Canadian International Labour Network

Labour Market Outcomes:

A Cross-National Study

CILN is a collaberative research venture between the Social Sciences and Humanities Research Council (SSHRC) and McMaster University. Additional funding is provided by the University of British Columbia, the University of Toronto, Queen's University, York University and Human Resources Development Canada (HRDC).

McMaster University

DEPARTMENT OF ECONOMICS

Human Capital Versus Signaling Models: University Access and High School Drop–outs

Kelly Bedard*
Department of Economics
McMaster University
Hamilton, Ontario
Canada, L8S 4M4

bedardk@mcmail.cis.mcmaster.ca

May, 1998

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 drop–outs 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 drop–out rates in regions with greater university access. Using NLSYM and NLSYW education data from the late 1960s and early 1970s, I find that labor markets that contain a university have higher high school drop–out rates.

* I thank Heather Antecol, Martin Browning, Peter Kuhn, John Spraggon, and Mike Veall for helpful comments. I gratefully acknowledge financial support from the Canadian International Labour Network (CILN) at McMaster University. I am responsible for all errors.

JEL Classification: I2, C25.

Keywords: Education, Human Capital, Sorting Models.

1. Introduction

Within a human capital framework, education augments natural abilities that are subsequently sold in the labor market. On the other side, 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 graduate rather than a drop–out.

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 drop–out rate. As some previously constrained, but relatively high ability, individuals 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 high school graduates drop out of high school. This is in stark contrast to the 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, or predictions, of the basic human capital and sorting models are similar, or identical. This is not particularly surprising since the firm and worker decision processes are the same in both models. Firms weigh the pro-

[1] The term "constrained" is used throughout this paper 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 marginal cost of attending university is much lower for people living in areas with universities, and enrollment is therefore higher.

ductivity 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 get around 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 the 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 that university access[2] plays in educational attainment decisions. 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 (more local universities) will increase university enrollment within an asymmetric information (signaling) framework, it might also increase the high school drop–out rate. If fewer high ability people are constrained from entering university, the high school graduate[3] skill pool is reduced, and the incentive to obtain the high school graduate designation is diminished. The least able graduates will, therefore, become drop–outs and the most able graduates will 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 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] Access refers to the presence of a university, and not to admittance.

[3] Throughout this paper I use high school drop–out 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.

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 where individuals know their own ability, the distribution of ability, and whether or not they are constrained from entering university. I initially assume that the probability an individual is constrained from entering university, $1 - p$, is independent of ability.[4] 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.[5] 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 of group s. In this environment, just as in the human capital framework, people choose the education level that maximizes their lifetime wealth.[6]

The framework presented in this section is a generalization of the standard signaling model (Spence 1973 and Stiglitz 1975). The model allows for three schooling choices (s): drop out of high school (d), graduate from high school (h), or enroll in university (u), and schooling costs ($C_s(\theta)$) that are decreasing in ability and increasing in educational designation.[7]

Within this framework, there will be a separating equilibrium with three distinct

[4] 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 more strong 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.

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

[6] Wealth is defined as discounted lifetime wages less the cost of education.

[7] Education costs must be paid in order; a university enrollee must pay the high school graduation cost as well as the university enrollment cost.

education groups, and cutoff points for group membership at θ_H and θ_U, as long as the cost structure is such that:

$$E(\theta|\theta < \theta_H) = \phi(\theta) - C_h(\theta_H)$$

$$E(\theta|\theta \geq \theta_U) = \phi(\theta) + C_u(\theta_U)$$

where $\phi(\theta) = \frac{[F(\theta_U)-F(\theta_H)]E(\theta|\theta_H \leq \theta<\theta_U)+(1-p)[1-F(\theta_U)]E(\theta|\theta\geq\theta_U)}{[F(\theta_U)-F(\theta_H)]+(1-p)[1-F(\theta_U)]}$, $F()$ denotes the cumulative density function, and $f()$ denotes the probability density function. Notice that this is a non–standard separating equilibrium since the high school graduate group will contain people with ability in excess of θ_U who are constrained from entering university.

Since there is a continuum of ability types, and educational costs are decreasing in ability, satisfying the break–point conditions specified above is sufficient to ensure a separating equilibrium. 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.[8]

Proposition: If we begin in a separating equilibrium, greater university access will be associated with both higher university enrollment rates and higher high school drop–out rates.

Proof: Totally differentiating the equilibrium conditions,

$$\gamma_H d\theta_H = \phi_U d\theta_U + \phi_p dp$$

$$\gamma_U d\theta_U = \phi_H d\theta_H + \phi_p dp$$

where ϕ_i for $i = H, U$, and p, denote the partial derivatives of $\phi(\theta)$ with respect to θ_H, θ_U, and p, $\gamma_H = \frac{\partial E(\theta|\theta<\theta_H)}{\partial\theta_H} - \phi_H + \frac{\partial C_h(\theta_H)}{\partial\theta_H}$ and $\gamma_U = \frac{\partial E(\theta|\theta\geq\theta_U)}{\partial\theta_U} - \phi_U - \frac{\partial C_u(\theta_U)}{\partial\theta_U}$. Solving

[8] 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.

simultaneously,

$$\frac{d\theta_U}{dp} = \frac{\phi_H\phi_p + \gamma_H\phi_p}{\gamma_H\gamma_U - \phi_H\phi_U}$$
$$\frac{d\theta_H}{dp} = \frac{\phi_U\phi_p + \gamma_U\phi_p}{\gamma_H\gamma_U - \phi_H\phi_U}.$$

Signing the total derivatives simply requires signing the partial derivatives. ϕ_H is clearly positive since shifting θ_H to the right, holding all else constant, increases the high school graduate skill pool. Similarily, a straight 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 high school graduates to the university enrollee group and therefore lowers the high school graduate skill pool ($\phi_p < 0$). $\gamma_H < 0$ since $\phi_p < 0$ and $\frac{d\theta_H}{dp} = \frac{\phi_p}{\gamma_H} > 0$ when θ_U is held constant. Similarily, $\gamma_U < 0$ because $\frac{d\theta_U}{dp} = \frac{\phi_p}{\gamma_U} < 0$ when θ_H is held constant. Restricting $\phi_U \geq 0$ and $\frac{\partial E(\theta|\theta<\theta_H)}{\partial\theta_H} < -\frac{\partial C_h(\theta_H)}{\partial\theta_H}$ is therefore sufficient to ensure that $\frac{d\theta_U}{dp} < 0$ and $\frac{d\theta_H}{dp} > 0$.

The first restriction, $\phi_U > 0$, ensures that the movement of the most able unconstrained individuals from the high school graduate group to the university enrollee group has a negative impact on the high school graduate skill pool. Stated somewhat differently, the proportion of the population that is constrained, must not be so large as to swamp the effect of unconstrained high school graduates moving to the university enrollee group. The second restriction, $\frac{\partial E(\theta|\theta<\theta_H)}{\partial\theta_H} < -\frac{\partial C_h(\theta_H)}{\partial\theta_H}$, ensures that the drop–out group is of sufficient size and that the density does not rise too steeply.

The intuition behind the proposition is very simple. The movement of previously constrained individuals with skills above θ_U into the university enrollee group, as constraints fall, reduces the high school graduate skill pool and encourages the most able previously unconstrained graduates to enter university as well. In other words, θ_U must fall or remain unchanged. Similarily, the reduced high school graduate skill pool encourages the least able graduates to become drop–outs, and θ_H therefore rises. The net result is an abandoning of the middle; more university enrollees and more high school drop–outs.

The changing education choices are particularly easy to see diagramatically. 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 darkly shaded areas of Figure 1 are free to choose any level of education, while people in the unshaded and lightly shaded regions are constrained from entering university. People below θ_H choose the drop–out designation and people between θ_H and θ_U choose to be graduates. It is the people above θ_U that make this a non–standard equilibrium; the people in rectangle A enter university but those in rectangles B and C are constrained from doings so and are therefore forced to leave school at high school graduation. This of course 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 people in both the lightly and darkly shaded regions of Figure 1 are now free to choose any education level. As a result, the people in rectangle B become university enrollees and thereby reduce the graduate skill pool. This in turn induces the most able, and unconstrained, graduates to enroll in university and the least able graduates to become drop–outs. In other words, the cutoffs for education group membership (θ'_H and θ'_U) shift inward.

The analysis is slightly 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. More specifically,

$$p(\theta_U) = \int_{-\infty}^{\theta_U} \int_{-\infty}^{g(\theta)} f(x)dxd\theta = \int_{-\infty}^{\theta_U} F(g(\theta))d\theta,$$

where $g(\theta) < f(\theta)$ for all θ and $g'(\theta) > 0$. In fact, a multiplicative increase in $g(\theta)$ leads to an even greater increase in the high school drop–out rate, as compared to the independent p case, because the high school skill pool is depleted to an even greater degree.[9]

[9] If, however, the probability of constraint is zero for the most able $k\%$ of the population, the high school drop–out rate will increase if, and only if the mean high school graduate skill level (holding the

Assuming that all ability types have some probability of constraint, an increase in university enrollment that results from better university access comes from two sources: previously constrained and previously unconstrained people. Access therefore has an ambiguous effect 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 mean skill level of previously constrained movers depends on the form of probability of constraint and educational cost functions.[10] Conversely, as access rises, those choosing to move from the high school graduate group to the drop–out group are more skilled than the initial high school drop–outs, and hence raise the average skill level. Given the exodus of both the most and least gifted high school graduates, the impact on the graduate skill mean is ambiguous.

It might appear that high school drop–outs 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. Firstly, employers can observe the institution from which a job applicant graduated. If there are differences between 'locals' and 'non–locals' he can use this information to sort workers. Secondly, 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 drop–out of high school in these regions than if they fail incorporate this information. The drop–out 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

drop–out/graduate cut point constant) falls. In other words, the drop–out rate will rise if the movement of newly unconstrained people into the university enrollee group is not off–set by an exodus of previously unconstrained university enrollees into the graduate group.

[10] If the probability of constraint is independent of ability, increased access will clearly decrease the skill mean.

increase university enrollment, but will have no impact on the high school drop–out 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 drop–out 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. 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.[11]

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 drop–outs and an ambiguous change for university enrollees. The high school drop–out 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 probability of constraint and educational cost functions.

3. Empirical Implementation

The models presented in Section 2 offer two specific testable predictions that differ across signaling and human capital models.[12] Firstly, the signaling model predicts a higher

[11] 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 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.

[12] Or more precisely, two alternatives ways to test the same prediction.

high school drop–out rate in regions that do not contain a university while the human capital model predicts no difference. Secondly, the signaling model predicts a higher skill pool among drop–outs 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[13] allow us to investigate the differences in educational decisions made by youths with and without access to a university, controlling for family background.

3.1. Educational Attainment

Following from the simple models, outlined in the previous section, I assume that people choose membership in one of three education groups (s): high school drop–outs (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

$$\frac{\kappa_h - \sum_s \beta_s X_{is}}{\sigma} < \theta_i < \frac{\kappa_u - \sum_s \beta_s X_{is}}{\sigma} \tag{1}$$

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.

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.

[13] The NLSYM and NLSYW data used in this paper are fully detailed in the next section.

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 asymmetric information model presented in the last section predicts that the cut points should be closer together in regions with university access because the incentive to hide behind constrained individuals is diminished. In contrast, within a human capital framework, university access should have no statistically significant effect on the drop–out/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.

$$\kappa_h = \bar{\kappa_h} + \gamma_h A$$
$$\kappa_u = \bar{\kappa_u} + \gamma_u A \qquad (2)$$

where $\bar{\kappa_h}$ and $\bar{\kappa_u}$ 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. This is attractive because it allows university access to enter the drop–out/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.[14] More specifically, we could restrict the model such that

$$\kappa_h = \bar{\kappa_h} + \gamma A$$
$$\kappa_u = \bar{\kappa_u} - \gamma A. \qquad (3)$$

[14] In fact, any prespecified function of access would be identified. For example, we could restrict the coefficient on the upper cut point to be $(-1/2)\gamma$.

Since there is no a priori reason to restrict university access to have the same impact on both cut points, all regressions reported in this paper use the first specification (equation (2)). However, it turns out that all of the results presented in this paper are similar if model (3) is used in place of model (2). Further, a likelihood ratio test rejects the standard ordered probit, with no university access measure in X, in favor of either specification (2) or (3) with p-values of less than 0.01 under most sampling rules and access definitions (all p-values are reported in tables A1-A4).

3.2. The Skill Level within Education Groups

The NLSYM and NLSYW include the respondents score on the *Knowledge of the World of Work* test, which has been used by both Card (1993) and Griliches (1977) as a measure of ability.[15] Using this information it is possible to examine how the mean test score of the three education groups varies across university access.

$$KWW_{is} = \alpha_0 + \alpha_1 A_{is} + Z_{is}\alpha_{2s} + \nu_{is} \tag{4}$$

where Z is a vector of family background 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 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. Firstly, the rapid expansion of the university system during the 60s and 70s might lead

[15] The weaknesses of this measure are discussed in the next section.

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 3496 men and 2957 women. Some descriptive statistics for the entire sample, and the subsample with valid parental education information, are presented in Table 1.

Years of education is defined as the highest grade completed in any survey year, so a person who does not report years education in 1981, but reported 14 years in 1980, is is assigned 14 years of schooling.[16] This method of measuring years of education is used to mitigate the problem of missing observations. However, I am interested in initial education decisions, and not the decision to return to school later in life, an individual must therefore complete grade 12 by age 20 to be considered a high school graduate[17] 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 mother's and father's years of education, unfortunately a relatively large fraction (approximately 15%) of the sample have missing values for these variables.[18] The respondents were also asked if either parent was an immigrant; 4.5% and 4.1% of men report and immigrant father and mother respectively while

[16] I exclude individuals who do not complete grade ten because it is unclear how they arrived at educational decisions.

[17] 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.

[18] 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.

the respective 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 on 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 is defined as the presence of: a four year degree granting institution, a two or four year degree granting institution, a public four year degree granting institution, and a public two or four year degree granting institution. There is substantial variation in university access, 70% of men and 67% of women lived a labor market that contained a four year university. However, access rates did vary across CDs. In the East South Central Division 41% of men and 51% of women had access to a four year university, whereas 91% of men and 87% of women had similar access in the Middle Atlantic Division (see Table 2 for more detail).

Finally, the baseline data also includes the *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 28 questions about job activities in ten occupations, the educational requirements for these occupations, an the relative earnings of eight different paired occupations. The KWW test administered to 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. Given the weakness of the KWW as an ability measure, the results presented in section 5.2 should be viewed as suggestive rather than conclusive.

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. Figures 2 and 3, as well as Table 3, report the percentage of people in each education group across university access levels. Both men and women are more likely to drop out of high school or go on to university in labor markets that contain a university. If access is defined as the presence of a four year degree granting institution, 20.6% of men and 19.1% of women drop out of high school in labor markets without access compared to 22.0% and 19.9% respectively in regions with access. The gap between drop–out rates in high and low access regions is larger when access is defined as the presence of a two or four year degree granting institution. Under this definition, 19.8% of men and 15.3% of women drop out in regions without access compared to 22.0% of men and 20.8% of women in labor markets with access. Of course, family and personal characteristic differences may be driving these results. The remainder of this section therefore focuses on more formally exploring the role that university access plays in determining educational decisions, holding family background and personal characteristics constant.

Tables A1-A4 report the ordered probit estimates using 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, and eight indicators for census division of residence in the base year, as well as father's and mother's years of education and the number of siblings. To check the robustness of the estimates to sample definitions, all regressions are run using two sampling criteria: including and excluding observations with missing parental education data.[19]

[19] The results are generally robust to this sampling restriction. The estimates for the sample restricted

The coefficient estimates, presented in Tables A1-A4, 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 earlier.

Most importantly, the coefficient on university access is positive for the lower cut point and negative for the upper cut point under all access measures and sampling rules.[20] In other words, university access increases the probability that and individual will choose to be a high school drop–out or a university enrollee (also see Table 4). The predicted high school drop–out rate in labor markets with access ranges from 1.2% to 6.0% higher for men and from 4.7% to 31.4% higher for women compared to labor markets without access, depending on the access definition.

The impact and statistical significance of access in the drop–out/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' female jobs, such as nursing, teaching, and more technical office jobs were more likely to take place at two year colleges and public universities. Therefore, it is not surprising that the female estimates are more sensitive to the definition of access.

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. 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 run 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

to respondents with full parental education data are therefore reported in the appendix.

[20] The access measure in the drop–out/graduate cut point is significant at better than the 5% level under most access measures and sampling rules. See Tables 4, A1-A4, and A6, for more detail.

are also very similar using a standard probit model, with the two education choices being drop–out of high school or high school graduation and beyond.

Finally, to check that macroeconomic factors are not driving the results, I also estimate the model by two and three year age groups. Again the results are very similar, although the estimates are quite imprecise in some cases because the samples become rather small.

5.2. The Skill Level within Education Groups

The simple signaling model presented in section 2 predicts that the skill pool will be greater among high school drop–outs in labor markets with university access, as compared to labor markets without access. Although the high school graduate and university enrollee skill pool predictions are in general ambiguous, one might expect the graduate skill pool should fall since the results presented in the previous section show that the university enrollment rate increases by more than the high school drop–out rate as access rises. It is important to remember, however, that only the drop–out ability prediction of the signaling model contradicts the human capital model.

Table 5 presents the average KWW test score differential for regions with and without access, controlling for all observable factors under all four sampling rules. [21] Controlling for family background and observable characteristics, the average score for a male drop–out is approximately 2% higher in regions with 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.

It is also important to point out that these results are sensitive to sample definitions. In general, there is no statistically significant difference in KWW scores across univer-

[21] Table A7 reports the regression results for equation (4) with access defined as the presence of a four year degree granting institution for the full sample. The estimates for the other access measures and sample definitions are very similar, and are therefore not reported in full detail.

sity access levels for high school drop–outs when the observations with missing parental education data are excluded. Small sample sizes are most likely driving this result.

6. Discussion

The results presented in this paper suggest that signaling played an important role in educational decisions during the late 1960s and early 1970s. In regions where it was possible to take advantage of constrained individuals, a significant number of individuals appear to have done so. More precisely, people living in labor markets that did not contain a university were less likely to attend university and less likely to drop–out of high school. While these results are consistent with a signaling story, they are not consistent with a pure human capital model.

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, or constraints, influence the choice set of individuals directly affected, the results presented in this paper suggest that they might also influence the decisions of people not directly affected.

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 lead to a decline in the relative position of the less able.

References

Card, David (1993), "Using Geographic Variation in College Proximity to Estimate the Return to Schooling," NBER Working Paper #4483.

Dickens, William T. and Kevin Lang (1985), "A Test of Dual Labor Market Theory," *American Economic Review*, 123-132.

Griliches, Zvi (1977), "Estimating the Returns to Schooling: Some Econometric Problems," *Econometrica*, 45: 1-22.

Lang, Kevin and David Kropp (1986) "Human Capital vs. Sorting: The Effects of Compulsory Attendance Laws," *Quarterly Journal of Economics*, 101: 609-24.

Riley, John (1979), "Informational Equilibrium," *Econometrica*, March: 331-359.

Riley, John (1979), "Testing the Educational Screening Hypothesis," *Journal of Political Economy*, 87: S227-52.

Riley, John (1985), "Competition with Hidden Knowledge," *Journal of Political Economy*, 93: 958-976.

Rothschild, Michael and Joseph Stiglitz (1976), "Equilibrium in Competitive Insurance Markets: An Essay on the Economics of Imperfect Information," *Quarterly Journal of Economics*, 89: 629-50.

Spence, Michael A. (1973), "Job Market Signaling," *Quarterly Journal of Economics*, 87: 355-374.

Spence, Michael A. (1974), *Job Market Signalling: Informational Transfers in Hiring and Related Processes*, Cambridge: Harvard University Press.

Stiglitz, Joseph. (1975), "The Theory of Screening Education and the Distribution of Income," *American Economic Review*, 65: 283-300.

Wolpin, Kenneth I. (1977), "Education and Screening," *American Economic Review*, 67: 949-958.

Figure 1. Uniformly Distributed Ability

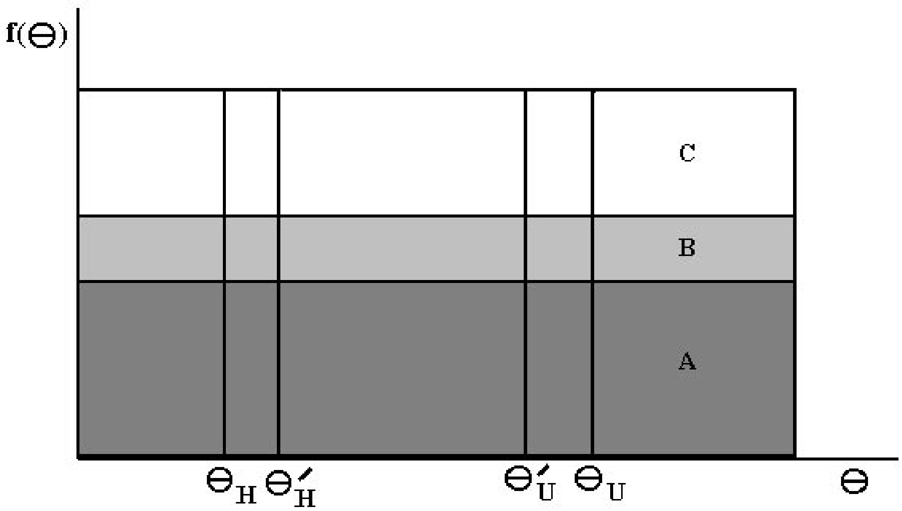
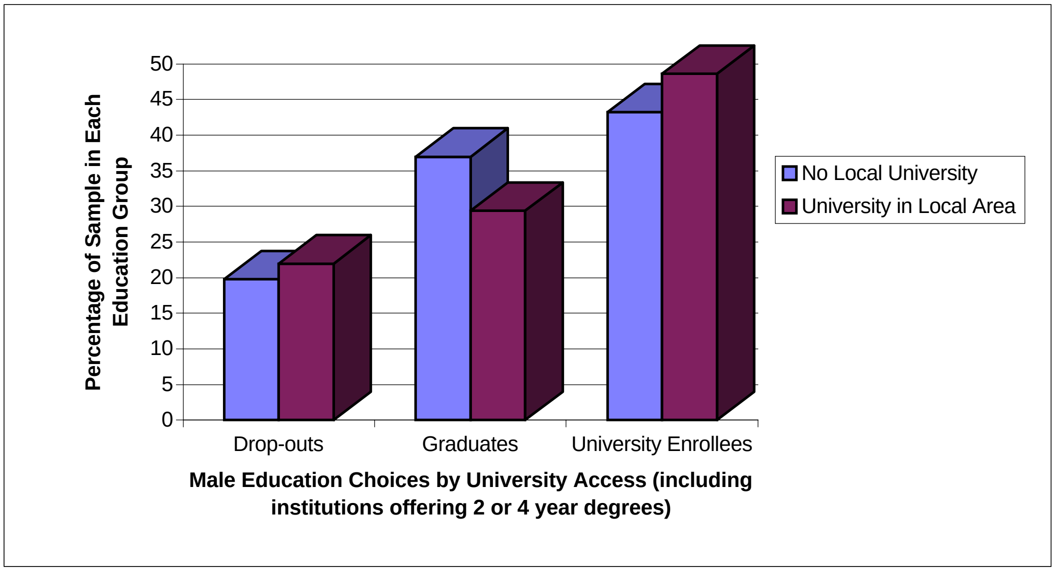


Figure 2. Male Education Choices by University Access



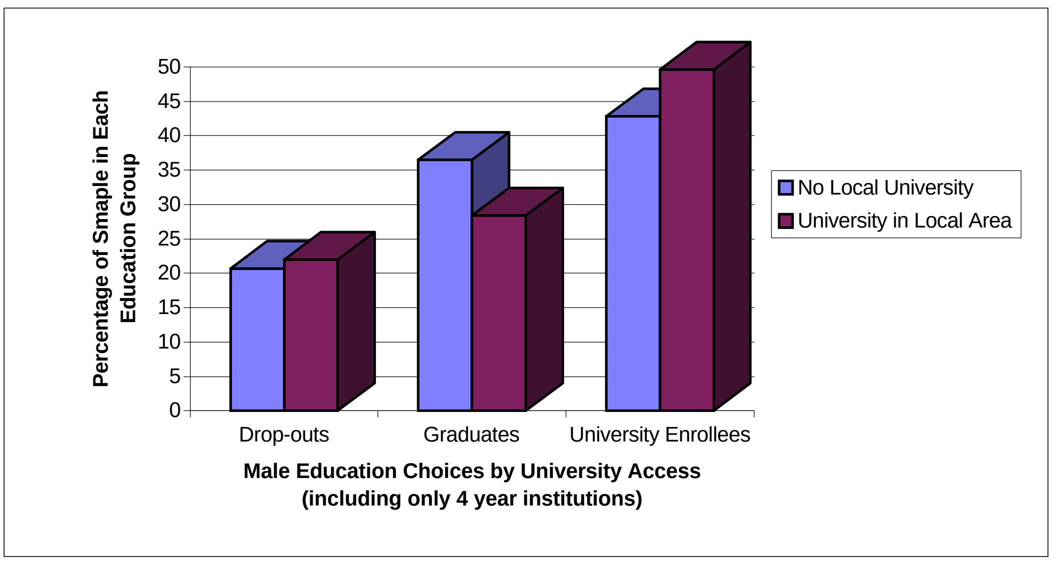
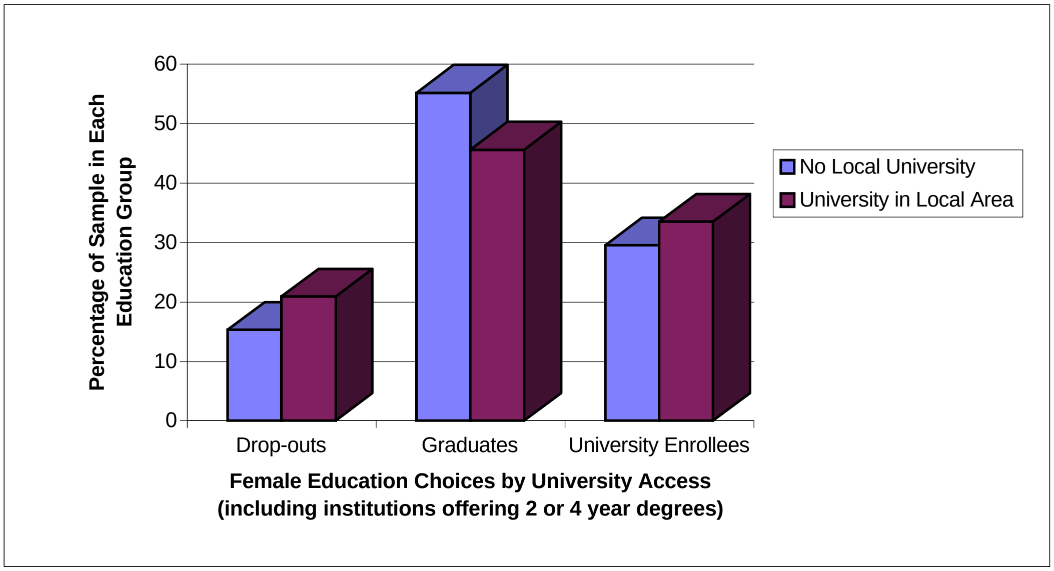


Figure 3. Female Education Choices by University Access



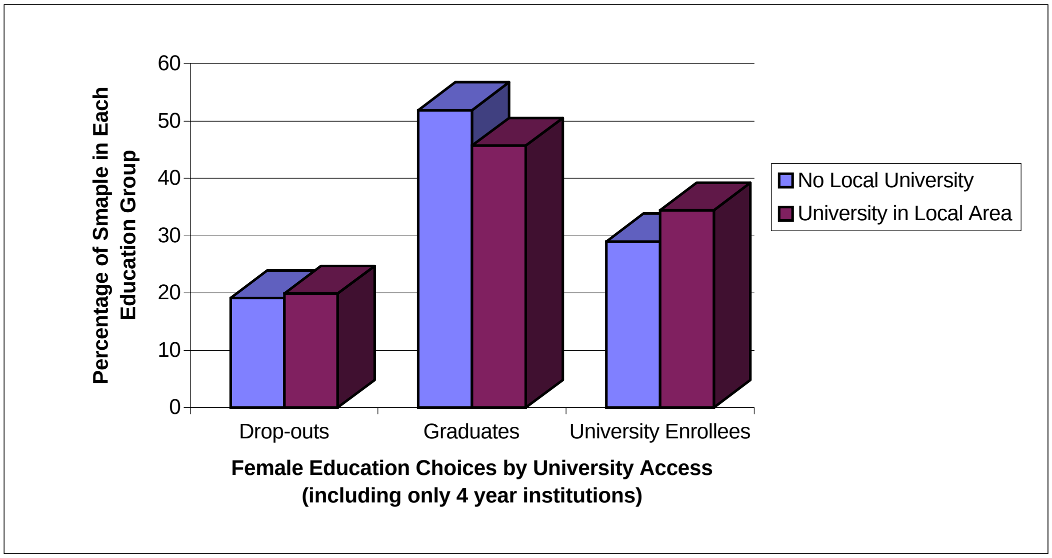


Table 1. Summary of Sample Characteristics

	Men		Women	
	Full Sample	Restricted Sample	Full Sample	Restricted Sample
Age Distribution (%)*				
14-15	37.2	37.7	28.7	29.7
16-17	36.9	37.0	36.5	36.5
18-19	25.9	25.3	34.8	33.8
Regional Distribution (%)*				
Northeast	20.5	21.6	19.9	21.0
Midwest	26.5	27.9	28.2	29.2
South	39.9	36.8	38.3	35.7
West	13.1	13.7	13.6	14.1
Residence in (%)*				
Inner-City	33.9	31.0	35.9	31.7
Suburb	32.4	36.1	30.2	33.3
Rural	33.7	32.9	33.9	35.0
University Access in Local Area				
4 year university	69.9	70.3	66.5	66.3
2 or 4 year university	80.6	79.9	77.5	76.6
4 year public university	51.8	51.8	47.9	47.3
2 or 4 year public university	61.6	60.6	58.0	56.3
Family Structure at Age 14 (%)				
Mother and Father	83.8	95.1	77.5	95.1
Average Parental Education				
Mother's Education	10.6	10.7	10.7	10.9
Father's Education	10.3	10.4	10.6	10.5
Black (%)	29.3	20.2	29.1	22.0
Newspaper at Age 14	87.0	90.5	86.1	89.3
Library Card at Age 14	70.2	73.5	72.0	75.2
Father is an Immigrant	3.9	4.0	3.0	3.3
Mother is an Immigrant	3.5	3.6	2.7	2.8
Average Number of Siblings	3.4	3.2	3.6	3.5
Average Score on KWW Test (%)	59.4	60.7	70.7	72.3
Mean Years of Education	13.3	13.5	13.0	13.2
High School Graduates (%)	78.4	82.5	80.4	84.3
Some College (%)	47.2	52.1	32.6	36.5
Sample Size	3203	2451	2693	2045

* In 1966 for men and 1968 women. Restricted samples include only respondents who report parental education levels.

Table 2. Percent of Sample Living in a Labor Market With A University of the Specified Type

	Men				Women			
	4 Year	2 or 4 Year	4 Year Public	2 or 4 Year Public	4 Year	2 or 4 Year	4 Year Public	2 or 4 Year Public
New England	84.3	84.3	57.0	57.0	83.8	83.8	53.5	53.5
Middle Atlantic	90.8	92.0	73.6	75.3	86.7	88.1	71.6	73.0
East North Central	76.3	85.7	53.0	66.8	71.4	79.8	45.1	58.7
West North Central	64.4	64.4	55.3	55.8	52.9	60.5	45.3	52.5
South Atlantic	60.2	73.8	39.5	45.8	54.5	70.9	30.3	37.7
East South Central	40.8	84.2	26.5	67.7	51.4	85.4	32.1	68.4
West South Central	55.5	65.8	33.3	40.4	57.7	69.6	40.4	49.2
Mountain	64.2	64.2	39.0	39.0	65.0	65.0	40.2	40.2
Pacific	82.2	92.3	78.8	90.2	74.1	87.0	71.9	85.2

Table 3. Percent of Sample in each Educational Category

Education Groups	Men		Women	
	Regions Without Access	Regions With Access	Regions Without Access	Regions With Access
Access is defined as a 4 year degree granting institution				
High School Drop-outs	20.6	22.0	19.1	19.9
High School Graduates	36.5	28.4	51.9	45.7
University Enrollees	42.8	49.6	29.0	34.4
Access is defined as a 2 or 4 year degree granting institution				
High School Drop-outs	19.8	22.0	15.3	20.8
High School Graduates	37.0	29.4	55.2	45.6
University Enrollees	43.2	48.6	29.5	33.6
Access is defined as a public 4 year degree granting institution				
High School Drop-outs	21.0	22.0	18.8	20.5
High School Graduates	34.3	27.7	51.0	44.3
University Enrollees	44.7	48.6	30.3	35.2
Access is defined as a public 2 or 4 year degree granting institution				
High School Drop-outs	20.5	22.3	17.3	21.3
High School Graduates	34.6	28.5	52.2	44.5
University Enrollees	44.9	49.2	30.5	34.2

Table 4. Predicted Educational Group Sizes

Education Groups	Men: Regions Without Access	Men: Regions With Access	Women: Regions Without Access	Women: Regions With Access
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
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 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 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

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

Table 5. Mean Percentage Difference in KWW Scores between Labor Markets With and Without a University

	Men		Women	
	Full Sample	**Restricted Sample**	**Full Sample**	**Restricted Sample**
Access is defined as a 4 year degree granting institution				
High School Drop-Outs	2.1 *	0.8	1.1	2.6
High School Graduates	-0.9	-1.0	0.9	1.4
University Enrollees	1.1	0.6	0.4	-0.1
Access is defined as a 2 or 4 year degree granting institution				
High School Drop-Outs	3.6 ***	3.6 **	-0.4	-0.4
High School Graduates	-0.7	-0.6	-0.9	-0.1
University Enrollees	-0.2	-0.7	1.9	1.5
Access is defined as a public 4 year degree granting institution				
High School Drop-Outs	1.9 *	1.0	2.2	4.4 *
High School Graduates	-0.1	-0.4	1.2	1.5
University Enrollees	1.8 ***	1.7 **	1.0	0.4
Access is defined as a public 2 or 4 year degree granting institution				
High School Drop-Outs	0.8	0.4	2.0	4.6 *
High School Graduates	-0.7	-1.0	-0.9	-0.2
University Enrollees	0.6	0.5	0.8	-0.2

The difference between mean test scores across university access is significant at the 1% (***), 5% (**) or 10% (*) level.

Table A1. Ordered Probit Estimates (Spec. 2)

	Men				Women			
Access Measure	**4 Year**		**Public 4 Year**		**4 Year**		**Public 4 Year**	
	Coeff.	**St. Error**	**Coeff.**	**St. Error**	**Coeff.**	**St. Error**	**Coeff.**	**St. Error**
Father's Education	0.0633	0.0082	0.0636	0.0082	0.0633	0.0090	0.0637	0.0091
Mother's Education	0.0725	0.0095	0.0723	0.0095	0.0915	0.0104	0.0911	0.0104
Immigrant Father	0.3579	0.1307	0.3578	0.1307	0.5262	0.1521	0.5254	0.1519
Immigrant Mother	0.2960	0.1392	0.3011	0.1390	0.1884	0.1561	0.1957	0.1561
Black Indicator	-0.0644	0.0582	-0.0590	0.0584	0.1002	0.0634	0.1086	0.0636
Number of Siblings	-0.0273	0.0090	-0.0272	0.0090	-0.0261	0.0099	-0.0265	0.0099
Newspaper*	0.3419	0.0680	0.3422	0.0680	0.3173	0.0725	0.3204	0.0725
Library Card*	0.2343	0.0505	0.2394	0.0505	0.1258	0.0556	0.1306	0.0556
Mom and Dad*	0.1757	0.0675	0.1746	0.0674	0.1951	0.0788	0.1906	0.0789
City	-0.2623	0.0609	-0.2441	0.0588	-0.2070	0.0638	-0.1708	0.0610
Suburb	-0.0989	0.0594	-0.0846	0.0576	-0.1147	0.0616	-0.0909	0.0604
Drop/Grad Cut Point								
Kappa H	0.7892	0.1534	0.8031	0.1509	0.8676	0.1712	0.8489	0.1680
University Access	0.1068	0.0641	0.1318	0.0575	0.0762	0.0681	0.1627	0.0630
Grad/Univ Cut Point								
Kappa U	1.9287	0.1549	1.8793	0.1527	2.4915	0.1748	2.4330	0.1718
University Access	-0.1322	0.0576	-0.0677	0.0514	-0.1270	0.0626	-0.0368	0.0576
Log-Likelihood	-3018		-3019		-2512		-2512	
N	3203		3203		2693		2693	
LR (2) vrs (1): p-value	0.0002		0.0009		0.0144		0.0078	
LR (3) vrs (1): p-value	0.0000		0.0002		0.0048		0.0031	

* These variables are household attributes at age 14. All models also include 8 Census Division of residence at 14 dummy variables and 2 dummy variables indicating missing parental education data.

Table A2. Ordered Probit Estimates (Spec. 2)

	Men				Women			
Access Measure	**2 or 4 Year**		**Public 2 or 4 Year**		**2 or 4 Year**		**Public 2 or 4 Year**	
	Coeff.	**St. Error**	**Coeff.**	**St. Error**	**Coeff.**	**St. Error**	**Coeff.**	**St. Error**
Father's Education	0.0632	0.0082	0.0634	0.0082	0.0634	0.0090	0.0634	0.0090
Mother's Education	0.0723	0.0095	0.0725	0.0095	0.0912	0.0104	0.0914	0.0104
Immigrant Father	0.3617	0.1306	0.3633	0.1306	0.5261	0.1520	0.5272	0.1521
Immigrant Mother	0.2947	0.1392	0.2977	0.1390	0.1918	0.1561	0.1923	0.1561
Black Indicator	-0.0663	0.0582	-0.0621	0.0583	0.1052	0.0637	0.1091	0.0637
Number of Siblings	-0.0277	0.0090	-0.0275	0.0090	-0.0264	0.0099	-0.0258	0.0099
Newspaper*	0.3411	0.0680	0.3404	0.0680	0.3156	0.0725	0.3185	0.0725
Library Card*	0.2348	0.0505	0.2387	0.0505	0.1285	0.0556	0.1307	0.0557
Mom and Dad*	0.1757	0.0675	0.1722	0.0674	0.1937	0.0788	0.1913	0.0788
City	-0.2553	0.0585	-0.2462	0.0588	-0.1848	0.0617	-0.1683	0.0616
Suburb	-0.0906	0.0575	-0.0850	0.0571	-0.0985	0.0609	-0.0918	0.0602
Drop/Grad Cut Point								
Kappa H	0.7677	0.1564	0.7892	0.1520	0.7559	0.1748	0.8229	0.1687
University Access	0.1142	0.0715	0.1248	0.0592	0.2127	0.0774	0.1851	0.0650
Grad/Univ Cut Point								
Kappa U	1.9348	0.1568	1.8873	0.1533	2.5188	0.1771	2.4561	0.1722
University Access	-0.1264	0.0632	-0.0772	0.0525	-0.1375	0.0686	-0.0621	0.0586
Log-Likelihood	-3020		-3020		-2507		-2509	
N	3203		3203		2693		2693	
LR (2) vrs (1): p-value	0.0018		0.0012		0.0001		0.0011	
LR (3) vrs (1): p-value	0.0005		0.0002		0.0000		0.0003	

* These variables are household attributes at age 14. All models also include 8 Census Division of residence at 14 dummy variables and 2 dummy variables indicating missing parental education data.

Table A3. Ordered Probit Estimates (Spec. 2) - Restricted to Respondents with Full Parental Education Data

	Men				Women			
Access Measure	**4 Year**		**Public 4 Year**		**4 Year**		**Public 4 Year**	
	Coeff.	**St. Error**	**Coeff.**	**St. Error**	**Coeff.**	**St. Error**	**Coeff.**	**St. Error**
Father's Education	0.0696	0.0090	0.0700	0.0090	0.0761	0.0101	0.0760	0.0101
Mother's Education	0.0689	0.0111	0.0687	0.0111	0.0839	0.0125	0.0836	0.0125
Immigrant Father	0.3399	0.1481	0.3350	0.1480	0.5726	0.1702	0.5675	0.1699
Immigrant Mother	0.2523	0.1559	0.2589	0.1557	0.2890	0.1780	0.2932	0.1779
Black Indicator	0.0357	0.0695	0.0404	0.0697	0.2411	0.0789	0.2464	0.0792
Number of Siblings	-0.0391	0.0110	-0.0391	0.0110	-0.0204	0.0118	-0.0204	0.0118
Newspaper*	0.2458	0.0877	0.2426	0.0876	0.2881	0.0931	0.2902	0.0931
Library Card*	0.2268	0.0593	0.2300	0.0593	0.1545	0.0666	0.1570	0.0668
Mom and Dad*	0.3377	0.1081	0.3360	0.1080	0.3162	0.1181	0.3122	0.1183
City	-0.2244	0.0711	-0.2064	0.0690	-0.2355	0.0751	-0.2035	0.0719
Suburb	-0.1139	0.0671	-0.1005	0.0652	-0.1535	0.0697	-0.1343	0.0682
Drop/Grad Cut Point								
Kappa H	0.7581	0.1905	0.7820	0.1879	1.0196	0.2109	1.0038	0.2072
University Access	0.1410	0.0764	0.1534	0.0681	0.0609	0.0817	0.1288	0.0761
Grad/Univ Cut Point								
Kappa U	1.9422	0.1923	1.8913	0.1900	2.7050	0.2152	2.6453	0.2119
University Access	-0.1187	0.0657	-0.0550	0.0584	-0.1732	0.0712	-0.1106	0.0656
Log-Likelihood	-2235		-2236		-1864		-1864	
N	2451		2451		2045		2045	
LR (2) vrs (1): p-value	0.0010		0.0042		0.0107		0.0097	
LR (3) vrs (1): p-value	0.0002		0.0010		0.0028		0.0059	

* These variables are household attributes at age 14. All models also include 8 Census Division of residence at 14 dummy variables.

Table A4. Ordered Probit Estimates (Spec. 2) - Restricted to Respondents with Full Parental Education Data

	Men				Women			
Access Measure	**2 or 4 Year**		**Public 2 or 4 Year**		**2 or 4 Year**		**Public 2 or 4 Year**	
	Coeff.	**St. Error**	**Coeff.**	**St. Error**	**Coeff.**	**St. Error**	**Coeff.**	**St. Error**
Father's Education	0.0693	0.0090	0.0696	0.0090	0.0761	0.0101	0.0759	0.0101
Mother's Education	0.0689	0.0111	0.0690	0.0111	0.0834	0.0125	0.0837	0.0125
Immigrant Father	0.3423	0.1479	0.3426	0.1479	0.5693	0.1700	0.5718	0.1701
Immigrant Mother	0.2538	0.1557	0.2564	0.1556	0.2975	0.1778	0.2939	0.1779
Black Indicator	0.0356	0.0695	0.0369	0.0696	0.2454	0.0792	0.2507	0.0791
Number of Siblings	-0.0395	0.0110	-0.0393	0.0110	-0.0206	0.0118	-0.0198	0.0118
Newspaper*	0.2393	0.0876	0.2375	0.0876	0.2891	0.0931	0.2927	0.0932
Library Card*	0.2279	0.0592	0.2295	0.0592	0.1569	0.0666	0.1605	0.0668
Mom and Dad*	0.3361	0.1081	0.3342	0.1079	0.3108	0.1182	0.3086	0.1183
City	-0.2169	0.0686	-0.2076	0.0690	-0.2032	0.0724	-0.1866	0.0722
Suburb	-0.1045	0.0650	-0.1003	0.0647	-0.1298	0.0686	-0.1226	0.0678
Drop/Grad Cut Point								
Kappa H	0.7623	0.1933	0.7818	0.1891	0.9116	0.2151	0.9559	0.2080
University Access	0.1072	0.0829	0.1174	0.0694	0.1894	0.0908	0.2006	0.0771
Grad/Univ Cut Point								
Kappa U	1.9045	0.1934	1.8790	0.1906	2.7006	0.2172	2.6509	0.2123
University Access	-0.0696	0.0705	-0.0405	0.0590	-0.1459	0.0767	-0.0922	0.0659
Log-Likelihood	-2239		-2239		-1863		-1862	
N	2451		2451		2045		2045	
LR (2) vrs (1): p-value	0.0840		0.0506		0.0024		0.0013	
LR (3) vrs (1): p-value	0.0262		0.0151		0.0005		0.0003	

* These variables are household attributes at age 14. All models also include 8 Census Division of residence at 14 dummy variables.

Table A5. Percent of Sample in each Educational Category - Restricted to Respondents with Full Parental Education Data

Education Groups	Men: Regions Without Access	Men: Regions With Access	Women: Regions Without Access	Women: Regions With Access
Access is defined as a 4 year degree granting institution				
High School Drop-outs	16.6	17.9	16.0	15.6
High School Graduates	36.2	27.9	52.7	45.3
University Enrollees	47.2	54.2	31.3	39.1
Access is defined as a 2 or 4 year degree granting institution				
High School Drop-outs	17.0	17.6	13.2	16.5
High School Graduates	35.1	29.2	55.0	45.5
University Enrollees	47.9	53.2	31.8	38.0
Access is defined as a public 4 year degree granting institution				
High School Drop-outs	17.3	17.7	16.0	15.4
High School Graduates	33.8	27.2	51.8	43.3
University Enrollees	48.9	55.1	32.2	41.3
Access is defined as a public 2 or 4 year degree granting institution				
High School Drop-outs	17.4	17.6	14.4	16.7
High School Graduates	33.3	28.5	53.2	43.6
University Enrollees	49.3	53.9	32.4	39.7

Table A6. Predicted Educational Group Sizes - Restricted to Respondents with Full Parental Education Data

Education Groups	Men		Women	
	Regions Without Access	Regions With Access	Regions Without Access	Regions With Access
Access is defined as a 4 year degree granting institution				
High School Drop-outs	16.7 **	17.7	16.0	15.5
High School Graduates	35.9	27.9	52.5	45.1
University Enrollees	47.4	54.4	31.5	39.4
Access is defined as a 2 or 4 year degree granting institution				
High School Drop-outs	17.0	17.6	13.1 *	15.4
High School Graduates	34.8	29.1	49.6	40.6
University Enrollees	48.2	53.3	37.3	44.0
Access is defined as a public 4 year degree granting institution				
High School Drop-outs	17.3 **	17.6	16.2 **	15.1
High School Graduates	33.6	27.2	51.3	43.5
University Enrollees	49.1	55.2	32.5	41.4
Access is defined as a public 2 or 4 year degree granting institution				
High School Drop-outs	17.3 *	17.5	14.8 ***	16.4
High School Graduates	33.2	28.4	52.4	43.9
University Enrollees	49.5	54.1	32.8	39.8

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

Table A7. OLS Regression - Dependent Variable: KWW Score

	Drop-outs		H.S. Graduates		University Enrollees	
	Coef.	**St. Error**	**Coef.**	**St. Error**	**Coef.**	**St. Error**
Men						
4 Year University in Labour Market	2.0691	1.2587	-0.8661	0.9202	1.1022	0.7246
Father's Education	0.3536	0.1895	0.1863	0.1578	0.3342	0.1072
Mother's Education	0.6160	0.2098	0.2567	0.1752	0.0884	0.1272
Immigrant Father	-1.6441	3.2861	-5.4159	2.6759	3.5629	1.5198
Immigrant Mother	0.1282	3.5422	2.1311	2.8344	-3.7498	1.5391
Black Indicator	-6.8778	1.1933	-7.1124	1.0758	-5.1671	0.8781
Number of Siblings	-0.8831	0.1889	-0.4330	0.1655	-0.5268	0.1330
Newspaper*	2.4299	1.2275	1.8883	1.1786	4.0787	1.3259
Library Card*	2.2586	1.0660	3.7548	0.8972	3.4783	0.7739
Mom and Dad*	-0.7696	1.3498	-0.2049	1.1995	0.8342	1.1078
1966 City Indicator	3.0375	1.3933	3.3805	1.1444	0.3004	0.8034
1966 Suburb Indicator	3.4442	1.4724	1.4444	1.0532	0.3238	0.7811
N	680		973		1502	
R-Squared	0.3301		0.3041		0.3167	
Women						
4 Year University in Labour Market	1.1219	2.3139	0.8995	1.1580	0.3772	1.2555
Father's Education	0.1392	0.4183	0.4801	0.2047	0.2445	0.1954
Mother's Education	1.4414	0.3948	0.4674	0.2330	-0.0075	0.2425
Immigrant Father	2.0462	7.8226	-0.3536	3.7349	1.5053	2.6133
Immigrant Mother	2.2521	8.6559	-0.2330	3.4244	-4.2809	2.8783
Black Indicator	-13.1031	2.3834	-11.0253	1.4031	-9.5452	1.6250
Number of Siblings	-0.6250	0.3607	-0.7961	0.2204	-0.5726	0.2450
Newspaper*	3.7156	2.3988	3.7153	1.5385	-0.0537	2.4276
Library Card*	3.4674	2.2333	3.2916	1.1617	5.1898	1.5369
Mom and Dad*	-2.0081	3.0416	-3.2900	1.6873	0.5395	2.1660
1968 City Indicator	2.9003	2.6894	0.6378	1.4114	1.5602	1.4490
1968 Suburb Indicator	4.3680	2.8689	1.4595	1.3226	-0.3174	1.3553
N	484		1248		863	
R-Squared	0.2925		0.3308		0.2360	

* These variables are household attributes at age 14. All models also include 8 Census Division of residence at age 14 dummy variables, 2 dummy variables for missing parental education data, 5 dummy variables for age, and a constant.

CILN Working Papers (downloadable)

wp43 **John Flemming John Micklewright**
Income Distribution, Economic Systems and Transition

wp42 **John Micklewright Kitty Stewart**
Is Child Welfare Converging in the European Union?

wp41 **W Bentley Macleod**
A Note on the Optimality of Bonus Pay

wp40 **Xin Meng Robert G Gregory**
Impact of Interupted Education on Earnings:
The Educational Cost of the Chinese Cultural Revolution

wp39 **Miles Corak**
Death and Divorce: The Long Term Consequences of Parental Loss on Adolescents

wp38 **Lori Curtis Martin Dooley**
Child Health and Family Socioeconomic Status in the Canadian National Longitudinal Survey of Children and Youth

wp37 **Heather Antecol**
An Examination of Cross-Country Differences in the Gender Gap in Labor Force Participation Rates

wp36 **W. Craig Riddell**
Canadian Labour Market Performance in International Perspective: Presidential Address to the Canadian Economics Association

wp35 **Shelley Phipps**
Economics and Well-Being of Canadian Children

wp34 **W. Craig Riddell**
Measuring Unemployment and Structural Unemployment

wp33 **Susan Johnson**
Automatic Certification or Mandatory Representation Votes? How the choice of union recognition procedure affects union certification success.

wp32 **James Andreoni Eleanor Brown Isaac C. Rischall**
Charitable Giving by Married Couples: Who Decides and Why Does it Matter?

wp31 **Herb Schuetze Peter Kuhn**

Self-Employment Dynamics and Self-Employment Trends: A Study of Canadian Men and Women, 1982-1995

wp30 **Isaac C. Rischall**
The Effect of High School Effort on Future Earnings

wp29 **Isaac C. Rischall**
The Roles of Education, Skill and Parental Income in Determining Wages

wp28 **Isaac C. Rischall**
The Value of a Fresh Start: Earnings Persistence and the Migration of Single Mothers

wp27 **Martin Browning Tom Crossley**
Shocks, Stocks and Socks: Consumption Smoothing and the Replacement of Durables During an Unemployment Spell

wp26 **Heather Antecol Kelly Bedard**
Against All Odds: The Surprising Labor Market Success of Young Mexican Women

wp25 **Heather Antecol**
Why is there Inter-Ethnic Variation in the Gender Wage Gap? The Role of "Cultural" Factors

wp24 **Martin Browning Tom Crossley**
Unemployment Insurance Benefit Levels and Consumption Changes

wp23 **Heather Antecol Peter Kuhn**
Employment Equity Programs and the Job Search Outcomes of Men and Women: Actual and Perceived Effects

wp22 **Thomas F. Crossley**
Firms and Wages: Evidence from Displaced Workers

wp21 **Jennifer Stewart Martin Dooley**
The Duration of Spells on Welfare and Off-welfare among Lone Mothers in Ontario

wp20 **Peter Kuhn Arthur Sweetman**
Vulnerable Seniors: Unions, Tenure and Wages Following Permanent Job Loss

wp19 **Kelly Bedard**
Human Capital Versus Signaling Models: University Access and High School Drop-outs

wp18 **Peter Kuhn Arthur Sweetman**
Assimilation and Economic Success in an Aboriginal Population: Evidence from Canada

wp17 **Martin D. Dooley**
The Evolution of Welfare Participation Among Canadian Lone Mothers From 1973 - 1991

wp16 **Lori Curtis Martin D. Dooley Ellen L. Lipman David H. Feeny**
The Role of Permanent Income and Family Structure in the Determination of Child Health in the Ontario Child Health Study

wp15 **LaDonna A. Pavetti**
A New Social Contract: Moving to a Work-Based Assistance System

wp14 **Gary Burtless**

The Job Prospects of U.S. Welfare Recipients: Lousier Pay but Bigger Earnings Supplements

wp13 **J.B. Burbidge L. Magee A.L. Robb**
Cohort, Year and Age Effects in Canadian Wage Data

wp12 **Martyn Andrews Alan Harrison**
Testing for Efficient Contracts in Unionized Labour Markets

wp11 **Herb J. Schuetze**
Taxes, Economic Conditions And Recent Trends in Male Self-Employment: A Canada-U.S. Comparison

wp10 **Peter Kuhn**
Canada and the "OECD Hypothesis": Does Labour Market Inflexibility Explain Canada's High Level of Unemployment?

wp9 **Stephen R. G. Jones W. Craig Riddell**
The Measurement Of Unemployment: An Empirical Approach

wp8 **Pierre Lefebvre Philip Merrigan Martin Dooley**
Lone Female Headship and Welfare Policy in Canada

wp7 **Heather Antecol Peter Kuhn**
Gender as an Impediment to Labor Market Success: Why do Young Women Report Greater Harm?

wp6 **John Myles Paul Pierson**
Friedman's Revenge: The Reform of "Liberal" Welfare States In Canada and the United States

wp5 **Jeff Borland**
Earnings Inequality in Australia: Changes and Causes

wp4 **Jeff Borland**
Union Effects and Earnings Dispersion in Australia, 1986-1994

wp3 **Robert Gregory Boyd Hunter**
The Macro Economy and the Growth of Income and Employment Inequality in Australian Cities

wp2 **Peter Kuhn**
Labour Market Polarization: Canada in International Perspective

wp1 **Peter Kuhn A. Leslie Robb**
Shifting Skill Demand and the Canada-US Unemployment Gap: Evidence from Prime-Age Men

Last updated March 27, 2000