Does the Format of a Financial Aid Program Matter?

The Effect of State In-Kind Tuition Subsidies

Bridget Terry Long*

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ABSTRACT

This paper examines the importance of format in aid programs focusing on state appropriations to public postsecondary institutions. While these funds subsidize costs for in-state students, they may also affect choices between institutions due to their in-kind format. Using the conditional logistic choice model and extensive match-specific information, the paper approximates the choice between nearly 2,700 college options to examine the impact of several dissimilar state systems. Moreover, it simulates how decisions would change if the aid were fungible. The results suggest that state subsidies do influence students choose public colleges even if the gap in resources with private options is substantial. If the aid could instead by applied to any in-state college, up to 29 percent more students would prefer to attend private four-year colleges.

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SECTION I: INTRODUCTION

State appropriations to public colleges form the most significant higher education aid policy in the United States. During the 2002-03 school year, contributions by state governments totaled $63.6 billion, nearly four times the amount of grant aid administered by the federal government (Palmer, 2003). These state subsidies constitute nearly two-fifths of the total revenue received by public colleges. In contrast, private institutions rely primarily on tuition income (nearly half of their total revenues). The resulting price gap between public and private four-year colleges, over $14,000 in 2002-03 according to the College Board (2002), is likely to affect the sector and quality of colleges chosen. The gap is even larger once considering differences in expenditures.[1] Therefore, while state subsidies may reduce price barriers to postsecondary education by allowing public colleges to charge in-state students a discounted price, they may also affect choices between colleges.[2] This paper examines how the in-kind format of this aid influences its effect on college enrollment and choice.

Governments have implemented several types of financial aid programs to reduce college price barriers and lower the cost of capital for liquidity-constrained individuals. Fungible aid, such as Pell Grants, may be applied to any school and thereby extends the entire budget constraint. In-kind aid is instead linked to specific colleges and extends the budget constraint only for particular choices. State tuition subsidies therefore disturb tradeoffs between colleges because schools in the unsubsidized private sector are expensive relative to state-supported public institutions. Since colleges vary in the resources they offer, this price distortion could affect college investment decisions in nontrivial ways such as persuading individuals to choose schools that devote fewer resources to the production of education. In summary, in-kind aid could cause individuals to invest in less quality-adjusted human capital than they would otherwise, and this could reduce the aggregate consumption of higher education (Peltzman, 1973).

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[1] During the focus year of this study (1991-92), private four-year colleges spent $1,258 more per student on instruction, academic support, and student services than public four-year colleges and $4,245 more in total educational and general expenditures. Source: IPEDS.

[2] Given budget constraints, state aid allows for reductions in other sources of revenue, most notably tuition. The correlation between mean tuition and state appropriations for four-year, public colleges was –0.7 from 1977 to 1997 (IPEDS). In practice, schools are discouraged by states from increasing the tuition above a certain percentage each year unless appropriations are reduced thereby implicitly linking the subsidy and tuition level. Recently, many public colleges have substantially increased price in response to reductions in state support.

This paper analyzes the effect of in-kind state tuition subsidies on several aspects of the enrollment decision. First, how does the aid affect whether individuals choose to attend college and which school they choose? Second, do in-kind subsidies induce students to choose colleges with fewer educational resources than they would otherwise as asserted by Peltzman? Finally, the paper examines the counterfactual proposition of how student decisions would change if the state aid were no longer in-kind and instead could be applied towards the tuition of any in-state college. This simulation provides a sense of the proportion of students who are influenced by the in-kind nature of the aid.

To assess the impact of tuition subsidies on college investments, the paper estimates a model of college choice designed to take advantage of important match-specific information between students and 2,669 potential colleges. I estimate a conditional logistic model with individual-specific variables such as tuition net a Pell Grant, similarity of the student to prospective college peers, and the distance of the college from the student. Additionally, estimation includes measures of the educational resources available to students including peer and faculty quality and expenditures. While this model estimates the probability of attending each college in the choice set conditional on college enrollment, a second model estimates whether the student would enroll in college at all using controls for background, local labor market conditions, and the characteristics of the college most-likely to be attended.[3]

The parameters of this two-step college choice model are identified by the considerable variation in states' in-kind subsidy programs. For example, during the 1991-92 school year (the focus of this study), state appropriations per public college student ranged from $10,296 in Alaska to $3,021 per student in Vermont. Likewise, the subsidized tuition prices of public four-year colleges differed by state: that year California charged only $1,448 on average while Vermont charged $4,625 (NCES, 1993). More importantly, however, states differ substantially in the way subsidies are distributed among schools of varying degrees of selectivity, expenditures, and levels (two-year versus four-year). Several possible subsidy regimes exist. At one extreme, a state could offer highly-selective, heavily-subsidized public colleges such as California (see Figure 1). In contrast, a state may only support schools that target average-ability students like Massachusetts (see Figure 2). While previous work masks this variation by using the mean characteristics of the colleges in a state, this study attempts to account for the substantial heterogeneity and test how the *distribution* of subsidies across colleges affects enrollment decisions.

Because populations vary by region, linking state aid to the enrollments of each state would be misleading. However, estimates from this college choice model allow me to simulate the effect of different subsidy regimes on a common group of students. While state policies may be endogenous to their populations, states with similar demographics pursue vastly different policies providing the opportunity to do such a comparison. Further simulations explore how decisions would change if states distributed their appropriations directly to students as a fungible voucher. Public college prices are adjusted upward to account for the loss of state appropriations and then reduced by the value of the state voucher. The results suggest that the level and distribution of state subsidies strongly influence college investment decisions. When in-kind subsidies are medium to large, students appear to choose public colleges even if the gap in resources with private options is substantial thus supporting Peltzman's hypothesis. If states instead awarded individuals with a voucher that could be applied to any in-state college, up to 29 percent would prefer to attend private four-year institutions instead.

SECTION II: AID AND COLLEGE DEMAND

Several justifications for the state support of higher education are rooted in economic theory. Capital markets for financing higher education are imperfect, and state subsidies supply liquidity-constrained individuals access to a long-term loan: individuals benefit as students and repay the state in taxes over the rest of their lives. State aid could also induce society to invest at a more optimal level. Private investment considerations ignore the public benefits of education, and so policies that encourage college attendance and the resulting externalities could move the economy toward a social optimum.

However, state in-kind aid could impact decisions in negative ways. Peltzman (1973) suggests that they may discourage students from investing in education beyond what is offered at the subsidized schools. Of particular concern are students who, in the absence of subsidies, would choose to invest in slightly more education than that offered by public colleges. Figure 3 illustrates the logic. Individuals

[3] While ordinarily a nested logit model would be used to estimate the two decisions simultaneously, the conditional

have a budget constraint that relates the level of investment in education to the consumption of other goods. Private options sit on the curve (which has been drawn linear for simplicity). However, subsidized public colleges, for any given level of educational expenditures, cost less than private options. The subsidy allows students to invest in more human capital than is dictated by their original budget constraint while still consuming the same amount of other goods. Therefore, the budget constraint becomes "kinked" at the public options, and individuals will tend to gravitate towards the public options. If many students adjust their investments downward in terms of educational expenditures, then aggregate investment could fall (Peltzman, 1973). This is the principal concern of the paper.

The price distortion may also affect the incentives of colleges and students. If the subsidies enable public colleges to avoid competing directly with private institutions, then publics will have less incentive to maximize educational quality while minimizing costs.[4] In fact, if private colleges are more efficient, inducing students to attend the subsidized, public colleges would result in a welfare cost (Sonstelie, 1982). Furthermore, because of the aid, individuals are not held fully responsible for the costs of higher education if they do not realize a large return, and adverse selection may be a problem. Additionally, a moral hazard problem may exist if individuals invest in a great deal of education but elect never to work and therefore do not "repay" the state at all. Finally, the distributional effects of state subsidies may be undesirable. Because they are awarded irrespective of income, they may help many inframarginal students who are without need even when facing unsubsidized costs. Moreover, Hansen and Weisbrod (1969a and 1969b) found that college attendance at highly-subsidized California colleges is primarily a middle- to upper-income activity, but because all income groups pay taxes, the subsidies may be regressive depending on the progressivity of state taxes.

To measure the effect of cost and aid on college investment, most studies use variation across time or geographic region in tuition and/or aid levels. Campbell and Siegel (1967) were among the first to do this when examining the demand for higher education from 1919 to 1964. Building upon this approach, Hopkins (1974) exploits 1963 state-level variation with controls for education and income

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logit model is too complex for a simple application of the theory, and therefore, a two-step method is applied.

[4] For this reason, several states, most notably Colorado, have begun to consider reforms that would reduce state operational subsidies in favor of direct vouchers to students.

levels and finds a demand elasticity of -0.10 with respect to net public tuition (mean state charges minus mean state scholarship aid). Hopkins also documents a substitution effect: he finds that private college enrollments increase when public tuitions rise thereby highlighting the importance of relative costs in students' decisions between colleges in different sectors. Hopkins concludes that policies that lower public tuition levels cause some inframarginal students who would have otherwise chosen a private college to reallocate themselves to the public sector.

Manski and Wise (1983) try to more precisely approximate the college outlook of a student using a multinomial logistic model of school choice. They define an opportunity set for each student using information on applications and the characteristics of the nearest community college and find tuition costs have the expected negative effect. Similar to the majority of studies reviewed by Leslie and Brinkman (1988), Manski and Wise predict that a $1,000 change in price would result in a three- to five-percentage point change in college attendance. Using more recent data, Kane (1995) finds an elasticity of -0.10 to -0.20 in response to public tuition levels. Additionally, Kane finds that low-income students and those attending two-year colleges appear most affected by price changes. McPherson and Schapiro (1991) provide further support for this notion finding that a $150 increase (1994 dollars) in net price over time led to a 1.6-percent decline in enrollment among poorer students (an elasticity of -0.41).

While these studies have established the importance of price in decisions, Ganderton (1992) provides the first direct test of Peltzman's hypothesis. He examines the effect of state subsidies on college choices particularly focusing on school quality defined as the mean student body SAT score of a school. Ganderton finds that students choose a substantially less-selective public college than they would have chosen in the private sector thereby providing suggestive support of Peltzman's hypothesis.

While college demand studies based on cross-sectional variation in state-level tuition data have been informative, the results are primarily identified by fixed differences between states. As Kane (1995) and Rouse (1994) caution, interpreting state variation as a natural experiment for tuition changes has the problem that omitted state factors may be correlated with enrollment, subsidy level, and tuition. It is difficult to distinguish the impact of tuition from any other characteristic of the state that has remained constant over time. For example, unobserved state preferences for higher education may influence the size of tuition subsidies, and therefore, these preferences may be negatively correlated with the tuition level of a state. Estimates of the relationship between enrollment and tuition cost could therefore be biased downward using state cross-sectional data. On the other hand, state income per capita may be positively correlated with tuition levels. This would result in the relationship between enrollment and price being biased upward.

Another weakness of cross-sectional data at the state level is that it masks much of the heterogeneity in the market of higher education. While state subsidy and tuition levels vary significantly by state, most of the variation exists at a finer level. First, subsidy amounts differ greatly by level of school with public universities typically receiving nearly the double the subsidy of public two-year colleges and ten percent more than public four-year colleges. Tuition levels differ in a similar manner by type of school. Moreover, heterogeneity also exists *between* four-year, public colleges and universities. For example, each University of California branch campus receives at least two and a half times the amount of state appropriations of a California State University site. Finally, states vary substantially in the number and quality of schools available to students. States like California and Pennsylvania offer over thirty public, four-year institutions while states like Michigan and Virginia offer half as many. In terms of student body aptitude, a proxy for peer resources at a school, only Virginia and California offer public institutions rated as the most selective.

Using state mean values masks much of the variation in cost, subsidies, and quality that could influence enrollment. For example, an above-average student in Massachusetts would have a very different opportunity set than one from California. While each student would face similar costs for any private college in the country (except for travel), the resident of California would have cheap public colleges available to her that provide substantial financial and peer resources. If the California resident chose an in-state, public college while the similar Massachusetts resident did not, one would be unable to discern why in the state-level data. Because ignoring the distribution of resources to different types, levels, and qualities of schools within a state could bias estimation of the parameters of college decisions, college heterogeneity is a major source of identification problems in determining the effect of price and subsidies. The next section outlines a framework designed to account for this variation.

SECTION III: THEORETICAL AND EMPIRICAL FRAMEWORK

Assume an individual has J colleges from which to choose.[5] Each school *j* can be characterized by a vector Y which is composed of measures of college price and resources:

(1) $$Y_j = \{ P_j , EX_j , SB_j \}$$

where P_j is the tuition price of school *j*. School resources are divided into two parts: expenditures (including faculty resources), denoted by EX_j, and peers, measured by student body aptitude, SB_j. In this way, each college can be viewed as a package containing resources for a given price. From these characteristics, an individual can infer how much value-added human capital each school will produce and consider the consumption goods the college offers.

A vector X contains the individual's attributes that might affect his demand for education and his opportunity set such as high school performance, family income, and residence. Let the value of the j^{th} college to the i^{th} decision-maker be given by $U(Y_j, X_i)$. This value depends partly on an interaction of the individual's characteristics with those of the school. For example, a discount for college *j* (e.g. a state tuition subsidy) may depend on the residence of the individual.

Utility may have random elements so that individuals are not assumed have the same tastes:

(2) $$U (Y_j, X_i) = \bar{U} (Y_j, X_i) + \varepsilon_{ij}$$

That is, there are random deviations from the mean valuation $\bar{U}$. If we assume that the non-random part of utility is a linear function of individual and college characteristics we get:

(3) $$U (Y_j, X_i) = Z_{ij1}\beta_1 + Z_{ij2}\beta_2 + Z_{ij3}\beta_3 + . . . + Z_{ijk}\beta_k + \varepsilon_{ij}$$

where β is a vector of parameters, Z_{ij} are the variables that affect utility, and k is the total number of variables. Z may include variables that describe the elements of Y (i.e. EX_j and SB_j), interact Y and X to form match-specific measures or dummy variables.

Individuals compare the potential returns to attending different colleges along with the option of not enrolling and entering the labor market directly. The college decision is therefore made up of two

[5] A more extensive discussion of the model can be found in XXX (forthcoming).

simultaneous choices: choosing the best college option and deciding whether to attend college at all. The individual chooses the option that maximizes his lifetime utility subject to his budget constraint:

$$\text{(4)} \qquad \text{choose } Y_k \text{ iff } U(Y_k, X_i) \geq U(Y_j, X_i) \quad \forall\, k \neq j \text{ with } P_{ik} \leq I_i$$

where I_i is the budget constraint and is related to income.

The above framework emphasizes several points that must be addressed in estimating college decisions. First, there is substantial heterogeneity among colleges that must be adequately characterized using institutional information on each school's tuition price, expenditures, and student body characteristics. Second, match-specific information is an important part of the model since colleges treat students differently depending upon residence. Furthermore, a particular college may not suit all students well, and this will depend on how the student's characteristics compare with those of the college's student body. Finally, to understand how students make decisions the framework needs to adequately capture the full opportunity set of individuals so that tradeoffs between the opportunity chosen and the alternatives not taken can be explored. Therefore, unlike ordinary regression analysis, the model must be equipped to handle multiple alternatives. The conditional logistic regression model is well-suited for this framework since it both allows for multiple alternatives and can be used to exploit match-specific information.

Also known as McFadden's choice model (1973), the conditional logit has been used to study choice behavior with such applications as choice of travel mode and occupation.[6] While the form of the likelihood function is similar to that of the multinomial logistic regression, the variables are choice-specific attributes rather than individual-specific characteristics.[7] The data are organized as pair-wise combinations of each student i with each school j so that there are a total of $i \times j$ observations. Using these combinations, the conditional logit model is made up of j equations for each individual i with each equation describing one of the alternatives. The dependent variable, signifying the choice of the individual, equals one for the alternative that was chosen. The conditional logit model then computes the likelihood of enrollment at each school relative to all other alternatives so that the probabilities sum to

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[6] Manski and Wise (1983) suggest using the conditional logit to study college decisions. However, limitations in computing power at the time forced them to use a multinomial logit to analyze the decisions of individuals.
[7] If the independent variables were instead attributes of the individuals rather than alternatives, then the models would be the same. However, the multinomial logit model forces one to aggregate information about choices and enter them in a restrictive manner.

one for each individual (or within one stratum). In other words, it considers the probability of a person attending any one of the available schools.

Under the assumption that the ε_{ij}'s are independent and identically distributed with the extreme value distribution, we get the conditional logit functional form:

$$\text{(5)} \qquad \Pr(E_{ij}) = e^{Z_{ij}\beta} / (e^{Z_{i1}\beta} + e^{Z_{i2}\beta} + \ldots + e^{Z_{iJ}\beta})$$

$$\text{where} \quad Z_{ij}\beta = \beta_1 P_{ij} + \beta_2 EX_j + \beta_3 SB_j + \beta_4 D_{ij} + \ldots + \varepsilon_i$$

The probability of individual *i* attending college *j*, $\Pr(E_{ij})$, will be a function of the variables that define Z_{ij} including elements that describe school characteristics and match-specific information with the student. The format allows for maximum likelihood estimates of β, and the probability of any particular choice can be calculated using the conditional logit specification displayed in (5).

Because the likelihood of attendance at each college is calculated relative to alternatives, there must be variation within the strata for estimation purposes. Therefore, student characteristics cannot be included independently in the estimation, and the model does not identify the causal effect of a student's attributes on enrollment.[8] Instead, the estimates indicate how college characteristics affect the likelihood of an individual enrolling at that school. Dummy variables are used to understand how reactions vary for different types of students. For instance, a low-income person may have a high cost of capital so that small differences in price could affect the probability of choice. Likewise, a high-ability individual may be influenced differently by school characteristics. If ability and school quality are complements in the production of education, higher-ability students should expect to realize greater gains from schools with more resources. School expenditures could therefore be more important in their decisions of whether to choose a college.

If the Independence of Irrelevant Alternatives (IIA) condition is met, the estimates will be consistent even if the decision to attend college is endogenous. Possible endogeneity in the choice set develops from the fact that colleges available to a student will depend upon the previous decision of where to apply. This application decision is based upon a student's ranking of the colleges, and therefore, the opportunity set that a student will ultimately face is partly endogenous. However, as long as students apply to schools they determine to be most preferred, estimation will retain good statistical properties due to the IIA property.[9]

The conditional logit model above will estimate the choice between colleges, but an individual must also decide whether to attend college at all.[10] As stated in equation (4), the individual will compare his options including attending college, entering the labor force, or not working at all. While individuals may decide to invest in higher education given one set of opportunities, when presented with another set of alternatives, they may not enroll at all. Using the parameters of the conditional logit model, I predict the college that is the most likely college alternative if the individual does decide to attend. This is a better approximation of the outlook of a prospective student than the state mean tuition level previously used. A basic logistic model then estimates the likelihood of enrollment using the characteristics of the most-likely college to understand how individuals weigh attendance against outside options. This analysis focuses on the group thought to be on the margin of attending college.

This estimation strategy assumes that individuals make decisions between colleges in the same way regardless of whether they decide to attend or not. This may be a concern if students who do not attend improperly weight their options or lack the information needed to make decisions that would maximize their utility. However, marginal students are likely to attend the nearest two-year or four-year, public college and are aware of these local options from peers, high school resources, and the local press. Furthermore, the literature suggests that local options do influence individuals with similar observable characteristics to make different college decisions (Rouse, 1994; Kane, 1995). Therefore, differences in enrollment may be due to the options available and not that the decision-making process differs.

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[8] The *j* equations within a stratum are not independent, and gender, for example, would difference out of all the equations. Therefore, proxies for alternatives such as local labor market conditions can not be included within the model since they are individual-specific.

[9] See Manski and Wise (1983) for further discussion. Also see Luce (1959) and McFadden (1979).

[10] Estimation of the enrollment decision is treated separately for several reasons. First, describing the "not attend" option as an alternative with zero tuition cost, zero median test scores, and a distance of zero would bias parameter estimates. For example, since some individuals would choose not to attend (the option with no cost), the negative effect of tuition price on college choice would be exaggerated. In addition, the decision of whether to attend college is most likely nonlinear relative to choosing between different schools. Therefore, a model including the "no college" option is unlikely to accurately describe both the college choice and the decision of whether to attend.

This college choice model avoids some of the fears of misinterpretation associated with aggregated, cross-sectional analysis since I am able to view the specific options available to a student rather than just the means of groups of alternatives. However, endogeneity problems could arise if preferences influence state aid policy. Unobserved tastes for education could affect *how* and *why* subsidies are distributed within a state in a certain way, and these preferences would in turn influence college decisions, thereby biasing estimates. Moreover, how a state prioritizes the education of certain groups could also affect the distribution of subsidies. For instance, a state's commitment to the education of low-income or older individuals might affect its generosity to two-year colleges. Concerns about endogeneity are mitigated by the fact that states with similar observable characteristics have vastly different subsidy schemes.[11] One reason for this is that the pattern of public colleges and the distribution of tuition subsidies are strongly influenced by historical factors.[12]

The problem of unobserved preferences is likely to be most serious for marginal students because these individuals are most sensitive to the specific characteristics of potential colleges. To illustrate, suppose state preferences affect the placement of colleges in particular areas of the state. Since the proximity of schools appears to be a determining factor in the attendance decisions of marginal students, this group would therefore be influenced by the state's unobserved preferences interacted with each individual's specific residence. However, because colleges appear to be distributed among heterogeneous communities in more populous states, this is a potential problem for estimation mainly in rural states. To address the concern that the assignment of location could unduly drive the choices of some individuals, specification tests are used to verify the results.[13]

Another concern of this methodology is its focus on the demand side of college decisions without explicit treatment of supply-side constraints. It is first important to note that the vast majority of

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[11] As shown in Figures 1 and 2, California and Massachusetts have considerably different systems in terms of the distribution and level of state in-kind tuition subsidies. However, each seems to have a strong commitment to education. Massachusetts has long been a leader in education indicators, and in 1992, the percentage of its population with a bachelor's degree was the highest in the nation (27.2 percent). Likewise, California has a very educated population with almost a quarter of its people with at least a bachelor's degree. The substantial financial state support of colleges in California may also be taken as a signal of its commitment to higher education.
[12] See Goldin and Katz (1999) and Quigley and Rubinfeld (1993) for a discussion of these historical factors.
[13] For the state simulations, I randomized each student's location assignment several times to examine whether the results vary. They changed little and never disputed the paper's basic results. See below for further discussion.

institutions are not selective and a large majority of students are accepted into their first-choice college.[14] Moreover, the conditional logistic choice model accounts for supply considerations in two ways. First, because a student's ability relative to that of a college's student body may be an important determinant of enrollment at that school, the model includes variables that measure the difference between the student's SAT percentile score and the median percentile score of the school. These variables, therefore, account for the likelihood of admission and prevent the model from predicting that individuals with low test scores would be accepted into the most selective schools. Additionally, the model includes controls for undergraduate enrollment to account for the fact that larger schools have a higher level of visibility and are able to admit greater numbers of students.

Several data sets provide the necessary individual, institutional, and state-level data. First, the National Education Longitudinal Study (NELS) provides information on the characteristics, ability, and family background of approximately 8,000 students from eighth grade to age twenty.[15] During this time frame, I am able to observe transitions from high school to postsecondary education or the workforce including the application to and enrollment in college. A second study, the Integrated Postsecondary Education Data System (IPEDS) provides extensive information on postsecondary institutions within the United States including financial expenditures and revenues, tuition costs, and enrollment.[16] These data were supplemented by information from the *Digest of Educational Statistics* and U.S. Department of

[14] According to Breland, Maxey, Gernand, and Trapani (2002), only 13 percent of public four-years and 20 percent of private four-years have competitive admissions processes. Most other four-year schools do impose selective criteria such as high school course requirements and minimum test scores, but they accept nearly everyone who meets those criteria. Among two-year colleges, 91 percent of publics and 46 percent of privates have completely open admissions without requirements; the rest have minimum standards.

[15] While the original data set in 1988 contained 14,622 observations, once accounting for attrition by 1994, only 7,870 observations remained with the necessary information. This sample has slightly higher mean years of parental education (14.07 years in the original compared to 14.44 years), slightly higher family income (as measured by a categorical variable), and were more likely to have attended a private high school (9.7 percent compared to 14.7 percent). If the student's SAT score was not available, then either: (i) an available ACT score was converted, or (ii) high school GPA was used to predict the SAT with controls for demographics.

[16] The sample was limited to nonspecialized, undergraduate institutions. Carnegie codes and school names were used to drop the following schools from the sample: graduate programs and other specialty schools (art college, seminaries, etc.); college administrative offices; schools without tuition and enrollment information; single-sex colleges. For schools that did not have student expenditure information in 1992, figures from other years were used and deflated. A total of 2,669 colleges remained in the sample.

Commerce for state-level characteristics. Finally, the College Board's *American Survey of Colleges* and Barron's *Profiles of American Colleges* provided information on test scores and other characteristics.[17]

In order to have a better sense of net price, the amount of Federal Pell Grants that a person could expect to receive was subtracted from the list tuition price. The lack of information about aid beyond Pell Grants is not a great concern given few students receive substantial grants. In 1991-92, the median college spent only $193 in institutional aid per student. Moreover, according to the 1992-93 National Postsecondary Student Aid Survey (NPSAS), only one-third of students at private four-year colleges and ten percent of students at public four-year colleges received any institutional grant aid.[18] Students who do receive scholarships or grants often do so from only a few schools within their opportunity sets making the awards school-specific and nearly impossible to predict. Furthermore, information on a student's specific need is unavailable.

To measure college resources, the models include expenditures. However, because total college expenditures include many items that do not directly affect education production (i.e. research and infrastructure), I only include student-focused expenditures: funds spent on instruction, academic support, and student services.[19] Median student body SAT score proxy for peer resources. Since a difference of 100 points does not mean the same thing at all places in the distribution of scores (e.g. a 400 versus 500 compared to a 1500 versus 1600), the median score was transformed into a percentile to better standardize the measure. Distance from a school was calculated using the zip code of the student's high school (the finest geographical indicator in the NELS) and the potential college. Quadratic tuition, distance, test score, and student expenditure variables along with a cubic distance variable are included to allow for nonlinear relationships. This is necessary because, for example, the difference between a distance of 20

[17] If the median score was missing for a college, a score equal to the mean of the college's competitiveness category was used. Since two-year colleges do not customarily require or request scores, all were assigned an SAT composite of 700, a level that qualifies basically all students.

[18] Institutional Aid is most likely to affect the net price for high-ability students. To address this concern, I tried an alternative measure of price equal to the list tuition price minus the expected Pell Grant minus the mean institutional grant per FTE student at a college (a proxy for net price). When using this alternative measure, price is estimated to have a more negative effect on the likelihood of choosing a particular college. However, the alternative measure of price did not improve the predictive value of the model. The original measure of price produced better predictions of the students' actual choices even among the high-ability students. The college with the highest choice probability is the same with each price measure 91 percent of the time.

to 30 miles may not be the same as a difference of 1200 to 1210 miles. Table 1 summarizes the data and variable definitions.

SECTION IV: THE DETERMINANTS OF COLLEGE CHOICE AND ENROLLMENT

Table 2 displays how college characteristics affected the choice of school by the NELS sample. Tuition and distance had a negative effect on the probability of choosing a particular college conditional on enrollment in higher education. As estimated in specification 1, a student was 39 percent less likely to attend a college that charged $1,000 more in tuition costs net a Pell Grant, *ceteris paribus* (1992 dollars). This translates into an own-price elasticity of –2.8.[20] However, each additional $1,000 has a less negative effect on choice. Likewise, students were 81 percent less likely to attend a school 100 miles farther away than a similar college, but the marginal negative effect of distance decreases.

In contrast, school resources, as measured by expenditures, the student-faculty ratio, and the percent of the faculty with a Ph.D. or other terminal degree, had a positive effect on the likelihood of choosing a college. The student-college match and school resources were also important determinants of college choice. The likelihood of attendance at a college decreases 29 percent for every ten percentile-points that the student's score is above that of the college's average student. The relationship was positive if the school's scores are higher perhaps signifying that students try to attend colleges with peers of higher quality. However, as the marginal difference between the scores increases, individuals became less likely to choose that college. School size was also positively related to the likelihood of attendance.

The effect of school costs and resources differ by student characteristics as shown in specification 2. The impact of cost on low-income individuals is examined using an interaction with a dummy variable equal to one for individuals with family incomes below $20,000 in 1991. While tuition is not found to have an additional negative effect on the likelihood of choosing a college, distance, another measure of cost, reduces the likelihood of enrollment by an additional 35 percentage points. High-ability students,

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[19] Eleven college with unreasonably high student expenditures in comparison with similar schools (possible due to measurement error) were assigned the mean expenditures for that type, quality, and level of school.

[20] While there is limited empirical evidence on the specifics of competition between colleges, several other papers have found significant cross-price effects for specific institutions (see Allen and Shen (1999) for further discussion). However, this is the first paper to estimate such effects for the entire higher education market.

defined as having a SAT above 1100, were less negatively impacted by tuition price perhaps suggesting that high-ability students expect a higher return to college and are therefore willing to pay more for their educations. Furthermore, this group is more likely to receive institutional financial aid, which could help to cover higher costs, and they were more likely to come from more affluent backgrounds. Additionally, a college that is 100 miles farther away was only 36 percent less likely to be chosen by a high-ability student while a $1,000 increase in student expenditures multiplies the likelihood of attendance by an additional 15 percentage points for the first $1,000, *ceteris paribus*.

The characteristics of colleges also affect the "whether to enroll" decision as shown in Table 3. The models compare students who differed in the attendance decision and for whom attendance was uncertain due to being of lower ability (and therefore confronting lower returns to education) or low-income (and facing extremely high capital costs).[21] This definition of marginal students seems accurate as evidenced by the mean demographics of the group in the NELS that elected not to attend college.[22]

Because this group presumably considers local public options when deciding whether to attend due to the fact these schools are less of a commitment in terms of cost and distance, the first models use the closest two-year and four-year public college.[23] However, as shown in specifications 1 and 2, price is not statistically significant and distance only plays a role in the first model. Given the wealth of literature denoting the importance of these two factors, these results suggest that the closest colleges may not approximate the colleges of interest for a student considering enrollment. The college predicted to be the most likely choice from the conditional logit model in Table 2, specification 2 does a better job identifying college characteristics related to the attendance decision.[24] As expected, price has a negative effect with an additional $1,000 in list tuition price reducing the likelihood of attendance by 7.8 percent translating into a price elasticity of –0.30. Given that this sample of marginal students is expected to be more responsive to price than others, it is likely that the estimate is an upper bound. However, because it

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[2121] The criteria for this group were: (1) family income below $30,000, or (2) parents' with less than 13 years of education, or (3) SAT scores below 900. The sample included 2,177 who did not and 3,484 who did attend.
[22] Individuals who did not attend college had a mean family income of $34,818 while those who enrolled made on average $57,370. Likewise, the mean SAT scores for the groups were 786 and 913, respectively.
[23] Rouse (1994) suggests that junior colleges provide a place in higher education for those not traditionally served by the four-year college system. She also demonstrates that proximity is important to marginal students.

is one-third larger than that found by Kane (1995), it may also suggest that previous estimates have underestimated the influence of cost by using aggregated measures or colleges in proximity.

The model predicts college choices with very similar statistics as those schools that were actually attended. To get the predicted choices, I first calculated the probability that each person in the sample would choose a particular school relative to their other options using equation (5) and the parameters of the model in Table 2, column 2. Second, I calculated the likelihood of attendance for each person given the characteristics of the most-likely college and the parameters of the model in Table 3, column 3.[25] Each student-college match was then weighted by each of these probabilities. This process gives mean statistics taking into account both the relative odds of choosing a particular school and the likelihood of enrollment. While 3,841 individuals in the sample actually attended a four-year college, the model predicts that 3,829 would. In addition, the mean list tuition at the colleges attended was $5,863 while the model predicted it would be $5,634, a four-percent difference. The model does a slightly better job predicting the college costs and resources of those that attend four-year schools than those that attend two-year colleges. However, the model does overestimate the proportion of students that choose to attend public, four-year colleges. See Appendix Table 1 for more information.

Differences between the actual and predicted choices could be due to several reasons. First, prospective students may not have full information about potential schools in order to make the most optimal decisions. Additionally, the variables do not perfectly describe each college option. Colleges offer more than can be measured by expenditures, test scores, and other variables, and these qualities may be perceptible to students. Furthermore, grants other than Pell alter the prices of options for some students and encourage different choices. As discussed above, I am unable to incorporate these types of aid into the model. Finally, supply constraints could also explain differences between the predicted and actual choices, and I do not directly take into account admissions policies. However, the test score difference variables account for most of the selectivity issues. On average, the school percentile predicted

[24] These predicted colleges are often either the closest public two-year (14 percent) or public four-year (36 percent), and therefore, specification (3) is partly a combination of the first two specifications.
[25] The parameters are used to calculate the probability of enrollment for each individual in the marginal group at each potential college. Individuals not in the marginal group were given an enrollment probability of one.

does not differ much from what it was in reality, and the model avoids predicting options in which there are great differences between the test scores of the individual and of the school.

Further support that the model does well in predicting decisions stems from the fact that the college attended was one the top three predictions in nearly one-third of the cases. However, the fact that the model does not always predict the exact school does not matter if the college predicted is similar to the school actually chosen (e.g. Harvard is predicted but Amherst is chosen). This is because the important characteristics of the schools (tuition and student expenditures) are similar.

SECTION V: THE EFFECT OF IN-KIND TUITION SUBSIDIES

Because tuition costs affect the probability of enrollment at a particular college, individuals may accept lower quality (i.e. fewer resources) for the sake of price. The state subsidization of public colleges and resulting price gap between public and private options provides an opportunity to test this notion set forth by Peltzman. Two sets of simulations are performed. The first involves calculating how decisions would change under various state subsidy regimes (i.e. given a different distribution of subsidies and colleges). The second simulation explores the counterfactual of what would happen if the aid were not in-kind. Using the same state spending amounts, I examine how decisions would change if students were instead given a voucher that was applicable to any in-state college.

State Simulations

Massachusetts and California are excellent states to compare and assess the effect of dissimilar state regimes. As shown in Figures 1 and 2, they have considerably different systems in terms of the distribution and level of in-kind subsidies. However, each seems to have a strong commitment to education as evidenced by indicators and history. Additionally, Illinois and Nebraska were chosen because each has a distribution of subsidies between the patterns exhibited in Massachusetts and California. Unlike Massachusetts, Illinois offers a highly competitive, public option, but it is the only option, and it does not receive as much state aid or spend as much in resources as the top-rated schools in California. Nebraska has a similar distribution of public schools as Massachusetts, but the state aid level is higher allowing a good test of whether large subsidies influence students to forego private options.

Unlike the other states, Nebraska does not have a highly selective private college although Creighton University spends the same amount in expenditures as do many colleges rated Most Competitive.

To compare the decisions that would be made under each state's system, the sample was first given the characteristics of a resident. For example, for the California predictions, the tuition values became in-state costs for California colleges and out-of-state costs for other schools. Location in the state was randomized based on the distribution of the population among zip codes (i.e. Los Angeles zip codes were assigned to members of the sample in an equal proportion to the number of Californians that reside there). For each location assignment, a new distance variable was calculated to each potential college.[26] Table 4 summarizes the predicted college decisions when presented with the revised opportunity sets based on residence within each state.

The greatest differences are between the states with the two extreme subsidy systems. California, with the most generous state support, has the highest percentage of students in public colleges and the lowest mean four-year tuition cost of the four states. Even with the lower cost, students under the California system are predicted to receive the greatest amount of student expenditures and the highest median student body SAT percentile due to the quality of institutions supported by the state. At the other end of the spectrum, Massachusetts, with much less state support, is predicted to have over one-third fewer students in public colleges with students paying nearly three times more tuition at four-years on average without comparable increases in college resources. More students are predicted to attend college under the generous California regime although many are predicted to attend two-year colleges with an average tuition price one-eighth the average cost of the two-year colleges chosen in Massachusetts.

There are also differences across the states among high-ability students. Nearly three times as many high-SAT students are predicted to choose public four-year colleges in California, and they are predicted to be charged one-third of the mean tuition relative to Massachusetts. However, in

[2626] As mentioned earlier, this methodology could affect the results because the placement of colleges may not be random, and proximity is an important determinant of enrollment. For example, community colleges may be located in poorer areas, but since poorer individuals are not necessarily assigned to live in those areas, their likelihood of attendance may be underestimated. However, in metropolitan areas, community colleges are found in both poor and rich areas minimizing this type of problem. This is a greater concern for rural areas. In order to get the most reliable results, the simulations were run several times for each state with a new random location assignment each time. The predictions did not significantly differ thereby suggesting this concern is not significant.

Massachusetts some high-ability students would elect to attend selective private institutions and pay five and a half times more while only receiving 30 percent more in student expenditures. Although this study does not take into account institutional scholarships, this aid is unlikely to completely close the net tuition gap for middleclass families between a selective private college in Massachusetts and a public four-year institution in California. In summary, when faced with California's generous subsidies and diverse system of public colleges as opposed to Massachusetts' less generous and limited array of public options, individuals paid far less but received a similar amount in resources. Low-income students appear to be particularly attracted to the public options regardless of the state subsidy level or distribution of public college quality. The percentage of low-income students predicted to choose public colleges in Massachusetts is only one-quarter less than in California, a far smaller difference than that found for the sample overall or among the subset of high-ability students.

Illinois and Nebraska demonstrate how choices are affected in systems more similar to what most states offer. In each case, more students are predicted to choose public colleges than under the Massachusetts system, but unlike in California, students do not receive as much on average in college expenditures and student body quality (SAT percentile). The reason stems from the fact that neither state offers public institutions with nearly as much in resources or peer quality as California but the low price of these colleges is sufficient enough to encourage students to attend them. This suggests that the discounted tuition price of an in-state, public four-year university is enough to encourage some individuals to forego schools with more resources, the precise concern of Peltzman. Further evidence of the Peltzman hypothesis is found by examining the predictions for Nebraska. Approximately 76 percent of four-year college students would choose to attend a public institution if they were residents of Nebraska, and the mean student expenditures and student body test scores are the lowest of the four states. The fact that none of the public options in Nebraska fit the criteria of more selective schools translates into less in financial and peer resources for students. In summary, the Peltzman hypothesis appears valid in situations in which the level of state aid is average to high but the availability of public options with high levels of resources is limited. Stated another way, students are enticed by lower prices to forego college resources.

Voucher Simulations

A better way to test the validity of the Peltzman hypothesis is to simulate what choices would be made if the aid were not in-kind. It is important to note that the following simulations do not represent general equilibrium outcomes. While the simulations suggest how students' preferred choices might change under different circumstances, I do not incorporate the full range of behavioral responses including changes (or lack thereof) in college capacity, admissions, and recruitment strategies. However, the simulations do provide a manner with which to judge the magnitude of the influence of the in-kind format. In effect, the predictions suggest how college preferences or intended choices might change if state subsidies were not linked only to public colleges.

To consider how choices might change under a different subsidy structure, I first assume public tuition prices would increase by the amount of state appropriations per FTE student at each public college.[27] While tuition costs do not vary significantly among public four-year colleges under the current system, if state in-kind subsidies were taken away, the more selective schools would become much more expensive than the less competitive and noncompetitive colleges reflecting the larger amount of state aid received by them. Additionally, the gap between public two-year and four-year colleges would grow since four-year institutions receive more in state operational subsidies. Note that while the price of private colleges would not change, they would still be more expensive than public colleges of similar competitiveness suggesting publics have a relative price advantage even without the state support. For example, competitive public colleges cost 28 percent less than competitive private colleges on average, partly due to differences in expenditures per student. See Appendix Table 2 for more information.

The last column of Table 5 displays how college decisions are predicted to change under a system with no state support. Two major trends are evident. First, state appropriations are found to strongly influence students to favor public colleges over private institutions. Although 71 percent of four-year attendants are predicted to choose public four-years under the current system, only 56 percent, or 29 percent fewer students, would do so without state support. Low-income students would be especially

[27] Public colleges that are out-of-state for the student are assumed to charge the greater of the out-of-state price and the revised in-state price. All of the following simulations assume that separate state grant programs are not affected.

impacted, as 38 percent fewer would choose public four-year colleges without a subsidy. At the same time, the number electing to attend a private college is predicted to increase by one-third.

A second observation is that more students would attend two-year rather than four-year colleges if states did not provide operational support. The number predicted to enroll in two-year colleges increases by 14 percent. The shift in enrollment is more substantial among low-income students: one-third more low-income students are predicted to choose to attend two-year colleges. This result implies that the current pattern of in-kind subsidies encourages students to not only attend public colleges, but in particular, public four-year colleges. Note also that although total enrollment is not predicted to significantly drop without state support, a shift in enrollment towards community colleges would have important implications for the general skill level of the labor force given the differences in resources and programs available at colleges of different levels.

The remaining simulations consider how prices and decisions would change if states continued to provide the same amount in appropriations for higher education, but the subsidies were distributed in the form of a direct voucher to students. In this way, the state aid would be similar to the Pell Grant in that it would follow the student to the institution of his or her choice. The value of the voucher is the total state appropriations for nonspecialized colleges divided by the FTE number of students attending these colleges.[28] In the simulation in which the four-year voucher is twice as large as the two-year voucher, 70 percent of students are assumed to attend four-year schools.[29]

If the state aid were distributed as a voucher that could be applied to any in-state public or private college the number of students predicted to choose public four-years falls. If the voucher were equal regardless of the level, the number of students enrolled at public four-year colleges would fall 24 percent. While many students would shift to public two-year colleges, the number choosing private four-year colleges is predicted to increase 20 percent in comparison to the level under the current in-kind subsidy system. If the voucher for four-year colleges was instead twice as large, the number at public four-year colleges is predicted to fall 14 percent but many more students would choose private institutions. The number electing to attend a private four-year institution would increase 29 percent. This difference lends

[28] This assumes a usage rate of 100 percent. Presently, around 85 percent of students remain in state for college.

support to Peltzman's assertion that in-kind tuition subsidies at public colleges draw students away from private options. However, the change in sector did not result in an increase in the mean resources received by students. In each case, the response of low-income students is predicted to be far greater. This suggests that the distortion created by the in-kind subsidy is strongest for these students possibly due to their heightened sensitively to price. In summary, without the in-kind format, many more students would opt out of the public system.

SECTION VI: CONCLUSION

The conditional logit model is an improvement in estimating the determinants of college choice. While models that use state cross-sectional variation to estimate student decisions ignore much of the heterogeneity in the market for higher education, this model exploits this variation to estimate the effect of cost and quality on the decisions of whether to go to college and which college to attend. Conditional on college attendance, higher tuition costs and distance reduce the likelihood of choosing a particular college while student expenditures increase the probability. These effects differ for particular groups. High-ability individuals are more influenced by quality measures, and low-income students are more responsive to distance. When individuals consider whether to enroll, price appears to be an important factor. Once determining the college the individual is most likely to consider by using the choice model, the elasticity of price with respect to enrollment is estimated to be much larger than previously found.

Using this college choice model to examine students' decisions, it is clear that the current state in-kind subsidy system creates a series of incentives in terms of college decisions. First, students are induced to favor in-state, public institutions. As shown by the simulations, the larger the tuition subsidy, the more likely students will forego a private or four-year option even if it offers far more in resources. Therefore, there appears to be validity to Peltzman's hypothesis that in-kind subsidies could reduce educational investment.

Removing the in-kind format and public focus of the aid would avoid some of the concerns of Peltzman by reducing the price gap between public and private colleges. As shown by the voucher

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[29] The value of the voucher for four-year colleges can be found by solving: appropriations/student = .7x + .3(x/2).

simulations, up to 24 percent of first-year students would no longer prefer a public, four-year school if given a voucher that could be applied to any in-state college (the decrease is smaller if the voucher were twice as large for four-year colleges). As a result, the number that would choose to enroll in a private four-year college would increase 20 to 29 percent. Given enrollment rates in 1992, this suggests that an additional 80,000 to 120,000 freshman would prefer to attend a private four-year college each year if the in-kind format of state subsidies was removed. The number of students choosing to attend private four-year colleges would increase by 575,000 to 830,000 students. While this is not a true estimate of the general equilibrium outcome of a voucher program given the absence of behavioral and supply responses, these results do suggest that the distortion of choice by the in-kind format is substantial. If states stopped giving subsidies altogether, the difference would be even larger. Without any state support, 29 percent fewer students overall and 38 percent of low-income students are predicted to attend public four-year colleges. The number attending private four-year colleges would increase by one-third.

In addition to creating preferences for public colleges, the pattern of state in-kind subsidies also favors public four-year over two-year institutions and more selective schools over those that are less competitive Simulations in which the state subsidies are equally distributed among two-year and four-year colleges suggest that students would choose inexpensive two-year colleges over four-year school with far greater resources. This provides further support of the influence of the in-kind aid can have on college decisions. However, because the four-year institutions have more in resources, the distortion in price between two- and four-year public schools is probably beneficial in terms of college investments.

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FIGURE 1: CALIFORNIA – Four-year Colleges and Universities

	Public Institutions	Private Institutions	
	MOST COMPETITIVE *Student Expenditures per Pupil = $21,571*		
$3,248	*One*	*Five*	$15,767
	state aid = $10,364 /student		
	HIGHLY COMPETITIVE *Student Expenditures per Pupil = $17,438*		
$2,903	*One*	***None***	----
	state aid = $10,820 /student		
	VERY COMPETITIVE *Student Expenditures per Pupil = $9,806*		
$2,448	*Six*	*Thirteen*	$13,233
	state aid = $7,829 /student		
	COMPETITIVE *Student Expenditures per Pupil = $6,190*		
$1,700	*Fourteen*	*Twenty-one*	$10,134
	state aid = $5,704 /student		
	LESS COMPETITIVE *Student Expenditures per Pupil = $6,160*		
$1,459	*Seven*	*Five*	$9,631
	state aid = $6,496 /student		
	NONCOMPETITIVE *Student Expenditures per Pupil = $3,908*		
----	***None***	*Seventeen*	$6,110

See the notes to the next figure.

FIGURE 2: MASSACHUSETTS – Four-year Colleges and Universities

	Public Institutions	Private Institutions	
	MOST COMPETITIVE *Student Expenditures per Pupil = $16,685*		
---	***None***	*Six*	$17,271
	HIGHLY COMPETITIVE *Student Expenditures per Pupil = $11,432*		
---	***None***	*Six*	$16,472
	VERY COMPETITIVE *Student Expenditures per Pupil = $7,745*		
---	***None***	*Ten*	$14,621
	COMPETITIVE *Student Expenditures per Pupil = $5,380*		
$3,520	*Nine*	*Thirteen*	$10,395
	state aid = $3,039 /student		
	LESS COMPETITIVE *Student Expenditures per Pupil = $5,420*		
$3,021	*Three*	*Ten*	$10,180
	state aid = $5,934 /student		
	NONCOMPETITIVE *Student Expenditures per Pupil = $5,627*		
	None	*Three*	$8,912

Sources: Barron's Educational Guides and 1991-92 IPEDS. Notes: Amounts are in 1992 dollars. State aid is appropriations divided by FTE students. Aid, tuition, and expenditures are reported as means for the group.

FIGURE 3: In-Kind Subsidies to Public Institutions

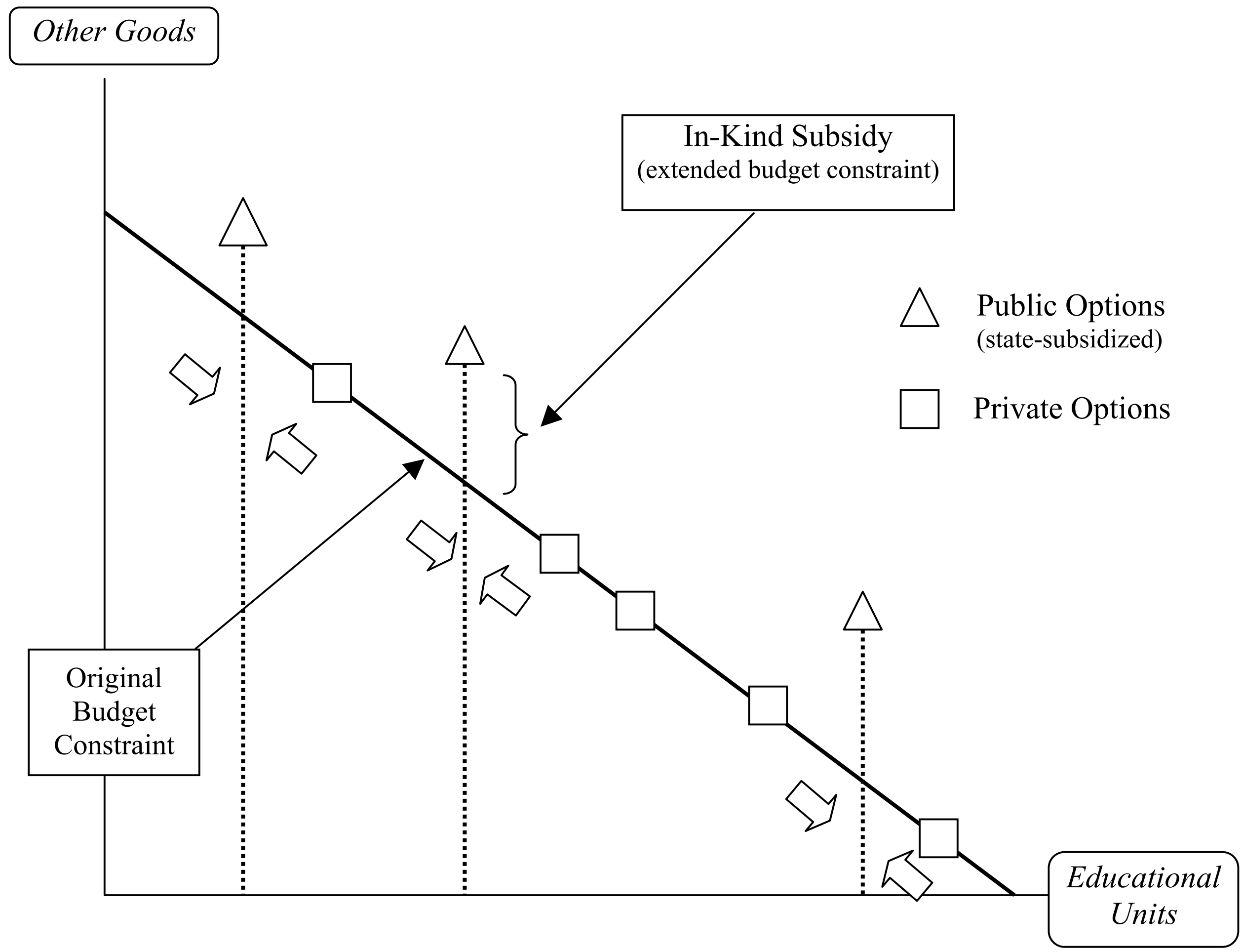

TABLE 1: Variable Descriptions and Summary Statistics

Variable	Description	Mean (standard deviation)
A. Student Characteristics (NELS88)		
Student SAT	Student SAT, converted ACT score, or predicted SAT based on high school GPA	878 (212)
Student SAT percentile	SAT score transformed into a percentile	49 (29)
High-Ability	Dummy Variable for Students with SAT greater than or equal to 1100	0.152
Low-Income	Dummy Variable for Students with a family income less than $20,000 in 1991	0.201
B. College Characteristics (1991-92 IPEDS unless otherwise noted)		
Student Expenditures	Expenditures on instruction, academic support, and student services per pupil (school resources)	$4,452 (3,516)
School SAT	Median student body SAT score (peer resources) (Barron's *Profiles of American Colleges*)	835 (153)
School SAT percentile	Median student body SAT transformed into a percentile	43 (23)
FTE Enrollment	Full-time Equivalent Undergraduate Enrollment in 1991-92	3,304 (4,389)
Student-Faculty Ratio	FTE Undergraduate Enrollment divided by FTE Faculty (Source: American Survey of Colleges, 1991-92)	15.2 (4.6)
Percent of Faculty with a Ph.D.	Percent of faculty with a Ph.D. or other terminal (Source: American Survey of Colleges, 1991-92)	31.4 (26.1)
College Competitiveness	Groupings based on student test scores, high school rank, and college acceptance rate (Source: *Barron's Guide*)	---
Two-year	Dummy Variable for Two-year colleges	0.430
Public	Dummy Variable for Public colleges	0.538
C. Match-Specific Variables (Interacting Student Characteristics with College Characteristics)		
List Tuition Price	In-state tuition if a resident of the state; Out-of-State tuition if not	$6,202 (3,684)
Distance	The number of miles between the student's high school and the college based off zip codes	1,031 (725)
SAT Difference: *Student* %tile higher	Equal to the difference in SAT percentiles if the student's SAT is greater than the school's	18.4 (22.9)
SAT Difference: *School* %tile higher	Equal to the difference in SAT percentiles if the school's median SAT is greater than the student's	12.3 (19.7)

TABLE 2: Conditional Logistic Estimation of the Decision between Colleges

Marginal Effect on the Probability of Enrollment (z-statistics in parentheses)

Dependent Variable: Attended College j within Two Years of Graduation

	(1)	(2)	Low-Income Interactions	High SAT Interactions
College Costs				
Tuition Price net Pell	-0.3924	-0.4038	-0.0014	0.0651
(per $1,000)	(41.67)	(34.68)	(0.04)	(2.33)
Tuition Squared	0.0182	0.0190	0.0031	-0.0033
(per $\$1,000^2$)	(34.19)	(27.11)	(1.70)	(2.97)
Distance	-0.8086	-0.8122	-0.3430	0.4498
(per 100 miles)	(80.70)	(76.31)	(9.70)	(13.12)
Distance Squared	0.1200	0.1171	0.0187	-0.0135
(per 100^2 miles)	(45.04)	(45.72)	(10.20)	(10.14)
College Quality and Size				
Student Expenditures	0.0405	0.0703		0.1770
(per $1,000)	(2.37)	(3.08)		(5.25)
Student Exp. Squared	0.0004	-0.0034		0.0003
(per $\$1,000^2$)	(0.80)	(3.88)		(0.29)
Student-Faculty	0.0053	0.0064		
Ratio	(1.18)	(1.42)		
Percent of Faculty with	0.0034	0.0032		
Ph.D. (per 10 pts)	(3.40)	(3.16)		
FTE Enrollment	0.1342	0.1339		
(per 1,000)	(23.51)	(23.29)		
Student-College Match				
Student %tile larger	-0.2774	-0.2736		
(per 10 pts)	(10.89)	(10.38)		
Student larger Squared	-0.0117	-0.0034		
(per 10^2 pts)	(2.68)	(0.70)		
School %tile larger	0.1661	0.2578		
(per 10 pts)	(4.38)	(6.35)		
School larger Squared	-0.0511	-0.0566		
(per 10^2 pts)	(9.19)	(9.90)		
Strata (individuals)	5,683	5,863		
N (combinations)	15,167,927	15,167,927		
Pseudo R-squared	.4026	.4106		

Sources: NELS88 individual data, 1991-92 IPEDS, and 1991-92 ASC.

Notes: Marginal effects are interpreted as the percentage by which the probability favoring attendance at college *j* is affected with a one-unit increase in that variable. Monetary amounts are in 1992 dollars. Tuition is defined as list price net the student's expected federal Pell Grant (based on income). Student expenditures are limited to instruction, academic support and student services. FTE Enrollment is for undergraduates in 1991. Low income is defined as a family income below $20,000 in 1991. High-SAT is defined as scoring 1100 or above. The model also includes controls for cubic distance, FTE enrollment squared, percentage of the student body that are undergraduates, and dummy variables for Carnegie Classification relative to Research/Doctoral institutions (Masters, Liberal Arts, Baccalaureate, Associates, Specialized, and not categorized).

TABLE 3: Logistic Estimation of the College Enrollment Decision

Marginal Effect on the Probability of Enrollment (z-statistics in parentheses)

Dependent Variable: Attended Any College within Two Years of Graduation

	(1) Closest Two-year Public College	(2) Closest Four-year Public College	(3) Predicted College Choice	
			Main Effect	Two-Year Interaction
Tuition Price	.0060	-.0010	-.0776**	.0355
(per $1,000)	(0.14)	(0.02)	(2.23)	(0.56)
Tuition Squared	-.0059	-.0035	.0085**	
(per $\$1,000^2$)	(0.94)	(0.62)	(3.74)	
Distance	-.4463**	-.1186	-.1930**	.3696
(per 100 miles)	(3.88)	(0.88)	(2.08)	(1.35)
Distance Squared	.0702**	.0039	.0060	
(per 100^2 miles)	(2.57)	(0.16)	(1.34)	
Student SAT percentile	.0037**			
(per 10 pts)	(3.14)			
Student %tile larger		-.1216**	-.0908**	
(per 10 pts)		(4.55)	(2.05)	
School %tile larger		-.0888**	-.0425**	
(per 10 pts)		(6.15)	(2.00)	
FTE Enrollment	-.0080	-.0117	.0107	-.0096
(per 1,000)	(0.64)	(1.46)	(0.95)	(1.01)
FTE Enrollment Squared	-.0003	.0003	-.0003	
(per $1,000^2$)	(0.68)	(1.46)	(1.12)	
Public, Two-year Dummy			-.3179**	
			(2.50)	
County Unemployment Rate (1992)	.0156	.0150	.0174	
	(1.50)	(1.42)	(1.63)	
Pseudo R-squared	5,661	5,661	5,661	---
Observations	.0479	.0500	.0522	---

** Significant at the 5% level * Significant at the 10% level

Sources: NELS88 individual data and 1991-92 IPEDS college data.

Notes: Marginal effects are interpreted as the percentage by which the probability favoring attendance at any college is affected with a one-unit increase in that variable. Figures are in 1992 dollars. FTE Enrollment is for undergraduates in 1991. All regressions include the following controls: gender, race (Black, Hispanic, Asian, Native American), 1991 family income, parents' education, private high school dummy, and a dummy for completing the GED. The predicted college choice (specification 3) is determined by the conditional logistic model in Table 2, specification 2. The predicted college choice is the closest public, two-year college for 14.1% and the closest public, four-year college for 35.6% of the sample. Of the remaining colleges, 74.9 percent are public, four-year colleges, 14.0 percent are public, two-year colleges, and 11.1 percent are private, four-year colleges.

TABLE 4: State Simulations – Predicted Choices as a Resident of each State (means reported)

	CALIFORNIA	ILLINOIS	NEBRASKA	MASSACHUSETTS
State Subsidy Level	High	Medium	Medium	Low
Public College Quality	Much variation	Some variation	Little variation	Little variation
A. The Whole Sample				
Total Predicted to Attend	5,785	5,692	5,768	5,731
Four-year Colleges				
Predicted to Attend	3,377	3,718	4,367	3,903
Number to Publics	3,110 (92%)	2,529 (68%)	3,329 (76%)	2,293 (59%)
List Tuition	$2,826	$5,781	$4,065	$8,252
Student Expenditures	$9,244	$7,369	$5,759	$8,085
SAT Percentile	68.74	65.41	60.22	67.73
Two-year Colleges				
Predicted to Attend	2,408	1,974	1,401	1,828
Number to Publics	2,367 (98%)	1,852 (94%)	1,339 (96%)	1,629 (89%)
List Tuition	$405	$3,038	$2,194	$3,199
B. High-Ability Students (SAT ≥ 1100)				
Total Predicted to Attend	1,088	1,079	1,072	1,111
Four-year Colleges				
Predicted to Attend	978	967	948	1,025
Number to Publics	880 (90%)	558 (58%)	605 (64%)	330 (32%)
List Tuition	$3,755	$7,946	$6,302	$11,991
Student Expenditures	$12,759	$10,448	$8,149	$12,979
SAT Percentile	80.22	75.04	68.29	80.86
Two-year Colleges				
Predicted to Attend	110	112	124	86
Number to Publics	105 (96%)	104 (93%)	116 (93%)	75 (88%)
List Tuition	$670	$3,132	$2,627	$3,400
C. Low-Income Students (Family income below $20,000 in 1991)				
Total Predicted to Attend	945	918	938	934
Four-year Colleges				
Predicted to Attend	525	503	676	544
Number to Publics	481 (92%)	367 (73%)	525 (78%)	380 (70%)
List Tuition	$2,721	$4,938	$3,356	$6,875
Student Expenditures	$8,688	$6,838	$5,240	$6,870
SAT Percentile	67.38	62.57	57.72	62.92
Two-year Colleges				
Predicted to Attend	420	415	262	390
Number to Publics	408 (97%)	391 (94%)	252 (96%)	350 (90%)
List Tuition	$545	$3,080	$2,130	$3,173

Sources: NELS88 individual data and 1991-92 IPEDS college data.
Notes: Colleges were weighted by: (1) the relative odds of that person choosing that college (calculated from Table 2, specification 2), and (2) the individual likelihood of attendance (calculated from Table 3, specification 3). Figures are in 1992 dollars. List tuition is the in-state price if the student attended high school in that state; otherwise it is the out-of-state price. Student expenditures are funds for instruction, academic support and student services.

TABLE 5: Predicted College Investments under Different Aid Schemes

	In-kind Subsidy	Voucher to *any* In-State College		No State Support
Voucher Details	*Current system*	*2yr = 4yr*	*2yr = ½ 4yr*	*None*
	(1)	(2)	(3)	(4)
A. The Whole Sample				
Total Enrollment	5,686	5,611	5,664	5,535
Four-year Colleges				
Predicted to Enroll	3,829	3,396	3,766	3,414
Percent to Publics	71%	60%	62%	56%
Tuition Price	$5,634	$5,840	$5,272	$7,956
Expenditures	$7,422	$6,802	$6,643	$7,245
SAT percentile	67.61	64.61	64.07	66.22
Two-year Colleges				
Predicted to Enroll	1,857	2,215	1,898	2,121
Percent to Publics	94%	92%	92%	92%
Tuition Price	$2,030	$1,833	$2,332	$3,328
B. High-Ability Students (SAT ≥ 1100)				
Total Enrollment	1,087	1,084	1,084	1,096
Four-year Colleges				
Predicted to Enroll	980	924	951	954
Percent to Publics	55%	49%	50%	45%
Tuition Price	$8,484	$8,621	$8,125	$10,407
Expenditures	$10,643	$9,973	$9,787	$10,688
SAT percentile	78.17	75.44	75	77.17
Two-year Colleges				
Predicted to Enroll	107	160	133	142
Percent to Publics	93%	91%	31%	91%
Tuition Price	$2,261	$1,994	$2,494	$3,343
C. Low-Income Students (Family income below $20,000 in 1991)				
Total Enrollment	915	898	906	864
Four-year Colleges				
Predicted to Enroll	542	497	536	446
Percent to Publics	80%	65%	66%	60%
Tuition Price	$4,004	$4,804	$4,471	$7,000
Expenditures	$6,315	$5,699	$5,701	$6,069
SAT percentile	62.2	59.11	59.19	60.3
Two-year Colleges				
Predicted to Enroll	373	401	370	418
Percent to Publics	94%	91%	91%	91%
Tuition Price	$1,970	$2,884	$3,019	$3,806

Sources: NELS88 individual data and 1991-92 IPEDS college data.
Notes: Colleges were weighted by: (1) the relative odds of that person choosing that college (calculated from Table 2, specification 2), and (2) the individual likelihood of attendance (calculated from Table 3, specification 3). Figures are in 1992 dollars. Where applicable, price is adjusted for the loss of state appropriations per FTE student minus a voucher. The voucher is total state appropriations for nonspecialized colleges divided by the FTE number of in-state students. Seventy percent of students are assumed to attend four-year schools when the voucher is calculated as being twice as large for these colleges.

APPENDIX TABLE 1: Comparing Actual to Predicted College Investments (means reported)

	ACTUAL COLLEGE CHOICES		PREDICTED CHOICES	
	4-Year Colleges	2-Year Colleges	4-Year Colleges	2-Year Colleges
A. The Whole Sample				
Attended or Predicted	3,841	1,842	3,829	1,857
Number to Publics	2,547 (66%)	1,764 (96%)	2,706 (71%)	1,749 (94%)
List Tuition	$5,863	$1,621	$5,634	$2,030
Distance (miles)	231	89	188	181
Student Expenditures	$7,466	$3,388	$7,422	$3,487
SAT Percentile	67.60	---	67.61	---
B. High-Ability Students (SAT ≥ 1100)				
Attended or Predicted	966	109	980	107
Number to Publics	506 (52%)	107 (98%)	539 (55%)	100 (93%)
List Tuition	$8,600	$1,563	$8,484	$2,261
Distance (miles)	337	117	311	344
Student Expenditures	$10,492	$3,407	$10,643	$3,749
SAT Percentile	79.79	---	78.17	---
C. Low-Income Students (family income below $20,000 in 1991)				
Attended or Predicted	507	370	542	373
Number to Publics	377 (74%)	356 (96%)	434 (80%)	352 (94%)
List Tuition	$4,335	$1,476	$4,004	$1,970
Distance (miles)	181	86	139	159
Student Expenditures	$6,396	$3,445	$6,315	$3,440
SAT Percentile	59.84	---	62.20	---

Notes: NELS88 and 1991-92 IPEDS data. Colleges were weighted by: (1) the relative odds of that person choosing that college (calculated from Table 2, model 2), and (2) the individual likelihood of attendance (calculated from Table 3, model 3). Figures are in 1992 dollars. Tuition is the in-state price for residents; otherwise it is the out-of-state price. Student expenditures are funds for instruction, academic support and student services.

APPENDIX TABLE 2: Mean Voucher and Tuition Price under Different Aid Schemes

Voucher Details	In-kind Subsidy		Voucher to *any* In-State College (2yr = 4yr)		Voucher to *any* In-State College (2yr = ½ 4yr)		No State Support
	Public (1)	Private (2)	Public (3)	Private (4)	Public (5)	Private (6)	Public (7)
Most, Highly, and Very Competitive	2,821 (1,100)	13,161 (3,686)	6,432 (3,280)	10,727 (3,816)	5,823 (3,262)	10,223 (3,868)	9,038 (3,281)
Competitive	2,291 (814)	9,204 (2,320)	4,073 (2,389)	6,705 (2,515)	3,517 (2,444)	6,202 (2,571)	6,672 (2,271)
Less Competitive	1,982 (790)	7,562 (2,356)	2,988 (1,747)	4,979 (2,594)	2,415 (1,830)	4,464 (2,684)	5,774 (1,566)
Four-Year Noncompetitive	2,720 (1,326)	5,714 (2,391)	3,081 (1,777)	3,063 (2,517)	2,728 (1,797)	2,519 (2,497)	5,447 (1,605)
Two-Year Noncompetitive	1,260 (961)	6,164 (2,161)	759 (1,286)	3,727 (2,254)	1,478 (1,484)	4,692 (2,216)	3,041 (1,494)

Notes: 1991-92 IPEDS data and Barron's *Profiles of American Colleges*. Figures are in 1992 dollars. Where applicable, price is adjusted for the loss of state appropriations per FTE student minus a voucher. The voucher is total state appropriations for nonspecialized colleges divided by the FTE number of in-state students. Seventy percent of students are assumed to attend four-year schools when the voucher is calculated as being twice as large for these colleges. Given the distribution of different types and levels of colleges across states with different levels of support, the mean values do not reflect the simple subtraction of the voucher amount from the unsubsidized cost.