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ABSTRACT

Using a model of rational student choice as its foundation, this study examined whether state policies toward higher education encourage junior colleges and universities to admit too many students. The optimal-size decisions of budget-maximizing junior colleges and universities were derived and compared to the optimal-size decisions of a social planner. Estimates were based on 1993-94 academic year data for average tuition, subsidy levels, and enrollments, along with average earnings by education status and graduation rates. These estimates suggested that junior colleges and universities behaved inefficiently by admitting more than the socially optimal number of students. The per-student subsidy levels that would be required to encourage both types of institutions to make socially efficient decisions were then determined. Finally, it was noted that government policies aimed at reducing the cost associated with transferring from a junior college to a university are demonstrated to improve the efficiency of the university system and worsen the efficiency of the junior college system. (Contains 20 endnotes.) (MDM)

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ARE THERE TOO MANY STUDENTS IN PUBLIC HIGHER EDUCATION?

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ABSTRACT

This paper examines whether current state policies toward higher education encourage junior colleges and universities to admit too many students. The optimal size decisions of budget maximizing junior colleges and universities are derived and compared to the optimal size decisions of a social planner. Estimation based on data for the 1993-94 academic year suggests that junior colleges and universities both behave inefficiently by admitting more than the socially optimal number of students. The per-student subsidy levels that would be required to encourage both institutions to make socially efficient decisions are then determined. Finally, government policies aimed at reducing the cost associated with transferring from a junior college to a university are demonstrated to improve the efficiency of the university system and worsen the efficiency of the junior college system.

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1. INTRODUCTION

A cornerstone of President Clinton's second term in office is his desire to make higher education accessible to all Americans. To this end, the federal government recently passed a bill increasing the tax deductibility of college tuition. In addition, the President is advocating further higher education reforms, such as his highly publicized HOPE scholarship program. Implicit in the pursuit of such policies is the assumption that increasing the number of students pursuing a post-secondary degree is in the public interest. This assumption, however, is not at all innocuous.

The assumption that increased college attendance has a positive effect on social welfare is derived from the positive return to a college degree that has consistently been demonstrated in the higher education literature (examples include Kane and Rouse (1995), Eide and Grogger [1995], Katz and Murphy [1992], and Murphy and Welch [1992]). Unfortunately, not all students who attend college are able to graduate. The fact that less than fifty percent of all students who start their post-secondary education seeking a bachelor's degree eventually receive one suggests that college attendance is a risky proposition (Digest of Education Statistics 1996). At the same time, college attendance is very expensive to both students and states that finance public education. The combination of these two factors creates a potential problem in that it is unclear whether the benefit of college attendance for those students who do not graduate exceeds the cost. Presumably, the majority of students who have a high probability of graduating are already making the decision to start attending college. As a result, the students whose college attendance decisions are most likely to be affected by the proposed policy changes are those who have lower probabilities of graduating. Because these students have low probabilities of graduating, it is entirely possible that the cost to society of their attendance will outweigh the benefit to society.

Using a model of rational student choice as its foundation, this paper examines whether state policies toward higher education encourage junior colleges and universities to admit too many students. A model of higher education size based on separate junior college and university systems that aim to maximize their individual budgets is developed. To evaluate the efficiency of the current governance structure, the optimal size decisions resulting from this model are compared to the optimal size decision of a social planner who aims to maximize the social return from higher education. This comparison indicates the number of students admitted to both

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institutions can either be too large, too small, or socially efficient depending on the relationship between the social benefit of admitting an additional student and the additional revenue that student provides. Estimates based on US data for the 1993-94 academic year suggest that universities and junior colleges both choose to admit too many students. This analysis suggests that states could increase the social benefit of higher education by pursuing policies that encourage universities and junior colleges to admit fewer students. Two important policy tools that state governments can employ to alter the social efficiency of their higher education systems are examined. It is demonstrated that states can encourage more efficient decision-making by decreasing current per-student subsidies or by decreasing the cost associated with transferring from a junior college to a university.

2. A MODEL OF HIGHER EDUCATION SIZE

The higher education structure we envision is as follows. Separate boards govern the statewide university and junior college systems. These boards are independent of the state government and act as budget maximizing bureaucrats. The boards main responsibility is to make decisions about the level of fees, and implicitly the size, of their respective systems. While the boards have autonomy in making this decision, they are dependent on the state government for public funds. Given the level of funding that the state budgets to the systems each year, the respective boards determine the number entering freshmen that should be admitted to maximize their overall budgets. Because potential students base their decisions on the expected costs of attendance, institutions are only able to effect their optimal sizes by setting tuition and fees at levels expected to attract the appropriate number of students.[1]

To outline this decision-making process, we begin by describing the individual student's problem. Given this student behavior, we then consider a state system of higher education which for simplicity we assume is composed of a single junior college and a single university each of which acts independently as a budget maximizing bureaucrat subject to a balanced budget constraint.[2] Finally, we consider an alternative decision-making structure in which all decisions are made by a social planner. The results provide a set of criteria by which to assess the efficiency of bureaucratic decision making.

2.1 The Individual Student's Problem

The basis of this discussion of the student's decision is the theoretical model developed in Hilmer (1998). Briefly, graduation from university is an uncertain event. While students will clearly be better off if they are able to graduate, due to the significant opportunity cost of attendance, they may be worse off if they are unable to do so. Thus, in making the decision of whether to attend a university, attend a junior college, or enter the labor force, students compare the expected benefits of each path and choose the one that's highest.

To determine the expected benefits, let $\pi \in [0,1]$ be a student's subjective probability that he or she has the ability to graduate from college. Let P_U and P_J represent the direct prices of attending a university or a junior college for two years,[3] and let $P_U > P_J$.[4] Let T represent the lost earnings resulting from the additional time required to graduate from a university if the students starts at a junior college, and assume that this is the only disadvantage associated with starting at a junior college.[5] Let I_D represent the difference in the present value of future earnings between a college drop-out and a person who never attends college less the foregone earnings of college attendance, and let I represent the difference in the present value of future earnings between a university graduate and a non-attendee less the foregone earnings of college attendance.[6]

Upon graduation from high school, students are not certain whether they will graduate. Assume, however, that students learn whether they will graduate by attending a university or a junior college for two years.[7] Thus, after two years of attendance, those who do not possess the ability to graduate drop out and enter the labor force, while those who do possess the ability to graduate attend a university for the final two years, thereby incurring the cost P_U of doing so.

The expected benefits associated with starting at a junior college and a university are thus:

(1) $$W_J = I_D - P_J + \pi(I - T - P_U - I_D)$$

(2) $$W_U = I_D - P_U + \pi(I - P_U - I_D)$$

It is important to note that the return to non-attendance has been normalized to zero, and thus these equations represent the expected benefit of each path relative to non-attendance. In both equations, the terms inside the brackets are assumed to be positive, while the terms outside the brackets are assumed to be negative. That is, the net additional benefit of completing the final two years of education is positive, while the total net benefit of dropping out is negative.

The student's enrollment decision can be written as:[8]

$$\text{(3)} \qquad \textit{start at a} \begin{cases} \textit{junior college} & \textit{if} \quad \pi_2 > \pi > \pi_1 \\ \textit{university} & \textit{if} \quad \pi > \pi_2 \end{cases}$$

where $\pi_1 = \dfrac{P_J - I_D}{I - T - P_U - I_D}$ is the minimum subjective probability associated with choosing to start at a junior college rather than not pursuing any form of higher education, and

$\pi_2 = \dfrac{P_U - P_J}{T}$ is the minimum subjective probability associated with choosing to start at a university rather than a junior college.[9]

Thus, if N represents the population of high school graduates and $f(\pi)$ represents the distribution of subjective graduation probabilities across the population of high school graduates, then $\int_{\pi_2}^{1} f(\pi)\partial\pi$ represents the fraction, and $\int_{\pi_2}^{1} Nf(\pi)\partial\pi$ the number, of high school graduates who choose to enroll at the university. Likewise, $\int_{\pi_1}^{\pi_2} f(\pi)\partial\pi$ represents the fraction, and $\int_{\pi_1}^{\pi_2} Nf(\pi)\partial\pi$ the number, of high school graduates who choose to enroll at the junior college.

2.2 The Junior College's Problem

Given the student behavior described above, consider a junior college that seeks to maximize the size of its budget subject to the constraint that its budget balances. For the junior college, expected revenues associated with an entering class of students consists of the fees paid by its entering students over their two-year stay at the junior college plus any exogenous per-student subsidy provided by the state legislature while those students are enrolled at the junior college.[10] Because junior college students are those with subjective probabilities that range from π_1 to π_2, the expected two-year revenue for the junior college can thus be defined as:

$$\text{(4)} \qquad R_J = \int_{\pi_1}^{\pi_2} (P_J + S_J) N f(\pi) d\pi = N_J (P_J + S_J)$$

where S_J is the two-year per-student subsidy provided by the state and N_J is the number of students that start at the junior college. The associated two-year cost of running the junior college is assumed to be a positive, convex function of the number of students admitted:[11]

(5) $$C_J = C_J(N_J)$$

The junior college's problem is to choose the level of junior college fees, P_J, that results in the number of entering junior college students, N_J, maximizing junior college revenues, R_J, subject to the balanced budget constraint, $R_J = C_J$. The results are the first order conditions:

(6) $$(P_J + S_J) - N_J \frac{I - T - P_U - I_D}{f(\pi_1)} = \frac{\lambda}{1+\lambda} \cdot \left[\frac{dC_J(N_J)}{dN_J} \right]$$

(7) $$R_J = C_J$$

where $\lambda > 0$ is the Lagrangian multiplier associated with the constraint (i.e. the marginal utility of junior college income).[12]

The marginal revenue term in equation (6) reflects the fact that two competing factors affect the marginal revenue associated with an additional junior college student. Marginal revenue increases to the extent that an additional student increases the total number of students paying tuition and being subsidized by the state. Marginal revenue decreases to the extent that junior college fees must be lowered for all attendees in order to encourage the additional student to attend.

2.3 The University's Problem

The university's problem is similar to the junior college's problem except that the university is a four-year institution and thus the relevant time horizon is now four years instead of two.[13] As a result, the expected revenues associated with admitting a group of freshman consists of the fees paid by those students over a four-year period plus any exogenous per-student subsidy provided by the state legislature over the same time period. In addition, during the latter two years the university will be responsible for educating those students who transfer from the junior college. Because every entering freshman, regardless of initial institution, may eventually finish at a university (with probability π), and because students that start at a university are those with subjective probabilities that greater than π_2, the four-year expected revenue for the university can be defined as:

$$
(8)\quad \begin{aligned} R_U &= \int_{\pi_2}^{1}(P_U + S_U)Nf(\pi)d\pi + \int_{\pi_2}^{1}(P_U + S_U)\pi\, Nf(\pi)d\pi + \int_{\pi_1}^{\pi_2}(P_U + S_U)\pi\, Nf(\pi)d\pi \\ &= (P_U + S_U)\left[N_U + \int_{\pi_1}^{1}\pi\, Nf(\pi)d\pi\right] = (P_U + S_U)\left[N_U + \hat{N}_U\right] \end{aligned}
$$

where S_U is the two-year per-student subsidy provided by the state, N_U is the number of students that start at the university, and $\hat{N}_U$ is the number of students who earn a university degree out of the initial class of university and junior college students.[14] As before, we define the two-year cost of running the university as a positive, convex function of the number of students in attendance at the university:

$$(9)\qquad C_U = C_U(N_U)$$

The four-year cost of running the university is then:

$$(10)\qquad \widetilde{C}_U = C_U(N_U) + C_U(\hat{N}_U)$$

The university's problem is to choose the level of university fees, P_U, that results in the number of entering university students, N_U, that maximizes university revenues, R_U, subject to the balanced budget constraint, $R_U = \widetilde{C}_U$. The results are the first order conditions:

$$(11)\qquad (P_U + S_U)(1+\pi_1) - \frac{T}{f(\pi^2)}(N_U + \hat{N}_U) = \frac{\lambda}{1+\lambda}\cdot\left[\frac{dC_U(N_U)}{dN_U} + \pi_1\frac{dC_U(\hat{N}_U)}{dN_U}\right]$$

$$(12)\qquad R_U = \widetilde{C}_U$$

where $\lambda > 0$ is the Lagrangian multiplier associated with the constraint (i.e. the marginal utility of university income).[15]

The marginal revenue term in equation (11) has a similar interpretation to the marginal revenue term in equation (6). Unlike the junior college, however, the university is interested in marginal revenue over a four-year period. Thus, university marginal revenue increases to the extent that actual tuition receipts and state subsidies for the first two years increase and that expected tuition receipts and state subsidies for the last two years increase. In addition, because the additional university enrollee is drawn away from the junior college,[16] the junior college will be forced to admit a new student (with $\pi_i = \pi_1$) in order to keep its total number of students fixed. Hence, the number of students attending a university for the final two years increases by π_1, and thus university revenues for the final two years increase by $(P_U + S_U)\pi_1$. As before,

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university marginal revenue decreases to the extent that university fees must be lowered for all students who attend the university during the four-year period.

2.4 The Social Planner's Problem

The fundamental question that this paper aims to address is whether the current governance structure encourages universities and junior colleges to admit the socially optimal number of students. To answer this question, consider the social planner's problem of maximizing the net social welfare generated by the entire higher education system. Assume the social benefit of post-secondary attendance is the increase in net income that a student expects to receive (see equations 1 and 2). Thus, the aggregate benefit associated with the entire higher education system can be defined as:

$$(13)\qquad \begin{aligned} B &= \int_{\pi_2}^{1}[I_D + \pi(I - I_D)]Nf(\pi)d\pi + \int_{\pi_1}^{\pi_2}[I_D + \pi(I - T - I_D)]Nf(\pi)d\pi \\ &= I_D(N_J + N_U) + (I - I_D)\int_{\pi_2}^{1}\pi\, Nf(\pi)d\pi + (I - T - I_D)\int_{\pi_1}^{\pi_2}\pi\, Nf(\pi)d\pi \end{aligned}$$

The total four-year cost of the higher education system can be defined as:

$$(14)\qquad C = C_J + \widetilde{C}_U = C_J(N_J) + C_U(N_U) + C_U(\hat{N}_U)$$

The social planner's underlying objective is to choose the level of junior college and university fees, P_J and P_U, that result in the number of entering junior college and university students, N_J and N_U, that maximizes the net social benefit of higher education, $B - C$. The results are the usual first-order conditions that require that the marginal social benefit of admitting an additional high school graduate into the junior college or into the university be equal to the marginal cost associated with that decision. For the junior college and the university these are:

$$(15)\qquad I_D + \pi_1(I - T - I_D) = \frac{dC_J(N_J)}{dN_J} + \pi_1\frac{dC_U(\hat{N}_U)}{dN_J}$$

$$(16)\qquad I_D + \pi_1(I - T - I_D) + \pi_2 T = \frac{dC_U(N_U)}{dN_U} + \pi_1\frac{dC_U(\hat{N}_U)}{dN_U}$$

The marginal benefit terms in equations (15) and (16) can be explained as follows. For the junior college, note that a marginal increase in the number of entering students results in the admission of a student with a subjective probability of earning a four-year degree equal to π_1. Hence, because a student who begins in a junior college but eventually completes a four-year degree must incur the transfer cost, T, and because the probability of earning a four-year degree for the marginal junior college student is π_1, the expected increase in net income will be $I_D + \pi_1(I - T - I_D)$.

For the university, the decision to increase the number of entering freshmen affects two students. The first student affected is the one who increases N_U by deciding to enter the university instead of the junior college. Entering the university directly allows this student to avoid the cost associated with transferring should he or she persist to graduation, which in turn increases his or her expected future earnings. Given that the student's subjective probability of earning a four-year degree is π_2, the change in his or her expected net earnings is $\pi_2 T$. The second student affected is the new enrollee accepted by the junior college in order to keep the number of entering junior college students constant once the previously described student switches to the university. The expected increase in net future earnings for this student is $I_D + \pi_1(I - T - I_D)$. Hence, the total increase in aggregate expected net future earnings when N_U rises will be $I_D + \pi_1(I - T - I_D) + \pi_2 T$.

The marginal cost terms in equations (15) and (16) can be explained as follows. The marginal cost of admitting an additional freshman student at either institution is equal to the actual cost of educating the student during the first two years at that institution plus the expected cost of educating the student for the final two years at the university. While this marginal cost is the same as before for the university, it is different for the junior college. This difference is explained by the fact that when it acts as a self-interested budget-maximizing bureaucrat, the junior college only considers the effect that an additional student has on the two-year cost of running the junior college.

2.5 Efficiency Criteria

By comparing the first-order conditions under the bureaucratic and the social planner's problems, we can develop a set of criteria that are useful in assessing the degree to which the bureaucratic outcome is efficient. Consider first the university. The solution to the university bureaucrat problem requires that the marginal revenue to the university exceed the marginal cost to the university (equation 11). Accordingly, the university's budget-maximizing size is depicted as N* in Figure 1. In contrast, the solution to the social planner's problem requires that the marginal social benefit associated with an additional university enrollee be equal to the marginal social cost (equation 16). Recall that for the university system, the marginal cost of admitting an additional university student is the same for both the bureaucratic problem and for the social planner's problem. Hence, determining whether the university admits the socially optimal number of students is simply a matter of determining where the social marginal benefit curve intersects the marginal cost curve in Figure 1. Clearly, this intersection can occur exactly at, to the right, or to the left of N^*. These three possibilities and their interpretations are outlined below.

If:	then:
$MB_U = \frac{1+\lambda}{\lambda} MR_U$	universities are optimal size (A)
$MB_U > \frac{1+\lambda}{\lambda} MR_U$	universities are too small (B).
$MB_U < \frac{1+\lambda}{\lambda} MR_U$	universities are too large (C).

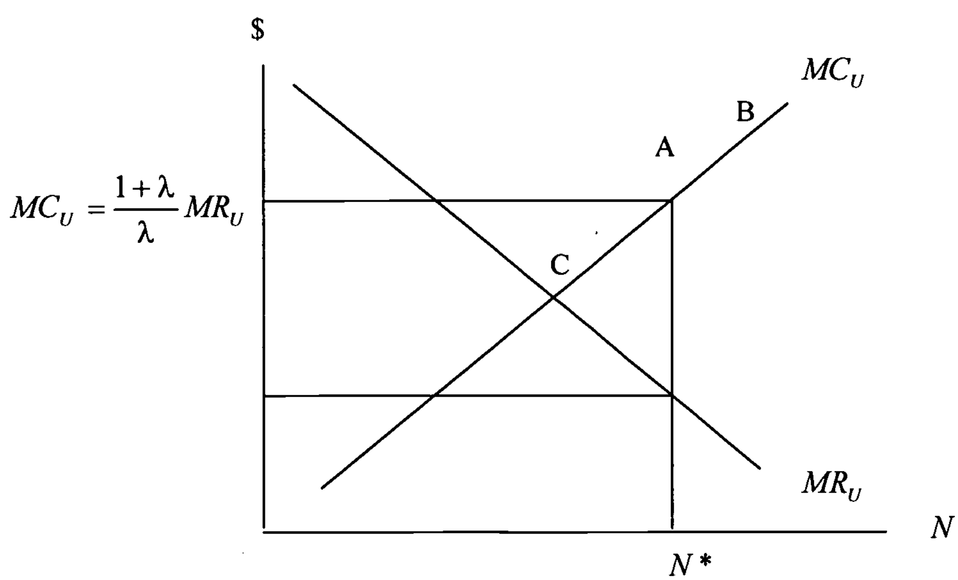

Figure 1

Efficiency Comparison for the University

The junior college comparison is not as straightforward. As with the university, the solution to the junior college bureaucrat problem requires that the marginal revenue to the junior college exceed the marginal cost to the junior college (equation 6). This size is depicted as N* in Figure 2. Likewise, the solution to the social planner's problem requires that the marginal social benefit to an additional junior college enrollee equal the marginal social cost (equation 15). An important difference between the university and junior college problems is that the budget maximizing junior college is only concerned with the two-year cost of educating the additional student, MC_J^{2yr}, while the social planner is concerned with the four-year cost, MC_J^{4yr}. In other words, the marginal cost to the junior college of admitting an additional student is not equal to the marginal social cost. Consequently, determining whether the junior college admits the socially optimal number of students is the more complex matter of determining where the intersection of the social marginal benefit curve and the four-year marginal cost curve lies in relation to the optimal bureaucratic size in Figure 2. Again, this intersection can occur exactly at, to the right, or to the left of N^*. These three possibilities and their interpretations are outlined below.

If:	then:
$MB_J = \frac{1+\lambda}{\lambda} MR_J + \pi_1 \frac{dC_U(\hat{N}_U)}{dN_J}$	junior colleges are optimal size (A)
$MB_J > \frac{1+\lambda}{\lambda} MR_J + \pi_1 \frac{dC_U(\hat{N}_U)}{dN_J}$	junior colleges are too small (B).
$MB_J < \frac{1+\lambda}{\lambda} MR_J + \pi_1 \frac{dC_U(\hat{N}_U)}{dN_J}$	junior colleges are too large (C).

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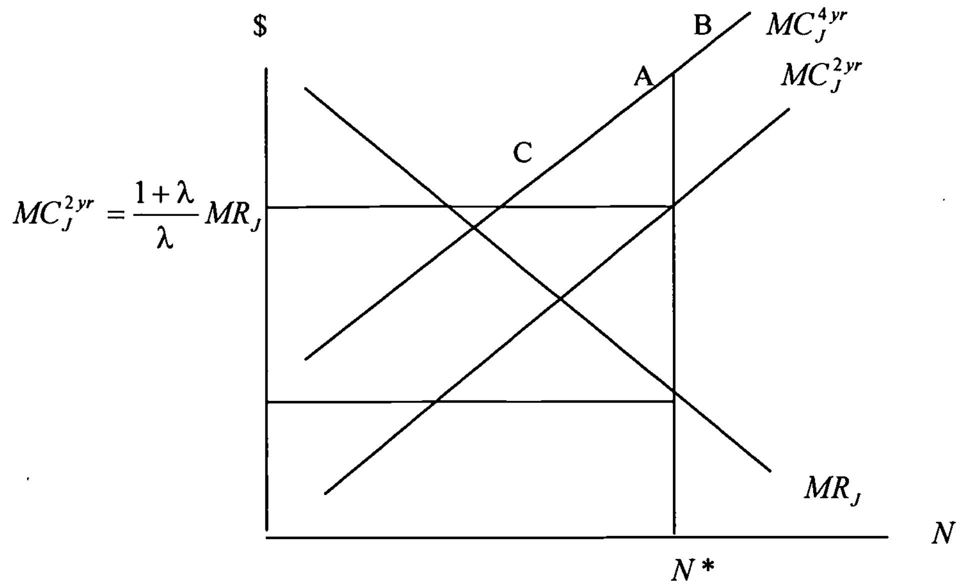

Figure 2

Efficiency Comparison for the Junior College

3. EVALUATING THE EFFICIENCY OF CURRENT SIZE DECISIONS

As the previous section indicates, under current higher education policies, universities and junior colleges may choose to admit either too many, too few, or the socially efficient number of students. To make informed policy decisions, it is important to develop some idea which of these outcomes is most likely. This involves estimating which of the situations depicted in Figures 1 and 2 are most likely to describe the current state of higher education in the United States. Unfortunately, the marginal revenue terms in equations (6) and (11) and the marginal benefit terms in equations (15) and (16) lack common values and therefore cannot be directly compared. It is possible however to get some idea of the efficiency of the junior college and university systems by combining observed cost and earnings data with previous estimates of student attendance decisions to develop estimates of the marginal revenue and marginal benefit terms that can be directly compared.

Much of the data used to estimate the marginal revenue and marginal benefit terms is available from published government sources. Average per-student tuition and subsidy levels and full-time equivalent enrollments for the 1993-94 academic year as well as average earnings by education status and graduation rates are collected from the *Digest of Education Statistics* (1996).[17] One concern is that the tuition and subsidy terms in the marginal revenue equations are only for two years while the earnings terms in the marginal benefit equations are for a student's working lifetime. To account for this difference, the values used in the following analysis are discounted to represent the differing time horizons.

A more difficult problem is finding values for the terms in equations (6) and (11) that represent the changes in fees required to encourage an additional student to attend each institution. Clearly, these values depend on student responses to changes in post-secondary fees. Four previous studies, Hilmer (1998), Rouse (1994), Leslie and Brinkman (1987), and Corman and Davidson (1984), have estimated student response to changes in both university and junior college fees.[18] Using the results of those studies, it is possible to estimate the changes in university and junior college fees required to encourage an additional student to attend each institution. See Appendix for a detailed description.

Inserting these observed data into the appropriate equations yields the following marginal revenue and marginal benefit estimates for increases in the number of entering junior college and university students:

Table 1
Estimated Relationship Between Marginal Revenue and Marginal Benefit

Marginal Revenue	Hilmer (1998)	Rouse (1994)	Leslie & Brinkman (1987)	Corman & Davidson (1984)
Junior College:				
Current	$5,659.37	$10,271.79	$13,958.84	$13,087.10
Social Planner	$4,487.59	$4,487.59	$4,487.59	$4,487.59
University:				
Current	$56,754.89	$41,674.29	$57,798.80	$53,571.99
Social Planner	$14,491.41	$14,491.41	$14,491.41	$14,491.41

To interpret these results it is important to note that the values used in this analysis are actual values and therefore are a consequence of the current governance structure. Because these values result from the actual number of students who attend, the estimates above are for the same number of students and must therefore occur along the same vertical line in a graph with the number of students on the horizontal axis. With these observations in mind, the values in Table 1 suggest Figures 3 and 4 for the university and the junior college, respectively.

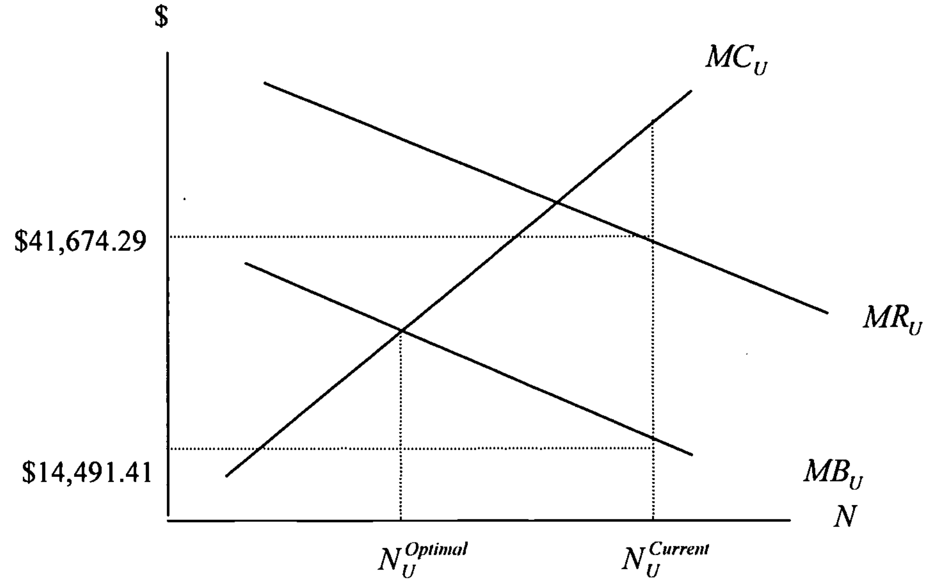

Figure 3 Using Rouse (1994)

Estimated Relationship for the University

The representation in Figure 3 indicates that for the current number of students attending the university, university marginal revenue is greater than social marginal benefit of an additional university student. This suggests that under current higher education policies, the university is choosing to enroll too many students.

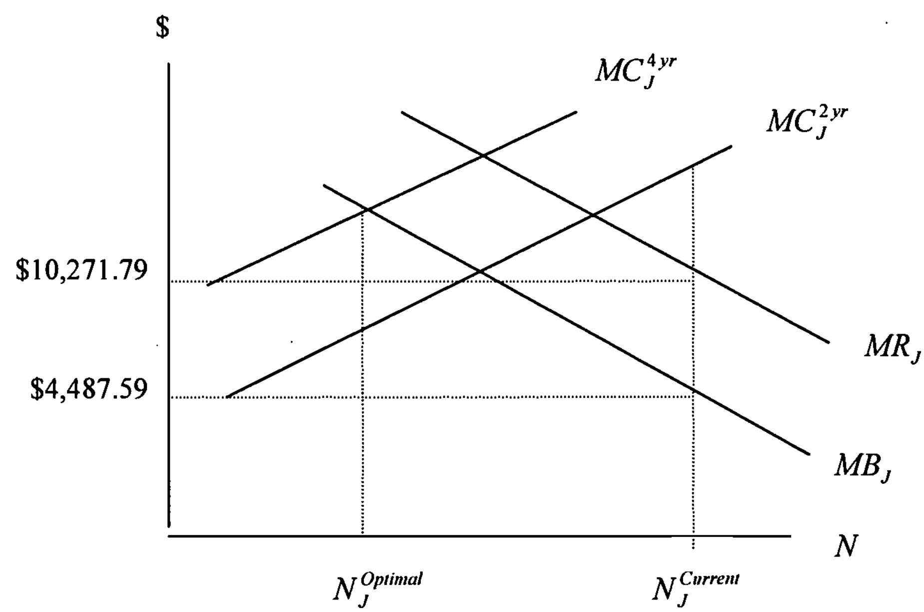

Figure 4 Using Rouse (1994)

Estimated Relationship for the Junior College

The representation in Figure 4 indicates that for the current number of students attending the junior college, junior college marginal revenue is greater than social marginal benefit of an additional junior college student. As with the university, this suggests that under current higher education policies, the junior college is choosing to enroll too many students. In other words, under current conditions, the university and the junior college are acting in a socially inefficient manner by choosing to enroll too many students.

It is interesting to interpret the values presented in Table 1. At current attendance levels, an additional university student would be expected to increase the university's revenue by roughly $56,000. At the same time, however, that additional student would only be expected to increase net benefit to society by roughly $14,500. For an additional junior college student, the values are roughly $13,000 and $4,500, respectively. It is this large discrepancy between the marginal revenue of an additional student and the marginal social benefit leads the two systems to admit more than the socially efficient number of students.

4. GOVERNMENT HIGHER EDUCATION POLICY

The previous section demonstrates that the junior college and university systems are currently making size decisions that are socially inefficient. As yet, however, the role that state governments can play in affecting the institutional size decisions of the junior college and the university systems has not been considered. State governments have two main policy tools at their disposal: per-student subsidies and transfer costs. By changing these two values a state will be able to influence junior college and university decisions and by so doing, may be able to force the institutions to make socially optimal decisions.

4.1 Optimal Subsidies

Altering the level of the per-student subsidy will change the revenue functions for the junior college and university systems, thereby affecting their size decisions. Presumably, there is some optimal subsidy level that the state can use to "trick" the two institutions into making socially optimal decisions regardless of the type of governance structure employed.

The optimal subsidy levels for the university and the junior college are those that equate the first order conditions for the current governance problem with the first order conditions for the social planner's problem. Recall that for the junior college the marginal costs for those two problems differ. To correct for that fact, the expected marginal cost for the last two years is subtracted from the social marginal benefit. Equating equations (6) and (15) and equations (11) and (16) finds that they optimal subsidy levels for the junior college and university systems are:

$$(17) \quad S_J^* = \left[I_D + \pi_1 (I - T - I_D) - \pi_1 \frac{d C_U(\hat{N}_U)}{d N_J} \right] \frac{\lambda}{1+\lambda} - \left[P_J - N_J \frac{I - T - P_U - I_D}{f(\pi_1)} \right]$$

$$(18) \quad S_U^* = \frac{\left[I_D + \pi_1 (I - T - I_D) + \pi_2 T \right] \frac{\lambda}{1+\lambda} - \left[(1+\pi_1) P_U^{\cdot} - \frac{T}{f(\pi_2)} \left[N_U + \hat{N}_U \right] \right]}{1+\pi_1}$$

The optimal per-student subsidies for the junior college and university systems are equal to the difference between the marginal utility deflated marginal social benefits and the non-subsidy components of the institution's revenue. Setting subsidies at these levels will alter each institution's revenue to the point that even though they are acting as budget maximizing bureaucrats, they will both choose to enroll the same number of students as the social planner.

The results in Figures 3 and 4 give an indication of how actual subsidies compare to the optimal subsidies. The fact that the both systems are currently too large suggests that the actual junior college and university subsidies are greater than the optimal junior college and university subsidy. Hence, it appears that states can encourage junior colleges and universities to make more efficient admission decisions by decreasing current per-student subsidies.

4.2 Transfer Costs

Students who transfer from a junior college may have to spend more than two years at a university completing their degree for a number of reasons.[19] Because the additional time spent pursuing a degree is time that the student does not spend working, it can be considered the cost associated with transferring. A state government is able to influence this cost through legislation it passes concerning the coordination between its junior college and university systems over lower division transfer courses. If coordination is poor, junior college attendees will likely not receive transfer credit for every class completed at the junior college, and as a result will be forced to retake some courses, thereby increasing the transfer cost. By enacting "matriculation agreements" which require better coordination, state governments can decrease the transfer cost by guaranteeing junior college attendees that their classes will successfully transfer to the university.

To consider the effect that decreasing the transfer cost has on higher education efficiency, it is necessary to examine how transfer costs affect student attendance decisions. This can be found by examining the effect that changes in the transfer cost have on the threshold probabilities for junior college and university attendance.

$$(19)\qquad \frac{\partial \Pi_2}{\partial T} = \frac{-(P_U - P_J)}{T^2} = -\frac{\pi_2}{T}$$

$$(20)\qquad \frac{\partial \Pi_1}{\partial T} = \frac{-(P_J - I_D)(-1)}{(I - T - P_U - I_D)^2} = \frac{(P_J - I_D)}{(I - T - P_U - I_D)^2} = \frac{\pi_1}{(I - T - P_U - I_D)}$$

These results can be explained as follows. The cost associated with transferring is the prime deterrent to staring at the lower cost junior college. A student who starts at a junior will be forced to incur this cost if he or she is to graduate while a student who starts at a university will not. For this reason, increasing transfer costs decreases the expected cost of starting at a university and increases the expected cost of starting at a junior college. Hence, when transfer costs are increased we would expect to see an increase in the number of students enrolling at the university and a decrease in the number of students enrolling at the junior college. Conversely, when transfer costs are decreased, we would expect fewer students to enroll in the university and more students to enroll in the junior college.

As this demonstrates, decreasing the costs associated with transferring has opposing effects on the number of students who attend junior college and universities. Such policies would therefore be expected to have opposing effects on the social efficiency of the two systems. Policies that reduce transfer costs decrease the number of university enrollees thereby improving the efficiency of the university and increase the number of junior college enrollees thereby worsening the efficiency of the junior college. Hence, it is not entirely clear whether decreasing transfer costs will improve the social efficiency of the current higher education system.

Given this discussion, one might wonder why many states have recently been passing legislation aimed at lowering the cost associated with transferring by improving coordination between junior colleges and universities.[20] An answer may be found in the relationship between the transfer cost and the total subsidy the state must pay to each institution. Decreasing transfer costs makes students likely to attend a university, which in turn decreases the total subsidy paid to the university. Likewise, decreasing transfer costs makes students more likely to enroll at the junior college, which in turn increases the total subsidy paid to the junior college. While these are apparently competing effects, states currently spend much more on their university systems than on their junior college systems, and thus the decrease in university subsidies will dominate. This may provide an explanation as to why many states have recently enacted legislation designed to lower transfer costs. By decreasing transfer costs, legislators may be able to decrease state-funded expenditures on higher education, thereby freeing up public funds for competing uses that may be politically more appealing.

5. CONCLUSION

The federal government has recently enacted legislation aimed at increasing the number of students attending post-secondary institutions. Implicit in such policymaking is the assumption that increasing college attendance increases social welfare. This paper has asked whether that assumption is reasonable. Estimates based on data for the 1993-94 academic year suggest that under current policies, universities and junior colleges in the United States choose to admit more than the socially efficient number of students. Such results are important and indicate the need for further research because they suggest that society may actually be harmed by policies aimed at increasing attendance at America's public junior colleges and universities.

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NOTES

[1] This is the governance structure in California, the state with the largest higher education system. Most other states employ a governance structure that is similar if not exactly the same.

[2] This assumption is convenient for expositional purposes. The results can be easily generalized to a case in which the two systems are composed of several institutions rather than one institution.

[3] It is recognized that not all students who attend a post-secondary institution and find they do not possess the ability and/or desire to graduate attend for two years before dropping-out. Likewise, not all community college attendees who do possess the ability and/or desire to graduate do not all attend exactly two years before transferring. This simplifying assumption makes the current exposition easier but is not necessary for the following results.

[4] According to the Digest of Education Statistics (1996), for the 1994-95 academic year the US average undergraduate tuition and fees and room and board at public four-year institutions was $6,670, while the US average tuition at public two-year institutions was $1,192. This same relationship held for all 50 states. Average two-year tuition ranged from a low of $365 in California to a high of $3,430 in South Dakota. Average four-year tuition and fees and room and board ranged from a low of $4,196 in Oklahoma to a high of 10,327 in Vermont. Tuition and fees and room and board are used for universities to represent the fact that many university students live on campus while attending, whereas tuition alone is used for junior colleges to represent the fact that a majority of junior college student live at home while attending.

[5] Among college graduates taken from the third follow-up of the High School and Beyond survey, students who initially attended a community college took, on average, roughly one semester longer to complete their degrees than did those who attended a university directly (Hilmer 1996). It should be noted that in the third follow-up, sophomores and seniors were last questioned four and six years after leaving high school. Therefore, this value does not include all students who eventually completed their degree.

[6] The assumption of equal returns to schooling for junior college and university attendees is not trivial. However, according to Kane and Rouse (1995), "the estimated returns to a credit at a two-year and a four-year college are both positive and remarkably similar: roughly 4-6 percent for every 30 units completed." Accordingly, the assumption of equal returns appears to be justified.

[7] The fact that a student starts attending a college in order to gain information about whether he or she has the ability and/or desire to persist on to graduation is referred to as the "option value" of college attendance. For a detailed discussion see Comay et al (1973), Manski (1989), and Altonji (1993).

[8] The intuition behind this decision rule is easily explained. To avoid the time cost associated with transferring, a student who thinks he or she is likely to graduate will start at a university. A student who is uncertain about his or her ability will start at a junior college since the foregone cost of the first two years will be much lower should he or she be forced to drop out. A student who is not likely to graduate will choose to work since doing so will make him or her better off than attending a junior college for two years

and dropping out. Figure 1 in Hilmer (1998) demonstrates that this decision rule accurately describes the decision-making process of students in the High School and Beyond data set.

9 The threshold probabilities have particular interpretations. The expression for Π_2 reflects the fact that college-bound students decide the type of institution they will attend by comparing the benefit derived from the decreased cost of community college attendance with the penalty resulting from the time cost it entails. If the decrease in attendance costs is small relative to the time cost, the penalty exceeds the benefit, and students are likely to start at universities. If it is large, the opposite is true, and students are likely to start at a community college. The expression for Π_1 reflects the fact that students decide between starting at a community college and entering the labor force by comparing the penalty resulting from the decreased future earnings should they drop out with the benefit from the increased future earnings should they be able to graduate. If the penalty of dropping out is small relative to the potential benefit of graduating students choose to start at a community college. If it is large, they choose to enter the labor force directly.

10 During the 1993-94 academic year, the annual subsidy was $23,150 at public universities and $6,438 at public two-year institutions. Note also that actual junior college and university budgets are more complex than modeled here because the revenues and costs they incur in any given year are actually the result of admission decisions made over a period of several years. Although we have chosen to ignore such dynamics in order to lay out a clearly picture of the social tradeoffs associated with the provision of higher education, the question of whether the dynamic qualities of the budgets of higher education are a critical characteristic is an interesting one worthy of consideration at some future point.

11 The total cost of operating a higher education system merits some discussion. Presumably, the total cost will be non-decreasing with the number of students. It may be argued that adding an additional student will not increase either educational or facilities costs, because it would likely not be necessary to offer additional courses or build additional classrooms in order to accommodate one additional student. However, the total costs of running a system also include several other costs, such as administrative costs. Many of these costs will likely increase once an additional student is added, as that student will lead to additional paperwork, counseling, etc. In additional, for the university system, there may also be the costs associated with housing that student on campus. For the current analysis, however, a specific form of the total cost function is not required. All that is required to guarantee a maximum can be reached is the familiar second-order condition for a constrained maximization. (Silberburg 1990).

12 The second term in equation (8) follows from the implicit function theorem and the implicit function $H \equiv N - N_U - F(\pi^1) - N_J = 0$.

13 For the same of simplicity, we have chosen not to worry about discounting future revenues and costs. Because our model is essentially static (though there are two periods, all decision making is make in the first period), such a simplification should have little effect on our results.

[14] For empirical purposes, note that $\hat{N}_U = \bar{\pi}_U N_U + \bar{\pi}_J N_J$ with $\bar{\pi}_U$ being the average probability of earning a university degree among entering university students and $\bar{\pi}_J$ being the average probability of earning a university degree among entering junior college students.

[15] The second term in equation (8) follows from the implicit function theorem and the implicit function $G \equiv N - F(\pi^2) - N_U = 0$.

[16] This follows from the fact that the marginal university freshman would, in the absence of an university admittance, attend the junior college.

[17] Earnings values are collected from the 1990 census and represent the median annual income of year-round full-time workers 25 years old and over. Graduation rates are calculated for the sophomore cohort of the High School and Beyond survey. The values represent the percentage of 1980 high school sophomores who had graduated by the 1992 follow-up.

[18] Hilmer (1998) uses ordered probit to estimate student responses to one standard deviation increases in university and junior college fees for students drawn from the HSB. Rouse (1994) uses a multinomial logit model to estimate student responses to $100 increases in university and junior college fees for students drawn from the NLSY, HSB and CPS. Leslie and Brinkman (1987) conduct a meta-analysis of twenty-five studies of student price response to changes in post-secondary fees. Corman and Davidson (1984) use a multinomial logistic approach to estimate the effects increases in university and junior college fees would have on observed enrollments based on aggregate state-level data for 1976.

[19] Two likely reasons are as follows. First, a transfer student may not receive the same level of instruction at a community college as his peers at the university. If so, the individual will not only have to keep up in his current classes, but he will have to spend extra hours studying to compensate for the lower level of instruction received at the community college. This extra studying may prevent the individual from taking a full course load, forcing him to spread his coursework over more than two years. Second, since the individual is not guaranteed that he will receive transfer credit for every class he completes at the community college, he may be forced to take more than two years of coursework at the university. Hilmer 1996 reports that for students in the High School and Beyond data set who had received a bachelor's degree by 1986, those who started at a community college took 125 days, or roughly one semester, longer to receive their degree than did those who attended a university directly.

[20] Examples of such legislation are widespread. For instance, in the 1997 Higher Education Reform Bill, the state of Kentucky enacted the "2+2" rule which required that the state's public universities accept all transfer credit courses that student completed at one of the state's junior colleges.

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