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ABSTRACT

Lowering dropout levels would not necessarily make society better off and, consequently, student aid policy should not be evaluated by its effects on dropout. Analysis of the model of postsecondary enrollment and completion developed in this paper results in two striking findings. First, making reduction of dropouts the policy goal yields the perverse conclusion that it would be best to eliminate student aid entirely because eliminating aid would make enrollment less attractive than work and hence reduce the number of students who choose to enroll. The students who choose to work rather than enroll are those with the lowest complet on probabilities, so eliminating the aid shifts the composition of those enrolled toward those students with the highest completion probabilities. Second, a policy that reduces dropout probabilities does indeed lower dropout among those students who would have enrolled in the prepolicy regime; at the same time, however, it also induces new students to enroll. The dropout level rises if the number of induced enrollees who drop out exceeds the gain in completion among existing enrollees. The dropout rate rises if the completion probabilities of induced enrollees are sufficiently lower than those of existing enrollees. Completion subsidies may induce students to choose programs with high pass rates and thus may inhibit good matches between students and careers. The document develops a model elaborating on the idea that completion of schooling is exogenous, applies the model to the study of enrollment and completion, and extends the analysis to allow for the possibility that completion is partly endogenous. An appendix provides proofs for the two major propositions. Seven references are included. (CML)

SHOULD WE SUBSIDIZE ENROLLMENT IN OR COMPLETION OF POSTSECONDARY SCHOOLING?

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The inquiry into student aid mechanisms reported in Section 4 was commissioned by the National Assessment of Vocational Education through a contract to MPR Associates, Inc. To provide the basis for this analysis, I found it necessary to first perform the research reported in Sections 2 and 3, which examine the process of enrollment in and completion of postsecondary schooling. A version of the material in Sections 1 through 3 is available as the paper "Schooling as Experimentation: A Reappraisal of the College Dropout Phenomenon," Institute for Research on Poverty Discussion Paper 865-88. I have benefitted from the comments of Arthur Goldberger, David Goodwin, and Norton Grubb.

INTRODUCTION

Dropout from postsecondary schooling is widely considered a social problem. Reducing dropout is often cited as an objective of student financial aid. In a recent issue of Change, Fischer (1987) states: "All knowledgeable observers bemoan current dropout levels and believe society would be better off if these levels were lower" (p. 42). The presumption that current dropout levels are too high leads Fischer to propose replacement of existing federal programs of grants and subsidized loans by a "graduation-contingent" aid program. This would give "unsubsidized loans while the student is in school, with subsidies provided in the form of partial loan cancellation only after degree attainment" (p. 44).

Writing in the *Economics of Education Review,* James (1988) states: "And, does this aid accomplish one of its major purposes, reducing the above-average attrition rates of low socio-economic students, so that more of them complete college?" (p. 3). In the same issue, Stampen and Cabrera (1988) examine the effect of student aid on dropout and provide numerous references to previous work on the subject.

I shall show in Sections 2 and 3 that the conventional wisdom regarding dropout has no normative basis. *Lowering dropout levels would not necessarily make society better off. Student aid policy should not be evaluated by its effect on dropout.*

These conclusions cut the ground out from under the dropout- reduction argument made by Fischer (1987) in proposing that student aid should be contingent on graduation. They leave open the basic question that Fischer poses: Should society subsidize enrollment in or completion of postsecondary schooling?

The analysis of Section 4 suggests that graduation-contingent aid is most appealing if the following conditions hold:

(a) society values completion of schooling more than students do privately

(b) society values dropping out and working no more than students do privately

(c) students drop out of school not because they are unable to graduate but because they do not want to graduate.

Traditional scholarship aid, which subsidizes enrollment rather than completion, is most appealing if

(d) Society values enrollment, regardless of its outcome, more than students do privately.

(e) Society values working no more than students do privately.

(f) Before enrolling, students do not know whether they will complete their schooling. Moreover, they are risk-averse.

Thus, to determine the relative merits of contingent aid and traditional scholarships, it will be necessary to answer both normative and empirical questions.

SCHOOLING AS EXPERIMENTATION

Suppose that a student has enrolled in postsecondary education. What determines whether he or she will graduate? Completion of schooling presumably requires that two conditions hold. First, the student must be able to pass the prescribed courses. Second, the student must decide that it is worthwhile to persist to graduation. Thus, completion has both exogenous and endogenous determinants. The student must be able to graduate and must want to.

Now consider a student contemplating enrollment. At this point, the student does not know whether he has the ability to complete the program under consideration. Nor does he know whether he will find it worthwhile to do so. The only way the student can definitively determine whether schooling is for him is by enrolling. Thus, the decision to enroll is a decision to initiate an experiment.

Viewing schooling as experimentation has important implications for our interpretation of postsecondary dropout. The usefulness of an experiment cannot be judged by its outcome. Nor does it suffice to know the experiment's ex ante probability of success. The appropriate way to evaluate an experiment is by its ex ante expected return.

An observer given data on the success rate of those experiments that are performed cannot, in general, judge whether the right experimentation decisions have been made. To see why, suppose that each member of a population must decide whether or not to perform an experiment which has cost C and, if successful, benefit B. Suppose that the probability of success, denoted P, varies across the population while C and B do not. Then an individual should perform the experiment if his expected return $PB - C$ exceeds zero. That is, the threshold success probability at which experimentation becomes worthwhile is C/B. The success rate of those experiments that are performed is $E(P|P>C/B)$, the expected value of P within the subpopulation for whom P exceeds C/B. This rate depends on the manner in which P varies across the population and on the value C/B. In principle, it can be any number between zero and one.

This reasoning applies to the analysis of enrollment and persistence. Let schooling have cost C and, if completed successfully, benefit B. Let P be the probability of completion. Suppose that an observer is told the completion rate of enrolled students but is not told C, B, nor the manner in which P varies across students. Then the observer cannot judge whether the right enrollment decisions have been made.

Postsecondary dropout and high school dropout are fundamentally different phenomena. Postsecondary enrollment is voluntary; high school enrollment is compulsory. A student entering college recognizes that dropout may be the outcome and feels it worthwhile to accept this risk. A student entering high school does not thereby signal his acceptance of the risk of dropout. Many high school dropouts are people who, in the absence of compulsory attendance laws, would have chosen not to enroll.

The observation that postsecondary schooling is an experiment is not new. Manski and Wise (1983) note:

> "Like trial and error in the job market, postsecondary education may for many young people be part of the search process that leads to discovery of what they like and don't like and of which occupations are compatible with their interests and abilities. To this extent, students may derive informational value from attendance, even if they drop out." (p. 10)

Fischer (1987) says: "There are so many college dropouts for the same reason there are so many small business failures - start-up costs are not exorbitant and the risk is rationally worth taking" (p. 44).

Curiously, the implications of thinking of schooling as experimentation seem not to have been worked out. In particular, it has not been appreciated that postsecondary dropout statistics carry no normative message. Much of the literature on the economics of education ignores dropout entirely by treating schooling as an investment which, when undertaken, will definitely be completed. Recent survey articles by Blaug (1985) and Freeman (1986) make no mention of the dropout phenomenon.

Those studies which treat schooling as an investment with uncertain outcome do not analyze the interaction between ex ante dropout probabilities, enrollment decisions, and subsequent dropout levels. See, for example, Chapters 6 and 8 of Manski and Wise (1983). One study, by Comay, Melnik, and Pollatschek (1973), does present a model which can be applied to study schooling as experimentation. These authors do not, however, develop the experimentation theme.

In an attempt to shed light on the interaction between dropout probabilities, enrollments, and realized dropouts, I develop here a model of postsecondary enrollment and completion. The simpler version of this model assumes that, conditional on enrollment, completion is exogenous. A more general version makes completion partly endogenous. Working through the implications of this model makes clear that student aid policy should not be evaluated by its effect on dropout. Two findings are especially striking.

First, setting the policy goal to be reduction of dropout yields the perverse conclusion that it would be best to eliminate student aid entirely. The reason is that eliminating aid makes enrollment less attractive relative to working. Lowering the attractiveness of enrollment reduces the number of students who choose to enroll. The students who choose to work rather than enroll are those with the lowest completion probabilities. Hence, eliminating aid shifts the composition of enrollment towards those students with the highest completion probabilities.

Second, suppose it is possible to introduce a policy which reduces the ex ante dropout probability of each member of the population. This policy may either reduce or raise ex post dropout, for the following reason. A policy which reduces dropout probabilities does lower dropout among those students who would have enrolled in the pre-policy regime. But introduction of the policy also induces new students to enroll. The observed dropout level (i.e. the number of dropouts) rises if the number of induced enrollees who drop out exceeds the gain in completion among existing enrollees. The dropout rate (i.e., the fraction of enrollees who dropout) rises if the completion probabilities of induced enrollees are sufficiently lower than those of existing enrollees.

The analysis supporting these findings is presented below.

MODELS OF POSTSECONDARY ENROLLMENT AND COMPLETION

The word model sketched in Section 2 presumes that completion of schooling is exogenous; the experiment either succeeds or fails. Section 3.1 develops a formal model elaborating on this idea. Sections 3.2 and 3.3 use the model to study the determination of aggregate postsecondary enrollment and completion. Section 3.4 extends the analysis to allow for the possibility that completion is partly endogenous.

A Model with Exogenous Completion

Assume that a student graduating from high school may either work or pursue further schooling. Let V_w denote the expected utility of working, V_c the expected utility associated with completing a postsecondary program, and V_d the expected utility associated with dropping out. Let P denote the probability of completing schooling should the student enroll. Then the student will enroll if

(1) $PV_c + (1-P)V_d > V_w$.

Note that the student is indifferent between enrolling and working if $PV_c + (1-P)V_d = V_w$. Provided that the number of students exactly on the margin is negligible, it is innocuous to assume that all such students enroll.

In principle, all of the quantities V_w, V_c, V_d, and P may vary across students. To make the main points, it is simplest to condition on specified values of the expected utilities (V_w, V_c, V_d) and to consider the population of students characterized by these values. These students may vary in their completion probabilities P.

We shall focus on the case in which $V_d < V_w < V_c$. Otherwise the analysis is trivial. In particular, if $V_w < V_d < V_c$, then every student enrolls, regardless of his completion probability. If $V_d < V_c < V_w$, then no student enrolls. If $V_c < V_d$, then the enrolled students prefer to drop out rather than graduate. Given that $V_c > V_d$, the enrollment criterion (1) is equivalent to $V_w - V_d$

(2) $P > \frac{V_w - V_d}{V_c - V_d}$.

Let

(3) $\pi \int \frac{V_w - V_d}{V_c - V_d}$

be the threshold completion probability at which enrollment becomes worthwhile. Let F denote the distribution of P across students, conditional on the specified values of V_w, V_c, and V_d. Let Q denote the enrollment level, that is the fraction of the student population who choose to enroll. Then Q is the fraction of the population for whom P exceeds π. That is,

(4) $Q = \int_{\pi}^{1} dF$.

Let Q_c denote the completion level, that is the fraction of the population who enroll in and complete postsecondary education. Then

$$(5) \quad Q_c = \int_{\pi}^{1} P\,dF$$

Let Q_d denote the dropout level, that is the fraction of the population who enroll and then drop out. Then

$$(6) \quad Q_d = Q - Q_c = \int_{\pi}^{1} (1-P)\,dF$$

Finally, let R_d denote the dropout rate, that is the fraction of enrollees who drop out. Then

$$(7) \quad R_d = \frac{Q_d}{Q} = \frac{\int_{\pi}^{1} (1-P)\,dF}{\int_{\pi}^{1} dF}$$

Effect of a Change in π

In this subsection and the next, we ask how the quantities Q, Q_c, Q_d and R_d are affected by changes in π and F.

Here we consider a rise in π, holding F fixed. By (3), a rise in π can be achieved by increasing the expected utility of working, by decreasing the expected utility of completing schooling, or by decreasing the expected utility of dropping out. That is, a rise in π follows from any change that makes enrolling less attractive relative to working. Proposition 1 gives the qualitative consequences.

PROPOSITION 1: Suppose that the threshold completion probability at which enrollment becomes worthwhile rises from π to some $l > \pi$. Then

A. The enrollment level Q falls.

B. The completion level Q_c falls.

C. The dropout level Q_d falls.

D. The dropout rate R_d falls.

This proposition is proved in the Appendix. The reasoning can be explained easily. Raising π obviously reduces the number of students who choose to enroll (Part A). Hence it reduces the number who complete schooling (Part B) and the number who drop out (Part C). The students who choose to work rather than enroll are those with the lowest completion probabilities. Hence, raising π shifts the composition of enrollment towards those students with the highest completion probabilities (Part D).

Proposition 1 shows why student aid policy should not be evaluated by its effect on dropout. Suppose that a policy change worsens the terms of aid. Then, ceteris paribus, π rises. So the dropout level Q_d and the dropout rate R_d both fall. Thus, evaluating aid policy by its effect on dropout yields the perverse conclusion that aid should be reduced to zero. What this conclusion ignores, of course, is that reducing aid lowers the completion level as well.

As stated, Proposition 1 conditions on specified values of (V_c, V_d, V_w). That is, the Proposition concerns a population of students who have the same expected utility values but who vary in their completion probabilities. Parts A through C hold unconditionally. If Q, Q_c, and Q_d fall conditional on every possible value of (V_c, V_d, V_w), then these quantities necessarily fall in the aggregate. Part D, which involves a rate rather than a level, need not hold unconditionally.

Effect of a Change in F

Consider now the effects of a change in F, holding π fixed. Many types of changes might be contemplated. We shall examine an especially simple case. Suppose that the completion probability of each member of the population rises. This may, for example, be achieved by improving the quality of high school education or by providing tutoring while in college. Proposition 2 gives the qualitative consequences.

PROPOSITION 2: Suppose that each completion probability P rises to some $g(P) > P$. Then

A. The enrollment level Q rises.

B. The completion level Q_c rises.

C. The dropout level Q_d may rise or fall.

D. The dropout rate R_d may rise or fall.

Proposition 2 is proved in the Appendix. This proposition provides further evidence that policy should not be evaluated by its effect on dropout. It might have been thought that a policy which raises all completion probabilities must lower the level and rate of realized dropout. In retrospect, it is easy to see why this is not so.

A policy change which raises completion probabilities does lower dropout among students who enroll in the pre-change regime. But the change also induces new students to enroll (Part A). Of these new students, some complete their schooling (Part B). Others do not. The aggregate dropout level rises/falls if the number of induced enrollees who drop out is larger/smaller than the reduction in dropout among the pre-change enrollees (Part C). The dropout rate rises if the completion probabilities of induced enrollees are sufficiently lower than those of pre-change enrollees. Otherwise the dropout rate falls (Part D).

As stated, Proposition 2 conditions on specified values of (V_c, V_d, V_w). The entire proposition holds unconditionally. Parts A through C concern levels, so the reasoning applied to Proposition 1 applies here as well. Part D states that, conditional on (V_c, V_d, V_w), the rate R_d can either rise or fall. If so, then R_d can obviously either rise or fall unconditionally.

A Model With Partly Endogenous Completion

This section generalizes the foregoing analysis by making completion of schooling partly endogenous.

Assume that an enrolled student completes his postsecondary program if he or she works hard enough. It may be that the effort needed to graduate is infinite, so that graduation is impossible. This is equivalent to saying that the student does not have the requisite ability. On the other hand, it may be that finite effort suffices. If so, the student decides whether exerting that effort is worthwhile. The student can determine the required effort only by enrolling. Before enrolling, he has effort expectations. In what follows, we first formalize the completion decision and then work backwards to the enrollment decision.

As earlier, let V_c be the expected utility associated with completing schooling and Vd be the expected utility associated with dropping out. Let $R \int V_c - V_d$. Let Z denote the effort required to graduate, a non-negative value expressed in units of utility. Then an enrolled student will choose to complete if

(8) $Z < R$

and to drop out otherwise.

Now consider a student facing the enrollment decision. The student knows V_c, V_d, and V_w. Not yet having enrolled, he does not know Z. He believes, however, that Z will be drawn from some probability distribution G. In this setting, the expected utility of enrollment is

$$\int (V_c - Z)\, 1[Z<R]\, dG + \int V_d 1[Z>R]\, dG$$

$$= V_c \mathrm{Prob}(Z<R) + V_d \mathrm{Prob}(Z>R) - \int_0^R Z dG.$$

Hence the student chooses to enroll if

$$(9) \quad V_c \mathrm{Prob}(Z<R) + V_d \mathrm{Prob}(Z>R) - \int_0^R Z dG > V_w.$$

(This assumes that a student who is indifferent between enrolling and working does enroll.)

Conditioning on specified values for (V_c, V_d, V_w), the enrollment decision is determined by the student's effort expectations, as embodied in G. A particularly simple case is that in which G is Bernoulli, with probability P that $Z = 0$ and probability 1-P that $Z = \infty$. Here $\mathrm{Prob}(Z<R) = P$, $\mathrm{Prob}(Z>R) = 1-P$, and

$$\int_0^R Z dG = 0,$$

whatever non negative value R may take. It follows that the completion probability for an enrolled student is P and that the enrollment criterion (9) reduces to

$$PV_c + (1-P)V_d > V_w.$$

Thus, making G Bernoulli with mass points at zero and infinity generates the model with exogenous completion of Section 3.1.

Propositions 1 and 2 hold for other specifications of G that make completion partly endogenous. A complete analysis will not be attempted here. Instead, we shall consider a simple generalization of the Bernoulli model. Assume that, for each student, G is Bernoulli, with probability P on the event $Z = K$ and 1-P on the event $Z = \infty$. The exogenous completion model made $K = 0$. Here K varies across students.

For this specification, $Prob(Z<R) = P$, $Prob(Z>R) = 1-P$, and

$$\int_0^R Z\,dG = K$$

if $K < R$. On the other hand, $Prob(Z<R) = 0$, $Prob(Z>R) = 1$, and

$$\int_0^R Z\,dG = 0$$

if $K > R$. Hence, the student chooses to enroll if

(10) $1[K<R]\{PV_c + (1-P)V_d - PK\} + 1[K>R]V_d > V_w$.

An enrolled student chooses to complete his schooling if

(11) $Z = K < R$.

When $K < R$, (10) is equivalent to saying that the student enrolls if

(12) $P > \dfrac{V_w - V_d}{R - K} \equiv \pi_K$.

Condition (12) has the same form as the criterion (2) that applies when completion is exogenous. We may therefore conclude that, conditioning on specified values for (V_c, V_d, V_w) and K, Propositions 1 and 2 hold.

SUBSIDIZATION OF POSTSECONDARY SCHOOLING

The foregoing analysis suffices to show that student aid policy should not be evaluated by its effect on dropout. It leaves open the question of whether society should subsidize enrollment in or completion of postsecondary schooling. This Section examines the subsidization question.

The analysis of Sections 4.1 through 4.3 supposes that the generalized Bernoulli model of Section 3.4 describes enrollment and completion. Thus, the student chooses to enroll if (10) holds. An enrolled student completes his schooling if (11) holds. Section 4.4 discusses issues not addressed by this model.

My inquiry into student aid mechanisms restricts attention to economic considerations. In particular, I make no attempt to weigh the possible political appeal of graduation-contingent aid.

It seems that a segment of the public view existing student aid programs negatively, as giveaways. Such people may feel more favorable to rewarding achievement through the provision of subsidies to graduates.

PRIVATE ACTIONS AND SOCIAL PREFERENCES

Any discussion of public subsidization of schooling must begin from the premise that social and private interests somehow diverge. In proposing that student aid be graduation-contingent, Fischer (1987) presumes that society values completion of schooling more than students do privately. He also presumes that society values dropping out and working no more than students do privately. These premises will be adopted here and in Section 4.2. In doing so, I do not necessarily accept their validity. Alternatives will be considered later.

Interpreted in the context of our enrollment and completion model, Fischer presumes that the social value of completing schooling is $V_c + G$, for some expected utility increment G. He presumes that the social values of dropping out and working are V_d and V_w respectively. Note that G need not be constant across students. For example, society may feel that college graduation by minority students carries greater externalities than does graduation by other students.

In this setting, society prefers that a student enroll if

(13) $1[K<R+G]\{P(V_c+G) + (1-P)V_d - PK\} + 1[K>R+G]V_d > V_w$.

Society would like an enrolled student to complete school if

(14) $Z = K < R + G$.

Comparing (10) and (13), we see that society would like some students who work to enroll instead. Comparing (11) with (14), we see that society would like some students who drop out to complete school.

It might be thought that society's desire to see more students graduate implies a desire to see a lower rate of dropout. This is so among students for whom $R < K < R + G$. When such students enroll, they do so with the intention of dropping out. Society prefers that those who satisfy (14) graduate.

Society does not wish to see a lower dropout rate otherwise. All enrolled students for whom $K > R + G$ drop out; society agrees that they should. Students for whom $K < R$ enter school hoping to graduate; they drop out only if forced to do so. Such students choose to enroll if condition (12) holds. By (13), society prefers that they enroll whenever

$$(15)\quad P > \frac{V_w - V_d}{R + G - K} \equiv \pi_{GK} .$$

The socially-preferred threshold completion probability π_{GK} is lower than the private threshold π_K given in (12). Hence, among students for whom $K < R$, society prefers a *higher* dropout rate than that generated privately.

THE CASE FOR COMPLETION SUBSIDIES

Suppose that the government wishes to induce students to behave in the socially preferred manner. Suppose that two mechanisms are available. One is the traditional scholarship program, such as the Pell grant, which subsidizes enrollment. The other is graduation-contingent aid, which subsidizes completion.

We shall compare these two mechanisms here under the assumptions of the preceding section. We shall also make three simplifying assumptions. First, students are risk neutral. Hence each dollar of subsidy increases expected utility by the same amount. The implications of risk aversion will be discussed in Section 4.3.

Second, scholarships are awarded up-front rather than incrementally. Hence, the recipient of a scholarship receives the same amount whether he drops out or graduates. This assumption makes the distinction between enrollment and completion subsidies larger than it is in practice. Existing scholarship programs provide incremental awards. Funding for year i+1 is contingent on satisfactory completion of the coursework for year i.

Third, we assume that the government knows (V_w, V_d, V_c, P, K, G) for each student. This ensures that the government can determine the appropriate subsidy level to give each student. We shall not examine the moral hazard problem that arises if the government does not know how much subsidy each student warrants.

Given these assumptions, the socially preferred outcomes can be achieved by offering a subsidy of amount G to each student who graduates. This subsidy makes the private value of completing school equal $V_c + G$. The private values of dropping out and of working remain V_d and V_w. Hence, the private enrollment and completion criteria (10) and (11) become the same as the socially preferred ones (13) and (14). (Note that the government could give the student a smaller subsidy, namely the minimal amount that induces the socially preferred enrollment and completion decisions. I take no stand on this distributional question.)

Now consider an enrollment subsidy. If the subsidy is of amount S, the private value of completing school becomes $V_c + S$ and the private value of dropping out $V_d + S$. The private value of working remains V_w. Applying (10) and (11), the private enrollment and completion criteria become

(16) $1[K<R]\{PV_c + (1-P)V_d - PK\} + 1[K>R]V_d + S > V_w$.

(17) $Z = K < R$.

Comparing (16)-(17) with (13)-(14), we see that an enrollment subsidy can induce students to change their enrollment decisions but cannot induce changes in completion decisions. This means that enrollment subsidies are useless when applied to students with $K > R$, who enter postsecondary schooling with the intention of dropping out. Such subsidies increase the number of such students who enroll but persuade none of them to graduate.

Enrollment subsidies can induce socially preferred behavior when applied to students with $K < R$. These students want to complete the programs they begin; they may be forced to drop out by poor grades but will not do so voluntarily. For such students, the socially-preferred decision criteria (13)-(14) reduce to

(18) $PV_c + (1-P)V_d - PK + PG > V_w$.

(19) $Z = K$.

The private criteria (16)-(17) reduce to

(20) $PV_c + (1-P)V_d - PK + S > V_w$.

(21) $Z = K$.

Hence private actions and social preferences coincide if the government sets the enrollment subsidy at level $S = PG$.

Observe that the completion subsidy G required to induce socially-preferred behavior is larger than the enrollment subsidy PG that accomplishes this objective. The reason, of course, is that the student receives the completion subsidy only if he should graduate, an event with probability P. He receives the enrollment subsidy with certainty. To a risk-neutral student, the two subsidies are equivalent. They also imply the same level of federal funding of student aid.

Thus, one should not think of completion subsidies as replacing Pell grants by graduation-contingent awards of the same face value. A one-for-one replacement implies a decline in expected awards; hence, a reduction in enrollments and completions. If contingent aid is meant as something other than a cover for reducing Federal support of postsecondary schooling by low income students, the face amounts of contingent awards will need to be higher than those of Pell grants.

THE CASE FOR ENROLLMENT SUBSIDIES

The assumptions maintained in Sections 4.1 and 4.2 make completion subsidies more appealing than enrollment subsidies. The former mechanism always produces the socially desired outcomes: the latter does so only when applied to students who want to complete their schooling.

This comparison is reversed if society values enrollment in postsecondary schooling more highly than students do privately. Assume that, contrary to Fischer's premise, enrollment generates an externality S, regardless of whether the outcome is dropout or completion. Then (16) and (17) are the socially-preferred enrollment and completion criteria.

In this setting an enrollment subsidy of size S obviously induces the socially desired outcomes. But a completion subsidy yields unwanted outcomes. In particular, a completion subsidy of size G induces some students for whom $R < K < R + G$ to complete school. Society prefers otherwise.

The case for enrollment subsidies strengthens if students are risk averse. Suppose, for simplicity, that dropout is exogenous. Then a risk-neutral student is indifferent between receiving an S dollar enrollment subsidy and an S/P dollar completion subsidy. A risk averse student, however, is made worse off by this change. To leave the student as well off as before, the completion subsidy must have face value $T > S/P$.

This implies that, if students are risk averse, contingent aid is not cost-effective relative to Pell grants. Government expenditure on an S dollar Pell grant is S dollars. The expected cost of a contingent award of size $T > S/P$ is PT, which exceeds S. Hence a contingent aid program which makes students no worse off than they are now costs more than the Pell grant program.

UNRESOLVED ISSUES

The analysis of Sections 4.1 through 4.3 makes clear that the relative merits of enrollment and completion subsidies depend on the answers to both normative and empirical questions. How, if at all, do the social and private values of postsecondary schooling diverge? What fraction of dropouts from postsecondary schooling are voluntary? Before enrolling, how well can students predict whether they will complete the programs they are about to begin? How risk averse are students?

These questions cannot be answered here. We know relatively little about the determinants of postsecondary dropout, about students' ability to predict the outcome of enrolling in postsecondary schooling, and about the degree to which students are risk averse. Moreover, the nature of the social value of schooling is a subject of longstanding controversy.

Comparison of enrollment and completion subsidies also requires attention to important issues that my analysis has not even addressed. To conclude, I cite two of these.

INSTITUTIONAL BEHAVIOR: Sections 4.1 through 4.3 implicitly assume that the value of completing schooling is intrinsic. That is, obtaining a degree makes one more productive. This ignores the fact that student aid policy provides incentives to schools to alter their behavior. In particular, graduation-contingent aid gives schools an incentive to relax their graduation requirements. To the extent that this happens, the earnings value of schooling will decline. Hence, the supposed benefit of having more graduates will prove illusory.

CAREER CHOICE: Our treatment of schooling decisions has abstracted from the question of career choice. The probability that a student completes a postsecondary program presumably varies with the nature of that program. It should, therefore, be expected that student aid policy influences career choices.

It is reasonable to speculate that completion subsidies would induce students to choose programs with high pass rates and lock students in to the programs they select. Consider a student who enrolls in a given program, passes his courses, but finds that he does not like the subject matter. The student should change fields; but doing so opens the risk of failure and loss of aid. Completion subsidies may most limit the career mobility of students attending narrowly focussed vocational schools. These students can make program changes only by dropping out and starting over elsewhere, thereby losing their aid. In contrast, students at broad-based universities can remain within the same institution while making substantial changes in their programs.

Thus, completion subsidies may inhibit the formation of good matches between students and careers. This is a potentially serious effect. Schools perform an important function by allowing students to try out alternative careers at low cost in controlled settings.

APPENDIX: PROOF OF PROPOSITIONS 1 AND 2

PROOF OF PROPOSITION 1: Parts A, B, and C follow immediately from equations (4), (5), and (6) respectively. To prove part D, first define

$$\text{àa} \int \int_{\pi}^{l} dF \qquad\qquad b \int \int_{l}^{1} PdF \qquad\qquad g \int \int_{l}^{1} dF$$

and note that $lg < b$. Next observe that, by (7), the dropout rate under l minus that under π is

$$\frac{\int_{l}^{1}(1-P)dF}{\int_{l}^{1} dF} - \frac{\int_{\pi}^{1}(1-P)dF}{\int_{\pi}^{1} dF} =$$

$$-\frac{\int_{l}^{1} PdF}{\int_{l}^{1} dF} + \frac{\int_{\pi}^{l} PdF + \int_{l}^{1} PF}{\int_{\pi}^{l} dF + \int_{l}^{1} dF} < -\frac{\int_{l}^{1} PdF}{\int_{l}^{1} dF} + \frac{l\int_{\pi}^{l} PdF + \int_{l}^{1} PdF}{\int_{\pi}^{l} dF + \int_{l}^{1} dF} \int -\frac{b}{g} + \frac{la+b}{a+g}$$

$$= \frac{-ba-bg+lag+bg}{g(a+g)} = \frac{a(lg-b)}{g(a+g)}$$

We noted earlier that $lg<b$. Hence the above expression cannot be positive.

Q.E.D.

PROOF OF PROPOSITION 2: In what follows, we use 1[ ] to denote the indicator function taking the value one if the logical event inside the brackets is true and zero otherwise. In particular, $1[g(P)>\pi] = 1$ if $g(P) > \pi$ and $1[g(P)>\pi] = 0$ if $g(P) < \pi$.

Part A: By (4), the enrollment level before the change is $\int_{\pi}^{1} dF$. Following the change it is

$$\int_{\pi}^{1} dF + \int_{0}^{\pi} 1[g(P)>\pi]dF > \int_{\pi}^{1} dF.$$

Part B: By (5), the completion level before the change is $\int_{\pi}^{1} PdF$. Following the change, it is

$$\int_{\pi}^{1} g(P)dF + \int_{0}^{\pi} g(P)1[g(P)>\pi]dF > \int_{\pi}^{1} PdF.$$

Part C: By (6), the dropout level before the change is $\int_{\pi}^{1} (1-P)dF$. Following the change, it is

$$\int_{\pi}^{1} [1-g(P)]dF + \int_{0}^{\pi} [1-g(P)]1[g(P)>\pi]dF.$$

Depending on g(*), the post-change dropout level can be either higher or lower than the pre-change one. To show this, it suffices to consider two special cases.

Consider first any g(*) such that $g(P) < \pi$ for $P < \pi$. Then the post-change dropout level is

$$\int_{\pi}^{1} [1-g(P)]dF < \int_{\pi}^{1} (1-P)dF.$$

Next consider any g(*) such that $g(P) = P$ for $P > \pi$. Here the post-change dropout level is

$$\int_{\pi}^{1} (1-P)dF + \int_{0}^{\pi} [1-g(P)]1[g(P)>\pi]dF > \int_{\pi}^{1} (1-P)dF.$$

Part D: By (7), the dropout rate before the change is

$$\frac{\int_{\pi}^{1} (1-P)dF}{\int_{\pi}^{1} dF}.$$

Following the change, it is

$$\frac{\int_\pi^1 [1-g(P)]dF + \int_0^\pi [1-g(P)]1[g(P)>\pi]dF}{\int_\pi^1 dF + \int_0^\pi 1[g(P)>\pi]dF}.$$

Depending on g(*), the post-change dropout rate can be either higher or lower than the pre-change one. To show this, it again suffices to consider two special cases.

Consider first any g(*) such that $g(P) < \pi$ for $P < \pi$. Then the post-change dropout rate is

$$\frac{\int_\pi^1 [1-g(P)]dF}{\int_\pi^1 dF} < \frac{\int_\pi^1 (1-P)dF}{\int_\pi^1 dF}.$$

Next consider the particular transformation $g(P) = \pi$ for $P < \pi$ and $g(P) = P$ for $P > \pi$. Here the post-change dropout rate is

$$\frac{\int_\pi^1 (1-P)dF + (1-\pi)\int_0^\pi dF}{\int_\pi^1 dF + \int_0^\pi dF} = \int_\pi^1 (1-P)dF + (1-\pi)\int_0^\pi dF = \frac{\int_\pi^1 (1-P)dF}{\int_\pi^1 dF}\int_\pi^1 dF + (1-\pi)\int_0^\pi dF.$$

That is, the post-change dropout rate is a weighted average of the pre-change rate and of $(1-\pi)$. The pre-change rate is smaller than $(1-\pi)$. Hence, the post-change rate is larger than the pre-change one.

Q.E.D.

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