A Conceptual Analysis of State Support for Higher Education: Appropriations Versus Need-Based Financial Aid

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Abstract   In this paper, we use economic concepts to examine the choice that states make between giving appropriations to public colleges or need-based financial aid to students. We begin by reviewing the economic justification for state support for higher education. Next, we introduce a simple economic model for comparing and contrasting appropriations and need-based aid for supporting higher education. We then provide a graphical depiction of the model and simulate the effects of each policy on access to higher education. We show that it is in the best interest of states to provide need-based aid and not appropriations. Finally, we conclude with a discussion of the factors that complicate the reallocation of state funding away from appropriations and towards need-based aid.

Introduction

Higher education policy makers in the United States have been deeply concerned with identifying strategies to improve access to higher education for traditionally underrepresented and low-income populations. Data from the National Center for Education Statistics (2006) suggest that while the overall college participation rate for all populations has increased from 49% in 1980 to 73% by 2005, the gains for underrepresented and

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low-income populations have been only 13% for blacks and 8% for Hispanics (also see Kahlenberg 2004; McPherson and Schapiro 1998). The urgency to find solutions to this problem is heightened by the fact that population projections show that Hispanics and blacks—who disproportionately belong to underrepresented and low-income populations-will account for the largest share of population growth over the next 30 years (U.S. Census Bureau 2004).

States have played an important role in providing funding to make college more affordable for students and in the process improve access to college for students from underrepresented and low-income backgrounds. The main vehicle for state support has been through direct appropriations to designated (typically public) colleges and universities. In 2007–2008, for example, state appropriations for higher education totaled over $77.5 billion (Grapevine 2008). The hope among education policy makers is that the appropriations will be used by colleges to reduce the sticker prices charged to underrepresented and low-income students, and thus improve access to higher education.

States also give financial support directly to students in the form of either need-based or merit-based financial aid or scholarships. Although there are substantial variations across states, on average, state financial aid to students represents a relatively small share (6%) of total state support for higher education (State Higher Education Executive Officers 2008). These financial aid programs may be intended to achieve a variety of state goals, such as improve access to higher education, retain more high-ability students at in-state institutions, entice more students to reside in state following graduation, and foster economic development in the state (Fischer 1990).

Despite increases in the levels of state financial support over time, appropriations have generally failed to keep pace with education costs facing students (Clotfelter 1996; College Board 2006; Harter et al. 2005; National Center for Education Statistics 2006; Toutkoushian 2001). The slower growth in state support for higher education in recent years is an increasingly becoming an obstacle for underrepresented and low-income populations (Ehrenberg 2002; Ellwood and Kane 2000; Heller 2006; Perna and Titus 2004). Access to higher education for underrepresented and low-income populations may have also been hindered by the trend towards shifting state financial support away from appropriations (used for reductions in the sticker price for all students) and need-based financial aid and towards merit-based financial aid because underrepresented and low-income populations are less likely to qualify for merit-based aid (Dynarski 2000, 2002a, b; Ehrenberg et al. 2006; Pallais and Turner 2006). This shift in state financial support means that underrepresented and low-income students and their families on average face rising net prices for higher education, and consequently have weaker incentives to enroll and complete higher education (McPherson and Schapiro 1998).[1]

The persistent gaps in higher education enrollment rates between students from low- and high-income families raises the question as to whether the practice of providing the vast majority of assistance in the form of direct appropriations to designated colleges is the most effective way for states to meet their goal for postsecondary education. Because many students and their families benefit from the reduced prices charged to all in-state students

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[1] Inequities in higher education access may have also become exacerbated because of new approaches by the federal government and public higher education institutions to providing financial support to students. The federal government's emphasis on expanding higher education access for underrepresented and low-income populations is no longer a central mission, and is reflected by the reduced role of federally funded financial aid to lower net prices for students (St. John et al. 2005). For example, as noted by Kahlenberg (2004), the proportion of direct costs covered by Pell Grants (for students from low-income backgrounds) has been shrinking since the program's inception in the 1960s.

due to state appropriations, the current practice is very popular with many education stakeholders. Likewise, public colleges tend to favor appropriations because it is a relatively stable source of funding and colleges have discretion to use the funding to meet institutional and state goals.

Nonetheless, the argument can be made that appropriating state funds to public colleges in order to offer lower prices to all in-state students is a relatively inefficient and ineffective means to improving access to higher education. Fischer (1990) notes that the more general question of whether access to higher education is best supported by a low tuition, low aid strategy or a high tuition, high aid strategy received significant attention in the late 1960s and early 1970s. Researchers such as Hansen and Weisbrod (1969), Hearn and Longanecker (1985), Hoenack (1971), and Windham (1976) asserted that many of the students who benefit from state appropriations would have gone to college without the assistance, and perhaps these dollars should be redistributed to those students with greater financial need. At the same time, others including Griswold and Marine (1996), Lenth (1993), Lopez (1996), and St. John (1994) have countered that the high tuition, high aid model is problematic because of difficulties in implementation and the risk of the political process affecting the design of the program. The practice used by states for financially supporting higher education is in stark contrast to the federal model, where following passage of the Higher Education Act of 1965 the federal government increased financial support from colleges to students in the form of need-based aid (Fox 2006; Slaughter and Leslie 1997).

Despite its continued importance, there has been very little recent attention given to the evaluation of how states should financially support higher education (Doyle 2006; 2007; Fischer 1990; Hossler et al. 1997). The arguments made in the 1970s in favor of a high tuition, high aid model have apparently not convinced enough policymakers to lead to a substantial change in practice. The voucher programs for state residents in Colorado and Ohio are examples of how states continue to struggle to identify the best way to allocate state support for higher education (Fox 2006; Lopez 1996). Hossler et al. (1997) and Lopez (1996) further document that state legislatures have expressed substantial interest in moving toward a high tuition, high aid model. One limitation of the literature to date, however, is that statements about the advantages of a high tuition, high aid model were often made without clear demonstrations or empirical evidence.

In this study, we use economic concepts to discuss the various aspects that should inform decisions as to the level of state financial support for higher education, and the choice that states must make between appropriations and need-based financial aid. We begin by reviewing the justification often used by economists for why states provide assistance for higher education; namely, that positive externalities are created when students acquire higher education. Next, we review the ways in which states fund higher education, through either appropriations to public colleges, need-based financial aid to students, or merit-based financial aid to students. In the following section, we introduce a simple model to help illustrate how economists might compare and contrast state appropriations and need-based financial aid for supporting higher education. We then conduct a simulation of the effects of appropriations and need-based aid on improving access to higher education. Finally, we conclude with a discussion of what we believe are some of the reasons why states have not reallocated funding away from appropriations for colleges and towards need-based financial aid for students.

The purpose of our study is to carefully describe the rationale for the arguments in favor of states using need-based financial aid rather than appropriations to better achieve their goals. It is important to clarify the scope of our study at the onset. Our analysis focuses only on *state* financial assistance and does not address the question of how *colleges* should

best provide financial assistance to students. Second, our model and illustration centers on state need-based financial aid and not merit-based financial aid. Third, we do not consider other forms of financial assistance to students including loans and work study, and thus our analysis is focused on financial assistance to students that does not have to be repaid (in time or money). Fourth, our analysis does not consider state support for purposes other than assisting students, such as state support for research and athletics. Finally, we center our discussion on state assistance for public colleges.

Forms of State Support for Higher Education

States have several choices available to them with regard to how to support the postsecondary aspirations of students. The most frequently used option is to provide funding directly to a select set of colleges in the form of appropriations. The hope of state policy makers is that in return some portion of appropriations will be used by these colleges to reduce the price charged to in-state students (see Fig. 1). In the absence of appropriations, all in-state students are charged price P_0. It is useful to think of P_0 as the average cost of higher education, and also the price charged to out-of-state students when they have to cover their full cost of attendance. If the institution distributed state funding, defined by area (A, B, P_0, P_1), evenly across all in-state students, then the price for in-state students is reduced to P_1.

A second alternative for states to financially support higher education is to distribute funding directly to students as financial aid. Figure 2 shows how states might target financial aid towards a subset of students, in effect differentiating the net prices paid by state residents. In this example, the financial support is allocated over fewer students N_1, enabling the institution to lower the price to P_2 for these students and charge the full price P_0 to the remaining $(N_0 - N_1)$ students. If the N_1 students are chosen based on ability to pay, then the state assistance can be thought of as need-based financial aid. Likewise, in a merit-based financial aid program, the recipients are identified through their academic ability.

As noted in the Introduction, states vary considerably in terms of their overall levels of financial support for higher education and their chosen mix between appropriations and financial aid (also see Hearn et al. 1996). To compare states according to their relative levels of financial support for higher education, we divided the appropriation and financial aid totals by the estimated population in the state ages 18–24 in 2005. This age group represents the category that would traditionally be most likely to benefit from state

Fig. 1 Effect of state appropriations on higher education pricing
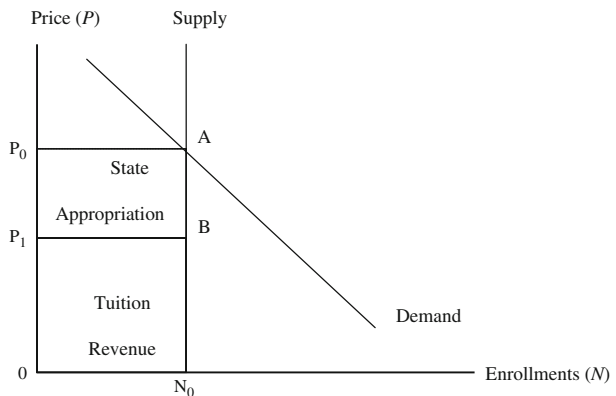
Fig. 2 Effect of state financial need-based aid on higher education pricing
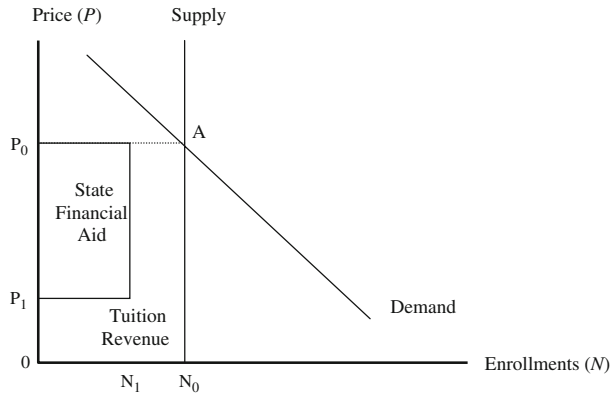
appropriations and financial aid. The results for each state are shown in Table 1. Based on this calculation, on average states allocated $2,305 per capita ages 18–24 in the form of direct appropriations, and $231 per capita ages 18–24 in financial aid, for the year 2005–2006. Overall, states allocated over $74 billion in financial assistance for higher education in 2005–2006, with approximately 90% of the total being given as appropriations to select colleges. The last two columns indicate whether a state had above average or below average values for appropriations or financial aid per person.

Some states such as North Carolina, New Mexico, and New Jersey are high financial aid and high appropriation states because their per-capita amounts for each exceed the national averages. At the other extreme, New Hampshire, Massachusetts and Oregon are states with both low per-capita appropriations and financial aid. However, there are also some states that have chosen either a high aid, low appropriation strategy (e.g., Vermont) or a low aid, high appropriation strategy (e.g., Wyoming). The distribution of states by level of appropriations and financial aid per capita are shown graphically in Fig. 3, where the chart is divided into four quadrants at $300/person for state financial aid and $2,000/person for state appropriations. Based on these break points, it can be seen that relatively few states pursued a strategy of high aid and low appropriations, whereas many states could be categorized as high appropriations and low financial aid.

These two approaches to providing state financial support for higher education differ in several important respects. First, appropriations and financial aid affect different *numbers* of students. State appropriations provide financial support to all in-state students who attend an in-state public institution, and thus benefit many students (unless colleges transform appropriations into merit-based aid or use appropriations for other purposes). State financial aid, on the other hand, only benefits those students who meet the eligibility criteria established by the state for financial support. It is usually the case that more students benefit from appropriations than from state financial aid.

A second important difference between appropriations and especially need-based financial aid is that the two support mechanisms often benefit different *groups* of students. By definition, need-based financial aid will provide assistance to only those students who come from lower-income families or whatever group of students is specifically targeted by the state. In contrast, appropriations to colleges tend to benefit a wider range of students, many of whom come from middle- and upper-income families and would not qualify for much need-based financial aid. On average, students from lower-, middle- and upper-income families differ in their likelihoods of attending college with or without financial support for higher education (McPherson and Schapiro 1998). Indeed, for some time critics

**Table 1** Average state financial assistance per capita by state, 2005–2006

State	Merit and need-based financial aid per capita age 18–24	Appropriation per capita age 18–24	Total state financial assistance per capita age 18–24	Merit and need-based aid per capita category	Appropriation per capita category
Alabama	$17	$3,112	$3,129	Low	High
Alaska	$7	$3,267	$3,273	Low	High
Arizona	$5	$1,697	$1,702	Low	Low
Arkansas	$102	$2,637	$2,739	Low	High
California	$211	$2,830	$3,041	Low	High
Colorado	$131	$1,289	$1,420	Low	Low
Connecticut	$125	$2,635	$2,760	Low	High
Delaware	$123	$2,600	$2,724	Low	High
Florida	$259	$2,074	$2,333	High	Low
Georgia	$506	$2,270	$2,776	High	Low
Hawaii	$3	$3,602	$3,605	Low	High
Idaho	$34	$2,199	$2,233	Low	Low
Illinois	$304	$2,110	$2,414	High	Low
Indiana	$293	$2,301	$2,594	High	Low
Iowa	$173	$2,513	$2,686	Low	High
Kansas	$51	$2,538	$2,589	Low	High
Kentucky	$424	$2,962	$3,386	High	High
Louisiana	$234	$2,497	$2,731	High	High
Maine	$106	$1,971	$2,078	Low	Low
Maryland	$144	$2,385	$2,528	Low	High
Massachusetts	$135	$1,634	$1,770	Low	Low
Michigan	$200	$2,033	$2,233	Low	Low
Minnesota	$246	$2,560	$2,806	High	High
Mississippi	$71	$2,523	$2,593	Low	High
Missouri	$71	$1,451	$1,522	Low	Low
Montana	$38	$1,731	$1,768	Low	Low
Nebraska	$52	$2,877	$2,929	Low	High
Nevada	$181	$2,555	$2,736	Low	High
New Hampshire	$30	$951	$981	Low	Low
New Jersey	$338	$2,681	$3,020	High	High
New Mexico	$295	$3,374	$3,669	High	High
New York	$492	$2,414	$2,906	High	High
North Carolina	$231	$3,571	$3,802	High	High
North Dakota	$25	$2,875	$2,900	Low	High
Ohio	$198	$1,886	$2,084	Low	Low
Oklahoma	$152	$2,198	$2,350	Low	Low
Oregon	$83	$1,769	$1,852	Low	Low
Pennsylvania	$342	$1,734	$2,077	High	Low
Rhode Island	$120	$1,662	$1,782	Low	Low
South Carolina	$600	$1,855	$2,455	High	Low

Table 1 continued

State	Merit and need-based financial aid per capita age 18–24	Appropriation per capita age 18–24	Total state financial assistance per capita age 18–24	Merit and need-based aid per capita category	Appropriation per capita category
South Dakota	$39	$1,935	$1,974	Low	Low
Tennessee	$302	$2,021	$2,323	High	Low
Texas	$152	$2,169	$2,321	Low	Low
Utah	$23	$2,122	$2,145	Low	Low
Vermont	$276	$1,289	$1,565	High	Low
Virginia	$176	$2,110	$2,286	Low	Low
Washington	$269	$2,381	$2,651	High	High
West Virginia	$422	$2,062	$2,484	High	Low
Wisconsin	$164	$1,978	$2,142	Low	Low
Wyoming	$3	$4,132	$4,135	Low	High
Totals	$231	$2,305	$2,536		

Notes: Data obtained from the 37th Annual Survey Report on State-Sponsored Student Financial Aid (NASSGAP 2006). Financial aid totals include all need-based and non need-based aid given to under-graduate students. State appropriations were obtained from Grapevine and represent direct state appropri-ations for operating expenses

Appropriations Per Capita Ages 18-24
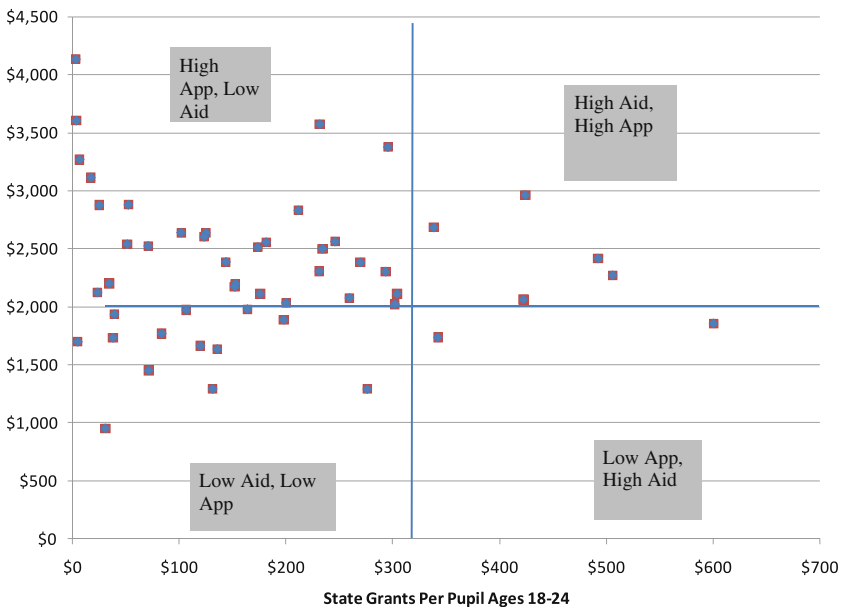
Fig. 3 States by appropriations and financial aid per capita ages 18–24. *Notes*: Data obtained from the 37th Annual Survey Report on State-Sponsored Student Financial Aid (NASSGAP 2006). Financial aid totals include all need-based and non need-based aid given to undergraduate students. State appropriations were obtained from Grapevine and represent direct state appropriations for operating expenses

of the traditional appropriation approach to state support for higher education have raised equity issues because all in-state students face the same price but have different abilities to pay for college (Hansen and Weisbrod 1969). In addition, their families differ on average in terms of their political engagement and clout with legislators.

Economic Explanations for State Support of Higher Education

In order to evaluate the alternative approaches that states can use to support higher education, it is essential to start by asking the question: why do states support higher education in the first place? What is it about this particular service—higher education—that would justify the government subsidization of it? We will argue here that the answer to this question has important implications for evaluating the alternatives to states for supporting higher education.

Public sector economists have long been interested in explaining the behavior of governments and their interaction in specific markets. The economics of the public sector examines how government policy, especially tax and expenditure policy, affects the economy and thus the welfare of its citizens (Browning and Browning 1994). Much of the work on public sector economics has focused on the efficiency and equity of governmental funding (Stiglitz 2000). Economists justify government support for higher education as a means of rectifying perceived inefficiencies, inequities, or failures in the higher education market. The notion is that by financially supporting higher education, governments can help make the market more equitable with regard to educational opportunities for all citizens, and lead to a more efficient provision of higher education (Hansen and Weisbrod 1969; Hoenack 1971; Windham 1976).

Economists often assert that the government needs to become involved in the provision of goods and services when the competitive market fails to produce the optimum amount of outcomes. The first instance where market failures are said to occur is when a good/service is a public good. A public good is a good/service where (a) the consumption of the good/service by one person does not preclude another from consuming the same good/service (non-rival), and (b) the supplier of the good/service cannot easily prevent someone who does not pay for the good/service from consuming it (non-excludable). Commonly used examples of public goods would include air and national defense. Although general knowledge itself can be thought of as a public good, the *provision* of education does not fall into this category because students can be excluded from receiving the service, and in non-open admission colleges the acceptance of one student can lead to the denial of admission for another student.

The other instance in which many economists believe that the competitive market leads to suboptimal production of a good/service is when the consumption of the good/service results in either positive or negative externalities. A positive externality occurs when individuals other than those who consume the good/service also benefit from it, and vice versa for a negative externality. For example, it is believed that when students receive an education, not only do they directly benefit from their education, but others in society also benefit. Accordingly, one theoretical argument in favor of government support for higher education is that the consumption of higher education leads to benefits for others in society (Bowen 1977; Lange and Topel 2006; Schultz 1963; Weisbrod 1968). When students receive a higher education, not only do they reap benefits by improving their human capital/earnings potential and realizing non-pecuniary gains, but others potentially benefit in many ways. The consumption of higher education by some may lead to pecuniary

benefits for others from higher tax collections, stronger economic development and employment prospects for citizens, and non-pecuniary benefits such as reduced crime and improved civic behavior.

Economists assert that when the consumption of a good leads to positive externalities, the good/service would be underproduced if production was left solely to the competitive market. The underproduction would occur when individual consumers do not include the external benefits into their calculations of how much they would be willing and able to pay for the good or service. A second argument that has been used by economists to explain why states support higher education is that the funding is due to the response of legislators to the demands of voters in their districts. This notion, formalized in the median voter model of public choice theory, is used to determine whether specific factors affect the legislative demand for higher education (Borcherding and Deacon 1972; Clotfelter 1976; Bös 1980; Coughlin and Erekson 1986; Creedy and Francois 1990; Toutkoushian and Hollis 1998). Individual legislators are assumed to act in ways that appeal to the average, or median, voter to help increase their chances of being elected (Coughlin and Erekson 1986; McLendon et al. 2005).

Analysis of State Appropriations and Need-Based Financial Aid for Higher Education

To examine the alternative state policies for providing financial assistance to higher education, a starting place is to specify the conceptual arguments as to why financial assistance is thought to affect student behavior. In this section, we use a simple model of student choice, a graphical depiction, and a numerical illustration to make the argument that the optimal strategy for states is to provide assistance as need-based financial aid rather than appropriations. The three methods we present here rely on the positive externality explanation for why states provide financial support for higher education.

Model of Student Choice

A student's decision to enroll in college is often described as being dependent on the student's perceived utility of going to college versus not going to college. The utility for the i-th student (subscript i) from going to college (subscript c) will be positively related to the net financial gain from going to college. The net financial gain is the discounted stream of future incomes after completing college less the foregone earnings while in college (Y_{ic}), minus the direct costs of a college education (T_c). Similarly, it is assumed that each student can estimate the future income stream and hence the utility from not going to college (subscript n), and would base his or her decision about whether to go to college on a comparison of the two expected utilities.

In the first case (subscript 0), we assume that the state provides no appropriations or need-based financial aid. A student would opt to go to college provided that the net utility of going to college exceeds the net utility of not going to college, and vice versa. This decision rule can be written as follows:

$$E_{0i} = \{1 \text{ if } U_i(Y_{ic} - T_c) \geq U_i(Y_{in}), \ 0 \text{ otherwise}\} \tag{1}$$

Though Eq. 1 describes the decision rule for attending college without any form of state financial support, in practice states provide financial support (S) in an attempt to influence

the college-going decisions of students.[2] The support could be in the form of either appropriations to colleges (S_A), which would reduce the sticker price for all in-state students, or financial aid (S_F), which would cover a designated portion of the sticker price for a subset of students. To simplify the exposition, we make two simplifying assumptions. First, we treat both state appropriations for colleges and financial aid to students as subsidies rather than price reductions. Second, we assume that states have only two choices for distributing assistance—appropriations and need-based grants—and that both cannot be used at the same time.

To introduce state financial assistance into the model, we first consider the case where state appropriations reduce the net prices by S_A/N_A for all N_A students who enroll in public colleges. In the second case, the state allocates need-based aid in the amount of $S_F/(N_F - N_0)$ to only the $(N_F - N_0)$ students who are enticed to enroll in college after receiving need-based aid. We assume that the need-based aid can only be used at the same college that would receive appropriations. Introducing state financial assistance into the model changes the student's college choice rule to be the following when he/she receives state appropriations:

$$E_{Ai} = \{1 \text{ if } U_i(Y_{ic} - T_c + S_A/N_A) \geq U_i(Y_{in}), 0 \text{ otherwise}\} \tag{2}$$

or the following when he/she receives need-based aid from the state:

$$E_{Fi} = \{1 \text{ if } U_i(Y_{ic} - T_c + S_F/(N_F - N_0)) \geq U_i(Y_{in}), 0 \text{ otherwise}\} \tag{3}$$

Equations 2 and 3 simplify to Eq. 1 when the student receives no assistance ($S = 0$).

To calculate the number of students going to college under each option, the decision rules can be summed for all individuals or expressed in terms of the probability of going to college ($\Pr(E = 1)$):

$$N_0 = \sum_{i=1}^{N} E_{0i} = (N)(\Pr(E_0 = 1)) \tag{4}$$

$$N_A = \sum_{i=1}^{N} E_{Ai} = (N)(\Pr(E_A = 1)) \tag{5}$$

$$N_F = \sum_{i=1}^{N} E_{Fi} = (N)(\Pr(E_F = 1)) \tag{6}$$

Equation 4 shows the quantity of students who would attend college under a system without any state appropriations or need-based aid; Eq. 5 indicates the total number of students who would attend college under a system where state appropriations is the only form of state financial assistance; finally, Eq. 6 shows how many students would attend college if need-based aid is the only form of state financial assistance.

We assume here that positive externalities of α accrue to the state from each student who enrolls in college. The parameter α captures the total general benefits received by a

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[2] States can also provide funding to institutions for reasons other than reducing tuition rates for resident students. These reasons might include supporting academic programs in fields such as agriculture and medicine that meet specific needs of states. In this study, we only focus on the portion of state financial assistance that is targeted to improving access to higher education for state citizens.

state when a student enrolls in college.[3] Accordingly, the total positive externalities (X) for the state in alternative scenarios are found as follows:

$$X_0 = \alpha N_0 = \alpha \sum_{i=1}^{N} E_{0i} \tag{7}$$

$$X_A = \alpha N_A = \alpha \sum_{i=1}^{N} E_{Ai} \tag{8}$$

$$X_F = \alpha N_F = \alpha \sum_{i=1}^{N} E_{Fi} \tag{9}$$

Equations 7, 8, and 9 reflect the total externalities under a system of no state financial assistance, only institutional appropriations, and only need-based aid, respectively.

The state's goal in each instance is to choose the subsidy level that would maximize the gains in positive externalities after subtracting the subsidy, as in:

$$L_A = X_A - X_0 - S_A = \alpha(N_A - N_0) - S_A \tag{10}$$

$$L_F = X_F - X_0 - S_F = \alpha(N_F - N_0) - S_F \tag{11}$$

Equations 10 and 11 can be rewritten by substituting the probabilities in Eqs. 4–6 and noting that gains can only occur for the $(N - N_0)$ students who would not go to college without some form of financial assistance. The resulting equations become:

$$L_A = \alpha(N - N_0)[\Pr(U(Y_{ic} - T_c + S_A/N_A) \geq U(Y_{in}))|E_0 = 0] - S_A \tag{12}$$

$$L_F = \alpha(N - N_0)[\Pr(U(Y_{ic} - T_c + S_F/(N_F - N_0)) \geq U(Y_{in}))|E_0 = 0] - S_F \tag{13}$$

where the quantities in square brackets represent the probabilities that a student receiving state financial assistance will go to college, conditional on the student not going to college without financial assistance.

We now use this model to examine the impacts of the type of state financial assistance on the goals of states. The state's objective is to choose S that will maximize (12) and (13).

Differentiating Eqs. 12 and 13 with respect to S shows that the state should provide financial support for higher education up to the point where the marginal benefit of doing so is equal to the marginal cost ($1):

$$\frac{dL_A}{dS_A} = \alpha(N - N_0)\left(\frac{1}{N_A}\right)\left(\frac{\partial \Pr(E_A = 1|E_0 = 0)}{\partial U}\right)\left(\frac{\partial U}{\partial S_A}\right) - 1 \tag{14}$$

$$\frac{dL_F}{dS_F} = \alpha(N - N_0)\left(\frac{1}{N_F - N_0}\right)\left(\frac{\partial \Pr(E_F = 1|E_0 = 0)}{\partial U}\right)\left(\frac{\partial U}{\partial S_F}\right) - 1 \tag{15}$$

In comparing the results for appropriations versus need-based aid (Eqs. 14 and 15), it can be seen that at the maximizing values of state funding (denoted by superscript *), the difference in state funding comes down to the effect of a change in the probability of a student going to college due to an additional dollar of state funding:

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[3] To simply the discussion, we assume that all students generate the same positive externality, and that the externality is due solely to the act of going to college. A more complete model could allow the positive externalities to vary by student depending on factors such as their academic ability, choice of major, and likelihood of graduating and choosing to reside in-state following graduation. Expanding the model in this way would facilitate an analysis of state aid programs with varying goals and objectives.

$$\left(\frac{\partial \Pr(E_F = 1|E_0 = 0)}{\partial U}\right)\left(\frac{\partial U}{\partial S_F^*}\right) = \left(\frac{\partial \Pr(E_A = 1|E_0 = 0)}{\partial U}\right)\left(\frac{\partial U}{\partial S_A^*}\right)\left(\frac{N_F - N_0}{N_A}\right) \quad (16)$$

As long as $N_A > (N_F - N_0)$ and $\partial U/\partial S_A^* > \partial U/\partial S_F^*$, then S_A^* would have to be greater than S_F^* for the equality to hold. This result means that the state would have to distribute more funding in appropriations than it would in need-based aid to reach the same optimum points shown in Eqs. 14 and 15. The finding arises because N_0 students who would have gone to college without financial assistance do not receive funding under a state need-based aid system, but would receive funding with appropriations. As a result, state appropriations are more expensive than state need-based aid for generating the same level of positive externalities. Another way of comparing the two policy options is to note that holding constant the total level of state support ($S_A^* = S_F^* = S$), the marginal benefit in Eq. 15 will be greater than the marginal benefit in Eq. 14, meaning that the state would receive more positive externalities by using need-based aid than appropriations.

Graphical Depiction

We now illustrate the model described in the previous section with the aid of a graph (Fig. 4). The line (A, B) shows the distribution of students by utility from going to college in the absence of subsidies. Without any subsidy, N_0 of the N students would be willing and able to go to college. Suppose, instead, that the state adopts appropriations, whereby state financial assistance is distributed equally to all students. This uniform assistance leads to a vertical shift in the utility received by all N students, leading to the new line (C, D). The amount of financial assistance is high enough to entice ($N_A - N_0$) additional students to go to college who would not have gone to college without the assistance. The appropriations are then evenly distributed among the N_A students who go to college (i.e., each student receives a benefit of S_A/N_A), and the college going rate would increase from N_0/N to N_A/N. However, the policy is inefficient because some assistance is provided to students who would have gone to college without the aid ($E_{0i} = 1$). Although the N_0 students all personally benefit from the subsidy because of larger net income, the state does not receive any additional positive externalities by assisting these students.
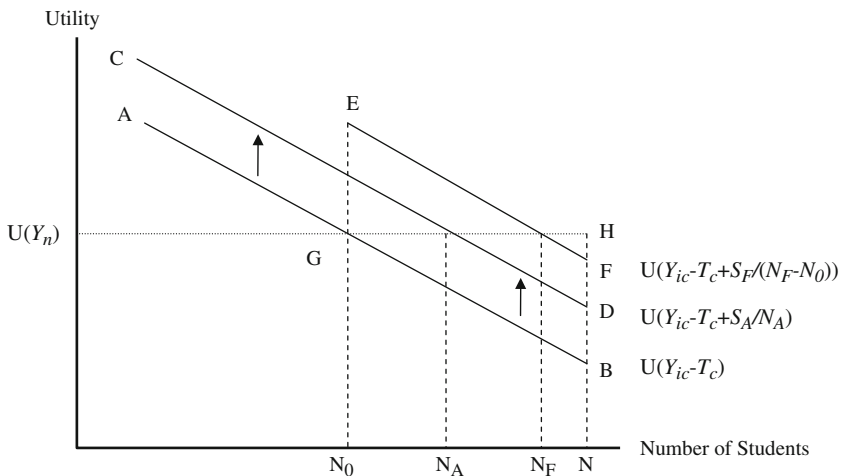

Fig. 4 Depiction of effects of state financial assistance on college enrollment decision

Alternatively, the state can distribute financial assistance S uniformly for only those $(N_F - N_0)$ students who would not have gone to college in the absence of state support. As long as $(N_F - N_0) < N_A$, the same total dollars is distributed over fewer students, and hence the per-student subsidy is larger, when states use need-based aid as opposed to appropriations. The new utility distribution for students after the financial assistance is now represented by the line segments (A, G, E, F). As a result, an additional $(N_F - N_A)$ students enroll in college because of the state using need-based aid in place of appropriations, thus increasing the college-going rate to (N_F/N).

Providing a uniform level of financial assistance to a subset of students is still inefficient because some students would receive more in assistance than is necessary to cause them to choose to enroll in college. The most efficient policy is for the state to vary the per-student support so that each of the $(N - N_0)$ students receives just enough state aid to entice them to go to college. Such a policy causes the utility line for students to become (A, G, H). The total cost of this option is represented by the area (G, B, H), and it results in a college going rate of 100%. As noted before, however, there may be a point at which the additional financial assistance needed to entice a student to enroll in college exceeds the additional positive externality. In this instance, the optimal level of enrollments is some value less than 100%.

Similar logic can be used to show that states are better off if they awarded financial aid on the basis of need rather than merit. If it is true that students who would be eligible for merit-based aid are more likely than students who are normally eligible for need-based aid to go to college, then state need-based aid leads to larger gains in positive externalities. This is not to say, however, that colleges and universities should not award merit-based aid to students. In fact, an equally compelling argument could be made that colleges should award merit-based aid and not need-based aid to students. This follows from the assumption that the goal of colleges is to maximize their prestige or reputation. If the prestige or reputation of a college is a function of the average perceived quality of its students, then the college will seek to award financial aid to students in such a way that it will lead to gains in the average quality of students. Therefore, colleges only benefit when the financial assistance that they give to students results in an increase in the average quality of students; in other words, the aid entices an above-average student to enroll at the institution.

Numerical Illustration

A third way to compare the relative benefits to states of using need-based aid and appropriations is through a numerical example. In Table 2, we illustrate how alternative state funding mechanisms can affect access to higher education and hence the accrual of positive externalities. The second column presents the full price tuition rate in the absence of state financial assistance, which we set equal to $16,000. State appropriations per pupil and the state need-based aid per student by income category are shown in columns 3–4. The net price is obtained by subtracting the state appropriations and grant aid per student from $16,000. The estimated numbers of eligible students by income category are based on the breakdown of families with children ages 6–17 by income category for 2006 from the Annual Social and Economic Supplement to the U.S. Census Bureau's Current Population Survey.[4] For this example, we assume that there are a total of 100,000 students in the state who are eligible to attend college.

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[4] Data were obtained from Table FINC-03 "Presence of Related Children Under 18 Years Old—All Families by Total Money Income in 2006." U.S. Census Bureau, Current Population Survey, 2007 Annual Social and Economic Supplement (http://pubdb3.census.gov/macro/032007/faminc/new03_001.htm).

Table 2 Simulation of effects of state funding options on access to higher education

Income	Tuition	Appropriation	Need-based aid	Net price[a]	Number eligible students[b]	Pr(attend) (%)	Pr(attend|net price)[d] (%)	Number attend[e]
Option 1: No state appropriations or need-based aid								
$10,000	$16,000	$0	$0	$16,000	4,963	50.0	0.0	0
$20,000	$16,000	$0	$0	$16,000	8,156	54.0	14.0	1,142
$30,000	$16,000	$0	$0	$16,000	8,939	58.0	31.3	2,801
$40,000	$16,000	$0	$0	$16,000	9,611	62.0	42.0	4,037
$50,000	$16,000	$0	$0	$16,000	9,058	66.0	50.0	4,529
$60,000	$16,000	$0	$0	$16,000	8,472	70.0	56.7	4,801
$70,000	$16,000	$0	$0	$16,000	7,342	74.0	62.6	4,594
$80,000	$16,000	$0	$0	$16,000	7,063	78.0	68.0	4,803
$90,000	$16,000	$0	$0	$16,000	5,929	82.0	73.1	4,334
$100,000	$16,000	$0	$0	$16,000	30,526	86.0	78.0	23,810
Totals =					100,000			54,851

Income	Tuition	Appropriation	Need-based aid	Net Price[a]	Number eligible students[b]	Pr(attend|net price)[c] (%)	Number attend[d]
Option 2: State appropriations = $7,687 per pupil, no state need-based financial aid							
$10,000	$16,000	$7,687	$0	$8,313	4,963	8.4	419
$20,000	$16,000	$7,687	$0	$8,313	8,156	33.2	2,709
$30,000	$16,000	$7,687	$0	$8,313	8,939	44.1	3,946
$40,000	$16,000	$7,687	$0	$8,313	9,611	51.6	4,960
$50,000	$16,000	$7,687	$0	$8,313	9,058	57.7	5,225
$60,000	$16,000	$7,687	$0	$8,313	8,472	63.1	5,344
$70,000	$16,000	$7,687	$0	$8,313	7,342	68.1	4,997
$80,000	$16,000	$7,687	$0	$8,313	7,063	72.8	5,142
$90,000	$16,000	$7,687	$0	$8,313	5,929	77.4	4,588
$100,000	$16,000	$7,687	$0	$8,313	30,526	81.8	24,984
Totals					100,000		62,314
Total state funding = $479,005,113							

Income	Tuition	Appropriation	Need-based aid	Net Price[a]	Number eligible students[b]	Pr(attend|net price)[d] (%)	Number attend[e]
Option 3: State need-based financial aid of $16,000 for all students with family incomes of $60,000 or less, no state appropriations							
$10,000	$16,000	$0	$16,000	$0	4,963	50.0	2,482
$20,000	$16,000	$0	$16,000	$0	8,156	54.0	4,404
$30,000	$16,000	$0	$16,000	$0	8,939	58.0	5,184
$40,000	$16,000	$0	$16,000	$0	9,611	62.0	5,959
$50,000	$16,000	$0	$16,000	$0	9,058	66.0	5,978
$60,000	$16,000	$0	$16,000	$0	8,472	70.0	5,930
$70,000	$16,000	$0	$0	$16,000	7,342	62.6	4,594
$80,000	$16,000	$0	$0	$16,000	7,063	68.0	4,803

Table 2 continued

Income	Tuition	Appropriation	Need-based aid	Net Price[a]	Number eligible students[b]	Pr(attend|net price)[d] (%)	Number attend[e]
$90,000	$16,000	$0	$0	$16,000	5,929	73.1	4,334
$100,000	$16,000	$0	$0	$16,000	30,526	78.0	23,810
Totals =					100,000		67,480
Total state funding = $479,008,966							

[a] Calculated as tuition—appropriation—need-based aid

[b] Number of students by income level are estimated based on the distribution of families with children ages 6–17 as reported by the 2007 Annual Social and Economic Supplement to the Current Population Survey (Table FINC-03), U.S. Census Bureau

[c] The probabilities of attending represent estimates of the likelihood of an eligible student in each income category attending college when the net price of attendance is zero

[d] The probabilities of attending conditional on net price are obtained using the formula Pr(attend\|net price) = Pr(attend) − 0.00001 * (50,000/Income) * (Net Price)

[e] Obtained by multiplying the number of eligible students by the probability of attending conditional on net price

The next two columns contain our assumed probabilities of attending college for students. The seventh column presents the probabilities of students in each income category going to college if the net price were zero. We set these probabilities so that they are bounded between 0% and 100%, rise with family income level, and are higher than current college-going rates (because net prices are, on average, positive). The eighth column contains the estimated probabilities of a student in each income category going to college conditional on the net price. These probabilities were chosen so that the net price sensitivity of students decreased with family income, and the conditional probabilities were bounded by 0% and 100%. We use a relatively simple function of the form Pr(attend\|net price) = Pr(attend) + $a*b$*(Net Price). The value a represents the price sensitivity that is in common across all income categories, and b captures the extent to which the price sensitivity varies by income category. For this illustration, we chose $a = -0.00001$ and $b = (\$50,000/\text{Income})$ to reflect the assumption that students from low-income families are more price sensitive than students from high-income families:

$$\text{Pr(attend|netprice)} = \text{Pr(attend)} - 0.00001 * (50,0000/\text{Income}) * \text{NetPrice} \qquad (17)$$

Finally, the last column shows the estimated number of students who would enroll in college. The estimates are obtained by multiplying the number of eligible students by the probability of attending conditional on the net price faced by students in each income category.

The first part of the table shows the results for the case where states provide no financial assistance in the form of either appropriations or need-based aid. Accordingly, all students faced a net price of $16,000. In this case, 54.8% of the eligible students would enroll in postsecondary education, with the attendance rates varying from 0% for students in the $10,000 family income category up to 78% for students in the income category of $100,000 or greater.

In the second portion of Table 2, we repeated the example after providing students with state appropriations of $7,687 per student. The appropriations reduce the net price faced by students to $8,313, which leads to an increase across all income categories in the

probability of attending college. In this hypothetical example, the college-going rate would rise to 62.3%, with gains being seen for students in all income categories.

In the last panel, we replace appropriations with grant aid in the amount of the full price of attendance ($16,000) for all students from families with incomes of $60,000 or less. This means that the net price is $0 for students from family incomes of at most $60,000, and $16,000 for students from families with incomes above $60,000. The probability of attending college rises for only those students in the family income range of $60,000 and lower. The simulation shows that in this scenario, the college-going rate increases to 67.5%, while holding total state funding relatively constant at $479 million.

Table 3 provides a comparison of the key outcomes from the two state funding options. The first two columns show the gain in enrollments by income category. Note that with the need-based aid option, the gain in enrollments—and hence positive externalities—are higher than if the same amount of state funding were distributed in the form of appropriations. The next four columns illustrate the differences that arise in the distribution of state funding across students. Approximately 40% of the state funding in this simulation goes to students in the highest income bracket and only about 10% of funding is distributed to students from families with incomes of $30,000 or less. In contrast, the state need-based aid option allocates over 40% of the state funding to students in the lowest three income categories. Finally, the last two columns show that with state appropriations, more students receive financial assistance as compared to when state funding is given as need-based aid.

We perform four additional simulations to test for the sensitivity of the findings in the illustration to the assumptions that we made regarding the price sensitivity of students. Table 4 shows the selected findings from all simulations. Option 1 represents the simulation presented earlier ($a = -0.00001$, $b = \$50,000/\text{Income}$). In Option 2, we set $a = -0.00002$, meaning that students in all income categories are more price sensitive than before. We examine the opposite case in Option 3, where we set $a = -0.000005$. In Option 4 we set $b = (\$50,000/\text{Income})^{1/2}$ so that there was a reduction in price sensitivity variations by income category. Finally, in Option 5 we changed the functional form to $b = (\$50,000/\text{Income})^2$ so that there is an increase in the variability of price sensitivities across income categories.

Across all five simulations, the use of state need-based aid leads to gains in college participation, and hence positive externalities, for the state relative to when appropriations are used. A comparison of Options 1, 2, and 3 shows that as the overall price sensitivity (a) rises, so do the gains in access to higher education from using need-based aid. Similarly, the gains in participation from using need-based aid rise as the differences in prices sensitivity (b) rise across income categories. This is seen by comparing the results from Options 1, 4, and 5. Taken together, the simulations show that the findings we presented in the illustration hold across a reasonable range of estimates regarding price sensitivity.

Overall, our analyses indicate that a greater number of students would be able to access higher education if states relied on a need-based aid system rather than an appropriations system. This conclusion is strengthened if we consider that all financial assistance is used by students whereas colleges are under no requirement to allocate appropriations (usually given in the form of a block grant) entirely to reduce in-state tuition rates. Indeed, the evidence suggests that colleges are using an increasing share of state appropriations for providing merit-based aid rather than reducing the cost for all students or underrepresented and low-income students (Rizzo and Ehrenberg 2004). This shift is driven by greater competition among colleges to attract meritorious students, who in turn improve institutional prestige more than less-meritorious students (Frank 2005; Griffith and Rask 2007; James 1988).

Table 3 Comparison of selected outcomes from state funding options in simulations

Income	Gain in enrollments		State funding		Share of state funding		Number of beneficiaries	
	Appropriations	Need-based aid	Appropriations	Need-based aid	Appropriations (%)	Need-based aid (%)	Appropriations	Need-based aid
$10,000	419	2,482	$3,218,263	$39,707,228	0.7	8.3	419	2,482
$20,000	1,567	3,263	$20,826,918	$70,471,729	4.3	14.7	2,709	4,404
$30,000	1,145	2,384	$30,332,821	$82,951,144	6.3	17.3	3,946	5,184
$40,000	924	1,922	$38,129,062	$95,342,726	8.0	19.9	4,960	5,959
$50,000	696	1,449	$40,165,194	$95,648,673	8.4	20.0	5,225	5,978
$60,000	543	1,130	$41,075,963	$94,887,466	8.6	19.8	5,344	5,930
$70,000	403	0	$38,413,810	$0	8.0	0.0	4,997	0
$80,000	339	0	$39,528,606	$0	8.3	0.0	5,142	0
$90,000	253	0	$35,265,480	$0	7.4	0.0	4,588	0
$100,000	1,173	0	$192,048,996	$0	40.1	0.0	24,984	0
Totals =	7,463	12,629	$479,005,113	$479,008,966			62,314	29,938

Table 4 Sensitivity analysis for illustration effects of state appropriations and state need-based aid

Simulation	Parameter (a)	Parameter (b)	College-going rate				Comparison to state financial aid	
			No state assistance (%)	State appropriations (%)	State need-based aid (%)		Gain in beneficiaries for state appropriations	Change in state funding with appropriations
Option 1	−0.000010	$50,000/Income	55	62	67		32,376	−$3,853
Option 2	−0.000020	$50,000/Income	42	54	63		24,339	−$61,779,525
Option 3	−0.000005	$50,000/Income	63	67	70		37,216	$37,204,140
Option 4	−0.000010	($50,000/Income)$^{1/2}$	56	64	66		33,671	$9,957,170
Option 5	−0.000010	($50,000/Income)^{2}	54	59	69		29,455	−$22,454,188

Constraints in Expanding Need-Based State Financial Aid Programs

Even though 40 years have passed since the first arguments were made in favor of a high tuition, high aid model, most states have continued their practice of providing the vast majority of financial assistance in the form of appropriations directly to colleges. Although Colorado's voucher scheme can be thought of as replacing appropriations with aid to students, the aid is uniform across students and therefore should have the same material effect as an appropriation. If, as Fischer (1990) argues, the case for state need-based aid is so convincing, it begs the question why haven't we seen a change in practice in the United States? In this section, we review the various arguments that might help account for the continued reliance on appropriations among state policymakers.

Lack of Political Support

The first constraint is that it might be difficult to acquire enough political support to convert appropriations into need-based financial aid. Coughlin and Erekson (1986), Hoenack (1982), and others argued that legislators will be very concerned with how their positions on issues such as state financing for higher education are received by either special interest groups (Becker 1983) or median voters. By construction, state appropriations tend to benefit more individuals than would state need-based grants. In addition, the lower-income families who would be most helped by need-based aid are less likely to vote than are middle- and upper-income families who benefit from state appropriations. Taken together, there are more voters who would stand to lose if appropriations were eliminated than there are voters who would stand to gain if need-based financial aid were increased. Therefore, even if an argument could be made on efficiency grounds that it is in the state's best interest to reallocate funding towards need-based financial aid, the politics behind funding issues may prevent this policy from being successfully adopted.

Reductions in Institutional Aid

A second reason why states may have continued to favor appropriations over need-based grant aid is that there is concern that increases in state financial aid would be partially or totally offset by decreases in institutional financial aid from non-state sources of revenue. Our analysis in the previous section ignores institutional financial aid, and yet public colleges and universities also provide need- and merit-based aid to students from revenue sources including tuition, private donations, and endowments. If colleges responded to increases in state grant dollars by either reducing their own need-based aid and scholarships or raising tuition, then there would be a smaller gain in the student's ability to pay for college and hence the state policy may not lead to an increase in the college-going rate of underrepresented and low-income populations. Hearn and Longanecker (1985) described how institutional policies may offset increases in federal need-based aid:

> It is well-known that individual states and institutions can do much to effectively neutralize federal policy in student financing. One way this has been accomplished in the past is for a state to raise public tuition levels by amounts roughly in line with new increases in federal grant programs for students. The result is a transfer of federal funds to the state; the new funds may pass through student hands but do not necessarily accrue to their benefit. (p. 500)

Because the proposed state need-based financial aid discussed in this paper would fully cover the cost of attendance for recipients, however, they are likely to be larger than the amounts typically awarded by colleges and thus would still have a positive impact on the probability of a student going to college. The gain would be largest for students attending non-flagship public colleges because these colleges typically provide less financial aid than the flagship colleges.

Brain Drain

A third possible explanation for the reluctance of states to move to more need-based aid is the fear that it may cause more students to leave the state following graduation. This is important from the perspective of policy makers because states will only receive the positive externalities when students choose to stay in-state after completing their education (Fischer 1990). If a student attends college in State X and then moves to State Y after graduation, then the external benefits from the student's education accrue to residents of State Y. Given this assumption, states would be less likely to support higher education in any form if there is a low probability that students receiving the support would reside in the state following their graduation. Appropriations to in-state colleges are not portable because they require the student to use the subsidy at an in-state institution, and some policy makers believe that students who attend college in-state are more likely than others to stay in-state after they graduate. By restricting the need-based grants to be used at in-state public colleges, the effect of using need-based aid rather than appropriations would be minimized. More research is needed, however, to determine if the state in which a student attends college affects where he/she will reside after graduation, holding constant the student's initial preference for staying in state.

Effect of Sticker Shock on Students

Fourth, it might be argued that the sharp increases in in-state tuition rates that would accompany a reduction in appropriations would lead to "sticker shock" and cause some students to decide that they cannot afford to go to college (Hearn and Longanecker 1985; Fischer 1990). It is possible that students may be affected by the higher sticker prices at public colleges and not fully understand how state financial aid would actually reduce the net prices that many students would pay at public colleges. The problem could be addressed through a more aggressive information campaign to convince low-income students and their families that the change will make college more affordable for them. One group that would clearly be hurt, however, are middle- or upper-income students who are not eligible for the state grant and may have been at the margin for attending college with the state appropriations. These students would end up paying more for college and may increasingly opt to attend private or out-of-state public colleges. Public colleges could, however, direct more merit aid towards this group of students to help offset the net price increases they would face.

Difficulty in Targeting Aid

Fifth, states may find it difficult to target need-based financial aid to only those students who would not have attended college without the financial aid. One of the clear advantages of state appropriations is that the policy is easy to implement (Hearn and Longanecker

1985). It is true that some students with very low levels of income may still opt to attend college without any financial assistance if their utility from going to college or their expected future income stream from going to college is sufficiently high. Similarly, some students who could definitely afford to go to college without financial assistance may not want to go to college because of their low preferences for college, low expected future income stream, or both. It is also impossible for policy makers to determine how large of a financial incentive would be needed to entice each individual student to go to college because preferences are unobservable and a student's ability to pay for college will be affected by many factors, including family income, wealth, number and ages of children, and health. The best that states could do is to award financial aid on the basis of a student's estimated ability to pay using established guidelines such as through a family's federal tax return or the Free Application for Federal Student Aid (FAFSA), or provide larger uniform subsidies to groups of students that are known to have some reduced ability to pay for college. Finally, there are large administrative costs with assigning student-level financial aid, relative to assigning appropriations.

Resistance from Public Colleges

A sixth reason why states may have resisted moving to a high tuition, high aid model is that many public higher education institutions are likely to argue against the policy change. Such a change could reduce the number of high-ability students who would want to attend public colleges even though in-state tuition rates would still compare favorably with tuition rates at most private colleges. Similarly, if students were allowed to use state financial aid to attend private, religiously affiliated colleges, then public colleges could argue that the state would be indirectly providing financial support to religious organizations, and thus blur the line separating church and state and perhaps violate state constitutions. If the need-based financial aid were restricted to be used at in-state public colleges as we assumed here, then much of the concern over revenues and the separation of church and state could be alleviated. In fact, public colleges may benefit financially from the movement away from appropriations if they are able to increase their enrollments due to the larger numbers of students who would demand a postsecondary education.

Public colleges might also be concerned that the change in policy would decrease the stability of their revenue stream because they would be more dependent on tuition revenue than before. To help address this issue, states might phase in the change towards need-based financial aid so that public colleges would have ample opportunity to see how the change will affect their finances. Public colleges may also argue that they require appropriations to support particular programmatic needs of the state, in areas such as medicine and education. The above model, however, does not preclude states from earmarking some portion of funding to support the costs of operating specific academic programs while distributing the remaining aid directly to students. Our analysis only addresses the portion of state funding that is intended to improve access to higher education for state citizens.

Other Explanations

Finally, there are other possible concerns that have been raised in the literature with regard to a heavy reliance on state need-based financial aid. Fischer (1990) suggests that because states have long relied on appropriations to help fund higher education, the practice is difficult to change and would require federal intervention. Similarly, it is argued by Fischer (1990) that states may be reluctant to be the first to change towards a high tuition, high aid

model due to competition concerns with other states. Hearn and Longanecker (1985) offer the suggestion that it is difficult for policy makers to predict how students will react to the change in policy. They further posit that state need-based aid systems may be more susceptible to manipulations by politicians for reasons beyond economic efficiency.

Conclusion

State funding for higher education is a complex issue that poses a number of policy challenges for analysts. What level of support is needed for higher education? How should support be allocated to students? What barriers might states face in implementing policies, and how can they be overcome? In this paper, we have used economic concepts to show why it would be more efficient and effective for states to provide financial support in the form of need-based aid to students rather than appropriations to public colleges if the goal of states is to maximize student participation in postsecondary education. This result is at odds with the fact that the vast majority of state funding continues to be in the form of direct appropriations to public colleges rather than need-based aid to students.

Providing state support to students rather than public colleges could introduce some changes in the incentive structure facing public colleges. The competition for in-state students would likely intensify if funding for higher education was distributed through students and not institutions. In fact, this is one of the rationales used for the voucher program in Colorado (Fox 2006). The possibility exists that a public college could increase its level of state funding by attracting more in-state students to its campus than before. Increased competition among public colleges could lead to gains in efficiency and better provision of services that are demanded by in-state students.

Although the focus of our analysis has been on the manner in which state governments within the United States provide funding for improving access to higher education, the analysis can be generalized to other settings as well. The federal government in the United States is as interested as state governments in supporting access to higher education in order to produce economic and non-pecuniary gains for the nation as a whole. Similarly, the analysis could be applied to many governmental contexts outside of the United States, and to both the primary/secondary and higher education levels.

The barriers and constraints that would inhibit changing current practice towards need-based aid to students would need to be given serious consideration before attempting to implement such a policy. Restricting the need-based aid to be used at designated public colleges within the state's boundaries could reduce concerns about conflicts between church and state, loss of revenues by public colleges, and brain drain. We would further recommend that such a policy change be phased in over a series of years so that public colleges could more thoughtfully prepare for the impact of the change.

Implementation challenges would also have to be addressed when designing a state need-based aid program, as noted by Lenth (1993). The conceptual arguments that we make in this paper assume that states are able to target need-based support to those students who are less likely to attend college without the aid. The policy may prove to be less effective than hoped if state aid is not distributed to the right students. Similarly, reductions in institutional or federal aid and/or large increases in tuition may offset the benefits students receive from higher need-based state aid. In addition, if students do not understand how to take advantage of the need-based aid, then fewer students will benefit from the state support and the gains in externalities will be reduced.

Political, economic and implementation concerns notwithstanding, a policy shift towards greater use of state need-based aid could result in a more efficient allocation of scarce state resources. Equally important, if implemented correctly this shift could improve access to higher education for traditionally underrepresented and low-income populations. If states are truly committed to raising the educational attainment levels of their citizens, then a movement towards more need-based financial aid and less direct appropriations to public colleges would be desirable.

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