The Consumption Value of Postsecondary Education*

Brian Jacob
University of Michigan and NBER

Brian McCall
University of Michigan

Kevin Stange
University of Michigan

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Abstract

In this paper, we examine the consumption value of postsecondary education, by which we mean the direct and immediate utility that one derives from attending a particular type of schooling or a particular institution. To do so, we estimate a discrete model of college choice using micro data from the high school classes of 1972, 1980, 1992, and 2004, matched to extensive information on all four-year colleges in the U.S. We find that students do appear to value several college attributes which we categorize as "consumption" because their benefits arguably accrue only while actually enrolled, including college spending on student activities, sports, and dormitories.

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1. Introduction

The economic view of education traditionally has employed the human capital framework developed by Becker (1964). In this framework, education is viewed primarily as an investment in that individuals forgo current labor market earnings and incur direct costs in return for returns in the form of higher future wages. The original theoretical work by Becker (1964), Ben Porath (1967) and others spurred a tremendous amount of empirical work, which has generally supported the implications of the human capital model (Freeman 1986).[1]

At the same time, the human capital framework does not rule out that education may also provide immediate consumption. Indeed, many economists have discussed the consumption value of education. For example, Schultz (1963) identifies current consumption as one of three benefits of education, along with investment and future consumption. For the most part, however, consumption aspects of education have received relatively little attention in the literature.

Several trends suggest that consumption is becoming an increasingly important part of the choice of whether, where, and how to attend college. Babcock and Marks (forthcoming) document that academic time investment among full-time college students fell from 40 hours per in 1961 to 27 hours per week in 2003. They show that this change cannot be explained by compositional changes in students or schools, or changes in work or major choices. At the same time, some observers have argued that increased market pressure has caused colleges to cater to students' desires for leisure (Kirp 2005). Recent analysis by the Delta Cost Project (2010) found that colleges' spending on student services has outpaced that on instruction for the past decade for all postsecondary sectors. Bound et al. (2007) document that college completion rates have declined, primarily among men entering two-year or less selective four-year institutions. Scott-Clayton (2007) shows that college students are working substantially more today than in the past, and that the increased labor supply cannot be easily explained by compositional changes in students or schools, or credit constraints.[2]

Educational choices may thus mirror a broader shift towards present-day consumption and away from investment. Recent macroeconomic literature has documented that the share of output that is consumed has increased dramatically since the early 1980s, reducing the personal savings rate. Possible explanations include a wealth effect from capital gains, changes in the discount rate and preferences, an increase in consumption propensities of older Americans, relaxed liquidity constraints, and government's redistribution of resources toward older generations with high consumption propensities from younger ones.[3] As less investment creates concern about the future productivity of America's physical capital, a greater share of educational resources devoted towards (non-productive) immediate consumption creates concerns about the future productivity of America's workforce.

[1] The model implies that the demand for education increases with the years of potential employment, the rate of return of education, and the efficiency with which the individual can translate time and money into human capital. Conversely, the demand for education will decrease with an individual's discount rate.

[2] To the extent that college-related leisure and income are complementary, this result is consistent with an increasing importance of consumption.

[3] See Parker (1999); Gokhale, Kotlikoff, Sabelhaus (1996); Gale and Sabelhaus (1999), Poterba (2000), Juster, Lupton, Smith, and Stafford (2005), Greenspan and Kennedy, (2007).

In this paper, we attempt to more carefully quantify the direct consumption aspects of postsecondary education, and how their importance may have changed over time. As we describe in more detail below, by consumption we mean the direct and immediate utility that one derives from attending a particular type of schooling or a particular institution.[4] In contrast to previous work on the subject, our approach is to infer demand for consumption aspects of education from students' college choices. Just as colleges are able to attract students by increasing their academic reputation, students' responses to colleges' desirable location or spending on recreational activities signal a willingness to pay for educational consumption. More specifically, we estimate a discrete model of college choice using micro data from the high school classes of 1972, 1980, 1992, and 2004, matched to extensive information about the universe of nearly all four-year colleges in the U.S.

We find that students do appear to value several college attributes which we categorize as "consumption" because their benefits arguably accrue only while actually enrolled. For instance, college spending on student activities, sports, and dormitories are significant predictors of college choice, on par with instructional spending and academic support. While it is not obvious ex-ante that these spending measures would be good proxies for "consumption amenities," information on students' self-reported preferences suggests that these spending measures do capture the type of consumption aspects we hope to measure. Specifically, high school students who list "social environment" as an important factor in their college decision are more likely to attend colleges that spend more on what we term "student services" whereas students who list "academic reputation" as a top priority are more likely to attend schools that spend relatively more on instructional services.

Our analysis makes several contributions to the existing literature. Relative to the previous college choice literature, our conditional logistic model exploits extensive match-specific attributes between colleges and individuals, relaxes the IIA assumption to allow more flexible substitution patterns across institutions, and examines a more recent cohort of students.

Our results suggest that current consumption is a major factor in schooling decisions, an aspect missing from the traditional human capital investment model. One consequence is that consumption value lowers the effective utility cost of schooling investment, thus increasing the effective return on investment.[5]

The remainder of the paper proceeds as follows. The next section reviews the prior literature on the consumption value of education and on college choice. Section 3 presents reduced-form college-level evidence and also introduces our college-level data. Section 4 introduces our micro (individual) empirical framework, data, and elaborates on the identification challenges. Our main micro-level results are presented in Section 5. Section 6 concludes.

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[4] Some related literature describes the benefits that education confers on subsequent household production as a "non-monetary" or "consumption aspect" of education in the sense that it increases the efficiency of future consumption (see Michaels 1973 for a discussion of the education and household production). These benefits of education would not count as consumption value in our framework.

[5] This counteracts non-monetary psychic costs of schooling (e.g. effort cost), which lowers the effective return, but builds on the non-pecuniary returns (Oreopoulos and Salvanes, 2009), which increases it.

2. Prior literature

2.1 Previous literature on the consumption value of postsecondary education

Prior studies have examined the consumption value of education in two different ways: (1) comparing the total amount of education one obtains to the income maximizing one; and (2) examining the type of degree (or major) one pursues.

The first line of inquiry has focused on the total amount of education attained. These papers seek to estimate the financially optimal amount of schooling for individuals, and then compare it to the observed level of schooling attained. If individuals consume more schooling than is optimal from a purely financial perspective, then one would conclude that schooling itself must contribute directly to utility. In one of the first papers to take this approach, Lazear (1977) develops a model to test whether the observed relationship between income and education reflects a causal impact of education. In other words, he attempts to estimate the causal return to schooling. To do so, he develops a model of education that incorporates both investment and consumption goods. He then estimates the parameters of this model using data from the National Longitudinal Survey, which follows 14-24 year olds starting in 1966. He finds that individuals obtain less than their wealth-maximizing level of education, suggesting that education actually has a negative consumption value – i.e., it is a bad.[6]

Kodde and Ritzen (1984) develop a similar model of educational attainment that allows schooling to have a direct, positive impact on utility. They start with the observation that many studies show positive income effects of education, which is ruled out in the case of the standard model and perfect capital markets. They also note that studies find different enrollment effect of forgone earnings and direct tuition costs, which have been explained in terms of capital constraints or measurement error. However, they point out that these differential enrollment effects are consistent with the model they develop. Specifically, an increase in wage rate will reduce enrollment less than increase in the direct cost of schooling because higher wages imply greater wealth and people will choose to consume some of this greater wealth by buying more education.

Oosterbeek and van Ophem (2000) write down a structural model of the determinants of schooling attainment that allows utility to be a function of future earnings as well as schooling itself. The model includes two simultaneously determined outcomes: years of schooling and log wage rate. They model the preference for schooling as a function of a student's grades in the final year of compulsory school and the parent's interaction with the child's school. They model discount rates as a function of father's education and occupation. They include student IQ and a quadratic in years of experience and a quadratic in schooling in the wage equation directly. In addition to functional form, their model is identified by assuming that the father's education, the student's grades and the parent's interaction with the child's school only influence schooling and do not enter the wage equation directly. They find that the school preference parameter is non-zero and depends positively on student grades and family social status, suggesting that consumption is a significant determinant of educational attainment.

A related approach is exemplified by Heckman et al (1999) and Carniero et al (2000). They attempt to quantify the psychic benefits and costs of attending college. Using data on male earnings in the United States, Heckman et al (1999) find that individuals in the second-highest ability quartile enjoy large nonpecuniary benefits from attending college; individuals in the other

[6] The paper is not really directly focused on consumption aspects, at least in terms of how we are thinking of them. The approach describes income effects in education as consumption value.

quartiles suffer non-pecuniary costs. Carneiro et al. (2003) estimate that, when ignoring psychic gains, forty percent of college attendees would regret it. Once they account for psychic benefits and costs of attending college, only 8 percent of college graduates regret attending college. The authors conclude, therefore, that much of the gain from college is nonpecuniary.

A second strand of research focuses on the type of degree (or major) that students choose. The general intuition in these papers is that an individual's decision to obtain a degree with a significantly lower long-term financial return than the individual could have obtained in another field (given the individual's observed ability) provides evidence that schooling (or at least certain degrees) have direct utility value. For example, Alstadsæter (2009) estimates that individuals who attended Teacher's College in Norway during the 1960s gave up substantial future wages to do so. She calculates that their willingness-to-pay for the teaching degree (relative to a business degree) was roughly 35 percent of the present value of their potential lifetime income. However, this study cannot distinguish between an individual's preference for a particular type of work and a preference for a particular type of academic experience.

Arcidiacono (2004) develops a more comprehensive model of student choice of institution type and college major that allows for both direct and immediate utility effects of the type of schooling (i.e., the "costs" of studying a particular field in a particular institution) and direct (but future) utility effects of working in a particular occupation. He finds large differences in wage returns across college majors, even conditional on student ability. He concludes that preferences for different educational types are critical to decision-making. Importantly, preferences for studying a particular field in college are critical.

While these approaches help understand the choice process, they are not able to separate an individual's preference for a particular type of work from a preference for college itself. The choice to attend college implies a particular career path, which incorporates not only monetary rewards, but different working conditions and, indeed, a different "type" of work that may provide different direct utility to individuals. The same is true in the case of a college major. For example, the choice to major in engineering instead of education influences not only how the individual will spend the next four years, but also the type of work one will do for the following 40+ years.

2.2 Previous literature on college choice

Our approach deviates from this existing literature by using the college attributes demanded by students and supplied by institutions to identify preferences for consumption.[7] Empirical models of college choice have a long history, exemplified by the seminal work of Manski and Wise (1983). In general, discrete choice models of college enrollment have focused on estimating the importance of price, academic quality and distance. In perhaps the most thorough application of this approach, Long (2004) estimates a conditional logit model using data on high school graduates in 1972, 1982 and 1992. She finds that the role of college costs decreased over this period, and were not a significant factor in the decision to enroll, though it continues to be a significant factor in the decision of where to enroll. Distance also became less important while proxies for college academic quality such as instructional expenditures per student became more important over time. More recently, McDuff (2007) exploits cross-state variation in the cost and quality of public flagship universities and estimates that students'

[7] Our approach is somewhat related to the approach of Jacob and Lefgren (2007). They find that wealthy parents want teachers that both teach and increase student satisfaction. This latter aspect could be considered "consumption value" in our framework.

willingness to pay for academic quality is large. There are also a number of papers that use a reduced form approach to estimate the effect of academic quality or reputation (as measured by USWNP rankings) on number and quality of applicants and student yield. Typical is Monks and Ehrenberg (1999) who find that a ranking decline leads institutions to accept more of its applicants, have a lower matriculation rate among admitted students, enroll lower-ability students (as measured by average SAT scores), and decrease net tuition.

These models have not traditionally examined college consumption amenities. However, the recognition that college choice depends on a variety of factors beyond investment is not new. Writing in 1939, Tunis remarks that "Boys and girls and their parents too often choose an educational institution for strange reasons: because it has lots of outdoor life; a good football team; a lovely campus; because the president or the dean or some professor is such a nice man" (Tunis 1939, p. 7). Various studies since then have identified social considerations as an important factor in the college choice decision (Bowers and Pugh 1973, Keller & McKewon, 1984; Stewart, et al., 1987; Chapman & Jackson, 1987, Weiler 1996, Rosenbaum, Miller and Krei 1996).

While most of the research that focuses on social considerations is qualitative in nature, several studies have attempted to estimate the importance of such factors. For example, Weiler (1996) analyzes the matriculation decisions of a sample of high ability students who were admitted to a single selective research university. The researchers administered a survey to the top half of the admitted class as measured by academic aptitude. The survey asked students to rate the survey institution and up to two others to which s/he was admitted on a variety of non-monetary characteristics such as the quality of the social life and the academic reputation. Students were also asked about the financial aid and costs of attendance at each school. Finally, the survey asked students to rank his or her top choices. Using the information, the author estimates discrete choice models to assess the importance of various school attributes. Weiler finds that attendance costs and non-monetary institutional characteristics are both significant determinants of institutional choice. Among the non-monetary characteristics, those associated with non-academic items like housing and recreational options have about the same impact as academic concerns such as availability of majors or concentration on undergraduate education. [8]

Using a panel of NCAA Division 1 sports schools, Pope and Pope (2008, 2009) find that football and basketball success increases the quantity of applications colleges receive and the number of students sending SAT scores. Since the additional applications come from both high and low SAT scoring students, colleges are able to increase both the number and quality of incoming students following sports success.

To summarize, while there is ample evidence on the responsiveness of college decisions to academic and cost attributes of colleges, there is virtually no evidence on the importance of consumption considerations or how this importance has changed over time. This paper attempts to fill this gap. We also provide an approach which unifies college-level analysis with individual-level analysis. Both approaches are useful for identifying different aspects of the importance of consumption amenities. The former enables transparent identification of main effects of characteristics which do not vary across individuals. The latter permits identification of effects of characteristics which vary across people in the same school, such as cost, distance, and interactions between student and college characteristics. By imposing a structural model of

[8] Chapman and Jackson (1987) explore similar factors. Lin, L. (1997) and Donnellan, J. (2002) are marketing studies that also are relevant. Also see Drewes and Michael (2006).

behavior, individual-level analysis also permits reasonable substitution patterns and methods to account for admissions constraints. It also provides parameters that are more easily interpretable as willingness-to-pay.

3. Theoretical model and parameters of interest

Individuals have J total colleges to choose from, each with a variety of different attributes. We partition college characteristics into those that are primarily oriented towards academic pursuits (i.e. investment) versus those that are more related to current consumption while in school. For instance, we think of colleges' instructional spending and the quality of peers as academic attributes, while intercollegiate sports spending and good weather are consumption amenities. In the following section, we more carefully describe the college characteristics used in the analysis.

Individuals receive indirect utility from attending college *j* that is separable in these two dimensions (denoted by A_j and C_j, respectively) and consumption of all other goods $(Y_i - T_{ij})$ where Y_i is income and T_{ij} is the price of college *j* to individual *i.* Individuals also care about the distance from their home to college *j*, D_{ij}, a proxy for the non-monetary commuting costs. Indirect utility is given by:

$$U_{ij} = \alpha_{1i}\left(Y_i - T_{ij}\right) + \alpha_{2i}A_j + \alpha_{3i}C_j + \alpha_{4i}D_{ij} + \varepsilon_{ij} \qquad (1)$$

where ε_{ij} is an unobserved individual-specific taste preference for school *j*. Individuals compare the potential utility received from attending each college and choose to attend the college that maximizes their utility.

We are interested in estimating the coefficients $\alpha_{1i}, \alpha_{2i}, \alpha_{3i}, \alpha_{4i}$, which correspond to the marginal utility individual i receives from each of the four college attributes. Since the absolute level of these coefficients does not matter, we focus instead on ratios between these coefficients as measures of the willingness to trade-off one characteristic for another. For instance, we interpret α_{2i}/α_{1i} as student i's willingness to pay (in dollars) for a one unit increase in academic quality. The ratio α_{3i}/α_{2i} is the rate at which student i could trade academic quality for consumption amenities and maintain a constant utility.

In general, these parameters will differ across individuals in the population. We are interested in estimating the central tendency (mean) of each parameter and how they differ with observable student characteristics, such as academic ability and income. In some specifications, we will also permit these parameters to differ with unobservable student characteristics to permit more realistic patterns of substitution between colleges with similar attributes.

If the random components ε_{ij} are assumed to be independent and identically distributed across individuals and choices with the extreme value distribution, the likelihood that individual *i* is observed choosing college *j* is given by the simple conditional logit formula:

$$\Pr\left(d_{ij} = 1\right) = \frac{\exp(\delta_{ij})}{\sum_{k=1}^{J}\exp(\delta_{ik})} \qquad (2)$$

where $\delta_{ij} \equiv -\alpha_{1i}T_{ij} + \alpha_{2i}A_j + \alpha_{3i}C_j + \alpha_{4i}D_{ij}$ is the value function for school *j* as perceived by individual i. Note that student characteristics that do not vary across their choices (e.g. race) cannot enter independently into this basic model. Differentiating shows that the marginal effect of a change in some attribute of college j, z_j, on the probability that college j is chosen is $dp_j/dz_j = p_j[1 - p_j]\alpha_z$ and the effect from a change for college k is $dp_j/dz_k = -p_j p_k \alpha_z$.

4.Reduced-form (college-level) evidence

4.1 Empirical set-up and identification

Under several very simplifying assumptions, the central tendency of (1) can be estimated using aggregate (college-level) data. The share of students choosing college j is simply the integral of (2) over the density of preference parameters in the population of students.

$$S_j = \int \frac{\exp(\delta_{ij})}{\sum_{k=1}^{J}\exp(\delta_{ik})} dF(\alpha_1, \alpha_2, \alpha_3, \alpha_4), \tag{3}$$

where F( ) is the joint density of the preference parameters. If this density is degenerate (i.e. there is no preference variation in the population) and school characteristics do not vary with student (i.e. tuition and community costs are the same for everyone), then the value/index function is a constant for each school and total enrollment is given by:

$$Enroll_j = S_j N = \frac{\exp(\bar{\delta}_j)}{\sum_{k=1}^{J}\exp(\bar{\delta}_k)} N, \tag{4}$$

where N is the total number of students attending any college and $\bar{\delta}_j \equiv -\bar{\alpha}_1\bar{T}_j + \bar{\alpha}_2 A_j + \bar{\alpha}_3 C_j + \bar{\alpha}_4 \bar{D}_j$ is the index function for school j. Taking logs,

$$logEnroll_j = -\bar{\alpha}_1\bar{T}_j + \bar{\alpha}_2 A_j + \bar{\alpha}_3 C_j + \bar{\alpha}_4 \bar{D}_j + \mathrm{B} \tag{5}$$

where $B = \log(N) - \log\left(\sum_{k=1}^{J}\exp\left(\bar{\delta}_k\right)\right)$ is a constant. In our college-level regressions we estimate a panel version of (5). Since tuition and our main academic and amenity measures are time-varying, our preferred specifications also include institution-level fixed effects to control for any omitted (time-invariant) characteristics of colleges that are related to enrollment.[9] The panel data also allows us to identify changes in coefficients over time (linearly or flexibly with year). Our preferred estimation model is:

$$logEnroll_{jt} = -\bar{\alpha}_{1t}\bar{T}_{jt} + \bar{\alpha}_{2t} A_{jt} + \bar{\alpha}_{3t} C_{jt} + \gamma_j + \gamma_t + \varepsilon_{jt} \tag{6}$$

It is useful to think of the identification of the cross-year average level of a coefficient separately from the identification of the yearly change in the coefficient. The level of a coefficient is identified by within-school changes in enrollment that coincide with changes in a characteristic. For instance, the change in enrollment a given school experiences beyond what its peers experience when it adjusts its tuition levels will identify the overall level of $\bar{\alpha}_1$ across all years. Changes in parameters over time are identified by differences in enrollment trends between schools with different levels of a characteristic, but for whom this characteristic does not change over time. For instance, different enrollment trends between high and low tuition schools during a period of time for which tuition is constant for both will identify changes in $\bar{\alpha}_{1t}$ over time.

[9] For instance, we do not include average distance from all potential students which may be negatively related to enrollment or visibility as a large in-state public university, which is positively related to enrollment.

While our school and year fixed effects will absorb constant unobserved differences across schools and across years that may be correlated with both enrollment and observed characteristics, our estimates are still susceptible to omitted variable bias stemming from time-varying unobserved characteristics. For instance, if colleges raise tuition while expanding the breadth of offered majors (in a way not captured by our other academic measures), then our estimate of $\bar{\alpha}_1$ may understate the true importance of college cost. Simultaneity may also cause bias if, for example, schools increase tuition in order to capture a known anticipated increase in enrollment.

4.2 College-level data

We combine data from a number of different sources to construct an unbalanced panel dataset of postsecondary institutions for most years from 1972 to 2007. We limit our sample in several ways to facilitate our focus on amenities arguably related to direct, immediate consumption value. First, limit our sample to public and non-profit private undergraduate four-year schools only, excluding all two-year (or less) schools, all for-profit schools, and schools offering professional degrees only. Second, we drop specialized divinity, law, medical, specialized health (e.g. nursing), and art schools, though we keep engineering, teaching, military, and business schools. Finally, we drop schools with an average of fewer than 50 freshmen or 300 FTEs over our four sample years in an effort to eliminate remaining specialized schools which are arguably not in many students' choice set.[10]

Total undergraduate tuition and fees for in- and out-of-state students were obtained from the IPEDS Institutional Characteristics surveys, as were sector (public or private), and level (4-year or 2-year). From this source we also obtained information on religious affiliation, same-sex status, historically black college or tribal college status, and whether the institution is focused on a specific major area (business, engineering, education, health, law, seminary, etc). Total freshmen enrollment, freshmen enrollment by state, and full-time equivalent students (including undergraduate and graduate students) were obtained from the IPEDS Fall Enrollment surveys.[11] As a measure of the geographic reach of each college, we calculate the enrollment-weighted average distance between each college and it's freshmen students' home state centroid, estimated using institution zip code and a commercial zip code conversion file.

We use several different measures of academic quality and consumption amenities in our analysis. Following the prior literature, we use the average SAT score of students in the college as one of our primary measures of academic quality. We obtained the average SAT percentile score (or ACT equivalent) of the incoming student body from Cass and Birnbaum's *Comparative Guide to American Colleges* (1972) and Barron's *Profiles of American Colleges* (1982 and 1992).[12] For 2004, we used the average of the 25th and 75th SAT percentile, which we obtained from IPEDS. We use expenditures on instruction and academic support per FTE as an additional measure of the institution's academic quality. The expenditure data comes from the IPEDS Finance survey and the Delta Cost Project.[13] These categories include expenses for all forms of

[10] This also drops branch offices of large college systems, which are not easily identified in some of the years.
[11] The contribution of part-time students to FTE was directly reported by institutions in 19XX and 19XX. For 19XX, part-time students were counted as 30% in FTE calculations, following IPEDS guidelines.
[12] We thank Bridget Terry Long for providing us this data, which she used in her 2004 paper (Long 2004).
[13] This survey was changed considerably in 2000, but the spending categories are mostly comparable across year.

instruction (i.e., academic, occupational, vocational, adult basic education and extension sessions, credit and non-credit) as well as spending on libraries, museums, galleries, etc.

Longitudinal data on consumption amenities are more difficult to come by. Our two primary measures of consumption amenities are spending on student services and auxiliary enterprises and an index that measures the desirability of the area in which the institution is located. Spending on student services includes spending on admissions, registrar, student records, student activities, cultural events, student newspapers, intramural athletics, and student organizations. Auxiliary expenditures include those for residence halls, food services, student health services, intercollegiate athletics, college unions and college stores.

To measure locational amenities that students may consider when choosing a college, we use a county-level "Quality of Life" index constructed by David Albouy (2009). Places such as University of California – Santa Cruz, University of Hawaii, and Western State College of Colorado (Gunnison) have the highest quality of life according to this index, while locations such as Indiana University at Kokomo, SUNY-Potsdam, and Texas A&M - Kingsville, have the lowest quality of life. While this index is based on data from 2000, we assume that it is constant over our sample period (1972 – 2004).

For a select number of years, data on other school attributes (number of sports teams, number of clubs, fraction in fraternities or sororities, and fraction of faculty with PhD) was obtained from the Annual Survey of Colleges, collected by The College Board. This data is available annually since 1986, though we have obtained it for 1986, 1992, and 2006. Data for 1986 is applied to colleges in our 1972 and 1980 sample.

4.3 Descriptive correlations

Table 1 presents summary statistics of the college data, separately for 1972, 1980, 1992, and 2004. These are the four years corresponding to the individual-level analysis conducted in Section 5. Though mostly stagnant during the 1970s, real tuition costs and spending on instruction and student services have increased dramatically since 1980. The average SAT percentile score of colleges' students actually declined over this period.

Many of these measures are highly positively correlated, as depicted in Tables 2a and 2b. Schools that have high SAT-scoring students tend to spend more on both instruction and student services and also charge higher tuition.

Most important for our identification of models with fixed school effects is the presence of independent variation in our main school characteristics over time. For example, schools must have changes in spending on instruction that are independent from changes in tuition or spending on services. To quantify the extent of independent variation between characteristics within schools that is present in the data, we estimated school-specific pair-wise correlation coefficients between de-meaned versions of each of our four main college characteristics (tuition, instructional spending, student services spending, and average SAT score) using data for the four micro sample years. Figure 1 plots the distribution of these correlation coefficients for the six pair-wise correlations While there are some schools for which there is very little independent variation between spending and tuition levels, there are quite a few schools with ample independent variation.

To assess the reliability of our measures of college academic and consumption amenities, Table 3 regresses two subjective assessments of colleges by students (obtained from the Princeton Review guidebooks in 1992 and 2006). Students attending colleges with more spending on student services and auxiliary enterprises rate the quality of life of the institution higher, whereas instructional spending has little correlation with subjective quality of life. By contrast, students rate colleges with high instructional expenditure as having a better "academic environment."

4.4 School characteristics and enrollment decisions

In Figure 2 and Table 4 we present estimates of the time-varying coefficients in equation (6) using a panel of schools from 1972 to 2007. Each figure plots coefficient estimates (and 95% confidence intervals) for five college characteristics over time: log of tuition, location QOL index, average SAT percentile, log of spending on instruction and academic support per FTE student, and log of spending on student services and auxiliary enterprises. Table 4 presents results from analogous regressions that restrict the coefficients to be time-invariant (column 3) or linear in time (column 6).

Changes in cost have a negative (and marginally significant) relationship with enrollment changes controlling for fixed effects, and this relationship is relatively stable over time. College academic quality has a mixed relationship with enrollment: increases in peer quality are desirable (and increasingly so), but instructional spending is not (and is in-fact undesirable). The faster growth among high SAT schools comes almost entirely since 1990. Quality of life seems to becoming more desirable, but spending on student services is insignificant with no clear trend. Schools located in desirable places grew more quickly from 1972 to 2007, with this growth concentrated in the early and later years. Since quality of life is time-invariant, we are unable to estimate the level of its importance, though a coefficient trend is identifiable.

In Figure 3 and Table 5 we present estimates from analogous regressions using the number of out-of-state students as the dependent variable. Colleges with desirable attributes should be better able to attract students from out-of-state. The results are broadly consistent with the pattern seen using total freshmen enrollment as the dependent variable. One difference is that increases in spending on student services are significantly associated with out-of-state enrollment growth, though the strength of the relationship is diminishing over time.

We examine an alternative measure of attractiveness – the applicant rejection rate – in Figure 4 and Table 6. Colleges whose attributes are valued by students should receive more applications per enrollment slot, and should thus be able to reject more undesirable applicants. Again, all regressions include school and year fixed effects to control for fixed unobserved differences between schools and aggregate trends in the rejection rate that may correlate with aggregate trends in the college characteristics. Again tuition is negative (but insignificant) with no clear time trend. Spending on instruction is insignificant on average, but is increasingly desirable, while peer quality is positive with no clear trend.[14] The importance of spending on student services is diminishing over time

Figures 5 and 6 and Tables 7 and 8 exploit information about the source-state of freshmen students to infer the value of college attributes. In these regressions the outcome is the log of the average distance traveled by incoming freshmen and a similar measure exclusively for out-of-state students. Intuitively, if students are willing to travel further to attend a particular college, it suggests that the attributes of that college are desirable. For both spending measures and tuition, both distance measures suggest the same pattern: cost is not a strong deterrent (and is becoming less important) but spending on both instruction and student services is desirable. The desirability of peer quality differs depending on which outcome measure is used.

[14] Caution is warranted when interpreting the coefficient on average SAT score, however, since this may reflect changes in selective admissions, creating an endogeneity problem with the rejection rate.

4.5 Limitations of college-level analysis

While the preceding reduced-form, college-level analysis has the benefit of computational ease and identification transparency, it has several drawbacks that micro (individual-level) analysis can address. First, there is no obvious correct way to include variables that include meaningful cross-individual variation, such as distance and tuition fees. Individual-level analysis will exploit cross-individual distance and also take advantage of in-state/out-of-state tuition differentials to estimate the effect these attributes on college choice.

Another drawback of the college-level analysis is that different measures of "desirability" (total enrollment, out-of-state enrollment, distance traveled, etc) may generate different results since they are not constrained to be consistent with a unified theoretical model of individual behavior.

Finally, the college-level analysis is not able to permit preference heterogeneity across individuals. Observed heterogeneity in the responsiveness to college characteristics (e.g. Are high ability students more responsive to college academic quality?) is of interest in of its own right and is important to accurately predict the consequences of policies that may cause individuals to substitute between colleges. Individual-level analysis also permits methods to account for admissions constraints and provides parameters that are more easily interpretable as willingness-to-pay than those estimated with college-level data.

5. Micro (individual-level) evidence

Our objective is to estimate the willingness to pay for attributes that reflect direct consumption amenities as well as academic quality. To do so, we estimate a discrete choice model of college choice, taking the supply of college attributes as exogenous. In this section, we review the basic setup of the model, discuss some critical issues involving identification and interpretation of the parameter estimates, and detail our estimation strategy.

5.1 Basic setup

Our approach follows Long (2004) closely, but controls for fixed unobserved differences between schools when identifying main effects, examines a wider set of college attributes, permits greater heterogeneity of effects, more realistic substitution patterns between colleges, and extends the analysis to a more recent time period.

Recall that if the random components ε_{ij} are assumed to be independent and identically distributed across individuals and choices with the extreme value distribution, the likelihood that individual *i* is observed choosing college *j* is given by the simple conditional logit formula:

$$\Pr(d_{ij} = 1) = \frac{\exp(\delta_{ij})}{\sum_{k=1}^{J} \exp(\delta_{ik})} \quad (7)$$

where $\delta_{ij} \equiv -\alpha_{1i} T_{ij} + \alpha_{2i} A_j + \alpha_{3i} C_j + \alpha_{4i} D_{ij}$ is the value function for school *j* as perceived by individual i. The parameters of (7) can be estimated directly using maximum likelihood.

5.2 Interpretation and identification

As is standard in such college choice models, the coefficients $(\bar{\alpha}_k)$ parameterize the average preference for attribute k in the population. It is worth considering how these coefficients are identified. Differences in the likelihood of enrollment across institutions in the analysis sample underlie identification in these models. Schools with larger enrollments in the population should have higher attendance rates in any representative sample. Hence, if one does not control for college enrollment, the coefficients of other college characteristics that are correlated with size generally will be biased. For example, if very large schools have lower tuition or weaker academic qualities, a choice model that does not control for enrollment will tend to understate student willingness to pay for academic quality and overstate the disutility associated with high tuition. For this reason, most college choice models include some measure of enrollment.

However, what is less well understood is that, at least in the case of a single cross-section, the inclusion of college enrollment still does not allow one to identify preferences for college characteristics that are invariant across students. To see this, consider the following. If one had data on all students and colleges in the population, the average likelihood of any particular student attending a particular school would be exactly that college's share of the college market. Hence, inclusion of fully flexible enrollment variables would lead to a perfectly fit model. If one estimates a model using a subset of the population, sampling variability alone will determine which schools have enrollment greater or less than what would be predicted by the college's enrollment.

Importantly, this is not the case for college characteristics that vary across students within an institution such as price or distance. The coefficients on these models are identified off of the differing likelihoods of attendance among students with different values of the characteristics. For example, the coefficient on distance is identified by differences in enrollment shares among individuals living closer or farther away from a given institution.[15]

There are several strategies for identifying WTP of student-invariant college characteristics. One approach exploits the variation in student characteristics across colleges. This strategy can provide compelling estimates, but requires that one make some assumption about the college admission process. If, for example, one were willing to assume that colleges select the most academically talented students that apply, then one could conclude that, all else equal, a college with higher-ability students enjoys higher demand than an identical school with lower-ability students. And, then one could infer that students had a preference for specific attributes of this institution, such as the talented and caring faculty who taught there. Several papers have taken this approach, including Arcidiacano (2005). While there is reasonable evidence about at least some factors that enter into the college admissions decision, this approach – like all structural models – does require one to take a stand on the exact criteria.

An alternative approach is to exploit variation across cohorts, leveraging the fact that both enrollment and other college characteristics can vary over time. The intuition here is that if student's are willing to pay for an attribute, schools with high values of this attribute should see their enrollment and/or tuition increasing over time and one should observe schools with high values of this attribute entering the market. To estimate this type of model, one would stack data from multiple cohorts and model the probability that individual i attends college j at time t:

$$\Pr\left(d_{ijt} = 1\right) = \frac{\exp\left(\alpha_{1i} T_{ijt} + \alpha_{2i} A_{jt} + \alpha_{3i} C_{jt} + \alpha_{4i} D_{ij} + \gamma_j\right)}{\sum_{k=1}^{J} \exp\left(\alpha_{1i} T_{ikt} + \alpha_{2i} A_{kt} + \alpha_{3i} C_{kt} + \alpha_{4i} D_{ik} + \gamma_k\right)} \qquad (8)$$

[15] Similarly, the in-state versus out-state tuition difference helps identify the coefficient on price by a comparison of the likelihood of in-state versus out-state students attending a particular college. One limitation is that many public universities place a cap on the number of out-of-states students they enroll, which may be correlated with in-/out-of-state tuition differentials.

A critical choice in this setup is whether or not to include some control for unobserved, time-invariant college factors, as one might do with college fixed effects (γ_j). If one does not include controls for school enrollment or college fixed effects, then identification comes from changes in enrollment within colleges over time, differences across schools in the cross-section, and entry/exit of colleges from the market. If, for example, the market responds to a demand for college amenities with the creation of new amenity rich schools (e.g., Denver Institute of Skiing, Miami Academy of Recreational Therapy), then the inclusion of school fixed effects would tend to understate the value students place on amenities. On the other hand, one might be concerned that enrollment changes as well as entry/exit might be driven by factors uncorrelated with a preference for amenities. For example, regions that experience greater population growth may be more likely to open new colleges. If these colleges tend to have fewer amenities, estimates that *exclude* school fixed effects would lead one to understate the value placed on amenities. Indeed, to the extent that one is concerned with unobservable factors that are time-varying (as the scenario described above implies), then the inclusion of school fixed effects alone will not eliminate the potential bias.

In practice, we estimate equation (8) with and without controls for time-invariant school factors. However, given the computational challenges of including an individual fixed effect for all 1500 colleges in our sample, we instead include measures of a school's initial enrollment, defined as the number of first-time freshmen enrolled in the college in the first year we observe the college in our sample. Specifically, we include a set of binary indicators for enrollment categories (e.g., fewer than 100 students, 101-200 students, etc.). This sets the baseline probability of enrollment for each college in proportion to its enrollment category at baseline. Hence, in models where we include these baseline enrollment indicators, we identify our parameters using the following sources of variation in a college's enrollment: (a) variation across colleges within the same enrollment category at any given point in time, and (b) variation in enrollment changes over time in the colleges within enrollment category.

The concerns described above are merely a subset of a broader set of omitted variable bias issues. For example, the model described above implicitly assumes that college characteristics are exogenous from the perspective of school administrators. While colleges clearly have some discretion over characteristics such as amenities and tuition, in practice it appears that many of the attributes on which we focus (such as fraction of resources devoted to instruction versus amenities) are surprisingly invariant over time.

Similarly, we assume college attributes are uncorrelated with unobserved tastes for individual colleges. Violation of this assumption may cause omitted variable bias. For instance, if colleges that spend more on student services also happen to other favorable attributes (desirable alumni network), then our estimates will overstate the causal effect of increases in student services on colleges ability to attract students. Currently we address this concern by including a number of different variables that may be correlated with our regressors of interest. In the future, we may exploit changes in amenities driven by arguably exogenous factors (e.g. state budget shocks) or model the supply of amenities explicitly.

Finally, there are several other limitations to the panel model described above. While colleges have some flexibility to adjust enrollment and tuition, neither of these factors is perfectly elastic (certainly not in the very short-run). For example, an individual college could not quadruple the size of its incoming class to accommodate increased demand due to short-run constraints in physical capital. Similarly, there are probably at least some barriers to entry in the college market. These frictions will lead us to understate student preferences for college characteristics in the model.[16]

5.3 Separating Admission and Enrollment Decisions

Another critical issue in most college choice models involves the role of the admissions process. While a few papers have attempted to explicitly model the admissions process (e.g., Arcidiacano 2005), the vast majority of papers in this field simply model the enrollment choice out of a set of potential schools which may include many schools to which the student did not apply or to which the student would not have been admitted had s/he applied. In doing so, these papers confound the enrollment and admissions decisions and may lead to biased estimates of student preferences. Long (2004) addresses this concern by including interactions between a college's academic quality and student ability (measured by test scores), which is intended to control for the likelihood that an individual would have been admitted to the school. A limitation of this approach is that it does not allow one to distinguish between admissions constraints and heterogeneity in preferences by student ability.[17]

To address this concern, we estimate some models in which we explicitly limit an individual's choice set to those schools that we predict the student would have been admitted. To obtain this prediction, we first group schools on the basis of the Barron's selectivity indicator. We then estimate a multinomial logit to predict the probability that student i will enroll (E) in a school in each of the six Barron's categories b as a function of various student characteristics (X):

$$E(ib) = a + bX(i) + e(ib) \qquad (9)$$

Our student covariates include 12th grade achievement score and its square, self-reported 12th grade GPA and its square, an interaction between 12th grade achievement and 12th grade GPA, student race, and interactions between all of the math and GPA variables and an indicator for whether the student is black or Hispanic (to account for differential admissions probabilities due to affirmative action). We then calculate the predicted probability that s/he will enroll in a school in Barron's category b or a more selective category (P_{ib}). That is, we calculate five different cumulative probabilities – e.g., P(i2) = P(i1)+P(i2), P(i3)=P(i1)+P(i2)+P(i3), etc. We then exclude a school s in Barron's category b from student i's choice set if P(ib)<.15.

Using this method, we exclude 11% of schools on average. For 7% of students, we do not exclude any schools. For the students with the weakest academic record, we only exclude 30% of schools, which speaks to the large number of nonselective institutions. Of course, given the probabilistic nature of our prediction exercise, there are some cases in which our algorithm would dictate exclude a particular school from a student's choice set despite the fact that we observe the student attending this school. This occurs in roughly 7% of students in our sample. As one expect, we are more likely to inappropriately exclude schools for students with weak academic preparation as reflected by the characteristics we observe in the data. In the models where we limit a student's choice set, we exclude students who we observe attending a school outside of their predicted choice set. We recognize that this approach does impose certain assumptions and is, essentially, a rough approximation of a more formal structural model of admissions. In future versions of this paper, we may write down and estimate an admissions model simultaneously with the student choice model.

[16] Note that in this model we are assuming that colleges can manipulate their enrollments and their tuition, but not their college's amenities or academic features.

[17] Moreover, as noted above, it is not possible to identify average preferences for academic quality in a single cross-section without imposing additional structure on the model.

5.4 Relaxing the IIA Assumption

A limitation of the standard conditional logit model outlined above involves the restrictions it places on the error terms. While our preferred specifications permit taste variation to vary with observed attributes, the conditional logistic model is not able to accommodate tastes that vary with unobserved variables or purely randomly. For instance, if tastes vary with respect to an unobserved variable, then is necessarily correlated over alternatives and its variance also varies over alternatives (Train, 2003). Thus, the logistic model is misspecified. Thus the standard conditional logistic model imposes the property of independence from irrelevant alternatives (IIA). That is, the relative choice probabilities for any two alternatives will not depend on the presence or characteristics of any other alternatives. The relative likelihood of choosing one specific college over another is the same regardless of the other colleges available.

One implication is that cross-elasticities will exhibit proportional substitution. Since the ratio of probabilities between two alternatives is always the same, any change in the characteristics of a third alternative will impact the two alternatives by the same proportion. For instance, our basic conditional logit model predicts that if Cal State Long Beach increased instructional spending, then the share of students attending Cal State Northridge and Harvard University would decrease by proportionately the same amount. This pattern of substitution seems unrealistic.

While violation of the IIA may or may not impact our point estimates of the average taste parameters (Train, 2003), it will impact our statistical inference and will influence any simulations that we do using the model estimates. To address these concerns, we estimate a random coefficients model.

ADD DESCRIPTION OF THE R.C. MODELS HERE….

5.5 Individual-level data

For the micro data, we rely on nationally representative samples of the high school classes of 1972 (National Longitudinal Survey, NLS72), 1980 (High School and Beyond Senior Cohort, HSB80), 1992 (National Educational Longitudinal Study, NELS), and 2004 (Educational Longitudinal Survey, ELS04). These longitudinal surveys collected by the National Center for Educational Statistics follow students from high school into college. We limit our sample to individuals who graduated from high school, attended a four-year institution within two years of expected high school graduation, attended a college in our choice set, and were not missing key covariates (test scores, race, gender, family SES, college choice, etc).

We assign out-of-state tuition levels to individuals residing in all states other than the one in which the institution is located, so (at this point) we do not take into account tuition reciprocity agreements between neighboring states. Tuition does not vary by in-state status for private institutions. As a proxy for the distance between a student's home and a college, we calculate the distance between the centroid of the zipcode in which the student's high school is located and the centroid of the zipcode in which each institution is located.[18]

Table 9 presents summary statistics for our analysis sample. Note that our sample constitutes roughly 25 percent of the population of high school seniors through the 1990s and 43 percent of the high school seniors in 2004. The bottom panel presents statistics on the colleges

[18] For the 1982 cohort, it is not possible to identify a student's high school even using the restricted data. For this reason, we use the distance between the county in which the student's high school is located.

attended by our sample. Over our analysis period, the real cost of tuition increased more than twofold, from $5,315 in 1972 to $12,295 in 2004, while the average distance traveled to college increased from 160 to 208 miles. Schools attended by our sample increased spending on instruction 71 percent over the period and spending on student services by roughly 46 percent. Interestingly, the fraction attending a religious school remained roughly constant at around 17 percent, as did the fraction attending a single-sex school (roughly 3 percent). The fraction attending a historically Black college increased from 3 to 5 percent.

Each of these surveys asked high school seniors what factors they viewed as most important in selecting a college. These self-reported preferences provide some interesting descriptive information, and allow us to validate some of our more objective college characteristdics (see below). The bottom panel of Table 9 shows that the fraction of students citing the reputation of the college, the courses available and the availability of financial aid as "very important" has increased substantially from 1972-2004. The fraction citing factors such as athletics and social life jumps around a bit, but does increase substantially from 1992 to 2004.

For the purpose of the analysis below, we create three composite measures based on a simple average of these items. The variables, standardized using the mean and standard deviation from the 1972 cohort, capture the self-reported value that students place on academics, cost and social life. The summary statistics for these composites shown in Table 9 are for the analysis sample, and show an increasing value placed on all three factors. In the analysis below, we rely primarily on the across-student variation in these measures rather than the across-cohort variation.

6. Results from micro (individual-level) analysis

We present results in four parts. We first replicate the specification of Long (2004) as closely as possible then extend this specification by including our measures of consumption amenities. We then present our main results: estimates of the conditional logistic model described above. We next permit more substitution flexibility through use of a random coefficients model. Lastly, we use parameter estimates to calculate an average willingness to pay for college characteristics.

6.1 Replication and extension

To provide a direct comparison with previous work, we first extend the analysis of Long (2004) by including measures of college consumption amenities into her conditional logit specifications. Before doing so, we verify that our estimates reproduce her results using a specification as close as possible to hers. Table 10 presents these results. The first two columns for each cohort year show her results (BTL) and our results (JMS) for a comparable specification side by side, indicating that we are able to successfully replicate her findings.[19] The third column for each cohort adds four measures of consumption amenities to this basic model. We find that spending on student services and auxiliary enterprises have a large and statistically significant relationship with the likelihood of choosing a particular college, as does the presence of a division 1 basketball or football team and the fraction of students who join fraternities or sororities. Interestingly, the Albouy QOL index is negatively related to college choice.

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[19] It should be noted that our results should not be exactly comparable to hers since her estimation includes two-year colleges and students (which we exclude) and not all variables are interacted with sector in her model.

6.2 Estimates from conditional logistic model

Table 11 shows odds ratios and standard errors from our conditional logit model described above. Columns 1-3 show our preferred model. Specifically, we stack the micro data for all four cohorts, and in lieu of school fixed effects, we include a set of 20 binary variables that capture the baseline enrollment in the institution (i.e., fewer than 100 students, 100-200 students, etc.). For computational ease, in columns 1-5 we limit each student's choice set to 100 schools – the one school that the student attended and 99 other randomly selected schools from our analysis sample. Train (2003) demonstrates that this estimation strategy yields consistent estimates though sacrifices precision, which we confirm in column 6.

Focusing on column 3, we see that cost and distance are both negative related to college choice. Specifically, the odds ratios indicate that students are only 31.7 percent as likely to choose a college that is one log point more expensive and only 27.5 percent as likely to choose a college that is one log mile further away. As expected, our two proxies for academic quality – instructional spending and mean SAT score – are both positively correlated with student choice. Students are roughly 8 percent more likely to choose a school that spends one percent more on instruction. Interestingly, students are considerably are more than twice as likely to choose a college that spends one percent more on student services, suggesting the importance of consumption amenities.

In order to provide a better sense of the magnitude of these results and to quantify the relative tradeoffs that students are making, the bottom panel of the table reports measures of "willingness-to-pay" (WTP) derived from the specifications. For each college attribute, we calculate the WTP for attribute X as the (negative) ratio of the estimated coefficient on that attribute to the estimated coefficient on the log(tuition) variable. For example, the WTP of .064 for instructional spending (column 3, bottom panel) indicates that a student is willing to pay .64 percent more in tuition to attend a school that spends a mere 1 percent more on student services. In contrast, the student would be willing to pay 6.8 percent more in tuition to attend a school that spends 1 percent more on student services. The WTP of .008 on school mean SAT indicates that a student would pay .08 percent more to attend a school whose mean SAT score is 10 percentage points higher on the national distribution. The -1.135 WTP for distance indicates that a student would be willing to pay roughly 1.1 percent more to attend a school that was 1 percent closer.

In column 4, we show results that omit the enrollment controls. While the odds ratios for tuition and distance remain roughly the same, the coefficients on spending change considerably. Specifically, the coefficient on student service spending goes down while the coefficient on instructional spending goes up. This suggests that larger schools tend to have higher instructional spending, which makes sense given that large research institutions spend considerable amounts on faculty.

In column 5, we replicate our preferred specification (column 3) restricting student choices to those schools we predict the student could have gained admission (using the strategy described above). Interestingly, the coefficients on both measures of academic quality – instructional spending and mean SAT – increase significantly relative to our baseline.

Table 12 shows the results of two additional specifications, both of which add a set of interactions between student and school characteristics. Columns 2-4 show the results of a single conditional logit model that shows interactions between the student's 12th grade math score and composite SES and the six college attributes shown earlier, along with interactions between a student's race, gender and religion and relevant college attributes. Not surprisingly, we find that students are substantially more likely to attend institutions that match their background (e.g., Black students attending historically Black colleges, Catholic students attending Catholic colleges, etc.).

More interestingly, we see that both high ability students and students from more affluent families place *less* emphasis on college cost and distance, and are more likely to attend schools with high mean SAT scores and that spend more on instruction and student services. It is noteworthy that the interaction between student math score and school mean SAT is substantially larger than the comparable interaction between student SES and school mean SAT.

Columns 5-8 show the results of a second specification that includes interactions between the six college attributes and the three self-reported student "preferences" measures described above. Recall that these measures are standardized composite variable that aggregate information on how important students report different college characteristics to be in their decision to enroll in a particular school. We view this specification as a useful check on the validity of our college attribute measures, particularly those measures we hope are capturing consumption amenities. For example, if spending on student services were really capturing something about the consumption value of an institution, we would expect students who report that a school's social life is important to be more likely to attend these institutions. Similarly, if instructional spending were a good proxy for academic quality, students who report academics to be very important to them should be more likely to attend schools with higher spending on instruction. Indeed, we find exactly these patterns, bolstering our confidence in the college attribute measures we use.

Table 13 shows how much various "types" of students are willing to pay for various college attributes. High and low ability and SES refer to one standard deviation above or below the average of all high school seniors.

Table 14 shows the results of a model that allow the coefficients on college attributes to vary across our four cohorts. Several interesting results appear. First, the odds ratio on tuition increases somewhat over time, indicating that cost is becoming a somewhat *less* of a deterrent for students. Looking at the WTP measures at the bottom of the table, we see that students have become less willing to pay for spending on student services over time, with the biggest change coming between 1992 and 2004. Specifically, students in 2004 were only willing to pay 3.5 percent more for a 10 percent increase in student service expenditures, compared with students in 1992 who were willing to pay 7.8 percent for the same increase. This appears to contradict the common wisdom that student recreation is becoming more important over time. On the other hand, our result here could be driven by large enrollment increases in low-amenity public institutions, resulting from population shifts. Consistent with current views, school mean SAT scores appear to have become a much more important factor in student choice over time. By 2004, students were willing to pay .19 percent more to attend a school with a school mean SAT that was 10 percentage points higher.

Tables 15 and 16 present the estimates and WTP from a model that includes student math and SES interactions and allows these interactions to vary over time.

6.3 Estimates from random coefficients model

TO BE ADDED

7. Conclusion

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Table 1: College Characteristics

	1972 (mean)	1980 (mean)	1992 (mean)	2004 (mean)
Public Institution	0.36	0.36	0.37	0.39
Lagged Freshman Enrollment	810	834	756	919
Full-Time Equivalent Enrollment	3,946	4271.95	4543.51	5,450
In-State Tuition	6,826	6,117	10,539	14,843
Out-of-State Tuition	8,174	7,174	12,623	17,958
Instructional/Academic Support $ per FTE	6,540	6,425	8,241	10,136
Student Services/Auxiliary Support $ per FTE	3,874	3,959	4,701	5,712
Median or mean SAT Ptile	65.30	63.59	61.68	57.57
Fraction of FT Faculty with PhD	0.56	0.55	0.64	0.76
Barron's "Most Competitive"	0.03	0.03	0.03	0.03
Barron's "Highly Competitive"	0.05	0.05	0.04	0.04
Barron's "Very Competitive"	0.15	0.15	0.14	0.14
Barron's "Competitive"	0.43	0.42	0.40	0.38
Barron's "Less Competitive"	0.18	0.19	0.17	0.16
Barron's "Noncompetitive"	0.16	0.17	0.21	0.24
% of Students who join Frat/Sor	0.10	0.10	0.10	0.07
Has Div1 Basketball/Football	0.25	0.24	0.23	0.22
Num Intercollegiate Sports	13.39	13.03	12.63	14.40
Num Intramural Sports	19.14	18.80	18.81	15.30
Num Activities	4.19	4.13	4.08	4.01
Population of Town/City	355,267	365,102	357,756	345,492
In Princeton Review Best Colleges	0.28	0.27	0.26	0.25
In Princeton Review Best Party Schools	0.05	0.04	0.04	0.04
Albouy QOL index	-0.01	-0.01	-0.01	-0.01
Highest degree offered is BA	0.31	0.33	0.32	0.25
	0.42	0.41	0.44	0.45
Highest degree offered is PhD/prof	0.22	0.21	0.23	0.29
All men's college	0.02	0.02	0.02	0.02
All women's college	0.07	0.07	0.07	0.06
Historically black college or univ	0.06	0.06	0.06	0.05
Tribal college	0.00	0.00	0.00	0.00
Catholic college	0.11	0.10	0.11	0.11
Jewish college	0.00	0.00	0.00	0.00
Protestant college	0.24	0.24	0.25	0.27
Other religious affiliation college	0.00	0.00	0.02	0.00
College has no religious affiliation	0.65	0.66	0.62	0.61

Table 2a: Unweighted Pairwise Correlations, 2004

		Pairwise Correlations between college characteristics													
	mean (std dev)	Tuition	Enroll	FTE Enroll	SAT	Barrons	Faculty PhD	Academic$	Services$	% Frat	Div1 Sports	Intercoll Sports	Intramur Sports	Activities	QOL
Out-of-State Tuition	17957.71	1.000													
	(7191.40)														
Lagged Freshman Enrollment	919.38	-0.022	1.000												
	(1122.96)	(0.396)													
Full-Time Equivalent Enrollment	5449.63	0.000	0.946	1.000											
	(7077.52)	(0.985)	(0.000)												
Median or mean SAT Ptile	57.57	0.625	0.220	0.216	1.000										
	(18.11)	(0.000)	(0.000)	(0.000)											
Barron's Rating	-4.344	0.636	0.125	0.138	0.741	1.000									
	(1.256)	(0.000)	(0.000)	(0.000)	(0.000)										
Fraction of FT Faculty with PhD	0.76	0.453	0.198	0.229	0.519	0.453	1.000								
	(0.18)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)									
Instructional/Academic Support $	10136.02	0.516	0.119	0.175	0.553	0.598	0.337	1.000							
	(7999.87)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)								
Student Services/Auxiliary Support $	5711.68	0.610	-0.137	-0.156	0.520	0.588	0.312	0.602	1.000						
	(3593.80)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)							
% of Students who join Frat/Sor	0.07	0.234	0.068	0.054	0.226	0.237	0.215	0.196	0.238	1.000					
	(0.12)	(0.000)	(0.010)	(0.037)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)						
Has Div1 Basketball/Football	0.22	0.081	0.616	0.636	0.188	0.121	0.249	0.189	-0.001	0.144	1.000				
	(0.42)	(0.002)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.979)	(0.000)					
Num Intercollegiate Sports	14.40	0.413	0.360	0.355	0.443	0.436	0.379	0.359	0.373	0.279	0.364	1.000			
	(6.60)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)				
Num Intramural Sports	15.30	0.103	0.415	0.401	0.274	0.188	0.227	0.198	0.086	0.171	0.357	0.458	1.000		
	(9.21)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.002)	(0.000)	(0.000)	(0.000)			
Num Activities	4.01	0.357	0.341	0.330	0.372	0.338	0.373	0.277	0.249	0.242	0.337	0.548	0.373	1.000	
	(1.38)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)		
Albouy QOL index	-0.01	0.248	0.107	0.157	0.145	0.183	0.157	0.177	0.123	-0.131	0.069	0.025	-0.075	0.092	1.000
	(0.06)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.008)	(0.341)	(0.004)	(0.000)	

Table 2b: Weighted Pairwise Correlations, 2004

		Pairwise Correlations between college characteristics													
	mean	Tuition	Enroll	FTE Enroll	SAT	Barrons	Faculty PhD	Academic$	Services$	% Frat	Div1	Intercoll	Intramur	Activities	QOL
	(std dev)										Sports	Sports	Sports		
Out-of-State Tuition	17817.51	1.000													
	(7113.16)														
Lagged Freshman Enrollment	2290.07	-0.026	1.000												
	(1948.30)	(0.319)													
Full-Time Equivalent Enrollment	13658.91	0.054	0.927	1.000											
	(11466.24)	(0.041)	(0.000)												
Median or mean SAT Ptile	62.29	0.626	0.313	0.335	1.000										
	(16.80)	(0.000)	(0.000)	(0.000)											
Barron's Rating	-4.012	0.597	0.201	0.239	0.756	1.000									
	-1.22	(0.000)	(0.000)	(0.000)	(0.000)										
Fraction of FT Faculty with PhD	0.80	0.460	0.081	0.230	0.538	0.434	1.000								
	(0.16)	(0.000)	(0.006)	(0.000)	(0.000)	(0.000)									
Instructional/Academic Support $	11320.09	0.587	0.060	0.166	0.586	0.595	0.338	1.000							
	(8658.85)	(0.000)	(0.027)	(0.000)	(0.000)	(0.000)	(0.000)								
Student Services/Auxiliary Support $	5127.33	0.612	-0.149	-0.120	0.549	0.556	0.328	0.602	1.000						
	(3355.32)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)							
% of Students who join Frat/Sor	0.08	0.303	0.101	0.117	0.330	0.304	0.306	0.276	0.278	1.000					
	(0.09)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)						
Has Div1 Basketball/Football	0.54	0.120	0.515	0.609	0.250	0.151	0.336	0.179	0.030	0.220	1.000				
	(0.50)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.266)	(0.000)					
Num Intercollegiate Sports	17.33	0.446	0.314	0.422	0.533	0.483	0.446	0.441	0.410	0.285	0.416	1.000			
	(6.20)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)				
Num Intramural Sports	19.98	0.093	0.367	0.426	0.229	0.125	0.211	0.158	0.041	0.186	0.387	0.441	1.000		
	(10.35)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.137)	(0.000)	(0.000)	(0.000)			
Num Activities	4.59	0.348	0.324	0.383	0.413	0.349	0.356	0.280	0.230	0.306	0.383	0.523	0.306	1.000	
	(1.23)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)		
Albouy QOL index	-0.00	0.259	0.196	0.238	0.223	0.237	0.160	0.181	0.120	-0.091	0.095	0.092	-0.068	0.135	1.000
	(0.06)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.001)	(0.011)	(0.000)	

Table 3: Predictors of Subjective Quality of Life and Academic Environment Rankings (1992 and 2006)

	QOL ranking percentile					Academic environment percentile				
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Student Services/Auxiliary Support $ per FTE	23.226***	23.760***	21.021***	18.249***	17.619***	27.981***	28.276***	8.906***	7.676***	7.277***
	(2.816)	(2.758)	(3.966)	(4.143)	(4.289)	(2.615)	(2.539)	(2.798)	(2.936)	(2.596)
Instructional/Academic Support $ per FTE	-0.610	-1.633	-2.497	-0.490	-2.666	20.038***	19.472***	20.322***	19.779***	13.957***
	(3.224)	(3.271)	(3.969)	(3.957)	(4.307)	(2.850)	(2.811)	(2.520)	(2.583)	(2.235)
year2004	-2.897	-2.562	-0.630	-0.028	0.094	-6.457***	-6.272***	1.418	1.905	1.038
	(1.800)	(1.802)	(2.682)	(2.734)	(2.787)	(1.401)	(1.400)	(1.894)	(2.157)	(1.961)
Albouy QOL index		43.954**	39.070*	46.270**	42.406*		24.283	20.403	22.124	16.719
		(21.846)	(22.917)	(22.424)	(22.787)		(17.773)	(16.541)	(16.786)	(14.929)
lenroll			2.221	2.140	3.251			-9.741***	-9.747***	-7.675***
			(3.137)	(3.041)	(3.148)			(1.975)	(1.984)	(1.820)
Public Institution			-1.296	3.884	3.921			2.025	0.959	0.609
			(4.532)	(4.758)	(4.821)			(2.662)	(3.211)	(2.901)
Highest degree offered is MA			2.632	3.383	3.207			-1.035	-0.603	0.025
			(3.539)	(3.680)	(3.642)			(2.300)	(2.388)	(2.218)
Highest degree offered is PhD/prof			-7.584	-8.091*	-8.936*			-5.522*	-4.772	-4.753*
			(4.947)	(4.779)	(4.842)			(3.041)	(3.139)	(2.878)
Median or mean SAT Ptile from BTL			0.572***	0.601***	0.633***			0.791***	0.790***	0.371***
			(0.133)	(0.140)	(0.183)			(0.141)	(0.153)	(0.142)
Fraction of FT Faculty with PhD			-8.524	-9.914	-7.238			4.324	4.717	9.067*
			(7.288)	(7.390)	(7.457)			(5.213)	(5.196)	(4.923)
% of Students who join Frat/Sor			9.166	14.813	14.536			-1.662	-1.432	-2.329
			(8.554)	(9.308)	(8.994)			(4.469)	(5.435)	(4.616)
Has Div1 Basketball/Football			10.212***	8.835**	7.326*			1.689	2.275	-0.394
			(3.889)	(3.985)	(4.091)			(2.483)	(2.580)	(2.332)
Num Intercollegiate Sports			-0.194	-0.032	-0.153			0.335**	0.396***	0.132
			(0.191)	(0.201)	(0.202)			(0.143)	(0.148)	(0.129)
Num Intramural Sports			-0.263**	-0.227*	-0.227*			-0.166*	-0.153*	-0.130*
			(0.129)	(0.127)	(0.126)			(0.085)	(0.086)	(0.077)
Num Activities			-1.798	-1.379	-1.677			-1.035	-0.996	-1.110
			(1.378)	(1.370)	(1.385)			(0.971)	(0.967)	(0.901)
Catholic college				12.284**	13.684**				-1.673	0.448
				(5.312)	(5.473)				(3.297)	(2.835)
Protestant college				6.565	8.160**				0.267	1.151
				(4.033)	(4.043)				(2.541)	(2.277)
Other religious affiliation college				29.745	31.208				8.840	6.955
				(20.858)	(19.590)				(7.097)	(11.301)
All women's college				22.458***	20.620***				6.323	2.901
				(5.302)	(5.882)				(4.002)	(3.443)
All men's college				4.774	2.029				5.130	1.477
				(6.626)	(6.365)				(3.421)	(3.695)
Historically black college or univ				-4.842	-6.503				-3.834	-4.539
				(5.406)	(7.105)				(7.930)	(5.557)
Barron's "Highly Competitive"					-8.429*					-14.721***
					(4.919)					(2.610)
Barron's "Very Competitive"					-11.701**					-26.500***
					(5.318)					(2.875)
Barron's "Competitive"					-5.532					-28.849***
					(6.793)					(4.171)
Barron's "Less Competitive"					-2.598					-36.449***
					(9.827)					(8.845)
Barron's "Noncompetitive"					-4.299					-9.142*
					(9.045)					(5.186)
Observations	562	562	505	504	504	562	562	505	504	504
R-Squared	0.158	0.166	0.244	0.282	0.298	0.521	0.523	0.680	0.683	0.738

Robust standard errors in parentheses, clustered at institution level. *** p<0.01, ** p<0.05, * p<0.1 Sample includes all four-year public and private non-profit colleges appearing in the Princeton Review guidebooks in 1992 or 2006 (or both) and with non-missing covariates

Table 4: Determinants of total enrollment

	Dependent variable: log(total enrollment)					
	(1)	(2)	(3)	(4)	(5)	(6)
log(tuition)	-0.6982***	-0.1350***	-0.0265	-0.6416***	-0.1194***	-0.0513*
	(0.0370)	(0.0165)	(0.0228)	(0.0479)	(0.0170)	(0.0274)
QOL index	0.1670	0.3440*		-0.3715	-0.3600*	
	(0.3463)	(0.1803)		(0.4452)	(0.1928)	
SAT	0.0153***	0.0046***	0.0006	0.0122***	0.0019***	-0.0010
	(0.0011)	(0.0006)	(0.0005)	(0.0015)	(0.0006)	(0.0007)
log(intruction per FTE)	0.6798***	-0.0005	-0.1908***	0.5826***	-0.0414	-0.1856***
	(0.0515)	(0.0277)	(0.0288)	(0.0708)	(0.0312)	(0.0413)
log(services+auxilary per FTE)	-0.2189***	-0.0929***	-0.0057	-0.2185***	-0.0522**	-0.0078
	(0.0449)	(0.0233)	(0.0248)	(0.0582)	(0.0263)	(0.0349)
Time X						
log(tuition)				-0.0032*	-0.0007	0.0004
				(0.0017)	(0.0009)	(0.0008)
QOL index				0.0319**	0.0422***	0.0466***
				(0.0135)	(0.0094)	(0.0088)
SAT				0.0002***	0.0002***	0.0001***
				(0.0001)	(0.0000)	(0.0000)
log(intruction per FTE)				0.0050*	0.0016	-0.0022
				(0.0029)	(0.0019)	(0.0017)
log(services+auxilary per FTE)				-0.0007	-0.0032**	-0.0014
				(0.0024)	(0.0014)	(0.0014)
Constant	7.0972***	6.5135***	8.1186***	7.6469***	6.5692***	8.4046***
	(0.4109)	(0.2166)	(0.3016)	(0.6270)	(0.2721)	(0.4132)
Enrollment category FE	No	Yes	No	No	Yes	No
School FE	No	No	Yes	No	No	Yes
Observations	37,460	37,460	37,460	37,460	37,460	37,460
R-squared	0.3926	0.8112	0.9221	0.3958	0.8137	0.9234

Robust standard errors clustered by school in parentheses*** p<0.01, ** p<0.05, * p<0.1. Sample includes approximately 1200 schools each year from 1972 to 2007, excluding 1983, 1995, and 1999.

Table 5: Determinants of total out-of-state enrollment

	Dependent variable: log(total out-of-state enrollment)					
	(1)	(2)	(3)	(4)	(5)	(6)
log(tuition)	-0.3778***	0.1295*	-0.0398	0.0561	0.3291***	-0.0220
	(0.0859)	(0.0718)	(0.0440)	(0.1118)	(0.0947)	(0.0663)
QOL index	1.4380***	1.4974***		1.5152**	1.7331***	
	(0.5272)	(0.4742)		(0.6642)	(0.5577)	
SAT	0.0159***	0.0090***	0.0037***	0.0019	-0.0013	-0.0004
	(0.0018)	(0.0016)	(0.0009)	(0.0024)	(0.0020)	(0.0014)
log(intruction per FTE)	0.7728***	0.0393	-0.1671***	0.6689***	-0.0277	-0.1895***
	(0.0797)	(0.0772)	(0.0488)	(0.1130)	(0.1059)	(0.0725)
log(services+auxilary per FTE)	0.3912***	0.6745***	0.2756***	0.6222***	0.8883***	0.4446***
	(0.0629)	(0.0590)	(0.0448)	(0.0825)	(0.0751)	(0.0680)
Time X						
log(tuition)				-0.0210***	-0.0096**	-0.0029
				(0.0045)	(0.0040)	(0.0030)
QOL index				0.0032	-0.0061	0.0414**
				(0.0198)	(0.0182)	(0.0167)
SAT				0.0007***	0.0005***	0.0003***
				(0.0001)	(0.0001)	(0.0001)
log(intruction per FTE)				0.0042	0.0026	0.0014
				(0.0045)	(0.0042)	(0.0029)
log(services+auxilary per FTE)				-0.0117***	-0.0110***	-0.0105***
				(0.0033)	(0.0030)	(0.0026)
Constant	-3.0021***	-4.0920***	3.8406***	-6.3289***	-5.9836***	3.0145***
	(0.7161)	(0.6583)	(0.5886)	(1.0144)	(0.9116)	(0.7352)
Enrollment category FE	No	Yes	No	No	Yes	No
School FE	No	No	Yes	No	No	Yes
Observations	14,024	14,024	14,024	14,024	14,024	14,024
R-squared	0.2212	0.4175	0.8794	0.2296	0.4222	0.8813

Robust standard errors clustered by school in parentheses*** p<0.01, ** p<0.05, * p<0.1. Sample includes approximately 1100 schools each year 1975, 1981, and even years 1984-2006.

Table 6: Determinants of applicant rejection rate

	Dependent variable: Applicant rejection rate					
	(1)	(2)	(3)	(4)	(5)	(6)
log(tuition)	0.0033	-0.0021	-0.0094	0.0159	0.0115	-0.0019
	(0.0066)	(0.0085)	(0.0095)	(0.0138)	(0.0144)	(0.0135)
QOL index	0.4226***	0.4467***		0.3480**	0.3468*	
	(0.0864)	(0.0920)		(0.1734)	(0.1796)	
SAT	0.0024***	0.0026***	0.0016***	0.0042***	0.0044***	0.0022***
	(0.0003)	(0.0003)	(0.0003)	(0.0006)	(0.0006)	(0.0005)
log(intruction per FTE)	0.0703***	0.0757***	0.0117	0.0381	0.0421	-0.0330
	(0.0154)	(0.0170)	(0.0129)	(0.0341)	(0.0351)	(0.0319)
log(services+auxilary per FTE)	0.0143	0.0202*	-0.0087	0.0560**	0.0635**	0.0251
	(0.0113)	(0.0114)	(0.0098)	(0.0261)	(0.0259)	(0.0223)
Time X						
log(tuition)				-0.0006	-0.0006	-0.0004
				(0.0005)	(0.0005)	(0.0005)
QOL index				0.0030	0.0041	-0.0058
				(0.0065)	(0.0067)	(0.0061)
SAT				-0.0001***	-0.0001***	-0.0000
				(0.0000)	(0.0000)	(0.0000)
log(intruction per FTE)				0.0016	0.0017	0.0024*
				(0.0013)	(0.0013)	(0.0012)
log(services+auxilary per FTE)				-0.0018*	-0.0018*	-0.0014*
				(0.0010)	(0.0010)	(0.0009)
Constant	-0.7061***	-0.7510***	0.1560	-0.8513***	-0.9003***	0.1296
	(0.1264)	(0.1264)	(0.1281)	(0.1858)	(0.1871)	(0.1709)
Enrollment category FE	No	Yes	No	No	Yes	No
School FE	No	No	Yes	No	No	Yes
Observations	19,976	19,976	19,976	19,976	19,976	19,976
R-squared	0.2503	0.2695	0.7594	0.2558	0.2752	0.7607

Robust standard errors clustered by school in parentheses*** p<0.01, ** p<0.05, * p<0.1. Sample includes approximately 1100 schools each year 1984-2004, excluding 1995 and 1999.

Table 7: Determinants of total distance traveled by freshmen

	Dependent variable: log(enrollment-weighted distance traveled by all freshmen)					
	(1)	(2)	(3)	(4)	(5)	(6)
log(tuition)	0.0455	-0.0688*	0.0417	0.0251	-0.0743	-0.0610*
	(0.0351)	(0.0363)	(0.0270)	(0.0476)	(0.0467)	(0.0314)
QOL index	1.0428**	1.1539***		0.4513	0.4640	
	(0.4545)	(0.4378)		(0.5789)	(0.5507)	
SAT	0.0018	0.0040***	0.0008	-0.0044**	-0.0026	0.0018**
	(0.0016)	(0.0015)	(0.0006)	(0.0018)	(0.0017)	(0.0008)
log(intruction per FTE)	0.1386*	0.2920***	0.1793***	0.2729***	0.4040***	0.0516
	(0.0821)	(0.0822)	(0.0427)	(0.0957)	(0.0954)	(0.0559)
log(services+auxilary per FTE)	0.4419***	0.4281***	0.1367***	0.6122***	0.6084***	0.1581***
	(0.0550)	(0.0528)	(0.0257)	(0.0640)	(0.0589)	(0.0413)
Time X						
log(tuition)				0.0015	0.0007	0.0056***
				(0.0016)	(0.0017)	(0.0016)
QOL index				0.0304*	0.0352**	0.0544***
				(0.0167)	(0.0162)	(0.0165)
SAT				0.0004***	0.0004***	0.0000
				(0.0001)	(0.0001)	(0.0000)
log(intruction per FTE)				-0.0074**	-0.0061*	0.0028
				(0.0033)	(0.0031)	(0.0021)
log(services+auxilary per FTE)				-0.0097***	-0.0103***	-0.0033*
				(0.0024)	(0.0024)	(0.0018)
Constant	-0.3562	-0.4738	1.8207***	-2.0095**	-2.1035***	3.4160***
	(0.6533)	(0.6303)	(0.5867)	(0.7895)	(0.7557)	(0.5509)
Enrollment category FE	No	Yes	No	No	Yes	No
School FE	No	No	Yes	No	No	Yes
Observations	14,118	14,118	14,118	14,118	14,118	14,118
R-squared	0.1850	0.2313	0.9336	0.1924	0.2397	0.9374

Robust standard errors clustered by school in parentheses*** p<0.01, ** p<0.05, * p<0.1. Sample includes approximately 1100 schools each year 1975, 1981, and even years 1984-2006.

Table 8: Determinants of total distance traveled by out-of-state freshmen

	Dependent variable: log(enrollment-weighted distance traveled by out-of-state freshmen)					
	(1)	(2)	(3)	(4)	(5)	(6)
log(tuition)	-0.3772***	-0.4016***	-0.0031	-0.4173***	-0.4372***	-0.2079***
	(0.0618)	(0.0645)	(0.0242)	(0.0853)	(0.0870)	(0.0401)
QOL index	3.8005***	3.8099***		3.8118***	3.8125***	
	(0.5791)	(0.5765)		(0.6286)	(0.6250)	
SAT	-0.0017	-0.0016	-0.0014**	-0.0094***	-0.0092***	0.0001
	(0.0013)	(0.0013)	(0.0006)	(0.0017)	(0.0017)	(0.0007)
log(intruction per FTE)	0.3935***	0.4236***	0.1360***	0.4249***	0.4603***	0.0946**
	(0.0692)	(0.0782)	(0.0299)	(0.0814)	(0.0880)	(0.0403)
log(services+auxilary per FTE)	0.1401***	0.1312**	0.0876***	0.4994***	0.4835***	0.0971**
	(0.0535)	(0.0552)	(0.0289)	(0.0789)	(0.0803)	(0.0460)
Time X						
log(tuition)				0.0026	0.0020	0.0116***
				(0.0029)	(0.0028)	(0.0022)
QOL index				0.0024	0.0031	0.0118
				(0.0187)	(0.0182)	(0.0113)
SAT				0.0004***	0.0005***	-0.0000
				(0.0001)	(0.0001)	(0.0000)
log(intruction per FTE)				-0.0026	-0.0023	-0.0004
				(0.0030)	(0.0030)	(0.0016)
log(services+auxilary per FTE)				-0.0190***	-0.0189***	-0.0014
				(0.0029)	(0.0028)	(0.0016)
Constant	4.9315***	5.0758***	4.2728***	3.0049***	3.1397***	6.0143***
	(0.6046)	(0.5935)	(0.4019)	(0.7475)	(0.7511)	(0.4659)
Enrollment category FE	No	Yes	No	No	Yes	No
School FE	No	No	Yes	No	No	Yes
Observations	13,979	13,979	13,979	13,979	13,979	13,979
R-squared	0.1597	0.1770	0.8909	0.1763	0.1934	0.8933

Robust standard errors clustered by school in parentheses*** p<0.01, ** p<0.05, * p<0.1. Sample includes approximately 1100 schools each year 1975, 1981, and even years 1984-2006.

Table 9: Student Characteristics

	1972	1980	1992	2004
Number of students in the full sample of high school seniors	16,683	11,500	16,409	13,307
Fraction attending any postsecondary institution	??	??	??	??
Fraction attending an institution in our analysis sample	??	??	??	??
Fraction attending an institution in our analysis sample with non-missing data on key variables	??	??	??	??
Number of students in our analysis sample	4,408	3,023	4,088	5,753
Background Characteristics of Analysis Sample				
Male	0.51	0.45	0.47	0.44
Asian/Pacific Islander	0.01	0.02	0.05	0.06
Hispanic	0.02	0.05	0.07	0.08
Black	0.07	0.10	0.10	0.11
White	0.88	0.83	0.77	0.71
Jewish	0.05	0.04	0.04	0.02
Protestant	0.45	0.47	0.41	0.30
Catholic	0.31	0.35	0.32	0.29
Christian	0.11	0.05	0.09	0.15
Other Religion	0.02	0.03	0.04	0.04
Standardized SES				
Standardized 12th grade math score				
Fraction of colleges in student's choice set	0.89	0.89	0.89	0.89
Characteristics of institution student attended				
Tuition and fees	5,315	4,810	8,864	12,295
Distance from institution to home (miles)	160	144	190	208
School Mean SAT (percentile)	68.14	65.74	66.46	60.82
Spending on student services/fte ($2009)	7,273	7,228	9,559	11,226
Spending on instruction/fte ($2009)	3,538	3,707	4,559	5,113
Quality of life of college location	-0.01	-0.01	-0.01	0.00
Historically Black College	0.03	0.04	0.05	0.05
Historically Male College	0.01	0.01	0.01	0.01
Historically Female College	0.02	0.02	0.02	0.02
Catholic College	0.05	0.06	0.07	0.07
Protestant College	0.10	0.10	0.11	0.11
Percent of high school seniors listing the following characteristics as very important:				
Reputation of College	42.7%	50.4%	49.6%	57.7%
Courses Available	62.2%	66.1%	62.5%	66.5%
Low Costs	40.5%	35.4%	30.9%	35.6%
Availability of Financial Aid	28.6%	36.8%	45.7%	57.3%
Athletics	7.8%	12.0%	9.5%	14.8%
Social Life	--	24.7%	21.6%	30.0%
*Standardized composite measure of importance of various college characteristics in analysis sample**				
Academics (courses, reputation)	0.14	0.3	0.26	0.34
Cost (low costs, availability of financial aid)	-0.11	-0.01	-0.13	-0.01
Social Life (athletics, social life)	-0.02	0.11	-0.03	0.17

*Simple item average, standardized with 1972 mean and s.d.

Table 10: College choice conditional on attendance

Dependent variable: attended college j within 2 years of high school graduation (odds ratios)

	1972			1980			1992		
	BTL	JMS	JMS	BTL	JMS	JMS	BTL	JMS	JMS
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Tuition & Fees ($1000)	0.4686**	0.543***	0.523***	0.5809**	0.573***	0.555***	.6548**	0.755***	0.738***
	[32.32]	(0.00979)	(0.010)	[26.68]	(0.0114)	(0.0117)	[39.21]	(0.00639)	(0.00656)
Tuition & Fees ($1000) sq	1.0485**	1.030***	1.030***	1.0328**	1.030***	1.030***	1.0147**	1.008***	1.008***
	[24.87]	(0.00116)	(0.001)	[21.98]	(0.00128)	(0.00138)	[31.91]	(0.000292)	(0.000308)
Distance (100mi)	.1665**	0.213***	0.208***	0.1954**	0.204***	0.196***	.2668**	0.235***	0.235***
	[65.29]	(0.00522)	(0.005)	[60.91]	(0.00583)	(0.00571)	[64.66]	(0.00525)	(0.00526)
Instruct expend. ($1000)	1.038	1.053***	0.992	1.0303	1.071***	1.029	1.1035**	1.040***	1.023**
	[1.46]	(0.0200)	(0.019)	[1.27]	(0.0191)	(0.0184)	[6.08]	(0.00929)	(0.00992)
% Faculty with PhD	1.0050**	1.233***	1.106	1.0048**	0.950	0.903	1.0060**	1.266***	1.222***
	[7.18]	(0.0752)	(0.068)	[5.46]	(0.0656)	(0.0629)	[6.20]	(0.0918)	(0.0902)
Enrollment (100)	not	1.052***	1.048***	not	1.045***	1.040***	not	1.070***	1.062***
	reported	(0.00333)	(0.004)	reported	(0.00349)	(0.00417)	reported	(0.00401)	(0.00506)
Enrollment (100) sq	not	1.000***	1.000***	not	1.000***	1.000***	not	0.999***	1.000***
	reported	(4.71e-05)	(0.000)	reported	(4.33e-05)	(4.95e-05)	reported	(6.71e-05)	(7.56e-05)
Student - School test score ptile (pos)	0.6525**	0.805***	0.815***	0.8662**	0.858***	0.883***	.7129**	0.850***	0.875***
	[10.26]	(0.0285)	(0.029)	[4.64]	(0.0357)	(0.0370)	[11.26]	(0.0385)	(0.0398)
Student - School test score ptile (neg)	0.995	0.899***	0.898***	0.8324**	0.886***	0.885***	1.1809**	0.808***	0.784***
	[0.16]	(0.0338)	(0.034)	[5.75]	(0.0352)	(0.0352)	[4.78]	(0.0324)	(0.0317)
Student services + auxilary expend. ($1000)			1.457***			1.371***			1.209***
			(0.045)			(0.0496)			(0.0281)
Albouy QOL index			0.308***			0.232***			0.0837***
			(0.113)			(0.104)			(0.0319)
Has Div1 Basketball/Football			1.202***			1.200***			1.212***
			(0.054)			(0.0629)			(0.0593)
% of Students who join Frat/Sor			2.421***			2.095***			2.052***
			(0.322)			(0.358)			(0.293)
Individuals	5,666			4881			5,693		
Observations	12118588	4108256	4108256	9,651,768	2566527	2566527	15,011,370	4006240	4006240

Notes: [z-statistics] or (standard errors) reported below odds ratio. *** p<0.01, ** p<0.05, * p<0.1. All specifications also include a square and cubic in distance, square in cost, expenditure squared, and student-school match variables squared. BTL does not interact % faculty with PhD or student-school match variables with sector (2-year or 4-year), so our estimates for 4-year college students only are not directly comparable.

Table 11: Conditional Logit Estimates of the Predictors of College Choice

Independent Variables	(1)	(2)	(3)	(4)	(5)	(6)
Log (Tuition + Fees)	0.330***	0.365***	0.317***	0.292***	0.300***	0.331***
	(0.005)	(0.005)	(0.004)	(0.004)	(0.005)	(0.004)
Log (Distance)	0.271***	0.275***	0.271***	0.273***	0.258***	0.317***
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.001)
Log (Spending on Student Services/fte)	2.325***		2.185***	1.544***	2.379***	1.992***
	(0.053)		(0.051)	(0.032)	(0.061)	(0.040)
Log (Spending on Instruction/fte)	1.191***		1.076***	1.455***	1.490***	0.995
	(0.030)		(0.030)	(0.036)	(0.048)	(0.024)
Quality of Life in College Location		0.114***	0.169***	0.258***	0.195***	0.152***
		(0.022)	(0.034)	(0.049)	(0.043)	(0.027)
School Mean SAT (percentile)		1.019***	1.010***	1.016***	1.015***	1.009***
		(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Willingness to pay for:						
log(Distance)	-1.177	-1.280	-1.135	-1.053	-1.126	-1.037
log(Student spending)	0.761		0.680	0.353	0.720	0.623
log(Instructional spending)	0.158		0.0638	0.305	0.331	-0.00473
Quality of Life in College Location (mean 0, sd 1)		-2.151	-1.545	-1.101	-1.357	-1.706
School Mean SAT (percentile)		0.0187	0.00842	0.0133	0.0127	0.00797
Enrollment Controls	yes	yes	yes	no	yes	yes
Restricted choice set	no	no	no	no	yes	no
Full sample	no	no	no	no	no	yes
Number of observations	1,727,200	1,727,200	1,727,200	1,727,200	1,423,125	
Number of students						

*** p<0.01, ** p<0.05, * p<0.1

Notes: Odds ratios and s.e. shown above.

Table 12: Conditional Logit Estimates of the Predictors of College Choice, Interactions with Student Ability and SES

		Interactions with standardized 12th Grade Math Score:			Interactions with student self-reported importance of:		
Independent Variables	Baseline	Main Effects	Math Score	Family SES	Main Effects	College social life	College expenses
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Log (Tuition + Fees)	0.317***	0.279***	1.053***	1.181***	0.292***	1.036**	0.831***
	(0.004)	(0.004)	(0.016)	(0.018)	(0.005)	(0.017)	(0.018)
Log (Distance)	0.271***	0.267***	1.058***	1.159***	0.258***	1.069***	0.802***
	(0.002)	(0.002)	(0.008)	(0.009)	(0.002)	(0.009)	(0.009)
Log (Spending on Student Services/fte)	2.185***	2.006***	1.459***	1.104***	2.122***	0.895***	0.841***
	(0.051)	(0.048)	(0.044)	(0.033)	(0.055)	(0.027)	(0.035)
Log (Spending on Instruction/fte)	1.076***	0.827***	1.053**	1.099***	0.899***	1.098***	0.769***
	(0.030)	(0.025)	(0.026)	(0.027)	(0.029)	(0.028)	(0.027)
Quality of Life in College Location	0.169***	0.128***	0.729	3.076***	1.007***	0.787	0.396***
	(0.034)	(0.027)	(0.163)	(0.677)	(0.001)	(0.179)	(0.124)
School Mean SAT (percentile)	1.010***	1.017***	1.018***	1.007***	0.161***	0.997***	0.983***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.038)	(0.001)	(0.001)
Historically Black College x Black Student		9.030***					
		(0.662)					
Historically Male College x Male Student		0.904					
		(0.101)					
Historically Female College x Female Student		1.986***					
		(0.137)					
Catholic College x Catholic Student		3.236***					
		(0.158)					
Protestant College x Protestant Student		1.883***					
		(0.082)					
Number of observations							
Number of students							

Notes: Odds ratios and s.e. shown above.

Table 13: Willingness to pay for various college attributes, by student ability and SES

College Attribute	Student Type	Willingness to pay
log Distance	Average ability, average ses	-1.037
	Higher ability, average ses	-1.034
	Lower ability, average ses	-1.039
	Average ability, higher ses	-1.060
	Average ability, lower ses	-1.019
School mean SAT (percentile)	Average ability, average ses	0.0129
	Higher ability, average ses	0.0283
	Lower ability, average ses	-0.00134
	Average ability, higher ses	0.0209
	Average ability, lower ses	0.00673
Student Instruction Expenditures	Average ability, average ses	-0.149
	Higher ability, average ses	0.154
	Lower ability, average ses	-0.428
	Average ability, higher ses	-0.0820
	Average ability, lower ses	-0.201
Student Service Expenditures	Average ability, average ses	0.546
	Higher ability, average ses	0.612
	Lower ability, average ses	0.486
	Average ability, higher ses	0.418
	Average ability, lower ses	-0.0820
Quality of life of school location	Average ability, average ses	-1.615
	Higher ability, average ses	-1.941
	Lower ability, average ses	-1.313
	Average ability, higher ses	-0.844
	Average ability, lower ses	-2.207

Notes: Willingness to pay measured in terms of log Tuition Costs

Table 14: Conditional Logit Estimates of the Predictors of College Choice, Interactions with Student Cohort

VARIABLES	1972	1980	1992	2004
Log (Tuition + Fees)	0.210***	0.252***	0.391***	0.325***
	(0.008)	(0.011)	(0.010)	(0.008)
Log (Distance)	0.277***	0.277***	0.248***	0.283***
	(0.004)	(0.004)	(0.004)	(0.003)
Log (Spending on Student Services/fte)	2.707***	3.543***	2.077***	1.485***
	(0.118)	(0.201)	(0.106)	(0.056)
Log (Spending on Instruction/fte)	0.915	1.027	1.281***	1.039
	(0.051)	(0.069)	(0.073)	(0.046)
Quality of Life in College Location	0.307***	0.508	0.076***	0.262***
	(0.128)	(0.260)	(0.031)	(0.087)
School Mean SAT (percentile)	1.009***	1.003**	1.011***	1.022***
	(0.001)	(0.001)	(0.002)	(0.001)
Willingness to pay for:				
log(Distance)	-0.824	-0.934	-1.482	-1.124
log(Student spending)	0.639	0.919	0.778	0.352
log(Instructional spending)	-0.0573	0.0193	0.263	0.0337
Quality of Life in College Location (mean 0, sd 1)	-0.758	-0.493	-2.743	-1.193
School Mean SAT (percentile)	0.00593	0.00192	0.0116	0.0193

Notes: Odds ratios and s.e. shown above.

Table 15: Conditional Logit Estimates of the Predictors of College Choice, Interactions with Student Cohort, Ability and SES

Independent Variables	1972	1980	1992	2004
Log (Tuition + Fees)	0.178***	0.223***	0.339***	0.288***
	(0.007)	(0.010)	(0.009)	(0.008)
Log (Distance)	0.277***	0.275***	0.244***	0.275***
	(0.004)	(0.005)	(0.004)	(0.003)
Log (Spending on Student Services/fte)	2.506***	3.085***	1.928***	1.407***
	(0.116)	(0.185)	(0.105)	(0.056)
Log (Spending on Instruction/fte)	0.895*	0.817***	0.889*	0.772***
	(0.054)	(0.062)	(0.057)	(0.039)
Quality of Life in College Location	0.166***	0.318**	0.101***	0.199***
	(0.073)	(0.173)	(0.044)	(0.070)
School Mean SAT (percentile)	1.015***	1.011***	1.015***	1.029***
	(0.001)	(0.002)	(0.002)	(0.001)
Historically Black College x Black Student	7.974***	6.773***	13.504***	8.387***
	(1.297)	(0.909)	(2.122)	(1.162)
Historically Male College x Male Student	1.498*	1.835**	1.028	0.613***
	(0.345)	(0.488)	(0.236)	(0.112)
Historically Female College x Female Student	1.887***	1.929***	2.225***	1.724***
	(0.239)	(0.286)	(0.303)	(0.228)
Catholic College x Catholic Student	3.507***	3.182***	3.364***	3.323***
	(0.371)	(0.385)	(0.336)	(0.256)
Protestant College x Protestant Student	2.495***	2.003***	1.644***	1.608***
	(0.191)	(0.204)	(0.136)	(0.135)

Table 16: Willingness to pay, Interactions with Student Cohort, Ability and SES

College Attribute	Student Type	Willingness to pay 1972	1980	1992	2004
log Distance	Average ability, average ses	-0.745	-0.861	-1.304	-1.036
	Higher ability, average ses	-0.792	-0.839	-1.240	-1.021
	Lower ability, average ses	-0.704	-0.882	-1.363	-1.049
	Average ability, higher ses	-0.729	-0.873	-1.386	-1.061
	Average ability, lower ses	-0.759	-0.852	-1.244	-1.016
School mean SAT (percentile)	Average ability, average ses	0.00865	0.00729	0.0142	0.0233
	Higher ability, average ses	0.0178	0.0177	0.0318	0.0472
	Lower ability, average ses	0.000535	-0.00269	-0.00210	0.000770
	Average ability, higher ses	0.0135	0.0114	0.0285	0.0336
	Average ability, lower ses	0.00464	0.00392	0.00386	0.0157
Student Instruction Expenditures	Average ability, average ses	-0.0644	-0.135	-0.109	-0.208
	Higher ability, average ses	0.163	0.0841	0.430	-0.0418
	Lower ability, average ses	-0.267	-0.345	-0.609	-0.365
	Average ability, higher ses	-0.0998	-0.0371	0.124	-0.160
	Average ability, lower ses	-0.0348	-0.215	-0.276	-0.243
Student Service Expenditures	Average ability, average ses	0.533	0.751	0.607	0.274
	Higher ability, average ses	0.548	0.920	0.687	0.250
	Lower ability, average ses	0.519	0.590	0.532	0.297
	Average ability, higher ses	0.714	0.882	0.883	0.305
	Average ability, lower ses	0.382	0.643	0.408	0.251
Quality of life of school location	Average ability, average ses	-1.043	-0.764	-2.122	-1.296
	Higher ability, average ses	-1.605	-1.107	-2.454	-1.240
	Lower ability, average ses	-0.542	-0.436	-1.815	-1.350
	Average ability, higher ses	0.0414	-0.841	-2.069	-0.0349
	Average ability, lower ses	-1.949	-0.701	-2.161	-2.235

Notes: Willingness to pay measured in terms of log Tuition Costs

Figure 1

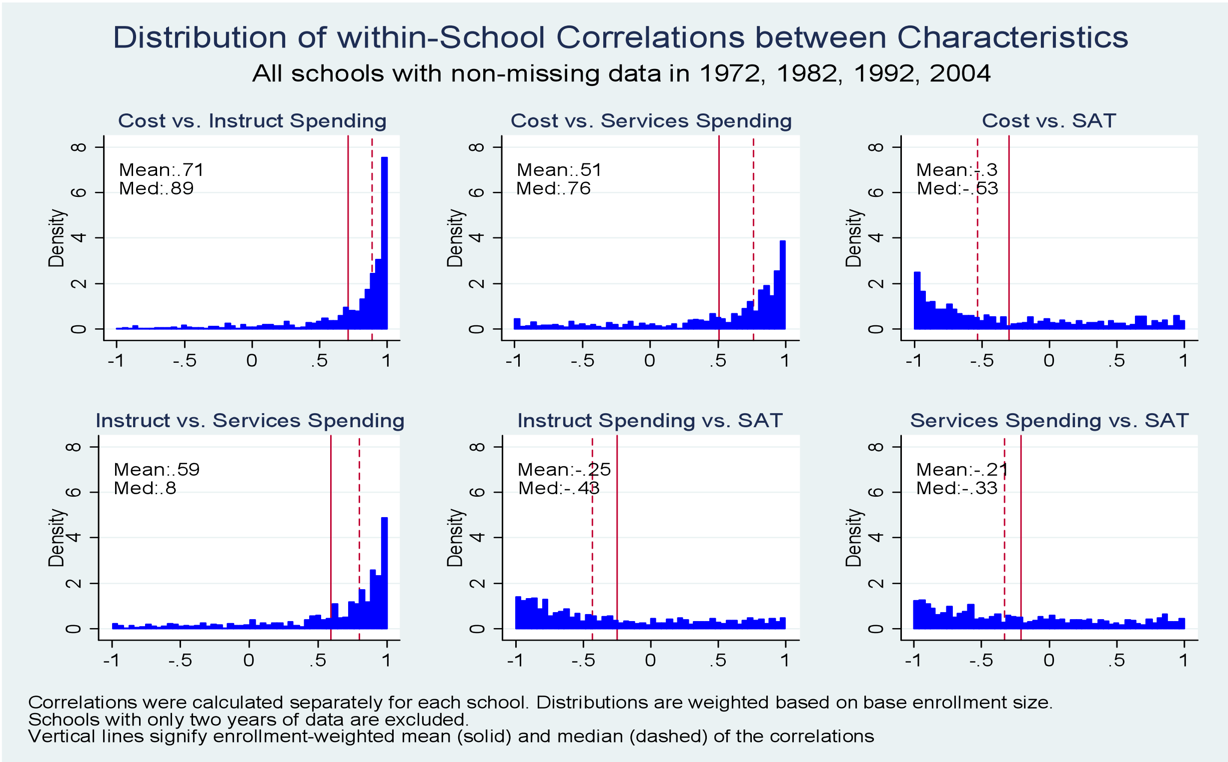

Distribution of within-School Correlations between Characteristics
All schools with non-missing data in 1972, 1982, 1992, 2004
Cost vs. Instruct Spending
Mean:.71
Med:.89
Cost vs. Services Spending
Mean:.51
Med:.76
Cost vs. SAT
Mean:-.3
Med:-.53
Instruct vs. Services Spending
Mean:.59
Med:.8
Instruct Spending vs. SAT
Mean:-.25
Med:-.43
Services Spending vs. SAT
Mean:-.21
Med:-.33
Density
0
2
4
6
8
-1
-.5
0
.5
1
Correlations were calculated separately for each school. Distributions are weighted based on base enrollment size.
Schools with only two years of data are excluded.
Vertical lines signify enrollment-weighted mean (solid) and median (dashed) of the correlations

Figure 2

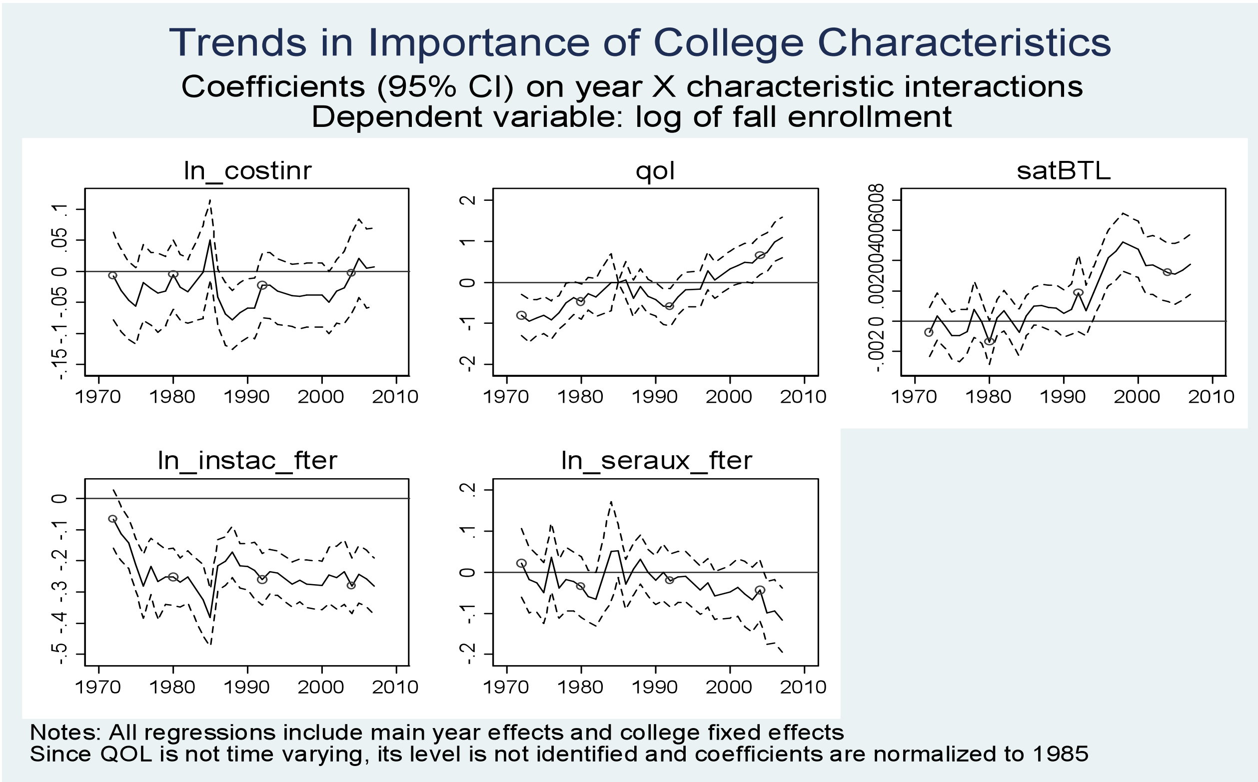

Trends in Importance of College Characteristics
Coefficients (95% CI) on year X characteristic interactions
Dependent variable: log of fall enrollment
ln_costinr
qol
satBTL
ln_instac_fter
ln_seraux_fter
1970
1980
1990
2000
2010
Notes: All regressions include main year effects and college fixed effects
Since QOL is not time varying, its level is not identified and coefficients are normalized to 1985

Figure 3

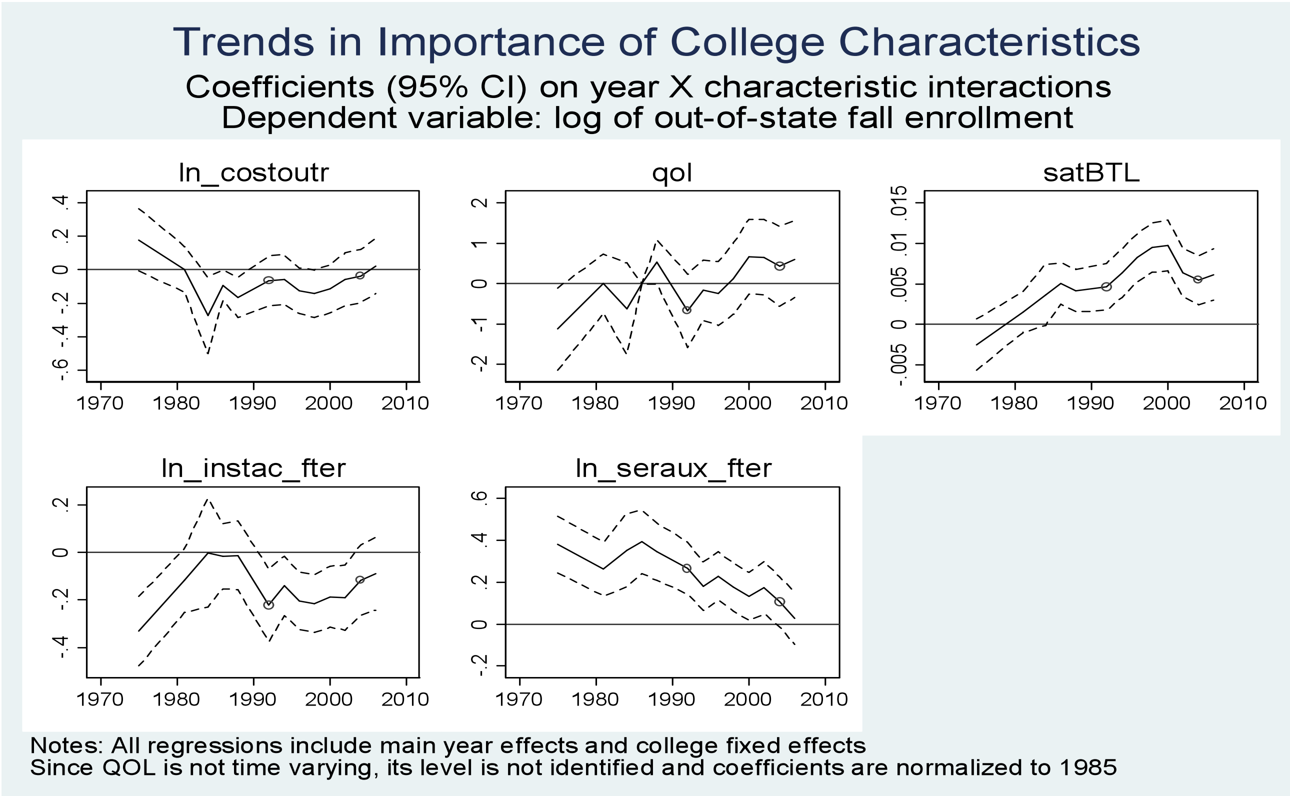
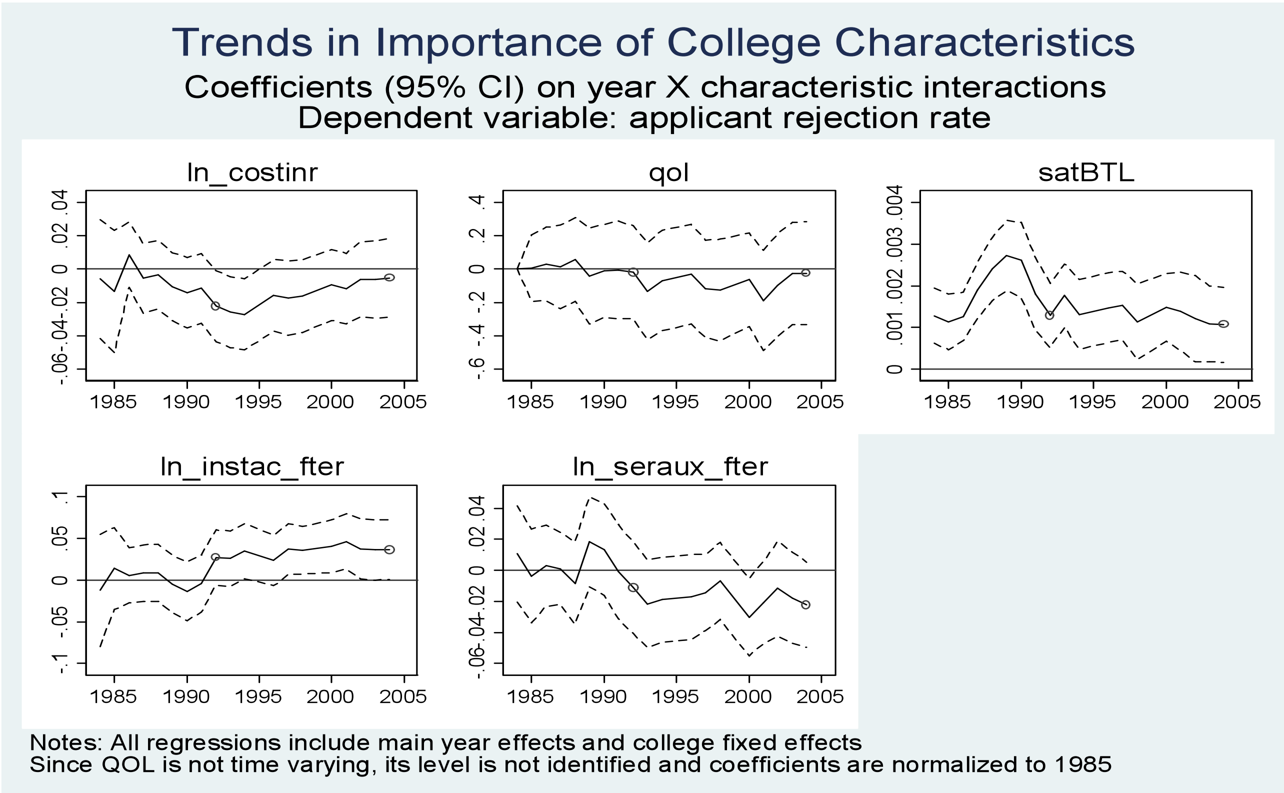

Trends in Importance of College Characteristics
Coefficients (95% CI) on year X characteristic interactions
Dependent variable: log of out-of-state fall enrollment
ln_costoutr
qol
satBTL
ln_instac_fter
ln_seraux_fter
-.6 -.4 -.2 0 .2 .4
-2 -1 0 1 2
-.005 0 .005 .01 .015
-.4 -.2 0 .2
-.2 0 .2 .4 .6
1970 1980 1990 2000 2010
Notes: All regressions include main year effects and college fixed effects
Since QOL is not time varying, its level is not identified and coefficients are normalized to 1985

Figure 4



Trends in Importance of College Characteristics
Coefficients (95% CI) on year X characteristic interactions
Dependent variable: applicant rejection rate
ln_costinr
qol
satBTL
ln_instac_fter
ln_seraux_fter
1985 1990 1995 2000 2005
Notes: All regressions include main year effects and college fixed effects
Since QOL is not time varying, its level is not identified and coefficients are normalized to 1985

Figure 5

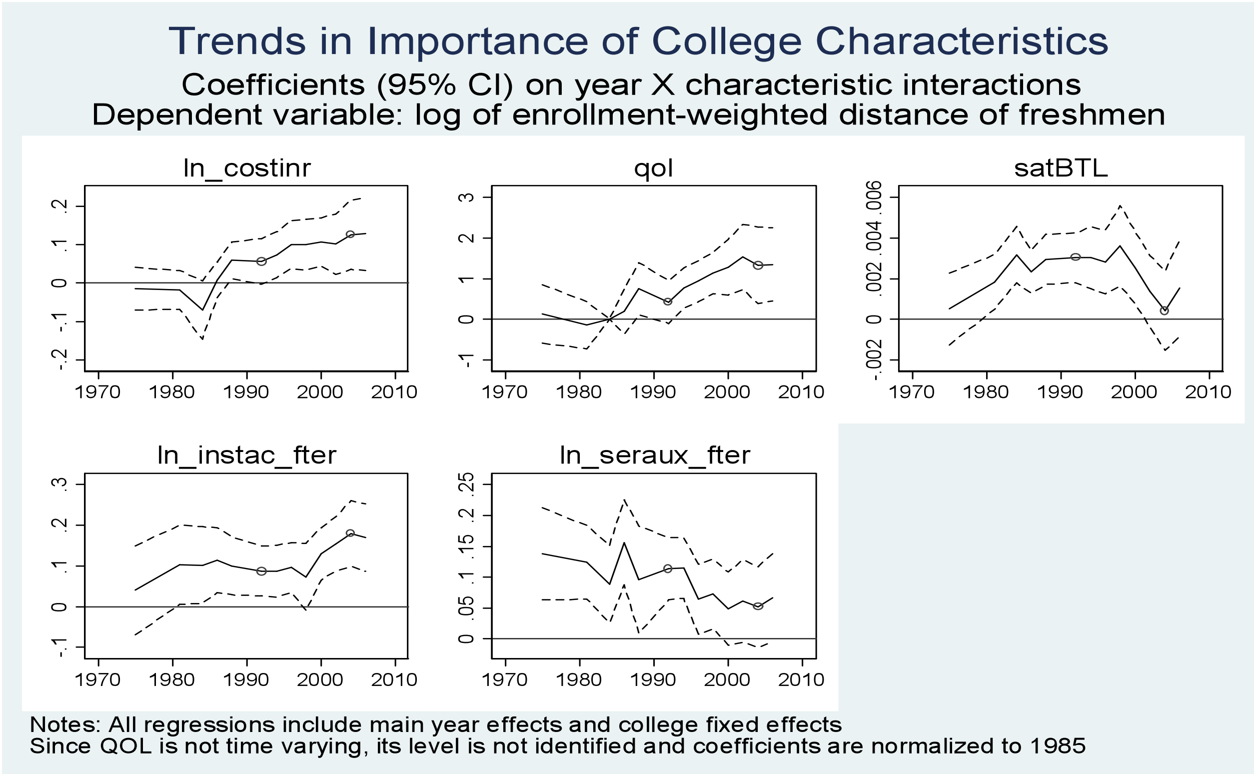
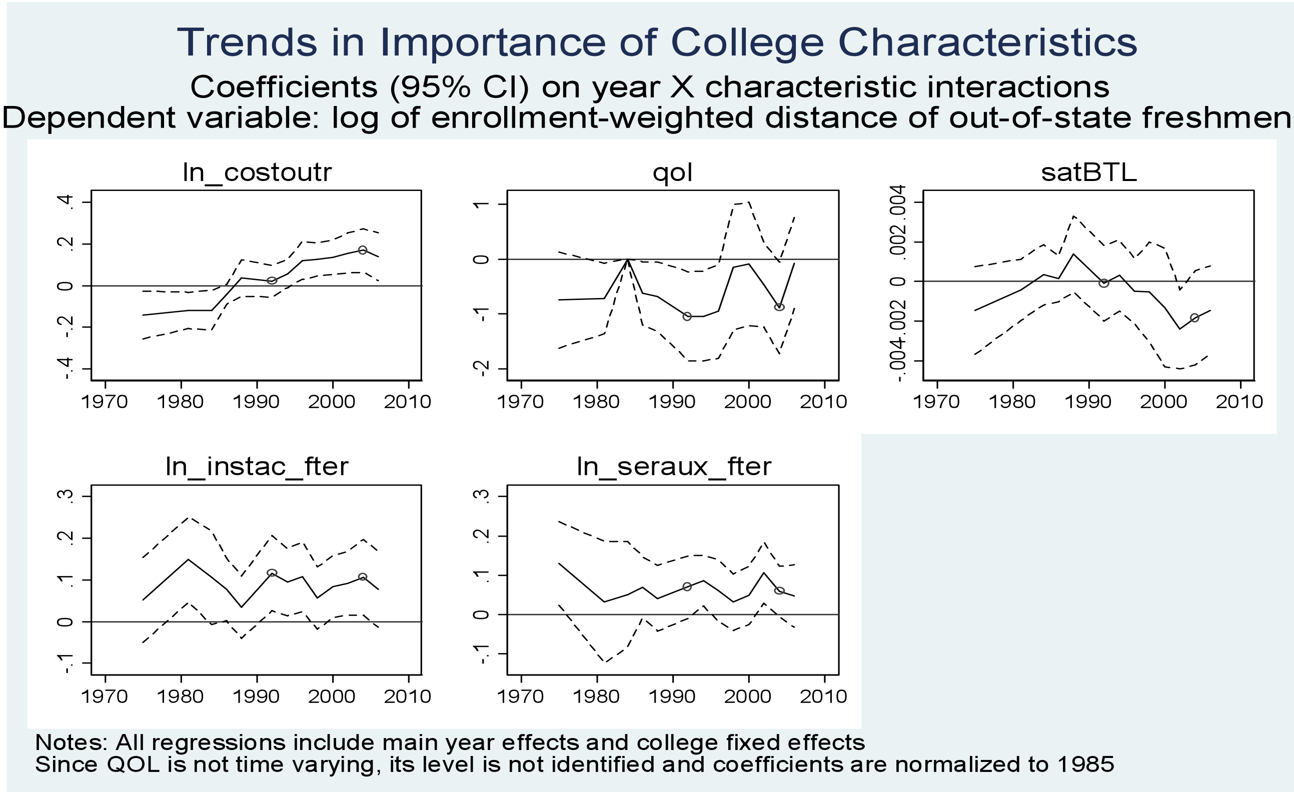

Trends in Importance of College Characteristics
Coefficients (95% CI) on year X characteristic interactions
Dependent variable: log of enrollment-weighted distance of freshmen
ln_costinr
qol
satBTL
ln_instac_fter
ln_seraux_fter
Notes: All regressions include main year effects and college fixed effects
Since QOL is not time varying, its level is not identified and coefficients are normalized to 1985

Figure 6



Trends in Importance of College Characteristics
Coefficients (95% CI) on year X characteristic interactions
Dependent variable: log of enrollment-weighted distance of out-of-state freshmen
ln_costoutr
qol
satBTL
ln_instac_fter
ln_seraux_fter
1970
1980
1990
2000
2010
Notes: All regressions include main year effects and college fixed effects
Since QOL is not time varying, its level is not identified and coefficients are normalized to 1985