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Predicting Enrollment Decisions of Students Admitted to Claremont McKenna College

Michael Zaytsev
Claremont McKenna College

CLAREMONT McKENNA COLLEGE

**PREDICTING ENROLLMENT DECISIONS OF STUDENTS ADMITTED TO
CLAREMONT McKENNA COLLEGE**

SUBMITTED TO

PROFESSOR MANFRED KEIL

AND

DEAN GREGORY HESS

BY

MICHAEL ZAYTSEV

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Abstract

College admission has become increasingly competitive in the internet era. This is especially true for the highest caliber of students and institutions. College admission is a process filled with asymmetric information. One of the biggest asymmetries occurs when schools admit students not knowing whether or not students will actually enroll. This uncertainty is economically costly to schools. As national rankings become more and more influential, schools are more sensitive to their rank and the statistics that determine them. One of these is yield, the percentage of admitted students who enroll. This paper examines data on admitted students to Claremont McKenna College and uses a probit regression to predict their enrollment decision. By successfully predicting enrollment decisions schools can eliminate some information asymmetry and therefore raise their yield.

I. Introduction

Every year millions of anxious high school seniors scramble to put together applications that they hope will grant them admission to one of the institutions of their choice. For students, the college admissions process is a grueling one that involves making many decisions. However, this tumultuous process is not one sided. Just as prospective students have to make strategic choices in terms of how they plan on developing their human capital, colleges and universities also face many economically important choices. Many of these choices come down to the fundamental question of which students to admit. It is important for schools to attract students who are both sufficiently academically capable and who are "good fits." This is especially true for top tier institutions, which have the luxury of being highly selective. These institutions seek to foster an environment in which students learn in and outside of the classroom. Furthermore, schools want to build and maintain strong alumni networks. Accordingly, elite schools face the challenge of putting together a group of students that will both work well together and with the school.

Throughout the college admissions process there are many instances of asymmetric information leading to inefficiency. One example of this is that institutions offer students admission not knowing whether or not the students will accept. Top tier institutions typically only admit very qualified, competitive students —students who have a good chance of being accepted to other top schools. At best, schools have limited information regarding where they rank relative to other schools on an applicant's list. To compensate for this they admit more students than they have spots for, knowing that not all admits will enroll. The percentage of admitted students who end up enrolling is known as the college's yield.

This metric has become increasingly important in the past few years as schools and students have started paying more and more attention to rankings like those released annually by *U.S. News*, *Princeton Review*, etc. Empirical evidence suggests that these rankings influence student behavior in the college admissions process[i]. College guidebooks include information about school rankings and comparable schools. Top ranked schools compete with each other for talent just as top ranked students compete with each other for admission. Thus, schools are constantly looking to improve their value add to students, which should theoretically coincide with improvements in rankings. As the L.A. Times reported on April 12, 2011, "Fueled in part by recession-linked money worries, colleges are trying harder than ever to close enrollment deals with students who applied on average to many more schools than did previous generations."[ii] In today's competitive college admissions environment, yield has become a good indicator of how good a college is at attracting the talent it admits.

At Claremont McKenna, the yield ranges from 35 to 41%. Most highly selective schools (29% or lower acceptance rate) have yields ranging from 30 – 79%. The schools on the higher end of that spectrum –Harvard, Cooper Union, Stanford, Yale, and Princeton– also enjoy very low acceptance rates and high rankings. There is a huge divide between the top and bottom halves of the top tier institutions.

National Universities[iii]			
School	U.S. News Rank	Acceptance Rate	Yield
Harvard	1	9%	79%
Stanford	4	10%	70%
MIT	4	12%	69%
Yale	3	10%	69%
Princeton	2	10%	68%
U Penn	6	16%	66%
Columbia	8	11%	59%
Brown	16	14%	56%
Notre Dame	18	24%	56%

Dartmouth	11	15%	52%
Cornell University	14	21%	47%
Georgetown	23	21%	47%
Duke	8	23%	42%
U.C. Berkley	21	23%	41%
Vanderbilt	18	33%	40%
NYU	33	37%	39%
Cal Tech	6	17%	38%
UCLA	25	24%	38%
William and Mary	32	34%	37%
Univ. of Chicago	8	35%	36%
Johns Hopkins	15	24%	34%
Northwestern	12	27%	34%
Wash U St. Louis	12	17%	34%
Rice	17	25%	33%
Tufts	28	27%	33%
Emory	18	27%	30%
GWU	53	37%	30%
Boston College	34	27%	29%
Carnegie Melon	22	28%	23%

Liberal Arts Colleges[iv]			
School	U.S. News Rank	Acceptance Rate	Yield
U.S. Naval Academy	22	12%	85%
U.S. Military Academy	14	15%	78%
Washington and Lee	17	27%	45%
Williams	1	18%	45%
Middlebury	5	21%	44%
Barnard	27	29%	43%
Bowdoin	6	19%	42%
Davidson	9	28%	41%
Wellesley	4	36%	41%
Amherst	1	18%	40%
CMC	**11**	**16%**	**40%**
Pomona	6	16%	39%
Swarthmore	3	18%	39%
Smith	18	52%	38%
Bryn Mawr	23	45%	37%
Vassar	11	29%	37%
Bard	37	27%	36%
Haverford	10	25%	36%

Carleton	8	30%	35%
Wesleyan	13	27%	35%
Bates	25	30%	34%
Colorado College	30	32%	34%
Hamilton	20	28%	34%
Kenyon	32	29%	34%
Oberlin	20	31%	34%
Colgate	18	26%	33%

In this paper, I intend to use probit regression analysis to determine if Claremont McKenna could use econometric analysis to improve its yield. Specifically, if the admissions office had a reliable estimate of how likely a student was to enroll after being admitted it could admit fewer students. This would simultaneously lower the acceptance rate and raise the yield. This would most likely lead to a more favorable ranking, which would result in substantial economic impact on the school.

II. Literature Review

The college admissions process and more specifically the admitted student's enrollment decision are vastly complicated. A great deal of academic research has been devoted to understanding and analyzing the admissions process from a variety of standpoints. It would be foolish to attempt to tackle the entirety of the college admissions process in one paper; however, in order to conduct analysis that is grounded on empirical evidence, an understanding of some major points is necessary.

The market for higher education in America is constantly in flux. Changes in demographics, economic conditions, and technology are responsible for shaping the education market into something that is different from what it was just a decade ago. "Enrollment in degree-granting institutions increased by 14 percent between 1987 and 1997. Between 1997 and

2007, enrollment increased at a faster rate (26 percent), from 14.5 million to 18.2 million. Much of the growth between 1997 and 2007 was in full-time enrollment; the number of full-time students rose 34 percent, while the number of part-time students rose 15 percent." [v] On the supply side of the college admissions process, there has been a sizeable shift. Undergraduate enrollment has risen over 25% in the past decade.[vi] The result of this exogenous change is a more competitive college admissions process. In addition to an increase in the amount of students seeking a college degree, there has been a significant change in the general applicant pool. The percentage of American college students who are minorities has more than doubled since 1976.[vii] Fundamental differences in the applicant pool directly translate to differences in the application and enrollment process.

College admission is a two party matching process; students choose colleges and colleges choose students. As this study is concerned with the process by which students make their enrollment decision, more focus will be put on the student's decision process. In his 1981 paper, David Chapman models student college choice. He presents a model that is built around student characteristics, college characteristics, and their interplay. He suggests that "the choice of which college to attend is influenced, first by the background and current characteristics of the student and the student's family and, second, by a series of external influences. These include the influence of significant persons, the fixed characteristics of the college, and the institutions' own efforts to communicate with prospective students."[viii] The student characteristics Chapman cites as being important are socioeconomic status, aptitude / high school performance, level of educational aspiration, and significant persons (parents, counselors, peers, teachers, etc). The fixed characteristics of the college include location, cost, availability of financial aid, campus environment, and the availability of desired programs. In most instances, these characteristics,

both on the college and student level, are fixed. This suggests that the interaction of the two parties –usually through promotional materials– is a powerful one.

Information asymmetry is common in the admissions process. One way it manifests itself is by what George G. Stern described as the "freshman myth." The freshman myth is the false, idealized image of college life that many high school students have prior to enrollment. Stern claims that students "are even more poorly informed about the composite character of the school."[ix] Stern observed this in 1970, before the internet and highly publicized college rankings. Despite the abundance of rankings and information available to prospective students, the freshman myth still exists. This suggests that the interactions between student and school have the ability to shape a student's perception and thus influence his decision making.

In 2000, Laura Perna examined differences in how African Americans, Hispanics, and Whites make the decision of whether or not to attend college. She focuses on differences in social and cultural capital. For example, on average a higher percentage of Whites had college educated parents relative to African Americans and Hispanics. This resulted in White students having greater educational expectations as well as having a lower reliance on guidance counselors and school advisors in the application process.[x] Additionally, she claims that social and cultural capital "play an important role in determining academic achievement, particularly with regard to the series of choices and selections that characterize a student's formal education."[xi] Her findings suggest that socioeconomic background is a major determinant of how students go about the entire college application process. The resources, both tangible and intangible, of a student's family largely shape the student and his decisions, however this impact is difficult to quantify. A more plausible way to observe this impact is to examine the way financial aid influences college choice.

Christopher Avery and Caroline Hoxby examine college choice by viewing it as a human capital investment by the student. Not surprisingly, their study reveals that teenagers do not always make rational financial decisions. They find that "students are more likely to attend a college if, all else equal, it offers them larger grants, larger loans, a larger amount of work study, is the most selective college to which they were admitted, is their father's alma mater, or is the same college that their sibling attended or attends."[xii] To understand the impact of aid, the study grouped students by family income. For each additional $1000 of grant offered by the school, students from the low income group raised their probability of matriculation by 11%, the medium income group by 13%, and high income group by 8%.[xiii] Overall, the study finds that "students from high income families, whose parents attended more selective colleges, and who themselves attended private high schools are less deterred by college costs and less attracted by aid. They are also more attracted by a college's being selective, either because they are more attracted by the resources correlated with selectivity or because they are more attracted by high aptitude peers."[xiv] An interesting feature of their study is that they examine differences in behavior between the overall student pool and high aptitude students. This is particularly relevant as CMC only admits high aptitude students.

High aptitude students behave differently in and out of the classroom. They do not make college admission decisions the same way as other students. "High aptitude students are nearly indifferent to a college's distance from their home, to whether it is in-state, and to whether it is public."[xv] In accordance with results of the overall group, high aptitude students prefer more selective schools and respond positively to financial aid. Students did not always respond rationally to financial aid. They were found to be excessively attracted by loans and work study, which given their lower value to grants is irrational. Furthermore, students were more attracted to

grants that were front loaded and/or had names (i.e. Brody Scholarship would be viewed more favorably than a grant of equal amount with no name). The study found that 38.9% of students responded to aid in a way that reduced their own lifetime present value. Interestingly, high aptitude students whose parents had high incomes or attended very selective colleges did not respond irrationally to financial aid.

Another important element in the college admissions decision is the option of being able to apply early. Certain schools offer early decision (ED) or early action (EA) applications. This paper will only focus on ED as it is binding and offered at CMC. If a student knows that a certain school is their definite number 1 choice they can apply early and be done earlier with the stressful college application process. Admitted ED applicants forego the ability to compare financial aid packages from other schools. However, "Avery, Zeckhauser, and Fairbanks (2003) find that ED applicants gain an admissions advantage that is approximately equivalent to 100 additional SAT points."[xvi] In their working paper, Janet Smith and Heather Antecol, find "a significant negative impact on cohort racial diversity of ED."[xvii] "Compared to other racial groups, Asian Americans and Hispanic students are the most likely to be squeezed out as school reliance on ED enrollments increases." [xviii] ED does, however, increase geographic diversity, attracting out of state students. Given the tradeoff students face when using ED, it seems reasonable that white and international students would be most likely to take advantage of ED. International students are not eligible for need based aid. White students who are more concerned about admission than cost are likely to apply ED to their top schools.

A probit model was used to see whether or not a student's enrollment decision was predictable. The first probit model was introduced in 1935 –years before Claremont Men's College existed– by biologist Chester Bliss. Bliss used the model to look at the effect of various

levels of pesticide on an insect. Specifically, he modeled the probability of a certain dosage killing the insect. Sir Ronald Fisher added an appendix to Bliss' paper which provided an iterative approach to finding maximum likelihood estimates in a probit model. However, econometrician Daniel McFadden is largely responsible for the use of probit models in examining discrete choices.

In 1972, McFadden began a research project that aimed to predict how commuters in the San Franciso area would respond to the introduction of the BART system. Building upon the work of economists R. Duncan Luce and Jacob Marschak, McFadden developed multinomial probit and logit models. For his contributions, McFadden was awarded the Nobel Prize in Economics in 2000. These models have been used widely to help predict discrete choices. Some uses include predicting whether a juvenile is likely to commit a crime, whether or not a country will wage war, and which brand of meat a grocery shopper would purchase. The IRS even uses probit models to help identify tax fraud.

III. Data

Sources and variables

The data set examined consisted of admitted students to Claremont McKenna College in 2005 and 2006. The set contains information for 1575 students. The data includes information about students' biographical and academic backgrounds. High school city/state size, rank, grade point average (GPA), standardized college admission test scores, ethnicity, financial aid status (whether or not a student was applying for financial aid), anticipated major choice, whether or not they applied early decision (ED), and enrollment status (whether or not a student committed to attending CMC or withdrew his application *after* being notified of acceptance) were available.

Information about students' extracurricular activities is described by what CMC's admissions office calls accomplishments and involvements. The distinction between these categories is a subtle one. Involvements include, but are not limited to, varsity sports, speech/debate, theatre, choir, orchestra, service clubs, and, of course, leadership. Accomplishments, meanwhile, include participation in student government, being an editor of a student publication, membership in the national honor society, being a state champion athlete, or being a highly ranked Boy or Girl Scout. Another category used by the admissions office is called references. This category keeps track of the students' interaction with the college. If a student emailed, requested information, visited campus, attended an information session, stayed overnight, or interviewed with CMC, it would be recorded as a reference. However, there are other examples of references that have nothing to do with showing interest in the school. In fact, quite the opposite is true. CMC has references for students that are being recruited, e.g. "physical education referral," "high social studies ability," or "high ability Hispanic."

	Observations	Mean	Std. Dev.	Min	Max
SAT	1401	1394	119	920	1600
GPA	1269	4.0144	0.35066	2.43	4.98
Applied ED 157		Applied Fin Aid 973		Enrolled 565	

Below is a series of graphs that describe some of the independent variables from the data set.

Geographic Origin of Applicants

International 8%
Midwest 8%
Northeast 11%
Pacific 2%
South 12%
West 59%

Ethincities of Accepted Students

Ethnicity	Value
Asian	323
Black	126
Did not answer	92
Hispanic	283
Native American	5
Other	17
Pacific Islander	15
White	713
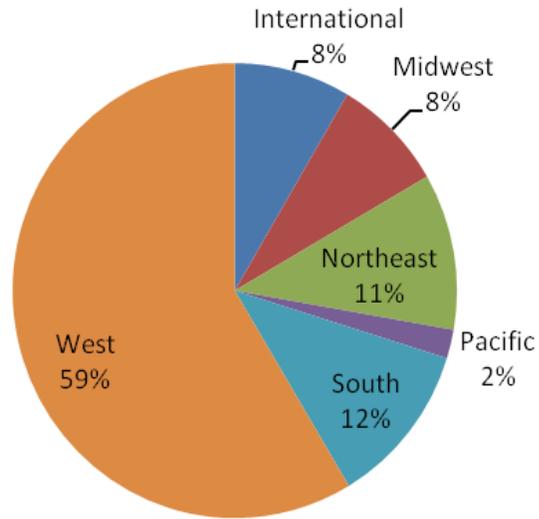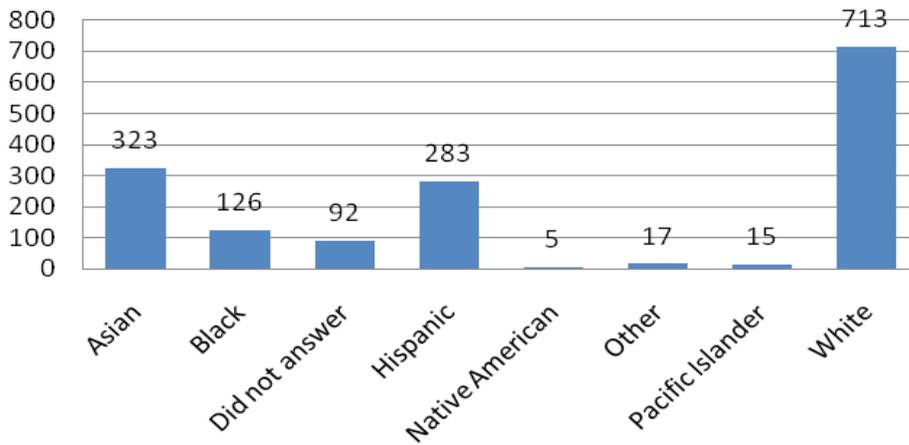
Ethincities of Accepted Students

■ 2005 ■ 2006

	2005	2006
Asian	168	155
Black	62	64
Did not answer	52	40
Hispanic	126	157
Native American	3	2
Other	9	8
Pacific Islander	5	10
White	354	359
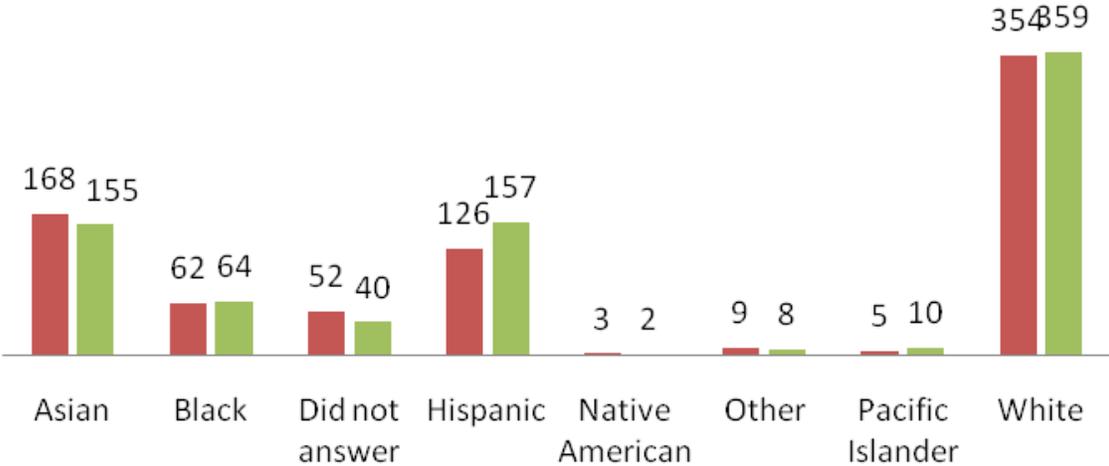
Number of Accomplishments

- 3 — 0.38%
- 2 — 5%
- 1 — 18%
- 0 — 77%
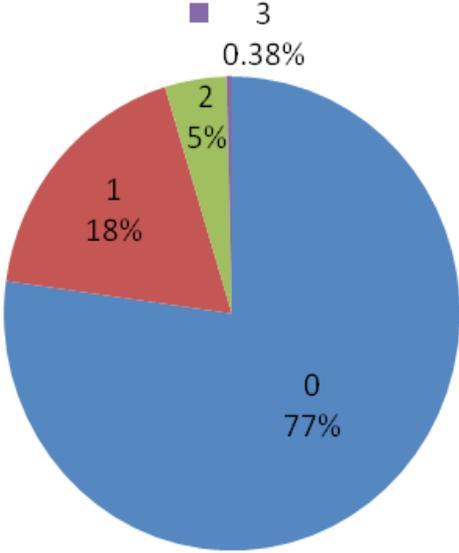
Accomplishments

■ 2005 ■ 2006

Value	2005	2006
0	628	587
1	108	176
2	41	28
3	2	4

Number of References

Value	Count
0	5
1	786
2	395
3	203
4	113
5	40
6	20
7	7
8	4
9	1

References

■ 2005 ■ 2006

Value	2005	2006
0	4	1
1	411	375
2	212	183
3	87	116
4	44	69
5	12	28
6	7	13
7	2	5
8	0	4
9	0	1

Number of Involvements

Value	Count
0	552
1	358
2	401
3	184
4	71
5	6
6	2

Involvements
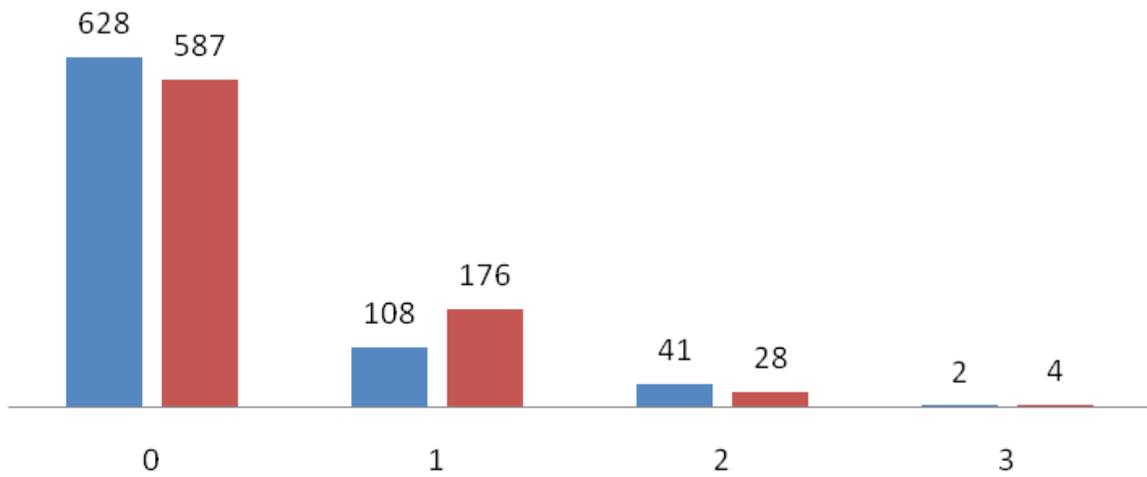
2005 ■ 2006 ■

| Involvements	2005	2006
0	309	243
1	213	145
2	177	224
3	57	127
4	20	51
5	2	4
6	1	1
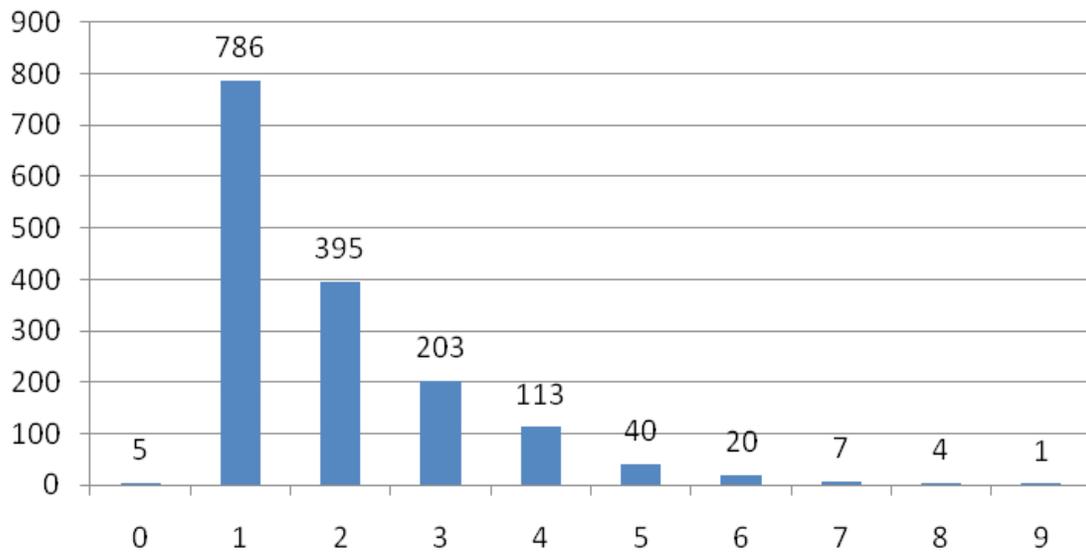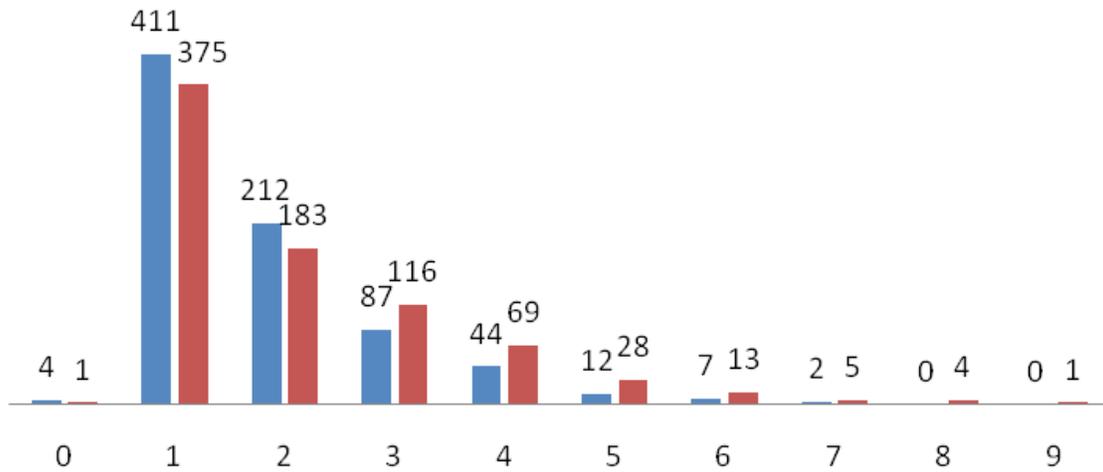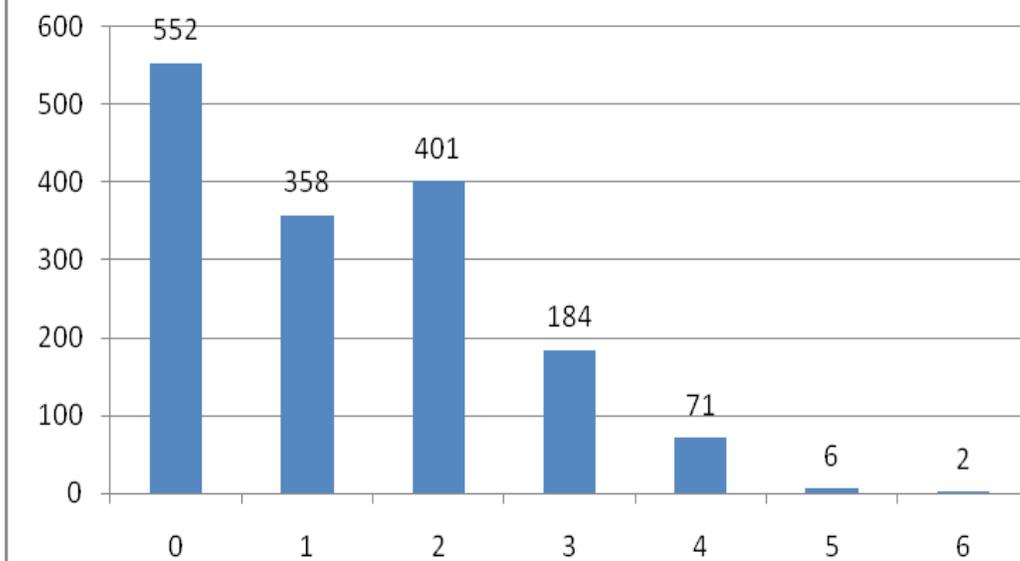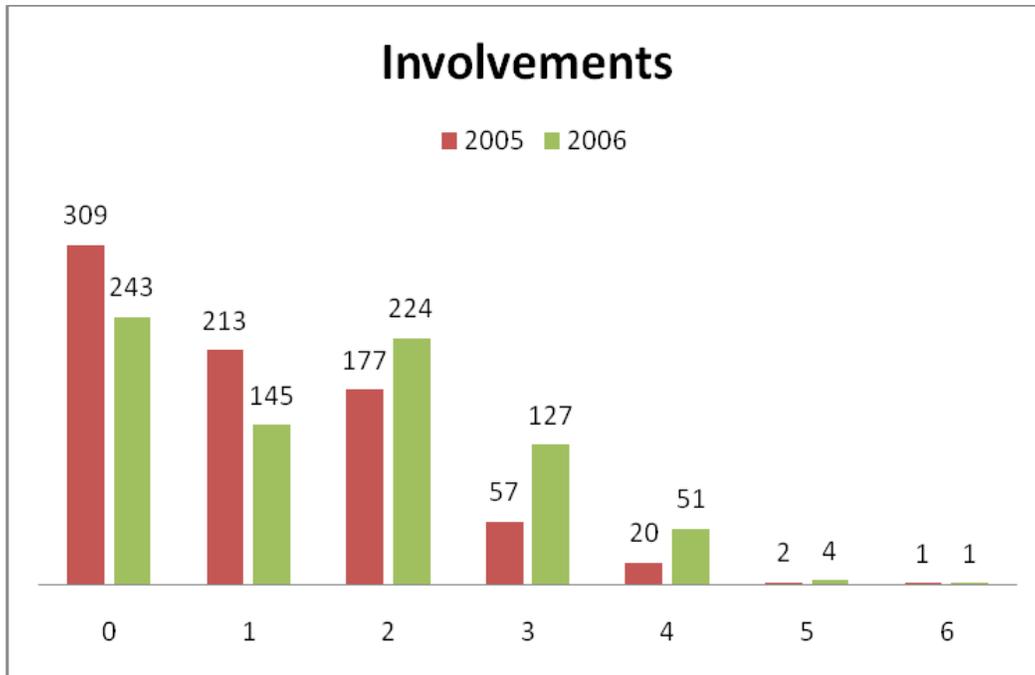
Limitations:

Naturally, there are limitations to the data set. In particular, high school GPA and standardized test scores, perhaps the biggest measures of a student's academic ability, are imperfect. GPA in many ways is influenced by the high school's location and policies. For example, public schools in New York grade students on a 100 scale rather than the 4.0 scale which is common in most of the country. Additionally, some schools weigh advanced placement and other upper level classes more favorably than regular classes. As a result there were many students with GPAs above 4.0. 81 students did not have GPAs on a 4.0 scale and many more did not report any GPA. Standardized test scores encounter a similar issue. The majority of students provided SAT scores, but some students only had ACT scores. This was the case for 174 students.

Unfortunately, high school class size and rank were missing for well over half the sample. Class size would have been an interesting variable to examine. CMC is a very small

school by many standards. Some students, namely those coming from significantly larger schools might hesitate to go to such a small school. Similarly, students coming from small schools may want to experience a large school. It may also very well be the case that neither of the above are true, and that competitive students —those who believe they are likely to be accepted— would have already considered and come to terms with Claremont's size. Regardless, without the data it is impossible to test these theories.

There was no data available on socioeconomic background and education of the parents. It would have been interesting to see if family income was a significant predictor of enrollment decision. Furthermore, information about parents' education would have allowed the testing of legacy effect. Perhaps the child of a CMC alumnus would be more likely to enroll. Or maybe an applicant would be less likely to enroll if his parent was an alumnus of Willams, Pomona, or Amherst. Accordingly, information about what other schools an applicant had applied to would be useful and could have potentially had some explanatory power.

Lastly, there was no information available about the gender of the admitted students. Thus, it was not possible to test whether or not male and female applicants make their decision to enroll CMC the same way.

IV. Methodology

A probit model was used to see whether or not a student's enrollment decision was predictable. Probit regressions are useful when modeling binary outcome variables. In this case, whether or not a student will accept his admission to CMC is the binary outcome variable. The student can either accept or reject. The predictors used to estimate enrollment are as follows: financial aid, GPA, SAT, if at least 1 accomplishment, if 3 or more involvements, if 3 or more

references, minority status, whether or not the student wanted to be an economics or government major, and whether or not applicant is from the West coast.

Financial aid is a binary variable, indicating whether or not the student applied for financial aid. Minority is also a dummy variable where all non white and non Asian American students were considered minorities. Ethnicities were grouped this way because more than two thirds of the students reported being a Caucasian white or Asian American. Also, as a result of affirmative action policies in university admissions it is reasonable to assume that minority students will behave differently when making their admission decisions.

A dummy was included for prospective economics and government majors as those two disciplines are considered by many to be Claremont's strongest. For example, a rational prospective student who plans on majoring in economics might be more likely to enroll given that CMC has one of the best economics departments in the nation. A literature major, however, may prefer to go to Swarthmore, Williams, or Pomona for example.

Rather than including location dummy variables and checking for differences between various regions of the United States and International students, a dummy was included that indicated whether or not a student was from the West Coast. California produces far more CMC students than any other state. Furthermore, CMC's brand and network are stronger on the West Coast. Thus, the impact of location would come across as a significant difference in the decisions of those from the West Coast and those not.

Using the coefficients predicted by a logit model and the average values for each independent variable I examined the impact of each variable on the enrollment decision. A logit model was used rather than a probit because there is no equation for a normal cumulative distribution function. The logit (in appendix) was modeled without ED applicants as they do not

face an enrollment decision after finding out whether or not they are admitted. Holding all of the variables constant at the sample averages except for the variable of interest allows the impact of that specific variable to be observed.

V. Results

The probit model found several of the independent variables to be significant predictors of admitted students' enrollment decisions. GPA and SAT were both significant with negative coefficients. Thus, students with higher GPAs or SATs would be less likely to enroll. It is important to note that the data only includes students who were already accepted to CMC. Accordingly, these students are considered very qualified. Thus, the students in this sample with the highest GPAs and SAT scores are likely to be admitted to at least one other elite institution, perhaps one that they prefer to Claremont. Similarly, admitted students on the lower end of the academic spectrum are expected to have fewer alternatives that are of equal or greater value. The average SAT score for the non ED applicants was 1400. A student with a 1500 would be 10 percentage points less likely to enroll than a student with a 1400. A student with a 1300 would be 14 percentage points more likely to enroll than a student with a 1400. GPA behaves much the same way as SAT score. The average GPA of non ED sample was 4.03. A .1 change in GPA – the difference between a 3.9 and a 3.8– would result in a 3 percentage point change in probability of enrollment. The coefficient of GPA was negative so all else equal, a 3.5 student would be about 10 percentage points more likely to enroll than a 3.8 student.

Accomplishments, involvements, and references were all significant predictors with positive coefficients. Specifically, the model tested whether or not students had a single accomplishment, 3 or more references, and 3 or more involvements. These cutoffs were chosen

because there was a huge divide in the applicant pool. 77% of students in the sample had 0 accomplishments. For references and involvements the sample had a clear divide as well. The majority of students had 2 or less references and 2 or less involvements. It is important to remember that Claremont's admission office determines what activities belong to accomplishments, involvements, and references. For the students, these accomplishments were activities to which they devoted significant time and effort, i.e. activities which the student valued. Given that Claremont views said activities as accomplishments rather than involvements, it suggests that the student and institution are good fits for each other. Hence, the presence of an accomplishment results in a higher likelihood to enroll. References, meanwhile, are indicative of how proactive a student was in contacting CMC throughout the application process. 75% of the sample of students had 2 or fewer references. 83% of the sample had 2 or fewer involvements.

Holding all other variables at their sample means, the difference in probability of enrollment between a student with 0 accomplishments and a student with at least 1 was 38 percentage points. A student with 3 or more references would be 14 percentage points more likely to enroll than a student with all else equal outside of references. A student with 3 or more involvements would be 9 percentage points more likely to enroll than a student with all else equal outside of involvements.

The final variable that predicted enrollment with significance was minority status. In fact, the probit suggests that if you had a two students who were identical in terms of GPA, SAT, accomplishments, references, and involvements, a black student would be 24 percentage points less likely to enroll than a white student. A Hispanic student would be 9 percentage points less likely to enroll than a white student with otherwise identical characteristics. Asian Americans did not behave significantly differently from white Americans. This is consistent with the basic laws

of supply and demand. High caliber minority students are in great demand, significantly greater than high caliber non minority students. Schools want to put together diverse student bodies, doing so attracts students and is good for rankings.

The need for financial aid was not a significant predictor of enrollment decisions. That may be a testament to Claremont McKenna's generous financial aid and need blind admissions process. CMC has a policy of meeting 100% of demonstrated financial need. Had it been significant, financial aid (which had a negative coefficient) would have indicated that students in need of aid were not receiving adequate financial support from CMC. The lack of significance suggests that students receive enough support from CMC that they feel comfortable enrolling regardless of their ability to pay the high price tag that comes with a private institution.

The dummy variable for West Coast did not prove significant. Another probit was run where each region (South, Northeast, Pacific, Midwest, and International) was compared to the West Coast and none of the regions were significantly different. This is not particularly surprising as students are aware of Claremont's location prior to applying. More so, it is unlikely that location is a determining factor in a highly qualified student's college application process, regardless of what region he is from.

The dummy variable for major choice was also insignificant. PPE, a major that is available to very few undergraduate institutions, was included with government and economics and although the results were closer to being significant, they still were not. The results from the probits are reported in the table below.

Results of Probit Regressions

	2005	no ED	2006	no ED	Aggregate	no ED
Financial Aid	-0.1296	-0.0922	-0.1264	-0.0827	-0.0552	-0.0129
	(0.1804)	(0.1845)	(0.1348)	(0.1377)	(0.1006)	(.1027)
SAT	**-0.0033**	**-0.0033**	**-0.0031**	**-0.0032**	**-0.0034**	**-0.0035**
	(0.0008)	(0.0008)	(0.0006)	(0.0006)	(0.0046)	(.0005)
GPA	**-0.6061**	0.6253*	**-0.7464**	**-0.7669**	**-0.7249**	**-0.7428**
	(0.2607)	(0.2722)	(0.1857)	(0.1919)	(0.1418)	(.1466)
Accomplishments > 0	**3.0106**	**3.0036**	0.1768	0.1465	**1.0411**	**1.0333**
	(0.2912)	(0.2916)	(0.1382)	(0.1414)	(0.1043)	(.1051)
3 or more Involvements	0.7983*	**0.7847**	0.1441	0.1236	0.3075*	0.2907*
	(0.2780)	(0.2795)	(0.1428)	(0.1459)	(0.1169)	(.1187)
3 or more References	0.0722	0.0697	**0.5097**	**0.5611**	**0.3666**	**0.3934**
	(0.2194)	(0.2286)	(0.1325)	(0.1365)	(0.1052)	(.1080)
Black	-0.5622	-0.5822	**-1.2369**	**-1.2840**	**-1.1278**	**-1.1592**
	(0.3601)	(0.3658)	(0.2821)	(0.3015)	(0.2169)	(.2269)
Hispanic	-0.2352	-0.1729	-0.3140	-0.3077	-0.3035*	-0.2791*
	(0.2351)	(0.2391)	(0.1686)	(0.1724)	(0.1288)	(.1312)
West	0.4049*	0.3824	-0.0968	-0.1251	-0.0352	-0.0623
	(0.1966)	(0.2028)	(0.1407)	(0.1444)	(0.1037)	(.1062)
Early Decision	**2.5657**	-	**1.6861**	-	**1.9676**	-
	(0.3912)	-	(0.2825)	-	(0.2247)	-
Observations	553	495	555	501	1108	996
Psuedo R^2	0.5859	0.5204	0.2115	0.1177	0.3027	0.2015

This table reports coefficients and (standard errors) of variables used to predict the likelihood of enrollment to CMC given acceptance. They were estimated by probit regressions, all of which were significant at .5% level. They are broken up by the year of students in the sample and then run again with Early Decision applicants dropped. Bold coefficients denote significance at 1% level. * denotes significance at 5% level.

In order to test how effectively the probit models predicted whether or not students would enroll it is necessary to compare the predicted outcomes with the actual outcomes. For each student without missing data points, the probit model can predict the likelihood that the student will enroll. This probability can be compared to what decision the student ultimately made. Students were grouped into two categories, those more likely to enroll and those less likely to enroll. Students whose predicted probability of enrollment was greater than 50% were placed in the more likely group and those whose predicted probability was less than 50% were placed in the less likely group. When these predictions were compared to students' actual decisions, the model was correct in predicting the students' decisions over 70% of the time. The table below shows the percent of students correctly predicted for each of the 6 probits.

2005	no ED	2006	no ED	Aggregate	no ED
81.2%	89.5%	74.8%	73.1%	76.8%	77.7%

Student Survey:

In an effort to better understand student enrollment decisions a survey of 24 current Claremont McKenna students was conducted. Using the coefficients from the aggregate sample with ED applicants excluded, the probability of these students enrolling was predicted. It is important to note that this method is inherently biased. The survey only includes currently enrolled students. By not having any data on students who chose not to enroll this test does not adequately test the model. It only tests on the conditional that students accepted. Regardless, the model correctly predicted that each of the 24 students was more likely to attend than not (greater than 50% probability of enrolling). I entered my own attributes into the model and it predicted that I had an 88% likelihood of accepting my admission to CMC.

The advantage of doing a survey was that it allowed for students to actually report why they chose to attend CMC. 7 students reported that Claremont was either their number 1 choice

or in their top 2 (usually with Stanford). Of those 7 students, 6 applied early. 7 students reported that their number one reason for coming to CMC was because it was the best deal /value they encountered. Of these 7 students all are on financial aid. This was the case in my own experience as well. Although Claremont was always in my top 3, the school's generous financial aid package was what finalized my decision to attend. This suggests that my model does not adequately capture the relationship between financial aid and a student's enrollment decision. 4 students, some of whom entertained offers from other top schools, chose CMC because they had a great experience doing a campus visit in which they stayed overnight with a current student. Claremont encourages admitted students to do a campus visit. This is an effective screening mechanism because it allows students to discover to some extent how good a fit the school really is. This encourages good fit students to enroll and poor fit students not to.

VI. Conclusion

The research conducted indicates that to a reasonably accurate extent, student enrollment decisions can be modeled. This has important economical implications for Claremont McKenna College. Namely this study confirmed that more often than not highly qualified students, the students who apply to CMC, make rational decisions when investing their human capital, time, and finances into an undergraduate institution. Students choose schools based on academics, social life, and price. The allocation of value to each of those categories is not generally known though. However, it can be reasonably estimated. Students with exceedingly high SATs and GPAs are likely to have other top schools admit them. Students who have stayed on campus, taken tours, and participated in activities in high school which are valued by CMC, are likely to view CMC as a good fit and are thus likely to enroll if admitted –especially if they are less likely

to get into other top schools. Students who apply for financial aid are likely to be sensitive to cost and aid packages.

Claremont McKenna recently released its admissions data for the class of 2015. Overall CMC's admissions office has the goal of attracting academically capable students who are going to fit CMC and each other well. Adam Miller, Associate Dean of Admissions, explained that a "fewer percentage of people were accepted early, but more applied, so a greater percentage of the total class was accepted early. That meant that we could accept a fewer number of people regular decision."[xix] A total of 619 students were admitted to the class of 2015. Of these students, 145 were admitted early decision –that is almost half of the entire class. The admission rate "dropped a considerable 3.4 percentage points from 17.2% in 2010 to 13.8% in 2011."[xx] Furthermore, the average SAT scores of admitted students increased this year. This indicates that CMC is not simply attracting more students; rather it is attracting higher caliber students.

Given the results of this research, it is safe to say that Claremont McKenna's admissions office is doing a good job of mitigating risk. This was cleverly accomplished by accepting a greater percentage of the incoming class via binding early decision. This produces several benefits for the school. Effectively ED admits have no bargaining power in terms of financial aid packages. Additionally, uncertainty about tuition revenue is eliminated for half the class, before the regular decision applications are even processed. Also, CMC can be more selective in regular decision, bringing down the acceptance rate, an action that can raise prestige and ranking, and thus attract even more qualified applicants in the future. Lowering the acceptance rate is one way to improve in the rankings. Raising yield is another. However, CMC did not do this. In fact,

CMC expects a yield close to 33.7%, last year's yield, for its regular decision applicants.[xxi] This seems to suggest that the admissions office has not found a way to improve yield.

Certainly students should not be admitted based on their likelihood of accepting admission. However, after CMC makes its admissions decision it can model how likely students are to accept and use this information prior to offering admission to applicants. This year 472 students were admitted regular decision for roughly 155 spots. If a model predicted enrollment correctly 75% of the time, CMC could admit the 250 most likely to enroll of the 472 and potentially enjoy a yield of 62% rather than 37%. This would give CMC a yield higher than any elite non military affiliated liberal arts college in America. This would certainly be helpful in the rankings and would be a good selling point to prospective students. As the admissions office noted, and as my data reflects, students are becoming more and more competitive, and CMC is attracting more and more qualified students. Furthermore, private institutions want to mitigate risk. This is exemplified by CMC's admittance of more students than ever before early decision. By modeling enrollment probability CMC can potentially increase its yield, rise in the rankings, and attract even more talented students. This would have long lasting benefits to the college and its alumni.

Appendix

Results of Logit Regression

Financial Aid	-0.0186
	(0.1775)
SAT	**-0.0059**
	(0.0009)
GPA	**-1.3700**
	(0.2602)
Accomplishments > 0	**1.7405**
	(0.1806)
3 or more Involvements	0.4508*
	(0.2028)
3 or more References	**0.6832**
	(0.1863)
Black	**-2.1559**
	(0.4157)
Hispanic	-0.5478*
	(0.2301)
Asian	-0.3157
	(0.2106)
West	-0.1439
	(0.1821)
Observations	996
Psuedo R^2	0.2043

This table reports coefficients and (standard errors) of variables used to predict the likelihood of enrollment to CMC given acceptance. They were estimated by a logit regression, which was significant at .5% level. Bold coefficients were significant at 1% level. * coefficients were significant at 5% level.

[i] Monks, James, and Ronald G. Ehrenberg. "The Impact of US News and World Report College Rankings on Admission Outcomes and Pricing Decisions at Selective Private Institutions." *National Bureau of Economic Research* 31.6 (1999): 42-51. JSTOR. Web. 44

[ii] Gordon, Larry. "Higher Education: Universities Step up Pitches to Admitted Students as Acceptance Date Nears - Latimes.com." *Los Angeles Times - Latimes.com*. Web.

[iii] "Most Popular Colleges: National Universities - US News and World Report." *US News & World Report*. Web. <http://www.usnews.com/education/articles/2009/01/26/most-popular-colleges-national-universities?PageNr=1>.

[iv] "Most Popular Colleges: Liberal Arts Colleges - US News and World Report." *US News & World Report*. Web. <http://www.usnews.com/education/articles/2009/01/26/0126popularlibarts?PageNr=1>.

[v] "Fast Facts." *National Center for Education Statistics (NCES) Home Page, a Part of the U.S. Department of Education*. Web. <http://nces.ed.gov/fastfacts/display.asp?id=98>.

[vi] ibid

[vii] ibid

[viii] Chapman, David W. "A Model of Student College Choice." *Journal of Higher Education* 52.5 (1981): 490-505. Print. 503

[ix] Stern, George G. *People in Context: Measuring Person-environment Congruence in Education and Industry*. New York, 1970. Print. 173

[x] Perna, Laura W. "Differences in the Decision to Attend College among African Americans, Hispanics, and Whites." *Journal of Higher Education* 71.2 (2000): 117-41. JSTOR. Web. 136

[xi] Ibid 137

[xii] Avery, Christopher, and Caroline M. Hoxby. "Do and Should Financial Aid Packages Affect Students' College Choices?" *National Bureau of Economic Research* (2003). Web. 18

[xiii] Ibid 21

[xiv] Ibid 24

[xv] Ibid 36

[xvi] Kiholm Smith, Janet, and Heather Antecol. "The Early Decision Option in College Admission and Its Impact on Student Diversity." *Journal of Economic Literature* (2011). Web. 2

[xvii] Ibid 29

[xviii] Ibid

[xix] Kakkar, Ana. "Admissions Office Announces Class of 2015 Acceptance Rate « Forum | The Official Student Publication of Claremont McKenna College." *Forum The Official Student Publication of Claremont McKenna College*. Web. <http://cmcforum.com/news/04122011-admissions-office-announces-acceptance-rate>.

[xx] Ibid

[xxi] Ibid