

The Effects of Academic and Athletic Quality on Undergraduate Admissions

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ABSTRACT. A great many factors influence students' choices regarding which college to attend, including social concerns, financial issues, academic reputation, and sports environment. In order to examine how the demand for education varies by economic conditions, a cross-section of colleges and universities was examined by looking at a basic demand function that included consumption factors, such as Power Five conference membership, in both a "typical" year and a year at the end of the Great Recession. The data used for the current study was the College and Universities 2000 Project (Brint, Mulligan, Rotondi, & Apkarian, 2011) that included data from select years through 2010. The authors used a model including two years of cross-sectional data to test overall demand, demand for private and public colleges and universities, and demand for very high research and lower research institutions. Quality, using a Barron's rating as a proxy, was an important influence on demand in all models. Membership in a Power Five athletic conference was also an important influence. Overall, the results did indicate that consumption factors were important inputs in the demand for colleges and universities, regardless of the overall condition of the economy. (121)

I. Introduction

According to the New York Times, the Bureau of Labor Statistics reported that in October 2013, "65.9 percent of people who had graduated from high school that previous spring had enrolled in college" (N.Y. Times, 2014). Although down 4.2% from a high of 70.1 percent reported in 2009, that figure indicated that nearly two-thirds of U.S. high school graduates still elect to attend some sort of college. A great many factors influence students' choices regarding which college to attend, most notably social concerns, financial issues, academic reputation, and sports environment. The current paper examined how the demand for a college education, as approximated by the number of applicants, is partially determined by consumption factors such as the perceived quality of the school in both academics and athletics.

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For many students the college decision is a financial one, leading them to select the public college closest to their homes (either two-year or four-year depending upon their interests). Others select the closest college because of marked preferences for remaining close to family and friends. In either case, this is often referred to as going to “thirteenth grade”, as the student’s experience is frequently rather similar to their high school experience (at least socially). Whether for financial or personal reasons, this group is not so much selecting a college, but is selecting whether or not to attend college and hence would be a part of the constant term in this study.

In this paper, we are more interested in observing the group who have chosen definitively to attend college and are conducting a broader search for the “perfect” college. Two factors of particular interest are the academic reputation of the school and the sports environment of the institution. Collectively, academic reputation and sports environment represent consumption factors, while tuition and other associated costs are investment factors in the decision to attend a certain college. One consumption variable is that of academic reputation. One way of measuring reputation is by its admissions selectivity, as measured by Barron’s Profile of American Colleges (Barron’s Educational Services, 2013). In the Barron’s guide a “one” is given to the most selective admissions process, while a “six” is given to the least or non-competitive admissions process. The more competitive schools are perhaps more attractive from both a consumption standpoint (i.e. the prestige of membership in an elite group) and an investment standpoint (i.e. a better network which could lead to a better job or graduate school placement). As noted, the sports environment is another important consumption variable. McCormick and Tinsley (1987) demonstrated a positive correlation between SAT scores and the number of applications to a given college after a particularly successful sports season. McCormick and Tinsley refer to this as an advertising effect in that potential applicants hear publicity about a college and its success in athletics and this type of advertising leads them to want to apply to that institution. The authors saw a symbiotic relationship between athletics and academics. Membership in one of the “Power Five” athletic conferences is one measurement of the sports atmosphere of a given institution. The Power Five conferences include the Atlantic Coast Conference (ACC), the Big Ten Conference, the Big XII Conference, the Pacific 12 Conference, and the Southeastern Conference.

For this study, we wished to determine whether these consumption factors' influence on the desirability of institutions varied according to the state of the economy. We were particularly interested in the impact of the Great Recession of 2008 to 2009 on these consumption factors. A dummy variable representing the year was included in the regression to see if demand changed between a year before the Great Recession and a year at the very end of it. In order to examine how the demand for education varied by economic conditions, we examined a two year sample of colleges and universities using a basic demand function that included consumption factors, such as Power Five conference membership, in both a "normal" year, economically speaking, and a year during the Great Recession. The results of the models show that consumption factors, specifically quality and athletics, are indeed important determinants of the demand for college as measured by the number of applicants.

II. Literature Review

Many studies on the demand for higher education have focused on postsecondary education as a consumption good. Some authors who included consumption variables in their demand for education functions were Gullason (1989), Lehr and Newton (1978), Quinn and Price (1998), and Quinn and Pelley (2013). In his study of the demand for postsecondary education, Gullason (1989) found that enrollment at a postsecondary institution could be used as a means of avoiding the draft during the Korean and Vietnam Wars. Similarly, Lehr and Newton (1978) examined the demand for higher education as a type of individual choice behavior. Quinn and Price (1998) added consumption variables to a basic human capital model with mixed, but overall weak, results for the significance of the consumption variables, while Quinn and Pelley (2013) found some evidence for the political environment as represented by the party of the President of the United States as an influence on the demand for law school, with the number of LSATs administered tending to be higher in years when a Republican was President of the United States.

Pissarides (2011) wrote that the demand for education, especially the demand for private education is known to rise during recessions. Similarly, Walstrum (2014) discussed local labor market shocks and showed that the demand for higher education does rise when the opportunity cost of higher education falls (as measured by a higher

unemployment rate). Kim (2014) also found the demand for higher education to be countercyclical, but subject to supply constraints and found that high prestige schools can respond to worsening economic conditions by becoming choosier in order to increase the quality of incoming students.

Numerous researchers have used cross sectional data, as well as longitudinal and panel data, to analyze the demand for education at colleges and universities. Jacob, McCall, and Strange (2011) use cross sectional data to examine undergraduate college choice and found that consumption attributes such as sports, activities, and academic quality were important determinants of demand. Fuller, Manski, and Wise (1982) used a multinomial logit model to look at the revealed preferences among the available schooling and work alternatives, and found the availability of financial aid to be an important determinant of demand. Hemelt and Marcotte (2011) examined the impact of rising tuition rates on enrollment at four-year public colleges and universities. They found no evidence, even with increases in real tuition that the price elasticity of the demand for public education had increased. Doyle and Cicarelli (1980) estimated the demand for education using a cross section of 40 public four-year institutions, with enrollment as the dependent variable. The authors also included a quality term, the ranking according to *Barron's Profiles of American Colleges*, and concluded that public education was an inferior good. Additionally, they found that price and quality, even though having the correct sign, were not significantly different from zero.

Other studies introduced the element of collegiate athletics, specifically the influences of big-time college football and basketball, success in these sports, conference membership, and football culture as determinants of the demand for postsecondary education. Smith (2009) directly examined football success as a determinant of the demand for a college and university education. Using random effects GLS models, he found football culture and tradition as measured by the number of years playing football to be the most important determinant of demand. Toma and Cross (1998) analyzed the effect of winning a national championship in football or men's basketball on the quantity of undergraduate applications received by institutions competing in Division I of the National Collegiate Athletics Association (NCAA). Their preliminary findings suggested that success in intercollegiate athletics translated into an increase in the number of applications received both in absolute terms and relative to peer institutions.

Similarly, Pope and Pope (2009) estimated a demand function for college education that included the success of the institution's football and basketball teams in the equation. The authors did use the number of applicants as a measure of demand. Regressions of approximately 330 Division I institutions were run separately for both public schools and private schools. The authors found that football and basketball success did increase the quantity of applications to institutions. They further suggested that the extra applications were used to increase both student quality and enrollment size.

III. Brief Look at the Data

The data used for the current study was the College and Universities 2000 Project (Brint, Mulligan, Rotondi, and Apkarian, 2011) which included data from select years through 2010. We used data from 2005 and 2010. This allowed us to compare a year at the end of the Great Recession with a slightly earlier, pre-recession year. Although the Great Recession ended in June, 2009 (NBER, 2016), the recovery was slow and potential students would still be affected by the recession in preparing for the 2009-2010 academic year. The survey included 382 colleges and universities in the U.S., with 209 private and 173 public institutions. Of these institutions, 130 were baccalaureate institutions, 126 were Master's institutions, 55 were doctoral or research universities, and 71 were research universities with very high research activity, according to their Carnegie classification. Forty of these institutions were members of one of the so-called Power Five football conferences: the Big 10, Big 12, Atlantic Coast Conference, Southeastern Conference, or the Pacific 12. The colleges and universities were from geographically diverse regions. The geographic dispersion by census region is shown in Figure 1.

The available data for this sample goes back to 1970, and most data was available in five years intervals through 2010. For this project data from 2005 and 2010 were analyzed. A major variable of interest, total entering students at the undergraduate level, was only available in these years. The total number of applicants each year was not available as a separate variable in the data set. The percentage of undergraduate applicants admitted, however, was available. A proxy for applicants was therefore calculated by dividing the total entering students at the undergraduate level by the percentage of undergraduates admitted.

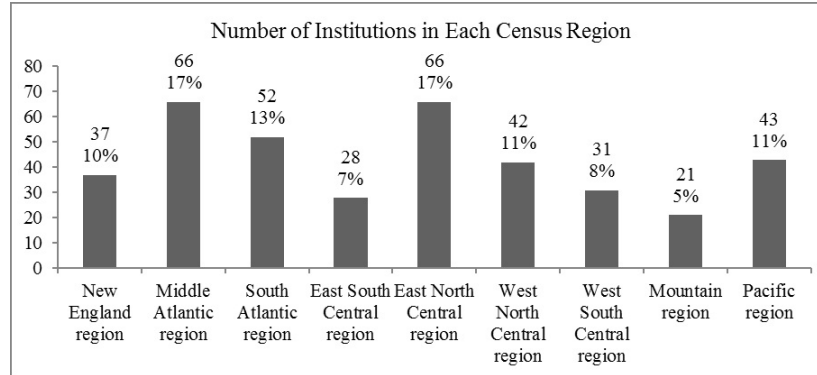


Figure 1. Number of four year colleges and universities included in the sample, by census region.

This should be a close measure of total undergraduate applicants, as the number of entering students would be expected to be close to the number of accepted students. The mean values of undergraduate enrollment, percentage of undergraduate applicants admitted, and the calculated dependent variable, undergraduate applicants, are shown in Tables 1 and 2.

TABLE 1—Mean Undergraduate Applicants and Enrollment, 2005

	Number of Schools	Mean First Time Enrollment	Mean Percent of Undergraduates Admitted	Mean Undergraduate Applicants
All colleges and universities	376	2001.26	65.82%	3630.98
Private colleges and universities	200	850.18	61.16%	2104.33
Public colleges and universities	163	3411.16	71.32%	5504.18
Public colleges and universities excluding very high research universities	175	692.77	65.74%	1187.23
Private colleges and universities excluding very high research universities	120	2416.63	74.08%	3608.50

TABLE 2—Mean Undergraduate Applicants and Enrollment, 2010

	Number of Schools	Mean First Time Enrollment	Mean Percent of Undergraduates Admitted	Mean Undergraduate Applicants
All colleges and universities	367	2246.20	61.36%	4499.77
Private colleges and universities	200	1000.82	56.29%	2975.44
Public colleges and universities	167	3761.05	67.40%	6325.33
Public colleges and universities excluding very high research universities	172	829.56	61.67%	1443.10
Private colleges and universities excluding very high research universities	125	2731.95	70.58%	4095.07

Most demand studies examine enrollment figures. In theory, enrollments at colleges and universities will be at an equilibrium level where supply = demand. Enrollment demand is negatively related to tuition while enrollment supply is positively related (Fortin, 2004). For the current study, we used using applicant data rather than enrollment data in order to reflect the number of potential students interested in attending a particular school as the dependent variable measuring the demand for education (Savoca, 1990; Pope & Pope, 2009; Quinn & Price, 1996). Doyle and Cicarelli (1980) discussed that “predicting enrollment for a given college is analogous to forecasting demand for an individual firm” (p. 53). Applicant numbers can potentially yield an even clearer picture of demand because they are unaffected by supply. Bound, Hershbein, and Long (2009) discussed how the supply of college admission slots did not keep pace with demand and therefore enrollments increased slower than the actual demand for education. While the supply function of education is likely to affect enrollments, the number of applicants should be a pure demand phenomenon.

IV. The Models

To analyze the data, we treated the data as a type of panel study with very a large number of cross sections while each unit was observed only twice (Beck, 2004; Hsiao, 2014). According to Hsiao (2014), analyzing the data

as a panel instead of two separate cross-sectional models increases the degrees of freedom, reduces collinearity among explanatory variables, and allows more research questions to be analyzed. Although the sample includes only two years of data, it is still is version of a panel model. Because only two years were used in the study, serial correlation would not be a problem. Heteroscedasticity, however, was a potential problem in the data because of the large cross-sectional component (Hecock, 2003). Therefore, because of this potential problem, all models were tested for heteroscedasticity.

The demand function used in the research was a basic demand function of the form:

- (1) Demand = f (Price, Availability of financial aid, Price of substitute good (if applicable), Academic quality, Athletic quality, Year)

The functional form of the model for all colleges and universities was:

- (2) $\ln(\text{applicants}_{i,t}) = a + b_1 \ln(\text{Tuition}_{i,t}) + b_2 \ln(\text{Change in financial aid}_{i,t}) + b_3 \ln(\text{Barrons}_{i,t}) + b_4 \text{High research}_{i,t} + b_5 \text{Power } 5_{i,t} + b_6 \text{Year}_{i,t} + u_{i,t}$

where $i=1, \dots, N$, or is the cross-sectional component, t is the time series component of 2005 or 2010, and u is the error term. The variables included in this demand function are explained in Table 3.

The demand function we employed in the study was based loosely on the demand functions of Doyle and Cicarelli (1980), Pope and Pope (2009), and Hemelt and Marcotte (2011). The demand function is also similar to that of Bezmen & Depken (1998) who also used the number of applicants to a given school as their measure of demand. Past research also influenced our choice of independent variables. Price (tuition) is an important element of any demand function, including the demand for education. Studies have closely examined the price elasticities of the demand for postsecondary education (Leslie & Brinkman, 1987; Heller, 1997). Although some studies have hypothesized that tuition is not a fully exogenous variable because “the supply of enrollment places is not fully elastic” (Allen & Shen, 1999, p. 466), many demand studies do treat tuition as a fully independent variable (Bezmen & Depken, 1998; Curs & Singell Jr., 2010; Doyle & Cicarelli, 1980; Fortin, 2004; Hemelt & Marcotte, 2011).

TABLE 3—Description of the Variables

Variable	Description	Expected Sign	Explanation
Applicants	The “demand” was calculated as total entering students at the undergraduate level divided by the percent of undergraduate applicants admitted		This is the variable that is used as the proxy for the demand for college/university education. It is calculated for the private and public institutions in the sample, as well as for all schools. The variable was calculated as total number of applications was not a variable that was available for the data set.
Tuition	Undergraduate in-state tuition and fees; the “price” of education	Negative	According to demand theory, the relationship between price and demand is negative; higher prices translate to lower demand for a good or service
Change in Financial aid	Change in the percent of undergraduate students on financial aid between the current survey and the previous survey (2010%-2005%) and (2005%-2001%)	Positive	An increase in the percent of students on financial aid could be a signal that the institution is offering more financial aid, which could entice more potential students to apply.
Public tuition	Mean tuition and fees at sample public institutions located in the census region of the school	Positive	Price of substitute good; higher public tuition should increase the demand for private education
Private tuition	Mean tuition and fees at sample private institutions located in the census region of the school	Positive	Price of substitute good; higher private tuition should increase the demand for public institutions
Barrons	Proxy for quality is Barron’s competitiveness ranking, from 1-6 where 1=most competitive and 6=least competitive. For ease of interpretation, the values were reversed so 1=least competitive and 6=most competitive.	Positive	The most competitive schools should be the most desirable and have the most applicants
High Research	High research dummy equal to one if the institution is a research institution with very high research activity; proxy for quality	Positive	Research institutions with very high research activity could be considered higher quality institutions and so the demand for these institutions should be greater.
Power 5	Power Five dummy equal to one of the Power Five conferences and zero otherwise; proxy for publicity	Positive	Membership in these football conferences gives the institution greater publicity and should hence translate to higher demand
Year	Year dummy equal to one for 2010 and equal to zero for 2005.	Positive	In general, the demand for higher education has risen over time. Additionally, 2010 represents the end of the Great Recession and the beginning of a long and slow recovery. Fewer jobs could mean more potential students seeing college as a viable option (Allen & Shen (1999)).

Although some measure of income is normally included in a demand function, it was omitted in this instance. Both the public and private schools included in the sample included out-of-state applicants. Because of this factor, including a measure of income for the state in which the school was located (Doyle & Cicarelli, 1980) would be misleading as applications were also being drawn from other states. The change in the overall economy (income) was proxied by the year variable, which indicated whether the data was from 2005 or 2010. Barron's ratings, which rate schools on their difficulty of admission, were also used as a measure of quality by Doyle and Cicarelli and by Pascarella et al. (2006). Smith (2009), as one of his measures of football culture, utilized the conference membership status of each institution in his study as a measure of athletic quality.

Originally we had planned on including a dummy variable indicating whether the college was public or private. However, tests for multicollinearity showed very poor statistics for the tuition and public variables. Including both variables in the equation yielded VIF statistics of 8.409 and 7.266 for tuition and the public dummy respectively. These were both high, and additionally the Pearson's correlation coefficient between these two variables was a very robust .89 ($p < .001$). To solve this problem, we decided to drop the public dummy from the overall equation but to also run separate regressions for private and public institutions. Hence, along with the demand for all colleges and universities in the sample, demand functions for private and public institutions were estimated separately. For these demand functions, variables representing average public tuition and average private tuition for the geographical census region of the institution for inserted into the demand equations for private and public institutions respectively (Leslie & Brinkman, 1987) as a proxy for price of a substitute good.

A. MODEL AND RESULTS—ALL COLLEGES AND UNIVERSITIES

A panel-type model was used to test the demand function, with a dummy variable representing the two different years. Because the model consisted of only two years, but with over 300 cross-sectional observations in each year, heteroscedasticity was a potential problem. Heteroscedasticity is often a problem in cross-sectional models. We tested for heteroscedasticity using the Breusch-Pagan test. According to the Breusch-Pagan test, the null hypothesis of homoscedasticity could not

be rejected, with $\chi^2(6) = 9.684$, $p = .139$. Hence, heteroscedasticity was not a problem for the overall demand function, and no adjustments were needed. OLS appeared to be an appropriate methodology for analyzing the demand function. The model for all colleges and universities in the sample was estimated in OLS using equation (2). The resulting demand function is shown in Table 4.

TABLE 4—Demand Function: All Colleges and Universities, Dependent Variable = Number of Applicants

Variable	β	SE	t
Constant	8.039***	0.114	70.779
Tuition	-0.743***	0.046	-15.982
Barron's Rating	0.905***	0.095	9.537
Change in Financial aid	0.373***	0.092	4.036
High research dummy	1.308***	0.100	13.117
Power 5 dummy	0.293**	0.118	2.483
Year	0.350***	0.062	5.660
N	668		
R-squared	0.598		
Adj. R-squared	0.595		
F-statistic	164.305***		

(t statistics in parentheses) ***significant at 1% level; **significant at 5% level; *significant at 10% level

The overall model showed demand to be inelastic with respect to price (tuition). This was a particularly strong variable, likely because both public and private institutions were included in the model. As shown in Tables 1 and 2, the mean number of applicants for public colleges and universities was much higher than the mean number of applicants for private institutions. Since private institutions also had higher average tuition levels, this result was expected. Additionally, higher quality

institutions, as proxied by higher Barron's ratings (the ratings were reversed so that higher ratings equated to the most competitive schools), attracted greater numbers of applicants, as did research institutions with very high research activity (another proxy for quality).

The change in the percentage of students receiving financial aid between the previous survey and the current survey was also a significant variable. This increase in the percent of students receiving financial aid may act as a signal that more (or less) aid is available to incoming students. Membership in a Power Five athletic conference attracted more applicants as well. Finally, demand was higher in the later year of the study (2010). This could be because demand for higher education has grown in general, or because at the tail end of the Great Recession/beginning of the long recovery jobs tended to be scarce and applying to college appeared a more attractive alternative to unemployment.

B. MODEL AND RESULTS—PRIVATE COLLEGES AND UNIVERSITIES

The results of the OLS estimation for private institutions also showed no evidence of heteroscedasticity. The results of the Breusch-Pagan test showed that the null hypothesis of homoscedasticity could not be rejected, with $\chi^2(6) = 6.594$, $p = .472$. The results of the regression are shown in Table 5.

The demand for private colleges and universities, when observed separately, did not seem to be influenced by tuition. The price of a private education (as proxied by tuition) was not a determinant of demand. Although tuition was a very strong predictor of overall demand, this may have been mainly serving as a proxy for the difference between public and private institutions. Between private institutions only, the price appeared to be much less important. Other factors appeared to be the main determinants of demand.

Quality, as approximated by the Barron's ranking of the institution, was an important determinant of demand, as was the other proxy for quality, the high research dummy variable. Changes in the percent of students receiving financial aid was also a significant predictor for private college applications. Publicity gained from being a member of a Power Five athletic conference was a positive influence on the number of applicants for private schools. The price of the substitute good,

approximated by regional public tuition, was a significant determinant of demand, as higher tuition at public institutions in the region predicted a higher number of applicants to the private schools in the sample.

TABLE 5—Demand Function: Private Colleges and Universities
Dependent Variable = Number of Applicants to Private Schools

Variable	β	SE	t
Constant	5.098***	0.479	10.640
Tuition	-0.093	0.164	-0.567
Barron's Rating	0.786***	0.153	5.145
Change in Financial aid	0.312**	0.127	2.454
Public Tuition	0.537**	0.260	2.063
High research dummy	1.529***	0.131	11.684
Power 5 dummy	1.042***	0.198	5.275
Year	0.040	0.105	0.377
N	372		
R-squared	0.566		
Adj. R-squared	0.558		
F-statistic	67.998***		

(t statistics in parentheses) ***significant at 1% level; **significant at 5% level; *significant at 10% level

Again, the differences between private and public tuitions appeared to be more important in this model than variations between the private tuition levels themselves. Finally, the year was not a significant variable, hence indicating that the number of applicants to private institutions did not increase significantly between 2005 and 2010.

C. MODEL AND RESULTS – PUBLIC COLLEGES AND UNIVERSITIES

The Breusch-Pagan test was also run for the public school model, with no evidence of heteroscedasticity shown. According to this test, the null hypothesis of homoscedasticity could not be rejected, with $\chi^2(7) = 11.503$, $p = .118$, meaning that the null hypothesis of homoscedasticity could not be rejected and that no adjustments to the model were needed. The results of the OLS estimation for public institutions are shown in Table 6.

TABLE 6—Demand Function: Public Colleges and Universities
Dependent Variable = Number of Applicants to Public Schools

Variable	β	SE	t
Constant	6.919***	0.831	8.322
Tuition	-0.244*	0.136	-1.787
Barron's Rating	0.773***	0.106	7.278
Financial aid	0.187*	0.113	1.654
Private Tuition	0.222	0.289	0.769
High research dummy	0.736***	0.136	5.426
Power 5 dummy	0.294**	0.144	2.043
Year	0.136	0.110	1.234
N	295		
R-squared	0.517		
Adj. R-squared	0.505		
F-statistic	44.001***		

(t statistics in parentheses) ***significant at 1% level; **significant at 5% level; *significant at 10% level

As with the demand function for private institutions, the demand for public colleges and universities was not sensitive to changes in tuition at a 5% significance level, although in this case it was significant at a 10%

level. The demand function for public schools may be somewhat negatively influenced by price. However, because of the low level of significance, the results still seem to indicate that the effect of tuition on applicants is more influenced by the public-private spread in tuitions than by differences between individual public college tuition levels. As with private colleges, quality was important, as the number of applicants to public colleges and universities was positively influenced by quality as approximated by its Barron's ranking and being a high research activity university. Being a member of a Power Five athletic conference predicted a higher number of applicants as well.

The financial aid variable was also significant, but only at a 10% level. It did exhibit a positive relationship between a change in the percent of students on financial aid and applicants. The price of the substitute good, regional private tuition was not a significant determinant of demand. The year variable was not significant, showing that, for public colleges separately, the Great Recession may not have had an influence on demand.

D. MODEL AND RESULTS – COLLEGES AND UNIVERSITIES EXCLUDING RESEARCH UNIVERSITIES WITH VERY HIGH RESEARCH ACTIVITY

In all regressions run to this point, the high research dummy variable was significant with a positive sign. Students appear to select institutions with high levels of research activity regardless of whether the schools were private or public. Due to their high research activity, these schools all have very good academic reputations. These are the postsecondary institutions that are the most likely to attract students each year regardless of the state of the economy. These are the “top” universities, but what about the lower tier colleges and universities? Are they more sensitive to economic fluctuations? Are consumption factors more or less important at these institutions? In order to examine these questions, we re-ran both the overall model first eliminating those college and universities rated as “research universities – very high research activities” by Carnegie and then using only the very high research universities.

As with the previous models, the Breusch-Pagan was performed for the lower research institution model, with no evidence of heteroscedasticity shown. According to the Breusch-Pagan test, the null hypothesis of homoscedasticity could not be rejected, with $\chi^2(5) = 3.211$,

$p = .668$. Therefore the null hypothesis of homoscedasticity could not be rejected, meaning that no adjustments were needed. The results of the OLS estimation of colleges and universities excluding those with high levels of research activity for the years are shown in Table 7.

TABLE 7–Demand Function: Private Colleges and Universities
Dependent Variable = Number of Applicants to Research
Universities without Very High Research Activity

Variable	β	SE	t
Constant	8.314***	0.123	67.797
Tuition	-0.851***	0.051	-16.772
Barron's Rating	0.875***	0.098	8.926
Change in Financial aid	0.395***	0.105	3.763
Power 5 dummy	1.478***	0.242	6.104
Year	0.390***	0.067	5.828
N	537		
R-squared	0.423		
Adj. R-squared	0.418		
F-statistic	78.082***		

(t statistics in parentheses) ***significant at 1% level; **significant at 5% level; *significant at 10% level

The demand for education at non-high research institutions was inelastic, as tuition was again a significant variable. Higher tuition levels predicted lower numbers of applicants at the schools within this sample. As with the overall sample, this result may be reflecting the public-private tuition differential and its influence. Quality as proxied by the Barron's ranking remained a determinant of demand with higher rated schools predicting more applicants. Membership in a Power Five conference remained a positive determinant of demand in this model, as with previous models. A positive change in the level of students on financial aid was also a positive predictor of applicants. Finally, the year predicted more applicants for the schools in 2010 as compared to 2005.

E. MODEL AND RESULTS – RESEARCH UNIVERSITIES WITH
VERY HIGH RESEARCH ACTIVITY

Lastly, a regression was run for research universities with very high research activity only. These are the schools with the highest Carnegie classification. The model again showed no evidence of heteroscedasticity, with $\chi^2(5) = 6.710$, $p = .243$. The null hypothesis of homoscedasticity could not be rejected, so no adjustments were needed. The results of the OLS estimation of research universities with high levels of research activity for the years are shown in Table 8.

TABLE 8–Demand Function: Dependent Variable =
Number of Applicants to Research Universities
with Very High Research Activity

Variable	β	SE	t
Constant	8.121***	0.354	22.962
Tuition	-0.323***	0.099	-3.249
Barron's Rating	1.035***	0.294	3.522
Change in Financial aid	0.100	0.175	0.570
Power 5 dummy	0.237**	0.110	2.163
Year	0.248*	0.135	1.837
N	130		
R-squared	0.200		
Adj. R-squared	0.168		
F-statistic	6.232***		

(t statistics in parentheses) ***significant at 1% level; **significant at 5% level; *significant at 10% level

The demand for education at high research institutions was inelastic, although the value of the elasticity shows the demand for high research institutions to be more inelastic than the demand for lower research institutions. The elasticity for the high research schools was 0.323 as

compared to 0.851 for the lower research schools. Quality remained an important influence, as the Barron's ranking remained a determinant of demand with higher rated schools predicting more applicants. Membership in a Power Five conference was a positive influence on demand in this model as well. The financial aid variable was not significant; applicants to the highest level of research universities seem less influenced by financial aid factors. Finally, year was significant, but only at a 10% level. Possibly higher research institutions are less influenced by economic fluctuation than lower research schools.

V. Conclusion

When comparing both years of data for all colleges and universities, private and public institutions, and colleges with and without very high research activity, a few consistent patterns emerged. Tuition was a factor only as long as public schools and private schools were both included in the model. As soon as they were separated, tuition became insignificant (at the 5% significance level). This result seems to indicate that tuition differences between public and private institutions are much more important to the application process than differences within each category.

The cross price elasticity of demand between public and private schools, as proxied by regional private and public tuition in the public and private education models, did not appear to be an important determinant of demand for public schools, but was a positive influence on the demand for private colleges and universities. Although other research has found little evidence of a positive cross price elasticity of demand between private and public colleges (Hight, 1975; Knudsen & Servelle, 1978), the current results indicate a positive cross-price relationship could exist for private institutions only. The year was a positive influence on demand in some models, but not others. It seemed to have little influence when the public and private institutions were separated. The financial aid variable also varied in significance, being an important variable in most models, but not for the top research universities. Overall, the value of the financial variables varied in significance.

Consumption factors, however, appeared to be very important to all models. Quality was proxied by two measures: the (reversed in value) Barron's ranking and a dummy variable representing research universities

with very high research activity. Quality as proxied by Barron's rating was a more important influence on demand in all models. The high research dummy was important in all of the models in which it was included as a predictor. In both cases, quality was a strong positive predictor of the number of applicants.

The other consumption variable included in the model was membership in a Power Five athletic conference. Membership was a positive influence on the number of applicants in all models as well. The idea that the publicity gained from participation in a major football conference can positively influence the number of applicants in those schools seems to be supported. This result strengthens the work of McCormick and Tinsley (1987) and Pope and Pope (2009) who found that success in football and basketball tended to increase the number of applicants to the successful schools. In conclusion, the results indicated that consumption factors such as being in a major athletic conference or having a strong academic reputation are important factors in the demand functions for colleges and universities, regardless of the condition of the overall economy.

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