The Behavioral and Distributional Implications of Aid for College

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Subsidizing the cost of education is one of the most common, and expensive, activities of governments. While primary and secondary schooling is available tuition-free in the United States, among post-secondary students the direct cost of schooling is quite heterogeneous. First, tuition prices vary widely across schools. During the 2000–2001 academic year, college tuitions varied from zero at some community colleges to over $27,000 at Ivy League institutions. Second, institutions heavily discount these "sticker" prices for many students, using detailed information on family finances and academic merit to engage in finely tuned price discrimination.[1] Third, the federal and state governments provide individual subsidies, such as the Pell Grant and low-interest Stafford loan, that are portable across institutions.

The standard model of human capital clearly predicts that such cost subsidies will raise the optimal level of schooling. While the theoretical predictions are clear, it is an empirical question how much a given dollar of subsidy affects behavior. Answering this empirical question is a challenge, since eligibility for subsidies is certainly not random and, in fact, is likely to be correlated with many other determinants of schooling. As a result, estimates based on the cross-sectional correlation of aid eligibility with schooling are subject to multiple sources of bias. This paper examines work that has used quasi-experimental methodology to isolate exogenous sources of variation in schooling costs in order to determine their effect on schooling decisions.

I. Empirical Issues

A long empirical literature examines the effect of college costs on schooling decisions; Larry Leslie and Paul Brinkman (1988) review 70 such studies. With few exceptions, discussed below, this long literature suffers from a key flaw: the response of schooling to price is poorly identified. That is, the variation in schooling prices that identifies the effect of price on schooling decisions is not exogenous to unobserved determinants of schooling.

Let me lay out why one may be concerned about identification in this context. Say one is interested in the effect of financial aid on schooling decisions. This relationship can be expressed with the following equation:

$$S_i = \alpha + \beta \mathrm{Aid}_i + \varepsilon_i. \tag{1}$$

Here, S_i is some measure of an individual's schooling, such as college entry or completed years of college, Aid_i is the amount of student aid for which an individual is eligible, and ε_i represents the unobserved determinants of schooling.[2] If aid is uncorrelated with ε_i then β can be interpreted as the effect of the offer of a dollar of aid on educational outcomes.

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[1] Even undiscounted sticker prices are generally less than the marginal cost of educating a student. Subsidies at public universities are particularly high (see Gordon Winston, 1999).

[2] I discuss single-equation ordinary least-squares (OLS) estimation for ease of exposition, but the issues of identification raised here apply equally to the wide range of methodologies used in this literature.

Aid_i would certainly be uncorrelated with ε_i were it randomly assigned. However, aid is offered to students on the basis of characteristics that have their own effect on schooling. For example, the federal government uses the Pell Grant to encourage the college attendance of low-income youth. If these students are relatively unlikely to attend college, perhaps because of low levels of parental education or poor secondary schooling, then estimates of β based on this source of variation in aid will be downwardly biased. Conversely, since many colleges use merit scholarships to attract high-achieving students, the bias on estimates of β will, in some cases, be positive.[3]

One can attempt to eliminate this bias by controlling for a vector of regressors $\mathbf{X}_i$:

$$(2) \qquad S_i = \alpha + \beta \text{Aid}_i + \boldsymbol{\delta}\mathbf{X}_i + \varepsilon_i.$$

Common covariates include measures of financial resources, such as parental income, and measures of individual ability, such as standardized test scores. Whatever the particular empirical strategy, these studies share the common assumption that controlling for observables can absorb individual differences correlated with schooling decisions and schooling costs.

Under plausible conditions, this approach will fail. First, one may not correctly model the schooling decision, by either improperly omitting variables from equation (2) or including them in the wrong functional form. Theory provides little guidance as to which attributes should be held constant in estimating equation (2). This is particularly problematic because point estimates in the literature are often quite fragile, even changing sign with small changes in specification. Second, even if one correctly models the schooling equation, data on relevant characteristics may simply be unavailable. For example, parental wealth affects schooling decisions, both directly and through eligibility for aid, but complete information on parental wealth is rarely available in survey data, especially among adults who have completed their education.

In sum, the omitted-variables problem may be unsolvable using the approach of equation (2). One solution is a randomized, controlled trial, in which aid amounts are randomly assigned to a pool of potential college students. Alternatively, the analyst can use observational data to study the outcome of a natural (or quasi-) experiment, in which a discrete shift in aid policy affects one group of individuals but not others. In the next section, I discuss in detail Dynarski (2000), which exploits the introduction of the Georgia HOPE Scholarship in estimating the effect of schooling costs on college attendance.

II. The Georgia HOPE Scholarship and College Attendance

In 1993, Georgia introduced the Georgia HOPE Scholarship, which is funded by a state lottery. The program allows free attendance at Georgia's public colleges for state residents with at least a B average in high school. Those attending private colleges are eligible for an annual grant, which was $500 in 1993 and had increased to $3,000 by 1996. I use the introduction of the HOPE Scholarship to estimate the sensitivity of the college attendance of young people to schooling costs. The empirical approach of the paper is straightforward. The effect of HOPE is identified by relative changes between Georgia and the rest of the southeastern United States in college attendance rates.[4]

I estimate the following equation using data from the 1989–1997 October Current Population Survey (CPS):

$$(3) \qquad S_i = \alpha_1 + \beta_1(\text{Georgia}_i \times \text{After}_i) + \delta_1 \text{Georgia}_i + \theta_1 \text{After}_i + \nu_{i1}$$

where the dependent variable is a binary measure of college attendance, Georgia_i is a binary variable that is set to 1 if a youth is a Georgia resident, and After_i is a binary variable that is set to 1 in the sample years in which HOPE was in place. This specification controls for time trends in college attendance, as well as for the

[3] Since many studies in this literature pool all sources of aid into a single variable, it is frequently impossible to sign the bias on a given estimate.

[4] The southeastern states are defined as the South Atlantic and East South Central Census Divisions.

TABLE 1—COLLEGE ATTENDANCE OF 18–19-YEAR-OLDS, OCTOBER CPS, 1989–1997

Independent variable	(i) Difference-in-differences	(ii) Add covariates
After × Georgia	0.079	0.076
	(0.029)	(0.029)
Georgia	−0.115	−0.117
	(0.023)	(0.019)
After	−0.001	
	(0.018)	
Age 18		−0.043
		(0.014)
Metro resident		0.036
		(0.015)
Black		−0.132
		(0.015)
State unemployment rate		−0.028
		(0.008)
Year dummies	yes	yes
R^2:	0.003	0.025
N:	6,811	6,811

Notes: Regressions are weighted by CPS sample weights. Standard errors are adjusted for heteroskedasticity and correlation within state-year cells.

average effect on attendance of being a Georgia resident. The reduced-form effect of the HOPE Scholarship is identified by β_1. The identifying assumption is that any relative trend in the attendance of Georgia youth is attributable to the introduction of HOPE.

Results are in Table 1. After the introduction of HOPE, the attendance rate of 18–19-year-olds in Georgia rose 7.9 percentage points more than it did in the other southeastern states. This suggests that the introduction of the HOPE Scholarship had a substantial, positive effect on the college attendance rate of youth in Georgia. However, this positive effect may be driven by Georgia-specific economic shocks that affected the state's college-going rate during this period. In order to control for this source of bias, in column (ii) I add to the regression the state unemployment rate along with a simple set of demographic controls. The estimate is unaffected. An alternative, nonparametric approach is to use a within-state control group that experiences the same economic shocks as the treatment group. Slightly older youths (those aged 23–24) are a natural control group, since they face the same labor-market conditions as their younger peers but were not eligible for HOPE during the period under study. Using this triple-differencing approach (results not shown), I again conclude that HOPE increased the college attendance rate by about 8 percentage points.[5]

These results suggest that for each $1,000 of subsidy the college attendance rate rises by 4–6 percentage points, which is of the same order of magnitude as the attendance effects found by Thomas J. Kane (1994) and Dynarski (2001a), both of which I discuss in the next section.[6] I find that this effect is almost fully concentrated among white and upper-income youth. There are two likely explanations for this distributional effect of the program. First, during the period under study, the HOPE Scholarship was reduced dollar-for-dollar by other aid received by a student. As a result, a low-income individual receiving the maximum Pell Grant was not eligible for a HOPE Scholarship.[7] Second, a lower proportion of low-income, black youths likely meet the academic requirements of HOPE.[8]

III. Other Quasi-Experimental Estimates of the Effect of Schooling Costs on Schooling Decisions

Beginning with W. Lee Hansen (1983), who examined the introduction of the Pell Grant in the early 1970's, a growing number of studies, listed in Table 2, have used the natural-experiment approach to estimate the effect of schooling costs on college-going. In this section, I provide an overview of the findings of this literature, which are remarkably consistent, especially given the variety of subsidies and populations under study.

[5] Using a similar methodology but different data set, Christopher Cornwell et al. (2001) also conclude that the Georgia program has increased attendance rates.

[6] All dollar amounts are expressed in constant 2000 values.

[7] In fact, those whose incomes were low enough to make them potentially eligible for federal need-based aid were required to apply for federal aid in order to apply for a HOPE Scholarship. This extra paperwork substantially increased the transaction costs of the program for low-income youth and likely intensified its distributional effect.

[8] Donald Heller and Christopher Rasmussen (2001) show that in Michigan's and Florida's HOPE-like programs, blacks are substantially less likely to meet the academic requirements for merit aid than whites.

TABLE 2—QUASI-EXPERIMENTAL ESTIMATES OF THE EFFECT OF SCHOOLING COSTS ON POST-SECONDARY SCHOOLING

Source of variation in schooling costs	Reference
Introduction of Pell	Hansen (1983), Kane (1995)
GI Bills	Angrist (1993), Stanley (2000), Turner and Bound (2000), Bound and Turner (2002)
Within-state tuition changes	Kane (1994, 1995)
Expansion of loan eligibility	Reyes (1995), Dynarski (2001b)
Introduction of Georgia HOPE Scholarship	Dynarski (2000), Cornwell et al. (2001)
Elimination of Social Security student benefits	Dynarski (2001a)
Shift from loans to grants at one school	Linsenmeier et al. (2001)
Discontinuities in a school's aid formula	van der Klaauw (2001)
Introduction of Pell; change in Pell rules	Seftor and Turner (2002)

The bulk of the studies in Table 2 consider the effect of grant aid on schooling decisions. Historically, veterans' educational benefits have been one of the largest sources of grant aid for college. Multiple studies of the post-World War II GI Bills (Joshua D. Angrist, 1993; Marcus Stanley, 2000; Sarah Turner and John Bound, 2000; Bound and Turner, 2002) have found that these subsidies have raised the schooling of veterans relative to that of a comparable control group. Today, the Pell Grant is the largest source of federal grants for college; studies of its introduction in 1973 have produced mixed results. Hansen (1983) and Kane (1995) find no effect of the Pell Grant on the college enrollment rate of low-income youth, but recent work by Neil Seftor and Turner (2002) has found a positive effect on the schooling of a slightly older population. Finally, Dynarski (2001a) takes advantage of variation in grant eligibility induced by the elimination of the Social Security student benefit program, which follows the GI Bills and Pell Grant among the largest historical sources of federal grants. Under this program, the Social Security Administration paid the college costs of the children of deceased, disabled, or retired Social Security beneficiaries. Using the death of a parent during a person's childhood to proxy for Social Security beneficiary status, Dynarski (2001a) finds that upon the withdrawal of benefits the college attendance of the affected group dropped by more than one-third, or about 4 percentage points per $1,000 of grant eligibility. Aid eligibility also appears to increase completed schooling, though this result is less precisely estimated.

Subsidized public tuition, which varies considerably by state, is another large source of education subsidies. Estimates based on cross-state variation in tuition may be biased, since states with a preference for education may have both low tuition prices and high college attendance rates. The solution of Kane (1994) is to use state fixed effects; his identifying assumption is that within-state changes in tuition prices are uncorrelated with changes in a state's taste for college. He concludes that a $1,000 drop in public tuition produces about a 4-percentage-point increase in college attendance rates of recent high-school graduates.

While loans are the dominant form of aid today, little is known about how they affect behavior. Suzanne Reyes (1995) examines the effect of relative changes in loan eligibility across income groups in the early 1980's and concludes that loan access increases attendance and completed schooling. In Dynarski (2001b), I address this question using variation in loan eligibility induced by the Higher Education Amendments of 1992, which removed home equity from the set of assets "taxed" by the federal aid formula. I find a small effect of loan eligibility on college attendance and a somewhat larger effect on the choice of college.

Two recent studies have produced well-identified estimates of the effect of a school's aid offers on its yield rate (i.e., the probability that admitted students will enroll). Wilbert van der Klaauw (2001) exploits idiosyncrasies in one school's aid formula that cause applicants with only slightly different standardized test scores to receive very different aid offers. David M. Linsenmeier et al. (2001) use variation across time in one school's mix of grants and loans to identify the effect of aid on the yield rate among low-income students, using higher-income students as a control group. Both studies find a positive effect of a school's aid offers on the probability that an accepted candidate will choose to enroll in that school.

IV. Quasi-experimental Estimates of the Distributional Effects of Aid

It is likely that the effect of educational subsidies is not homogeneous across the population. Of particular interest is heterogeneity across

income groups, since a long-standing goal of aid is to close the income gap in schooling.[9] Aid programs that explicitly or implicitly target upper-income groups, such as the Georgia HOPE Scholarship or the federal tax credits, will plausibly widen this income gap. Even an across-the-board subsidy such as low public tuition may increase (or decrease) the income gap, depending on whether low-income individuals are less (or more) sensitive to price than are high-income individuals.

A simple model of human-capital accumulation, developed in Dynarski (2000), suggests that low-income individuals will be more sensitive to price if the marginal cost of borrowing rises with the amount borrowed. This prediction follows from the assumption that the level of debt that a college student assumes for an additional year of schooling is a decreasing function of his family's income. Casual empirics suggest that students do face rising interest rates when borrowing for college, with subsidized student loans being the cheapest source of credit.[10] Under these conditions, a low-income individual on the margin of entering college will be more sensitive to price than a high-income individual.

While the predictions of the model regarding this structural parameter are clear, this result does *not* unambiguously predict that a larger share of low-income than high-income individuals will be induced to attend college by a given subsidy. This is because the share of an income group that is pushed over the college attendance margin by a given subsidy is a function not only of the sensitivity of that group to aid, but also the proportion of the group near the margin of college attendance.

Consider an individual-specific, nonfinancial cost of schooling (γ_i) that is identically and normally distributed within the low-income and high-income populations. This parameter might reflect, for example, the quality of an individual's secondary education and preparation for college-level work. In the absence of educational subsidies, the low debt of high-income youth can offset relatively high nonfinancial costs of college. As a result, the college attendance margin will cut at a relatively high point in the γ_i distribution of high-income youth. Whether that margin cuts at point of higher *density* in the low- or high-income distribution is ambiguous. Therefore, even if the nonfinancial costs of college are identical in the two populations, a given aid program, in theory, could have a greater impact on high-income attendance rates.

In order to determine the distributional effect of a given aid program, one could allow the effect of aid to differ across income groups in the type of analysis discussed in the previous section. Kane (1994) uses this approach in his study of the effect of tuition prices on attendance. He finds that tuition has a stronger effect on the attendance of low-income youth. Similarly, both van der Klaauw (2001) and Linsenmeier et al. (2001) estimate elasticities that are higher among low-income or minority students. By contrast, Turner and Bound (2000) find that the World War II GI Bill had a greater impact on white than black veterans. Stanley (2000) similarly finds that the effect of the Korean GI Bill is larger for veterans from more-educated families. Finally, Dynarski (2000) finds that the Georgia HOPE Scholarship has had its largest impact on white students and those from high-income families.

Overall, then, the results are evenly divided in their conclusions, suggesting that the distributional effect of aid is not a fixed parameter. The effect of a given subsidy may vary across groups due to relative differences in financial positions, academic preparation, access to information, the form taken by the subsidy itself, and interactions of these factors. Pinning down the sources of heterogeneous response to educational subsidies is of both theoretical and policy interest, as it will deepen understanding of how people make decisions about human-capital investments and thereby provide a firmer foundation for education policy.

V. Discussion and Conclusions

Subsidies to post-secondary schooling do appear to affect schooling decisions. The best estimates suggest that eligibility for $1,000 of

[9] David Ellwood and Kane (2000) document this gap, which persists when controlling for academic preparation as proxied by test scores.

[10] When a family reaches the annual limit on these loans ($2,625 for a freshman), the next cheapest sources of credit are, in turn, a home mortgage, unsubsidized student loans, unsecured personal loans, and credit cards.

subsidy increases college attendance rates by roughly 4 percent. Aid eligibility also appears to increase completed schooling, but the evidence is comparatively thin on this outcome. A given dollar of subsidy does not consistently have a larger impact on the schooling of low-income or minority individuals. Indeed, the strongest empirical evidence is evenly divided on this matter, with half of the well-identified estimates indicating that the effect of a subsidy *rises* with income. Unpacking the sources of variation in this parameter is an important priority for future research.

Do the results of the studies discussed in this paper show that credit constraints are binding on some potential college students? Not necessarily. The first-order effect of a subsidy is to increase the privately optimal level of schooling by lowering its cost. One therefore expects subsidies to increase schooling levels, irrespective of capital market conditions. When credit markets are not perfect, however, the effect of a subsidy is intensified, as it both lowers price and loosens credit constraints. "Large" effects of cost on schooling, such as those discussed in this review, are therefore often interpreted as evidence that credit constraints bind. However, this evidence is merely suggestive: to one economist it will suggest the presence of credit constraints, and to another it will not, depending on their priors about what constitutes a "large" response to a subsidy. In an ideal world, one would resolve this question by offering large, market-rate loans for college in a randomized, controlled trial and observing how, and for whom, schooling decisions are affected. The economist who pinpoints variation in aid that replicates this ideal experiment will resolve a long-standing and contentious debate on the importance of liquidity constraints in schooling decisions.

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