. (2003). Disease and development: Evidence from the American South. *Journal of the European Economic Association*, *1*(2-3), 376–386.

Bleakley, H. (2007). Disease and development: evidence from hookworm eradication in the American South. *The Quarterly Journal of Economics*, *122*(1), 73–117.

Bleakley, H., & Lange, F. (2009). Chronic disease burden and the interaction of education, fertility, and growth. *The Review of Economics and Statistics*, *91*(1), 52–65.

Bound, J., & Turner, S. (2002). Going to war and going to college: Did World War II and the GI Bill increase educational attainment for returning veterans? *Journal of Labor Economics*, *20*(4), 784–815.

Carruthers, C. K., & Wanamaker, M. H. (2013). Closing the gap? The effect of private philanthropy on the provision of African-American schooling in the US south. *Journal of Public Economics*.

Clay, K., Lingwall, J., & Stephens Jr, M. (2012). Do schooling laws matter? Evidence from the introduction of compulsory attendance laws in the United States. Tech. rep., National Bureau of Economic Research.

Clotfelter, C. T. (2011). *After Brown: The rise and retreat of school desegregation*. Princeton University Press.

Collins, W. J., & Margo, R. A. (2006). Historical perspectives on racial differences in schooling in the United States. *Handbook of the Economics of Education*, *1*, 107–154.

Currie, J., & Moretti, E. (2003). Mother's education and the intergenerational transmission of human capital: Evidence from college openings. *The Quarterly Journal of Economics*, *118*(4), 1495–1532.

Dee, T. S. (2004). Are there civic returns to education? *Journal of Public Economics*, *88*(9), 1697–1720.

Denison, E. F. (1962). Education, economic growth, and gaps in information. *The Journal of Political Economy*, *70*(5), 124–128.

Donohue, J. J., Heckman, J. J., & Todd, P. E. (2002). The schooling of southern blacks: The roles of legal activism and private philanthropy, 1910–1960. *The Quarterly Journal of Economics*, *117*(1), 225–268.

Eisenberg, M. J. (1988). Compulsory attendance legislation in America, 1870 to 1915. *Dissertations available from ProQuest*, (p. AAI8824730).

Finch, F. H. (1946). *Enrollment Increases and Changes in the Mental Level of the High-School Population*. American psychological Association.

Fishback, P. V. (1989). Can competition among employers reduce governmental discrimination - Coal companies and segregated schools in West Virginia in the early 1900s. *Journal of Law and Economics*, *32*, 311.

Fishback, P. V., & Baskin, J. H. (1991). Narrowing the black-white gap in child literacy in 1910: The roles of school inputs and family inputs. *The Review of Economics and Statistics*, (pp. 725–728).

Flynn, J. R. (1984). The mean IQ of Americans: Massive gains 1932 to 1978. *Psychological bulletin*, *95*(1), 29–51.

Galenson, D. W. (1981). The market evaluation of human capital: The case of indentured servitude. *The Journal of Political Economy*, (pp. 446–467).

Galor, O., Moav, O., & Vollrath, D. (2009). Inequality in landownership, the emergence of human-capital promoting institutions, and the great divergence. *The Review of Economic Studies*, *76*(1), 143–179.

Genovese, E. D. (1976). *Roll, Jordan, roll: The world the slaves made*, vol. 652. Vintage.

Go, S., & Lindert, P. (2010). The uneven rise of American public schools to 1850. *Journal of Economic History*, *70*(1), 1.

Goldin, C. (1998). America's graduation from high school: The evolution and spread of secondary schooling in the twentieth century. *Journal of Economic History*, *58*, 345–374.

Goldin, C. (2000). *Understanding the gender gap: An economic history of American women*. Oxford University Press.

Goldin, C., & Katz, L. F. (1996). Technology, skill, and the wage structure: insights from the past. *The American Economic Review*, *86*(2), 252–257.

Goldin, C., & Katz, L. F. (1998). The origins of technology-skill complementarity. *The Quarterly Journal of Economics*, *113*(3), 693–732.

Goldin, C., & Katz, L. F. (2000). Education and income in the early twentieth century: Evidence from the Prairies. *The Journal of Economic History*, *60*(3).

Goldin, C., & Margo, R. A. (1992). The Great Compression: The wage structure in the United States at mid-century. *The Quarterly Journal of Economics*, (pp. 1–34).

Goldin, C. D., & Katz, L. F. (2009). *The race between education and technology*. Harvard University Press.

Graff, H. J. (1991). *The legacies of literacy: Continuities and contradictions in western culture and society*, vol. 598. Indiana University Press.

Hanushek, E. A., & Woessmann, L. (2008). The role of cognitive skills in economic development. *Journal of Economic Literature*, (pp. 607–668).

Hatton, T. J., O'Rourke, K. H., & Taylor, A. M. (2007). *The new comparative economic history: Essays in honor of Jeffrey G. Williamson*. The MIT Press.

Jones, C. I. (1995). R&D-based models of economic growth. *Journal of Political Economy*, *103*(4), 759–784.

Kaestle, C. (1983). *Pillars of the republic: Common schools and American society, 1780-1860*. Hill and Wang.

Lindert, P. H. (2009). Revealing failures in the history of school finance. Tech. rep., National Bureau of Economic Research.

Lleras-Muney, A. (2002). Were compulsory attendance and child labor laws effective? An analysis from 1915 to 1939. *Journal of Law and Economics*, *45*(2), 401–437.

Lochner, L., & Moretti, E. (2004). The effect of education on crime: Evidence from prison inmates, arrests, and self-reports. *The American Economic Review*, *94*(1), 155–189.

Long, J. (2006). The socioeconomic return to primary schooling in Victorian England. *Journal of Economic History*, *66*(4), 1026.

Margo, R. A. (1986). Race, educational attainment, and the 1940 census. *Journal of Economic History*, *46*(1), 189–198.

Margo, R. A. (1991). *Race and schooling in the South, 1880-1950: an economic history*. University of Chicago Press.

Margo, R. A. (2000). *Wages and Labor Markets in the United States, 1820-1860*. University of Chicago Press.

Milligan, K., Moretti, E., & Oreopoulos, P. (2004). Does education improve citizenship? Evidence from the United States and the United Kingdom. *Journal of Public Economics*, *88*(9), 1667–1695.

Moehling, C. M. (2004). Family structure, school attendance, and child labor in the American South in 1900 and 1910. *Explorations in Economic History*, *41*(1), 73–100.

Moretti, E. (2004). Human capital externalities in cities. *Handbook of Regional and Urban Economics*, *4*, 2243–2291.

Nelson, R. R., & Phelps, E. S. (1966). Investment in humans, technological diffusion, and economic growth. *The American Economic Review*, *56*(1/2), 69–75.

Parman, J. (2011). American mobility and the expansion of public education. *Journal of Economic*

History, *71*(1), 105.

Parman, J. (2012). Good schools make good neighbors: Human capital spillovers in early 20th century agriculture. *Explorations in Economic History*.

Platt Boustan, L. (2012). School desegregation and urban change: Evidence from city boundaries. *American Economic Journal: Applied Economics*, *4*(1), 85–108.

Reber, S. J. (2005). Court-ordered desegregation successes and failures integrating American schools since Brown versus Board of Education. *Journal of Human Resources*, *40*(3), 559–590.

Romer, P. M. (1990). Endogenous technological change. *Journal of Political Economy*, (pp. S71–S102).

Rundquist, E. A. (1936). Intelligence test scores and school marks of high school seniors in 1929 and 1934. *School and Society*, *43*, 301–04.

Schultz, T. P. (2002). Why governments should invest more to educate girls. *World Development*, *30*(2), 207–225.

Stanley, M. (2003). College education and the midcentury GI Bills. *The Quarterly Journal of Economics*, *118*(2), 671–708.

Stoddard, C. (2009). Why did education become publicly funded? Evidence from the nineteenth-century growth of public primary schooling in the United States. *Journal of Economic History*, *69*(1), 172.

Troen, S. K. (1975). *The public and the schools: Shaping the St. Louis system, 1838-1920*. University of Missouri Press.

Tyack, D. B. (1974). *The one best system: A history of American urban education*. Harvard University Press.

Wanamaker, M. (2009). Essays in American fertility. *Dissertations available from ProQuest*, (p. ISBN:9781109518559).

Wheeler, L. R. (1942). A comparative study of the intelligence of East Tennessee mountain children. *Journal of Educational Psychology*, *33*(5), 321.