Human Capital Versus Signaling Models:
University Access and High School Dropouts

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ABSTRACT

Under the educational sorting hypothesis, an environment in which some individuals are constrained from entering university will be characterized by increased pooling at the high school graduation level, as compared to an environment with greater university access. This results because some potential high school dropouts and university enrollees choose the high school graduate designation in order to take advantage of high ability individuals who are constrained from entering university. This is in stark contrast to human capital theory which predicts higher university enrollment, but identical high school dropout rates in regions with greater university access. I test the contradictory high school dropout predictions of the human capital and signaling models using NLSYM and NLSYW education data from the late 1960s and early 1970s. I find that labor markets that contain universities have higher high school dropout rates. This result is consistent with a signaling model, and inconsistent with a pure human capital model.

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1. Introduction

Within a human capital framework, education augments natural abilities that are subsequently sold in the labor market. While agreeing with this description, supporters of sorting models argue that education also acts as a signaling, or screening, device for unobservable ability. More specifically, firms infer ability from education and students choose an education level to signal their ability to potential employers. The earnings reward for high school graduation is therefore the combined effect of human capital accumulation as well as the effect of being identified as a graduate rather than a dropout.

In this paper I develop, and test, a simple signaling model in which some fraction of the population is constrained[1] from entering university. I show that increasing university access, by expanding the university system and thereby lowering the cost of post-secondary education, may increase the high school dropout rate. As some previously constrained, but relatively high ability, students leave the high school graduate group to become university enrollees, the incentive to hide behind the remaining "constrained" high school graduates is diminished. As a result, the most able "unconstrained" high school graduates enroll in university and the least able drop out of high school. This is in stark contrast to a pure human capital model which predicts only an upward movement in educational attainment.

Despite the importance of the debate surrounding human capital and sorting interpretations, empirical evidence is fairly limited and often unconvincing. The difficulty largely arises because many of the empirical implications of the basic human capital and sorting models are similar or identical. This is not particularly surprising since the firm and worker

[1] The term "constrained" is used to convey the idea that the cost of going to university is too high for some fraction of the population to pay. Since it is significantly cheaper to attend a local university, "access" is said to be higher in areas that have a university. In other words, the cost of attending university is much lower for people living in areas with universities, and enrollment is therefore higher.

decision processes are the same in both models. Firms weigh the productivity of workers with different amounts of schooling against the wages they command, and select the education mix that maximizes profits. At the same time, workers compare wages to education costs and choose the schooling level that maximizes wealth (or utility).

To avoid this problem, Riley (1979) takes advantage of the fact that within a sorting framework extra information about worker productivity reduces the importance of education as a signal. He divides workers into jobs with and without observable productivity, and tests whether education is less important in jobs where productivity is observable. Although Riley's results are consistent with a sorting model, they are also compatible with the view that his two samples simply consist of workers in more and less risky occupations.

Using a somewhat different approach, Wolpin (1977) estimates separate earnings functions for self-employed and privately employed workers in the NBER-Thorndike sample. He finds that average schooling is lower among the self-employed, but that education has a larger impact on their earnings. Since the self-employed enjoy average earnings that are one-third higher in each of the educational categories, it seems reasonable to conclude that the amount of schooling required to attain each earnings level is lower for the self-employed. Wolpin's results provide some support for the sorting hypothesis.

An alternative approach, employed by Lang and Kropp (1986), is to look at the comparative statics properties of the models. Lang and Kropp consider the effect of a compulsory attendance law in the presence of educational sorting. Under a sorting model, an increase in the minimum school leaving age will increase the educational attainment of individuals not directly affected by the rule change. A rise in the school leaving age from s to $s+1$ will be accompanied by a decrease in the average ability level of people with $s+1$ years of education. As this happens, the most able people with *s*+1 years of education will choose to remain in school for *s*+2 years and so on. In contrast, under the human capital model a change in the minimum schooling age will only alter the behavior of directly affected individuals. Using school enrollment data and compulsory attendance laws across U.S. states from 1910-70, Lang and Kropp (1986) show that the enrollment rates for individuals with schooling levels beyond those directly affected by compulsory attendance laws did in fact rise with minimum leaving age requirements.

Departing from previous work, but following most closely in the spirit of Lang and Kropp (1986), this paper considers the role of university access in educational attainment decisions. Access refers to the presence of a university, and not to admission. Within a symmetric information (standard human capital) framework, local universities and satellite campuses provide lower cost post-secondary alternatives, and consequently increase university enrollment. While fewer barriers to higher education will increase university enrollment within an asymmetric information (signaling) framework, it might also increase the high school dropout rate. If fewer high ability people are constrained from entering university, the high school graduate[2] skill pool is reduced, and the incentive to obtain the high school graduate designation is diminished. The least able graduates therefore become dropouts and the most able enroll in university.

Using National Longitudinal Survey of Young Men (NLSYM) and Young Women (NLSYW) data for men aged 14-19 in 1966 and women aged 14-19 in 1968, I investigate the role that university access plays in schooling decisions. This time period is well suited to this

[2] Throughout this paper I use high school dropout to describe any individual not completing grade 12, high school graduate to identify any individual who completes high school but does not enter university, and university enrollee to describe a person with some university training.

study because there was substantial variation in university access, and the NLSYM and NLSYW report the presence of a university in the respondent's local labor market.

The remainder of the paper is as follows. The next section sketches a simple theoretical framework. Section 3 details the empirical approach. Section 4 discusses the NLSYM and NLSYW data. Section 5 presents the results. Section 6 concludes.

2. The Determinants of Degree Choice

2.1 A Simple Asymmetric Information Framework

Consider a simple environment in which ability (θ) is continuously distributed and the distribution of ability and the probability of constraint are common knowledge, but only individuals know their actual ability and whether or not they are constrained. I initially assume that the probability an individual is constrained from entering university, $1-p$, is independent of ability.[3] The implications of relaxing this restriction are discussed later in this section. For expositional convenience, and with no loss of generality, I ignore any human capital accumulation associated with education.[4] Finally, I assume that employers can observe schooling, but not ability, output, or whether an individual was constrained from entering university, and therefore pay workers with education level s the average product (ability) of group s. In this environment, just as in the human capital framework, people choose the

[3] With imperfect capital markets, a student might be constrained from entering university if he does not live near a university and his parents lack the financial resources to board him at an out of town school. This description is clearly stronger than it needs to be; university participation will obviously be higher in areas that have a university since the marginal cost of attending university is substantially lower if you can live with your parents while in school. In other words, some fraction of the population will choose to attend university even if expensive private, or distant universities are the only option, while another proportion of the population will choose to attend only if a university exists in their local area.

[4] The notation also blurs all lifecycle wage components, but θ can be viewed as the discounted value of lifetime ability.

education level that maximizes their lifetime wealth, discounted lifetime wages less the cost of education.

The framework presented in this section is a generalization of the standard signaling model (Spence 1973 and Stiglitz 1975). There are three schooling choices (s): drop out of high school (d), graduate from high school (h), or enroll in university (u). Schooling costs, $C_s(\theta)$, are a continuous decreasing function of ability and are increasing in educational designation. Education costs must be paid in order; a university enrollee must pay the high school graduation cost as well as the university enrollment cost.

Within this framework, a separating equilibrium with three distinct education groups, and cutoffs for group membership at θ_h and θ_u, must satisfy the following break point conditions:

$$E(\theta \mid \theta < \theta_h) = \phi(\theta) - C_h(\theta_h)$$
$$E(\theta \mid \theta \geq \theta_u) = \phi(\theta) + C_u(\theta_u)$$

where

$$\phi(\theta) = \frac{[F(\theta_u) - F(\theta_h)]E(\theta \mid \theta_h \leq \theta < \theta_u) + (1-p)[1 - F(\theta_u)]E(\theta \mid \theta \geq \theta_u)}{[F(\theta_u) - F(\theta_h)] + (1-p)[1 - F(\theta_u)]}$$

is the expected wage of high school graduates, $E(\theta \mid \theta < \theta_h)$ is the expected wage of high school dropouts, $E(\theta \mid \theta \geq \theta_u)$ is the expected wage of university enrollees, F() denotes the cumulative distribution function, and f() denotes the probability density function. Notice that this is a non-standard separating equilibrium since the high school graduate group contains people with ability in excess of θ_u who are constrained from entering university. Such a separating equilibrium satisfies the intuitive criterion,[5] as well as other standard refinements, since all signals are sent in equilibrium by some type. Although the assumption of a separating equilibrium is somewhat restrictive, and Spence (1974) shows that Nash behavior is not sufficient to rule out pooling, empirical evidence clearly proves that any model that does not give rise to some sorting can be rejected.[6]

Proposition: If we begin in a stable separating equilibrium, greater university access leads to more high school dropouts.

The intuition behind the proposition is very simple. As constraints fall, the movement of previously constrained individuals with skills above θ_u into the university enrollee group reduces the high school graduate skill pool, encouraging the least able graduates to drop out. The changing education choices are particularly easy to see diagrammatically. For illustrative purposes, suppose that skills are uniformly distributed and that we begin in a separating equilibrium with cutoffs for education group membership at θ_h and θ_u. Individuals in the shaded region in the top half of Figure 1 are free to choose any level of education, while people in the unshaded area are constrained from entering university. It is the people above θ_u that make this a non-standard equilibrium; the people in the shaded area beyond θ_u enter university, but those in the unshaded area beyond θ_u are constrained from doing so and are forced to leave at high school graduation. Stated somewhat differently, the high school graduate group consists of the entire unshaded region beyond θ_h as well as the shaded region between θ_h and θ_u. This means that the graduate skill pool is substantially greater than would otherwise be the case.

Now consider an increase in university access, or an increase in p. The bottom half of Figure 1 illustrates the equilibrium education choices after an increase in university access (an

[5] See Cho and Kreps (1987).
[6] Rothschild and Stiglitz (1976) and Riley (1979) prove that a Nash equilibrium might not exist if the concentration of low ability types is too low, but Riley (1985) and Dickens and Lang (1985) show that this possibility is not important in practical terms.

increase in the shaded area). Individuals beyond θ_u, and above the hatched line, become university enrollees and thereby reduce the high school graduate skill pool. This in turn induces the most able, and unconstrained, graduates to enroll in university (those in the shaded region between θ'_u and θ_u) and the least able graduates to become dropouts (individuals between θ_h and θ'_h). In other words, the cutoffs for education group membership shift inward. The net result is an abandoning of the middle; more university enrollees and more high school dropouts.

The Proposition can be more formally shown by totally differentiating the equilibrium conditions and solving simultaneously to obtain:

$$\frac{d\theta_h}{dp} = \frac{\phi_p(\phi_h + \gamma_u)}{\gamma_h\gamma_u - \phi_h\phi_u}$$
$$\frac{d\theta_u}{dp} = \frac{\phi_p(\phi_h + \gamma_h)}{\gamma_h\gamma_u - \phi_h\phi_u}$$

where, ϕ_h, ϕ_u, and ϕ_p are the partial derivatives of $\phi(\theta)$ with respect to θ_h, θ_u, and p, and where

$$\gamma_h = \frac{\partial E(\theta \mid \theta < \theta_h)}{\partial \theta_h} - \phi_h + \frac{\partial C_h(\theta_h)}{\partial \theta_h} \quad \text{and} \quad \gamma_u = \frac{\partial E(\theta \mid \theta \geq \theta_u)}{\partial \theta_u} - \phi_u - \frac{\partial C_u(\theta_u)}{\partial \theta_u}.$$

A reduction in the proportion of constrained individuals leads to more high school dropouts.[7] Local stability ensures that $\gamma_h\gamma_u - \phi_h\phi_u < 0$. A decrease in the proportion of the population that is constrained (an increase in p, holding all else constant) leads to an exodus of high ability graduates to the university enrollee group and therefore lowers the high school

[7] In contrast, the sign of $\frac{d\theta_u}{dp}$ is ambiguous.

graduate skill pool ($\phi_p < 0$). Finally, the assumption that *p* is independent of ability guarantees that $\phi_h + \gamma_h > 0$ by ensuring that $\frac{\partial E(\theta \mid \theta \geq \theta_u)}{\partial \theta_u} > \phi_u$. Hence we conclude that $\frac{d\theta_h}{dp} > 0$.[8]

The analysis is somewhat more complicated if the probability of constraint is a function of ability, $1 - p(\theta)$. However, as long as the probability of constraint is a decreasing function of ability and is non-zero for the most able, both before and after the constraint is eased, the Proposition continues to hold.

Assuming that all ability types have some probability of constraint, an increase in university enrollment that results from better university access may come from two sources: previously constrained and previously unconstrained people. Access therefore has an ambiguous impact on the university enrollee skill mean. While the previously unconstrained people moving into the university enrollee group are less able than the university enrollees they are joining, the skill mean of previously constrained movers depends on the probability of constraint and educational cost functions. In contrast, those moving from the high school graduate group to the dropout group are more skilled than the initial high school dropouts, and hence unambiguously raise the average skill level. Given the potential exodus of both the most and least gifted high school graduates, the impact on the graduate skill mean is also ambiguous.

It might appear that high school dropouts in high access regions have an incentive to graduate from high school and then look for work in low access areas where high school graduates are more highly paid. There are a couple of points that one should bear in mind. First, employers can observe the institution from which a job applicant graduated. If there are differences between `locals' and `non-locals' employers can use this information to sort workers.

[8] Note that this comparative static result refers to a small change in *p*. If there are multiple equilibria, a large change in *p* might induce a shift to a different equilibrium.

Second, if students in high access regions take the behavior of students in low access areas into account when choosing an education level, fewer people will dropout of high school in these regions than if they fail to incorporate this information. The dropout estimates presented in this paper might therefore be viewed as a lower bound.

2.2. The Standard Symmetric Information Framework

The predictions of a standard, symmetric information, human capital model differ substantially. Within in this framework, reducing the barriers to higher education will increase university enrollment, but will have no impact on the high school dropout rate. An increase in access to local universities will bring the cost of higher education within range for some proportion of previously constrained individuals, and thereby encourage higher university enrollment. It will not, however, have any impact on the high school dropout rate, or the university enrollment rate of unconstrained people.

It might seem that university access rate differences might alter the number of people in each education category, and thus the return to a specific degree. However, since regions are relatively small, there is a free flow of goods across regions, and we are concerned with the variation in access at a point in time, the return to education will be the same across regions under the human capital hypothesis.[9] Even if the return to education differs across access levels, the human capital model is consistent with a higher school dropout rate only if college enrollees are substitutes for high school graduates but complements with high school dropouts.[10] Grant (1979), as reported in Hamermesh and Grant (1979), is the only study that estimates the labor

[9] Even if goods and factors do not move perfectly, Lang and Kropp (1986) show that changes in school policy will not have a significant impact on people not directly affected by the policy. The analysis presented in this paper uses local labor market (based on 1966 county definitions) data, whereas Lang and Kropp (1986) use state level data. It

substitutability using more than two education groups. Defining education groups as those with 0-8, 9-12, and 13+ years of education, Grant (1979) finds that college enrollees are substitutes for both high school dropouts and graduates. Studies breaking education into only two categories, regardless of break-point, also find that more and less educated workers are substitutes. Examples include, Johnson (1970) using college versus high school graduates, Welch (1970) using college graduates versus some college, Dougherty (1972) using 9+ versus -8, and Berger (1983) using 0-15 versus 16+ years of education. These results are not consistent with a human capital model generating more high school dropouts in areas with university access.

In contrast to the skill pool predictions of the signaling model, the human capital model predicts a decrease in the mean skill level of high school graduates, no change for high school dropouts and an ambiguous change for university enrollees. The high school dropout skill mean is unchanged since there is no entry or exit. Conversely, higher access decreases the graduate skill pool by encouraging the most able graduates to become university enrollees.   Finally, access has no impact on the university skill mean if the probability of constraint is independent of ability, but more generally, it depends on the form of the constraint probability.

3. Empirical Implementation

The model presented in Section 2 offers two specific testable predictions that differ across signaling and human capital models. Or more precisely, it offers two alternative ways to test the same prediction. First, the signaling model predicts a higher high school dropout rate in regions that contain a university while the human capital model predicts no difference. Second, the

is even less likely that differences in educational category sizes would give rise to differences in the return to schooling levels across local labor markets.

signaling model predicts a higher skill pool among dropouts in regions with a university and the human capital model does not.

The United States during the late 1960s offers a good opportunity to test the predictions of the signaling model across university access levels. During this era approximately 30% of the population lived in labor markets that did not contain a university. The NLSYM and NLSYW data, described in the next section, allow us to investigate the differences in educational decisions made by youth with and without access to a university, controlling for family background.

3.1. Educational Attainment

Following from the simple model outlined in the previous section, I assume that people choose membership in one of three education groups (*s*): high school dropouts (*d*), high school graduates (*h*), and university attendees (*u*). While this is clearly a simplification, it captures the essence of the problem and is necessary for tractability. Since choosing between education groups is a single decision among ordered alternatives, it can easily be estimated as an ordered probit model.

Within the framework of a standard ordered probit model, individual *i* chooses to be a high school graduate if

$$\frac{\kappa_h - \sum_s \beta_s X_{is}}{\sigma} < \theta_i < \frac{\kappa_u - \sum_s \beta_s X_{is}}{\sigma}$$

where θ_i is a standard normal variate, κ_h and κ_u are the cut points that induce individual *i* to drop out of high school or enroll in university, and X is a vector of family background and regional characteristics.

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[10] I am indebted to two anonymous referees for making this point.

As is well known, σ is not identified in the ordered probit model described above. I follow standard practice and normalize σ to one and then interpret the coefficient estimates as relative to this variance term. This model also produces standardized cut points κ_h and κ_u which are assumed to be the same for all individuals in the sample (Specification 1).

The form of the κ's is the crucial issue. Since the existence of a local university (*A*) may alter an individual's choice set, either by opening up new educational options or by changing the return to an existing option, the cut points are a function of university access. More specifically, the signaling model presented in the last section predicts that the high school dropout/graduate cut point should be a positive function of access. In contrast, within a human capital framework, university access should have no statistically significant effect on the dropout/graduate cut point. I therefore modify the standard ordered probit model to allow for the possibility that access may shift the cut points, and that the effect might differ across the two cutoffs.

$$\kappa_h = \overline{\kappa}_h + \xi_h A$$
$$\kappa_u = \overline{\kappa}_u + \xi_u A$$

where $\overline{\kappa}_h$ and $\overline{\kappa}_u$ are constant across individuals and access.

This is a relatively straight forward extension of the standard model, however, there is an identification problem. It is not possible to identify all of the parameters if university access is included in *X*, and each cut point is allowed to be an independent function of *A*. There are two obvious identification strategies. First, university access could be excluded from *X*, so that access simply shifts the cut points (Specification 2). This is attractive because it allows university access to enter the dropout/graduate and graduate/university enrollee cut points with different magnitudes. Alternatively, we could allow university access to enter *X* and the cut points, but restrict access to have the same impact (but of opposite sign) on both cut-points[11] (Specification 3). More specifically, we could restrict the model such that

$$\begin{aligned} \kappa_h &= \overline{\kappa}_h + \xi A \\ \kappa_u &= \overline{\kappa}_u - \xi A \end{aligned}.$$

Since there is no a priori reason to restrict university access to have the same impact on both cut points, all results reported in this paper are for Specification 2. However, all results are similar using Specification 3. Further, a likelihood ratio test rejects the standard ordered probit (Specification 1), with no university access measure in *X*, in favor of either Specification 2 or 3 with p-values of less than 0.01 under all access definitions.

3.2. The Skill Level within Education Groups

The NLSYM and NLSYW include scores for the *Knowledge of the World of Work* test, which has been used by both Card (1995) and Griliches (1977) as a measure of ability. Using this information it is possible to examine how education group mean test scores vary across university access.

$$KWW_{is} = \alpha_0 + \alpha_1 A_{is} + Z_{is}\alpha_{2s} + \upsilon_{is}$$

where *Z* is a vector of family and individual characteristics and *s* denotes education group.

4. Data

The data used in this paper are drawn from the National Longitudinal Surveys of Young Men (NLSYM) and Young Women (NLSYW). The NLSYM began in 1966 with 5225 men aged 14-24 and continued with follow-up surveys through 1981. The NLSYW began in 1968 with 5159 women aged 14-24 and continued through 1993. As the primary

[11] In fact, any pre-specified function of access would be identified.

variable of interest (access to a local university) is only reported in the base year, I limit the sample to individuals aged 14-19 in the base year in order to measure access as accurately as possible. Restricting the sample in this manner is important for two related reasons. First, the rapid expansion of the university system during the 60s and 70s might lead to significant measurement error if the access measure refers to access 6 or 8 years after schooling decisions are made. Secondly, university access information was only collected in 1966 (1968), for the labor market of residence in that year. This data is therefore less likely to correspond to the labor market of residence when educational decisions were made the older the individual was in 1966 (1968). Restricting the sample in this manner leaves 3203 men and 2693 women. Summary statistics are reported in Table 1.

Education is defined as the highest grade completed in any survey year. For example, a person who does not report years of education in 1981, but reported 14 years in 1980, is assigned 14 years of schooling.[12] This method of measuring years of education reduces missing observations. Since I am interested in initial education decisions and not the decision to return to school later in life, an individual must complete grade 12 by age 20 to be considered a high school graduate,[13] and enter university by age 22 to be considered a university enrollee. The average man has 13.3 years education while the average woman has only 13.0. The male/female education gap is largely due to university participation differences; 47% of men, but only 33% of women attended university.

In the 1966 (1968) baseline interview, respondents were asked numerous family background questions. Individuals were asked their mothers' and fathers' years of education, but

[12] I exclude individuals who do not complete grade ten because it is unclear how they arrived at educational decisions.
[13] This definition also reduces the probability of mixing high school graduates who completed their education at a high school and people receiving high school equivalency diplomas.

unfortunately a relatively large fraction (approximately 15%) of the sample have missing values for these variables.[14] The respondents were also asked if either parent was an immigrant; 4.5% and 4.1% of men report an immigrant father and mother respectively while the corresponding rates for women are 3.7% and 3.3%. Family status at age 14 is also reported in both surveys; 88% of men and 81% women lived with both parents at age 14.

The baseline survey also asked a series of questions about the respondent's local labor market. The Census Division (CD) of residence and community size (city, suburb, or rural) are reported for all individuals. Most importantly, the NLSYM and NLSYW report the existence of several types of post-secondary educational institutions in the respondent's local labor market. In order to check the robustness of the estimates to the access definition, I define four different access measures and report all estimates under each of the four definitions. Access definitions include the presence of: a public two or four year degree granting institution, a public four year degree granting institution, a two or four year degree granting institution, and a four year degree granting institution. There was substantial variation in university access: 62% (58%) of men (women) lived in a labor market containing a public two or four year university and only 52% (48%) of men (women) had access to a public four year institution.

Finally, the baseline data also includes *Knowledge of the World of Work* (KWW) and IQ test scores. Unfortunately, the IQ test-instrument differed across schools and states. All analysis presented in this paper is therefore restricted to the KWW test which was administered to all respondents in the base year of the survey. The male version of this test consists of twenty-eight questions about job activities in ten occupations, the educational requirements for these

[14] I use two approaches to deal with this problem, I run all regressions with the complete data set assigning mean fathers' and mothers' education to those with missing values (and include dummies too indicate imputed data) as well as simply excluding people who do not report parental education information.

occupations, and the relative earnings of eight paired occupations. The KWW test for women was a shorter version of the same test.

Although I report the results for the KWW scores by education group, a better ability measure, such as an IQ score from a standardized test instrument, would clearly be preferable. Thus, while the results presented in section 5.2 are supportive of the main results reported in section 5.1, they are best viewed as suggestive rather than conclusive given the weakness of the KWW test.

5. Results

5.1. Educational Attainment

Before turning to the formal analysis, it is helpful to compare the distribution of educational attainment for individuals living in labor markets with and without a university. The bottom of Table 1 reports the percentage of people in each education group across university access. If access is defined as the presence of a two or four year public institution, 20.5% of men and 17.3% of women drop out of high school in labor markets without access compared to 22.3% and 21.3% in regions with access respectively. However, differences in educational attainment levels do not prove that university access plays a role since we have not controlled for regional, family, or individual characteristics that clearly influence schooling choices. The remainder of this section therefore focuses on more formally exploring the role that university access plays in determining educational decisions, holding other factors constant.

Table 2 reports the ordered probit estimates allowing university access to enter the high school dropout/graduate and graduate/university enrollee cut points independently (Specification 2). All regressions include dummy variables indicating residence in a city in 1966 (1968), residence in a suburb in 1966 (1968), race being black, immigrant father, immigrant mother, household subscribed to a newspaper when the respondent was 14 years of age, someone in the household had a library card when respondent was 14, eight indicators for census division in the base year, father's and mother's years of education, and number of siblings.[15]

The coefficient estimates, presented in Table 2, generally have the expected signs. Parental education, the presence of a newspaper in the home, and access to a library card, all have a positive impact on the probability that an individual stays in school longer. Conversely, family size and residence in an inner city increase the probability that an individual will leave school early.

Most importantly, university access enters the high school dropout/graduate cut point positively, and is statistically significant at conventional levels under most access definitions. In other words, university access increases the probability that an individual chooses to be a high school dropout. Table 3 reports the predicted education group sizes under all access definitions. The predicted high school dropout rate in labor markets with access is 0.8-1.3 percentage points, or 4.2%-7.0%, higher for men and 0.8-4.4 percentage points, or 4.7%-31.4%, higher for women compared to labor markets without access, depending on the access definition. To the extent that area of residence is endogenous and families with university-bound children choose to reside in areas with a university, these estimates understate the high school dropout increase associated with university access.

The impact and statistical significance of access on the dropout/graduate cut point differs across access measures for men and women. This likely reflects differences in program/degree preferences between men and women during the late 1960s and early 1970s. Training for `good'

[15] To check the robustness of the estimates to sample definitions, all regressions were also run excluding observations with missing parental education data. The results are robust to this sampling restriction and are

female jobs, such as nursing, teaching, and more technical office jobs was more likely available at two-year colleges. It is not, therefore, surprising that the female estimates are more sensitive to the definition of access. Further notice that the estimates are more precise when access is defined as a local public university. This is exactly as one would expect. It is more likely that `constrained' individuals can gain access to a local public institution compared to a private university.

One might also wish to control for ability. Adding the KWW score to the independent variable list does not substantially alter any of the results, and are therefore not reported. The statistical significance of all coefficients are largely unchanged, as are coefficient magnitudes and the probabilities of opting for various education groups.

To check that model specification is not driving the results I also ran all regressions using Specification 3. The estimates, including the access measure coefficients and the predicted educational group sizes, are similar in all cases. Further, the flavor of the results is also similar using a standard probit model, with the two education choices being dropout of high school or high school graduation and beyond.

Table 4 presents a variety of specification and robustness checks. Columns 1-3 for men, and column 1 for women[16], add the unemployment rate,[17] labor demand index,[18] and market size[19] combined with the unemployment rate respectively. The impact and statistical significance of the university access measure in the high school dropout/graduate cut point is similar to previous specifications in all cases.

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therefore not reported.

[16] Fewer variables are reported for women.

[17] The NLSYM and NLSYW report local unemployment rates for 1967-70. The unemployment measure in Table 4 is the average for the available years.

[18] This index ranges from 0-73, with higher numbers reflecting greater labor demand. The labor demand index in Table 4 is the average for the available years, 1967-70.

Table 5 replicates Table 2 with the addition of the father's Duncan socioeconomic index[20] to the list of regressors and the replacement of university access in the cut points with an interaction between access and the socioeconomic index. This index ranges from 0-100, with larger numbers reflecting higher socioeconomic status as computed by occupation and industry codes.[21] I use this index rather than parental income or education to avoid sample size reduction due to missing information. The results are again similar; having a father with a higher Duncan index increases the probability of staying in school longer, but the interaction of access and the socioeconomic index also shifts the dropout/graduate cut point to the right. Finally, the first two panels of Table 6 repeat Table 4 with the addition of the socioeconomic index and the second two panels exclude the socioeconomic index and interact access with father's education.[22] Once again the results are similar.

5.2. The Skill Level within Education Groups

The signaling model presented in Section 2 also predicts that the skill pool will be greater among high school dropouts in labor markets with university access, as compared to labor markets without access. This is supported by the raw average test score differences for high school dropouts. Table 1 reports a 2.5 (3.3) percentage point higher mean for male (female) high school dropouts with university access than without.

Table 7 reports the average KWW test score differential for regions with and without access, controlling for observable factors. Controlling for family background and observable characteristics, the average score for a male dropout is 1.9%-3.6% higher in regions with

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[19] The size of the labor force for the repondents' labor market is reported in thousands for the 1960 Census. The mean labor market has 622,000 workers.
[20] The Duncan index for the women's sample is reported for the head of the household.
[21] For a detailed description of the index see Duncan (1961).

university access. In contrast, there is no statistically significant relationship between university access and KWW scores for women in any education group. The difference between the male and female versions of the KWW test instrument is the most likely explanation for this result. The female test instrument is very coarse; it consists of only 10 questions, while the male version has 28.

6. Discussion

While a pure human capital model predicts higher university attendance in regions containing a university, it predicts no difference in the high school dropout rate. In contrast, signaling allows for the possibility that higher university access may actually discourage high school graduation. Using data from the late 1960s and early 1970s, I find that areas with universities did indeed have higher post-secondary participation, from 10%-15% higher, depending on access definitions and gender. At the same time, high school dropout rates were also 4%-31% higher in areas with university access. To put this in context, the percent increase in high school dropouts is at least 33% of the percent increase in university enrollment.

Although fewer people are constrained from entering university today than twenty years ago, there remain individuals who are unable to attend university due to geographic or financial barriers. Coming at this from a somewhat different perspective, many European countries use selective education systems that effectively bar a large percentage of the population from entering university. Although a human capital model clearly predicts that these types of rigidities influence the choice set, and earnings, of individuals directly affected, the results

[22] Individuals who do not report their father's years of schooling are assigned the mean.

presented in this paper suggest that they might also influence the decisions of people not directly affected.[23]

Further, as it becomes easier for more able individuals to distinguish themselves from less able individuals, wages become more meritocratic. In other words, as constraints decline, or higher education becomes more accessible, wages more closely reflect productivity. This is an important finding for social policy. Although increased university access is often touted as part of the prescription to improve the lives of the `less' fortunate, the results presented in this paper suggest that increased university access might increase education and wage dispersion, and result in lower earnings power for the less able.

[23] In a similar vein, Betts (1998) shows that a higher educational standard can increase the earnings power of both the most and least able, even though the behavior of the least able is unaffected.

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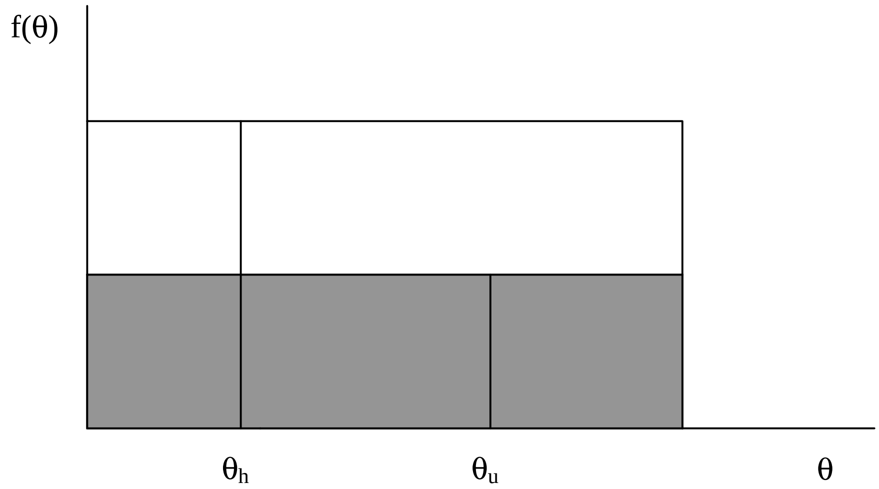
Figure 1. Uniformly Distributed Ability

Before Constraints are Eased



After Constraints are Eased

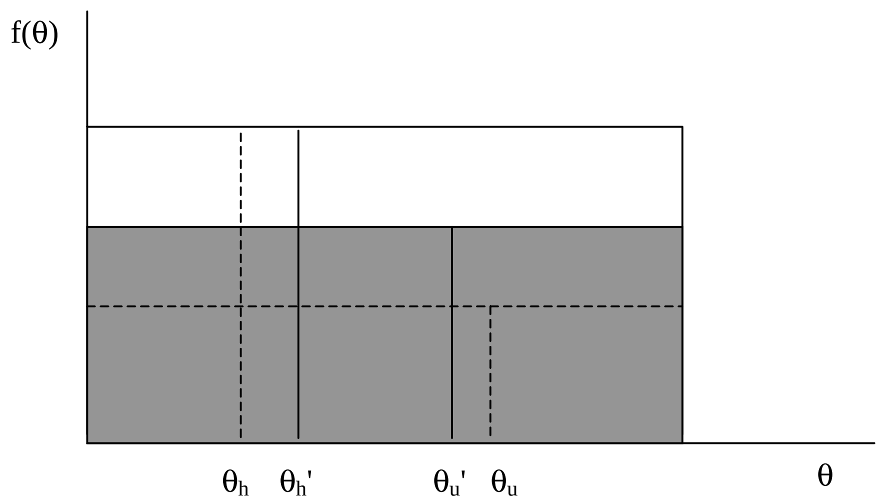


Table 1. Descriptive Statistics

	Entire Sample		Men		Women	
	Men	**Women**	**Access**	**No Access**	**Access**	**No Access**
Age Distribution (%)*						
14-15	37.2	28.7	37.0	37.6	27.8	31.2
16-17	36.9	36.5	36.3	37.9	38.1	35.5
18-19	25.9	34.8	26.8	24.5	34.0	33.4
Regional Distribution (%)*						
Northeast	20.5	19.9	23.9	14.9	23.8	8.2
Midwest	26.5	28.2	27.6	24.8	27.6	28.6
South	39.9	38.3	23.7	23.7	27.3	51.7
West	13.1	13.6	24.8	36.6	21.4	11.5
Residence in (%)*						
Inner-City	33.9	35.9	44.0	17.6	47.7	13.6
Suburb	32.4	30.2	33.9	29.9	32.2	22.6
Rural	33.7	33.9	22.1	52.5	20.1	63.8
University Access in Local Area (%)						
2 or 4-year public university	61.6	58.0	100.0	0.0	100.0	0.0
4-year public university	51.8	47.9	84.1	0.0	82.5	32.7
2 or 4-year university	80.6	77.5	100.0	49.6	100.0	18.7
4-year university	69.9	66.5	84.5	38.5	89.2	0.0
Family Structure at Age 14 (%)						
Mother and Father	83.8	77.5	82.7	85.4	75.1	80.7
Average Parental Education						
Mother's Education	10.6	10.7	10.6	10.4	10.8	10.5
Father's Education	10.3	10.6	10.6	10.0	10.9	10.0
Black (%)	29.3	29.1	31.1	26.2	31.6	25.8
Newspaper at Age 14	87.0	86.1	88.9	83.8	88.2	83.2
Library Card at Age 14	70.2	72.0	74.3	63.8	77.3	64.8
Father is an Immigrant	3.9	3.0	5.2	1.9	4.4	1.2
Mother is an Immigrant	3.5	2.7	4.5	1.9	3.7	1.3
Average Number of Siblings	3.4	3.6	3.3	3.5	3.6	3.7
Average Score on KWW Test (%)						
High School Drop-outs	50.4	57.0	51.3 *	48.8	58.2 *	54.9
High School Graduates	55.3	70.2	55.7	54.7	70.5	70.0
University Enrollees	61.8	79.1	62.4	60.8	80.0	78.1
Mean Years of Education	13.3	13.0	13.4	13.2	13.1	13.0
Distribution of Education Choices (%)						
High School Droup-outs	21.6	19.6	22.3	20.5	21.3 *	17.3
High School Graduates	30.9	47.8	28.5	34.6	44.5	52.2
University Enrollees	47.6	32.6	49.2	44.9	34.2	30.5
Sample Size	3203	2693	1972	1231	1563	1130

* In 1966 for men and 1968 women. Access (in the last 4 columns) is defined as the presence of a 2 or 4-year public degree-granting institution. The raw difference between high school drop-out outcomes for labor markets with and without university access are statistically significant at the 1% (***), 5% (**) and 10% (*) levels.

Table 2. Ordered Probit Estimates (Specification 2)

	Men				Women			
Access Measure	**Public 2 & 4-Year**	**Public 4-Year**	**2 & 4-Year**	**4-Year**	**Public 2 & 4-Year**	**Public 4-Year**	**2 & 4-Year**	**4-Year**
Father's Education	0.0634	0.0636	0.0632	0.0633	0.0634	0.0637	0.0634	0.0633
	(0.0082)	(0.0082)	(0.0082)	(0.0082)	(0.0090)	(0.0091)	(0.0090)	(0.0090)
Mother's Education	0.0725	0.0723	0.0723	0.0725	0.0914	0.0911	0.0912	0.0915
	(0.0095)	(0.0095)	(0.0095)	(0.0095)	(0.0104)	(0.0104)	(0.0104)	(0.0104)
Immigrant Father	0.3633	0.3578	0.3617	0.3579	0.5272	0.5254	0.5261	0.5262
	(0.1306)	(0.1307)	(0.1306)	(0.1307)	(0.1521)	(0.1519)	(0.1520)	(0.1521)
Immigrant Mother	0.2977	0.3011	0.2947	0.2960	0.1923	0.1957	0.1918	0.1884
	(0.1390)	(0.1390)	(0.1392)	(0.1392)	(0.1561)	(0.1561)	(0.1561)	(0.1561)
Black Indicator	-0.0621	-0.0590	-0.0663	-0.0644	0.1091	0.1086	0.1052	0.1002
	(0.0583)	(0.0584)	(0.0582)	(0.0582)	(0.0637)	(0.0636)	(0.0637)	(0.0634)
Number of Siblings	-0.0275	-0.0272	-0.0277	-0.0273	-0.0258	-0.0265	-0.0264	-0.0261
	(0.0090)	(0.0090)	(0.0090)	(0.0090)	(0.0099)	(0.0099)	(0.0099)	(0.0099)
Newspaper*	0.3404	0.3422	0.3411	0.3419	0.3185	0.3204	0.3156	0.3173
	(0.0680)	(0.0680)	(0.0680)	(0.0680)	(0.0725)	(0.0725)	(0.0725)	(0.0725)
Library Card*	0.2387	0.2394	0.2348	0.2343	0.1307	0.1306	0.1285	0.1258
	(0.0505)	(0.0505)	(0.0505)	(0.0505)	(0.0557)	(0.0556)	(0.0556)	(0.0556)
Mom and Dad*	0.1722	0.1746	0.1757	0.1757	0.1913	0.1906	0.1937	0.1951
	(0.0674)	(0.0674)	(0.0675)	(0.0675)	(0.0788)	(0.0789)	(0.0788)	(0.0788)
City	-0.2462	-0.2441	-0.2553	-0.2623	-0.1683	-0.1708	-0.1848	-0.2070
	(0.0588)	(0.0588)	(0.0585)	(0.0609)	(0.0616)	(0.0610)	(0.0617)	(0.0638)
Suburb	-0.0850	-0.0846	-0.0906	-0.0989	-0.0918	-0.0909	-0.0985	-0.1147
	(0.0571)	(0.0576)	(0.0575)	(0.0594)	(0.0602)	(0.0604)	(0.0609)	(0.0616)
Drop/Grad Cut Point								
Kappa H	0.7892	0.8031	0.7677	0.7892	0.8229	0.8489	0.7559	0.8676
	(0.1520)	(0.1509)	(0.1564)	(0.1534)	(0.1687)	(0.1680)	(0.1748)	(0.1712)
University Access	0.1248	0.1318	0.1142	0.1068	0.1851	0.1627	0.2127	0.0762
	(0.0592)	(0.0575)	(0.0715)	(0.0641)	(0.0650)	(0.0630)	(0.0774)	(0.0681)
Grad/Univ Cut Point								
Kappa U	1.8873	1.8793	1.9348	1.9287	2.4561	2.4330	2.5188	2.4915
	(0.1533)	(0.1527)	(0.1568)	(0.1549)	(0.1722)	(0.1718)	(0.1771)	(0.1748)
University Access	-0.0772	-0.0677	-0.1264	-0.1322	-0.0621	-0.0368	-0.1375	-0.1270
	(0.0525)	(0.0514)	(0.0632)	(0.0576)	(0.0586)	(0.0576)	(0.0686)	(0.0626)
Log-Likelihood	-3020	-3019	-3020	-3018	-2509	-2512	-2507	-2512
N	3203	3203	3203	3203	2693	2693	2693	2693

* These variables are household attributes at age 14. All models also include Census Division of residence at age 14 and missing parental education indicator variables. The standard errors are in parentheses.

Table 3. Predicted Educational Group Sizes

	Men		Women	
Education Groups	**Regions Without Access**	**Regions With Access**	**Regions Without Access**	**Regions With Access**
Access is defined as a public 2 or 4 year degree granting institution				
High School Drop-outs	18.5 **	19.8	15.8 ***	18.5
High School Graduates	34.2	28.3	51.5	45.0
University Enrollees	47.3	51.9	32.7	36.5
Access is defined as a public 4 year degree granting institution				
High School Drop-outs	18.9 **	19.7	17.0 ***	17.8
High School Graduates	33.8	27.5	50.3	44.9
University Enrollees	47.3	52.8	32.7	37.3
Access is defined as a 2 or 4 year degree granting institution				
High School Drop-outs	18.0	19.6	14.0 ***	18.4
High School Graduates	36.5	29.2	54.6	45.7
University Enrollees	45.5	51.2	31.4	35.9
Access is defined as a 4 year degree granting institution				
High School Drop-outs	18.6 *	19.6	17.2	17.5
High School Graduates	35.9	28.3	51.6	45.8
University Enrollees	45.5	52.1	31.2	36.7

The access measure in the drop-out/graduate cut point is statistically significant at the 1% (***), 5% (**) or 10% (*) level.

Table 4. Ordered Probit Estimates (Specification 2) – Robustness Checks

	Men			Women	Men			Women
	1	2	3	1	1	2	3	1
	Access: 2 or 4-Year Public Schools				**Access: 4-Year Public Schools**			
City	-0.2407	-0.2129		-0.1769	-0.2436	-0.2157		-0.1803
	(0.0611)	(0.0702)		(0.0625)	(0.0610)	(0.0697)		(0.0619)
Suburb	-0.0740	-0.0483		-0.0985	-0.0772	-0.0514		-0.0980
	(0.0590)	(0.0673)		(0.0608)	(0.0594)	(0.0673)		(0.0609)
Unemployment Rate	-0.0001		0.0003	-0.0126	-0.0001		0.0003	-0.0147
	(0.0016)		(0.0016)	(0.0159)	(0.0016)		(0.0016)	(0.0160)
Labor Demand Index		0.0022				0.0023		
		(0.0028)				(0.0029)		
Labor Market Size			-0.0001				-0.0001	
			(0.0000)				(0.0000)	
<u>Drop/Grad Cut Point</u>								
Kappa H	0.7782	0.8557	0.7413	0.7617	0.8031	0.8847	0.7782	0.7761
	(0.1737)	(0.1821)	(0.1735)	(0.1856)	(0.1727)	(0.1825)	(0.1724)	(0.1858)
University Access	0.1406	0.1342	0.1549	0.1904	0.1289	0.1188	0.1237	0.1715
	(0.0623)	(0.0628)	(0.0623)	(0.0653)	(0.0602)	(0.0613)	(0.0616)	(0.0637)
<u>Grad/Univ Cut Point</u>								
Kappa U	1.9248	2.0027	1.8934	2.3945	1.9177	1.9995	1.8949	2.3604
	(0.1748)	(0.1834)	(0.1745)	(0.1890)	(0.1744)	(0.1842)	(0.1740)	(0.1891)
University Access	-0.0887	-0.0955	-0.0853	-0.0559	-0.0859	-0.0963	-0.0984	-0.0279
	(0.0542)	(0.0547)	(0.0549)	(0.0591)	(0.0530)	(0.0543)	(0.0550)	(0.0585)
Log-Likelihood	-2823	-2822	-2826	-2508	-2823	-2823	-2827	-2511
N	3051	3051	3051	2693	3051	3051	3051	2693
	Access: 2 or 4-Year Schools				**Access: 4-Year Schools**			
City	-0.2558	-0.2218		-0.1933	-0.2701	-0.2339		-0.2131
	(0.0610)	(0.0699)		(0.0629)	(0.0633)	(0.0707)		(0.0645)
Suburb	-0.0840	-0.0530		-0.1049	-0.0984	-0.0649		-0.1194
	(0.0595)	(0.0674)		(0.0615)	(0.0614)	(0.0680)		(0.0621)
Unemployment Rate	-0.0001		0.0003	-0.0112	0.0000		0.0003	-0.0103
	(0.0016)		(0.0016)	(0.0158)	(0.0016)		(0.0016)	(0.0159)
Labor Demand Index		0.0027				0.0033		
		(0.0029)				(0.0029)		
Labor Market Size			-0.0001				-0.0001	
			(0.0000)				(0.0000)	
<u>Drop/Grad Cut Point</u>								
Kappa H	0.7598	0.8575	0.7063	0.7010	0.8014	0.9156	0.7435	0.8151
	(0.1779)	(0.1878)	(0.1786)	(0.1911)	(0.1761)	(0.1871)	(0.1769)	(0.1894)
University Access	0.1169	0.1062	0.1582	0.2156	0.0878	0.0698	0.1377	0.0823
	(0.0755)	(0.0763)	(0.0740)	(0.0775)	(0.0674)	(0.0689)	(0.0647)	(0.0687)
<u>Grad/Univ Cut Point</u>								
Kappa U	1.9857	2.0845	1.9401	2.4636	1.9794	2.0942	1.9259	2.4395
	(0.1778)	(0.1884)	(0.1783)	(0.1933)	(0.1771)	(0.1885)	(0.1777)	(0.1923)
University Access	-0.1576	-0.1693	-0.1280	-0.1342	-0.1624	-0.1809	-0.1212	-0.1215
	(0.0657)	(0.0668)	(0.0645)	(0.0687)	(0.0599)	(0.0618)	(0.0572)	(0.0632)
Log-Likelihood	-2822	-2822	-2827	-2507	-2821	-2821	-2826	-2512
N	3051	3051	3051	2693	3051	3051	3051	2693

All models also include parental education, parental immigrant status, a black indicator, number of siblings, newspaper, library card, mom and dad present, and census division indicators (the variables used in all earlier specifications).
The standard errors are in parentheses.

Table 5. Ordered Probit Estimates (Specification 2) – Including an Interaction between the Duncan Index and University Access

	Men				Women			
Access Measure	**Public 2 & 4-Year**	**Public 4-Year**	**2 & 4-Year**	**4-Year**	**Public 2 & 4-Year**	**Public 4-Year**	**2 & 4-Year**	**4-Year**
Duncan Index	0.0052	0.0054	0.0043	0.0044	0.0055	0.0056	0.0058	0.0047
	(0.0014)	(0.0014)	(0.0018)	(0.0016)	(0.0015)	(0.0014)	(0.0018)	(0.0017)
Father's Education	0.0514	0.0517	0.0514	0.0515	0.0469	0.0474	0.0472	0.0477
	(0.0090)	(0.0090)	(0.0089)	(0.0089)	(0.0100)	(0.0100)	(0.0100)	(0.0100)
Mother's Education	0.0661	0.0657	0.0661	0.0661	0.0874	0.0874	0.0868	0.0875
	(0.0100)	(0.0100)	(0.0100)	(0.0100)	(0.0111)	(0.0111)	(0.0111)	(0.0111)
Immigrant Father	0.3023	0.2994	0.3046	0.3025	0.4799	0.4793	0.4879	0.4871
	(0.1362)	(0.1362)	(0.1362)	(0.1362)	(0.1570)	(0.1569)	(0.1572)	(0.1571)
Immigrant Mother	0.3268	0.3294	0.3213	0.3216	0.1593	0.1593	0.1597	0.1563
	(0.1448)	(0.1448)	(0.1450)	(0.1451)	(0.1622)	(0.1622)	(0.1622)	(0.1622)
Black Indicator	-0.0418	-0.0384	-0.0457	-0.0448	0.1922	0.1937	0.1936	0.1928
	(0.0629)	(0.0630)	(0.0628)	(0.0629)	(0.0701)	(0.0701)	(0.0700)	(0.0699)
Number of Siblings	-0.0269	-0.0269	-0.0274	-0.0272	-0.0296	-0.0297	-0.0302	-0.0297
	(0.0096)	(0.0096)	(0.0096)	(0.0096)	(0.0106)	(0.0106)	(0.0106)	(0.0106)
Newspaper*	0.3853	0.3855	0.3872	0.3879	0.2908	0.2890	0.2921	0.2907
	(0.0742)	(0.0742)	(0.0742)	(0.0742)	(0.0785)	(0.0785)	(0.0785)	(0.0785)
Library Card*	0.2378	0.2379	0.2351	0.2345	0.1114	0.1111	0.1123	0.1125
	(0.0534)	(0.0534)	(0.0534)	(0.0534)	(0.0596)	(0.0595)	(0.0596)	(0.0595)
Mom and Dad*	0.1259	0.1273	0.1299	0.1304	0.1777	0.1770	0.1787	0.1795
	(0.0741)	(0.0740)	(0.0740)	(0.0740)	(0.0846)	(0.0846)	(0.0846)	(0.0845)
City	-0.2489	-0.2460	-0.2577	-0.2608	-0.2081	-0.2100	-0.2069	-0.2273
	(0.0607)	(0.0606)	(0.0605)	(0.0617)	(0.0634)	(0.0631)	(0.0639)	(0.0649)
Suburb	-0.1357	-0.1339	-0.1400	-0.1446	-0.1234	-0.1256	-0.1190	-0.1352
	(0.0598)	(0.0600)	(0.0598)	(0.0607)	(0.0630)	(0.0632)	(0.0634)	(0.0637)
Drop/Grad Cut Point								
Kappa H	0.7410	0.7508	0.7290	0.7394	0.7763	0.7986	0.7552	0.7899
	(0.1591)	(0.1589)	(0.1595)	(0.1592)	(0.1789)	(0.1786)	(0.1794)	(0.1790)
Access*Duncan	0.0041	0.0044	0.0026	0.0027	0.0034	0.0026	0.0038	0.0013
	(0.0015)	(0.0015)	(0.0018)	(0.0016)	(0.0017)	(0.0017)	(0.0019)	(0.0018)
Grad/Univ Cut Point								
Kappa U	1.8289	1.8258	1.8307	1.8294	2.3620	2.3508	2.3783	2.3613
	(0.1608)	(0.1607)	(0.1610)	(0.1609)	(0.1822)	(0.1819)	(0.1824)	(0.1821)
Access*Duncan	-0.0015	-0.0012	-0.0023	-0.0023	-0.0024	-0.0020	-0.0020	-0.0029
	(0.0013)	(0.0013)	(0.0016)	(0.0015)	(0.0014)	(0.0014)	(0.0017)	(0.0015)
Log-Likelihood	-2729	-2729	-2732	-2731	-2263	-2266	-2263	-2266
N	2937	2937	2937	2937	2438	2438	2438	2438

* These variables are household attributes at age 14. All models also include Census Division of residence at age 14 and missing parental education indicator variables. The standard errors are in parentheses.

Table 6. Robustness Checks Including and Interaction between Socioeconomic Status and University Access

	Men			Women	Men			Women
	1	2	3	1	1	2	3	1
	Access: 2 or 4-Year Public Schools				**Access: 4-Year Public Schools**			
Drop/Grad Cut Point								
Access*Duncan	0.0033	0.0031	0.0030	0.0035	0.0034	0.0031	0.0028	0.0028
	(0.0016)	(0.0016)	(0.0016)	(0.0017)	(0.0016)	(0.0016)	(0.0016)	(0.0017)
Log-Likelihood	-2542	-2542	-2545	-2263	-2542	-2542	-2545	-2266
N	2795	2795	2795	2438	2795	2795	2795	2438
	Access: 2 or 4-Year Schools				**Access: 4-Year Schools**			
Drop/Grad Cut Point								
Access*Duncan	0.0018	0.0015	0.0023	0.0040	0.0017	0.0012	0.0024	0.0015
	(0.0019)	(0.0019)	(0.0019)	(0.0019)	(0.0018)	(0.0018)	(0.0017)	(0.0018)
Log-Likelihood	-2542	-2542	-2545	-2263	-2542	-2542	-2545	-2266
N	2795	2795	2795	2438	2795	2795	2795	2438
	Access: 2 or 4-Year Public Schools				**Access: 4-Year Public Schools**			
Drop/Grad Cut Point								
Access*Father's Education	0.0132	0.0126	0.0138	0.0172	0.0126	0.0117	0.0113	0.0160
	(0.0060)	(0.0060)	(0.0060)	(0.0061)	(0.0058)	(0.0059)	(0.0059)	(0.0059)
Log-Likelihood	-2828	-2828	-2828	-2506	-2828	-2828	-2826	-2509
N	3051	3051	3051	2693	2795	2795	2795	2438
	Access: 2 or 4-Year Schools				**Access: 4-Year Schools**			
Drop/Grad Cut Point								
Access*Father's Education	0.0079	0.0068	0.0113	0.0228	0.0068	0.0051	0.0110	0.0109
	(0.0071)	(0.0072)	(0.0069)	(0.0071)	(0.0064)	(0.0066)	(0.0062)	(0.0064)
Log-Likelihood	-2824	-2824	-2828	-2502	-2820	-2820	-2825	-2509
N	3051	3051	3051	2693	2795	2795	2795	2438

All models also include parental education, parental immigrant status, a black indicator, number of siblings, newspaper, library card, mom and dad present, and census division indicators (the variables used in all earlier specifications). Column 1 includes the local unemployment rate, column 2 includes the labor demand index, and column 3 replaces city and suburb dummies with labor market size. The first two panels also include the Duncan index. The standard errors are in parentheses.

Table 7. Mean Percentage Difference in KWW Scores between Labor Markets With and Without University Access

	Men			Women		
	High School Drop-outs	High School Graduates	University Enrollees	High School Drop-outs	High School Graduates	University Enrollees
Access is defined as a public 2 or 4 year degree granting institution						
Score Difference	0.8263	-0.6696	0.5790	2.0477	-0.9431	0.7929
	(1.1454)	(0.8739)	(0.6368)	(2.2200)	(1.0949)	(1.1500)
N	680	973	1502	484	1248	863
R^2	0.3279	0.3039	0.3160	0.2935	0.3309	0.2364
Access is defined as a public 4 year degree granting institution						
Score Difference	1.9063 *	-0.1396	1.8490	2.1817	1.1707	1.0059
	(1.1030)	(0.8626)	(0.6260)	(2.1017)	(1.0842)	(1.1307)
N	680	973	1502	484	1248	863
R^2	0.3304	0.3034	0.3197	0.2938	0.3312	0.2367
Access is defined as a 2 or 4 year degree granting institution						
Score Difference	3.5835 ***	-0.7480	-0.2494	-0.4250	-0.9450	1.9455
	(1.3891)	(0.9711)	(0.7914)	(2.6726)	(1.2002)	(1.3796)
N	680	973	1502	484	1248	863
R^2	0.3341	0.3039	0.3157	0.2922	0.3309	0.2378
Access is defined as a 4 year degree granting institution						
Score Difference	2.0691 *	-0.8661	1.1022	1.1219	0.8995	0.3772
	(1.2587)	(0.9202)	(0.7246)	(2.3139)	(1.1580)	(1.2555)
N	680	973	1502	484	1248	863
R^2	0.3301	0.3041	0.3167	0.2925	0.3308	0.2360

The difference between mean test scores across university access is significant at the 1% (***), 5% (**) or 10% (*) level. All models also include parental education, parental immigrant status, a black indicator, number of siblings, newspaper, library card, mom and dad present, and census division indicators (the variables used in all earlier specifications) as well as age indicator variables.