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Does Quality Matter? An Hedonic Analysis of College Tuition Price

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Introduction

Nearly eighteen million students are currently attending college—over the last decade college enrollment increased by about four million students. According to CollegeBoard's latest report on college pricing, over that same period tuition prices at private four-year institutions have increased an average of 2.9% each year, even after accounting for inflation. At public four-year institutions tuitions prices have risen 4.4% in real terms each year over the same period (Baum & Ma, 2007). Additionally, federal student aid in the form of Pell grants showed increases from $7.9 billion in 1997-98 to $11.42 billion in 2001-02—an increase of 43% over five years.[1] However in the five years following those increases Federal Pell Grant aid actually decreased by 1%, dropping from 13 billion in 2002-03 to 12.8 billion in 2006-07(Baum & Steele, 2007).[2] These trends caused the average net price paid by students to increase as well. As students continue to pay increasing amounts of money for their education, one would hope that the institutions are likewise increasing level of quality of the education being received.

College administrators work to improve the quality of their schools to continue attracting new potential applicants. They must find ways to showcase their schools in an effort to maintain enrollment to continue running their operations. However, some theorists, like Abbott & Leslie (2002), have shown

[1] In constant (2006) dollars.
[2] In constant (2006) dollars.

that by simply increasing the tuition or entrance standards[3] at a particular institution, administrators are trying to elevate the perceived quality of the school with other schools with more elite reputations. This is known in economics as the Veblen effect. This effect is named after Thorstein Veblen, whose thoughts on conspicuous spending offered a one of the first critiques on consumerism in the late nineteenth century. A Veblen good is one in which its demand will increase as a direct function of its price (Leibenstein, 1950). Luxury cars and diamonds are goods which are often considered to be Veblen goods.

Yet the concept of quality in an educational setting has no clear-cut definition. There are organizations such as The US News and World Report or Newsweek that organize institutional data and compute rankings of colleges. These organizations use statistics provided by educational institutions often through the Common Data Set Initiative. This initiative is a collaboration by publishers of these rankings and the CollegeBoard as a means "…to improve the quality and accuracy of information provided to all involved in a student's transition into higher education, as well as to reduce the reporting burden on data providers"(www.commondataset.org). The rankings put out by these publishers utilize different aspects of the data available to them and establish different weights on many characteristics, which results in different rankings and views on quality by these organizations. For example, US News and World Report rankings base 10% of their ranking on the financial resources of the educational

[3] Abbott & Leslie examined universities in the UK and compared enrollment data with other institutional statistics like entry grades which are similar to SAT Standards in the US system.

institution (Flanigan & Morse, 2007). Table One provides for more information about the methodology of U.S. News & World Report's college rankings.

Table 1 Methodology of College Rankings
from US News & World Report discussion of rankings.

Ranking Category	Category Weight		Subfactor	Subfactor Weight	
	National Universities and Liberal Arts Colleges	Universities Master's and Baccalareaute Colleges		National Universities and Liberal Arts Colleges	Universities Master's and Baccalareaute Colleges
Peer assessment	25%	25%	Peer assessment survey	100%	100%
Student selectivity (Fall 2006 entering class)	15%	15%	Acceptance rate	10%	10%
			High school class standing—top 10%	40%	0%
			High school class standing—top 25%	0%	40%
			SAT/ACT scores	50%	50%
Faculty resources (2006)	20%	20%	Faculty compensation	35%	35%
			Percent faculty with top terminal degree	15%	15%
			Percent full-time faculty	5%	5%
			Student/faculty ratio	5%	5%
			Class size, 1-19 students	30%	30%
			Class size, 50+ students	10%	10%
Graduation and retention rate	20%	25%	Average graduation rate	80%	80%
			Average freshman retention rate	20%	20%
Financial resources	10%	10%		100%	100%
Alumni giving	5%	5%	Average alumni giving rate	100%	100%
Graduation rate performance	5%	0%	Graduation rate performance	100%	0%
Total	100%	100%	—	100%	100%

(www.usnews.com)

The purpose of this paper is to explore the factors that ultimately make up the concept of quality in college institutions. Using several proxies to measure this concept of quality, this paper will seek to determine what effect the qualities of institutions have on tuition prices. By assessing this relationship, conclusions will be drawn about colleges' tuition prices as they pertain to the calculated value of the education being received. Before exploring these factors the paper will first set out to discuss the current trends involved with college tuition, specifically those trends involved in four-year private institutions. Then, a discussion of past research on quality as it relates to education. Following that will be the theoretical model to be used in the analysis, with details about each variable to be used. An overview of the data will be followed by the results of the analysis. After that, the conclusions and implications of the analysis will be discussed. Finally, an appendix, showing detailed regression data as well and endnotes and references will be included.

Trends in Tuition

On average, tuition levels across the country have increased greatly since the late 1970's. Tuition levels at both four-year private and four-year public institutions are almost ten times higher (8.78 and 9.44, respectively) in 2007-08 than they were in 1977-78 (Baum & Ma, 2007). Adjusting for inflation over that same period, prices today are more than twice what they were thirty years ago. The following graphic, Table 2, shows tuition price trends in constant dollars over the last ten years. It should be noted that

Table 2
Tuition and Fees—Constant (2007) Dollars

Academic Year	Private Four-Year	Annual % Change	Public Four-Year	Annual % Change
1997-98	$17,823	—	$4,022	—
1998-99	$18,715	5.0%	$4,131	2.7%
1999-00	$19,307	3.2%	$4,183	1.2%
2000-01	$19,337	0.2%	$4,221	0.9%
2001-02	$20,353	5.3%	$4,411	4.5%
2002-03	$20,778	2.1%	$4,715	6.9%
2003-04	$21,342	2.7%	$5,231	11.0%
2004-05	$21,991	3.0%	$5,624	7.5%
2005-06	$22,208	1.0%	$5,814	3.4%
2006-07	$22,746	2.4%	$5,918	1.8%
2007-08	$23,712	4.2%	$6,185	4.5%

(Baum & Ma, 2007, p.10)

among four-year institutions tuition price has outpaced inflation in each of the past ten years. The largest increase in private tuition price can be found from the years 2000-01 to 2001-02, at an annual increase of 5.3% with the public tuition reaching as high as an 11% increase in 2003-04. Additionally, looking at all ten yearly increases, there are only two years in which the inflation-adjusted increase is 1% or less. Attending a private four-year institution in 2007-08 will cost a student about 33% more in inflation adjusted dollars than it would have cost in 1997-98. To understand why tuition levels have increased over the last thirty years certain inputs to the education system should be considered. Some of these inputs are discussed in the next section.

Causes of Increased Tuition Price

There are certain easily identifiable inputs that could cause an increase in the tuition price by educational institutions. Since college is a labor intensive

industry, faculty, administrative, support staff and other workers' salaries make up a large part of a school's budget. By increasing the number of faculty, a school increases its costs. In order to pass some of these increased costs onto the students, schools charge an increased tuition. Construction of new buildings or renovating dormitories could also be likely causes of increased tuition. Most campuses additionally provide services and amenities that were not as widely available thirty or more years ago. These services often include fitness centers, health insurance, increased dining hall options, as well as others. Often institutions are able to essentially function as a self-sustaining being, with little need for students to leave campus for any service or activity unless they choose to leave.

Vedder (2004), however, claims part of the reasoning behind the rising costs is the inefficiency of the post-secondary education system. He claims from the introduction of his book that the productivity of college personnel is declining based on his observations that: "it takes *more* professors and college administrators to educate a given number of students" (2004, pg. xv). That is, schools have continued to increase the number of faculty while holding their enrollments relatively constant. This measure, the student-faculty ratio, is used by ranking organizations such as Newsweek or US News and World Report to denote higher quality. A lower student-faculty ratio demonstrates a higher likelihood of one-on-one student interaction. Vedder's research also points to data showing a decline in composite GRE scores from 1965 to 2000. He also states that students receiving a doctorate in 1999-2000 took, on average, 10.3

years to complete their doctorate after they received their undergraduate degree. This figure is 1.3 years longer than it took doctoral students in 1978-79 to complete their studies. Vedder goes further to say that the reason behind the waning productivity is a result of the largely non-profit market where most of these institutions reside. Cutting costs will have little to no impact on the presidents and other top administrators or committees responsible for much of the financial decision making at the institution.

A similar circumstance in the management of education institutions has prompted Ehrenberg (2002) to cite the organizational make-up of many colleges and universities as a main cause to tuition increase. Ehrenberg looks to larger universities and the management of their smaller individual colleges by deans, saying:

> "Once in office, if a dean is successful at fund raising and external relations, and maintains faculty support, it is difficult for a provost or president to penalize or remove the dean for failing to cooperate in university-wide initiatives. Thus, central administrators have limited power to influence the actions of deans, whose interests most often lie with their own colleges rather than the broader institution" (2002, p.163).

He argues that while at most of these institutions each college is responsible for strengthening its standing at the institution, individual departmental decisions might always be for the best of the department, but they are rarely the best for the institution as a whole.

Quality Measures in Previous Literature

College Rankings

The notion of college quality has been discussed and researched recently, but the concept of quality has been especially prevalent in research over the last few years, due at least in part, to the recent increases in tuition. College quality has also become an increasingly interesting topic with the growth in availability of third-party ranking systems such as Newsweek or U.S.News and World Report. These ranking organizations utilize statistical data such as retention rates, graduation rates, student/faculty ratio, as well as including some form of schools' reputations. By applying different weights to sections these ranking organizations establish their basis for quality in education (Flanigan & Morse, 2007).

These ranking organizations are of particular importance in this research because they are a major source of information about colleges to many college-bound high school students and their families. Research by Ehrenberg & Monks (1999), confirms that the information and rankings supplied by these organizations has an effect on enrollments at college institutions. Their study found that a school whose rank improved from 10^{th} to 6^{th} showed an increase in freshman SAT scores in the following year, indicating that higher aptitude students were applying to schools with higher rankings. Their study also showed that in the year after a school dropped in the rankings the percent of applicants accepted increased—likely due to fewer total applicants—and fewer acceptances from its admitted students occurred. Another important conclusion from the study showed that sometimes slight year to year modifications in the ranking

organization's methodology caused larger variations in the rankings themselves. For instance California Institute of Technology jumped from 9th place in 1998 to 1st place in 1999 mostly due to tweaks in U.S. News' methodology that year.

These ranking organizations have been criticized by college administrators for various reasons. Reed College has refused to participate in U.S.News and World Report college rankings since 1995. Their president, Colin Diver, has stated of the rankings: "They are primarily measures of institutional wealth, reputation, influence, and pedigree. They do not attempt, nor claim, to measure the extent to which knowledge is valued and cultivated "(reed.edu). Additional criticism of the college ranking organizations led the Annapolis Group—an alliance of more than one-hundred independent liberal arts colleges—to urge their members not to participate in the reputational survey which accounts for a quarter of the rankings established by U.S.News and World Report (Thacker, 2007). The Annapolis Group's displeasure with the survey was regarding:

> "The largest single factor in the U.S. News rating formula is a reputational score compiled from a survey that asks college presidents, provosts and admissions deans to rank schools' academic programs on a scale of one to five. It is unrealistic to expect academic officials to know enough about hundreds of institutions to fairly evaluate the quality of their programs "(Will, 2007, A15).

Additionally, Ehrenberg (2002) also makes a specific mention of criticism of the published rankings of institutions; he argues these ranking organizations place a heavy weight on an institution's financial spending per student, adding: "no administrator in his or her right mind would take actions to cut costs unless he or she had to"(p.16). Cutting costs, according to Ehrenberg, would negatively

affect the college's standings in the ranking polls. Financial resources account for 10% of the rankings in the U.S. News and World Reports ranking system. From their own website explaining the methodology of the rankings Financial Resources are: "measured by the average spending per full-time-equivalent student on instruction, research, public service, academic support, student services, institutional support, and operations and maintenance…" (US News, 2007, p. 2) Therefore if a school were to reduce costs in an attempt to reduce tuition prices, then the school would suffer in the rankings and would risk their own perception of quality in cutting costs to reduce tuition.

Single vs. Multiple Proxies for Quality

Understanding there are many components that might determine quality in the educational setting, it makes sense that these ranking organizations use many factors in determining the role of quality in educational institutions, although some researchers have included as a measure of quality only one or two variables such as admission selectivity rates and number of years in school attended (Weisbrod and Karpoff 1968; Wales 1973; Solmon 1975; Solmon and Wachtel 1975; Wise 1975; Morgan and Duncan 1979). But as is pointed out by Loury & Garman (1995) these earlier studies failed to acknowledge that the components of college education—choices among college selectivity, grades, and major—must be considered simultaneously. The studies of the past used a single variable because it was readily available, simple and did measure an aspect of education that could be argued to represent quality. However, the Loury and Garman study,

which used a combination of several of these related variables and compared them to the previous research, found differences demonstrating greater significance in combining these variables.

Variables that Loury & Garman used as measures of educational quality were SAT scores, number of years of college attendance, grade point average, and an interaction variable relating a person's own SAT score with the median SAT score of the college they attended—used as a measure of college selectivity. Using this data, Loury and Garman concluded the following:

> "Since choices among college grades, college major, and college selectivity are correlated holding years of schooling constant, the omission of one of these may bias estimates of the others. In particular, past studies fail to control for differences in G, college performance, or in *PZ*, the difficulty of gaining admission to more selective colleges. As indicated earlier, such an omission may bias estimates of the effects of college selectivity downward if lower values of P_Z are associated with poorer college performance or upward if lower values of P_z are associated with better performance"(1995, p.293).

While these earlier studies were able to obtain significant findings using just one or two factors to measure quality, this research shows that by including more variables, greater significance can be achieved. More recently, researchers such as Zhang (2005), Black & Smith (2006), and Strayer (2002) have supported the idea that multiple proxies for quality are necessary to reduce errors in measurement.

Zhang's (2005) research initially set out to discover what effect using different measures of quality would have on the eventual earnings of college-bound students. Zhang used several proxies for quality by using Barron's ranking system—which ranks intuitions on a scale of 1-5 based on students' entering class rank, high school GPA, average SAT score, and percentage of students admitted.

Zhang also used the Carnegie Category system to break down several types of schools to compare differences in quality. Additionally, Zhang used SAT score to separate schools into high-quality institutions (having an average SAT score higher than 980), middle-quality institutions (having average SAT scores between 885 and 980) and low-quality institutions (having average SAT scores below 885).[4] Zhang used these three different quality measures separately with the same data set to compare the difference in significance and effect of each on graduates' earnings.

Using these proxies for quality, Zhang discovered that a school might be classified as a "high quality" institution using one variable, but could be a "medium quality" institution using another variable. This led to many differences in the opinions in past research involving the effect of quality of education on earnings. Using mean SAT scores of entering freshman, Zhang found graduates from high-quality private institutions enjoyed 10% higher average annual earnings compared to low-quality private institutions. The effect was much larger at each level when using the Barron's ranking order, generally resulting in figures suggesting 20-40% increase in annual earnings for graduates of high-quality institutions over those from low quality institutions. The findings presented by Zhang found:

> "In studying the relationship between college quality and graduates' earnings, researchers often measure college by a single index, which is not capable of capturing the complexity of higher education institutions; thus any conclusion based on a particular measure of college quality may be misleading"(Zhang, 2005, p.589).

[4] This SAT score method is consistent with a similar study by Thomas (2000, 2003) relating college quality and earnings.

Zhang goes on to suggest that even using the *best* measure of quality would not compare to using multiple proxies for quality and would be reflected in the results put forth by those studies.

Black & Smith (2006), after researching other studies relating college quality and earnings, also disagreed with the trend of using one proxy for quality. Instead, these researchers use a series of proxies in an attempt to reduce the likelihood of measurement error. The college quality variables they use are: faculty-student ratio, admissions acceptance rate, freshmen retention rate, mean SAT score of incoming freshmen, and mean faculty salaries. Black and Smith utilized a General Method of Moments (GMM) estimation to compare each variable individually and compare it to using all the variables simultaneously. In using this GMM estimator the findings of this study "…indicated that papers in the existing literature that seek to estimate [college quality] using a single proxy for latent college quality likely underestimate the labor market effects of college quality" (Black & Smith, 2006, p.724). Black & Smith further conclude:

> "Specifically, our [generalized method of moments] estimator, which builds on a generalization of the classical measurement error model and makes use of information on four additional proxies for college quality[5], suggests a downward bias of around 20% relative to just using the SAT variable as a single proxy for quality"(p. 724).

This finding again demonstrates the importance of using multiple proxies for college quality.

[5] The four additionally quality variables were: faculty-student ratio, rejection rate, freshman retention rate, mean faculty salaries

Much of the past research involving a study on college quality is related to establishing a connection between the quality of the college attended and eventual earnings in the labor force (Weisbrod and Karpoff 1968; Wales 1973; Solmon 1975; Solmon and Wachtel 1975; Wise 1975; Morgan and Duncan 1979; Loury & Garman 1995: Zhang, 2005; Black & Smith 2006). Strayer (2002), however, attempts to extend the research further to include the quality of high school education, which ultimately leads to the choice in college. Strayer uses student-to-teacher ratio and percentage of high school teachers with graduate degrees as the main determinants of high school quality with five other variables—school-level attendance rate, school-level dropout rate, highest grade completed, and two dummy variables for technical or agricultural curriculums—acting as a basis to hold the high schools on a level field. Strayer's research finds that students coming from a high school with a larger fraction of teachers with graduate degrees and/or a lower student-to-teacher ratio were more likely to attend a four-year college as opposed to a two-year college or no-college. While this study still does not directly address college quality, it demonstrates the significance of two important variables—student-to-teacher ratio and percent of faculty with a graduate degree—in addressing high school quality, which should translate to college quality.

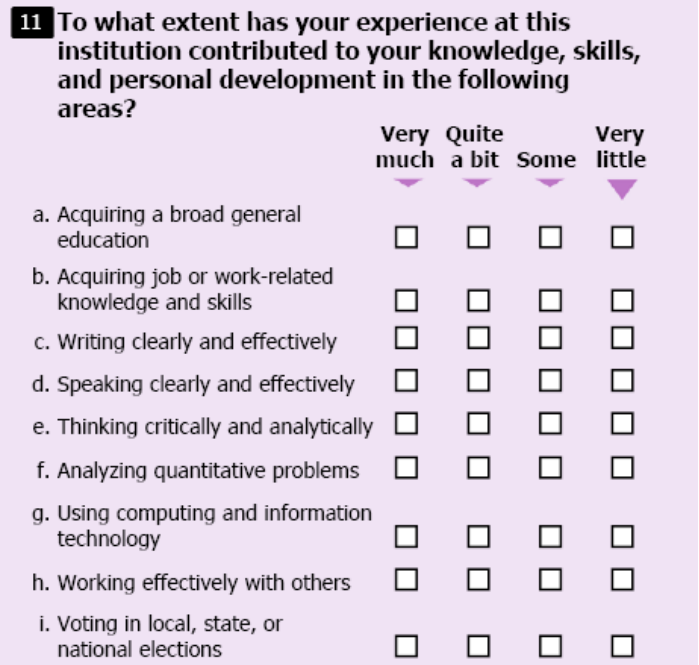
Variables: Quantitative or Qualitative?

In examining the factors that may attempt to measure quality, it is important to understand the nature of the variables. It is likewise important to understand the benefits and downfalls of each.

Quantitative measures as they relate to college quality are a numerical set of statistics usually involved with a school's enrollment financial, and/or faculty data. Statistics such as student-teacher ratio, retention rate, and faculty salaries are commonplace among studies using quantitative data because they can all be associated with quality of the institution and they are all readily available numbers from resources such as the Common Data Set (Strayer, 2002; Scafidi & Schwartz, 2004; Black & Smith 2006).

Qualitative measures are data that are often compiled through use of surveys or includes measures that may not be necessarily statistical in nature. Examples of qualitative data would be surveys filled out by graduating seniors on their experience at their educational institution, a measure of diversity at a given institution, and/or institution administrators filling out a reputational review of other similar institutions (Conrad & Pratt, 1985; Scafidi & Schwartz, 2004; Flanigan & Morse, 2007). However, an important aspect of these qualitative measures is that while many of these surveys may be qualitative in nature, the data they provide is often converted into ordinal data by ranking the answers from on a scale. An example of this type of data is often used by the National Survey of Student Engagement (NSSE), which uses series of questions to ascertain the

level of engagement by college students. Below is an excerpt from the NSSE Survey.[6]



11 To what extent has your experience at this institution contributed to your knowledge, skills, and personal development in the following areas?

	Very much	Quite a bit	Some	Very little
a. Acquiring a broad general education	☐	☐	☐	☐
b. Acquiring job or work-related knowledge and skills	☐	☐	☐	☐
c. Writing clearly and effectively	☐	☐	☐	☐
d. Speaking clearly and effectively	☐	☐	☐	☐
e. Thinking critically and analytically	☐	☐	☐	☐
f. Analyzing quantitative problems	☐	☐	☐	☐
g. Using computing and information technology	☐	☐	☐	☐
h. Working effectively with others	☐	☐	☐	☐
i. Voting in local, state, or national elections	☐	☐	☐	☐

The current trend is driving toward this survey-type data because it is proving to be more meaningful in explaining how colleges actually affect students. Proponents of qualitative assessment state that quantitative measures do not measure any amount of what is actually learned or experienced by the students (Conrad & Pratt, 1985). Assessments such as the NSSE are working to improve methods of qualitative assessment. NSSE has established a series of benchmarks which are based on the 42 questions in their survey. These benchmarks are: level of academic challenge, active and collaborative learning, student-faculty interaction, enriching educational experiences, and supportive campus environment. Researchers using NSSE believe maintaining satisfaction

[6] A complete copy of the 2008 NSSE Survey is located in the Appendix.

in these benchmark areas is essential to a positive effective learning experience (www.nsse.iub.edu).

The research and findings of NSSE are further supported by Kuh, Kinzie, Schuh, Whitt & Associates (2005) in their study: "Documenting Effective Educational Practice (DEEP)". This study examined twenty institutions that performed well according to the NSSE data findings and began a closer examination in an attempt to discover a pattern of practices that could be applied to any institution to elicit greater success.

> "Schools selected for the study had higher-than-predicted graduation rates and higher than-predicted scores on the five NSSE clusters of effective educational practice: level of academic challenge, active and collaborative learning, student interaction with faculty members, enriching educational experiences, and supportive campus environment" (nsse.iub.edu, 2007).

In visiting these schools and speaking and meeting with students, administrators and faculty at these schools, the researchers found that there is no exact science to maintaining an effective education institution. However, they did discover some common attributes of many of these successful institutions. Among these ideas is the belief that simply having the resources to educate does not lead to student success. A DEEP institution is one that induces higher percentages of students to utilize these resources. The researchers point to "the importance of a dense web of student success-oriented initiatives held together by redundant early warning systems and safety nets, such as Florida State University's early-alert system and Ursinus's academic warning slips" (2005, p.269).

Another area discussed was the overwhelming prevalence among DEEP institutions of culture components. It is this culture, the researchers noted, that

"represents in part tacit assumptions and beliefs that influence the substance policies, programs and practices as well as how they are implemented. Culture gives people a common language with which to communicate" (2005, p.273). The researchers describe how a strong culture creates diversity among members of a campus, while also bringing the campus together as a whole. Examples of culture components cited by the authors are often as simple as Winston-Salem State University's "Lamb to Ram" freshman orientation program which, "inspires confidence, builds a sense of membership in the community, and helps new students picture themselves as successful WSSU students"(p.120). Or Sweet Briar's sister program which pairs incoming freshmen with a junior student who helps the first year students to understand the Sweet Briar's traditions and events. A final example of culture components is found at Wabash College, an all-men's college whose code of conduct—often referred to as the Gentlemen's Rule—simply states:

> "'The College expects each student to conduct himself, at all times, both on and off campus, as a gentlemen and a responsible citizen.' As we noted [previously,] no other rule exists to govern student behavior at Wabash" (p. 122).

One administrator stated: "We focus on values here instead of rules. We say to young men, 'we trust you,' and they know we mean it" (p. 122). Kuh et al. go on to say: "Student success is advanced with the culture values talent development, academic achievement, and respect for human differences" (2005, p.273).

The overall conclusions of Kuh et al. (2005) are presented as a series of recommendations for maintaining a successful institution, but the researchers advise that it is not simply a checklist to ensure that an institution is working

towards students' success. True success is reflected through the institution's mission, along with how the student body perceives and believes in that mission. Equally important, is how well the administration interacts with and passes that mission onto the student body. Students who are challenged but lack support from the faculty and administration will refrain from optimal engagement. Likewise, an administration out of touch with its student body will lose track of its overall mission. From the prospective student to the alumni to the associate professor to the president, the institutions core culture and mission should be understood and upheld throughout all the daily activities of the institutions.

Not all researchers are satisfied with the growing trend towards qualitative data as a primary source of assessment. Conrad & Pratt (1985) break down several possible flaws involved with these types of assessments. In reputational surveys when administrators are called upon to rank their institutions as well as other similar institutions, there is an assumption made that the administrator is fully knowledgeable about the institutions in question. When administrators are unaware, they may either make an educated guess as to the quality or effectiveness of the other institutions, or simply decline to answer. These feelings were echoed by the statements of the Annapolis Group in their boycott of the reputational survey by U.S. News and World Report (Will, 2007).

Former students are also sometimes asked to participate in surveys to rate their own personal learning experience. These surveys, Conrad & Pratt (1985) state are often unreliable due to being influenced by "'alumni effects' where raters tend to rate highly their own alma maters" (p.605). These "alumni effects" cause

all the different sets of scores to be inflated. With these types of surveys, Conrad & Pratt (1985) also point out that students who graduate from institutions already perceived as of higher quality are more likely to participate in these surveys. Quality and perceptions of quality can also muddle qualitative assessments. This can especially be true when the institutions involved in the surveys are very well known.

> "…high visibility may even get in the way of people working toward quality by either being mistaken as quality or the reverse, being singled out for undue scrutiny. Either a comfortable acceptance of appearances or an over-zealous scrutiny will result in designs of indifference rather than ones of quality" (1985, p.606).

In other words, Conrad & Pratt argue that reviewers will look at a seemingly high quality institution, and simply mark it up for being "high quality" without any actual confirmation of the fact. Or, conversely, an institution with a negative history is placed under unnecessary scrutiny and held to a higher set of standards simply because of its visibility and the pre-existing stigma of poor quality—both situations lead to unfair results (1985). In understanding the possible downfalls in each type of assessment, a researcher must decide what type of data is most useful in their study and whether to use only one type of assessment or a combination of the two.

General Model

In developing a model to show the relationship between college price and the perceived quality of the given institutions, hedonic modeling seems most

appropriate. Hedonic modeling attempts to quantify the utility of a good and establish corresponding pricing levels. The first use of hedonic modeling was done by Waugh (1928), who compared physical characteristics of vegetables to their selling price in a fresh food market. The hedonic method was later undertaken by Court (1939) in studying automobiles. But hedonic modeling was not widely known until Zvi Griliches presented his work to the US Congress in 1961 on automobiles and quality. Griliches is credited with having formed the basis for modern hedonic price analysis.

In constructing this paper's hedonic price model to show the determinants of tuition price at college institutions, two studies were extensively used because of their relevance. Combris, Lecocq & Visser (1997) use a hedonic pricing model in looking at wines from the Bordeaux region of France. They utilized a panel of oenologists to sample about five-hundred wines and compared the taste ratings, published rankings of the wine quality, the vintage, and other label characteristics found on the bottle with the price of wine itself. Their study concluded that of the nine statistically significant variables in their equation, only two belonged to the sensory variables. This finding "suggests that the price of a wine is essentially determined by the objective characteristics of the bottle, i.e. the characteristics that are easily identifiable and identically perceived by all consumers" (1997, pg. 397).

While buying a bottle of wine and attending a liberal arts college are two very different events, the availability of measurable data for both is very similar. There are characteristics on a bottle of wine that a potential taster might perceive

to affect the quality of the wine positively or negatively. For instance, the wine could be a red or a white, it could be of a certain vintage, and it could have been ranked higher. Likewise measurable data in comparing college is very similar, one potential student may view a school with a larger enrollment to be of higher quality, or one with a higher student-faculty ration to be of lesser quality, but until the student actually gets a "taste" of that school they cannot really know the actual quality.

The second important study was undertaken by Scafidi & Schwartz (2004), who sought to create a quality adjusted net-price index for four year colleges. In using the study of Scafidi & Schwartz as a framework for the empirical modeling that will be used, certain assumptions must be made. First, for the purpose of this study it is assumed that attending college is a discrete commodity with several attributes that directly affect the utility of the education for those consuming it. Additionally, is assumed that the schools within the data set constitute the entire array of colleges available and the students attending those colleges are the whole college attending population. In other words, the purpose of this study will not be to examine the factors involved in decision process of potential college students. It is assumed that decision to attend the college in the data set has been made and these other factors are considered outside the model. Instead a hedonic price model examines those who have already purchased the good based on the attributes of the good; in this case those who have already chosen to attend various colleges base on the colleges traits.

In examining the relationship between tuition price and quality of the institution, the model will also include control factors, which often directly affect the costs incurred by the college and therefore should affect the amount charged by the institution. Lastly, several factors will be included, which may or may not necessarily influence quality but are believed to impact the tuition price—these factors will be referred to as time-invariant factors and fixed effects. Time-invariant factors are factors such as the location of the school, which will not change over time, or whether or not the school is in the National Collegiate Athletics Association is also a rather stable factor[7], as well as other unchanging characteristics of each individual school—culture components, or other traditions which may increase or decrease the value of a school over time.

Data and Empirical Model

This study covers data from the academic years 2001-02 through 2005-06, for 100 private liberal arts colleges, as defined by the Carnegie Classification system of 2000. The hedonic model for a given school *j* is:

$$P_{jt} = \beta_0 + \beta_q Q_{jt} + \beta_c C_{jt} + \beta_z Z_j + \beta Bj + \varepsilon \quad (1)$$

where P is the tuition and room and board price of the j college in year t; Q_{jt} are time varying quality parameters of college j, such as SAT scores, Student-Faculty Ratio, etc. in year t; C_{jt} is control factors of college j in year t, such as institutional grant aid per student; Z_j represents certain time invariant factors such as location,

[7] One institution, moved from the NAIA to the NCAA through the duration of the study period. This changed was reflected in the variables for those years.

year, and B_j represents a brand effect factor representing a separate dummy variable for each college j.

Colleges supply data to the Integrated Postsecondary Education Data System (IPEDS), a program of the National Center for Education Statistics. Much of this data is readily available to the public. IPEDS runs a website called College Opportunity Online Locater (COOL) aimed mainly at college bound students and their families as a tool for researching colleges. The data collected for this study was accessed through Association of Governing Boards of Universities and Colleges (AGB). Access to the AGB interface provided us with the ability to access the data sets used throughout this study. All AGB data, except endowment information is IPEDS derived. Data on institutional endowments was derived from the National Association of College and University Business Officers (NACUBO).[8] Table 3 delineates the independent variables used in the model.

[8] Some data information that was omitted by the AGB data set was filled in using various sets of additional information—often from the Common Data Set—was found from various schools sites. (See Appendix for more information regarding this matter.)

Table 3: Factors affecting College Tuition Price, Independent Variables Used in the Hedonic Model

Type	Variable	Label	Expected Sign
Quality Factor	SAT	Combined Math and Verbal SAT Scores at the 75th percentile	+
	HIGHENDOW	Value of 1 if school has an endowment larger than 378910000	+
	SFRATIO	Student-to-Faculty FTE ratio	-
	ACCEPT	Acceptance rate-Total FTFY Admitted as percent of Total FTFY Applicants	-
	GRAD	6-year graduation rate(%)	+
Control Factor	FINAID	Average Institutional Grant Per Student/Tuition	+
	SPENDPER	Average Instructional, Academic & Student Services Costs per student	+
	ENDOWPER	Endowment per student	-
	ENROLL	Enrollment-Undergrad Grand Total (FTE)	?
Time-Invariant & Fixed effect Factor	NCAA	NCAA Member Yes=1 All else=0	?
	BIGCITY	Campus located in large city or surrounding metropolitan area	?
	MIDCITY	Campus located in mid-sized city or surrounding metropolitan area	?
	TOWN	Campus located in a small or large town	?
	NESCAC	School is a member of the NESCAC	+
	CENTENNIAL	School is a member of the Centennial Conference	+
	SCIAC	School is a member of the SCIAC	+
	DEEP	School is a member of the DEEP research project	+
	BRAND	Name Brand Effect	?
		FFY-Full Time, First Year Students	
		FTE- Full-Time Equivilent	

Quality Factors

There are several factors included to represent quality in this model. The first of these variables is SAT, which represents the75th percentile of the incoming students' combined math and verbal SAT scores for each college.[9] This variable has been used in similar studies to represent quality in education with significant results (Black & Smith, 2006; Zhang, 2005; Scafidi & Schwartz, 2004; Ehrenberg & Monks, 1999). Since a higher SAT score represents a more qualified student, it is believed that this variable will have a positive effect on tuition price because a higher average SAT score means that the students at the college have higher aptitudes going into college. A prospective student should be willing to pay more to associate with those higher caliber students and to be associated with that school's perceived level of quality.

[9] For institutions which used ACT scores instead of SAT scores for admissions the 75th percentile Composite ACT score was used and then converted to an SAT score using the national concordance data developed by the Collegeboard and reiterated by Lavergne & Walker (2006)

The second variable is SFRATIO, the ratio of students to faculty at the institution. This ratio is often utilized by institutions as a demonstrator of smaller class sizes. Smaller class sizes, in turn, are believed to facilitate a greater interaction between each student and the professor. This study similarly adopts this belief, and takes the stance that this interaction between students and faculty will result in a higher quality education. Therefore it is expected that this ratio will have a negative effect on price because as the ratio increases, prospective students should be willing to pay more to attend a college, which comes with a greater likelihood of interaction with their professors and a higher likelihood of smaller classes.

The third variable making up the quality factor section, ACCEPT, is the percentage of students who applied to the institution divided by the number of students who were admitted. This variable represents quality because an institution with a higher selectivity is most often only accepting students at the top of their applicant pool. With only the "cream of the crop" being admitted, prospective students would be willing to pay to more to associate with this upper echelon of students. ACCEPT is expected to have a negative effect on tuition for this reason.

GRAD is the six-year graduation rate at each institution. Graduation rates demonstrate the education system is working, and as this number approaches 100% the school shows its commitment to their students in providing them with the means and resources to complete the tasks set out for them. An increase in this variable is expected to have a positive effect on tuition because an institution

with a higher graduation rate demonstrates the abilities of the students at that school. Prospective students would recognize this statistic and be willing to pay more in tuition dollars if they know a greater percentage of students are likely to graduate in less than six years.

The final quality variable, HIGHENDOW, is dummy variable given a value of one if the school's endowment is greater than $378,910,000. This value represents the third quartile and therefore separates and identifies the institutions in the top 25% in terms of endowment. This factor is expected to have a positive effect on tuition because a student would be willing to pay slightly more upfront if they believe that a school will provide more for them over the course of their years at the given institution. In this sense having a high endowment is seen as the school's ability to spend. Additionally, a high endowment can also be a reflection of a school's success, its ability to raise funds, or its influence on donors—which also reflects quality and students should be willing to pay more to attend a school with that aura of quality.

Control Factors

Some schools simply spend more money in their operating budgets. It would be assumed that any school that spent greater amounts of money would cost more to attend. To account for this, a couple variables are included in the model dealing with institutional costs. The first variable is called FINAID defined as the average amount of institutional grant aid dispersed by the college per student as a ratio of published tuition price. While the published tuition price

or “sticker price” is what is advertised as the cost for each student, very few students pay this full amount. Some students qualify for grants or scholarships based on their need or their previous academic accomplishments. These grants and scholarships come from the federal or state government, private companies or corporations, and sometimes the educational institution as well. While some students pay more than others, it is generally not known how much the financial aid package will be until after one has been accepted to a college. Therefore this measure of institutional aid would not play a role in choosing a college, but should have an effect on the cost of tuition. FINAID is expected to have a positive effect on tuition because as the school increases the amount of money that it is distributing to students the institution will have to recoup some of those costs in the form of higher tuitions.

A second control variable is SPENDPER, the average amount of institutional spending per student on instructional, academic & student services costs. This measure directly shows how much the institution is spending on the students attending the given school. Therefore, it is expected that SPENDPER will show a positive relationship with tuition price, because as the school spends more money educating students, they will need to recover some costs through tuition.

Another variable in this section is ENROLL, this is simply the student enrollment at the given institution. This variable is included for the purpose of being able to compare large and small schools on the same scale. This variable is again expected to have an ambiguous effect on tuition price. This variable might be one

best demonstrated by a quadratic function. There may be a certain point of enrollment which is commonly regarded as optimal, but after reaching that point the returns to increasing the student body further decrease. Students would be willing to pay a certain amount to have the enrollment numbers reach a certain level, but further increasing the number decreases the amount that students would be willing to pay.

The final control variable, ENDOWPER, is the school's endowment divided by its enrollment. A school's endowment is a measure of its fundraising efforts, its ability to expand, and in some cases the success of its alumni. A school with a larger endowment has a larger capability to attract and retain more qualified professors, build or renovate dormitories or academic buildings, or otherwise invest in the student body. A college with a larger endowment per student also has a greater capability to reduce its published tuition price because of its ability to back up the potential loss in tuition dollars with its endowment. It is these reasons that ENDOWPER is expected to have a negative effect on tuition price.

Time-Invariant & Fixed Effect Factors

The final set of variables is used to account for other factors involved in choosing a college. The first of these variables is called LOCALE and represents the degree of urbanization of the given institution. This variable is used by the

Carnegie Classification of Institutions of Higher Education. (See Table 2 for more information about how this variable is coded.)

Degrees of Urbanization		Value in Model		
Code	**Location of School**	Large City	Mid-size City	Large/Small Town
1	Large city	1	0	0
2	Mid-size city	0	1	0
3	Urban fringe of large city	1	0	0
4	Urban fringe of mid-size city	0	1	0
5	Large town	0	0	1
6	Small town	0	0	1
7	Rural	0	0	0

This variable is included to as a measure of personal taste. While one person may prefer an institution in a large city to one in a rural setting, the decision to choose one over the other is personal preference. The expected effect of this variable is ambiguous, because it largely depends on these personal tastes. One could argue that a school in a large city would be more expensive because of the increased costs of living and property value. However, people who dislike large cities may actually be willing to pay a higher price to attend an institution away from a larger city.

Taking into account where a school is located is also believed to have some effect on how much a prospective student would be willing to pay to attend a given college. In this model, the colleges will be broken down into four Locales: BIGCITY, MIDCITY, TOWN and Rural. BIGCITY will include schools located in a large city or within the metropolitan area of a large city. MIDCITY will include schools located in a mid-size city and the metropolitan

areas around mid-size cities. TOWN will include schools located in small to large towns, and finally, RURAL will include schools located in rural areas.[10]

The second variable in the institutional factors section of the model is NCAA, which is a dummy variable which will equal 1 for a school that is an NCAA member and zero for any institutions which are not members of the NCAA. The NCAA is the largest collegiate athletic association in the country, and has a strict set of standards for its members. These standards often force member schools to have a higher number of sports than other non-member institutions. Some students view sporting events as a great source of school spirit and entertainment, and would greatly value being in the NCAA, and would therefore be willing to pay more to attend such a school. However, some students, on the other hand, have no preference about sports, and may in fact prefer to attend a school whose reputation does not involve athletics and those students might be willing to pay more to attend a school with no NCAA affiliations.

Another variable that is included is called YEAR, this variable in included to show changes from year to year in tuition price. As has been noted, tuition prices have been increasing over the last several decades, so this variable is expected to have a positive effect on tuition, and will show the average variation in tuition price each year.

A series of athletic conference dummy variables is also included in the model. Conferences included in the model are the Centennial Conference, the

[10] Data for Locale was derived from Carnegie Classification Data from 2004. Data was supplemented using guidance from the US Census Bureau's Guidelines for determining cities, towns, and rural areas.

New England Small College Athletic Association (NESCAC), and the Southern California Intercollegiate Athletic Conference (SCIAC). These conferences were selected because of they each contain a series of colleges which have a reputation for being of a high quality. Five schools which took part in the DEEP research study which was previously mentioned also are in the data set, and this collection of schools is also included in a similar fashion with the athletic conferences. Each of these groupings is expected to have a positive effect on tuition because of the reputations of the schools within each conference. A prospective student is believed to be willing to spend more to get into a school within one of these groupings to be associated with that higher quality.

The final variable in the model, BRAND, is a brand effect variable. Since a school over time will develop a reputation this variable is used to pick up those effects. Each school will be coded by number, and act in a way as a dummy variable for itself. This variable will have an ambiguous effect, because it will be different from school to school. Setting a base school will provide a point of reference for comparison among all the included institutions.

Data

Table 4 provides descriptive statistics for the variables within the data set.[11] The data for this study involves cross-sectional data from one-hundred private liberal arts[12] colleges over the course of a five-year period, which is why

[11] An additional variable has been created in this table— ENROLLSQ is squared enrollment, understanding that the effects of enrollment may be a quadratic function.
[12] See Appendix for full list of schools included in this study.

the sample size, N, for all variables is 500. Within the data set, first looking at the published out-of-state tuition for all the colleges, the average tuition is

Table 4-Descriptive Statistics

Variable	Label	N	Mean	Standard Dev.	Min	Max
TUITION	Published out-of-state tution price	500	24,442.55	4,959.42	11,880	34,795
ROOMBOARD	Cost of room & board	500	6,978.71	1,322.74	3,900	11,126
SFRATIO	Student faculty ratio	500	11.04	1.98	6.20	16.40
ACCEPT	Acceptance rate	500	58.44	20.58	17.80	93.20
GRADRATE	6-Year graduation rate	500	76.88	10.38	43.50	100.00
ENROLL	Enrollment	500	1,714.00	616.98	386	3,579
SPENDPER	Instructional, academic & student services cost/student	500	22,013.05	7,518.98	9,371	48,959
FINAID	Institutional grant aid per student/tuition	500	55.86	11.82	13.82	92.79
SATACT	Combined 75th percentile math & erbal SAT score	500	1,340.42	95.67	1,080	1,560
ENDOWPER	Endowment per student	500	165,765.11	163,914.24	18,890.35	950,562.95
ENROLLSQ	Enrollment squared	500	3,319,354.15	2,309,437.33	48,996	12,809,241
NCAA	School is a member of the NCAA	500	0.98	0.15	0	1
HIGHENDOW	School has an endowment larger than 378910000	500	0.25	0.43	0	1
BIGCITY	Campus located in/near large city	500	0.31	0.46	0	1
MIDCITY	Campus located in/near mid-sized city	500	0.39	0.49	0	1
TOWN	Campus located in a small or large town	500	0.26	0.44	0	1
NESCAC	School is a member of the NESCAC	500	0.10	0.30	0	1
CENTENNIAL	School is a member of the Centennial Conference	500	0.07	0.26	0	1
SCIAC	School is a member of the SCIAC	500	0.07	0.26	0	1
DEEP	School is a member of the DEEP research project	500	0.05	0.22	0	1

$24,442.55—with a maximum tuition price of $34,795 and a minimum of $11,800. The average cost of room & board within the study is just $6,978.71, with a maximum of $11,126 and a minimum of $3,900. The highest student faculty ratio in the data set was 16.4 with a minimum of 6.2 and an average of 11.04.

Acceptance rates varied from 17.8% to as high as 93.2% with an average of 58.44%. The lowest 6-year graduation rate in the sample was 43.5%, with the highest being 100%--a little more than 23 percentage points higher than the average graduation rate of 76.88%. Enrollments varied from 386 to 3,579 with an average enrollment of 1,714 students. Institutional spending per student ranged

from just over nine-thousand dollars up to nearly fifty-thousand dollars—average spending was about twenty-two thousand dollars. Institutional grants covered anywhere from 13.82% to 93.79% of the total cost of tuition with an average figure of 55.86%. Combined 75th percentile math and verbal SAT scores ranged from 1080 to 1560 with an average score of 1340.42. Endowment figures varied from $18,890.35 per student to a high of $950,562.95 per student—average endowment per student was around $165,000. Among the dummy variables, 98% of the schools were NCAA members, 25% had total endowments larger than $378,910,000, 31% of the schools are in or near large cities, 39% of the schools are in or near mid-size cities, and 26% are in small to large towns.

Results

Table 5 shows OLS regression results from Models 2 & 2a.[13] Model 2 includes all the five quality proxies (SAT, student-faculty ratio, acceptance rate, graduation rate, and high-endowment), six control variables (room & board cost, spending per student, endowment per student, financial aid ratio, enrollment and enrollment squared), as well as the one-hundred brand variables. Model 2 shows significant effects in 92 out of 112 variables, as well as demonstrating a high adjusted-R^2 with a total value of .9791. Expected signs are present on all significant variables except endowment per student. Of the quality proxy

[13] Both models have been tested for multicollinearity and heteroscedasticity. While there is a high rate of multicollinearity present in the model, there is no correction used because most variables are already significant and it does not appear that the presence of multicollinearity negatively affects the models. The presence of heteroscedasticity is noted with the Chi-Square value of 499.7. The significance of both models is shown using ACOV corrected standard errors. Additional information tests can be found in the appendix.

variables, SAT scores, high-endowment and student-faculty ratio are shown to be significant, whereas acceptance rate, and graduation rates are shown to have no significant effect on tuition price. The parameter estimate on SAT scores shows that for each additional one-point score improvement on an institution's average SAT score at the 75^{th} percentile, a student is willing to pay $7.30 more in tuition. Therefore a hundred point improvement generates an expected $730 increase in tuition. The student-faculty ratio figure demonstrates that for each additional student per teacher, students desire to pay less by $232.07. Schools with a large endowment actually charged on average about $314.94 more than schools which have a lower endowment.

Progressing to the control factors, only endowment per student and enrollment figures were shown to be significant. This means that even though it was believed that the other finance measures such as room and board cost, spending per student, and institutional grant aid would affect tuition price, only these two variables—ENDOWPER, and ENROLL/ENROLLSQ—made a significant effect on the tuition price. The other interesting piece in this section is that endowment per student showed a positive effect on tuition, which is contrary to what was expected. Previously, it was stated that endowment per student was

Table 5-Regression Results from Models 2 & 2a

	Model 2		Model 2a	
Dependent Variable	Tuition		TuitionRB	
Adjusted R^2	0.9791		0.9832	
Variable	Parameter Estimate	Significance	Parameter Estimate	Significance
Intercept	-2,252,130.000	***	-2,986,652.000	***
YEAR	1,137.803	***	1,508.920	***
SATACT	7.297	**	7.011	**
SFRATIO	-232.074	***	-241.362	***
ACCEPT	-11.394		-9.069	
GRAD	-3.909		-5.261	
ROOMBOARD	0.229			
SPENDPER	0.034		0.056	**
HIGHENDOW	314.941	**	334.945	**
ENDOWPER	0.003	**	0.005	***
FINAID	-14.065		-13.212	
ENROLL	-6.875	*	-7.400	*
ENROLLSQ	0.002	*	0.002	*
Significant Brand Factors	84 / 99		82 / 99	

*,**,*** denotes significance at the .10, .05, and .01 levels, respectively

expected to have a negative effect on tuition since a school with a higher endowment could afford to reduce its tuition and back up any lost tuition with their endowment. However, this regression shows that for each additional thousand dollars of endowment per student at a given college, students pay on average about $3.22 more. In order to more fully understand the magnitude of this effect, take a look at the following example.

Using some example numbers, we will look at two schools, College A and College B. College A has an endowment per student of about $620,000, while College B has an Endowment per student of $44,000—a difference of $580,000. According to this regression, College A will on average then, charge a tuition of about $1,867 more than College B, even though College A's endowment per student is more than half a million dollars greater per.

Enrollment is found to be a function of a quadratic and based on the quadratic functional form for enrollment, a school with 1,000 students enrolled will find students are willing to pay $2.875 less for and increase in enrollment by one student. For a school with an enrollment of 2,000 students, an increase in one student yields a predicted increase in the willingness to pay of $1.125. Additionally, an enrollment of 1,719(6.875/.002) represents the level wherein the willingness to pay goes from decreasing rates to increasing rates, suggesting students are willing to pay more once enrollments exceed 1,719, ceteris paribus.

The other control factors, cost of room & board, spending per student, and institutional grant aid ratio were shown to be insignificant in this model. While it is still believed that these factors do have an effect on the overall costs or ability to spend of the college, their effect on the increase or decrease in tuition price is unfounded in this model.[14]

The last component of this model was the brand effect variables. Of the ninety-nine institutions used as variables, eighty-four had significant differences in tuition price from the base school. Significant differences in tuition price ranged from about $18,000 less than the base school to $2,400 more than the base school.

The conference and urbanization variables were not used in this regression because when they are run simultaneously with the brand effect variables, the factors of the locations and conferences were essentially double-counted and the results were therefore biased. Additional models were run using

[14] These variables are kept in the model due to the high R^2 attained, as well as their presence in the previous literature which supports their existence as factors of quality.

these variables without the brand variables—see the appendix for these models and results.

In Model 2a, the variable for room and board cost is removed and combined with the dependent variable of tuition price creating TUITIONRB. Running the regression using this new dependent variable establishes significance in an additional variable--SPENDPER. In this set there is significance in 94 out of 111 variables. Eighty-two out of ninety-nine schools were shown to have significant tuition price differences from the base school. Aside from the newly significant variable, Model 2a presents similar results as Model 2. Due to the increase in significant variables and belief that room and board cost should be included with tuition, Model 2a has demonstrated that it is the best model, and will be further discussed in the conclusions section.. In regard to SPENDPER, the variable shows a positive effect and shows that for each additional dollar increase per student at a given school, the tuition of that school is 5.6 cents higher.

Multiple vs. Single Proxies for Quality

The implications of this study confirm the use of multiple variables to establish effective proxies for quality in education. The following table shows the results from several other regressions in which this hypothesis was tested. While SAT score is shown to be significant when used as the sole quality proxy, by

adding in all of the quality proxies there is not only a slightly higher R^2 value, but also the effects on the magnitude of the other variables is affected.[15]

Table 6 Regression Results Single vs. Multiple Proxies for quality

	Model 4	Model 5	Model 6	Model 7	Model 8	Model 9
	Adjusted R^2 0.746	Adjusted R^2 0.716	Adjusted R^2 0.715	Adjusted R^2 0.697	Adjusted R^2 0.699	Adjusted R^2 0.752
	Parameter Estimate	Parameter Estimate	Parameter Estimate	Parameter Estimate	Parameter Estimate	Parameter Estimate
Intercept	-1969434 ***	-2029323 ***	-2051885 ***	-2001997 ***	-1995566 ***	-2020405 ***
year	972.642 ***	1018.023 ***	1022.485 ***	1000.921 ***	996.368 ***	1001.373 ***
SATACT	19.644 ***					16.217 ***
Accept1		-59.987 ***				-32.578 ***
Grad1			108.845 ***			18.205
SFRatioB				-139.138		42.406
highendow					-1073.651 **	-865.962 **
RB	0.259 **	-0.086	0.075	-0.007	-0.038	0.154
SpendPer	0.328 ***	0.378 ***	0.392 ***	0.462 ***	0.502 ***	0.300 ***
endowper	-0.012 ***	-0.009 ***	-0.011 ***	-0.010 ***	-0.009 ***	-0.011 ***
FinAid	68.284 ***	76.007 ***	88.141 ***	90.606 ***	96.426 ***	69.918 ***
Enroll	9.165 ***	8.318 ***	8.331 ***	10.100 ***	10.090 ***	8.332 ***
enrollsq	-0.002 ***	-0.002 ***	-0.002 ***	-0.002 ***	-0.002 ***	-0.002 ***

*,**,*** denotes significance at the .10, .05, and .01 levels, respectively

College Tuition Predictor

Now that pricing levels have been established for all of these aspects of college education, another implication of this study is the implementation of a college tuition price predictor. If a school's attributes are entered into the equation that Model 2a has established we should be able to see how much it should cost to attend that college given its attributes. For this section all 100 colleges will be reviewed. Once the prediction price is determined the actual price will be shown and conclusions can be drawn as to whether the given school is charging tuition price at a discount or premium according to the pricing index established by Model 2a. Table 7 presents the results from the schools with predicted values greater or less than their actual values by a difference of $1,000

[15] See appendix for multiple regression analysis using single vs. multiple proxies for quality.

Ta ble 7-Tuition Predictions

Colleges with the Highest Values

College	Predicted Tuition	Actual Tuition	Discount on Tuition
Alma College (Alma, MI)	$ 26,627.01	$ 21,134.00	$ (5,493.01)
Bethany College (Bethany, WV)	$ 16,770.28	$ 14,370.00	$ (2,400.28)
Coe College (Cedar Rapids, IA)	$ 25,601.89	$ 23,570.00	$ (2,031.89)
Morehouse College (Atlanta, GA)	$ 17,325.87	$ 16,016.00	$ (1,309.87)
Wells College (Aurora, NY)	$ 16,865.53	$ 15,790.00	$ (1,075.53)
Ripon College (Ripon, WI)	$ 22,588.43	$ 21,550.00	$ (1,038.43)
Hope College (Holland, MI)	$ 22,559.26	$ 21,540.00	$ (1,019.26)

Colleges with the Lowest Values

College	Predicted Tuition	Actual Tuition	Premium on Tuition
Allegheny College (Meadville, PA)	$ 20,299.60	$ 26,950.00	$ 6,650.40
Washington and Lee University (Lexington, VA)	$ 26,274.99	$ 28,635.00	$ 2,360.01
Hendrix College (Conway, AR)	$ 19,526.82	$ 21,636.00	$ 2,109.18
Rhodes College (Memphis, TN)	$ 25,834.91	$ 27,874.00	$ 2,039.09
Saint Anselm College (Manchester, NH)	$ 22,952.59	$ 24,660.00	$ 1,707.41
Amherst College (Amherst, MA)	$ 30,843.83	$ 32,395.00	$ 1,551.17
Claremont Mckenna College (Claremont, CA)	$ 29,264.89	$ 30,800.00	$ 1,535.11
St Lawrence University (Canton, NY)	$ 30,761.11	$ 32,150.00	$ 1,388.89
Vassar College (Poughkeepsie, NY)	$ 32,436.63	$ 33,800.00	$ 1,363.37
Ursinus College (Collegeville, PA)	$ 30,299.84	$ 31,600.00	$ 1,300.16
Pitzer College (Claremont, CA)	$ 31,906.69	$ 33,012.00	$ 1,105.31
Kenyon College (Gambier, OH)	$ 32,824.76	$ 33,930.00	$ 1,105.24
Scripps College (Claremont, CA)	$ 30,401.74	$ 31,500.00	$ 1,098.26
Trinity College (Hartford, CT)	$ 32,608.09	$ 33,630.00	$ 1,021.91

or more.[16] Of the one-hundred schools reviewed only seven had a tuition price which was $1,000 or more less than the predicted price—indicating a bargain. Fourteen schools showed an actual price which was $1,000 or more higher than the predicted price—indicating an overcharge. The greatest bargain—according to these results is found at Alma College with a tuition price $5,493.01 less than the predicted tuition price. The greatest overcharge is found at Allegheny College with a tuition price of $6,650.40 greater than the predicted tuition price.

[16] See the appendix for how these results were calculated.

Conclusions

Now that this hedonic price analysis has been constructed and interpreted it can be noted that of the five factors chosen to be proxies for quality—SAT scores, student-faculty ratio, acceptance rate, graduation rate and having a high endowment—only three are shown to be statistically significant. Graduation rate and acceptance rate never prove to be significant factors in tuition price in this model. That is not to say that these factors are not elements of quality—as there is still considerable literature which affirms this—but that these aspects of quality are not shown to affect tuition.

If it is assumed that these five factors and only these five factors are proxies for quality, this finding demonstrates that there are aspects of quality that do not have any effect on price in respect to private liberal arts colleges. The signs of the three significant variables for quality additionally demonstrate that students pay more to attend institutions of higher quality—that is institutions with higher average SAT scores, lower student-faculty ratios, and larger endowments.

Of these quality factors, the largest influence on tuition price is from student-faculty ratio. Students pay on average about $241 less for each additional student per teacher. A school with a 10:1 student teacher ratio costs about $1,200 dollars more than a school with a 15:1 ratio. These results suggest that if a school wanted to increase its value the best measure to focus on would be either increasing faculty and/or reducing the enrollment—both of which would have a direct effect on this student faculty ratio.

While it might seem a bit surprising that schools with high endowments actually charge on average a higher tuition than schools with lower endowments, understanding that having a large endowment should represent the success and ability to spend of the college it makes sense that this scenario is more desirable and students actually pay around $300 more to attend these schools.

SAT scores have long been used within literature as a measure of quality. The results of this study support their use in demonstrating quality and additionally, state the case that students are willing to pay more to attend colleges with higher average SAT scores. Administrators already know that by being more selective and only admitting students with higher SAT scores they can help to increase the appearance of quality within their school. This study now demonstrates that by doing so, administrators can affect how much potential students are willing to pay to attend a school with certain average SAT scores.

Additionally, having shown that enrollment is a function of a quadratic, it has been shown that for schools with enrollments greater than 1,719 can charge more in tuition dollars. Perhaps larger schools have a greater ability to offer more programs, which are more desirable to students. Increasing enrollments beyond 1,719 is another method which an institution could utilize which might help to demonstrate a boost in value.

Understanding the magnitudes of the significant factors affecting tuition price should also prove useful to potential students looking at various colleges. These figures will help them to examine the value of the colleges they are

interested in, to be sure that they are not overpaying for these aspects of the educational system. Hedonic price analysis could perhaps even become another tool for reviewing and ranking these institutions for potential students in the future.

With this model explaining the variance in tuition price by greater than 98% as evidenced by the R^2 value, there is a lack of significant evidence to support an overwhelming belief that there are other characteristics of the education system which this model has not accounted for. Therefore in reviewing the college tuition predictions, it would seem there is in fact some "je ne sais quoi" aspect of college quality which can inflates the price of tuition.

Further, by establishing the tuition price predictor, using each school's attributes, the varying levels of value can be seen. Without this hedonic analysis it would be otherwise difficult to quantify a bargain price from an overcharge price. Understanding how each aspect of the education system affects the tuition price is essential to finding not only the right college, but the right deal. Of the one-hundred schools included in the study thirty-seven were found to have tuition prices lower than their predicted price. Meaning, more often then not—about 60% of the time—schools are overcharging in tuition price. However, with the appropriate information, it is possible to find some good bargains, as well.

Appendix

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Data Sources

Main data collection source was the Association of Governing Boards of Universities and Colleges Benchmarking Services web-interface. This service allows the user to create reports using selected variables within pre-determined Comparison Groups. For this study the Comparison Group included only Private Liberal Arts Colleges, of which the service contrived a listing of 180 institutions. The service also allows the user to choose a year or years of interest. In this case the study used the academic years 2001-02 through 2005-06 a total of five years of data. Within the AGB reports there were omitted values for certain variables in certain years. The following information is an explanation about how some of those omitted values were corrected.

In some cases the missing data was found simply by running the college through a search engine and locating their schools Common Data Set information online—most often this was found by reaching their Office of Institutional Research or similar department. The following links were used to gather missing data for one or more variables in one or more years.

Albion College-Institutional Data
http://www.albion.edu/institutionaldata/dataset.asp

Amherst College- Common Data Set
https://cms.amherst.edu/aboutamherst/glance/common_data_sets

Bates College- Office of Institutional Planning & Analysis
http://www.bates.edu/planning-analysis.xml\

Bowdoin College- Office of Institutional Research
http://www.bowdoin.edu/ir/index.shtml

Barnard College- Finance and Planning Office
http://www.barnard.edu/opir/geninfo.html

Bridgewater College- Institutional Research Office
http://www.bridgewater.edu/index.php?id=1130

Bryn Mawr-Institutional Research
http://www.brynmawr.edu/institutionalresearch/index.shtml

Bucknell College-Office of Planning and Institutional Research
http://www.bucknell.edu/x5178.xml

Carleton College-Office of Institutional Research & Analysis
http://apps.carleton.edu/campus/ira/

Centre College-Office of Institutional Research
http://web.centre.edu/ir/index.php

Claremont-Mckenna College- Office of Institutional Research
http://www.claremontmckenna.edu/registrar/IR/

Colby College- Office of Institutional Research and Assessment
http://www.colby.edu/administration_cs/ir/

College of Wooster- Office of Institutional Research
http://www.wooster.edu/oir/default.php

Colorado College- Office of Institutional Research
http://www.coloradocollege.edu/dean/oir/comdata.htm

Davidson College- The Office of Planning and Institutional Research
http://www3.davidson.edu/cms/x1052.xml

Hampden-Sydney College- Research Office
http://www2.hsc.edu/research/

Haverford College- Office of Institutional Research
http://www.haverford.edu/ir/

Middlebury College- Office of Institutional Research
http://www.middlebury.edu/administration/instres/

Pomona College- Office of Institutional Research
http://www.pomona.edu/institutionalresearch/

Vassar College- Office of Institutional Research
http://institutionalresearch.vassar.edu/index.html

When data could not be found through the Institutional Research Office's web-site, an email was to the IR Coordinator asking for the specific data. Responses were received from the following schools from this method: College of the Holy Cross and Claremont-Mckenna College. Some IR offices never responded to the information request and at least one, responded that they could not supply the information.

Additional endowment data was located at the National Association of College and University Business Officers website (NACUBO)
http://www.nacubo.org/x2376.xml

U.S. News and World Report most recent online data set was used for information regarding the Locale variable. Additionally, micro-film copies from America's

Best Colleges issues were used to supplement missing data as well. The following issues were used:

(2002, September). America's Best Colleges. U.S.News and World Report, 88-89.

(2003, September). America's Best Colleges. U.S.News and World Report, 98-100.

(2004, August). America's Best Colleges. U.S.News and World Report, 98-100.

(2005, August). America's Best Colleges. U.S.News and World Report, 86-88.

(2006, August). America's Best Colleges. U.S.News and World Report, 116-118.

College List

1 Agnes Scott College (Atlanta/Decatur, GA)
2 Albion College (Albion, MI)
3 Allegheny College (Meadville, PA)
4 Alma College (Alma, MI)
5 Amherst College (Amherst, MA)
6 Augustana College (Rock Island, IL)
7 Barnard College (New York, NY)
8 Bates College (Lewiston, ME)
9 Beloit College (Beloit, WI)
10 Bethany College (Bethany, WV)
11 Birmingham Southern College (Birmingham, AL)
12 Bowdoin College (Brunswick, ME)
13 Bridgewater College (Bridgewater, VA)
14 Bryn Mawr College (Bryn Mawr, PA)
15 Bucknell University (Lewisburg, PA)
16 Carleton College (Northfield, MN)
17 Centre College of Kentucky (Danville, KY)
18 Claremont Mckenna College (Claremont, CA)
19 Coe College (Cedar Rapids, IA)
20 Colby College (Waterville, ME)
21 Colgate University (Hamilton, NY)
22 College of The Holy Cross (Worcester, MA)
23 College of Wooster (Wooster, OH)
24 Colorado College (Colorado Springs, CO)
25 Concordia College at Moorhead (Moorhead, MN)
26 Connecticut College (New London, CT)
27 Cornell College (Mt Vernon, IA)
28 Davidson College (Davidson, NC)
29 Denison University (Granville, OH)
30 Depauw University (Greencastle, IN)
31 Dickinson College (Carlisle, PA)
32 Earlham College (Richmond, IN)
33 Franklin and Marshall College (Lancaster, PA)
34 Furman University (Greenville, SC)
35 Gettysburg College (Gettysburg, PA)
36 Goshen College (Goshen, IN)
37 Goucher College (Baltimore, MD)
38 Grinnell College (Grinnell, IA)
39 Guilford College (Greensboro, NC)
40 Gustavus Adolphus College (Saint Peter, MN)
41 Hamilton College (Clinton, NY)
42 Hampden-Sydney College (Hampden-Sydney, VA)
43 Harvey Mudd College (Claremont, CA)
44 Haverford College (Haverford, PA)
45 Hendrix College (Conway, AR)
46 Hobart and William Smith Colleges (Geneva, NY)
47 Hope College (Holland, MI)
48 Illinois Wesleyan University (Bloomington, IL)
49 Juniata College (Huntingdon, PA)
50 Kenyon College (Gambier, OH)
51 Knox College (Galesburg, IL)
52 Lafayette College (Easton, PA)
53 Lake Forest College (Lake Forest, IL)
54 Lawrence University (Appleton, WI)
55 Luther College (Decorah, IA)
56 Lycoming College (Williamsport, PA)
57 Macalester College (St Paul, MN)
58 Middlebury College (Middlebury, VT)
59 Millsaps College (Jackson, MS)
60 Moravian College and Theological Seminary (Bethlehem, PA)
61 Morehouse College (Atlanta, GA)
62 Mount Holyoke College (South Hadley, MA)
63 Nebraska Wesleyan University (Lincoln, NE)
64 Oberlin College (Oberlin, OH)
65 Occidental College (Los Angeles, CA)
66 Ohio Wesleyan University (Delaware, OH)
67 Pitzer College (Claremont, CA)
68 Pomona College (Claremont, CA)
69 Presbyterian College (Clinton, SC)
70 Randolph-Macon College (Ashland, VA)
71 Randolph-Macon Womans College (Lynchburg, VA)
72 Reed College (Portland, OR)
73 Rhodes College (Memphis, TN)
74 Ripon College (Ripon, WI)
75 Roanoke College (Salem, VA)
76 Saint Johns University (Collegeville, MN)
77 Saint Olaf College (Northfield, MN)
78 Scripps College (Claremont, CA)
79 Skidmore College (Saratoga Springs, NY)
80 Smith College (Northampton, MA)
81 Southwestern University (Georgetown, TX)
82 Spelman College (Atlanta, GA)
83 St Lawrence University (Canton, NY)
84 Swarthmore College (Swarthmore, PA)
85 Sweet Briar College (Sweet Briar, VA)
86 Trinity College (Hartford, CT)
87 University of The South (Sewanee, TN)
88 Ursinus College (Collegeville, PA)
89 Vassar College (Poughkeepsie, NY)
90 Washington & Jefferson College (Washington, PA)
91 Washington and Lee University (Lexington, VA)
92 Wellesley College (Wellesley, MA)
93 Wells College (Aurora, NY)
94 Wesleyan University (Middletown, CT)
95 West Virginia Wesleyan College (Buckhannon, WV)
96 Whitman College (Walla Walla, WA)
97 Whittier College (Whittier, CA)
98 Williams College (Williamstown, MA)
99 Wittenberg University (Springfield, OH)
100 Wofford College (Spartanburg, SC)

Data Transformations

Student-faculty ratio

After all data had been supplemented there were still some areas of missing data. The main variable which was missing data was for student-faculty ratio. Since this variable was deemed to be very important to the model, a transformation was undertaken which produced data in place of missing data. Since this figure undergoes very little change from year to year—save for a great influx in student enrollment or mass hiring or firing of faculty members—in places where there was simple a gap between two years of data, a simple average of the two bookend years provided the data for the missing entry. See the example:

BEFORE

College	2001-02	2002-03	2003-04	2004-05	2005-06
Furman University (Greenville, SC)	12.90	11.80	12.60		12.30
Gettysburg College (Gettysburg, PA)	11.40		11.40		11.50

AFTER

College	2001-02	2002-03	2003-04	2004-05	2005-06
Furman University (Greenville, SC)	12.90	11.80	12.60	**12.45**	12.30
Gettysburg College (Gettysburg, PA)	11.40	**11.40**	11.40	**11.45**	11.50

As you can see for the year 2004-05, Furman University is missing a student faculty ratio, and Gettysburg College is missing values for both the years 2002-03 and 2004-05. However, since both years of missing values have data for the year prior and after the missing value, an average of those two values is used in place of the missing data.

(12.6 + 12.3)/2=12.45 (11.4+11.4)/2=11.4 (11.4+11.5)/2=11.45

Tuition/Room & Board

There are a few schools within the data set which do not distinguish the difference between their tuition price and their room & board cost, calling this totaled cost the "Comprehensive Fee". For these schools, the average room & board cost for that year was subtracted from the "Comprehensive Fee" data and used at the tuition price. Additionally, that average room & board figure was used as the room & board figure for those schools as well. Average room & board costs per year were:

2001-02: $6,075
2002-03: $6,346
2003-04: $6,661
2004-05: $6,954
2005-06: $7,325

Regressions

The REG Procedure
Model: MODEL1
Dependent Variable: Tuition Tuition

Number of Observations Read 500
Number of Observations Used 500

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	112	12082731507	107881531	219.05	<.0001
Error	387	190595027	492494		
Corrected Total	499	12273326534			

Root MSE	701.77889	R-Square	0.9845
Dependent Mean	24443	Adj R-Sq	0.9800
Coeff Var	2.87114		

	Parameter Estimate	Standard Error	T Value	Pr>|t|		Parameter Estimate	Standard Error	T Value	Pr>|t|
Intercept	-2249371.00	150782.00	-14.92	<.0001	Haverford	-2869.97	811.46	-3.54	0.0005
year	1139.06	76.16	14.96	<.0001	Hendrix	-12120.00	706.50	-17.16	<.0001
SATACT	4.73	1.82	2.60	0.0096	HobartWSmith	1525.22	570.78	2.67	0.0079
SFRatioB	-207.91	63.46	-3.28	0.0011	Hope	-8643.82	1237.59	-6.98	<.0001
Accept1	-9.99	6.76	-1.48	0.1403	IllinoisWU	-3305.76	680.97	-4.85	<.0001
Grad1	-8.33	9.78	-0.85	0.3948	Juniata	-4151.78	494.29	-8.40	<.0001
RB	0.32	0.22	1.45	0.1484	Kenyon	1969.25	693.92	2.84	0.0048
SpendPer	0.03	0.02	1.45	0.147	Knox	-3980.36	572.81	-6.95	<.0001
highendow	306.06	211.82	1.44	0.1493	Lafayette	-2103.25	872.51	-2.41	0.0164
endowper	0.00	0.00	1.92	0.055	LakeF	-2937.50	559.54	-5.25	<.0001
FinAid	-6.78	7.39	-0.92	0.3594	Lawrence	-3648.90	583.85	-6.25	<.0001
Enroll	-5.82	2.20	-2.65	0.0085	Luther	-4524.54	990.05	-4.57	<.0001
enrollsq	0.00	0.00	2.47	0.0139	Lycoming	-4984.74	591.73	-8.42	<.0001
NCAA	-3738.40	892.54	-4.19	<.0001	Macalester	-4248.31	710.90	-5.98	<.0001
AgnesScott	-10635.00	772.22	-13.77	<.0001	Middlebury	1273.07	997.48	1.28	0.2026
Albion	-4668.78	535.85	-8.71	<.0001	Millsaps	-9985.02	546.93	-18.26	<.0001
Allegheny	-2278.60	581.18	-3.92	0.0001	Moravian	-4779.62	497.16	-9.61	<.0001
Alma	-9067.69	498.42	-18.19	<.0001	Morehouse	-12387.00	1062.24	-11.66	<.0001
Amherst	-2548.09	1120.17	-2.27	0.0235	MTHolyoke	-368.06	783.59	-0.47	0.6388
Ausgustana	-5448.01	712.92	-7.64	<.0001	NebraskaW	-9505.49	697.12	-13.64	<.0001
Barnard	-2703.54	1099.00	-2.46	0.0143	Oberlin	-793.07	1137.65	-0.70	0.4861
Bates	2371.64	636.43	3.73	0.0002	Occidental	-574.00	597.26	-0.96	0.3371
Beloit	-3644.48	575.33	-6.33	<.0001	Ohio	-1921.46	561.00	-3.43	0.0007
Bethany	-13193.00	855.39	-15.42	<.0001	Pitzer	-1129.79	757.65	-1.49	0.1367
Birmingham	-9452.78	464.95	-20.33	<.0001	Pomona	-6285.79	1277.43	-4.92	<.0001
Bowdoin	-667.96	802.95	-0.83	0.406	Presbyterian	-8762.92	570.73	-15.35	<.0001
Bridgewate	-9617.45	679.88	-14.15	<.0001	RMacon	-6916.36	611.01	-11.32	<.0001
BrynMawr	-4388.47	785.13	-5.59	<.0001	RMaconW	-10624.00	887.04	-11.98	<.0001
Bucknell	-1787.42	1916.79	-0.93	0.3517	Reed	-4875.09	1022.24	-4.77	<.0001
Carleton	-1080.40	845.59	-1.28	0.2021	Rhodes	-5265.12	521.21	-10.10	<.0001
Centre	-8783.22	573.83	-15.31	<.0001	Ripon	-7022.48	830.83	-8.45	<.0001
Coe	-6329.14	547.11	-11.57	<.0001	Roanoke	-5893.28	555.20	-10.61	<.0001
Claremont	-4355.69	855.71	-5.09	<.0001	SaintJohns	-5782.22	596.07	-9.70	<.0001
Colby	2019.78	685.44	2.95	0.0034	SaintOlaf	-4458.18	1287.14	-3.46	0.0006
Colgate	-10.30	1113.72	-0.01	0.9926	Scripps	-4182.38	877.03	-4.77	<.0001
CofHolyCro	-1253.16	1098.07	-1.14	0.2545	Skidmore	901.41	840.26	1.07	0.284
CofWooster	-2096.85	542.63	-3.86	0.0001	Smith	-3414.99	1176.85	-2.90	0.0039
Colorado	-1558.17	667.03	-2.34	0.02	SouthW	-10338.00	554.30	-18.65	<.0001
Concordia	-9498.29	1101.51	-8.62	<.0001	Spelman	-13553.00	787.44	-17.21	<.0001
Connecticu	2715.63	601.75	4.51	<.0001	StLawrence	875.14	660.57	1.32	0.186
Cornell	-6776.42	615.82	-11.00	<.0001	Swarthmore	-4593.70	1179.06	-3.90	0.0001
Davidson	-3239.43	655.47	-4.94	<.0001	SweetBriar	-11451.00	941.27	-12.16	<.0001
Denison	-3028.32	739.63	-4.09	<.0001	Trinity	804.12	742.31	1.08	0.2794
Depauw	-4800.04	766.68	-6.26	<.0001	UniSouth	-4614.83	492.63	-9.37	<.0001
Dickinson	640.62	692.01	0.93	0.3552	Vassar	-874.99	960.49	-0.91	0.3629
Earlham	-3906.18	752.10	-5.19	<.0001	WashJeff	-4849.24	554.83	-8.74	<.0001
FranklinMa	511.75	598.37	0.86	0.3929	WashLee	-5990.37	794.35	-7.54	<.0001
Furman	-5403.73	1003.63	-5.38	<.0001	Wellesley	-3246.33	1109.98	-2.92	0.0037
Gettysburg	545.01	753.64	0.72	0.47	Wells	-17712.00	1333.72	-13.28	<.0001
Goshen	-16848.00	1132.79	-14.87	<.0001	WesleyanU	-922.56	1153.39	-0.80	0.4243
Goucher	-3878.43	589.48	-6.58	<.0001	WestVW	-5934.61	735.71	-8.07	<.0001
Grinnell	-7747.31	1325.85	-5.84	<.0001	Whitman	-3978.70	559.27	-7.11	<.0001
Guilford	-7040.27	624.16	-11.28	<.0001	Whittier	-4195.66	616.04	-6.81	<.0001
Gustavus	-5551.54	839.15	-6.62	<.0001	Williams	-3877.84	1197.12	-3.24	0.0013
Hamilton	228.17	726.10	0.31	0.7535	Wittenberg	-1743.47	609.07	-2.86	0.0044
HampdenSyd	-7819.36	599.88	-13.03	<.0001	Wofford	-7272.68	587.51	-12.38	<.0001
HarveyMudd	-5263.08	1149.46	-4.58	<.0001					

Results from Model 2 are shown next:

Variable	Parameter Estimate	Standard Error	T Value	Pr>|t|	Corrected SE	Corrected T	+/-
Intercept	-2252130.00	153961.00	-14.63	<.0001	215964.188	-10.428	4.20
year	1137.80	77.77	14.63	<.0001	108.814	10.456	4.17
SATACT	7.30	1.75	4.18	<.0001	2.868	2.544	1.64
SFRatioB	-232.07	64.53	-3.60	0.0004	65.908	-3.521	0.08
Accept1	-11.39	6.89	-1.65	0.0991	7.210	-1.580	0.07
Grad1	-3.91	9.93	-0.39	0.6939	8.858	-0.441	0.05
RB	0.23	0.23	1.01	0.3113	0.252	0.908	0.10
SpendPer	0.03	0.02	1.81	0.0704	0.023	1.512	0.30
highendow	314.94	216.27	1.46	0.1461	123.732	2.545	1.09
endowper	0.00	0.00	2.07	0.0392	0.001	2.341	0.27
FinAid	-14.06	7.34	-1.92	0.056	9.539	-1.474	0.45
Enroll	-6.88	2.23	-3.08	0.0022	3.722	-1.847	1.23
enrollsq	0.002	0.001	2.93	0.0036	0.001	1.814	1.12
AgnesScott	-10834.00	787.01	-13.77	<.0001	1266.660	-8.553	5.22
Albion	-4477.91	545.18	-8.21	<.0001	593.367	-7.547	0.66
Allegheny	-2266.77	593.43	-3.82	0.0002	658.341	-3.443	0.38
Alma	-9096.34	508.89	-17.87	<.0001	469.469	-19.376	1.51
Amherst	-3333.85	1127.65	-2.96	0.0033	1355.488	-2.460	0.50
Augustana	-5462.19	727.95	-7.50	<.0001	771.927	-7.076	0.42
Barnard	-2695.53	1122.18	-2.40	0.0168	1237.379	-2.178	0.22
Bates	2021.61	644.23	3.14	0.0018	694.601	2.910	0.23
Beloit	-3898.25	584.20	-6.67	<.0001	553.811	-7.039	0.37
Bethany	-12802.00	868.21	-14.75	<.0001	1666.068	-7.684	7.07
BirminghamSouthern	-9408.25	474.63	-19.82	<.0001	462.555	-20.340	0.52
Bowdoin	-1196.26	809.71	-1.48	0.1404	935.899	-1.278	0.20
Bridgewater	-8872.27	670.03	-13.24	<.0001	769.541	-11.529	1.71
BrynMawr	-4620.77	799.69	-5.78	<.0001	1082.950	-4.267	1.51
Bucknell	-2797.72	1941.67	-1.44	0.1504	2186.498	-1.280	0.16
Carleton	-1829.95	843.87	-2.17	0.0307	906.235	-2.019	0.15
Centre	-9078.48	581.50	-15.61	<.0001	690.176	-13.154	2.46
Coe	-6333.52	558.65	-11.34	<.0001	536.954	-11.795	0.46
Claremont	-4914.67	863.07	-5.69	<.0001	1438.336	-3.417	2.27
Colby	1653.29	694.17	2.38	0.0177	681.123	2.427	0.05
Colgate	-530.74	1130.12	-0.47	0.6389	1190.397	-0.446	0.02
CofHolyCross	-1469.44	1119.99	-1.31	0.1903	1038.383	-1.415	0.11
CofWooster	-2050.49	553.97	-3.70	0.0002	531.958	-3.855	0.15
Colorado	-1704.31	680.17	-2.51	0.0126	610.487	-2.792	0.28
Concordia	-9608.21	1124.43	-8.54	<.0001	940.336	-10.218	1.68
Connecticut	2475.42	611.65	4.05	<.0001	615.872	4.019	0.03
Cornell	-6796.78	628.79	-10.81	<.0001	750.071	-9.062	1.75
Davidson	-3633.12	662.38	-5.48	<.0001	739.424	-4.913	0.57
Denison	-3141.47	754.73	-4.16	<.0001	636.703	-4.934	0.77
Depauw	-4912.70	782.37	-6.28	<.0001	649.678	-7.562	1.28
Dickinson	542.76	706.21	0.77	0.4426	614.255	0.884	0.11
Earlham	-4221.54	764.10	-5.52	<.0001	739.864	-5.706	0.19
FranklinMarsh	289.48	608.58	0.48	0.6346	557.499	0.519	0.04
Furman	-5881.67	1018.15	-5.78	<.0001	839.058	-7.010	1.23
Gettysburg	436.28	769.08	0.57	0.5709	630.014	0.692	0.12
Goshen	-13513.00	822.71	-16.43	<.0001	1051.989	-12.845	3.58
Goucher	-3683.38	600.04	-6.14	<.0001	613.706	-6.002	0.14
Grinnell	-8611.51	1337.33	-6.44	<.0001	1365.571	-6.306	0.13
Guilford	-6820.91	635.08	-10.74	<.0001	673.423	-10.129	0.61
Gustavus	-5836.03	854.05	-6.83	<.0001	746.280	-7.820	0.99
Hamilton	-117.64	736.61	-0.16	0.8732	723.624	-0.163	0.00
HampdenSyd	-7790.67	612.50	-12.72	<.0001	664.508	-11.724	1.00
HarveyMudd	-6301.77	1146.07	-5.50	<.0001	2209.604	-2.852	2.65
Haverford	-3329.49	820.97	-4.06	<.0001	1337.879	-2.489	1.57
Hendrix	-12452.00	716.87	-17.37	<.0001	882.920	-14.103	3.27
HobartWSmith	1786.81	579.33	3.08	0.0022	580.419	3.078	0.00
Hope	-9065.15	1259.52	-7.20	<.0001	994.923	-9.111	1.91
IllinoisWU	-3700.59	688.64	-5.37	<.0001	714.023	-5.183	0.19
Juniata	-4031.07	503.86	-8.00	<.0001	463.643	-8.694	0.69
Kenyon	1381.13	693.90	1.99	0.0473	741.200	1.863	0.13
Knox	-4240.85	581.44	-7.29	<.0001	580.928	-7.300	0.01

Variable	Parameter Estimate	Standard Error	T Value	Pr>|t|	Corrected SE	Corrected T	+/-
Lafayette	-2185.14	890.70	-2.45	0.0146	840.682	-2.599	0.15
LakeF	-2924.85	571.34	-5.12	<.0001	512.893	-5.703	0.58
Lawrence	-4046.27	588.25	-6.88	<.0001	601.355	-6.729	0.15
Luther	-4861.99	1007.58	-4.83	<.0001	986.559	-4.928	0.10
Lycoming	-4609.14	597.24	-7.72	<.0001	693.876	-6.643	1.08
Macalester	-4675.23	718.40	-6.51	<.0001	704.679	-6.635	0.12
Middlebury	479.60	999.99	0.48	0.6318	1055.794	0.454	0.03
Millsaps	-9981.89	558.47	-17.87	<.0001	634.303	-15.737	2.13
Moravian	-4526.43	503.88	-8.98	<.0001	539.145	-8.396	0.58
Morehouse	-11768.00	1074.09	-10.96	<.0001	935.944	-12.573	1.61
MTHolyoke	-483.81	799.62	-0.61	0.5455	775.465	-0.624	0.01
NebraskaW	-9375.90	711.12	-13.18	<.0001	948.933	-9.880	3.30
Oberlin	-1449.31	1150.58	-1.26	0.2086	1229.782	-1.179	0.08
Occidental	-622.80	609.74	-1.02	0.3077	544.670	-1.143	0.12
Ohio	-1738.84	571.10	-3.04	0.0025	537.762	-3.233	0.19
Pitzer	-1302.44	772.49	-1.69	0.0926	1312.700	-0.992	0.70
Pomona	-6925.61	1295.02	-5.35	<.0001	1623.698	-4.265	1.08
Presbyterian	-8549.89	580.45	-14.73	<.0001	558.874	-15.298	0.57
RMacon	-6835.24	623.59	-10.96	<.0001	572.390	-11.942	0.98
RMaconW	-10722.00	905.44	-11.84	<.0001	1455.795	-7.365	4.47
Reed	-1447.64	625.58	-2.31	0.0212	965.739	-1.499	0.81
Rhodes	-5587.06	526.38	-10.61	<.0001	630.847	-8.856	1.75
Ripon	-7000.57	848.34	-8.25	<.0001	879.258	-7.962	0.29
Roanoke	-5519.64	559.55	-9.86	<.0001	695.123	-7.941	1.92
SaintJohns	-5838.02	608.49	-9.59	<.0001	796.951	-7.325	2.26
SaintOlaf	-5190.24	1302.12	-3.99	<.0001	1091.553	-4.755	0.76
Scripps	-4655.46	888.08	-5.24	<.0001	1635.943	-2.846	2.39
Skidmore	870.80	857.96	1.01	0.3108	771.134	1.129	0.12
Smith	-3665.54	1200.13	-3.05	0.0024	1237.964	-2.961	0.09
SouthW	-10655.00	560.68	-19.00	<.0001	570.981	-18.661	0.34
Spelman	-13355.00	802.60	-16.64	<.0001	913.032	-14.627	2.01
StLawrence	1202.41	669.77	1.80	0.0734	758.718	1.585	0.22
Swarthmore	-5384.21	1188.41	-4.53	<.0001	1518.244	-3.546	0.98
SweetBriar	-11619.00	960.25	-12.10	<.0001	1446.743	-8.031	4.07
Trinity	583.10	756.05	0.77	0.441	824.367	0.707	0.06

The following table shows the regression results from four different models. All variables have been corrected for heteroscedasticity, using the SAS procedure ACOV.[17] The variables within the model have been tested for multicollinearity, which was found to be present. However, to the degree at which the multicollinearity occurs, the value of the test shows that there is actually minimal if any effect on the results.

Variable	Model 10		Model 11		Model 12		Model 13	
Intercept	-2,233,074.000	***	-2,134,811.00	***	-2,132,986.000	***	-2,126,058.000	***
YEAR	1,110.174	***	1,063.11	***	1,062.234	***	1,057.132	***
SATACT	13.661	***	14.73	***	14.932	***	14.438	***
SFRATIO	-95.772		91.67		88.154		-91.529	
ROOMBOARD	-0.115		0.01		0.015		0.033	
SPENDPER	0.267	***	0.24	***	0.237	***	0.258	***
ACCEPT	-23.837	**	-39.03	***	-37.708	**	-30.142	***
GRADRATE	19.871		23.39		22.906		0.223	
HIGHENDOW	-333.851		-384.13					
ENDOWPER	-0.011	***	-0.01	***	0.010	***	-0.011	***
FINAID	79.493	***	70.73	***	68.308	***	76.840	***
ENROLL	8.878	***	1.14	***	1.067	***	9.940	***
ENROLLSQ	-0.002	***					-0.002	***
CENTENNIAL	2,362.395	***	2,766.76	***	2,824.727	***	2,522.973	***
NESCAC	694.143		979.93	*	1,024.480	**	405.914	
SCIAC	2,732.524	***	2,237.38	***	2,322.363	***	3,169.633	***
DEEP			186.35		145.312		336.146	
NCAA	-101.663		105.78		92.707		-414.618	
BIGCITY			-1,113.03	*	-1,150.628	*	-1,459.069	**
MIDCITY			-472.62		-509.490		-732.227	
TOWN			-554.15		-608.389		-340.024	
R^2	0.740		0.74		0.741		0.774	

*,**,*** denotes values that are significant at the 10%, 5% and 1% levels respectively.

Model 10 shows significant effects in nine of the 18 variables used. The signs on all ten of the hypothesized variables are as expected. Of the variables with uncertain expectations, ENROLL shows a positive effect on tuition price,

however, figuring in a quadratic factor shows that there is a slight decline in willingness to pay more as the student enrollment increases. This effect should be minimal within this data set since these liberal arts colleges are by nature smaller institutions. NCAA membership was shown to be an insignificant factor of tuition price, as were student-faculty ratio, room & board costs, graduation rate, having a high endowment, and being member of the NESCAC. The other two athletic conferences, Centennial and SCIAC were shown to have positive significant effects on tuition.

Being an institution in one these conferences increases a prospective student's willingness to pay by $2,362 for the Centennial Conference and $2,732 for the SCIAC compared to all other colleges. Next to these conference variables YEAR had the next greatest effect with $1,110, meaning that every year tuition prices increase on average by that amount each year.

Of the other significant variables, FINAID had the largest effect on tuition price. Again, remember that this variable is expressed as a ratio of institutional grant money to the tuition price. So for each addition percentage point increase, a student is willing to spend $79.49 more dollars in tuition price.

It is surprising in this model that student-faculty ratio and graduation rate proved to be insignificant factors affecting tuition price. Both of these factors have been used in past research, and were believed in this study to play a role in how much a student would be willing pay in tuition dollars.

The results of Model 11 are consistent with those of the first model. Additionally, NESCAC and BIGCITY show some significance. With NESCAC school students paying a premium of about $700 more than students at other schools. Students attending schools in/near large cities pay on average about $1,100 less than students attending schools in rural areas. Schools in small to large towns or mid-sized cities pay no significant difference compared to students attending schools in rural areas.

Notably changes in effects which occurred in Model 11 were the change in the effect of acceptance rate, which negatively increased significance from -23.83 to -39.03. Also, the premium paid for Centennial Conference schools increased by about $400 to $2,766, while the premium for SCIAC schools dropped by nearly $500 to $2,237. Removing ENROLLSQ from the model caused the effect of ENROLL to shift from 8.878 to 1.14.

Model 12 shows very little notable difference from Model 11. Model 13 again brings back the significant variable ENROLLSQ which remains significant and has a negative effect on tuition. The effect of this variable on ENROLL can again be seen as it increases to 9.94. Throughout all of these models the variable DEEP never attains significance.

Single Vs Multiple Proxies for Quality

	Model 4	Model 5	Model 6	Model 7	Model 8	Model 9
	Adjusted R^2 0.746	Adjusted R^2 0.716	Adjusted R^2 0.715	Adjusted R^2 0.697	Adjusted R^2 0.699	Adjusted R^2 0.752
	Parameter Estimate	Parameter Estimate	Parameter Estimate	Parameter Estimate	Parameter Estimate	Parameter Estimate
Intercept	-1969434 ***	-2029323 ***	-2051885 ***	-2001997 ***	-1995566 ***	-2020405.000 ***
year	972.642 ***	1018.023 ***	1022.485 ***	1000.921 ***	996.368 ***	1001.373 ***
SATACT	19.644 ***					16.217 ***
Accept1		-59.987 ***				-32.578 ***
Grad1			108.845 ***			18.205
SFRatioB				-139.138		42.406
highendow					-1073.651 **	-865.962 **
RB	0.259 **	-0.086	0.075	-0.007	-0.038	0.154
SpendPer	0.328 ***	0.378 ***	0.392 ***	0.462 ***	0.502 ***	0.300 ***
endowper	-0.012 ***	-0.009 ***	-0.011 ***	-0.010 ***	-0.009 ***	-0.011 ***
FinAid	68.284 ***	76.007 ***	88.141 ***	90.606 ***	96.426 ***	69.918 ***
Enroll	9.165 ***	8.318 ***	8.331 ***	10.100 ***	10.090 ***	8.332 ***
enrollsq	-0.002 ***	-0.002 ***	-0.002 ***	-0.002 ***	-0.002 ***	-0.002 ***

*,**,*** denotes significance at the .10, .05, and .01 levels, respectively

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