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# The effects of perceived quality on tuition and net tuition

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# The Effects of Perceived Quality on Tuition and Net Tuition

by

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## Abstract

This paper examines the effects of perceived quality on tuition and net tuition utilizing both direct and indirect measures to account for quality and the U.S News and World Ranking to measure perceived quality. Tuition is the sticker price, whereas net tuition is the sticker price less discounts. Judgments of quality will be more apparent in tuition, therefore perceived quality and tuition should have a larger relationship than net tuition and perceived quality. When regressed with quality variables held constant on tuition and net tuition, effect of reputation on prices is captured. The coefficient for perceived quality on tuition had more significance than for net tuition. The implications are that changes in perceived quality impact prices regardless of actual quality.


## Introduction

When choosing a college, classic investment theory states that an individual will weigh returns to college against the cost. If the future benefits exceed the future costs, then a student will choose to enroll (Oreopoulous and Petronijevic, 2013). In the last ten years, private universities averaged a 2.4% annual tuition increase adjusted for inflation. With the classic investment theory, one might expect to see a decline in enrollment with rising prices, but according to college board, college enrollment increased by 15% since 2005 (College Board, 2016). For students to bear this increased marginal cost every year, they must believe that the added benefit or college quality is worth it.

Students may associate higher tuition with better quality. Early studies showed that consumers believe price to be an indicator of quality (Leavitt, 1954). Scitovsky (1944) suggests that such behavior is not unreasonable as the basic law of demand and supply creates a hierarchal order of products based on price. Especially with expensive products, consumers have a 'you-

get-what-you-pay-for' mentality, even if the customer shows no familiarity with the product prior to purchase (Rao and Monroe, 1989). Despite the theory behind this phenomenon, there have been no significant studies to demonstrate that a causal relationship between price and quality exists. However, it can generally be agreed upon that there is a positive relationship between price and perceived quality (Rao and Monroe, 1989).

Under this assumption, it is reasonable to hypothesize that students agree to pay rising prices based on perceived levels of quality. Rarely can consumers understand quality at a glance, and several studies show that customers will purchase products with relatively little information even when the financial burden is significant (Gerstner, 1985). Economists believe that prices influence decisions. In higher education, if prices do not reflect the benefits of quality, then there is a discrepancy between tuition costs and value, and consumers make the wrong decisions. In applying consumer behavior to the decision for selecting a college, this paper aims to understand what determines tuition.

This paper begins by reviewing the relevant literature with respect to measuring educational quality. Section 2 will separate quality into actual and perceived measures, and then discuss the associations of actual measures in section 2.1, perceived measures in 2.2, and the implications for perceived measures in 2.3. Section 3 will review the data source in 3.1, describe the model and variables in 3.2, and explain the intuition behind the model in 3.3. The results will be explained in section 4 and conclusions and results in sections 5 and 6.

## 1. Literature Review

The definition for the quality of education has been defined in multiple ways. Longanecker and Blanco (2003) define quality as the how and the who, which refers to the teaching methods and the teachers. Akareem and Hossain (2014) define quality of education as the quality of

students, faculty credentials, academic features, and administrative supports. Mitchell (2010) describes quality as the student's perceptions, quantifiable elements, course design and outside factors. Economists have criticized almost all these approaches to measure quality. When thinking about how to measure quality, it is also important to consider two factors: the ability to measure the independent variables and whether the variables encompass all aspects of quality.

There are criticisms that many of the early definitions of quality are flawed because they do not encompass the whole student experience or measure intangible variables. Early literature attempted to estimate the labor market effects of college quality to determine how higher quality colleges affected wages (Black and Smith, 2004). The measures of quality used in these studies include inputs such as student-to-falculty ratio and endowment per student, both of which were found to be significant in the labor market. Critiques of these types of methods involve being unable to account for variables such as improvement of a student's problem solving skills or motivation to learn. Black and Smith (2004) argue that there is a selection bias in estimating college quality because more motivated and able students will self-select into better colleges. Therefore, those colleges are perceived to have a higher level of education, when in fact, it is the student, not the college, that provides a higher outcome. In other words, how can the student's ability be separated from the measure of college quality?

One way to avoid this problem would be to measure quality by what Bennet (2001) defined as the value-added approach. This approach measures student improvement, and is the difference between the student's attainments immediately after college and the attainments they already had upon entering college. Student ability would be held constant, and only the benefits of the

college would be measured. While this would be the most accurate approach, Bennet (2001) himself admits to fundamental flaws in obtaining data for these measures. [1]

Because a student's improvement is hard to measure, Bennet suggests that the second-best approach would be to measure outcomes such as GRE test scores or accolades such as the Rhodes, Watson, or Fulbright awards. Retention rates are one of the most used indicators for outcomes because they imply that the students were satisfied enough by the school's services to return for the next year. Even so, retention rates cannot be the sole indictor of quality as they do not show how much a student has learned (Bennet, 2001). Unfortunately, there is no set formula for estimating student quality. For the purposes of this paper, quality will be measured with a combination of inputs and outputs that can be measured despite the flaws of each.

## 2. Measures of Quality Used in this Study

Unlike the previous literature, this paper attempts to separate variables that describe actual quality and variables that describe perceived quality. Buss, Parker and Rivenburg, (2004) categorize these measures into direct attributes and indirect attributes. Direct attributes are the tangible actions and quantifiable measures a university takes to improve the quality of life for students. Indirect measures involve summary rankings or ratings of colleges by a third party (Buss, Parker, and Rivenburg, 2004). The most well-known example of an indirect measure is the U.S News and World Report, the validity of which will be discussed further in this paper.

### 2.1 Direct Measures

From a cost perspective, it is reasonable to assume that the more money a university spends to improve education, the better that education will be. In their study, Pike et al. (2010)

[1] Bennet mentions finding value-added measures might be costly and complex. Another complication is that these benefits may have a lagged effect that is not apparent immediately after graduation. Therefore, quantifying and identifying the lagged effect is not feasible.

assessed how students responded to increases in expenditures. Students were given a survey measuring cognitive outcomes with four options to rank their college experience regarding general education, writing and speaking effectively, quantitative analysis, and critical thinking. The survey was scaled on a 1-4-point system. The points were as follows: 4) Very Much, 3) Quite a Bit, 2) Some, and 1) Very Little. The scaled responses 1-4 were respectively 0.00, 33.33, 66.67, and 100, and averaged to obtain a mean score between 0 and 100. The study found that better expenditures were related to certain institutional characteristics such as academic challenge, student faculty interaction, enriching experiences, student engagement, and a supportive environment. They found that improved institutional characteristics accounted for nearly 17% of the variance across in cognitive means across institutions in their survey. Their conclusion suggested that money did matter for a college student's learning and development (Pike et al., 2010)[2]. These results provide support for using educational costs and financial investment as a proxy for educational quality.

In this analysis, variables that are representative of financial investment will be used. Endowment per student, student-to-faculty ratio, and financial aid per student are all measures of inputs that directly affect the student and learning environment. A larger endowment allows the university to provide better academic facilities, and offer better learning opportunities for students. A lower student-to-faculty ratio implies that a college spends a larger amount to hire an adequate number of faculty for their student body. The more money spent on scholarships or financial aid allows the student body to consist of the best cohort available. These measures of financial investment increase educational quality.

[2] Only public schools were surveyed in Pike et al.'s study, and the degree to which these results may apply to private universities Is unknown.

## 2.2 Indirect Measures

Among the most controversial measures of quality is reputation. Students have begun to rely more on subjective rankings when making a college decision. There is no question that guidebooks and magazines that rank reputation play a major role in where students choose to apply to college. The U.S News & World Report "ranking" includes around 1400 colleges and in the 2013, the digital magazine had over 20 million monthly views (U.S News and World Report, 2017). With numerous colleges, there is a growing rivalry among universities to stand out and attract the best students (Monks and Ehrenberg, 1999). Technology has made college rankings highly visible to prospective students, and universities have responded by expending resources on improving rank that might have otherwise gone to improving student productivity or the learning environment (Dill, 2005).

There are a couple of ways in which colleges might "beat the system". In Kuh and Pascarella's (2004) study, they found college selectivity and educational practices to improve student learning were uncorrelated with each other. In other words, a more selective school would not necessarily have a better learning environment. Dill argues that perhaps this is because universities invest money in administrative efforts to lure potential students instead of improving quality (Dill, 2005). Another criticism of ranking systems is that it encourages grade inflation within universities, which makes the student body look more impressive without improving the academic rigor of the university. A study that surveyed students in the 1990's reported that students spent significantly less time in academic related activities than their predecessors did, but had higher grades (Kuh, 1999). Grade inflation may even lower the quality of the college as it lowers a student's motivation for academic effort (Dill, 2005).

An alternative to the U.S News and World report is the NSSE benchmarks[3]. The benchmarks are calculated using responses from the college student report, a survey that asks first year and senior students to report levels of engagement in activities that indicate a good learning environment. These benchmarks include 1) Level of Academic Challenge 2) Active and Collaborative learning 3) Student interaction with Faculty Members 4) Enriching Educational Experiences and 5) Supportive Campus environment (Pike, 2004). The benchmarks were designed to measure how an institution could improve and provide a more accurate indication of actual quality.[4] Pike measured these benchmarks against the U.S News and World Report ranking and found few statistically significant correlations.[5] His results imply that the quality of an institution is not representative of the institution's reputation and rank (Pike, 2004). Therefore, in this analysis, the U.S News and World Report ranking will serve as a proxy for perceived quality.

**2.3 Implications of Indirect Measures**

While the U.S News and World Report rank may not directly reflect quality, it does affect student and administrative decisions. Monks' and Ehrenberg's (1999) study on the impact of the U.S News & World Report Rankings and college admissions outcomes show that a lower rank results in a college being less selective in their applicant pool. This in turn leads to not as

[3] There is little research done to show that the NSSE survey yields different results from the U.S News and World Report. It is important to note that scores from the NSSE survey are based on responses from the students themselves. The survey therefore cannot account for differing student interpretations of these indications across different institutions.

[4] While the NSSE would be a good indication of actual quality in this analysis, it does not provide the individual scores across school needed for comparison.

[5] Only selectivity and enriching educational experiences were significant. Pike explains that this relationship could have resulted because more selective institutions may indeed offer more opportunities for student to get involved. Other theories are that selective institutions happen to be smaller and smaller colleges have more opportunities for students to engage. He also admits to the possibility that the relationship was completely random.

many students enrolling in the college and a lower yield rate. The lower yield rates result in a lower SAT scores for the incoming class, indicating that the level of student quality decreased for the entering class. Alternatively, a higher rank may attract a higher quality student (Monks and Ehrenberg, 1999). While this study was conducted around twenty years ago the relevance remains. A higher reputation has implications for student quality that were not a result of the university's characteristics.

Reputation may attract more competent students. Higher student quality may increase the educational rate of return due to peer effects, which are the positive or negative spill overs of people grouped together. Carrell, Fullerton, and West (1999) estimated the peer effects on college achievement for peer groups of 30 at a naval academy. Individuals were randomly assigned to groups and had limited ability to interact with people outside the group. They found positive peer effects in freshman academic performance measured by SAT score and freshman year fall grades. The results suggest that the benefit of studying with peers with higher SAT scores is significant as it increases the success of the entire group (Carrell, Fullerton, and West, 1999). Therefore, a smarter cohort of students will provide a benefit, the extent of which is unmeasurable.

Reputation undeniably opens doors for students that might not have been available at less prestigious universities. A study in 1995, examined the relationship between prestige and career success of 1388 executives. Those who went to Ivy League schools enjoyed higher expected earnings of around $600,000 over a 20-year span than those people who went to lower ranked schools controlling for educational quality (Tang et al., 2004). Businesses compete for the best employees, and they look to universities with higher accolades to find them. With connected alumni, and better networking opportunities, qualified candidates who attend schools with a

higher reputation are associated with having better qualifications (Tang et al., 2004). Employers think that those universities are better equipped to invest in the human capital of their students.

One of the challenges of this paper is understanding what impact reputation has, and analyzing how tuition reflects that impact. This paper acknowledges that the U.S News and World Ranking has quality implications that are not measurable. However, this paper hopes to understand the relative relationship between perceived quality and tuition. If a university sets a tuition higher than the perceived and actual benefit, they are charging beyond their value.

## 3. Methodology

### 3.1 Data Source

The Integrated Postsecondary Education Data System (IPEDS) consists of information found from a set of surveys conducted annually from every college, university, or institution that participates in financial student aid programs. The most recent and updated year for IPEDS was the 2014-2015 school year. Therefore, only information from that year is used in this data set. All variables used in this model except for the ranking variable were retrieved from the IPEDS data set. The data in this analysis contains information from 144 liberal arts colleges which were selected for the following reason: private institutions may set tuition charges whereas public institutions rely more on public funding. To analyze the relationship between price and perceived quality, the university must set the price instead of taking it as given. Another criterion was that the schools had to be ranked in the U.S News report for the 2014-2015 academic year. Schools, like the Naval Airforce academy although ranked, were not eligible because they are free for students. Colleges which promised 100% financial aid were also excluded from the data set because in those institutions, it is hard to measure perceived quality because no one pays the full price.

## 3.2 Model, Variables, and Descriptive Statistics

When applied to a market economy, in higher education, the university acts as the supplier and the students are the consumers. Therefore, tuition is the price of the service the university provides (Baba, Yonezawa, 1998). In a well-functioning market, tuition should then reflect the different aspects of quality, and higher tuition should imply higher quality. In the hopes of analyzing this relationship, tuition is used as the dependent variable, and factors that influence college quality or perception of quality are used as independent variables.

This study will define price in two ways. Tuition will represent the yearlong cost of college for tuition, room and board, cost of books, and mandatory fees. This price is commonly known as the sticker price as it is the most visible to prospective students. However not all students pay the sticker price because some students receive federal aid, which are grants received on the federal, state or local government level or by institution. The second measure, average net tuition, is defined as the tuition less the average number of discounts, which include financial aid and scholarships. All three variables, tuition, net tuition, and financial aid will be used as dependent variables to understand how the measures of quality interact and differ across models. These variables are in log form because to represent the marginal effects of the dependent variables.

The empirical model for the relationship between tuition and measures of quality are specified in equation 1:

(1) $$Log(T_i)=\beta_o+\beta_1(Log(rank))_i+\beta_2(Log(SAT))_i+\beta_3(Log(endowment))_i+\beta_4(student)_i+\beta_5(yield)_i+\beta_6(retention)_i+\beta_7(need\_met)_i+\varepsilon_T$$

And the empirical model to describe the relationship between net tuition and measures of quality are specified in equation 2:

(2) $Log(NT_i) = \gamma_0 + \gamma_1(Log(rank))_i + \gamma_2(Log(SAT))_i + \gamma_3(Log(endowment))_i + \gamma_4(student)_i + \gamma_5(yield)_i + \gamma_6(retention)_i + \gamma_7(need\_met)_i + \varepsilon_T$

A empirical model looking at financial aid is included as stated in equation 3:

(3) $Log(AvgFinAid_i) = \alpha_0 + \alpha_1(Log(rank))_i + \alpha_2(Log(SAT))_i + \alpha_3(Log(endowment))_i + \alpha_4(student)_i + \alpha_5(yield)_i + \alpha_6(retention)_i + \alpha_7(need\_met)_i + \varepsilon_T$

Where:

| | | |
|---|---|---|
| $T_i$ | = | Tuition |
| $NT_i$ | = | Net Tuition |
| *Finaid* | = | Average Financial Aid |
| *rank* | = | U.S News and World Ranking |
| *SAT* | = | SAT score |
| *endowment* | = | endowment per student |
| *student* | = | student-to-faculty ratio |
| *yield* | = | number enrolled students/ number of admitted students |
| *retention* | = | retention rate |
| *need_met* | = | meets 100% demonstrated financial aid |
| $\beta_1$-$\beta_7$ | = | estimated coefficients for tuition equation |
| $\gamma_1$-$\gamma_7$ | = | estimated coefficients for net tuition equation |
| $\alpha_1$-$\alpha_7$ | = | estimated coefficients for the average financial aid equation |

Quality factors are divided into two categories, the direct and indirect. Indirect measures are measured by the rankings for the U.S News and World Report to measure perceived quality. In the beginning of this paper, a relationship between perceived quality and tuition was hypothesized. As perceived quality increases by a more favorable rank, both tuition and net tuition would be expected to increase. Rank is logged because it most likely has diminishing marginal effects. A change in ranking from 1st place to 2nd place will have a more dramatic impact than a change from 145th place to 146th place. While analyzing the relationship between perceived quality and price, actual measures of quality are included in the model to be held constant. One way to account for student quality, is to include SAT scores of the entering class.

SAT scores measure the ability of the students, which will somewhat control for peer effects. SAT is in log form because a one unit change will not capture the effect of SAT as much as a percent change due to the magnitude of the variable. Better students go to better schools, so as the entering class' SAT scores increase, tuition and net tuition are also expected to increase.

The direct variables include both inputs and outputs that are measurable and reflective of actual quality. The rationale behind using both inputs and outputs is that inputs reflect quality from an administrative perspective and outputs reflect quality from a student's perspective. In this model, inputs are endowment per student and student-to-faculty ratio and yield rates. Endowment and student to faculty ratio are measures of financial investment and financial investment increases quality, there should be a positive correlation with these variables and tuition and net tuition. Yield should measure student demand, and an increase in demand should correlate with an increase in tuition. The output for direct measures is the retention rate to measure student satisfaction. The higher the number of students that want to return to the college, the better the experience or quality of the college. Intuitively, a more expensive college may be able to provide students with the resources to have a better experience. Higher retention rates can then be expected to positively correlate with tuition and net tuition. In order to acknowledge different policies regarding pricing, a dummy variable capturing whether the schools meets 100% financial aid is included in the model. The rationale for this variable is that colleges that meet 100% percent financial aid will charge a higher tuition and net tuition to subsidize needier students.

Financial aid is determined through the need of the student body uninhibited by quality measures. The expectation would be that if a school meets 100% demonstrated need, their average financial aid would be higher. Also, if a school has better resources such as endowment,

then a school would be able to offer better financial aid. However, the directionality and magnitudes of the other variables impact on financial is unclear. Refer to Table 1 for descriptive statistics for the variables in this model and Table 2 for further explanation of variables and definitions.

### 3.3 Theoretical Framework

For a consumer to judge quality based on price, the assumption is that the consumer knows the price. Typically, tuition is the price advertised by the school and is more visible to perspective students. Net tuition is less visible due to the complex process to receive financial aid. One of the complexities of financial aid is federal loans, and because people inherently discount the future, students cannot fully understand the impact of loans plus accumulated interest. Also, the financial package differs based on need, which is different for everyone. Intuitively, if a school uses a more favorable reputation to increase their price, then it would be apparent in the more visible measure of price. Therefore, the coefficient for rank in the tuition equation, $\beta_{1,}$ is expected to be greater than $\gamma_{1,}$ the coefficient for rank in the net tuition equation. If no price inflation exists, then the impact for rank should be the same for both tuition and net tuition, meaning $\beta_1$ is not statistically different from $\gamma_{1.}$

## 4. Results and Discussion

A simple OLS model was used to estimate three basic models on the effects of perceived quality on tuition, net tuition, and financial aid.

### 4.1 Model 1

The first model simply includes the measures of quality. The coefficient for $\beta_1$ the log of rank is significant in the tuition model and $\gamma_1$ is insignificant in the net tuition model. This suggests that holding actual quality constant, the perceived measure of quality will increase

tuition which is consistent with the theory that colleges increase tuition based on better reputation. The coefficient for the log of rank can be interpreted as for a one percent decrease or better in rank, tuition is correlated to increase by .071% ceteris paribus.

The model is fairly good at capturing measures of actual quality as all variables are significant in the tuition model with the exception of SAT score. As measures of quality increase such as higher retention rates and lower student to faculty ratios, tuition also increases. Tuition and endowment per student have a negative elasticity, but an explanation could be that schools with bigger endowments do not have to charge as high of a tuition to cover operating expenses. SAT score was insignificant which means that it did not capture the expected quality implications. Many liberal arts schools emphasize the importance of looking at the big picture of a student's application during the admissions process and not solely on test scores.

In fact, some colleges choose to forgo the SAT component of the application altogether by providing students with a test optional section. If this is the case, SAT score would be a bad indicator in determining how the admissions process judges student quality, and it explains the lack of significance in this model. The directionality of admissions yield is not what was expected earlier. If yield is a proxy for demand, logically tuition would increase as yield does. This result can be interpreted that students who apply to lower quality schools do not have many options, and therefore are forced to enroll. In this way, schools with lower tuition and overall lower quality could have higher yield rates.

In the financial aid model, a 1 percent decrease in rank will increase financial aid by approximately .14%. The interaction between tuition and financial aid makes intuitive sense because when schools increase tuition due to ranking they must increase financial aid to meet the same levels of need. While the average financial aid should theoretically be determined by

student need, the larger the resources for a college, typically the better the financial aid policies. Higher student to faculty ratios imply that colleges do not have the resources to employ a larger number or faculty and therefore are less able to provide as much financial aid. Endowment is a measure of resources as well, but this effect is captured in driving tuition prices down instead of pushing financial aid up. For yield rate, the tuition model indicated that yield and tuition are negatively correlated. According to the correlation matrix in table 4, tuition and financial aid have a significant strong positive correlation. In this way, financial aid and yield should also be negatively correlated.

In the net tuition model, the independent variables that are significant are also significant and in the same direction for the tuition model. Because these variables effect the cost that most people pay, they should be better at portraying an effect of actual quality. Student to faculty ratio is insignificant, which is surprising. Perhaps this effect is captured in the ability to give more financial aid, and therefore means that the net tuition and resources implied by lower student to faculty ratios are not correlated. Also, the adjusted $R^2$ for net tuition is lower than the adjusted $R^2$ for the other models, which indicates that there are other independent factors that impact net tuition not captured in this model.

**4.2 Model 2**

In addition to measures of quality, universities use prices to influence the diversity of the student cohort. According to The Vice President for enrollment management at the University of Richmond, price is determined by a variety of different factors, but there are four main components and goals (Stephanie Dupaul, 2018). The first is to keep within the same price range of other similar colleges. Admissions look at schools of similar quality and raise their prices comparably. The second factor is to maintain and attract a diverse student body. The logic

behind universities charging higher tuition is so high payers can subsidize low income students. To accept a larger number of students from lower socioeconomic spheres, tuition must be increased. Similarly, colleges want to attract students from diverse racial backgrounds, and they increase tuition to subsidize high ability minority students from lower socio-economic classes. The forth objective is to meet demand and the higher the demand, the higher the price.

The first model captures demand through yield rates, and regulating price in accordance to other colleges does not contribute to the actual quality of a university. In trying to understand more abstract measures of why price is set, this second model tries to grasp how diversity impacts tuition. The second model includes discrete variables for different racial backgrounds. The variables were determined from data on the IPEDS data set as the percent of each racial group that was self-identified by the student body at each college. The descriptive statistics are shown on table 4. Nonresidential is synonymous with international students, and the other category encompasses all the smaller minorities on college campuses such as native American and native Hawaiian. As the percentages of minorities increase, tuition and financial aid would be expected to increase and net price should decrease. Financial aid policies towards international students tend to be less generous and therefore there should be a negative correlation between nonresidential, and tuition and financial aid. The modified base equation is as follows where $\lambda$ is $\beta$ for the tuition model, $\gamma$ for the net tuition model, and $\alpha$ for the financial aid model:

$$Log(T_i),\ Log(NT_i)\ and\ Log(Finaid_i) = \lambda_o + \lambda_1(Log(rank))_i + \lambda_2(Log(SAT))_i + \lambda_3(Log(endowment))_i + \lambda_4(student)_i + \lambda_5(yield)_i + \lambda_6(retention)_i + \lambda_7(need\_met)_i + \lambda_8(Asian)_i + \lambda_9(Black)_i + \lambda_{10}(Hispanic)_i + \lambda_{11}(non\text{-}residential)_i + \lambda_{12}(other)_i + \varepsilon_T$$

Where:

| | | |
|---|---|---|
| $T_i$ | = | Tuition |
| $NT_i$ | = | Net Tuition |
| *Finaid* | = | Average Financial Aid |
| *rank* | = | U.S News and World Ranking |
| *SAT* | = | SAT score |
| *endowment* | = | endowment per student |
| *student* | = | student-to-faculty ratio |
| *yield* | = | number enrolled students/ number of admitted students |
| *retention* | = | retention rate |
| *need_met* | = | meets 100% demonstrated financial aid |
| *Asian* | = | percentage of Asian students |
| *Black* | = | percentage of African American students |
| *Hispanic* | = | Percentage of Hispanic students |
| *Non-residential* | = | Percentage of international students |
| *other* | = | Percentages of the rest of minority students |
| $\lambda_1$-$\lambda_{12}$ | = | estimated coefficients for base model |

The results captured in model 3 show that the quality variables are unaffected for the tuition model and net tuition model. The only significant term for the tuition model is the coefficient for other. Additionally, a one percent increase in other minorities does not affect the average amount of financial aid compared to a one percent increase in the percentage of white people. This suggests that having a higher number of minority students in other does not correlate with better financial aid, and therefore high payers do not have to subsidize those students. A possible explanation is that the racial groups that make up other would further diversify the colleges. Therefore, colleges may measure a more diverse student body as a measure of quality and increase tuition.

The log of SAT score, Hispanic, and nonresidential are significant in the financial aid model. For a one percent increase in SAT score, financial aid decreases by .692%. Students who do well on the SAT characteristically have the resources to higher tutors and take classes, and because they have those resources they do not need as much financial aid. Hispanic is consistent

that an increase in the percent of a minority group increases financial aid if typically, that group comes from a lower socioeconomic class. The direction of non-residential is confusing, but a possible justification may be that international students are attracted to higher perceived quality schools. The marginal benefit of a US university would have to be higher than the marginal benefit from a school in that student's home country. Consequently, those students attend schools with better reputations, higher tuitions, and in turn schools that give higher financial aid.

The main takeaway from this model is that even accounting for different demographics, the coefficient for the log of rank $\beta_1$ on tuition is significant and the same coefficient, $\gamma_1$ is not significant for the log of net tuition. This still confirms the theory that perceived levels of quality are seen in tuition and therefore getting a diverse student body and measures of quality do not explain price increases. The adjusted $R^2$ is higher for model 2 than for model 1, for both the tuition and the financial aid models, but not for net tuition. This implies that the inclusion of racial groups explains the model of tuition and financial aid better, but only slightly.

**4.3 Model 3**

The third model captures the effect of different income brackets on tuition, net tuition and financial aid. The data was retrieved from the IPEDS data set, which separates income into five brackets. The variables were determined by taking the number of incoming first year undergraduate students in each income bracket on financial aid and dividing them by the total number of first time enrolled first year students. They are discrete variables that represent the percentages of each income bracket in the freshman class. The modified base model is as follows where $\lambda$ represents $\beta$ for the tuition model, $\gamma$ for the net tuition model, and $\alpha$ for the financial aid model:

$$Log(T_i),\ Log(NT_i)\ and\ Log(Finaid_i) = \lambda_o + \lambda_1(Log(rank))_i + \lambda_2(Log(SAT))_i + \lambda_3(Log(endowment))_i + \lambda_4(student)_i + \lambda_5(yield)_i + \lambda_6(retention)_i + \lambda_7(need\_met)_i + \lambda_8(Group1)_i + \lambda_9(Group2)_i + \lambda_{10}(Group3)_i + \lambda_{11}(Group4)_i + \lambda_{12}(Group5)_i + \varepsilon_T$$

Where:

| | | |
|---|---|---|
| $T_i$ | = | Tuition |
| $NT_i$ | = | Net Tuition |
| *Finaid* | = | Average Financial Aid |
| *rank* | = | U.S News and World Ranking |
| *SAT* | = | SAT score |
| *endowment* | = | endowment per student |
| *student* | = | student-to-faculty ratio |
| *yield* | = | number enrolled students/ number of admitted students |
| *retention* | = | retention rate |
| *need_met* | = | meets 100% demonstrated financial aid |
| *Group1* | = | percentage of freshmen with incomes of $0-30,000 |
| *Group2* | = | percentage of freshmen with incomes of $30,001-48,000 |
| *Group3* | = | percentage of freshmen with incomes of $48,001-75,000 |
| *Group4l* | = | percentage of freshmen with incomes of $75,001-110,000 |
| *Group5* | = | percentage of freshmen with incomes of 110,001 or more |
| $\lambda_1$-$\lambda_{12}$ | = | estimated coefficients for base model |

Surprisingly the descriptive statistics in table 4 show that the average percentage for students in the fifth income bracket whose families have assets of $110,000 or more is the highest with a mean of 21.4%. An explanation for such a high statistic compared to the rest of the income brackets is that liberal arts schools tend to attract higher income students. Students from lower income families would choose a state or community college, where the initial price tag is much lower.

This logic is consistent with the results in model 3 for the tuition and net tuition models. The income variables are discrete with the percentage of students not on financial aid being the

excluded party. Group 2 and Group 3 with income brackets of 30,0001- 48,000 and 48,001-75,000 are significant with negative coefficients. The interpretation is that a one percent increase in the percentages of group 2 and 3 will correlate with a decrease in tuition of .9% and .81% relative to students who are not on financial aid. The average cost of tuition is 54,020.12, for group 2 and 3, this is a cost that exceeds or is most of their families' income. The intuition behind this is that students in these income brackets will self-select into lower priced liberal arts colleges. These students also generally might not have had the resources such as a private school education to get into highly selective liberal arts colleges, and chose less selective colleges with lower price points. The same logic can be used for why the coefficients for group 2 and group 3 are significant and negative for the net tuition model. Group five is significant for the net tuition model as well, but that can be explained simply. Price is not as much of a deterrent for this income bracket as much as it is for groups 2 and 3. Therefore these students believe they can attend higher priced schools, and higher income families do not need as much financial aid driving net tuition up.

In this model, holding student socioeconomic class constant, will make retention rates insignificant for the tuition and net tuition model. It is unclear what causes this change because retention rates depend on individual preferences and students choose to stay at colleges or universities for a variety of reasons. One possible theory could be that reasons for staying at a college may be likeness of fit, and if a student feels that he or she is dissimilar to the student body, they will drop out. Keeping the socioeconomic makeup of the student body constant controls in part for likeness of fit because students of the same socioeconomic class may have more characteristics in common. Colleges with a lower tuition may attract people of similar socioeconomic background and a student's sense of relatedness to their peers increases.

Therefore, schools that have higher tuitions and net tuitions may not correlate with better satisfaction.

In the net tuition model, the coefficient for endowment becomes insignificant, and the coefficient for meeting 100% demonstrated need becomes more significant. Net tuition is determined by subtracting the average amount of financial aid from tuition, and financial aid is determined based on student need. It would make intuitive sense that the more resources a university has does not impact the need of the student cohort controlling for whether a school meets 100% of demonstrated need and the percentages of students in each income bracket. Then if a school is dedicated to meeting full need given the same socioeconomic diversity, then the amount of financial aid given increases and the net tuition will be lower.

Overall controlling for socioeconomic characteristics the measures of quality are not effected dramatically. The coefficient in the tuition model for rank, $\beta_1$, is greater and more significant than the coefficient for net tuition, $\gamma_1$, which indicates that there are price increases correlated with a better reputation and higher perceived levels of quality regardless of student need.

## 5. Limitations and Future Research

First, the results of this study examine correlation, not causation. It is difficult to tell if perceived quality causes price increases and therefore the results should be read with skepticism. The limitations of this study also lie in the inability to accurately estimate college quality as discussed in the literature review. College quality in this model can only be a prediction, and will never accurately depict the whole effect of college quality. Many measures of quality can be interpreted in a variety of different ways. For example, retention rates can measure student satisfaction or if the student cohort has a low ability, many students would flunk out and

retention rate measures student aptitude. It is difficult to standardize what these measures of quality capture across schools. Also, it is unreasonable to think that measures of actual quality are not included in the U.S News and World Report. Factors include SAT score, financial indicators, alumni giving, and retentions rates (U.S News and World Report, 2017). It would be naive to think that U.S News and World report does not have some indicators for quality. These models hope to combat this issue by including actual quality measures in the model to control for the effects of actual quality, but the extent to how well this model has this effect is unknown.

Further research might include better measures of quality for both inputs and outputs. This could include obtaining first year salaries for recent graduates or conducting satisfaction surveys to better capture individual preferences for students. Another study going forward would be to compare national universities and liberal arts colleges. While they have different objectives and attract different types of students, perspective students compare their relative values. A student does not choose between one type of college, but typically decides between state schools, national universities, and liberal arts colleges. It would be interesting to see how perceived quality impacts both national universities and liberal arts schools if actual quality can be standardized between the two classifications of colleges.

## 6. Conclusion

Students judged quality based on price, and therefore higher priced universities are seen to have better worth than lower priced universities. Despite the cost the average student pays, which is net tuition, students perceptions of value are still caused by tuition. Controlling for quality and different incentives for price regulation, all three models indicated that the coefficient for the log of rank, $\beta_1$, in the tuition model is greater than the coefficient for the log of rank, $\gamma_1$, in the net tuition model. As rank represents perceived levels of quality, the effect is apparent in the

more visible indicator, tuition. There is no such significant correlation in the net tuition model, which represents the real marginal cost because most students pay net tuition. If colleges did not increase price to make their universities look more prestigious, then rank should affect net tuition and tuition similarly. This indicates that there is a positive correlation between perceived levels of quality and tuition, and colleges may increase their prices to gain a better reputation.

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## Appendix

**Table 1. Descriptive Statistics for Quality Variables Source: IPEDS 2014-2015**

| Variable | N | Mean | Std Dev | Minimum | Maximum |
|---|---|---|---|---|---|
| **Average Net Tuition** | 144 | 25,993.01 | 5,106.63 | 14,312 | 40,550 |
| **Tuition** | 144 | 54,020.12 | 7,879.99 | 25,872 | 66,627 |
| **Rank** | 144 | 76.7 | 44.2 | 1 | 148 |
| **Retention Rate** | 144 | 87.4 | 6.6 | 67 | 98 |
| **Student to Faculty Ratio** | 144 | 10.43 | 1.61 | 6 | 14 |
| **Endowment per student** | 144 | 206,460.17 | 235,549.78 | 18,890 | 1,332,569 |
| **SAT Score** | 144 | 1318.28 | 101.29 | 1090 | 1570 |
| **Average Financial Aid** | 144 | 27,833.31 | 7,553.06 | 5,845 | 47,145 |
| **Yield Rate (%)** | 144 | 27.11 | 10.47 | 12 | 72 |
| **Need_Met** | 144 | 0.3194 | 0.4678 | 0 | 1 |

**Table 2. Variable Definitions**

| Variable | Definition |
|---|---|
| Average Net Tuition | The Average Net Tuition is the sticker price less any discounts received. Discounts include grant aid or scholarships from federal, state, or local governments or the institution. Other sources of grant aid are excluded. |
| Tuition | Tuition is the sticker price. The sticker price consists of the total cost of books, room and board, mandatory fees, and tuition for one year at college. |
| Average Financial Aid | The average financial aid is the total amount of grant aid on the federal, state or local government level and institutional grants divided by the number of full time undergraduates |
| Rank | Ranks were as published by the U.S News and World Report rank for the 2014-2015 school year. |
| SAT | SAT score was determined from the combined scores from the critical reading and math sections. The maximum score is 1600. The writing section was excluded because some schools do not require scores for this section, and it was no consistent for the schools use in the data set. |
| Endowment | Endowment assets are gross investments of endowment funds, term endowment funds, and funds functioning as endowment for the institution and any of its foundations and other affiliated organizations. Endowment funds are funds whose principal is nonexpendable (true endowment) and that are intended to be invested to provide earnings for institutional use. Commonly endowments provide annual income to alieve tuition burdens. It is calculated by divided the total amount of assets by the number of full time undergraduate and graduate students. The rationale behind including all students is that the endowment provides funds for all students. |
| Student-to-faculty Ratio | Student to Faculty Ratio is the number of full time undergraduates enrolled divided by the number of full time instructional staff for undergraduates. |
| Yield Rate | The number of full time undergraduate first years enrolled divided by the number of first year undergraduate admitted students |
| Retention Rate | The full-time retention rate is the percent of the fall full-time cohort from the prior year minus exclusions from the fall full-time cohort that re-enrolled at the institution as either full- or part-time in the current year. |
| Need_Met | a dummy variable for meeting 100% demonstrated need (1) or not (0) |
| Groups 1-5 | The number of first time undergraduate first year students on financial aid in each income bracket divided by the total number of first time undergraduate first year students |

**Table 3. Correlation Matrix between Tuition, Financial Aid, and Net Tuition**

| | Tuition | Average Financial Aid | Net Tuition |
|---|---|---|---|
| **Tuition** | 1 | 0.78694<br>(<.0001) | 0.40741<br>(<.0001) |
| **Average Financial Aid** | | 1 | -0.24033<br>(-0.0037) |
| **Average Net Price** | | | 1 |

**Table 4. Descriptive Statistics for Racial Backgrounds**

| Variable | N | Mean | Std Dev | Minimum | Maximum |
|---|---|---|---|---|---|
| Asian | 144 | 4.7% | 4.0% | 0.00% | 24.1% |
| Black | 144 | 6.6% | 11.0% | 0.00% | 94.3% |
| Hispanic | 144 | 7.3% | 4.9% | 0.30% | 44.4% |
| White | 144 | 67.5% | 15.3% | 0.00% | 93.3% |
| nonresidential | 144 | 6.7% | 5.0% | 0.00% | 27.3% |
| Other | 144 | 7.30% | 5.00% | 0.02% | 28% |

**Table 5. Descriptive Statistics for Different Income Levels Source: IPEDS 2014-2015**

| Variable | N | Mean | Std Dev | Minimum | Maximum |
|---|---|---|---|---|---|
| **Group 1 ($0-30,000)** | 144 | 10.4% | 6.0% | 2.3% | 32.7% |
| **Group 2 ($30,001-48,000)** | 144 | 7.2% | 3.2% | 2.0% | 15.8% |
| **Group 3 ($48,001-75,000)** | 144 | 10.3% | 3.9% | 3.0% | 21.3% |
| **Group 4 ($75,001-110,000)** | 144 | 12.5% | 5.3% | 3.2% | 37.0% |
| **Group 5 (>$110,000)** | 144 | 21.4% | 6.8% | 6.7% | 47.2% |

**Model 1. Measures of Quality on Tuition, Financial Aid, and Net Tuition IPEDS 2014-2015**

| | Log (Tuition) | Log (Financial Aid) | Log (Net Tuition) |
|---|---|---|---|
| Intercept | 11.38<br>(8.19)*** | 13.531<br>(3.66)*** | 7.3599<br>(3.22)*** |
| Log (rank) | -0.071<br>(-3.27)*** | -0.1408<br>(-3.19)*** | 0.0166<br>(0.43) |
| Log (SAT Score) | 0.037<br>(0.19) | -0.1853<br>(-0.36) | 0.316<br>(1) |
| Log of Endowment | -0.036<br>(-2.09)** | -0.0278<br>(-0.92) | -0.044<br>(-1.85)* |
| Student to Faculty Ratio | -0.034<br>(-3.41)*** | -0.0588<br>(-3.18)*** | -0.011<br>(-0.87) |
| Admission Yield | -0.007<br>(-4.7)*** | -0.0071<br>(-2.33)** | -0.008<br>(-4.82)*** |
| Retention Rate | 0.0052<br>(2.07)** | -0.0043<br>(-0.89) | 0.015<br>(4.83)*** |
| Meets 100% Demonstrated need | 0.08185<br>(2.67)*** | 0.22612<br>(4.01)*** | -0.05829<br>(-1.16) |
| Adjusted $R^2$ | .5881 | .5444 | .2147 |

Notes: (*,**,***) Statistically Significant from zero at the (10%, 5%, 1%) level, white corrected t-values

**Model 2. Measures of Quality and Diversity on Tuition, Financial Aid, and Net Tuition**
**Source: IPEDS 2014-2015**

| | Log (Tuition) | Log (Financial Aid) | Log( Net Tuition) |
|---|---|---|---|
| Intercept | 12.227 | 17.037 | 6.806 |
| | (9.14)*** | (6.22)*** | (2.75)*** |
| Log Rank | -0.074 | -0.168 | 0.032 |
| | (-3.41)*** | (-3.87)*** | (0.8) |
| Log SAT | -0.1 | -0.692 | 0.381 |
| | (-0.54) | (-1.97)* | (1.13) |
| Log Endowment | -0.034 | -0.024 | -0.045 |
| | (-2.1)** | (-0.86) | (-1.81)* |
| Student to Faculty Ratio | -0.031 | -0.052 | -0.012 |
| | (-3.27)*** | (-3.16)*** | (-0.88) |
| Yield Rates | -0.007 | -0.007 | -0.008 |
| | (-4.62)*** | (-2.51)** | (-4.77)*** |
| Retention Rate | 0.006 | -0.004 | 0.015 |
| | (2.45)** | (-0.83) | (5.19)*** |
| Meets 100% Need | 0.067 | 0.208 | -0.061 |
| | (2.39)** | (4.09)*** | (-1.12) |
| Asian | -0.098 | -0.572 | 0.566 |
| | (-0.33) | (-1.03) | (1.11) |
| Black | -0.086 | -0.443 | 0.136 |
| | (-0.7) | (-1.54) | (1.15) |
| Hispanic | 0.228 | 0.574 | -0.244 |
| | (1.31) | (1.87)* | (-1.02) |
| nonresidential | 0.268 | 0.816 | -0.115 |
| | (1.27) | (2)** | (-0.35) |
| Other | 0.375 | 0.39 | 0.106 |
| | (1.69)* | (1.05) | (0.23) |
| Adjusted $R^2$ | .5975 | .5810 | .1989 |

Notes: (*,**,***) Statistically Significant from zero at the (10%, 5%, 1%) level, white corrected t-values

**Model 3. Measures of Quality and Socioeconomic Class on Tuition, Average Financial Aid and Net Tuition Source: IPEDS 2014-2015**

| | Log (Tuition) | Log (Financial Aid) | Log (Net Tuition) |
|---|---|---|---|
| Intercept | 12.99 | 14.99 | 9.98 |
| | (9.61)*** | (4.91)*** | (4.65)*** |
| Log (rank) | -0.07 | -0.14 | 0.02 |
| | (-3.62)*** | (-3.16)** | (0.44) |
| Log (SAT Score) | -0.11 | -0.33 | 0.08 |
| | (-0.58) | (-0.79) | (0.27) |
| Log of Endowment | -0.03 | -0.04 | -0.03 |
| | (-2.36)** | (-1.17) | (-1.38) |
| Student to Faculty Ratio | -0.03 | -0.06 | -0.01 |
| | (-3.54)*** | (-3.2)*** | (-0.96) |
| Admission Yield | -0.01 | -0.01 | -0.01 |
| | (-4.85)*** | (-2.43)** | (-3.53)*** |
| Retention Rate | -0.0003 | -0.0059 | 0.0044 |
| | (-0.09) | (-0.9) | (1.05) |
| Meets 100% Demonstrated need | 0.06 | 0.21 | -0.08 |
| | (2.22)** | (3.51)*** | (-1.94)* |
| Group 1 (0-30,000) | -0.01 | -0.51 | 0.13 |
| | (-0.06) | (-0.8) | (0.3) |
| Group 2 (30,001-48,000) | -0.9 | -0.23 | -1.62 |
| | (-2.23)** | (-0.27) | (-2.5)** |
| Group 3 (48,001-75,000) | -0.81 | 0.25 | -1.68 |
| | (-2.28)** | (0.38) | (-2.93)*** |
| Group 4 (75,001-110,000) | -0.29 | -0.32 | -0.19 |
| | (-1.47) | (-0.71) | (-0.51) |
| Group 5 (>110,000) | 0.16 | -0.3 | 0.65 |
| | (1.24) | (-1.12) | (2.75)*** |
| Adjusted R2 | .6579 | 0.5336 | .3921 |

Notes: (*,**,***) Statistically Significant from zero at the (10%, 5%, 1%) level, white corrected t-values