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Student abilities during the expansion of US education

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ABSTRACT

The US experienced two dramatic changes in the structure of education in a 50 year period. The first was a large expansion of educational attainment; the second, an increase in test score gaps between college-bound and non-college-bound students. This paper documents the impact of these two trends on the composition of school groups by ability and the importance of these composition effects for wages. The main finding is that there is a growing gap between the abilities of high school and college-educated workers that accounts for one-half of the college wage premium for recent cohorts and for the entire rise of the college wage premium between the 1910 and 1960 birth cohorts.

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1. Introduction

The twentieth century witnessed an extraordinary and well-documented expansion of education in the United States (Goldin and Katz, 2008). Fig. 1a illustrates this trend. For the birth cohorts born every 10 years between 1910 and 1960, it displays the fraction of white men in four exhaustive and mutually exclusive education categories: high school dropouts (< HS), high school graduates (HS), those with some college but not a 4-year degree (SC), and college graduates with at least a 4-year degree (C+). Of the men born in 1910, only one-third finished high school. By the 1960 cohort, high school graduation had become nearly universal and the median man attended at least some college.²

At the same time that high school completion and college enrollment were expanding, there was also a systematic and less well-known change in who pursued higher education. The general trend was for education to become more meritocratic, with ability and preparation becoming better predictors of educational attainment. This paper builds on the earlier work of Taubman and Wales (1972) to provide systematic evidence by comparing the standardized test scores for those who stop their education with a high school degree (the HS group) and those who continue to college (the SC and C+ groups). Fig. 1b plots the average percentile rank of these two groups against the birth cohort; as is explained in Section 2, each pair of data points represents the results of a separate study. The trend is striking. For the very earliest cohorts, college-bound high school seniors scored just ten

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E-mail addresses: lutz@lhendricks.org (L. Hendricks), todd.schoellman@gmail.com (T. Schoellman).¹ Tel.: +1 919 966 5328.² These data are derived from 40-year olds in the 1950–2000 population censuses. Throughout this paper, “1910–1960 cohorts” can be read alternatively as “forty-year olds in years 1950–2000”. Descriptive facts use cohorts born at 10 year intervals to match with the 10 year intervals between censuses. For more details on the construction of the data in Fig. 1, see the appendix.

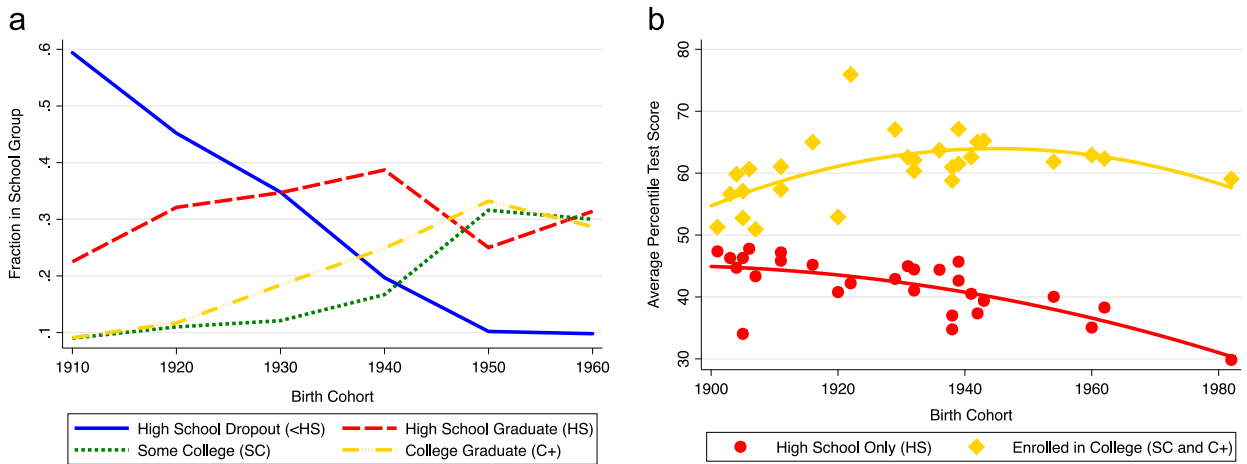


Fig. 1. Changes in US Education in the twentieth century. (a) The expansion of education. (b) Changes in test scores by college-going. *Note:* Figure (a) shows the fraction of each cohort obtaining less than a high school degree (< HS), a high school degree only (HS), some college (SC), or a college bachelor's or more (C+). Figure (b) shows the mean percentile test score of those who obtain a high school degree (HS) as compared to those who start college (SC and C+, pooled).

percentage points higher than non-college-bound seniors; by the 1940s cohorts, that gap had grown to nearly thirty percentage points.

The main idea of this paper is that these trends are likely to have changed the ability composition of students by educational attainment. For example, it is unlikely that the ability of high school dropouts is the same for the 1910 and 1960 cohorts, given that more than half of the 1910 cohort dropped out but less than ten percent of the 1960 cohort did. Likewise, the ability of college graduates is likely to have changed given the large expansion of college enrollment and the changes in how college students are selected.

The primary motivation for studying composition effects is to understand their importance for the evolution of wage patterns over the course of the twentieth century. The main results concern two well-known features of the college wage premium. First, the college wage premium rose by 15 percentage points between the 1910 and 1960 cohorts.³ Second, the current college wage premium is 50 percentage points, which is difficult to reconcile with the low college completion rate in human capital models.⁴ This paper finds that changes in the composition of student abilities by educational attainment between the 1910 and 1960 cohorts can explain quantitatively the entire rise in the college wage premium while simultaneously making it easier to reconcile the current college wage premium with human capital theory.

To fix ideas, the average log-wage of workers with a particular educational attainment is considered to be a function of the price of skills specific to that education group and the quantity of those skills the average worker provides. The quantity is in turn determined by workers' cognitive abilities and the human capital they acquire over the course of their lives. Much of the previous literature seeking to explain the college wage premium holds the quantity of skills fixed and focuses on reasons why skill prices may have changed – for example, due to skill-biased technological change.⁵ The analysis in this paper allows either component of wages to change. The primary challenge is that while mean wages are observed directly, the other terms – skill prices, human capital, and ability – are not. This problem is addressed through the use of standardized test scores, which are treated as observed, noisy proxies for cognitive ability. Test scores make it possible to disentangle the role of cognitive ability from the other two factors. The methodology used does not allow one to separate skill prices from human capital.

A simple model of school choice with heterogeneous ability formalizes the challenge. The model also shows that the quantitative impact of composition effects on wages is controlled by two parameters. The first governs how strongly sorted the different school groups are by ability; more sorting means larger gaps in mean ability between school groups. The second parameter governs the mapping from ability to wages; a higher value for this parameter means that a given gap in mean abilities has larger implication for wages. The model is taken to the data in two steps.

First, the model is calibrated to the National Longitudinal Study of Youth 1979 (NLSY79) (Bureau of Labor Statistics, 2002). The NLSY79 is a representative sample of cohorts born around 1960 that includes information on their wages, education, and test scores. The NLSY79 provides two key moments: the relationship between wages and test scores, and the degree of educational sorting by test scores. An introductory analysis follows the previous economic literature and considers

³ The reported magnitude of the rise varies considerably in the literature, for at least two reasons. First, studies define the “high school” and “college” groups differently. The rise is larger if “college” includes advanced degrees, or if “high school” includes high school or college dropouts (Goldin and Katz, 2008; Heathcote et al., 2010). Second, the rise in the skill premium is affected by the age or potential experience at which it is measured. The rise was greater for younger or less experienced workers than for middle-aged workers (Autor et al., 2008).

⁴ See for example Heckman et al. (2006) and Heckman et al. (2008), who also propose an alternative explanation.

⁵ This is the view espoused in Katz and Murphy (1992), Bound and Johnson (1992), Autor et al. (1998), and Goldin and Katz (2008). Bound and Johnson (1992) and the survey of Levy and Murnane (1992) propose other explanations including international trade or migration.

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