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EDUCATION AND INCOME IN THE EARLY 20TH CENTURY: EVIDENCE FROM THE PRAIRIES

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ABSTRACT

We present the first estimates of the returns to years of schooling before 1940 using a large sample of men and women, employed in a variety of sectors and occupations, from the Iowa State Census of 1915. We find that the returns to a year of high school, and to a year of college, were substantial in 1915 - about 11 percent for all males and in excess of 12 percent for young males. Some of the return to years of high school and college arose because more education allowed individuals to enter lucrative white-collar jobs. But we also find sizable educational wage differentials within the white- and blue-collar sectors. Returns to education above the "common school" grades were substantial even within the agricultural sector. Given the high overall rate of return to secondary schooling, it is no wonder that the "high school movement" took root in America around 1910, even in agricultural areas such as Iowa. Census data for 1940, 1950, and 1960 are used to show that returns to years of schooling were greater in 1915 than in 1940. We conclude that the return to education decreased sometime between 1915 and 1940 and then declined again during the 1940s.

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The distribution of earnings is substantially shaped by a race between technology and education.[1] There are times when technology forges ahead and the wage structure widens. At other times, education makes great strides and the distribution narrows. The first few decades of the twentieth century witnessed both changes simultaneously. America moved decisively ahead in education by putting the majority of its youth through high school, a feat that no other country would match for many decades to come (Goldin and Katz 1997). At the same time, there was enormously growing demand for skilled workers in the office and on production jobs (Goldin and Katz 1998).

A considerable amount is now known about the increase in education among Americans in the twentieth century (see, for example, Goldin 1998 on secondary schooling). But we know far less about the stock of educated Americans, occupations by education, the pecuniary returns to education, and the role of formal schooling in advancing productivity during the first half of the twentieth century. In large measure, our ignorance owes to data deficiencies. The 1940 U.S. population census was the first to inquire of education and earnings. This paper remedies some of these deficiencies by using a unique data source – the 1915 Iowa State Census. Together with the U.S. federal population censuses beginning with 1940, the 1915 Iowa State Census will allow us to say something concrete about the outcome of the "race" during the first half of the twentieth century.[2]

We present the first estimates of the returns to years of schooling before 1940 using a large sample of men and women employed in a variety of sectors and occupations.[3] We find that the returns to

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[1] The phrase the "race between technology and education" comes from Tinbergen (1975).

[2] See Goldin and Katz (1999a) for additional information on the "race" in terms of skill differentials within and between manual and white-collar occupations.

[3] By the return to a year of schooling we mean the log earnings difference between a worker with t+1 years of schooling and one with t years. Specifically we mean the coefficient on years of schooling in a log earnings regression with controls for potential labor force experience and other covariates. We do not construct an "internal rate of return" to education, and thus returns for women will be overstated when their participation rates are low. We follow the tradition since Mincer (1974) of denoting such earnings differentials as the "returns to schooling." We adopt the assumptions of the Mincer framework that there are no direct costs of education and that all persons, independent of schooling years, are in the labor force for the same period. We cannot measure increased productivity outside the labor market nor can we assess the consumption value of education. We are aware of the difficulties in providing a causal interpretation to earnings differences by years of schooling. See Card (1999) on these issues.

a year of high school, and to a year of college, were substantial in 1915 – about 11 percent for all males and in excess of 12 percent for young males. Some of the return to years of high school and college arose because more education allowed individuals to enter lucrative white-collar jobs. But we also find sizable educational wage differentials *within* the white- and blue-collar sectors. Of great importance for this largely farming state is that returns to education above the "common school" grades were substantial within the agricultural sector. Given the high overall rate of return to secondary schooling, it is no wonder that the "high school movement" took root in America around 1910, even in agricultural areas.

We begin with a description of the high school movement and why prairie states, such as Iowa, led most others in secondary education. Data deficiencies concerning the measurement of the returns to education and the human capital stock for the first half of the twentieth century are taken up next, and the unique features of the Iowa State Census of 1915 are discussed. We then use the Iowa data to assess educational stocks and flows and the returns to education in 1915. We evaluate the returns generally and for white- and blue-collar workers separately. Because Iowa was largely a farming state, we also assess the role of schooling in enhancing agricultural productivity. To put the findings from 1915 in perspective, we use the Integrated Public Use Microdata Samples (IPUMS) from the 1940, 1950, and 1960 U.S. population censuses to evaluate changes in the returns to education in the first half of the twentieth century. The comparison suggests that the return to a year of high school declined over time and thus that the "race" was won, at least for a while, by education.

The High School Movement and the Prairie States

In 1900 just 6 percent of all 17-year olds in the United States graduated from secondary schools. By 1930, 30 percent did – 35 percent outside the South. Public secondary schooling did not diffuse uniformly across America, even across the non-southern states. New England took an early lead, but its states were quickly surpassed by many in the West and some in the central portion of the nation, an area we call the "prairie states." In 1910, as the "high school movement" was just beginning, the secondary school graduation rate among youth in New England was 16 percent, although it was 9 percent nationally

and 11 percent in the states outside the South.[4] In 1926, however, when the national high school graduation rate was 26 percent and that in New England was 34 percent, the rate for the Pacific and prairie states exceeded 40 percent (see Figure 1).[5] Not only did the prairie states lead in education early in the century, many of them remain educational leaders today.[6]

The prairie may appear to have been an unlikely place for an educational movement to sprout a century ago. The communities that then fostered progressive education are, even today, rural cross-roads and isolated towns. But on further consideration, it is more transparent why these places became educational leaders. The prairie states were wealthy farming areas during the first three decades of the twentieth century and wealth in land is more easily taxed than in its more portable forms. Of the five highest states in per capita taxable wealth in 1912, three are in the West North Central (Iowa was second, North Dakota third, and Nebraska fifth). Four of the six "prairie states" were among the top ten wealthiest, on a per capita basis, in 1922.[7]

The prairie states were populated by progressive farmers at a time when running a farm increasingly required knowledge of chemistry, botany, accounting, electricity, and other tools of modern science. Youths in these states could not have worked in industry, for there was scant manufacturing in these mainly commercial and agriculturally oriented communities.[8] And although many farmers would have preferred that their children remain on the land, most knew it would prove impossible for all but one.

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[4] By graduation rate, we mean the number of graduates divided by the number of seventeen-year olds.

[5] We define the "prairie states" to include those of the West North Central census division minus Missouri. Some of these states are better described as Great Plains states, but the state on which we focus (Iowa) and the other more populous states of the region are "prairie states." If we instead use a narrower definition and include only Iowa, Kansas, and Nebraska (all prairie states), the high school graduation rate for the prairie and the Pacific states would have been 46 percent in 1926.

[6] The top three states of a recent educational index are all in the West North Central: North Dakota, Iowa, and Minnesota, in that order. Six of the seven West North Central states are in the top twelve. The educational index averages three components: (1) a combination of seven National Assessment of Educational Progress (NAEP) scores; (2) the average Scholastic Aptitude Test (SAT) score adjusted for participation rate differences among states; and (3) a measure of the high school dropout rate that combines four factors. The components of the index are for 1990 to 1996. See Braatz and Putnam (1997)

[7] See U.S. Department of Commerce (1926).

[8] In 1910 the share of employment in manufacturing was 9.1 percent in the prairie states (10.5 percent in Iowa), but 20.2 percent for all states and 26.8 percent for those outside the South and the West North Central (excluding

The best they could do was to endow their children with education to be mobile. The prairie state on which we will focus – Iowa – was, moreover, about as "urban" in 1915 as was the rest of the nation. Iowa was densely dotted with the "central places" of location theory, and these small towns were incubators of "social capital."[9]

Evidence on schooling and income before 1950

Information that could reveal education's role in enhancing productivity in the first half of the twentieth century has been difficult to obtain. Only with the 1940 U.S. population census was there a survey at the national level that asked years of education and earnings.[10] Yet even the 1940 census omits considerable information on both variables.

As Americans made the transition from rural to urban areas and from farms to factories, American children made a related shift from the one-room "common school" to the graded grammar school. But the 1940 U.S. federal census asked about highest grade completed, not years in various types of schools. The information requested does not enable one to evaluate whether the transition from common to grammar schools, and then to high schools, made a difference over and above the increase in years of education.

The data on highest grade completed in the 1940 census, moreover, appear to contain various biases. Because many older Americans had attended "common," not graded schools, "highest grade completed" was often translated as "years of school attended." Contemporaneous evidence on high

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Missouri). Source: 1910 IPUMS, all workers greater than or equal to 14 years old.

[9] By the usual definition of "urban" – incorporated areas with more than 2,500 persons – Iowa was less "urban" than was the United States in 1910 (45.7 percent versus 30.6 percent). But Iowans had a much higher fraction of their residents living in incorporated places with fewer than 2,500 residents than did the rest of the United States. Including as "urban" in 1910 all residents of incorporated places makes the comparison 54.5 percent for the United States and 50.3 percent for Iowa. For the U.S. data, see U.S. Bureau of the Census (1975), series A 57-72; for the Iowa data, see State of Iowa (1916). On the role of small towns in the diffusion of high schools, see Goldin and Katz (1999).

[10] Ever since 1850, the U.S. population census inquired about school attendance during the year. It is possible that the U.S. Bureau of the Census believed that a question on highest grade completed would be ambiguous since large numbers of individuals had attended rural or European ungraded ("common") schools. For them, years of

school enrollments and graduates reveals that older Americans in the 1940 census greatly inflated their completion of the upper secondary school grades.[11]

With regard to the earnings variable in the 1940 census, wage and salary information was requested, but income from self-employment was not. Thus the relationship between earnings and education cannot be studied for the 25 percent of the male labor force (25 to 64 years old) that was self-employed in 1939. The self-employed, moreover, included virtually all of the farm population as well as a disproportionate number of the highly educated among the non-farm group.[12]

Even if the estimates of educational returns from the 1940 census had no measurement problems, the year is too late in the nation's history to explain why the "high school movement" occurred. By 1940 half of all youths across the United States were high school graduates, and graduation rates exceeded 65 percent in many states, such as those in the New England, Pacific, and West North Central regions. Thus many issues regarding education and economic growth cannot be addressed with the 1940 census either because the data are not available or because the time period is after the fact.

Several data sets for the period before 1940 contain information on education and income.[13] But only one is of substantial size and has adequate breadth of coverage regarding related variables, such as age, occupation, sex, and family background. That data set is derived from the Iowa State Census of 1915. Almost all states since the early nineteenth century, or from the time they achieved statehood, surveyed their populations at ten-year intervals, often mid-decade between two U.S. population

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school, not grade, would have been the relevant metric.

[11] See Goldin (1998) regarding the overstatement of secondary school graduation in the 1940 census. It appears that many of the older cohorts inflated their high school graduation rate (that is, whether they had attended twelve or more years of school), some by as much as 1.5 to 2 times the actual rate. The inflation may be due to the confusion between years of school and highest grade completed.

[12] Individuals are considered self-employed if they are employers or "working on own account." Among (male) farmers and farm managers, 98 percent are listed as self-employed. Source: 1940 IPUMS.

[13] See, for example, Gorseline (1932), which contains a sample of brothers. Goldin and Katz (1995, 1999a) present a wage series, from 1890 to 1960, for occupations that had differing schooling qualifications. The 1934/36 Consumer Expenditure Survey has recently been made available in electronic form. The survey contains data on education and earnings for about 14,000 families, although mainly from the central portion of the wage structure.

censuses.[14] Both Iowa and South Dakota, in their respective censuses of 1915, inquired of their residents' educational attainment. It was the first time a state had asked such a question in its census. Although Iowa retained the education question in its 1925 census, that on income was dropped.

The Iowa State Census of 1915

The 1915 Iowa State Census is a 100 percent sample that was taken by county assessors on a household-to-household basis. An index card was filled out for each individual containing information on age, sex, race, school attendance, educational attainment (by type of school, viz., common, grammar, high school, college), occupation, income in 1914, value of property, incumbrance on home or farm, church affiliation, and years in the United States and in Iowa, among other items (see a facsimile of the form in the Data Appendix). Although the census did not ask relationship to others in the household, information on the cards allows the reconstruction of nuclear family units for those living in the same household. The cards were stored in Des Moines, filed in alphabetical order by county, and microfilmed in 1986 by the Genealogical Society of Salt Lake City.

Using the microfilms, we have collected a cluster sample of almost 60,000 individuals (1 in 40 sample) from three cities (Davenport, Des Moines, and Dubuque) and ten counties that did not contain a city with more than 25,000 people. We term the sample from the three cities the "urban" sample and that from the ten counties the "rural" sample, although the counties contained urban places of various sizes.[15]

Why the state of Iowa undertook a census that was twenty-five years ahead of its time is not fully clear. One possibility is that Iowans wanted to broadcast to the rest of the nation that their people were highly educated. They wanted to be seen as a sophisticated and cosmopolitan people, not backward, rural "hayseeds." The published census proclaimed that: "The enumeration for the first time included an

[14] On state censuses, see Dubester (1948).

[15] Our 1915 Iowa State Census sample is large, representative of the state, and derived from a true population census. See the Data Appendix for information on our Iowa sample, including the use of sampling weights. Others who have drawn samples from the 1915 Iowa State Census include Jensen and Friedberger (1976) and Smith (1996).

inquiry into the extent of education … and this happily confirms the claim of very high rank for Iowa in educational standing."[16] Another possibility – and one that we document below – is that Iowans were, in fact, twenty-five years ahead of the nation in educational attainment.

Even though high schools had already spread across much of Iowa by 1915, many adult Iowans had been educated at times when, and in places where, schooling was limited to that garnered in the rural common schools.[17] Among native-born Iowans older than 20 years in 1915, 47 percent had been educated in the common schools only. Furthermore, 69 percent of Iowa's foreign born older than twenty years, and 73 percent of those who arrived in the United States after age eighteen, had received all of their education in common schools, largely European ones.[18] Almost all adult Iowans had been educated before 1913 when the state passed a "free tuition" law, which made the payment of secondary school tuition the fiscal responsibility of the youth's school district.[19] Therefore adult Iowans in 1915 who had attended secondary school either had lived in districts maintaining a high school or had paid tuition to another district. Although the majority (51 percent) of adult Iowans were not educated beyond the common school, a small group was enabled to attend universities and colleges, many of which had a presence in the state ever since the mid-nineteenth century.[20]

The 1915 Iowa State Census, therefore, surveyed a population that had been educated across a wide variety of educational institutions – the one-room common schools of rural America and Europe, the

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[16] State of Iowa (1915), preface, n.p.

[17] In 1890 there were 140 secondary schools in Iowa, but in 1914 there were 805, of which 490 were approved. Approval meant that the state universities would accept graduates without examination (Johnson 1987). There were 928 independent city, town, and village corporations among the 99 counties in Iowa. Since there were 58 cities and towns with populations exceeding 3,000 and 63 with populations between 1500 and 3000, most of these corporations had populations under 1,500. That is, by 1914 most of the incorporated cities, towns, and villages had their own high school, although not necessary an approved one. Children in the open country, however, may still have been far removed from a secondary school. Data are from the State of Iowa, *Biennial Reports*.

[18] The native-born and foreign-born calculations use the Iowa 1915 sample and exclude those who attended no school (1 percent of the native born and 3 percent of the foreign born). Of those older than 20 years in 1915, 18 percent were foreign born.

[19] According to subsequent Iowa school reports, the law passed the 34th General Assembly in 1913. For many years after, about one-quarter of local revenue for secondary schools came from tuition payments.

[20] There were 19 colleges and universities spread across Iowa in 1897, only 4 of which had been founded after 1880 (see Goldin and Katz 1999b for source).

city and town grammar and secondary schools, and the college and university. In recognition of this diversity, the census inquired as to the type of institution in which the individual was educated – common, grammar, high school, and college – and the years in each. We are, thus, able to explore the role of educational institutions that disappeared as graded and secondary schools replaced them.

In rural communities having no secondary school, pupils often went to common school for longer than eight years.[21] The 1915 census allows an assessment of whether such training had the same impact on earnings as did years in the more modern high schools. The question takes on some importance when considering that the apparent overstatement of high school graduation in the 1940 census could have resulted from an inclusion in the secondary school grades of excess years taken at the common school level. Similarly, many youths desiring a college or university education attended the preparatory departments of those institutions, particularly if no high school existed in their locale or if the school could not adequately prepare them for college entrance. Such individuals may have attended eight years of common or grammar school and then, perhaps, six or more years of "college." The 1915 Iowa census is, to our knowledge, the only U.S. survey that allows an examination of the differential effectiveness of years in a wide range of pre-college institutions.

Educational stocks and flows

When Iowans proclaimed in 1915 that they attained a "very high rank … in educational standing," they could not have known just how high, since only one other state (and a neighboring one at that) had surveyed their residents on the question. Iowans were aware that they were more literate than those in other states, because the U.S. population census inquired of literacy ever since 1850. Iowans

[21] County school superintendents administered an eighth grade examination twice yearly to those in the common and graded schools. Passage of the examination allowed the students to advance to secondary school. Common schools in areas distant from a town high school occasionally added one or two extra years beyond that required for the eighth grade examination. The *Iowa Biennial* for 1903 noted that a two-year high school course existed "for advanced rural schools and the small graded schools" (p. xxi). The extended course was more usual before the advent of the "free tuition" law of 1913. After passage of the law, the state tightened controls on what constituted a high school course since districts not containing a secondary school were liable for tuition payments.

should also have known that they had achieved an admirable school attendance rate – second in the nation in 1900 and 1910 – for the U.S. census had inquired of school attendance since 1850.[22]

But Iowans could not have known that the school attendance rate of their 5 to 19-year olds – which was 73 percent in 1915 – was almost equal to that achieved in the nation by 1940.[23] Thus, youth in 1915 Iowa were, on average, about a quarter of a century ahead of other American children in their school attendance. Iowans would also have been unaware that the average educational attainment of their adult population would not be equaled in the entire United States until about 1940.

To demonstrate this point, we compare in Table 1 the educational attainment of 25 to 59-year olds in 1915 Iowa with that of the same age group in the United States in 1940. By the standard of mean highest grade completed (or average years of education), Iowans in 1915 had the same educational attainment as did the average American in 1940.[24] The proportion who were high school graduates was greater in the United States in 1940 than in Iowa in 1915, but the 1940 census overstates the high school graduation rate.[25] Probably closer to the truth is that the fraction attending some secondary school in 1915 Iowa, using the Table 1 version II estimate, is not much lower than that for the entire United States in 1940. The fraction with fewer than eight years of formal schooling is, however, lower in Iowa in 1915

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[22] According to the 1910 U.S. federal population census, Iowa had the lowest rate of illiteracy in the nation among its adult population. It ranked second to Vermont in 1910, and to Nebraska in 1900, in terms of the school attendance of its 5- to 20-year olds (U.S. Bureau of the Census 1913, tables 19, 29).

[23] In 1940 the school enrollment rate of 5 to 19-year olds in the United States was 0.748 (U.S. Department of Education 1993, table 2). The school attendance rate in 1915 for 5 to 19-year olds in Iowa was 0.726 (Iowa 1915 sample). Because attendance rates are generally lower than enrollment rates, the 1915 Iowa attendance level may have been even higher than the enrollment rate for the entire country in 1940.

[24] The 1940 U.S. population census asked individuals their highest grade attended, but many gave their total years of education and the census enumerators were instructed to translate years into grades. We have, for 1915, years in various types of schools, and thus have more complete information concerning years and grades than exists for the 1940 census. We offer, in Table 1, three summary statistics for educational attainment (see notes to Table 1). The choice will depend on what was actually measured in 1940 – years or grades. All our tabulations from the 1940 population census use the sampling (person) weights from the 1940 IPUMS.

[25] The 1915 Iowa census data on high school attendance are in almost perfect agreement with contemporaneous administrative records on enrollment. The Iowa high school attendance rate for 1914, derived from the 1915 Iowa State Census, is 0.3148; the enrollment rate from administrative records, using 14 to 17-year olds as the reference group, is 0.3152. In 1914, the high school enrollment rate for the entire United States was 0.240, and it was 0.283 in the non-South. See Goldin (1998) on the overstatement of high school graduation in the 1940 census and for the administrative data sources.

than in the United States in 1940, possibly because the Iowa census requested "years of schooling" and the U.S. census inquired of "grades."

To judge the comparability of the education data in 1915 and 1940, Table 2 tracks a cohort of males born in Iowa between 1875 and 1890. The 1915 educational attainment data are adjusted to be consistent with the instructions to enumerators in 1940 (see notes to Table 1). As shown in cols. (1) and (2), the concordance between the two series is very close, although, as in Table 1, the fraction with fewer than eight years of education is lower in the 1915 than in the 1940 data.

Although many adult Iowans were educated entirely in the common schools, about half of their total years of education were earned in graded schools (see Table 3). Women had more years of schooling than did men yet fewer years above the secondary level, a finding familiar from other studies (see, for example, Tyack and Hansot 1990). More surprising is that Iowans currently living in the larger cities had total years of education about equal to that of those living in small towns and rural places. Thus a high level of basic education was almost uniformly distributed across Iowa. Some differences did matter. Those born in Iowa had the most schooling – a bit more than nine years, whereas those educated abroad had the least – barely exceeding seven.

More than half of all 15 to 18-year olds in Iowa attended school at all during 1914 and only 16 percent of those attending were in school fewer than six months during the year (Table 4). About half of the attendees were in grades above the common or grammar school level, and the figure is about the same in the rural and urban samples, although rural youth attended fewer months during the school year. Not surprisingly, farm youth were more likely to be in common school than were their city and town counterparts of the same age, either because they took more years to finish the common school program or because they lived far from the town high school. Despite claims that rural school-going youths routinely held jobs for pay or on their family farm, fewer than 10 percent of those in school also listed an occupation. The figure is 13 percent for the children of farmers, although all children in farm households went to school fewer months out of the year than did others.

The points these data make are clear. Iowa not only had an exceptional educational system for its

youth in 1915, it was also the home of an adult population that was about twenty-five years ahead of its time in formal schooling.

Schooling, income, and occupations: the premium to education in 1915

There are several reasons to believe that structural changes in the economy in the late nineteenth and early twentieth centuries increased the relative demand for educated workers. The growth of big business, for example as described in Chandler (1977), increased the demand for all types of managers. Compared with businesses in other industrial countries, American large-scale manufacturing was distinctive in its heavy reliance on skilled managers for decision-making rather than shop-floor craftsmen (Lazonick 1990). Offices expanded as modern accounting, marketing, and sales practices swept business around 1900 and increased the demand for clerical and sales workers. In 1900, as the era of big business was emerging, there were thirteen production workers for each white-collar employee in manufacturing, but in 1909 there were six.[26] For the economy as a whole, the share of clerical workers in the non-agricultural workforce grew from 4.8 percent in 1900 to 11.0 percent in 1920, and most of the growth occurred in the manufacturing sector (Rotella 1981). In fact, Goldin and Katz (1998) estimate that from 1890 to 1929 the relative demand for white-collar workers in manufacturing grew at a rate nearly as high as that reached from 1959 to 1989, a period of rapid growth in the demand for skills. The expansion of large retail sales establishments and of the banking and insurance sectors further increased the relative demand for white-collar workers. Various vocations, such as those of accountant, architect, and lawyer, were professionalized in the period around 1910, and the greater use by industry of scientific methods increased the need for chemists, engineers, and other science-related personnel.

The facts concerning the rising demand for white-collar workers, professionals, and skilled

[26] The 1900 and 1909 U.S. Census of Manufactures report proprietors and firm members, salaried officers, and superintendents, managers, clerks, and salesmen as an aggregate for the U.S. totals. We divide the number of all other employees by that aggregate, after subtracting the "hand trades," (e.g., blacksmiths, carpenters) from the 1900 figures. Sources: U.S. Census Office (1902); U.S. Bureau of the Census (1913b).

production workers beginning in the 1890s seem clear. But how these shifting labor requirements were translated into an increased demand for educated workers depends on educational requirements for various occupations. These requirements have remained somewhat of a mystery for the pre-1940 period. In previous work, we used job descriptions for the 1910s and 1920s to construct a group of white-collar occupations that required graduation from, or some years of, high school (Goldin and Katz 1995). In later work we used job descriptions for a host of blue-collar jobs to show that many, particularly those in high-tech industries, began to require and reward more formal schooling in the 1910s and 1920s (Goldin and Katz 1998). With the Iowa State Census we can now directly observe the occupations of the more highly educated in 1915.

Table 5, panel A, summarizes the educational distribution of workers by major occupation group. Although over 70 percent of all those (20 to 64 years old) employed in 1915 Iowa had no more than a common or grammar school education, the vast majority of white-collar workers had high school or college education in 1915. The table reveals large differences in average schooling levels between ordinary white-collar workers and blue-collar workers. Thus the ratios of non-manual to manual wages examined, for example, in Goldin and Katz (1995) are likely to provide good proxies for educational wage differentials.

We also examine in Table 5, panel B, the occupations in which workers with different levels of education were employed in Iowa in 1915. The vast majority of high school graduates and those who attended college were employed in white-collar occupations. For women (20 to 34-years old) with more than twelve years of schooling, only 5 percent were *not* white-collar workers, whereas 66 percent were among those with only common or elementary school. For young men with more than twelve years of schooling 36 percent were not white-collar workers, whereas about 91 percent were in the lowest education group listed. Women with some high school in 1915 were mainly clerical workers; among those having more than high school, about 60 percent were teachers. More educated men were professionals, managers, salesmen, and office workers.

We can infer, from the evidence just presented, that structural changes in the economy around

1900 increased the relative demand for workers with a high school education. But even though we have no direct evidence to show that the high school movement began because of an *increase* in educational returns, we can estimate returns in 1914 at the start of the high school movement in a state that was an educational leader – Iowa.

Pecuniary returns to education

We assess, in Table 6, the returns to schooling for males 18 to 65-years old and, in Table 7, for males and unmarried females 18 to 34-years old, using a human capital (log annual earnings) regression framework. Each earnings regression includes measures of schooling attainment and a standard set of control variables.[27] For males, we stratify by broad sector – non-farm and farm. Education returns are estimated in two manners in Table 6. The first method (odd numbered columns) includes separate variables for years of education by type of school. The second (even numbered columns) uses a linear spline function by type and years of schooling. The reason for estimating the linear spline function is, as we have already noted, that many Americans in 1915 had attended common (and grammar) school for more than the usual eight (or nine) years and a large fraction of those who attended college never went to high school.[28] We are able to evaluate whether earnings were augmented by the additional years in common (or grammar) school beyond the usual eight or nine, as well as what was meant by years of college for those who never attended high school. The estimates we report are robust to the inclusion of other (exogenous) covariates (e.g., nationality, parental nativity) and are not much altered by including controls for church affiliation and location.[29] We also include, in each specification, an indicator variable

[27] The control variables include: a quartic in potential experience, race and nativity dummies, and the number of years in the United States for the foreign born.

[28] Among males 18 to 65 years old (with positive earnings) who attended at least one year of college, 30 percent claimed to have had no years of high school, and among a similar group of females 19 percent listed no years of high school. For male farmers who attended at least a year of college, 59 percent had attended no high school. College attendees from rural areas would have been less able to attend the town high school and would, most probably, have gone to the preparatory department of the state university. "College" may have included commercial institutes, although they were often listed separately as "business schools" and coded as such in our data.

[29] See Appendix Tables A1 and A2 for estimates on different sub-samples and with more control variables. The coefficients on the control variables appear qualitatively similar to those from earnings function estimates using recent and national data. In particular, we find a steep, upward sloping, and concave experience-earnings profile for

for whether an individual attended a business or commercial school.[30]

Before discussing the results, we must first address the reliability and meaning of the income data. The Iowa State Census of 1915 asked the amount earned from the individual's occupation. Even though Iowa had no income tax in 1915, individuals may have been reluctant to provide income information or may have been unable to assess it accurately. Farmers, in particular, would have had to decide whether income should be net of costs or gross, similarly for other self-employed individuals.[31] In the "city sample" just 3.8 percent refused to answer the income question (or did not answer it for other reasons) and in the "rural sample" 7.1 percent refused (4.4 percent among farmers).[32] In contrast, in recent March Current Population Surveys 15 to 20 percent of wage and salary earners and 25 to 30 percent of the self-employed were unwilling to report their income (Lillard, Smith, and Welch 1986).

Across all occupations (Table 6, col. 1) the return to a year in common or grammar school was 4 to 5 percent, whereas that for high school or college was double the rate – around 10 percent. Returns were somewhat higher for the younger group (Table 7, col. 1), for which a year in high school garnered 12 percent and a year of college, 15 percent. Similarly for young, unmarried women (Table 7, col. 4), a year of high school returned 10 percent and a year of college 15 percent. Grammar school rates of return were lower for females than for males and common school rates of return were practically zero for young

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males with earnings increasing by about 8 percent per year in the first decade of labor market experience and peaking at around 33 years of experience. A dummy variable for "married" slightly reduces the educational coefficients for males but is the only additional control that makes a difference. The inclusion of the "married" dummy is questionable because it could be endogenous to labor market success. The other variables – years in Iowa, having foreign-born parents, urban and church affiliation dummies – have little impact on the schooling coefficients. There is also a substantial urban wage premium and a wage penalty to immigrants that narrows with years in the United States. Unemployment was more common for the less educated and the inclusion of "months unemployed" modestly reduces the education premium. Returns to high school and college are far higher for the native-born than for foreign-born Europeans.

[30] The estimates of schooling returns are not sensitive to including the "business school" dummy.

[31] The value of per farm gross product in Iowa in 1910 suggests that the income figures given in the 1915 census are net of production costs (U.S. Bureau of the Census 1913a).

[32] In most cases, a refusal to provide income information was indicated by the assessors, but in other cases we inferred refusal from the reporting of an occupation (for someone who was not retired), less than 12 months unemployment, and no income listed. In the rural, non-farmer sample almost 10 percent did not report their income. Interestingly, most individuals in rural areas would have known their assessor for they were almost always from the same township.

women. We will show momentarily that about half of the return to a year of post-grammar schooling came from switching between blue- and white-collar jobs for males in the non-farm group. For females, however, almost all the return came from the occupational shift to clerical work and teaching.

The greater return to a year of college for the younger, rather than the total, group deserves further comment. The issue is whether a college education changed over time and whether the college generally attended by the older group was different from that of the younger. Many in Iowa's older college-educated population had attended small denominational liberal arts colleges and bible schools characteristic of the nineteenth century. The return to a year in one of these older-style colleges may not have been as high as a year in a state university or in the larger and more modern liberal arts college attended by the younger group (see Goldin and Katz 1999b).

Of great importance in a state having 39 percent of its male labor force in farming, is the premium to post-common school years in the farm-sector sample (Table 6, col. 5). Although the return to the elementary grades was a bit lower for those in the farm sector, there was a hefty return for years at the high school and college levels.[33] But because do not know the value of farm land and capital that was inherited, our estimates of educational returns could be upwardly biased if the more highly-educated farmers were those who inherited more. We later reinforce our findings here by evaluating the relationship between education and farm productivity using cross-county data for which we can include the value of land and capital.

The linear spline function estimates (Table 6, even columns) reveal that almost nothing was gained from years beyond nine in common or grammar school, or from those above four in high school, by those in non-farm occupations. Rather than substituting for secondary school, most of the added years appear to have been taken by "retained" students. For those in farm occupations, however, years beyond nine in common school had some value, possibly because many of these adults could not, as rural

[33] Among male farmers 18 to 65 years old with positive earnings, about 13 percent had at least either a year of high school or college.

children, attend the geographically distant – and expensive – secondary schools in town.[34] In addition, the first four years of high school have an even greater return than in the even numbered columns – more than 11 percent per annum in both the farm and non-farm sectors – and years beyond four have no return.

Educational returns in blue-collar versus white-collar occupations.

Not only were returns to education considerable within the farm sector (as in Table 7, col. 3), they were also substantial among those in the blue-collar labor force (as in Table 8, col. 1 and col. 3). Thus even though higher returns were garnered by individuals who moved between sectors, such as from blue- to white-collar jobs, there were reasonably high returns to each year of high school *within* the blue-collar (operative, craft, service, and laborer) group.[35] For 18 to 34-year old males, for example, the return to a year of high school drops minimally from 11.4 percent for all non-farm occupations (Table 7, col. 2) to 9.1 percent for all blue-collar occupations (Table 8, col. 3).

One may wonder what high school educated blue-collar workers were doing in Iowa in 1915. Many high-tech industries of the day (e.g., business and electrical machinery, non-ferrous metals) and those using either continuous-process methods (e.g., oats, film) or batch technologies (e.g., dairy, chemicals, petroleum refining) demanded high school educated blue-collar workers in 1915 (see Goldin and Katz 1998). But Iowa did not have much industry and that which it did have was not disproportionately in the high-tech and high-education group. Many of Iowa's blue-collar workers were not working in manufacturing firms at all, but were, rather, employed in small repair shops or by the railroad. Because "industry" was not asked in the 1915 Iowa State Census, we can not always discern it.

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[34] Note that the curious coefficient on "grammar school years greater than nine" (Table 5, col. 6) should be discounted since the number of observations in that cell is small.

[35] The role of within and between occupation returns to education can be demonstrated more clearly by adding a full set of occupation dummies to the regressions in Tables 6, 7, and 8. For males 18 to 65-years old the addition of one-digit occupation dummies to the basic regression in col. (1) of Table 6 reduces the return to a year of high school from 0.103 to 0.062. The inclusion of a full set of 3-digit dummies lowers it to 0.054. Thus, for males, about half of the return to high school results from moving into better paying occupations and half remains even within detailed occupations. Comparable analysis for the blue-collar group separately results in similar findings. The return to years of high school was about equally divided between that due to higher earnings within narrowly defined occupations and that due to a shift to higher-paying occupations. A greater proportion of electricians and machinists, for example, were high school graduates and these occupations paid considerably more than did others

We do know that high school educated blue-collar workers in Iowa were far less often "laborers" than their less-educated counterparts, and were disproportionately in skilled occupations (e.g., electrician, machinist).[36] Our best guess, therefore, is that the ability to read and comprehend manuals, decipher blue-prints, do algebra, and solve formulas – a few of the skills provided in even small-town high schools – were valued by a wide range of employers.[37]

Similar findings hold even more forcefully for the white-collar group. Returns to a year of high school are lower in the within as opposed to the between occupational group analysis (that is Table 7, col. 2, versus Table 8, col. 4), but the reduction is modest. Furthermore, the addition of a full set of white-collar occupation dummies to the Table 8, col. (4) estimates, minimally reduces the high school coefficient and does little to that on college. Educational returns in the white-collar sector were primarily due to *within* occupation differences.

Returns to education among farmers

The finding of substantial returns to high school and college education for the farm population is a result of some importance, for the widespread support of education in the state of Iowa came from a mainly agricultural population. The demand for high schools was voiced not just by those in the towns and cities of Iowa, but also by many on the farm. In the farm press and the state school reports, the loss to a farm community in not having a high school in easy access of the farm children was a constant source of frustration. Farmers often retired when their eldest was ready for high school or, alternatively, parents remained on the farm and sent their children to board in the town. "The country school," noted the progressive Des Moines farm journal *Wallace's Farmer*, "will remove one of the inducements that leads farmers to retire in the town. The most potent of these inducements is that of giving children a better

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in the blue-collar group. But within most blue-collar occupations, more education also increased earnings.

[36] Among non-farm blue-collar workers without a high school education 44 percent were laborers or teamsters, compared with 20 percent among those with some high school (for males 18 to 34-years old). Similarly, 48 percent were craft workers among those with some high school, whereas 29 percent were for those without high school.

[37] Most Iowa high schools in the period before 1915 would not have had shop facilities, but they did have laboratories and often gave courses in bookkeeping (of the approximately 600 high schools in 1903 about 70 percent offered bookkeeping). But in general, the high school curriculum in most Iowa schools would have been more

education" (April 18, 1913, p. 691). It also warned that: "Farmers of the districts have been watching their boys and girls going to town schools and acquiring ideas that take them ultimately away from the farm" (March 21, 1913, p. 519).

Ironically perhaps, high school education in this mainly agricultural state often meant greater geographic mobility with or without a school close to the farm. But many in the farm community supported the funding of high schools, and in retrospect such support was highly rational. If there were no high school in the community, those desiring education would leave farming earlier or send their children to the town. Although a greater fraction of educated farm youth would eventually leave farming, others would become more productive farmers. We explore this possibility using county-level data.

The published versions of the 1915 and 1925 Iowa State Censuses provide education information for the adult population in the ninety-nine counties of Iowa.[38] The agricultural censuses of 1910 and 1920 contain the value of crops produced per farm and various inputs, such as the number of acres and the value of machinery and implements per farm, also by county.[39] We have, therefore, two cross sections to explore whether high school education was related to agricultural productivity by county, given county inputs and a measure of soil quality. We can also difference the two years to see if increased productivity was related to increased high school education, given input changes. The implicit framework, given by eq. (1), is a simple Cobb-Douglas production function in which output per farm (or per farmer), (Q/L), is a function of machinery per farm, (K/L), and land per farm, (T/L), each raised to the appropriate output elasticity ($, (). Education (E), as given by the fraction of adults (older than 20 years) with at least some high school or college education, and the various soil types (S_i) shift the production function.

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classically oriented than in the nation's large cities and than in Iowa in the years to come.

[38] The 1925 Iowa State Census is similar in certain respects to that for 1915, but did not ask income. It did inquire of education at various levels.

[39] The output measure in 1910 and 1920 is the value of crops produced per farm, whereas that for 1930 is the value of output sold per farm. The difference lies in the fact that most of the marketed output was in the form of animals and their products. The 1930 data provide the better output measure, but we cannot use it to produce the difference estimate in col. (3). We have verified that using the 1930 output and input data produces results virtually identical to those in col. (2). The number of farmers is nearly identical to the number of farms.

$$(Q/L) = A \cdot (K/L)^{b} \cdot (T/L)^{g} \cdot \exp^{a+\sum l_i S_i} \qquad (1)$$

We estimate eq. (1) in logs across the ninety-nine counties of Iowa for 1915 and 1925, and the results are given in Table 9, cols. (1) and (2). In both cases, the coefficients on the education variable are positive, statistically significant, and of consequential magnitude. Increasing the fraction of adults in the county who attended any high school or college by one standard deviation (0.0434) increases crop value per farm by 5.6 percent in 1915; similarly for 1925, increasing education by one standard deviation (0.0560) increases farm crop value by 5.2 percent.[40] The relationship, moreover, holds when we estimate the equation in difference form, as in col. (3).[41] Thus both the individual-level data for farmers (Table 7) and the county-level data (Table 9) indicate a strong positive connection between earnings or farm productivity, and education.

Much has been written about the role of education in enhancing agricultural productivity (Schultz 1964, Welch 1970; see also Huffman 1999).[42] Although the mechanisms are several, one stands out. In periods of technological change, the more educated are the first to be the adopters. High school and college educated Iowa farmers in the late 1920s and early 1930s adopted hybrid corn earlier than did other farmers (Ryan and Gross 1950). Although the diffusion of hybrid corn and the tractor came after 1915, many other important technological advances, such as fertilizers, electric and steam powered equipment, animal inoculation, and accounting techniques, swept the countryside before. Even though few high school educated Iowans in 1915 had been taught agricultural science, most had received instruction in algebra, geometry, biology, chemistry, and bookkeeping.

In sum, the returns to high school and college education in 1915 were substantial – about 11

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[40] The effects of schooling double in magnitude when the machinery variable is excluded from the regression.

[41] The change in the value of crops is from 1910 to 1920, but that for education is from 1915 to 1925. Although we would rather use the change in education preceding the change in crop values, we have no other data given the change in the farm production information in the 1930 census.

[42] Welch (1970), for example, emphasizes periods of technological change as affording an advantage to educated persons, particularly in agriculture.

percent per year for all males and more than 12 percent for younger male workers. Enhanced earnings with increased education at the secondary school level existed within broad classes of occupations. Blue-collar workers with a high school education earned substantially more than did other blue-collar workers, and the same was true, even more so, for white-collar workers. Farmers with secondary school or college training earned considerably more than did other farmers, and counties with a greater percentage of high school and college educated adults had higher agricultural productivity.

Returns to Education in the First Half of the Twentieth Century

It is now widely acknowledged that the return to years of secondary and college education was substantial in 1940 but that the decade of 1940s saw a marked reduction in the educational wage premium and a narrowing of the wage structure generally.[43] The "Great Compression" of the 1940s, as it has been dubbed, witnessed changes in the wage structure as wide-ranging and of as great a magnitude as those more recently experienced. But the changes were reverse in direction and occurred during a briefer period. One reason offered for the narrowing of the wage structure and the decrease in the educational premium in the 1940s is the large increase in the relative supply of educated workers in 1930s and 1940s. But secondary school expansion began much earlier and each successive year brought a new and even larger cohort of high school educated youth into the labor force. Even though the return to years of high school was substantial in 1940, it may have been even higher in 1915.

An estimate of the increase in educational attainment before 1950 has been hindered by data deficiencies. Given the overstatement of school years for older cohorts in the 1940 census, the increase in the educational stock derived from those data would be understated.[44] But, as Table 2 shows, we have direct evidence that the overstatement in the 1940 census is minimal for Iowa-born men, and we already

[43] See, for example, Goldin and Margo (1992), Juhn (1999), and Murphy and Welch (1993).

[44] Increases in the quality of education, mainly from an increase in the school term, reinforce the understatement in the growth of the educational stock. Note, however, that the school term in Iowa, even in 1900, was already nine months in most districts.

know that the bias is less for younger groups (Goldin 1998).

By using the Iowa data for 1915 and 1940, we can obtain a reliable estimate of the increase in the fraction of the male labor force with secondary schooling. In 1915, 17.4 percent of 25 to 40-year old men (14.8 percent of 25 to 65-year old men) in Iowa had graduated from high school (or went to college); in 1940, 36.5 percent (26.0 percent) – double the 1915 level – had, and by 1950 52.8 percent (39.1 percent) had. Given the expansion in high school across those years, the returns to secondary schooling may have declined, first from 1915 to 1940 and again in the 1940s.[45] The information in the Iowa State Census for 1915, together with that for Iowa residents in the 1940, 1950, and 1960 IPUMS, will allow us to evaluate whether the returns to post-elementary education were higher before 1940 than after.

Several data problems must first be addressed regarding comparability across the censuses. The 1940 federal census asked wage and salary income not self-employment income, whereas the 1915 Iowa State Census asked income from occupation without distinguishing between self-employment and wage and salary income. Fortunately, the 1950 and 1960 censuses contain separate data for the two income categories. By focusing only on the non-farm population in all years, we can eliminate a major group of the self-employed. But we are still left with potential problems of comparability between 1940 and the other years because relatively more college educated men were self-employed among the non-farm group. The results for 1950 and 1960 are, therefore, presented with and without the self-employed, and they will form the basis of our adjustments to the 1940 data to render them comparable with 1915. The 1960 census is included because education and earnings in 1950 are given for sample-line individuals only. The larger 1960 sample enables more precise estimates of the returns to education in Iowa.

Another data issue of importance concerns unemployment. The national unemployment rate was unusually high in 1939, which was toward the end of the Great Depression, but was moderate in 1914, 1949, and 1959 (the years of the census income question). We report the estimates of the educational returns for full-year workers in all censuses, but show (in Appendix Table A3) that the inclusion of part-

year workers greatly increases the return to education in 1939.

Finally, there is the issue concerning whether results using the Iowa data are representative of national trends. We find that educational wage differentials move similarly in Iowa and the United States from 1940 to 1960 (Goldin and Katz 1999a).[46] Even though Iowans did not have occupations that were fully representative of the national population and Iowans were more educated in the period under question, the trend in the variable of interest is similar for Iowa and the nation as a whole.

We summarize the educational return results in Table 10 for full-year, non-farm male workers in Iowa. Comparing the 1940, 1950, and 1960 results for wage and salary earners only, there is a decrease in the return to years of high school and to years of all schooling for the full age group (18 to 65-years old) and the younger group (18 to 34-years old). The decrease from 1940 to 1960 in returns to schooling are somewhat muted when the self-employed are included in the 1950 data.[47]

The most interesting comparison for the subject at hand is that between 1915 and the three later years. Returns to years of high school, college, and all schooling decreased from 1915 to 1950, and also from 1915 to 1960, using the comparable measures of income from both wage and salary and self-employment (Table 10, lines 1, 2, and 3). The decrease for years of high school is about 4 percentage points and that for years of all schooling is about 3 percentage points from 1915 to 1960. These declines are substantial and are about 35 percent of the 1915 level.

The comparison between returns to education in 1915 and 1940 of most important for our study since it is already well known that returns declined from 1940 to 1950. But the comparison is somewhat problematic. Self-employment income is included in the 1915 earnings measure but not in 1940. Ignoring these differences, for the moment, we find substantial declines, from 1915 to 1940, in the returns

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[45] The data on educational attainment use the version I definition in Table 1.

[46] U.S. data show a steeper decline of education returns from 1940 to 1950 than in Iowa. The national data also show a modest recovery in returns from 1950 to 1960, whereas the Iowa data reveal a continued but small decline. Changes in the overall 1940 to 1960 period are similar between the nation and Iowa for both high school and college returns. The small sample size for Iowa in 1950 leads us to rely on the 1940 to 1960 trend.

[47] One anomaly, relative to national data, is that the return to a year of college increases from 1940 to 1950 for the younger age group in Iowa, when self-employment income is excluded. The anomaly disappears when the

to high school, college, and all years of schooling (for full-year, non-farm male workers). The decline in the "all years of schooling" category is 2 to 2.5 percentage points; the others range from 0.8 for years of high school to 4.2 for years of college, both for the younger group (Table 10, rows 1 and 4).

But we cannot ignore the issue of self-employment income and have arrived at two methods of adjusting the 1940 results. Analysis of the 1950 and 1960 data reveals that returns to education are modestly greater when self-employment income is included in the earnings measure. We therefore adjust the estimates of returns to schooling in 1940 to account for the exclusion of self-employment income and present them in rows (7) and (8) in Table 10. The 1940 adjusted I estimates use an adjustment factor based on U.S. national estimates for 1950 and 1960 of differences in returns to education between all workers and wage and salary employees. The 1940 adjusted II estimates use an adjustment factor based on the 1960 data for Iowa.

The adjusted returns for 1940 are considerably lower than are those for 1915 in five of the six columns of Table 10. The one exception is the case of college years for all males, but, as noted before, this result may derive from the nature of colleges prior to 1900. We conclude, therefore, that substantial declines in the returns to post-elementary education in Iowa occurred from 1915 to 1940. Figure 2 illustrates the changes in returns to college and high school across the entire period, 1915 to 1960. The decline in education returns in Iowa is consistent with the sharp reduction in the white-collar wage premium nation-wide from 1914 to 1939 and also with its further collapse in the 1940s (Goldin and Katz 1995, 1999a).

An important caveat to our findings concerns unemployment. The summary data in Table 10 exclude, for each of the census years, those who worked fewer than fifty weeks. But education reduced the probability of unemployment and some of its return came through that route. When unemployment is relatively low, as was the case in 1914 and 1949, the effect of schooling in reducing unemployment increases the return to a year of schooling by only about 1 percentage point (see Appendix Table A3).

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sample is expanded to include neighboring states.

But in 1939 when unemployment was 17.2 percent nationwide, the premium to a year of schooling from reducing unemployment was between 4 and 5 percentage points or about a 60 percent increase.[48] Educational returns were greater in 1914 than in 1939 among full year workers. But the reverse holds when all workers experiencing unemployment over the year are included. Their inclusion, however, is not entirely justified since the unemployment risk was substantially greater in 1939 than in 1914.

One may wonder whether the large increase in high school educated youths from 1915 to 1960 led to a decline in their intrinsic ability and whether the increase in secondary school enrollments was accompanied by a decrease in educational performance. If so, the decline in the returns to education from 1915 to 1960 would come from differential selection or from reduced quality of education.

An exhaustive compilation of almost 30 separate large-scale studies of IQ test scores of high school students finds that, rather than declining, test scores increased from 1917 to 1942 (see Bishop 1989 for original citations). The increase should not be surprising since many rural youths who were not attending high school in the 1910s lived a considerable distance from the nearest school and many urban youths who were not in school were the children of recent immigrants. These teenagers were less constrained by ability than they were by circumstance. Evidence on achievement can be found in the history of the famed Iowa Test of Educational Development. Grades on the Iowa tests rose from the early 1940s, when the test first became statewide, to the late 1960s (Bishop 1989, figure 1). The evidence just cited suggests that the decrease in the rate of return to years of schooling was not caused by a decline in the ability of those who attended public high schools. Nor was it caused by a diminution in the content of high school education. Furthermore, among high school graduates continuing to college there was substantially less selectivity, measured by cognitive test scores, in the 1920s than in the 1930s and 1940s (Taubman and Wales 1972). Thus we suspect that there is *less* upward ability bias in estimates of returns to college and to high school in 1915 than there is for the 1940 to 1960 period. Therefore the decline in

[48] Nationwide the unemployment rate was 7.9 percent in 1914, 5.9 percent in 1949, and 5.5 percent in 1959 (U.S. Bureau of the Census 1975, series D 85).

the rate of return to education from 1915 to 1940 is not an artifact of a change in ability bias.

A related issue is whether our estimates can be interpreted as reflecting the causal effect of schooling on earnings rather than the effect of unmeasured "ability" differences among individuals with varying amounts of schooling. Individuals from Iowa's more elite families, for example, were more likely to attend high school and college and thus the estimated schooling effects could partially reflect the correlation of schooling with other labor market advantages. We find (as shown in Appendix Table A2) that the addition of controls for family background (such as church affiliation, national origin, and parental nativity) has almost no impact on the return estimates. The children of wealthier and more-educated parents were more likely to attend high school, but the vast majority of those attending Iowa's secondary schools in 1914 were from families that were not headed by a high school graduate nor an individual in a white-collar job (Goldin and Katz 1999). Recent studies that use plausibly exogenous sources of variation in schooling have found larger "causal" effects on earnings, for marginal workers affected by improved access to schooling, than those implied by OLS cross-section estimates.[49] Although we cannot rule out the possibility that ability bias afflicts the 1915 results, the literature using more recent data, as well as the evidence that there was less sorting across education levels by cognitive test scores in the earlier period, suggest that the overall bias may be modest.

Concluding Remarks

We have used a unique data set – the 1915 Iowa State Census – to estimate the returns to schooling on the eve of the "high school movement," the greatest transformation in the history of American education. We find substantial returns to a year of high school (and college) – on the order of 11 percent – and a large impact of secondary schooling on earnings for even blue-collar workers and farmers. Across all male workers, about half of the return to secondary school and college was gained

[49] Such sources of variation have included changes in compulsory schooling laws, interactions of compulsory schooling laws with quarter of birth, and geographic proximity to college. See Card (1999) for a careful survey of

within the sector or occupation; for those in white-collar occupations, almost all was garnered within occupations. Our finding on the premium to education for farmers is buttressed by an analysis of agricultural productivity by county for 1915 and 1925. In counties having a greater fraction of adults who had attended high school or college, agricultural productivity was markedly higher.

Comparisons with census data for Iowa in 1940, 1950, and 1960 reveal greater returns to years of schooling in 1915 with some qualifications due to substantial unemployment in 1940 and measurement issues regarding self-employment. Our estimate of the decrease in the return to years of education from 1915 to 1940 reinforces previous findings on wage ratios for occupations having different educational requirements.[50] We conclude from all these pieces of historical evidence that the return to education decreased sometime between 1915 and 1940 and then again during the "Great Compression" of the 1940s.

Given the substantial pecuniary returns to secondary and higher education in 1915 and their widespread nature across diverse sectors and occupations, it is no wonder that the high school movement took root at that moment in American history. With the increase in secondary schooling that swept the nation beginning around 1910, education narrowed the gap in its great "race" with technology. Technology advanced rapidly, but education appears to have been ahead at the halfway point of the twentieth century. More recently, however, the lead appears to have been lost and technology may have won the race at century's end.

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this literature.

[50] We have constructed a national time series for the earnings of "ordinary" white-collar workers (e.g., clerks, typists, stenographers, bookkeepers) by sex and occupation for 1895 to 1940. Relative to production workers in manufacturing, we find a marked decrease in the ratio around the late 1910s to early 1920s that remained in place for some time. These trends also hold for college professors, engineers, and as well as many blue-collar crafts, such as machinists and skilled printing tradesmen. See Goldin and Katz (1999a, 1995).

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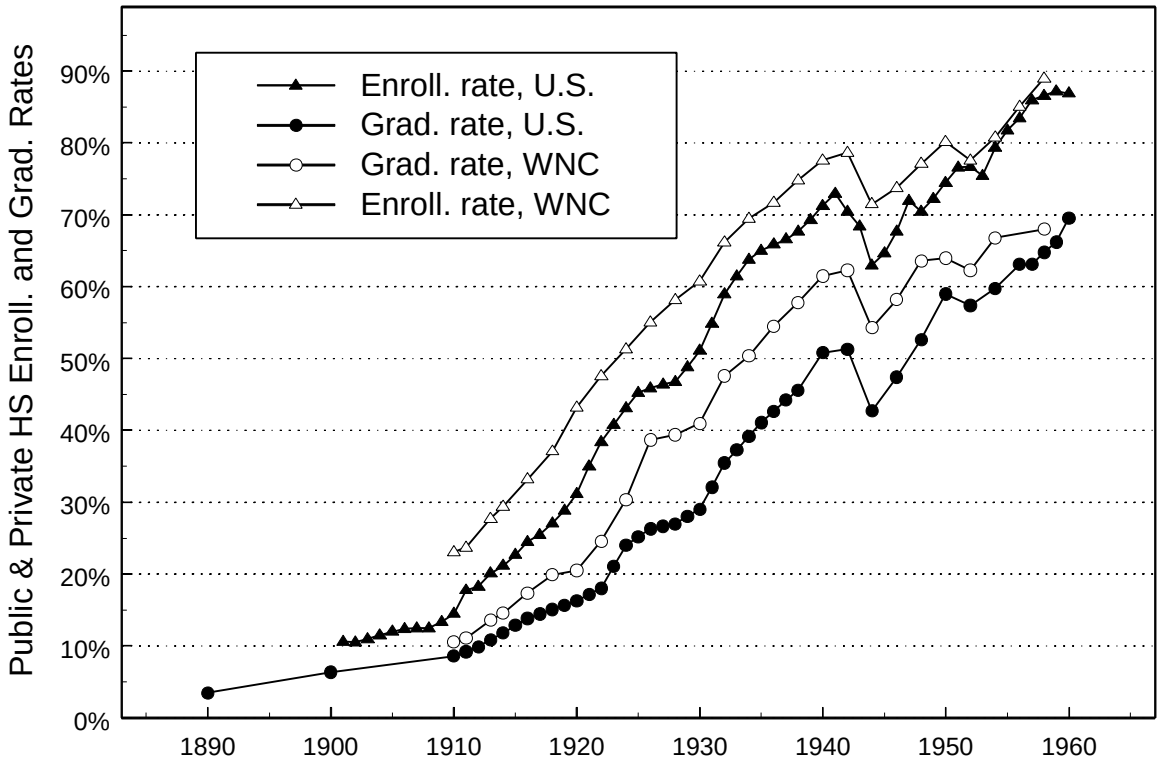

Figure 1: Public and Private High School Enrollment and Graduation Rates: United States and the West North Central Census Division, 1890 to 1960

Sources: U.S. Department of Education (1993); Goldin (1998); Goldin (forthcoming).

Notes: The enrollment rate divides the number of students enrolled in high school (grades nine through twelve) by the number of 14 to 17-year olds. The graduation rate divides the number of high school graduates by the number of 17-year olds. High schools include public schools, private schools, and the preparatory departments of colleges and universities. The West North Central census division includes the states of Iowa, Kansas, Minnesota, Missouri, Nebraska, North Dakota, and South Dakota. In the text, the "prairie states" are defined as those of the West North Central minus Missouri.

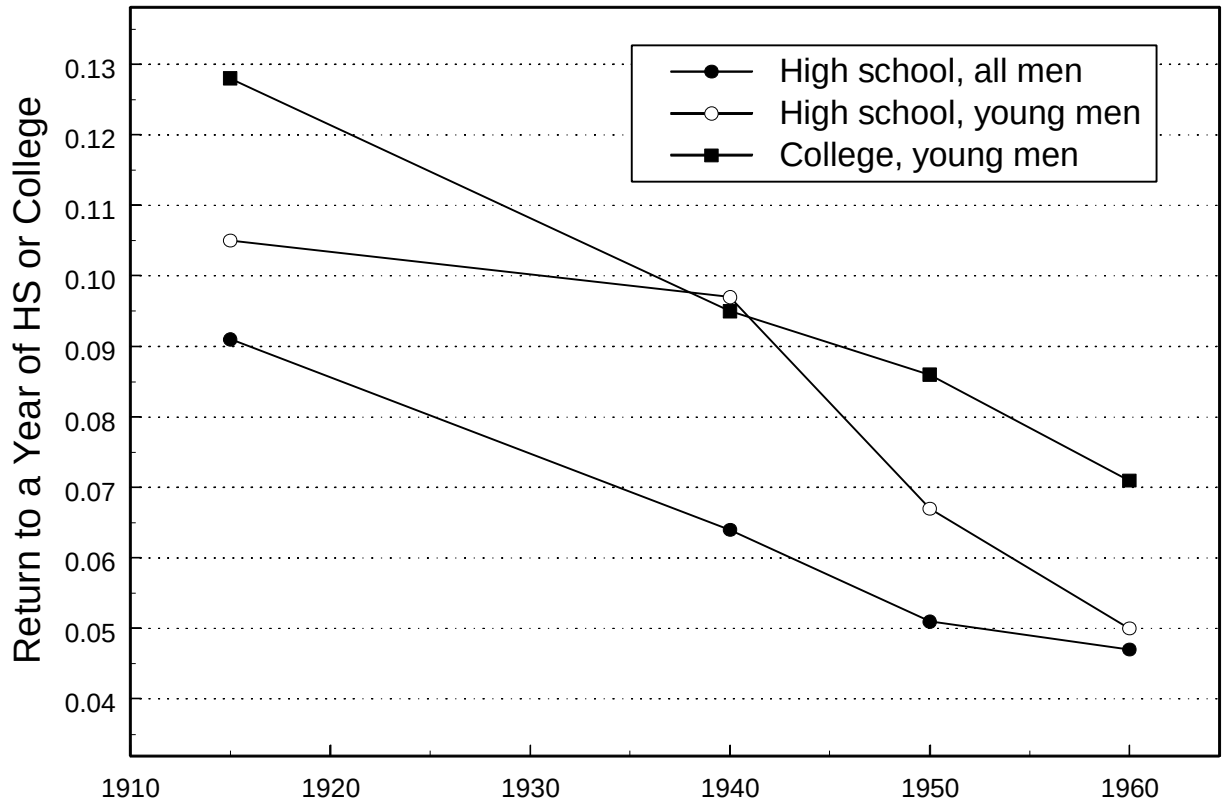

Figure 2: Returns to High School and College, Iowa 1915 to 1960

Source: Table 10, rows (1), (2), (3), and (7) for high school returns of all men and young men and for college returns for young men.

Table 1
Formal Schooling Indicators in 1915 Iowa and 1940 United States:
by Sex for 25 to 59 Year Olds

	Males, 25 to 59 years old		*Females, 25 to 59 years old*	
	1915 Iowa	*1940 United States*	*1915 Iowa*	*1940 United States*
Mean highest grade completed (I)	8.40		8.68	
Mean highest grade completed (II)	8.56	8.60	8.86	8.86
Average years of education	8.61		8.98	
Fraction with less than 8 years	0.235	0.311	0.185	0.278
Fraction with some high school (I)	0.233	0.410	0.290	0.462
Fraction with some high school (II)	0.379		0.446	
Fraction graduating high school (I)	0.152	0.248	0.179	0.287
Fraction graduating high school (II)	0.156		0.184	

Notes and Sources:

1915: Iowa 1915 sample (see Data Appendix). The assessors asked the "extent of education" in years, in common school, grammar school, high school, and college listed separately.

1940: IPUMS. The enumerators were asked to inquire "what is the highest grade of school completed." The instruction to the enumerators explains: "This question refers only to the education obtained in public, private, or parochial schools, colleges, or universities. Education obtained at vocational schools is not to be considered, unless such school or college was part of the regular school system. … Enter [college 1 through 5] whether or not the person was graduated from high school. For persons whose highest grade completed was in a junior high school, it will be necessary to ascertain the equivalent in terms of … grades." (ICPSR 1984, 6.40-6.41). The highest grade of school cannot exceed seventeen.

Mean highest grade completed [1915]: reconstructs the 1915 data to approximate the 1940 instructions to enumerators. In agreement with the 1940 census, the highest grade is truncated at seventeen. Consistent with the instructions to enumerators, if an individual attended eight years of grammar school and four years of college but no high school, for example, the individual received 16 years of schooling, rather than 12. For version (I) no individual in 1915 is given years of education beyond eight for the sum of common and grammar school years. For version (II) the cutoff is nine years.
Average years of education: the sum of years of schooling in the various school categories with a truncation at seventeen years.
Fraction with some high school [1915]: fraction with years of education equal to at least nine. Version (I) and (II) differ in the same manner as for *mean highest grade completed* [1915].
Fraction with some high school [1940]: fraction with highest grade completed equal to at least nine.
Fraction graduating high school [1915]: fraction with years of education equal to at least twelve. Version (I) and (II) differ in the same manner as for *mean highest grade completed* [1915].
Fraction graduating high school [1940]: fraction with years of education equal to at least twelve.

Table 2
Formal Schooling Indicators in 1915 and 1940: Males Born 1875 to 1890

	(1) *Iowa-born males, 25- to 40-years old in 1915*	(2) *Iowa-born males, 50- to 65-years old in 1940*
Mean highest grade completed	8.89	8.79
Average years of education	9.10	
Fraction with less than 8 years	0.172	0.237
Fraction with some high school	0.302	0.338
Fraction graduating high school	0.193	0.215
Fraction with some college	0.118	0.120

Notes and Sources:

1915: Iowa 1915 sample (see Data Appendix).
1940: IPUMS. See Table 1 for the instructions to the enumerators.

For definitions of the variables, see Table 1. Version (I) assumptions are used for 1915.

Table 3
Years of Schooling and by Type of Institution, Iowa 1915

Population 25 to 59 years old	*Years of schooling by type of institution*				*Total*	*Total, truncated*
	Common school	*Grammar school*	*High school*	*College*		
Entire sample	4.75	3.07	0.75	0.24	8.81	8.56
Males	4.82	2.89	0.64	0.28	8.63	8.40
Females	4.67	3.26	0.87	0.19	8.99	8.74
Native born	4.69	3.27	0.85	0.26	9.06	8.80
Iowa born	4.78	3.26	0.87	0.26	9.17	8.89
Foreign born	5.05	2.05	0.25	0.12	7.47	7.36
Male	5.07	1.96	0.28	0.18	7.49	7.38
Female	5.02	2.18	0.21	0.04	7.45	7.34
Arrived > 19 years	5.14	1.83	0.24	0.12	7.33	7.26
Urban sample	1.76	5.98	0.81	0.29	8.84	8.74
Rural sample	5.78	2.07	0.73	0.22	8.80	8.50

Source: Iowa 1915 sample (see Data Appendix).

Notes: "Years of schooling by type of institution" gives years in common, grammar, high school, or college respectively in each column. "Total" sums the years in each. "Total truncated" sums the years in each but truncates the sum of common and grammar school at nine years and high school at four years. "Arrived > 19 years" means that the individual came to the United States at age twenty or more. See text or Data Appendix for definitions of the "urban" and "rural" samples.

Table 4
School Attendance of 15 to 18 Year Olds, Iowa 1915

	Percentage of 15 to 18 year olds currently attending				*Percentage of those attending school during year*		
	common or grammar school	*high school*	*college*	*any school*	*fewer than 6 months*	*fewer than 4 months*	*listing an occupation*
All youths	28.2	23.8	2.0	54.0	15.9	5.9	8.9
Males	30.1	21.0	2.3	53.5	22.6	8.2	13.7
Females	26.2	26.6	1.7	54.6	9.3	3.7	4.1
Urban	23.8	24.7	4.2	52.7	5.1	1.9	5.5
Rural	29.3	23.6	1.5	54.8	18.6	6.9	9.7
Household head:							
Farmer	34.7	15.0	1.5	51.1	27.9	10.1	12.8
Blue-collar	26.5	26.7	1.5	54.4	7.9	2.9	7.5
White-collar	20.5	47.9	3.8	72.2	3.3	0.9	3.0

Source: Iowa 1915 sample (see Data Appendix).

Notes: "Household head" is generally the (presumed) father of the youth in question or the (presumed) mother if the former is not present in the household. See Data Appendix. "Farmer" indicates an occupation in agriculture.

Table 5
Occupations and Education: Iowa 1915

A. Educational distributions (percentage) by occupation, males and females 20 to 64 years old

	Common or grammar school	*Some high school*	*High school graduate*	*Some college plus*	*Mean years*
All employed	71.9	10.0	7.6	10.5	8.63
Blue collar, service	83.3	8.8	4.5	3.4	7.80
Craft	76.8	10.2	7.7	5.3	8.32
White collar	37.0	15.2	19.1	28.8	10.80
Professional	15.1	12.1	16.0	56.9	13.00
Managers	55.2	13.6	14.1	17.1	9.62
Clerical, sales	40.2	17.9	23.5	18.5	10.29
Farmers	87.0	7.0	1.7	4.3	7.82

B: Occupational distributions (percentage) by schooling, sex, and age

Schooling level	*20 to 64 years old*			*20 to 34 years old*		
	White collar	*Blue collar and service*	*Farmer*	*White collar*	*Blue collar and service*	*Farmer*
Males						
Common or grammar school	12.2	49.8	38.0	9.3	57.3	33.4
Some high school	33.2	41.1	25.6	29.1	47.3	23.6
High school graduate	58.3	32.0	9.7	57.1	33.6	9.3
Some college plus	67.4	16.6	5.9	63.8	20.8	15.4
Females						
Common or grammar school	29.1	61.1	9.8	33.8	62.8	3.3
Some high school	66.2	30.9	2.9	73.6	23.7	2.7
High school graduate	84.7	14.9	0.4	87.4	12.1	0.5
Some college plus	92.0	7.6	0.4	94.9	4.7	0.5

Source: Iowa 1915 sample (see Data Appendix).

Notes: Only those with positive occupational earnings for 1914 and legibly written occupations are used. Blue-collar occupations include those in craft, operative, service, and laborer occupations (codes 300 to 988 using the 1940 occupational classification). White-collar occupations include those in professional, semi-professional, managerial (excluding farming), clerical, and sales occupations (codes 1 to 45, and 100 to 299 using the 1940 occupational classification). Schooling level is based on highest grade completed using the version I definition of Table 1. Education categories represent the highest grade, or year in a type of school, completed.

Table 6
Returns to Education by Type of Schooling:
Males, 18 to 65 years old by Farm and Non-Farm Occupations

	Males, 18 to 65 years old					
	(1)	(2)	(3)	(4)	(5)	(6)
	All occupations		*Non-farm occupations*		*Farm occupations*	
Common school, years	0.0427		0.040		0.0375	
	(0.00269)		(0.00300)		(0.00555)	
Grammar school, years	0.0533		0.0647		0.0232	
	(0.00292)		(0.00304)		(0.00800)	
High school, years	0.103		0.102		0.114	
	(0.00448)		(0.00401)		(0.0146)	
College, years	0.103		0.106		0.132	
	(0.00604)		(0.00520)		(0.0254)	
Linear spline functions:						
Common school, years # 9		0.0452		0.0454		0.0322
		(0.00336)		(0.00352)		(0.00756)
Common school, years > 9		0.0291		0.00257		0.0462
		(0.00771)		(0.0111)		(0.0132)
Grammar school, years #9		0.0547		0.0685		0.0159
		(0.00340)		(0.00341)		(0.00941)
Grammar school, years > 9		0.0467		0.0233		0.122
		(0.0195)		(0.0175)		(0.0598)
High school, years #4		0.111		0.111		0.122
		(0.00491)		(0.00437)		(0.0163)
High school, years > 4		-0.0515		-0.0574		0.00817
		(0.0329)		(0.0318)		(0.0815)
Years of college ×		0.0958		0.0977		0.138
(if years of high school > 0)		(0.00729)		(0.00607)		(0.0408)
Years of college ×		0.0398		0.0532		0.0383
(if years of high school = 0)		(0.0172)		(0.0158)		(0.0547)
College but no high school,		0.265		0.290		0.231
dummy		(0.0491)		(0.0500)		(0.120)
Business school, dummy	0.379	0.371	0.393	0.381		
	(0.0850)	(0.0849)	(0.0705)	(0.0703		
Native born	0.222	0.214	0.178	0.162	0.262	0.259
	(0.0252)	(0.0252)	(0.0253)	(0.0253)	(0.0593)	(0.0593)
(Years in U.S. × 10^{-2}) ×	0.677	0.662	0.409	0.375	0.913	0.905
foreign born	(0.0923)	(0.0922)	(0.0943)	(0.0941)	(0.218)	(0.218)
R^2	0.199	0.202	0.256	0.262	0.209	0.211
Standard error	0.624	0.623	0.546	0.544	0.702	0.702
Number of observations	14,699	14,699	10,695	10,695	3,705	3,705

Source: Iowa 1915 sample (see Data Appendix).
Notes: Dependent variable is log (annual earnings). Sample excludes bottom 0.2 percent of the earnings distribution (less than $60) and is restricted to those out of school. Regressions also contain a quartic in potential experience, a race dummy, and a dummy variable for those missing "years in the U.S." Potential experience is defined as *min*(age – 15, age – years of schooling – 7). All regressions are weighted by urban and rural sampling weights (see Data Appendix for weighting information). Figures in parentheses are standard errors.

Table 7
Returns to Education by Type of Schooling:
Males and Unmarried Females, 18 to 34 Years Old

	18 to 34 years old Males			*18 to 34 years old Unmarried females*[a]
	(1) *All occupations*	(2) *Non-farm occupations*	(3) *Farm occupations*	(4) *All occupations*
Common school, years	0.0483	0.0375	0.0637	0.00714
	(0.00395)	(0.00442)	(0.00837)	(0.00877)
Grammar school, years	0.0693	0.0671	0.0568	0.0454
	(0.00421)	(0.00443)	(0.0110)	(0.00903)
High school, years	0.120	0.114	0.132	0.101
	(0.00564)	(0.00516)	(0.0176)	(0.00760)
College, years	0.146	0.143	0.166	0.151
	(0.00915)	(0.00799)	(0.0381)	(0.0122)
Business school, dummy	0.284	0.273		0.508
	(0.0988)	(0.0831)		(0.0969)
Native born	0.210	0.145	0.284	0.0422
	(0.0324)	(0.0330)	(0.0766)	(0.0765)
(Years in U.S. × 10^{-2}) × foreign born	1.14	0.497	1.78	0.0188
	(0.223)	(0.238)	(0.489)	(0.554)
R^2	0.251	0.296	0.241	0.273
Standard error	0.567	0.501	0.645	0.546
Number of observations	7,145	5,249	1,784	2,001

[a] "Unmarried" means single, widowed, divorced, or separated.

Source: Iowa 1915 sample (see Data Appendix).

Notes: Dependent variable is log (annual earnings). Sample excludes bottom 0.2 percent of the earnings distribution (less than $60) and is restricted to those out of school. Regressions also contain a quartic in potential experience, a race dummy, and a dummy variable for those missing "years in the U.S." All regressions are weighted by urban and rural sampling weights (see Data Appendix for weighting information). Figures in parentheses are standard errors.

Table 8
Returns to Education by Type of Schooling:
Males and Unmarried Females by Age and Occupational Groups (non-farmer)

	18 to 65 years old		*18 to 34 years old*		
	Males		*Males*		*Unmarried Females*[a]
	(1) *Blue-collar occupations*	(2) *White-collar occupations*	(3) *Blue-collar occupations*	(4) *White-collar occupations*	(5) *White-collar occupations*
Common school, years	0.0239	0.0275	0.0229	0.0438	0.00901
	(0.00314)	(0.00573)	(0.00450)	(0.00889)	(0.00975)
Grammar school, years	0.0585	0.0470	0.0634	0.0679	0.0396
	(0.00320)	(0.00591)	(0.00458)	(0.00909)	(0.0100)
High school, years	0.0740	0.0609	0.0908	0.0826	0.0666
	(0.00584)	(0.00566)	(0.00738)	(0.00747)	(0.00846)
College, years	0.0533	0.0783	0.0575	0.131	0.119
	(0.0151)	(0.00569)	(0.0195)	(0.00849)	(0.115)
Business school, dummy	0.441	0.202	0.452	0.0825	0.384
	(0.156)	(0.0776)	(0.180)	(0.0886)	(0.0899)
Native born	0.132	0.144	0.125	0.120	-0.810
	(0.0240)	(0.0653)	(0.0316)	(0.0940)	(0.233)
(Years in U.S. × 10^{-2}) × foreign born	0.454	0.309	0.570	0.762	-2.23
	(0.0981)	(0.211)	(0.249)	(0.569)	(1.23)
R^2	0.205	0.218	0.256	0.313	0.226
Standard error	0.506	0.539	0.484	0.478	0.491
Number of observations	7,588	3,733	4,021	1,744	1,248

[a] "Unmarried" means single, widowed, divorced, or separated.

Source: Iowa 1915 sample (see Data Appendix).

Notes: Dependent variable is log (annual earnings). Sample excludes bottom 0.2 percent of the earnings distribution (males earning less than $60; females earning less than $30) and is restricted to those out of school. Regressions also contain a quartic in potential experience, a race dummy, and a dummy variable for those missing "years in the U.S." All regressions are weighted by urban and rural sampling weights (see Data Appendix for weighting information). Blue-collar occupations include those in craft, operative, service, and laborer occupations (codes 300 to 988 using the 1940 occupational classification). White-collar occupations include those in professional, semi-professional, managerial (excluding farming), clerical, and sales occupations (codes 1 to 45, and 100 to 299 using the 1940 occupational classification). Figures in parentheses are standard errors.

Table 9
Farm Productivity and Education: Iowa Counties, 1915 and 1925

	Dependent variable: log (crop value per farm × 10^{-3}), 1910 or 1920 or difference			*Means*		
	(1) 1915	*(2) 1925*	*(3) 1925 - 1915 difference*	*(4) 1915*	*(5) 1925*	*(6) 1925 - 1915 difference*
Dependent variable				0.345	1.40	1.05
Log (machinery value per farm × 10^{-3}), 1910 or 1920 or difference	0.814 (0.0835)	0.820 (0.0533)	0.577 (0.102)	-0.834	0.343	1.177
Log (land in acres per farm × 10^{-3}), 1910 or 1920 or difference	0.130 (0.0928)	0.215 (0.0835)	0.104 (0.200)	-1.85	-1.84	0.00414
Fraction with any high school or college > 20 years old, 1915 or 1925 or difference	1.30 (0.270)	0.927 (0.165)	1.17 (0.432)	0.228	0.328	0.102
R^2	0.845	0.917	0.324			
Standard error	0.100	0.0821	0.116			
Number of observations	99	99	99			

Sources: Education variable is from State of Iowa (1916, 1926); all other variables in the table are from U.S. Bureau of the Census (1913a, 1923).

Notes: Years in column headings refer to the year of the educational information. Crop value, machinery value, and land in acres per farm are for 1910 in cols. (1) and (4) and for 1920 in cols. (2) and (3). Fraction with any high school or college is for 1915 in cols. (1) and (4), and 1925 in cols. (2) and (4). Regressions in cols. (1) and (2) also include four soil type dummies (Missouri loess, Iowa drift, Mississippi loess, and South Iowa loess), a dummy variable for Polk county (Des Moines), and a dummy variable indicating whether the county is on either the Mississippi or the Missouri rivers. The land types are from State of Iowa (1912, p. 670). Figures in parentheses are standard errors.

Table 10
Returns to Education for Full Year, Non-farm, Male Workers in Iowa:
1914, 1939, 1949, and 1959

Census year	*Years of high school*		*Years of college*		*Linear in all years of schooling*	
	18-65 years old	*18-34 years old*	*18-65 years old*	*18-34 years old*	*18-65 years old*	*18-34 years old*
(1) 1915	0.091	0.105	0.091	0.128	0.084	0.100
(2) 1950	0.051	0.067	0.073	0.086	0.054	0.069
(3) 1960	0.047	0.050	0.085	0.071	0.059	0.058
(4) 1940, wage and salary earnings only	0.064	0.097	0.081	0.086	0.064	0.075
(5) 1950, wage and salary earnings only	0.049	0.043	0.064	0.101	0.048	0.060
(6) 1960, wage and salary earnings only	0.040	0.049	0.064	0.057	0.046	0.050
(7) 1940, adjusted I	0.064	0.097	0.094	0.095	0.068	0.079
(8) 1940, adjusted II	0.071	0.098	0.102	0.100	0.077	0.083

Sources: Iowa 1915 Sample; 1940, 1950, and 1960 IPUMS.

Notes:
See Appendix Table A3 for standard errors, for the other schooling coefficients, and for the results in the unrestricted sample of all male non-farm workers. Coefficients listed for "years of high school" and "years of college" are those from a spline in years of education (1 to 8 years, 9 to 12 years, and 13 plus years) in a regression of (log) annual earnings. Coefficients listed for "linear in years of all schooling" are those from the sum of all years in school in a regression of (log) annual earnings. "Full year" is defined for 1940, 1950, and 1960 as more than 49 weeks of work; in 1915 it is defined as listing no unemployment. Controls in all regressions are: quartic in potential experience, whether native born, and whether white. Each of the samples deletes the lowest 1 percent of earners. The samples for 1940, 1950, and 1960 include only those living in the state of Iowa.

The estimates in rows (7) and (8) adjust for differences in education returns for all workers and for wage and salary workers. Row (7) uses a national adjustment factor, whereas row (8) uses an Iowa adjustment. The 1940 adjusted I estimates, row (7), take the 1940 wage and salary earnings estimates, row (4), and add an adjustment factor to account for the absence of self employment income for comparability with the estimates in row (1) for 1915. This adjustment factor, for each column, is constructed from U.S. national estimates (not reported) because the sample used here (for Iowa) is small, particularly for 1950. We take the difference in returns to each type of schooling for the entire U.S. sample and for the U.S. wage and salary sample, averaging the estimates for 1950 and 1960, and then add this adjustment factor to the 1940 estimates in row (4). The 1940 adjusted II estimates, row (8), use the differences in estimated returns in Iowa for the entire sample in row (3) and the wage and salary sample in row (6) as the adjustment factors in each column.

Appendix Table A1
Returns to Education for Different Sub-Samples:
18 to 65 Year Old Males, All Occupations, Iowa 1915

	(1) *All*	*(2)* *White, Native-born*	*(3)* *Foreign born*	*(4)* *Urban*	*(5)* *Rural*
Common school, years	0.0427	0.0420	0.0525	0.0602	0.0411
	(0.00269)	(0.00304)	(0.00607)	(0.00397)	(0.00383)
Grammar school, years	0.0533	0.0548	0.0491	0.0677	0.0412
	(0.00292)	(0.00331)	(0.00662)	(0.00374)	(0.00448)
High school, years	0.103	0.107	0.0538	0.120	0.103
	(0.00448)	(0.00471)	(0.0151)	(0.00468)	(0.00703)
College, years	0.103	0.113	0.0644	0.106	0.0986
	(0.00604)	(0.00656)	(0.0162)	(0.00609)	(0.00951)
Business school, dummy	0.379	0.383	0.184	0.277	0.169
	(0.0850)	(0.0874)	(0.366)	(0.0499)	(0.466)
Native born	0.222			0.148	0.272
	(0.0252)			(0.0271)	(0.0395)
(Years in U.S. $\times 10^{-2}$) $\times$ foreign born	0.677			0.228	0.912
	(0.0922)			(0.0993)	(0.145)
White	0.208			0.248	0.139
	(0.0550)			(0.0354)	(0.165)
Experience	0.123	0.124	0.128	0.123	0.127
	(0.00819)	(0.00875)	(0.0282)	(0.00870)	(0.0126)
Experience^2	-0.00544	-0.00557	-0.00573	-0.00624	-0.00543
	(0.000654)	(0.000714)	(0.00200)	(0.000705)	(0.00100)
Experience$^3 \times 10^{-2}$	0.0116	0.0121	0.0115	0.0143	0.0114
	(0.00199)	(0.00221)	(0.00557)	(0.00217)	(0.00303)
Experience$^4 \times 10^{-4}$	-0.00995	-0.0105	-0.00933	-0.0124	-0.00984
	(0.00202)	(0.00227)	(0.00528)	(0.00222)	(0.00307)
R^2	0.199	0.207	0.174	0.286	0.187
Standard error of the estimate	0.624	0.619	0.648	0.494	0.659
Number of observations	14,699	11,895	2,583	7,590	7,109

Source: Iowa 1915 Sample (see Data Appendix).

Notes: Dependent variable is log (annual earnings). A dummy variable indicating that "years in the United States" is missing is included in cols. (1), (4), and (5). All regressions are weighted by urban and rural sampling weights (see Data Appendix for weighting information). Standard errors are in parentheses. See also notes to Table 6.

Appendix Table A2
Sensitivity of Returns to Education Estimates to Alternative Control Variables:
18 to 65 Year Old Males, All Occupations, Iowa 1915

	Log (annual earnings)			
	(1)	*(2)*	*(3)*	*(4)*
Common school, years	0.0427	0.0320	0.0405	0.0357
	(0.00269)	(0.00250)	(0.00271)	(0.00264)
Grammar school, years	0.0533	0.0462	0.0446	0.0404
	(0.00292)	(0.00271)	(0.00299)	(0.00292)
High school, years	0.103	0.0846	0.0104	0.0953
	(0.00448)	(0.00417)	(0.00454)	(0.00443)
College, years	0.103	0.0972	0.0989	0.0919
	(0.00604)	(0.00559)	(0.00601)	(0.00585)
Business school, dummy	0.379	0.327	0.295	0.282
	(0.0850)	(0.0796)	(0.0846)	(0.0824)
Native born	0.222	0.171	0.211	0.192
	(0.0252)	(0.0234)	(0.0314)	(0.0306)
(Years in U.S. $\times 10^{-2}$) $\times$ foreign born	0.677	0.477	0.565	0.404
	(0.0922)	(0.0857)	(0.0982)	(0.0958)
White	0.208	0.161	0.205	0.189
	(0.0550)	(0.0508)	(0.0556)	(0.0541)
Experience	0.123	0.108	0.122	0.0869
	(0.00819)	(0.00759)	(0.00814)	(0.00806)
Experience^2	-0.00544	-0.00474	-0.00890	-0.00423
	(0.000654)	(0.000606)	(0.000650)	(0.000634)
Experience$^3 \times 10^{-2}$	0.0116	0.0102	0.0121	0.00978
	(0.00199)	(0.00184)	(0.00197)	(0.00192)
Experience$^4 \times 10^{-4}$	-0.00995	-0.00876	-0.0104	-0.00892
	(0.00202)	(0.00187)	(0.00200)	(0.00195)
Months unemployed		-0.132		
		(0.00232)		
Religious affiliation				
Jewish			0.403	0.352
			(0.770)	(0.0750)
Catholic			-0.00495	0.00926
			(0.0155)	(0.0151)
Lutheran			0.0378	0.307
			(0.0203)	(0.0198)
New England Protestant			0.105	0.0820
			(0.0243)	(0.0236)
Congregational			0.0731	0.0437
			(0.0367)	(0.0358)
Methodist			0.0961	0.0638
			(0.0193)	(0.0188)
Baptist			0.00661	-0.0348
			(0.0326)	(0.0318)
Other religious affiliation			0.105	0.0728
			(0.0189)	(0.0184)
Years in Iowa $\times 10^{-2}$			0.00317	0.00306
			(0.000481)	(0.000468)
Urban			0.128	0.130
			(0.0137)	(0.0133)
Married				0.343
				(0.0121)

	(1)	*(2)*	*(3)*	*(4)*
Parents' nativity (10 dummies)	no	no	yes	yes
R^2	0.199	0.316	0.213	0.254
Standard error of the estimate	0.624	0.577	0.619	0.603
Number of observations	14,699	14,639	14,699	14,699

Source: Iowa 1915 Sample (see Data Appendix).

Notes: Dependent variable is log (annual earnings). The omitted religion in cols. (3) and (4) is "religion not listed." A dummy variable indicating whether "years in the United States" was missing is included in all columns; cols. (3) and (4) also include whether "years in Iowa" was missing, and col. (4) includes whether marital status was omitted. All regressions are weighted by urban and rural sampling weights (see Data Appendix for weighting information). Standard errors are in parentheses. See also notes to Table 6.

Appendix Table A3
Returns to Education for Non-Farm, Male Workers in Iowa:
1915, 1940, 1950, and 1960

	18 to 65 years old						*18 to 34 years old*					
	1915	*1940, wage and salary*	*1950*	*1950, wage and salary*	*1960*	*1960, wage and salary*	*1915*	*1940, wage and salary*	*1950*	*1950, wage and salary*	*1960*	*1960, wage and salary*
	Full year, male non-farm workers											
Years of education	0.084 (0.0019)	0.064 (0.0042)	0.054 (0.0060)	0.048 (0.0062)	0.059 (0.0030)	0.046 (0.0028)	0.100 (0.0028)	0.075 (0.0069)	0.069 (0.010)	0.059 (0.011)	0.058 (0.0052)	0.050 (0.0051)
Spline in years												
1 to 8 years	0.063 (0.0046)	0.031 (0.013)	0.024 (0.019)	0.020 (0.019)	0.0051 (0.014)	0.0023 (0.012)	0.063 (0.0068)	-0.032 (0.024)	0.028 (0.043)	0.017 (0.043)	-0.0079 (0.029)	-0.0072 (0.028)
9 to 12 years	0.091 (0.0041)	0.064 (0.0078)	0.051 (0.011)	0.049 (0.011)	0.047 (0.0056)	0.040 (0.0052)	0.105 (0.0052)	0.097 (0.012)	0.067 (0.016)	0.043 (0.017)	0.050 (0.0097)	0.049 (0.0094)
13 plus years	0.091 (0.0061)	0.081 (0.0098)	0.073 (0.014)	0.064 (0.015)	0.085 (0.0057)	0.064 (0.0054)	0.128 (0.0085)	0.086 (0.013)	0.086 (0.020)	0.101 (0.021)	0.071 (0.0078)	0.057 (0.0076)
No. of observations	7799	2064	938	800	3439	2934	3788	866	368	333	1181	1093
	All, male non-farm workers											
Years of education	0.094 (0.0019)	0.102 (0.0046)	0.064 (0.0063)	0.056 (0.0065)	0.072 (0.0032)	0.061 (0.0033)	0.109 (0.0028)	0.126 (0.0075)	0.078 (0.011)	0.073 (0.012)	0.089 (0.0060)	0.084 (0.0060)
Spline in years												
1 to 8 years	0.074 (0.0040)	0.067 (0.012)	0.051 (0.020)	0.053 (0.020)	0.053 (0.013)	0.050 (0.013)	0.068 (0.0060)	-0.00044 (0.027)	0.147 (0.043)	0.157 (0.043)	0.116 (0.029)	0.112 (0.029)
9 to 12 years	0.109 (0.0044)	0.113 (0.0087)	0.072 (0.012)	0.070 (0.012)	0.062 (0.0060)	0.056 (0.0061)	0.125 (0.0056)	0.156 (0.012)	0.083 (0.019)	0.066 (0.020)	0.095 (0.011)	0.095 (0.011)
13 plus years	0.091 (0.0067)	0.110 (0.012)	0.059 (0.014)	0.036 (0.015)	0.090 (0.0064)	0.072 (0.0066)	0.129 (0.0094)	0.129 (0.015)	0.048 (0.021)	0.051 (0.023)	0.080 (0.0095)	0.070 (0.0096)
No. of observations	10698	3425	1295	1089	4642	3995	5251	1518	526	473	1692	1578

Sources: Iowa 1915 Sample; 1940, 1950, and 1960 IPUMS.

Notes: Coefficients for "years of education" are from a regression of (log) annual earnings on all years of education. In the 1940, 1950, and 1960 censuses, years of education is given as "highest grade completed." In the 1915 Iowa State Census, years of education is the (adjusted) sum of common school, grammar school, high school, and college years to approximate the 1940 U.S. population census measure of highest grade completed (see version I definition, Table 1). Years of education are truncated (top-coded) at 17 years in all the regression samples. Coefficients for the "spline in years" are also from a regression of (log) annual earnings. In 1940 and 1950 years in the various grades are inferred from "highest grade completed." In the 1915 Iowa State Census, years in each level are listed separately. "Full year" is defined for 1940, 1950, and 1960 as more than 49 weeks of work; in 1915 it is defined as listing no unemployment. Controls in all regressions are: quartic in potential experience, whether native born, and whether white. Potential experience in each sample is given by min(age – 15, age – years of education – 7). Each of the samples deletes the lowest 1 percent of earners. The samples for 1940, 1950, and 1960 include only those living in the state of Iowa. All regressions for 1915 are weighted by urban and rural sampling weights (see Goldin and Katz 1999b, Appendix for weighting information). Regressions for 1940 are weighted by the 1940 IPUMS sampling weights. Top-coded earnings in 1940 ($ $5,000), 1950 ($ $10,000), and 1960 ($ $25,000) are multiplied by 1.5. Standard errors are in parentheses.

DATA APPENDIX: The 1915 Iowa State Census Sample

The 1915 State Census of Iowa is a unique document. It is the first state and federal census to include information on education and income prior to the U.S. federal census of 1940. It contains considerable detail on other aspects of individuals and households, e.g., church affiliation, which was never asked in a federal census; wealth; years in the United States and in Iowa. The Iowa state census of 1915 is a complete sample of the residents of the state and the returns were written by census takers (assessors) on index cards, one for each individual. These cards were kept in the Iowa State archives in Des Moines and were microfilmed in 1986 by the Genealogical Society of Salt Lake City.

The census cards, see facsimile below, are sorted by county; the large cities (those having more than 25,000 residents) are grouped separately. Within each county or large city, records are alphabetized by last name and within last name by first name. The current project has sampled the records for three of the largest Iowa cities (Davenport, Des Moines, Dubuque). Counties that did not contain a city of more than 25,000 population in 1910 have also been sampled. The counties were chosen by grouping the 99 counties in Iowa into four equal units by education and then randomly taking three from each of the four groups. This procedure produced twelve counties and ten (Adair, Buchanan, Carroll, Clay, Johnson, Lyon, Marshall, Mitchell, Montgomery, and Wayne) have, thus far, been sampled. The ten conveniently span the geography of the state: Clay and Lyon in the northwest, Mitchell in the north central, Johnson and Buchanan in the east central, Marshall in the central, Wayne in the south central, Adair and Montgomery in the southwest, and Carroll in the west central.

Card No.	Name.....…..... Age .....
Sex: Male Female	County..... P.O. .....….....
Color	Town or Township .....…..... Ward .....
Marital Status	Occupation .....…..... Months in 1914 Unemployed .....
Months Schl. 1914	Total earnings for 1914 from occupation .....
Public ... High.... Private...College...	Extent of Education: Common ... yrs. Grammar school … yrs. High school .... yrs. College.... yrs.
Read	Birthplace ..... Do you own your home or farm? yes no
Write	Incumbrance on farm, home $….. Value of farm, home $….
Blind ... Deaf ... Insane ... Idiot ...	Milit. Service: Civil War .. Mexican .. Spanish .. Infantry.. Cavalry .. Artillery .. Navy .. State .. Regiment .. Company ..
If Foreign Born	Church Affiliation .....……...
Naturalized?	Father's Birthplace ..... Mother's Birthplace .....…...
Yrs IA... Yrs US...	Remarks ..... Signed .....……... Assessor

(1) Sampling strategy for the urban and rural samples and sampling weights

Urban Sample: In each of the cities about one-fourth of the films were purchased, distributed throughout the alphabet. We sampled every other name on each roll of microfilm chosen for the sample and entered only completed last names, e.g., the first name on a roll was not taken. If the cards did not go in alpha order, we attempted to re-alpha order.

Rural Sample: In each of the counties, one film (out of from four to seven, depending on the county) was purchased. We sampled all names on each roll of microfilm chosen for Buchanan, Carroll, Lyon and Marshall, and one-half of the names for Adair, Clay, Johnson, Mitchell, Montgomery, and Wayne.

All of the tabulations use sampling weights to reflect the differing sampling rates in the urban and

rural samples. The weighted tabulations are intended to be representative of the entire state of Iowa (except for individuals in the rural areas of counties containing large cities). Our "urban" sample contains 26,768 observations (including duplicates; see below) or 5.5 percent of Iowa's population in large cities, and the "rural sample" contains 33,305 observations (including duplicates) or 1.8 percent of the population in counties without large cities.

(2) Variables included

All variables on the census cards were taken for the data collection. These included (in order of recording on the card): card number, sex, color, marital status, months of schooling in 1914 by type of school (public elementary, private elementary, high school, college), whether individual could read and/or write, whether handicapped (blind, insane, deaf, idiot), if foreign born whether naturalized, years in Iowa and years in the United States, full name, age, address (county, post office, town or township, ward), occupation, months unemployed and total earnings from occupation for 1914, extent of education (years in common, grammar, high school, college), birthplace, whether person owned home or farm, incumbrance on and value of the same, military service, church affiliation, father's and mother's birthplaces, the assessor's name, and any remarks on the card.

(3) Family reconstitution

Entire households were surveyed, but because the cards were boxed alphabetically we can reconstitute only nuclear families in which all members have the same last name. Our interest was in grouping parents with their dependent children. The assessors numbered each of the cards, almost always in sequential order within a household. Additional information was provided by the address (of particular importance in the cities, although P.O. address was not given in Davenport), the places of birth of parents, and the assessor=s name. We used all these pieces of information to reconstitute the families, although we primarily used card number, last name, and address. Of those aged fifteen to eighteen in the rural county sample we matched 89.1 percent to an adult household head; we matched 78.7 percent in the large-city sample.

There are several reasons why we could not match all teenaged children to parents or guardians. Most important is that children and their guardians need not have had the same last name. Some children had been orphaned, some boarded with relatives to advance their education, and others boarded for reasons of work. The card of the parent could have been alphabetized incorrectly or the last name could have been misspelled. In two of the cities we also had complete addresses and the problem of misspelling would have been less important there. But because we skipped every other name, we could have missed parents whose last names were alphabetized differently from that of their children. The point is that there are many reasons, some pertaining to early twentieth century life and others having to do with late twentieth century data collecting, why all families could not be reconstituted.

(4) Duplicate cards

Because the census was taken over a period of time (although we do not know how long), individuals can appear more than once in the sample and we term these the "duplicates." In some cases, the origin of the "duplicate" is clear: the individual was in an asylum or at school and was counted in both places. In other cases, it seems evident that the individual moved or went through some other life transition, such as marriage. Certain ethnic groups (Russian Jews, for example) and blacks were most frequently counted twice, a likely result of their greater frequency of moving. We coded one record as the original and one as the "duplicate," and do not use the duplicated information in our sample. About 2 percent of the urban sample were "duplicates." Practically none of the "rural" sample was.